

SEPTEMBER 2022

Review of the Victorian CAR Reserve System: Synthesis Report

Final Report

DELWP

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Executive Summary

As part of Victoria's modernised Regional Forest Agreements (RFAs), the state has committed to the establishment and maintenance of a Comprehensive, Adequate and Representative (CAR) Reserve System. Consistent with this process, Victoria is required to specifically review the comprehensiveness, adequacy, and representativeness of the Reserve System, based on criteria described by the Joint ANZECC / MCFFA National Forest Policy Statement Implementation Sub-committee (the 'JANIS criteria'¹) which aims to provide a framework for balancing the competing demands of conservation and industry on Australia's forests.

This report represents the first of these reviews of the Victorian CAR Reserve System. It is important to highlight that this review is confined to examining only the areas of the state covered by the five RFAs, namely West Victoria, Central Highlands, Gippsland, East Gippsland and North East. The scope is also limited to assessing the *extent* of protections of forest vegetation types (based on spatial data regarding vegetation extent inside and outside the CAR Reserve), and does not assess the efficacy of the specific types of protection that comprise the CAR Reserve System, nor other important characteristics of vegetation including e.g. habitat quality.

KEY STRENGTHS

Through this assessment, the following key strengths of the Victorian RFA CAR Reserve System have been identified:

- The core components of a CAR Reserve System are well established and operating. This includes:
 - That the CAR principles underpinning protected area design are enshrined in intergovernmental agreements, established through the RFA commitments. These principles are based on sound ecological knowledge and best practice for reserve design.
 - A requirement for regular, timely reviews of the CAR Reserve System, again established through RFA agreements. This includes the role of the JANIS criteria to provide a framework for evaluation.
 - A range of mechanisms for on-ground protections including formal, dedicated reserves; informal reserves protected through zoning; areas managed through prescriptions and private land covenants. This range of mechanisms facilitates a flexible and practical approach to managing the reserve network (noting that the efficacy of each of these mechanisms is outside the scope of this review).
- The performance of the CAR Reserve System is strong in some areas (based on the subset of JANIS criteria for which quantitative assessment was possible as part of this review), including:
 - Protection of old-growth forests (across all regions, the criteria of '60% of old-growth forest included in the CAR Reserve was met for a majority of forest Ecological Vegetation Classes (EVCs)²).
 - Protection of wilderness areas (across all regions with designated areas identified as 'high quality wilderness', the 90% protection criteria was effectively met or exceeded).
- For many EVCs, the CAR Reserve System makes good use of available public land, with many EVCs protected to the maximum extent possible within State Forest areas.

¹ *Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia*. (1997). A report by the Joint Australian and New Zealand Environment and Conservation Council (ANZECC) and Ministerial Council on Forestry, Fisheries and Aquaculture (MCFFA) National Forest Policy Statement Implementation Sub-committee. Commonwealth of Australia, Canberra.

² It is important to note that this is based on data that does not incorporate the impacts of the 2019/20 bushfires.

AREAS FOR IMPROVEMENT

The assessment also highlighted some areas for improvement in current CAR Reserve System performance. This includes:

- Significant shortfalls in the protection of some EVCs against some of the JANIS criteria. This finding is in line with other assessments e.g. by the Victorian Environmental Assessment Council (VEAC) and as part of the development of the Victorian government's 'Protecting Victoria's Environment – Biodiversity 2037' strategy.
- Low levels of protection for several EVCs that are vulnerable to climate change. Increasing the extent of protection for these EVCs will be important for increasing climate resilience of the reserve network.
- Options for improving protections for some EVCs are limited. For many 'shortfall EVCs', much of the remaining 'unprotected' extent is on private land. Mechanisms for increasing protections for these EVCs are limited (conservation covenants) and rely on reaching agreements with individual private landholders. Targeting of private land conservation investment to priority EVCs will be necessary to address this challenge.
- There are significant areas for improvement in terms of data and evaluation, including a lack of:
 - A robust protocol to evaluate performance against the full set of JANIS criteria
 - Integrated data on habitat condition, structure and function
 - A protocol for quantifying and incorporating data on the impacts of major events (e.g. bushfires)
 - Clear criteria for evaluating performance against the broader objectives of the CAR Reserve System including e.g. cultural heritage and landscape objectives, ecosystem service provision etc.

FUTURE DIRECTIONS TO STRENGTHEN CAR RESERVE SYSTEM

Forest Management

This synthesis report has highlighted some potential options to strengthen the CAR Reserve System performance against the JANIS criteria:

- **On Public Land**

For some EVCs, there are options to improve performance against the JANIS criteria by incorporating public land into the CAR Reserve. This includes:

- a) Formally incorporating areas that are currently protected through policy (Immediate Protection Areas (IPAs), areas protected via VEAC recommendations) into the CAR Reserve System to enable more permanent protection.
- b) Incorporating currently unprotected State Forest land (General Management Zone (GMZ), Special Management Zone (SMZ)) into the CAR Reserve.

However, only a relatively small proportion of EVCs would be able to meet the JANIS criteria threshold through such additions.

Assessment of such future management options requires consideration of other stated objectives of the RFA agreements, particularly in relation to timber harvesting. Further work, including more detailed spatial analysis, would be necessary to explore these options and understand associated trade-offs.

- **Private Land**

For a significant majority of EVCs that fall short of the JANIS criteria thresholds, much of their currently unprotected extent falls on private land. Options for pursuing improved CAR Reserve coverage on private land could include specific targeting of private land conservation investment to EVCs that are currently under-represented in the CAR Reserve System. Any such efforts should particularly prioritise shortfall EVCs that are rare or endangered.

Further analysis could provide insights into potential opportunities/challenges in this area, including understanding the number of landholders that would need to be engaged to improve performance for individual target EVCs.

Data Gaps and Evaluation

This analysis examined opportunities to improve the ability to monitor and evaluate the performance of the CAR Reserve System. Improving the data available for these assessments is a key opportunity. The specific data improvements identified are:

- Incorporating data on EVC condition: current EVC data is focussed on vegetation extent. Including measures of condition, structure and function would enable a more robust assessment of the conservation effectiveness of the Reserve System.
- Incorporating data on bushfire impacts: timely assessment of the impact of bushfire on EVCs within the CAR Reserve would be a critical step forward. In particular, data on fire tolerance for individual EVCs would be a critical element of this improvement. This would make it possible to identify EVCs and (and in particular, old-growth areas) within the CAR Reserve System that have likely been significantly impacted by fire.
- Addressing 'mapping units' in the EVC data (areas classified as 'complexes', 'mosaics', 'aggregates' and 'niches') - these are 'mapping units' (typically combinations of two EVC types) requiring an appropriate EVC to be determined and assigned on site. There would be significant value in revisiting this analysis once more reliable site-based classifications have been completed.
- Testing key assumptions: key assumptions underpinning this analysis are that the data on EVC and Modelled Old-Growth (MOG) extent are accurate and reliable, and that the management of all CAR Reserve components (formal and informal reserves, areas managed by prescription and covenanted private land) offers sufficient protection of biodiversity values. Testing these assumptions would help to ensure future reviews are robust.
- Review and further development of the JANIS criteria:, including:
 - Setting out a clear and repeatable protocol for assessing performance against the full set of criteria (including the 'qualitative' criteria). This could include defining a set of indicators to assess performance against all eleven criteria.
 - Update any defined thresholds to align with more recent national and international policy commitments for protecting terrestrial biodiversity
 - Develop a complimentary set of criteria to include a broader set of values including cultural heritage, recreation, and other ecosystem services.

1 Introduction

1.1 BACKGROUND

As part of Victoria's modernised Regional Forest Agreements (RFAs), the state has committed to the establishment and maintenance of a Comprehensive, Adequate and Representative (CAR) Reserve System. Consistent with this process, Victoria is required to specifically review the comprehensiveness, adequacy, and representativeness of the Reserve System, based on criteria described by the Joint ANZECC / MCFFA National Forest Policy Statement Implementation Sub-committee (the 'JANIS criteria'³) which aims to provide a framework for balancing the competing demands of conservation and industry on Australia's forests..

This commitment is set out in all five RFAs⁴. The RFAs note that this review should be completed every five years as part of a more general review of the performance of the Agreement. The purpose of this component of the five-yearly review is to assess and evaluate the performance of the CAR Reserve System in terms of 'ensuring the long-term conservation and protection of Environment and Heritage Values, Listed Species and Communities and Ecosystem Services', and taking into account 'the current and forecast impacts of Climate Change'.

This report contributes to the first of these five-yearly reviews of the Victorian CAR Reserve System.

1.2 SCOPE OF THE REVIEW

In line with the relevant RFA clauses, and in order to deliver a timely and meaningful review, the scope of the review includes the following elements:

- Use of datasets and lines of evidence available to the Department of Environment, Land, Water and Planning (DELWP) to:
 - Assess the coverage and implementation of the CAR Reserve System against JANIS criteria and the system's contribution toward protecting selected listed species and communities.
 - Identify climate change impact pathways on forest ecosystems and identify management options for further protecting climate vulnerable ecosystems within the CAR Reserve Systems.
- In line with the RFA framework, the review focuses on forest ecosystems in RFA regions represented in the Ecological Vegetation Class (EVC) Layer (including rainforest) and assessed against the CAR Reserve data layer reflecting the most recently available data on previous zoning changes. In addition, an assessment will be made against old-growth forest and wilderness areas.
- The review is consistent with previous analyses (e.g., RFA renewal assessments) where possible and will use existing departmental datasets. It also seeks to maintain consistency with concurrent projects (including the Major Event Review which considers the impacts of the 2020 fires on the CAR Reserve System).
- The Review is intended to provide high-level recommendations which align with Government policy commitments e.g., the Victorian Forestry Plan, DELWP programs and state forest management strategies.
- The Review does not deliver:
 - Directions for new zoning amendments, revision of reserve boundaries, nor revisions to the CAR Reserve spatial data layer

³ *Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia.* (1997). A report by the Joint Australian and New Zealand Environment and Conservation Council (ANZECC) and Ministerial Council on Forestry, Fisheries and Aquaculture (MCFFA) National Forest Policy Statement Implementation Sub-committee. Commonwealth of Australia, Canberra.

⁴ E.g. see Clause 36 (a, j, k) of the Central Highlands RFA

- Extensive community engagement.

It is important to highlight that this scope means that the assessment reported here is confined to examining only the areas of the state covered by the five RFAs, namely West Victoria, Central Highlands, Gippsland, East Gippsland and North East Figure 1-1). This means it excludes much of northern and north-west Victoria as well as the areas immediately around Melbourne, the Mornington Peninsula and Westernport Bay.

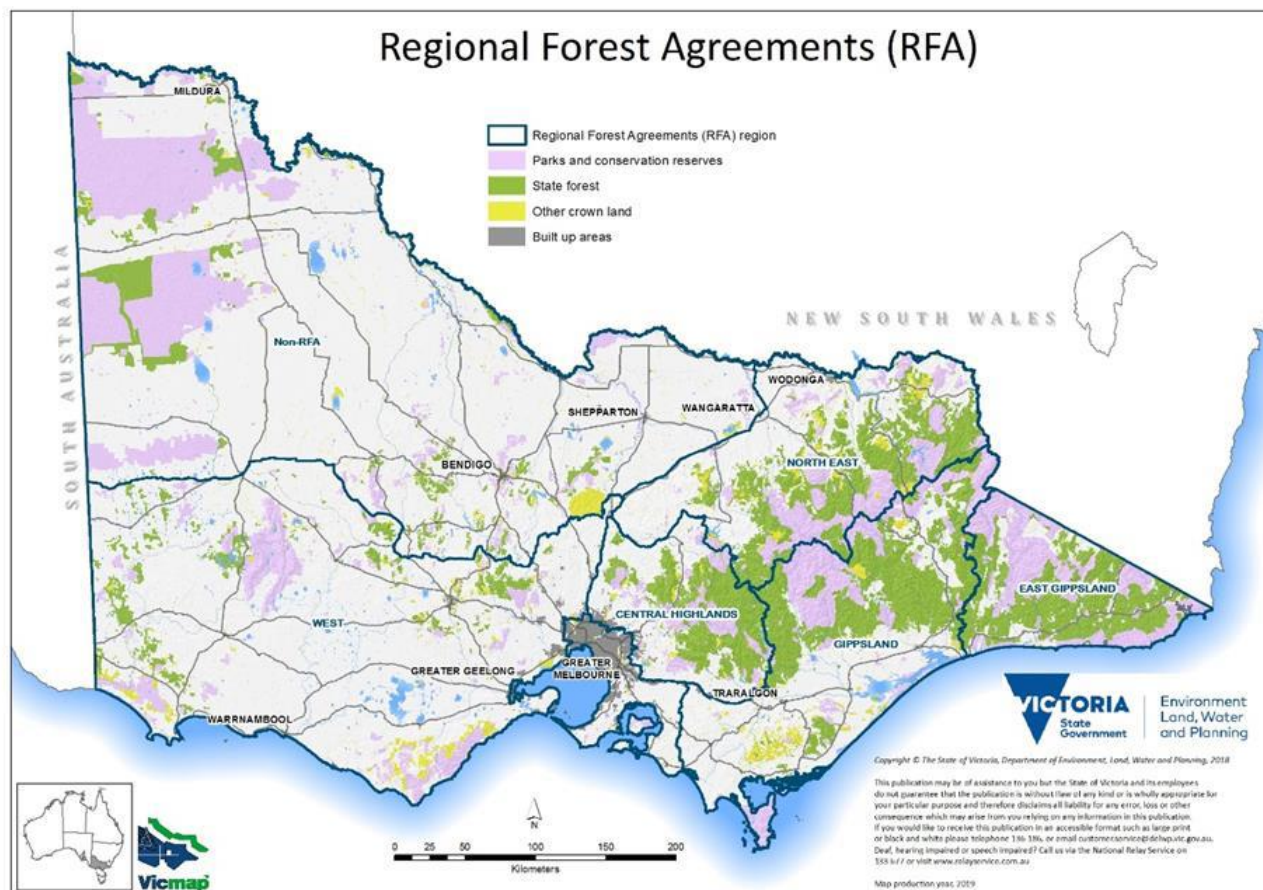


Figure 1-1: Regional Forest Agreement areas, Victoria (Source: Overview of Victoria's Forest Management System, DELWP 2019)

1.3 CONTEXT AND OUTPUTS OF THE REVIEW

The assessment reported here draws on analyses undertaken as part of this review process (including internal analysis by DELWP and work undertaken by the University of Melbourne), re-examines some of the data used in these analyses, and synthesises the findings to report on the specific question of the comprehensiveness, adequacy, and representativeness of the CAR Reserve System.

The findings of this assessment are presented here, highlighting:

- Strengths and weaknesses of the present CAR Reserve System
- Options for improving the current CAR Reserve System, including options for climate vulnerable EVCs
- Priorities for future data quality improvements, research, and analysis. Priorities for future forest management planning through a climate change lens
- Knowledge gaps and priorities for future forest monitoring

1.4 CAR RESERVE SYSTEM

The CAR Reserve System is the primary mechanism within each RFA region for the protection of biodiversity, old-growth forests and wilderness values within Victoria's forest ecosystems.

The three principles that underpin the CAR Reserve concept⁵ are:

- **Comprehensiveness** – *'includes the full range of forest communities recognised by an agreed national scientific classification at appropriate hierarchical levels'* (NFPS 1992). This principle requires that the reserve system samples the full range of forest communities across the landscape. The focus of the assessment of Victorian RFA regions aligns with the JANIS criteria recommendation that 'smaller and more manageable regional units are necessary as a basis for consideration of comprehensiveness.
- **Adequacy** – *'the maintenance of ecological viability and integrity of populations, species and communities'* (NFPS 1992). Adequacy addresses the difficult question of extent: what is the level of reservation that will ensure viability and integrity of populations, species and communities. Where data on the viability of populations are available, they should be incorporated in determining the adequacy of a reserve system.
- **Representativeness** – *'those sample areas of the forest that are selected for inclusion in reserves should reasonably reflect the biotic diversity of the communities'* (NFPS 1992). This principle focusses on ensuring that the diversity within each forest ecosystem is included in the reserve system.

For the purposes of this review, reserves within the CAR Reserve System fall into four categories (on both public and private land) (Figure 1-2):

1. **Formal (Dedicated) Reserve (public land)**– includes Crown land formally reserved for environmental protection such as national parks, state parks, nature conservation reserves and other conservation reserves. Timber harvesting is excluded from these formal reserves.
2. **Informal Reserve (public land)** – includes public land protected for its conservation values or protected under an approved management plan. Most of these informal reserves are defined as Special Protection Zones (SPZ) within State forest. Timber harvesting is excluded from these informal reserves.
3. **Values Protected by Prescription (public land)** – Under Victoria's Timber Code (the Code of Practice for Timber Production 2014) specific areas of timber producing forests are excluded from timber harvesting, so are considered to contribute to the CAR Reserve System. This includes areas of steep slopes, those with very rare values, or values with fragmented distributions, or values naturally occurring in linear form such as riparian vegetation.
4. **Private Land** – includes offset sites protected under conservation covenants or by agreements registered on-title.

It is important to note that areas currently protected through policy (i.e. Immediate Protection Areas or other VEAC protection mechanisms) are not included within the CAR Reserve System for the purposes of this review. However, where such areas could contribute materially to the protection of forest ecosystems, this is noted in both the findings and recommendations.

⁵ Overview of Victoria's Forest Management System, DELWP 2019

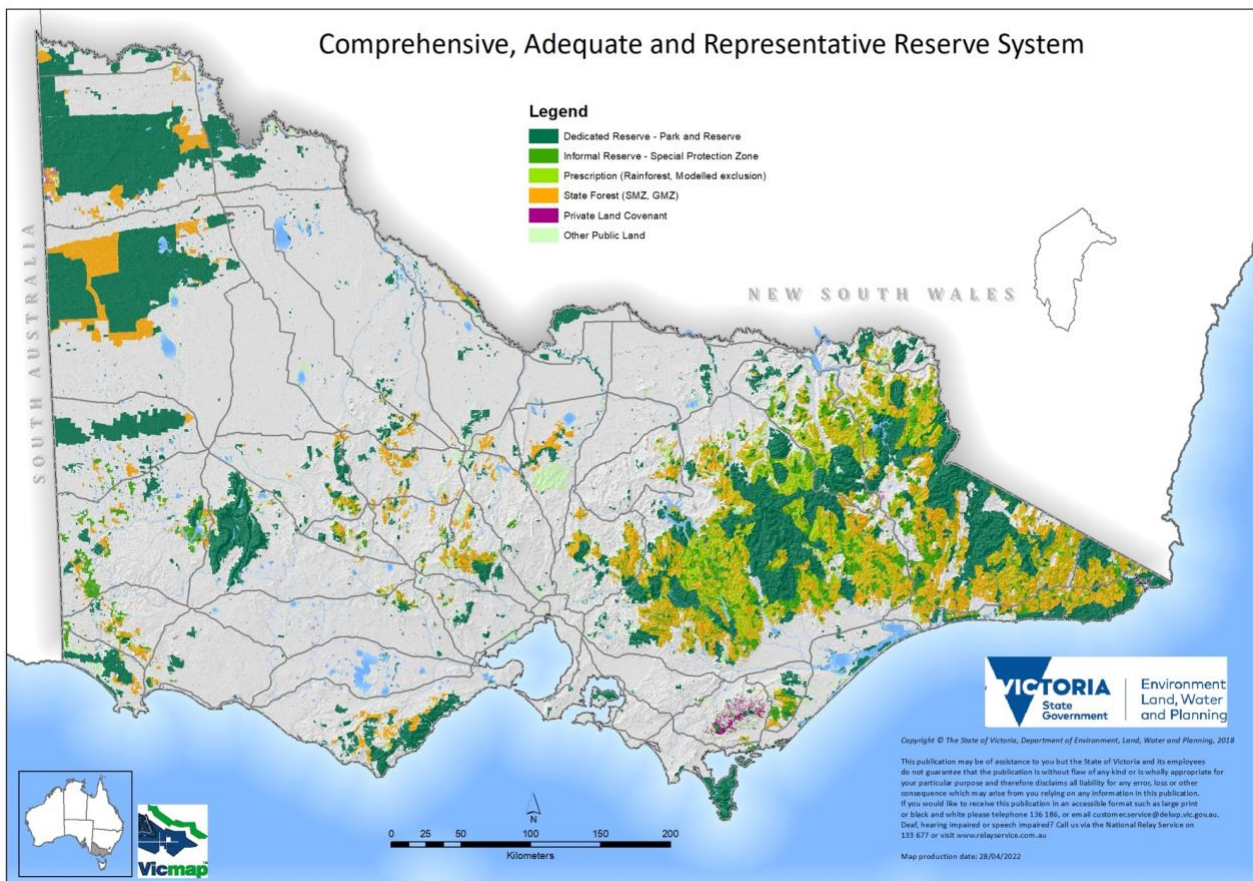


Figure 1-2: Reserve types in Victoria (Source: DELWP 2022⁶)

1.5 APPLICATION OF THE PRINCIPLES

The driver behind the assessment of the CAR Reserve System status of the reserves across the RFA areas is biodiversity conservation in these native forests. In 1997, a nationally agreed set of criteria for assessing the CAR Reserve System status of reserves was established⁷. This agreement, part of the National Forest Policy Statement (NFPS), emphasised that the CAR Reserve System criteria needed to be considered in the context of the overall objectives of the policy, which were to maintain:

- Ecological processes and the dynamics of forest ecosystems in their landscape context.
- Viable examples of forest ecosystems throughout their natural ranges.
- Viable populations of native forest species throughout their natural ranges; and
- The genetic diversity of native forest species.

In addition, the JANIS authors highlight that the reserve criteria need to be applied in such a way that meeting the percentage targets does not become the sole focus. **The criteria need to be treated as guidelines** and applied with three factors considered:

- **Flexibility** – regional circumstances differ widely as do acceptable social and economic outcomes. Flexibility is also necessary to allow for changes to the CAR Reserve System as a result of changes in knowledge and changes in biota (such as through climate change).

⁶ Map figure produced by DELWP and provided as part of this review.

⁷ Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia, 1997

- **Urgency and practicability** – the urgency of the task dictates a practical approach to the development of the CAR Reserve System. In most instances, local expertise and knowledge will need to be used to complement existing mapped data.
- **Economic and social considerations** – with many configurations of a CAR Reserve System within any particular region being possible, there is scope to integrate conservation requirements with social and economic outcomes. The extent of potential social and economic impacts may limit the ability to meet reserve criteria.

1.6 JANIS CRITERIA

As noted above, in 1997, a nationally agreed set of criteria for assessing the CAR Reserve System status of reserves was established – called the JANIS criteria. These criteria form the basis of the commitment to maintain a CAR Reserve System in the RFA agreements. The criteria are:

BIODIVERSITY:

1. As a general criterion, **15% of the pre-1750 distribution of each forest ecosystem should be protected** in the CAR Reserve System with flexibility considerations applied according to regional circumstances, and recognising that as far as possible and practicable, the proportion of Dedicated Reserves should be maximised
2. Where forest ecosystems are recognised as **vulnerable**, then **at least 60% of their remaining extent should be reserved**. A vulnerable forest ecosystem is one which is:
 - a. Approaching a reduction in areal extent of 70% within a bioregional context and which remains subject to threatening processes; or
 - b. Not depleted but subject to continuing and significant threatening processes which may reduce its extent.
3. **All remaining occurrences of rare and endangered forest ecosystems should be reserved or protected** by other means as far as is practicable.
4. Reserved areas should be replicated across the geographic range of the forest ecosystem to decrease the likelihood that chance events such as wildfire or disease will cause the forest ecosystem to decline.
5. The reserve system should seek to maximise the area of high-quality habitat for all known elements of biodiversity wherever practicable, but with particular reference to:
 - The special needs of rare, vulnerable or endangered species;
 - Special groups of organisms, for example species with complex habitat requirements, or migratory or mobile species;
 - Areas of high species diversity, natural refugia for flora and fauna, and centres of endemism; and
 - Those species whose distributions and habitat requirements are not well correlated with any particular forest ecosystem.
6. Reserves should be large enough to sustain the viability, quality and integrity of populations.
7. To ensure representativeness, the reserve system should, as far as possible, sample the full range of biological variation within each forest ecosystem, by sampling the range of environmental variation typical of its geographic range and sampling its range of successional stages.
8. In fragmented landscapes, remnants that contribute to sampling the full range of biodiversity are vital parts of a forest reserve system. The areas should be identified and protected as part of the development of integrated regional conservation strategies

OLD-GROWTH FOREST CRITERIA:

1. Where old-growth forest is rare or depleted (generally less than 10% of the extant distribution) within a forest ecosystem, all viable examples should be protected, wherever possible. In practice, this would

mean that most of the rare or depleted old-growth forest would be protected. Protection should be afforded through the range of mechanisms described in section 4.

2. For other forest ecosystems, **60% of the old-growth forest identified at the time of assessment would be protected**, consistent with a flexible approach where appropriate, increasing to the levels of protection necessary to achieve the following objectives:
 - The representation of old-growth forest across the geographic range of the forest ecosystem;
 - The protection of high-quality habitat for species identified under the biodiversity criterion;
 - Appropriate reserve design;
 - Protection of the largest and least fragmented areas of old-growth;
 - Specific community needs for recreation and tourism.

WILDERNESS CRITERIA:

1. **Ninety percent**, or more if practicable, of the area of **high-quality wilderness** that meet minimum area requirements should be **protected in reserves**.

1.6.1 LIMITATIONS OF JANIS CRITERIA

While the JANIS criteria provide a valuable set of indicators, they do have limitations. Identifying these limitations is an important part of developing a more nuanced understanding of this synthesis. Among the important limitations are:

- Some of the criteria include specified quantitative thresholds, enabling performance against them to be (relatively) easily measured. Of the 11 criteria, five have a target or threshold specified in the criteria, allowing performance to be assessed directly. The other six criteria are more complex and nuanced, and therefore more challenging to interpret and measure performance against. This situation creates the risk that assessments rely more heavily on the five quantitative criteria (as in the case of this review), which is an incomplete view of the reserve system.
- The quantitative criteria mainly focus on extent of key vegetation types (e.g. 15% of the pre-1750 distribution) and overall do not place a strong focus on habitat condition, structure and function – all key influences on the significance of vegetation from a biodiversity conservation perspective. Whilst some of these characteristics are reflected in the qualitative criteria, the lack of a clear framework for monitoring and evaluating performance (i.e. describing the types of data that could be used for such an assessment) make such analyses challenging.
- The impacts of extreme or large-scale events (e.g. bushfires or shifts in temperatures or moisture levels expected under climate change) are not readily apparent in assessments based on the criteria. For example, bushfire severity and frequency can have a major influence on the ecological functions of a forest. It is not clear how (or whether) fire impacts are accounted for in the criteria, short of a direct measurable impact on EVC extent.
- The criteria do not reflect some of the more contemporary challenges and policy imperatives. Indigenous landscape values and aspirations for landscape (as well as cultural heritage) are prominent examples of this.

1.7 STRUCTURE OF REPORT

This report is presented in four parts:

Section 1 (this section) of the report focuses on introducing the purpose, scope and key concepts of the review.

Section 2 presents the results of the assessment of the CAR Reserve System against the JANIS criteria. This information is presented for each RFA region and for the five RFA regions together. Because of the nature of the JANIS criteria and data limitations, the assessment is largely limited to five of the eleven criteria, namely:

1. 15 per cent of the **pre-1750 distribution** of each forest ecosystem...
2. 60 per cent of the **existing distribution** of each forest ecosystem **if vulnerable**...
3. All remaining occurrences of **rare** and **endangered** forest ecosystems⁸...
4. 60 per cent of the **existing old-growth forest**...
5. 90 per cent, or more, of **high-quality wilderness forests**...

...should be protected within the CAR reserve system⁹.

Sections 3 and 4 – Future Priorities and Conclusions – examine the implications of the assessment and propose some high-level recommendations for future monitoring and management of the CAR Reserve Systems in the RFA regions.

⁸ For the purposes of this review, 'all remaining occurrences' has been interpreted as meaning 100% of remaining extent of rare or endangered EVCs.

⁹ Adapted from *Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia, 1997*

2 CAR Reserve System Performance

CAVEATS, CONSTRAINTS AND DATA LIMITATIONS

- **Geographic scope.** This review has been undertaken to fulfil relevant RFA commitments to review the CAR Reserve System. The focus is on the reserves network within Victoria's five RFA regions only. Areas outside the RFA regions are outside the scope of this analysis.
- **Analytical scope.** This report is focused on synthesising the findings of existing analyses undertaken and/or commissioned by DELWP. Some limited data analysis has been undertaken to address gaps in the review (discussed below) using data provided by DELWP.
- **Data availability.** This review draws heavily on data relating to the extent of forest EVCs, Modelled Old-Growth forest and wilderness across the RFA regions. Whilst this data is appropriate for assessing performance against some of the 'quantitative' JANIS criteria (i.e. those with specified numeric thresholds), more detailed data (including spatial data and data on habitat quality/condition) would be required for an assessment against the 'qualitative' JANIS criteria (i.e. those without a specified numeric threshold). Because of these data and methodological gaps, assessment of these 'qualitative' criteria is outside the scope of this review.

Further, the data available to evaluate the performance of the CAR Reserve System for wilderness areas was limited compared to the biodiversity and old-growth forest criteria. The most recent evaluation of wilderness areas in Victoria was completed in 1995/1996, and the format of the data did not allow for the same level of detailed assessment (i.e. breakdown by individual EVC types, different land tenure etc) as for the other criteria. It should be noted that such detailed breakdown is not a requirement under the JANIS criteria, but may be desirable for more completeness.

- **Data integration challenges (bushfires).** The data used in this assessment (EVC extent data updated in 2019/2020) does not incorporate the impacts of the 2019/20 bushfires on EVC extent or condition. Whilst the findings of the Major Event Review (discussed in this report) do describe the impacts of the bushfires, it was not possible to access and incorporate data on their impacts into the quantitative analysis. Given the scale and intensity of those fires, the conclusions on the comprehensiveness, adequacy and representativeness of the reserve network within the RFA regions should therefore be considered provisional, and likely to understate some potential issues.
- **Data reliability.** The analyses presented here rely on existing data sets, which combine modelled and remote-sensed data. Conclusions are based on the assumption that this data is sufficiently accurate and reliable for the purposes of this review.
Of particular note are those areas within the EVC data classified as 'complexes', 'mosaics', 'aggregates' and 'niches' - these are 'mapping units' (typically combinations of two EVC types) requiring an appropriate EVC to be determined and assigned on site. These represent 168 of the 259 EVC classes included within this evaluation. As it is not possible to reliably attribute these classes to a more specific individual EVC (and given their significance in terms of both area and number), they have been retained in the analysis as classified in the original data. There would be significant value in revisiting this analysis once more reliable site-based classifications have been completed.
- **Effectiveness of protections.** The analyses presented here focus on the spatial extent of protections, rather than the effectiveness of the protections themselves (e.g. extent to which informal reserves and management prescriptions offer effective protection of key habitat values in practice on the ground). For the purposes of this review, we have assumed that these protections are effective, but this assumption may require further testing in subsequent reviews.

2.1 ASSESSMENT AGAINST JANIS CRITERIA

This component of the review is intended to assess the performance of the Victorian CAR Reserve System against the JANIS criteria. The primary focus is on the five 'quantitative' JANIS criteria (i.e. those with specified numeric thresholds) although discussion of the other criteria is included in section 2.1.4.

Data used for this component of the review primarily focuses on extent of forest Ecological Vegetation Classes (EVCs) in Victoria, as well as data on extent of Modelled Old-Growth forest and wilderness areas in Victoria.

2.1.1 OVERVIEW

Table 2-1 provides a high-level snapshot of the five Victorian RFA regions against five of the eleven JANIS criteria. The five criteria reported here are those that have a specific quantitative threshold defined. Therefore, it is critical to note that the data presented here only represents a partial assessment of the performance of the reserve system against the JANIS criteria.

Similarly, in the document that records the nationally agreed CAR criteria it is noted that *'reserves should be designed so that, to the extent practicable, all elements of biodiversity have the opportunity for expression but with particular emphasis on those components of biodiversity that are dependent on reservation for protection.'* It is important to note that this assessment has used data on Ecological Vegetation Classes (EVC) (and the extent to which they are found in the CAR Reserve) as the indicator of how forest ecosystems perform against the JANIS criteria. This assessment is confined to the CAR Reserve only, on the assumption that EVCs within the CAR Reserve are afforded a level of protection. It is possible that EVCs that are outside the CAR Reserve system are protected but this has not been assessed in this review.

KEY MESSAGES & CONTEXT:

- **For three of the five 'quantitative' JANIS criteria (pre-1750 extent, vulnerable EVCs and rare/endorsed EVCs), all RFA regions have a significant number of EVCs that fall below the criteria thresholds.** The most prominent of those is the rare or endangered EVCs. Given their inherent scarcity, these shortfalls are particularly significant. However, it is important to note that while the threshold for this particular criterion is that 'all remaining occurrences' of rare or endangered EVCs 'should be reserved or protected', the criteria also includes the term 'as far as is practicable'. This recognises the practical constraints at protecting every remaining fragment of a particular vegetation type. However, the shortfalls are significant for a large number of rare/endorsed EVCs (i.e. more than half have less than 75% of remaining occurrences protected) – see Figure 2.1c below.
- **There are significant nuances within the data which are not reflected in the summary table, particularly the relating to the specific performance for individual EVCs.** In some cases, there are several EVCs that are just below threshold (noting that the JANIS criteria were not intended to set out rigid thresholds), where others fall more significantly short. This is particularly critical given that the JANIS criteria thresholds are intended to be for guidance only and were not to be used as a simple, binary ('pass/fail') measure in these types of assessments. Data on the performance for individual EVCs is presented in the more detailed assessments below.

Areas protected by policy (e.g. Immediate Protection Areas) are not included within the CAR Reserve System and therefore are not reflected in the analysis presented in

- Table 2-1. However, these areas do represent a significant effort to provide additional targeted protections to priority areas, and where they materially contribute to the level of protection, this is noted in the findings. Further discussion of these areas is also included in section 3.1.
- **Consideration of land tenure is also important for interpreting these results.** For many EVCs that fall short of the JANIS criteria, much of their current distribution outside the CAR Reserve System is on private land. This means that options for protection are different and limited (primarily via conservation covenants that must be agreed with individual landholders). Further discussion on land tenure and opportunities for further protection are included in section 3.1.
- **In terms of protection of old-growth forest and high quality wilderness areas, the performance is significantly better** with all regions effectively meeting the relevant criteria¹⁰.

¹⁰ Noting that in the North East region, the data provided does not enable a precise and accurate assessment of the area of high quality wilderness that is protected, but demonstrates that the area is >89% (relative to a 90% threshold).

Table 2-1: Overview of performance against the five ‘quantitative’ JANIS criteria (i.e. those with a specified numeric threshold) across the five RFA regions. Data indicates the extent to which the EVCs meet the JANIS criteria.

JANIS CRITERIA	Notes on criteria	PROPORTION OF EVCs THAT MEET CRITERIA (BY RFA REGION)				
		CENTRAL HIGHLANDS	EAST GIPPSLAND	GIPPSLAND	NORTH EAST	WEST
BIODIVERSITY:						
(1) 15% of pre-1750 extent	Applied according to regional circumstances, aiming to maximise proportion in dedicated reserves.	21/39 (53.8%)	30/33 (90.9%)	39/60 (65%)	28/66 (42.4%)	132/210 (62.9%)
(2) 60% of vulnerable EVCs	Vulnerable is based on reduction in areal extent that is near 70%, or the ecosystem is subject to continuing and significant threatening processes.	7/27 (25.9%)	16/24 (66.7%)	18/46 (39.1%)	14/50 (28.0%)	56/128 (43.8%)
(3) All remaining occurrences of rare/ endangered EVCs	The requirement that ‘all remaining occurrences’ of rare or endangered EVCs are reserved or protected is very challenging. i.e. if any area of the key EVCs is outside the CAR Reserve, the criteria is not reached. Figure 2.1c shows there are EVCs close to the 100%, but also those that fall well short.	0/10 (0%)	0/4 (0%)	0/11 (0%)	2/11 (18.2%)	17/66 (25.8%)
OLD-GROWTH FOREST:						
60% of old-growth	60% of old-growth forest should be protected for ecological (habitat, genetics, functionality) and recreational objectives.	18/18 (100%)	27/30 (90.0%)	38/40 (95.0%)	18/18 (100%)	120/129 (93.0%)
WILDERNESS:						
90% of high-quality wilderness	Two wilderness areas – Macalister and Razor/Viking – fall across the Gippsland/North East RFA regions boundary. 100% of both are within CAR Reserves. This means the figure for North East could be >89%, thereby meeting the threshold.	None present	92%	100%	>89%	None present

2.1.2 BREAKDOWN BY JANIS CRITERION

This section presents a breakdown of performance of individual forest EVCs against each of the five 'quantitative' JANIS criteria. In this section, data are pooled across RFA regions¹¹, but a more detailed breakdown by RFA region is provided in Section 2.1.3.

Biodiversity (1): 15% of pre-1750 distribution of forest EVCs

The assessment of protection relative to pre-1750 distribution includes all forest EVCs. 155 out of 259 EVCs (59.2%) meet the 15% threshold whilst 104 (40.2%) fall below. Given that the JANIS criteria thresholds are intended to be indicative, rather than exacting, it is important to note that some EVCs are only just below (as shown in Figure 2-1a), whilst others fall more significantly short.

It is also important to note that for 16 forest EVCs, the total current extent (both within and outside the CAR Reserve System) equates to less than 15% of the pre-1750 extent. Therefore, it would not be possible for these EVCs to meet the JANIS criteria, even if 100% of the current extent were protected within the Victorian VCAR Reserve System (although it is further noted none of the 16 are fully protected).

Further, this analysis highlights that 17 EVCs that are present within Victoria's RFA regions are not represented within the CAR Reserve System at all. 15 of these are 'mosaic' or 'complex' habitat types, and some have a very small total extent (<100ha in total across the five regions). It is important to note that within the EVC data, 'complexes', 'mosaics', 'aggregates' and 'niches' are mapping units requiring an appropriate EVC to be determined and assigned on site. Further work is required to better understand whether these mosaics/complexes comprise genuinely rare/range-restricted EVCs (and should therefore be priorities for protection), or whether this finding is an artefact of the classification/mapping/data interpolation. The wider context (beyond RFAs) is also important here: it may be that the distribution of these EVCs is primarily outside the RFA regions and that there are significant areas of protection beyond the RFA boundaries.

Biodiversity (2): 60% of current distribution of vulnerable forest EVCs

This assessment focuses on the subset of forest EVCs classified as 'vulnerable' in each of Victoria's bioregions and focus on proportion of current distribution included within the CAR Reserve System. 76 out of 182 vulnerable EVCs meet or exceed the 60% threshold (41.8%), whilst 106 (58.2%) fall below. For those that fall short, the level of protection within the CAR Reserve System varies significantly (Figure 2-1b).

Biodiversity (3): All remaining occurrences of current distribution of rare/endangered forest EVCs

This assessment focuses on the subset of forest EVCs classified as 'rare' or 'endangered' in each of Victoria's bioregions and focus on proportion of current distribution included in the CAR Reserve System. 15 out of 86 rare or endangered EVCs (17.4%) meet or exceed the 100% threshold, whilst 71 (82.6%) fall below, and again the extent to which they fall short varies significantly (Figure 2-1c). It is important to note that the wording for this particular criteria states that 'all remaining occurrences' of rare or endangered EVCs '*should be reserved or protected by other means as far as is practicable*'. This wording recognises the practical constraints at protecting every remaining fragment of a particular vegetation type and, therefore, the challenges in meeting the implied 100% threshold. Even so, the shortfalls are significant for a large number of rare or endangered EVCs (i.e. more than half have less than 75% of remaining occurrences protected) (Figure 2-1c).

¹¹ The results described in this section are based on the data used to prepare Table 2-1 however, because the same EVCs occur in multiple regions, the number of EVCs above and below the thresholds cannot be calculated directly from the results in Table 2-1.

Old-growth forest: 60% of current distribution of old-growth forest

This assessment is based on the modelled extent of old-growth forest in Victoria (using DELWP's Modelled Old-Growth data layer, 'MOG'). The performance in terms of protection of old-growth forest appears to be good, with over 90% of EVCs meeting the relevant JANIS criteria. This is in line with the Victorian government's commitment to end timber harvesting of old-growth forests. However, there were some significant shortfalls for a small number of EVCs in each region (Figure 2-1d). This includes Floodplain Riparian Woodland, Low Rises Woodland, Sand Forest, Sedgy Swamp Woodland, Drainage-line Woodland, Lunette Woodland and a number of 'mosaic' EVCs (requiring further investigation). It should be noted that in all of these cases, the total extent of the EVC is very small (in several cases, >1ha). Further information and assessment is required to determine if these are truly rare areas of old-growth forest, or a data aberration (given that this is based on *modelled* extent) and should therefore be disregarded.

Wilderness: 90% of current distribution of high quality wilderness areas

This assessment is based on analyses undertaken outside this review process, and so there is not perfect data alignment with the RFA boundaries (i.e. some areas classified as 'wilderness' span two RFA regions). However, there is clear indication that across all RFA regions where high quality wilderness has been identified (East Gippsland, Gippsland and North East), the performance in terms of protection of wilderness areas also appears to be good, with all RFA regions being very close to (within <1%) or exceeding the 90% threshold set out in the JANIS criteria.

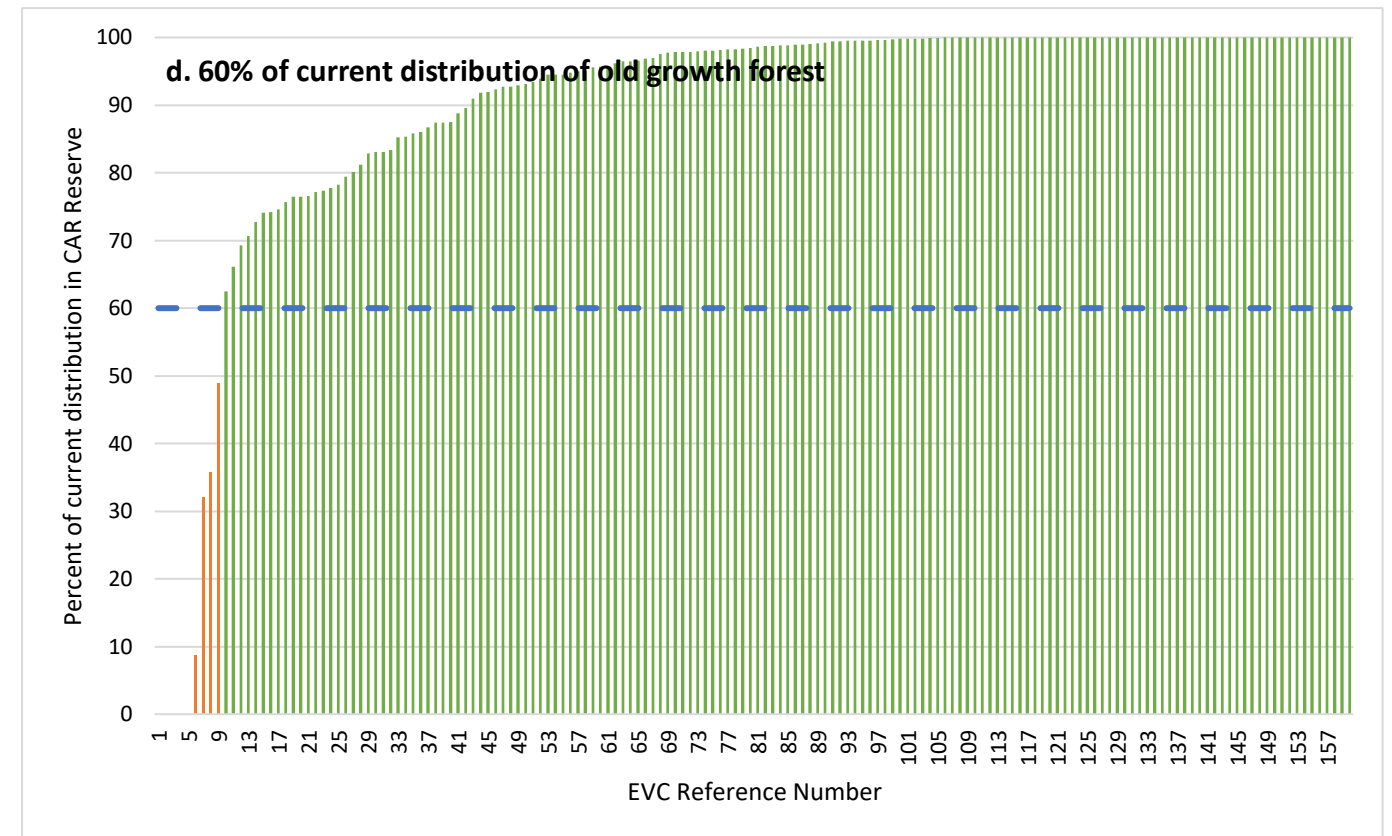
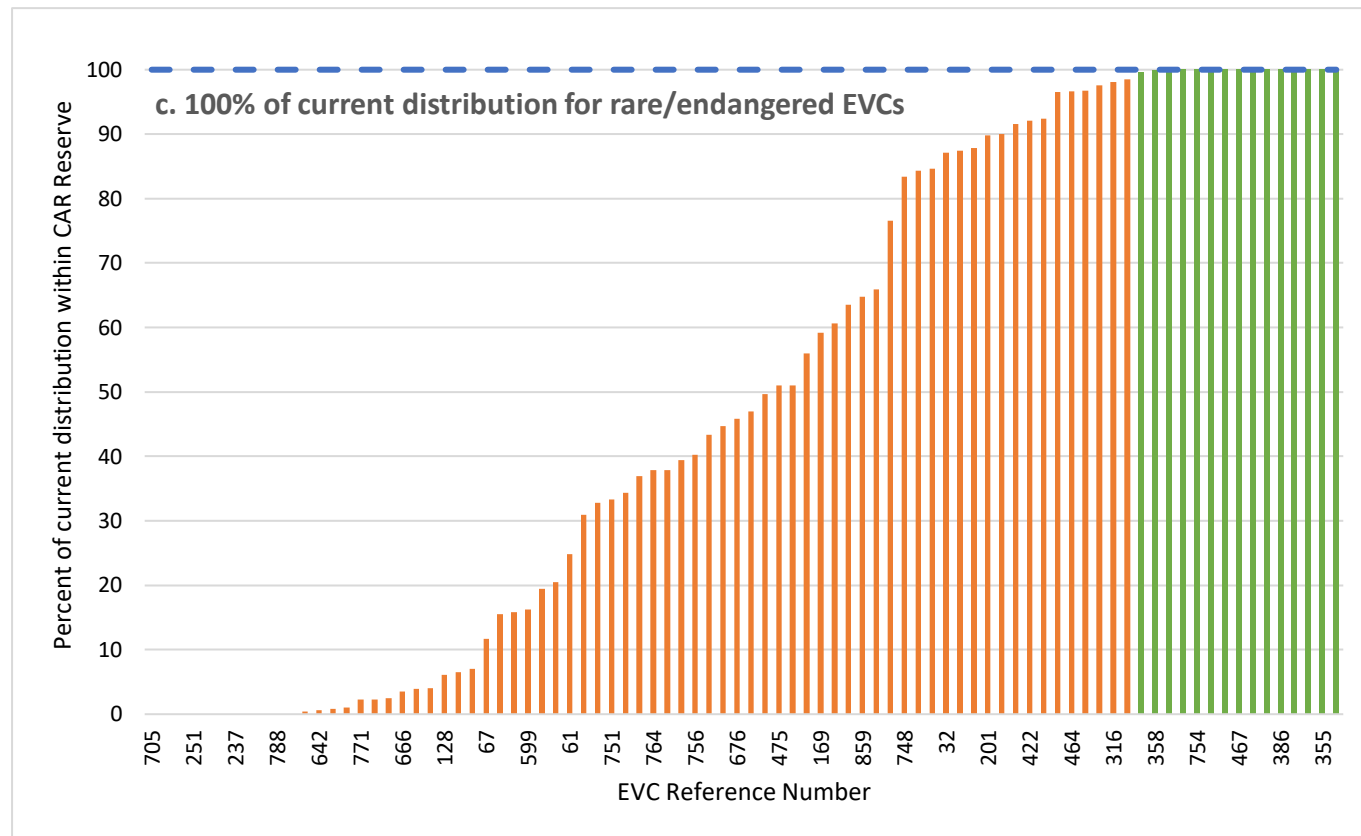
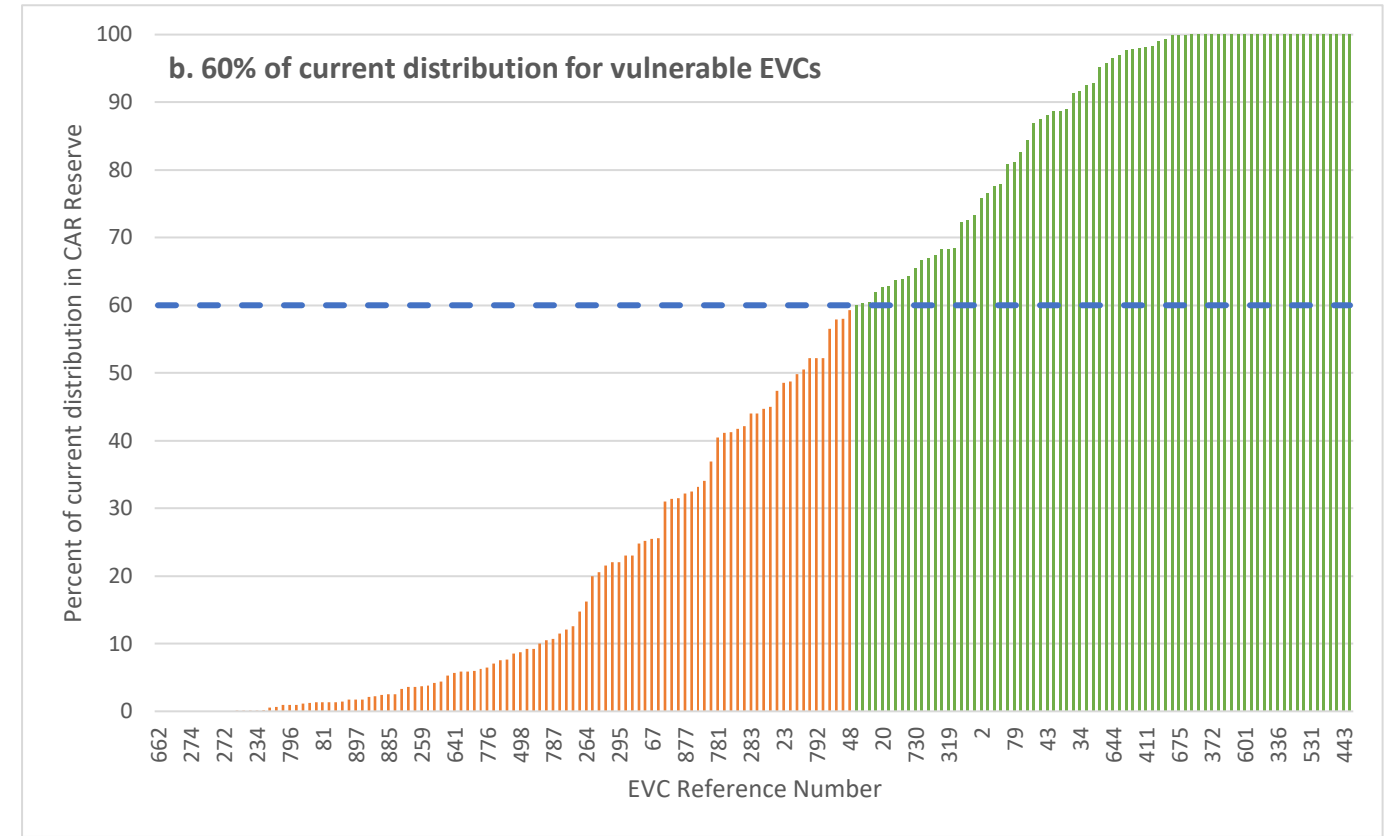
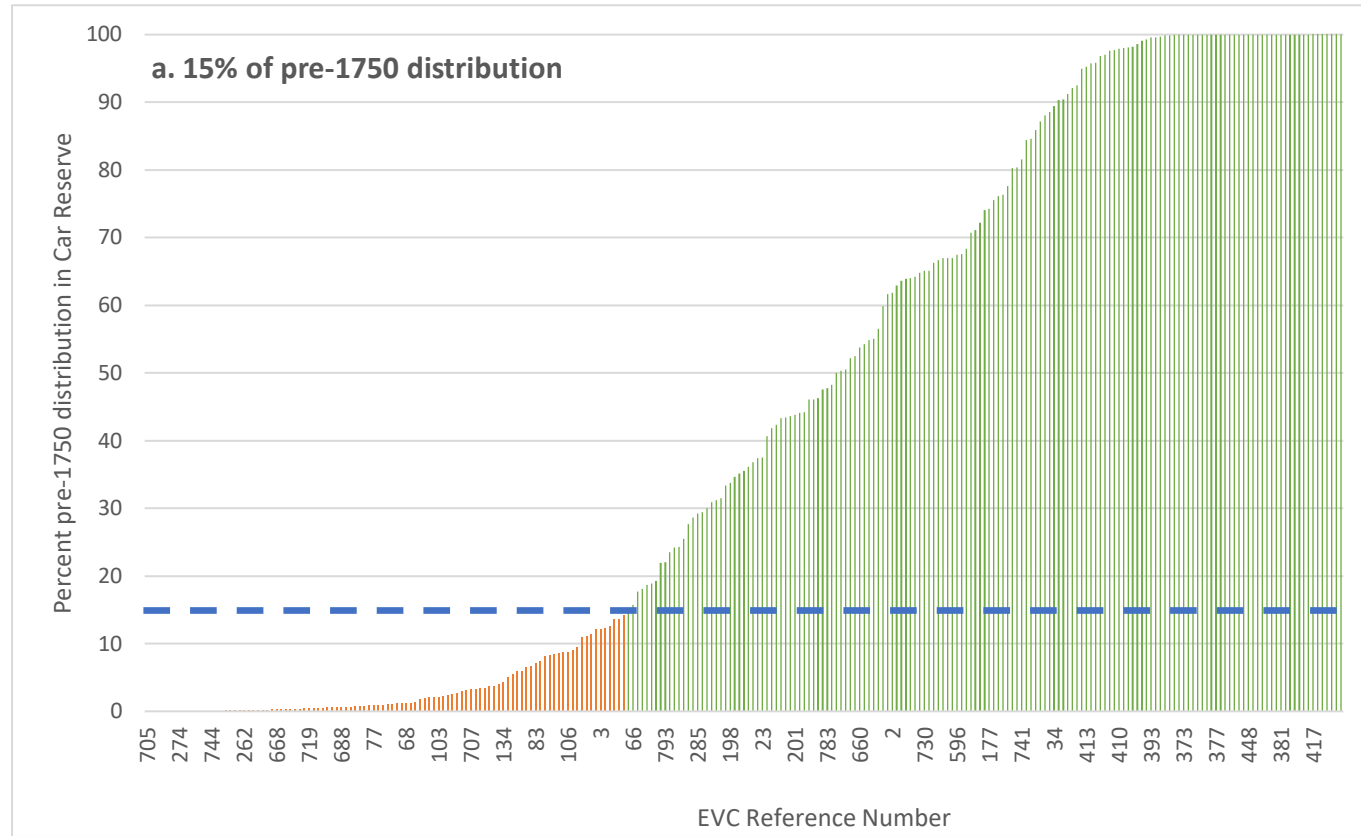


Figure 2-1: Performance of individual EVCs against the key JANIS criteria. EVCs that meet the threshold (dashed line) are shown in green, those that do not are shown in orange. Data are pooled across all RFA regions.

2.1.3 BREAKDOWN BY RFA REGION

This section of the report includes a breakdown of the assessment against the 'quantitative' JANIS criteria for each of the five Victorian RFA regions individually:

- Central Highlands (Figure 2-2)
- East Gippsland (Figure 2-3)
- Gippsland (Figure 2-4)
- North East (Figure 2-5)
- West (Figure 2-6).

Whilst there are some significant variations in forest types present (in terms of specific EVCs included, and the total number of EVCs in each region), the patterns discussed earlier in this section are repeated across all regions. Reviewing the figures for the five RFA region shows that no region performs significantly better or worse than the others.

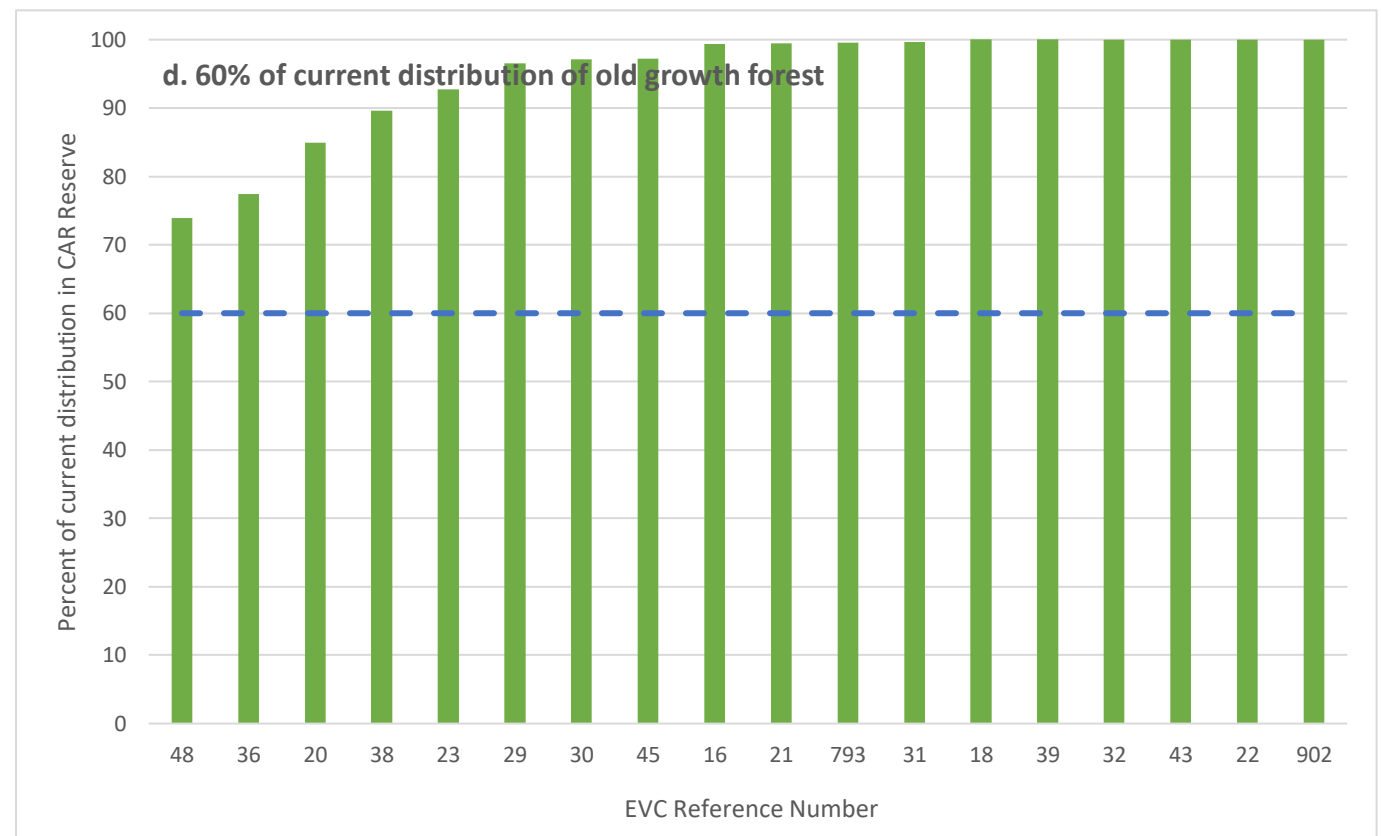
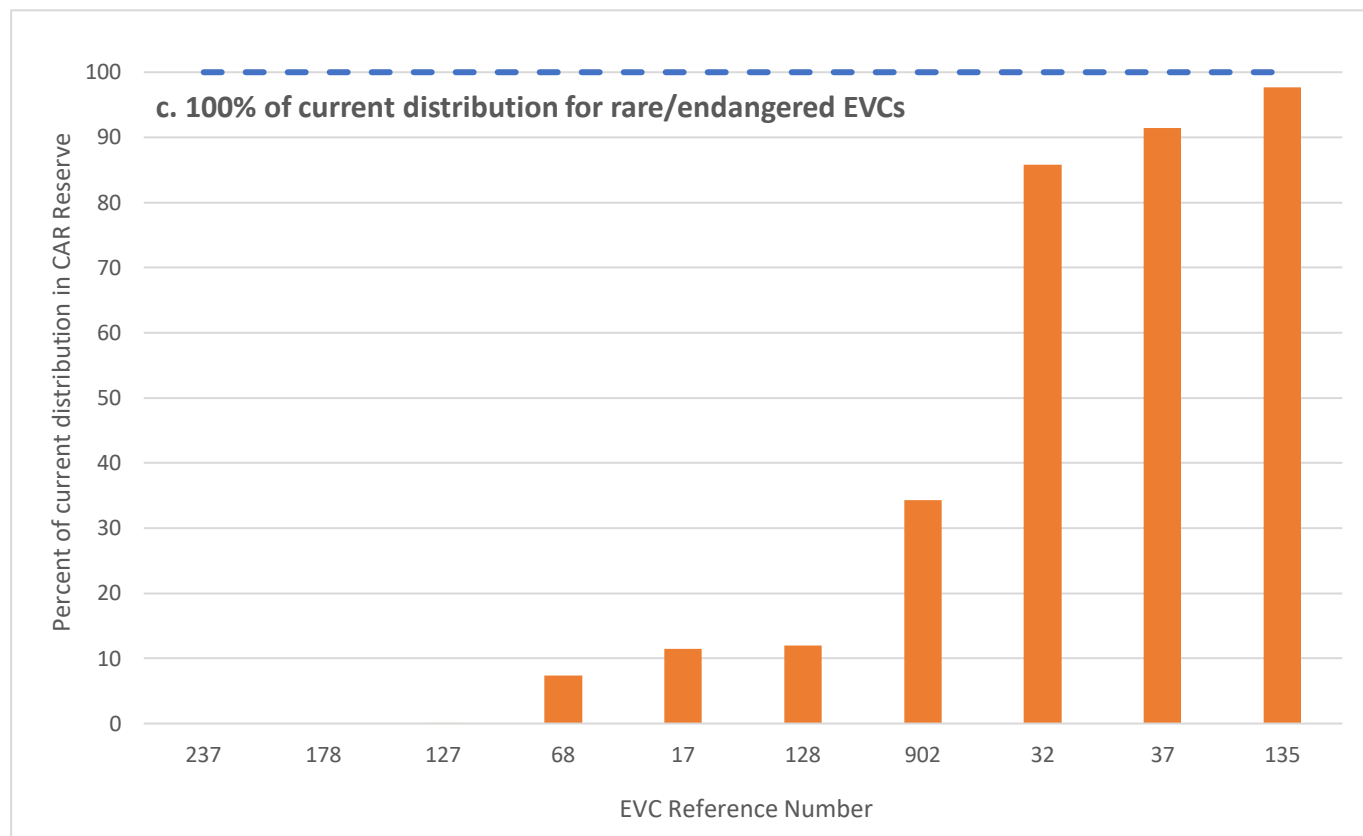
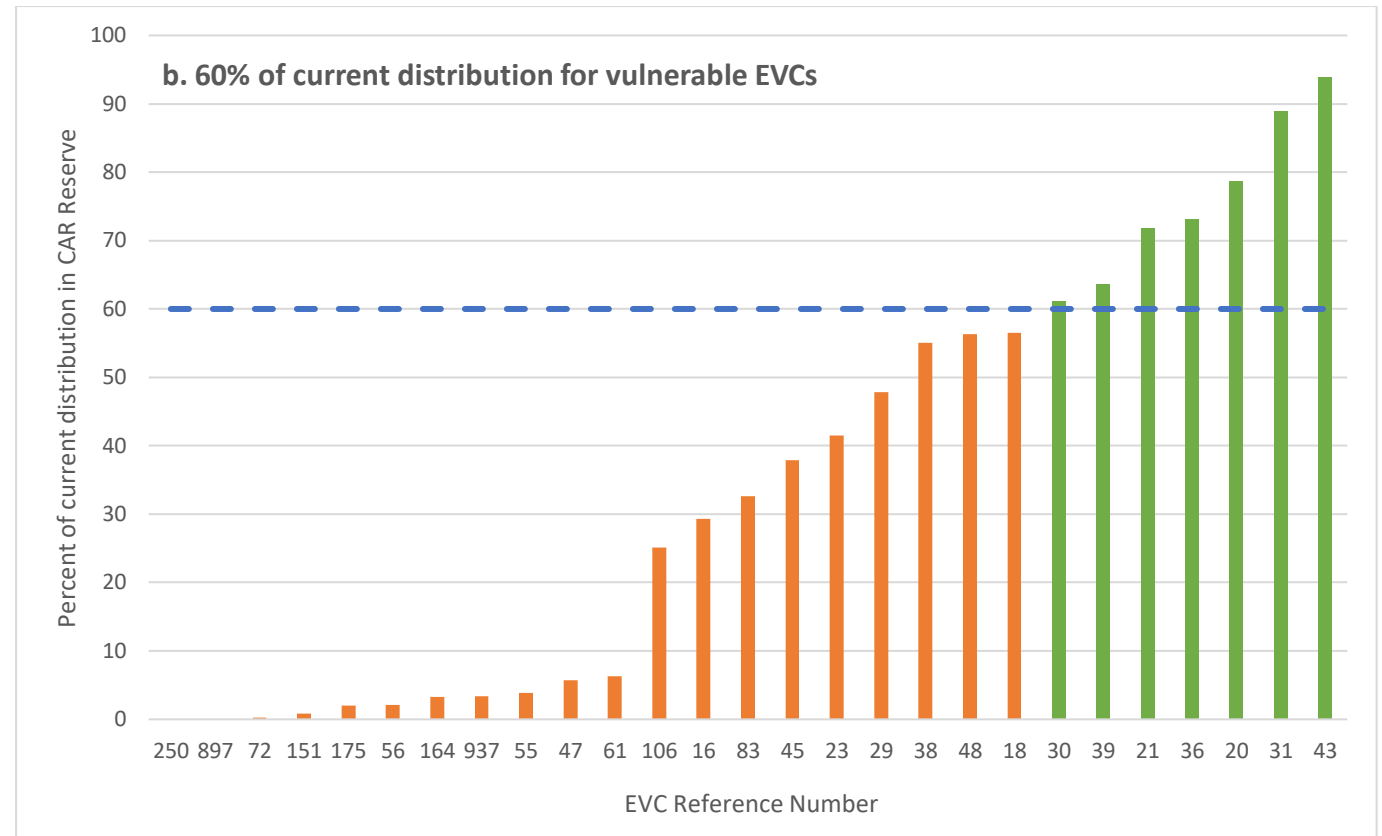
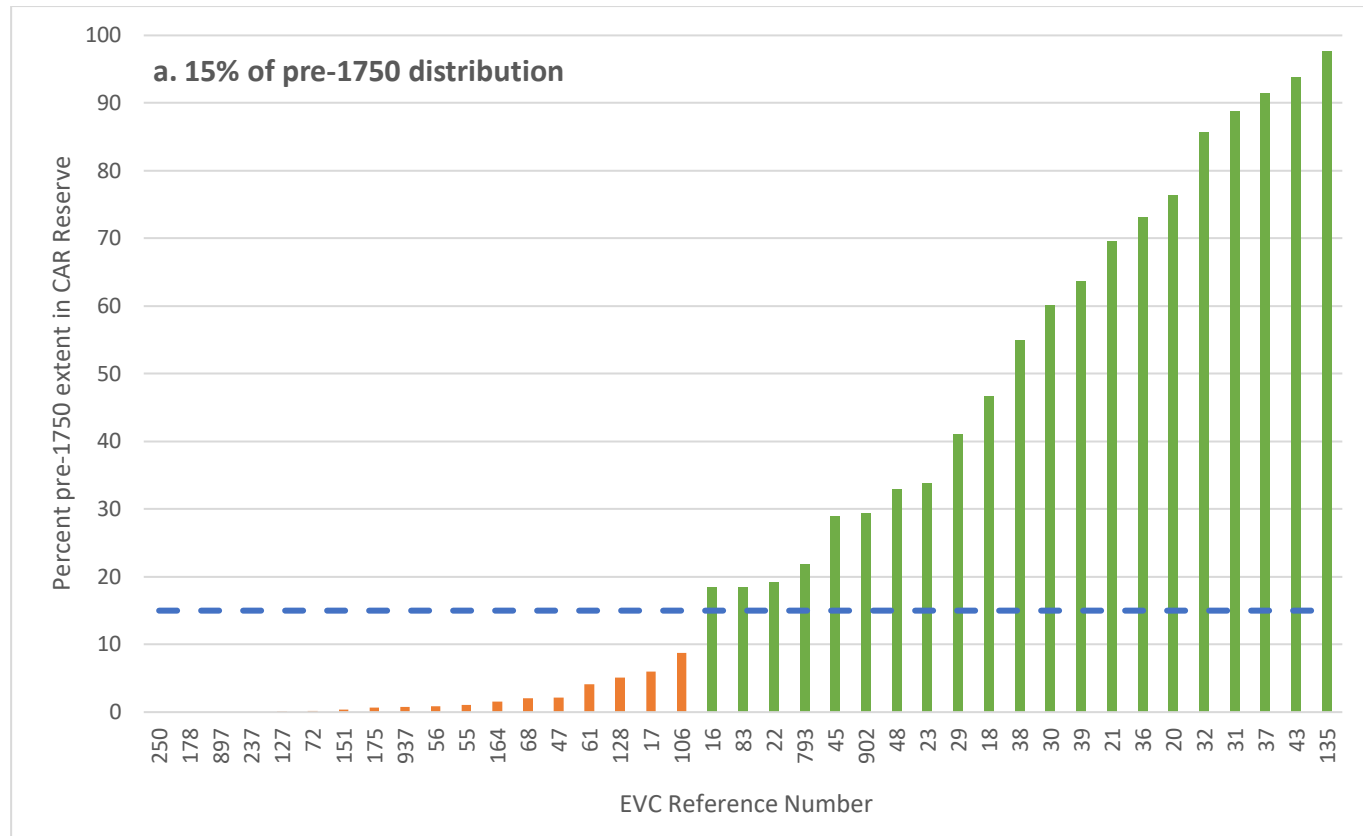


Figure 2-2: Central Highlands RFA Region - Performance of individual EVCs against the key JANIS criteria. EVCs that meet the threshold (dashed line) are shown in green, those that do not are shown in orange.

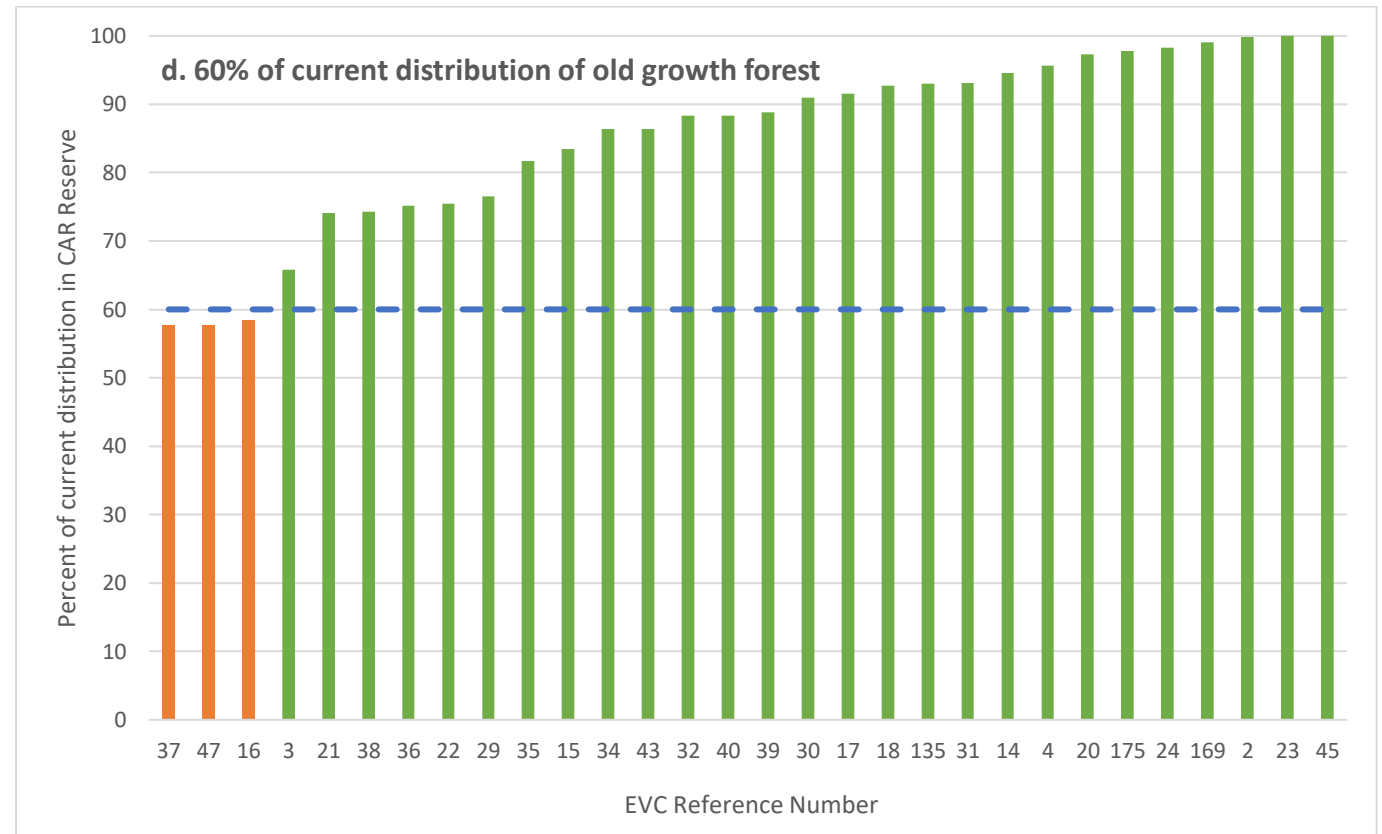
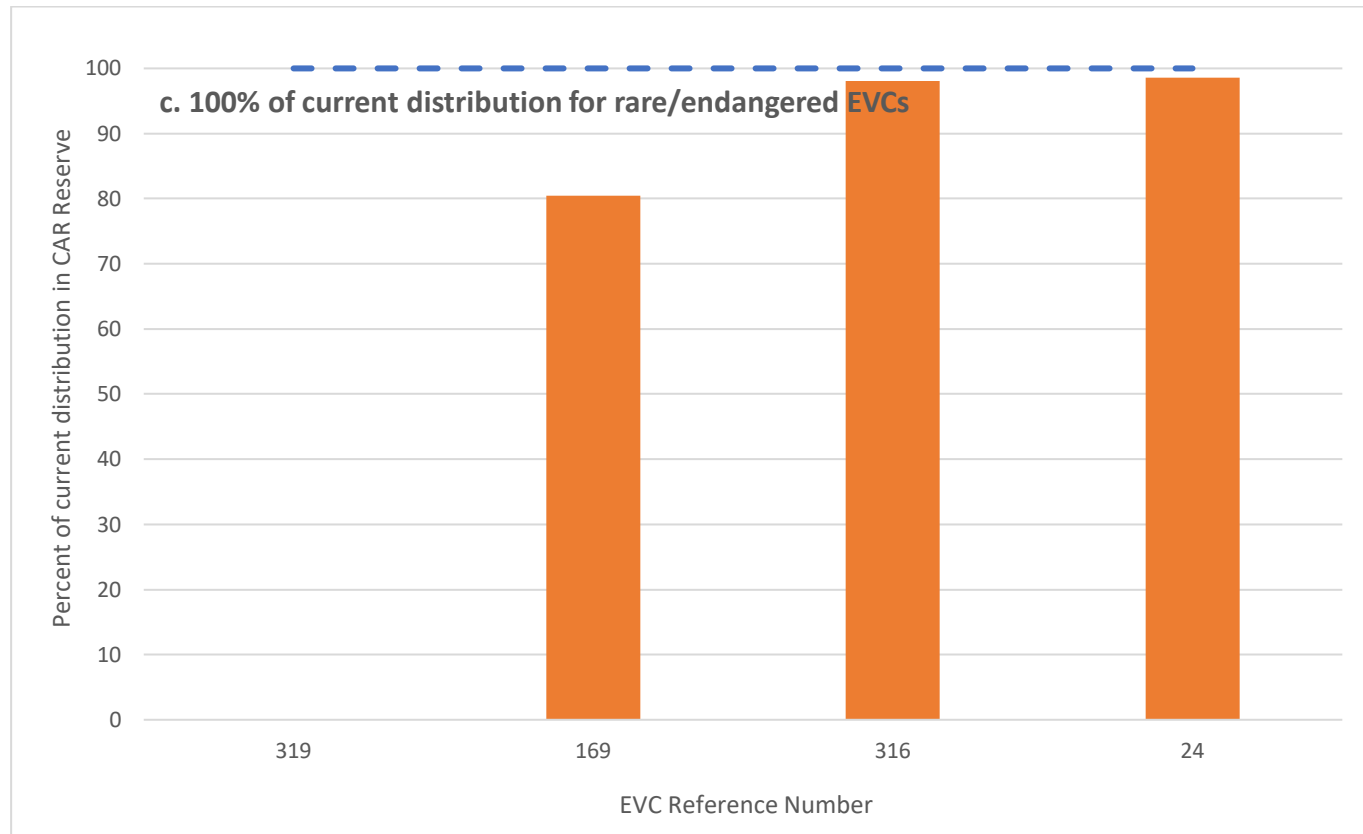
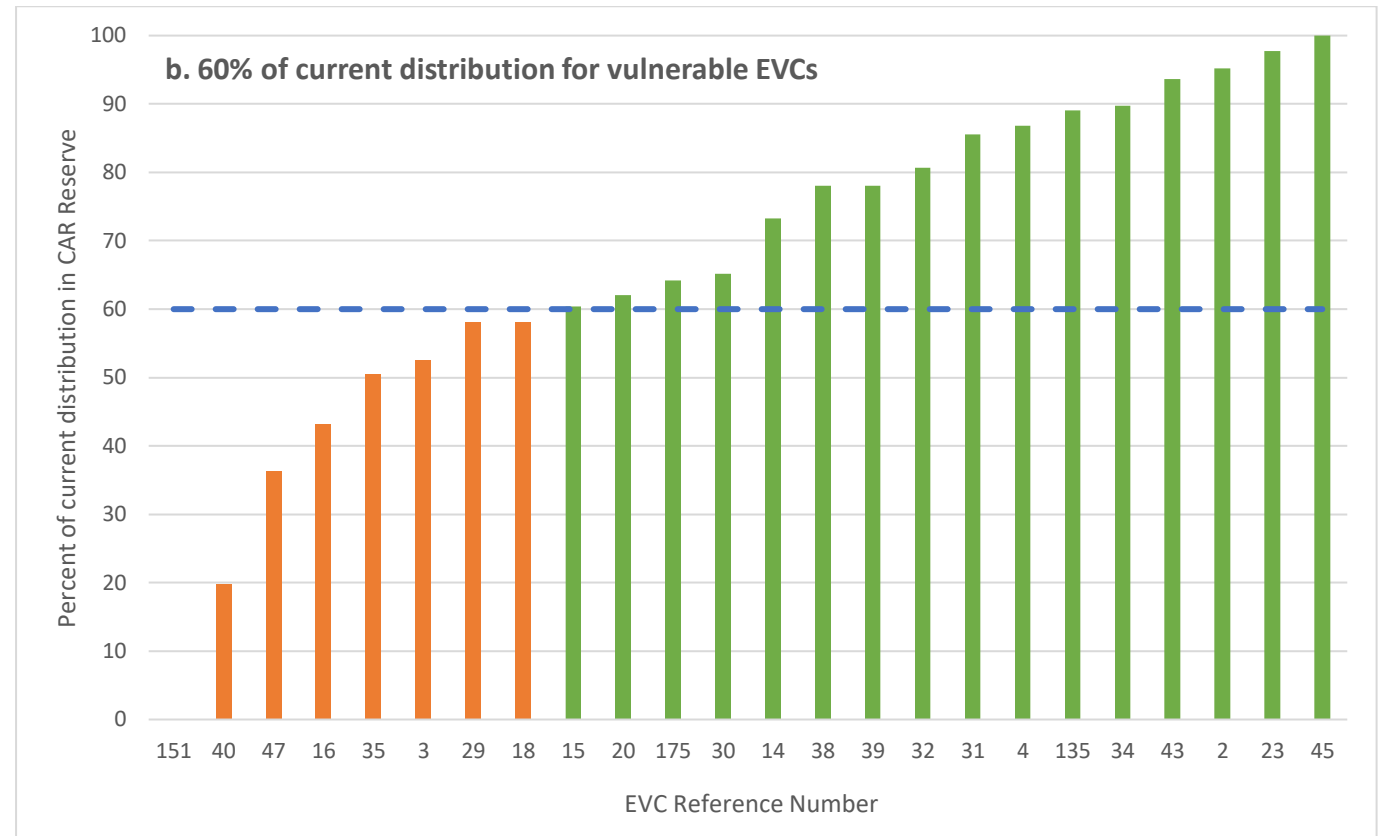
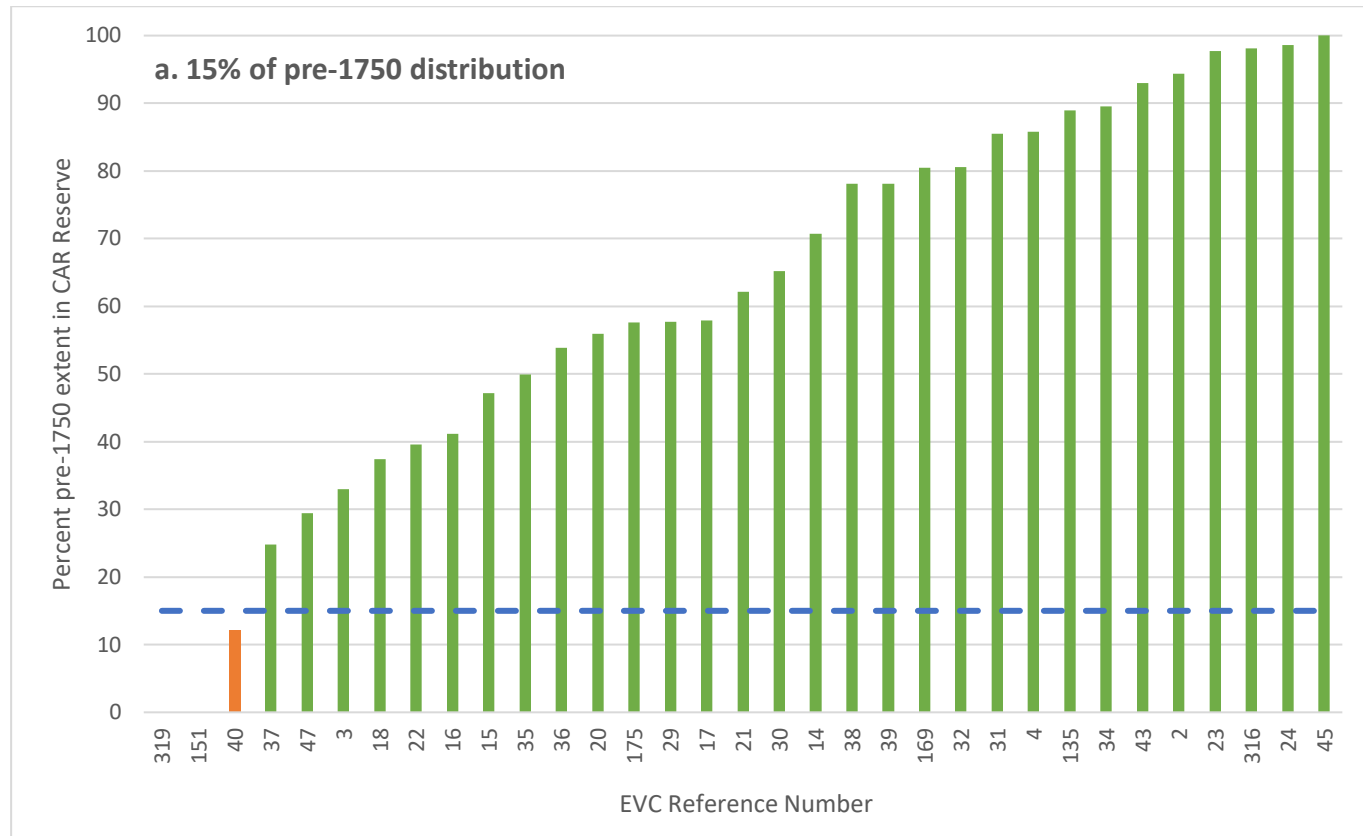


Figure 2-3: East Gippsland RFA Region - Performance of individual EVCs against the key JANIS criteria. EVCs that meet the threshold (dashed line) are shown in green, those that do not are shown in orange.

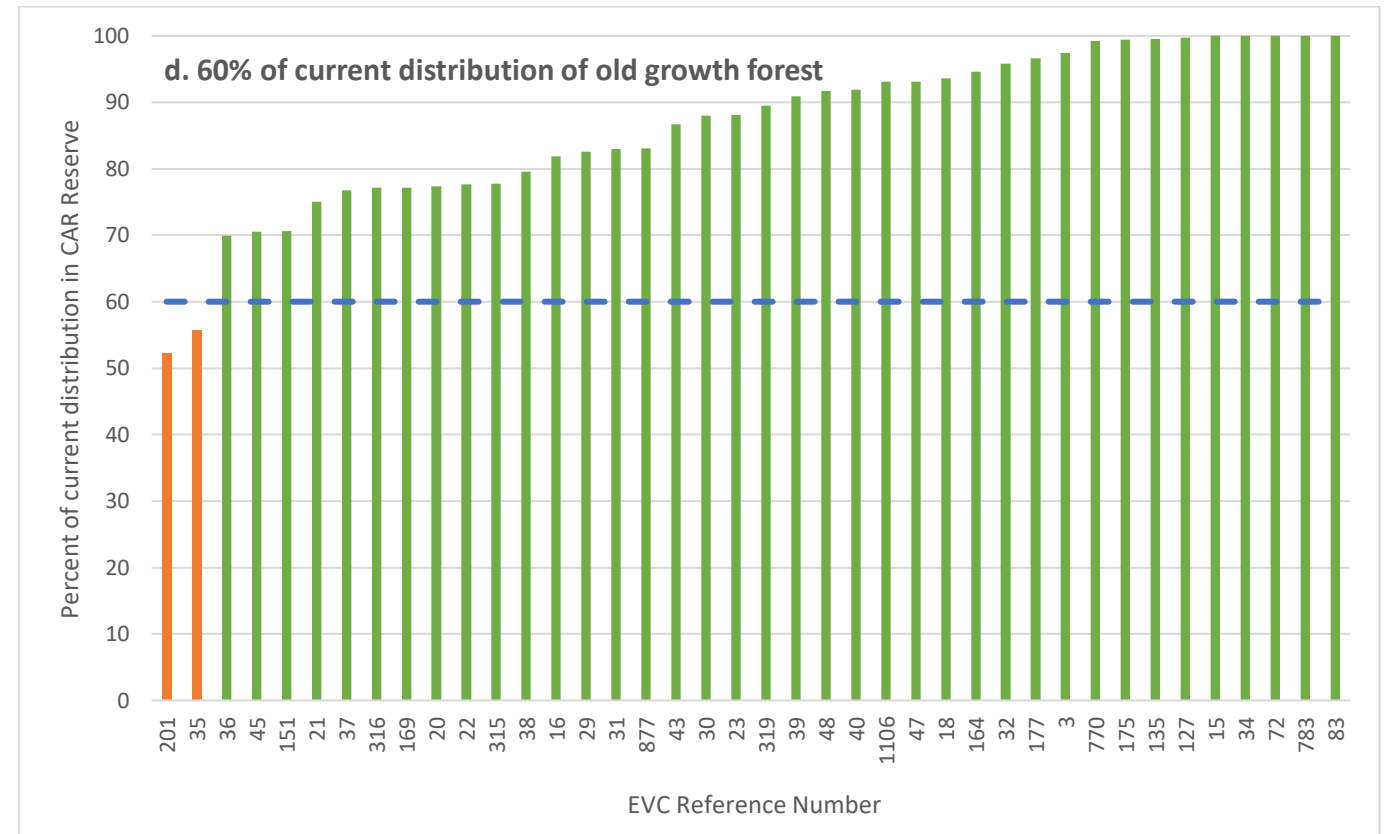
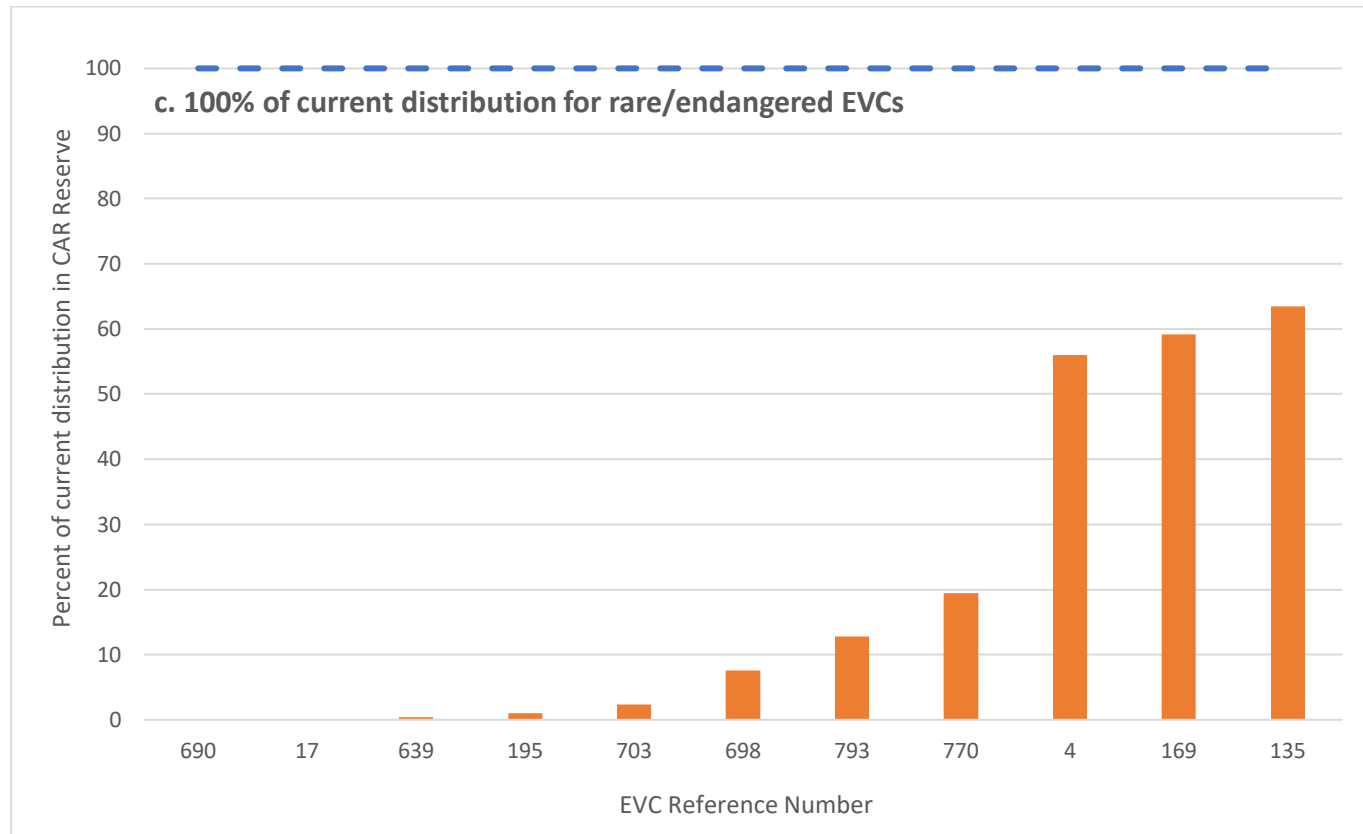
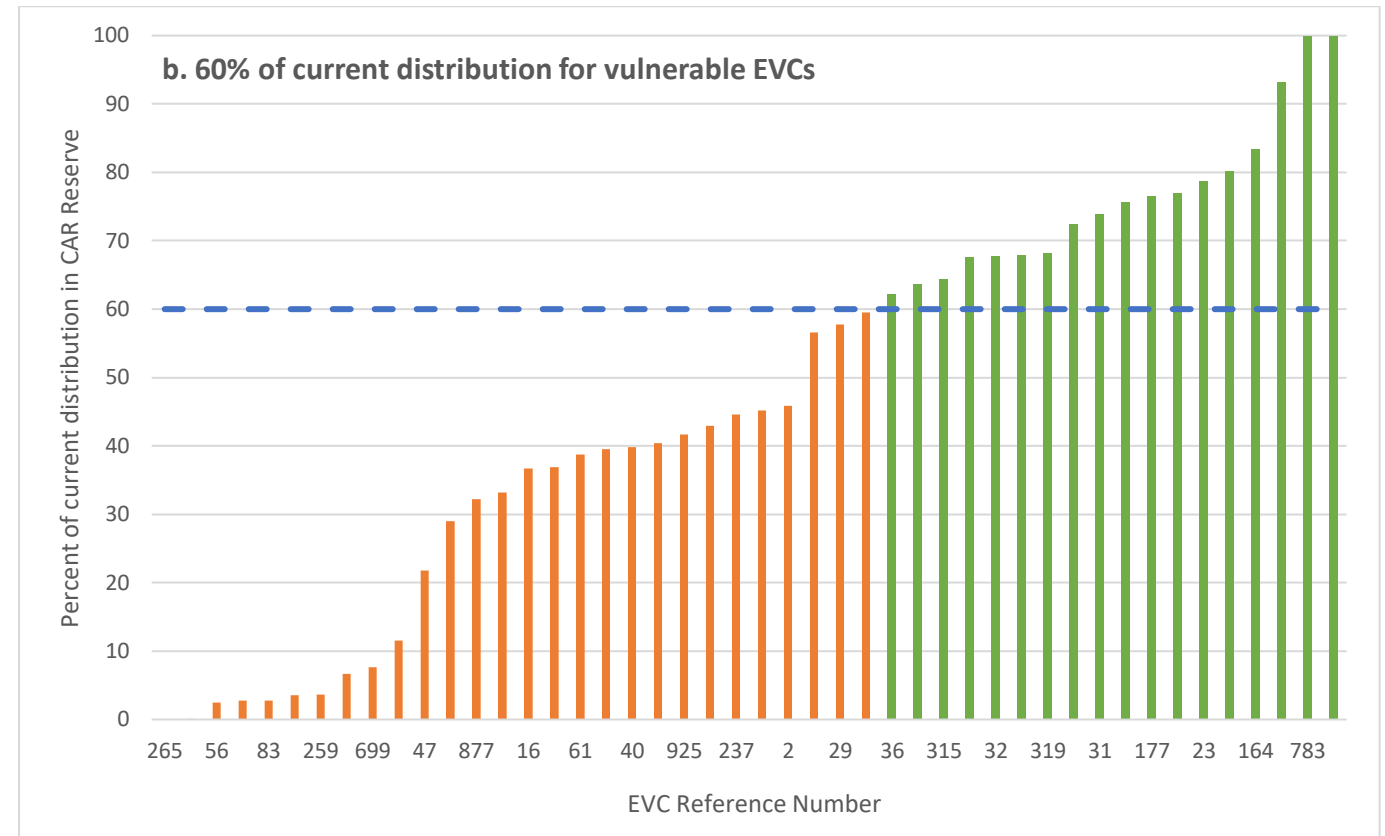
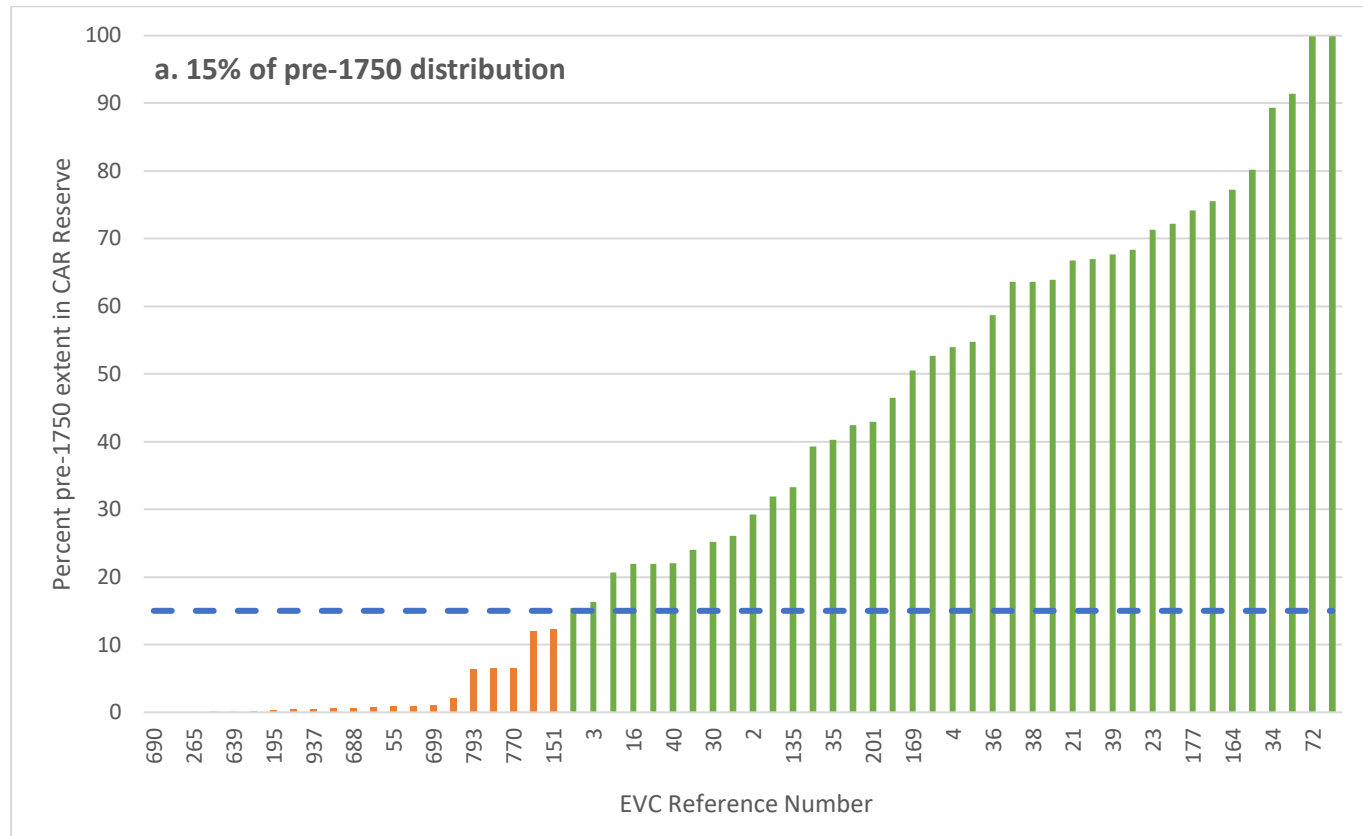


Figure 2-4: Gippsland RFA Region - Performance of individual EVCs against the key JANIS criteria. EVCs that meet the threshold (dashed line) are shown in green, those that do not are shown in orange.

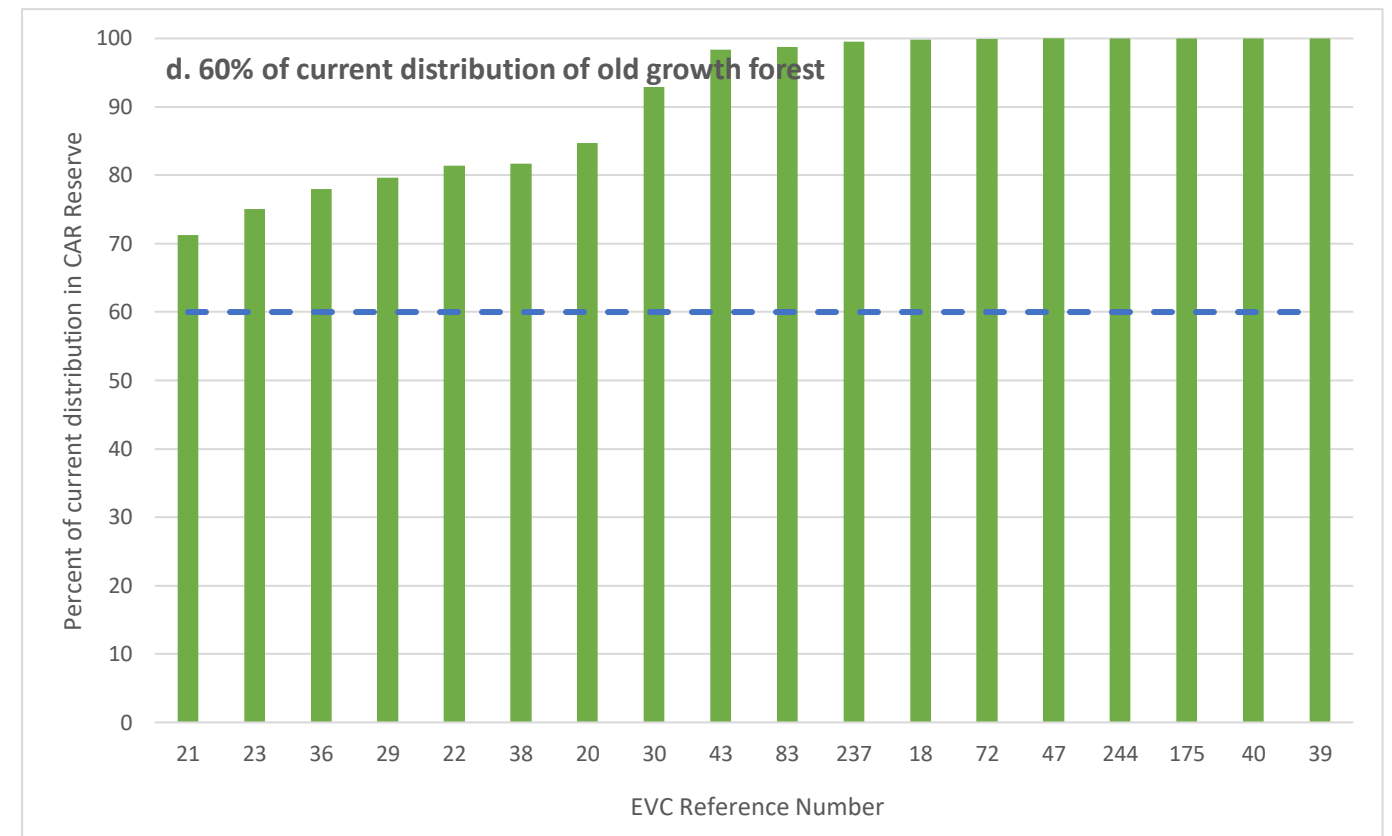
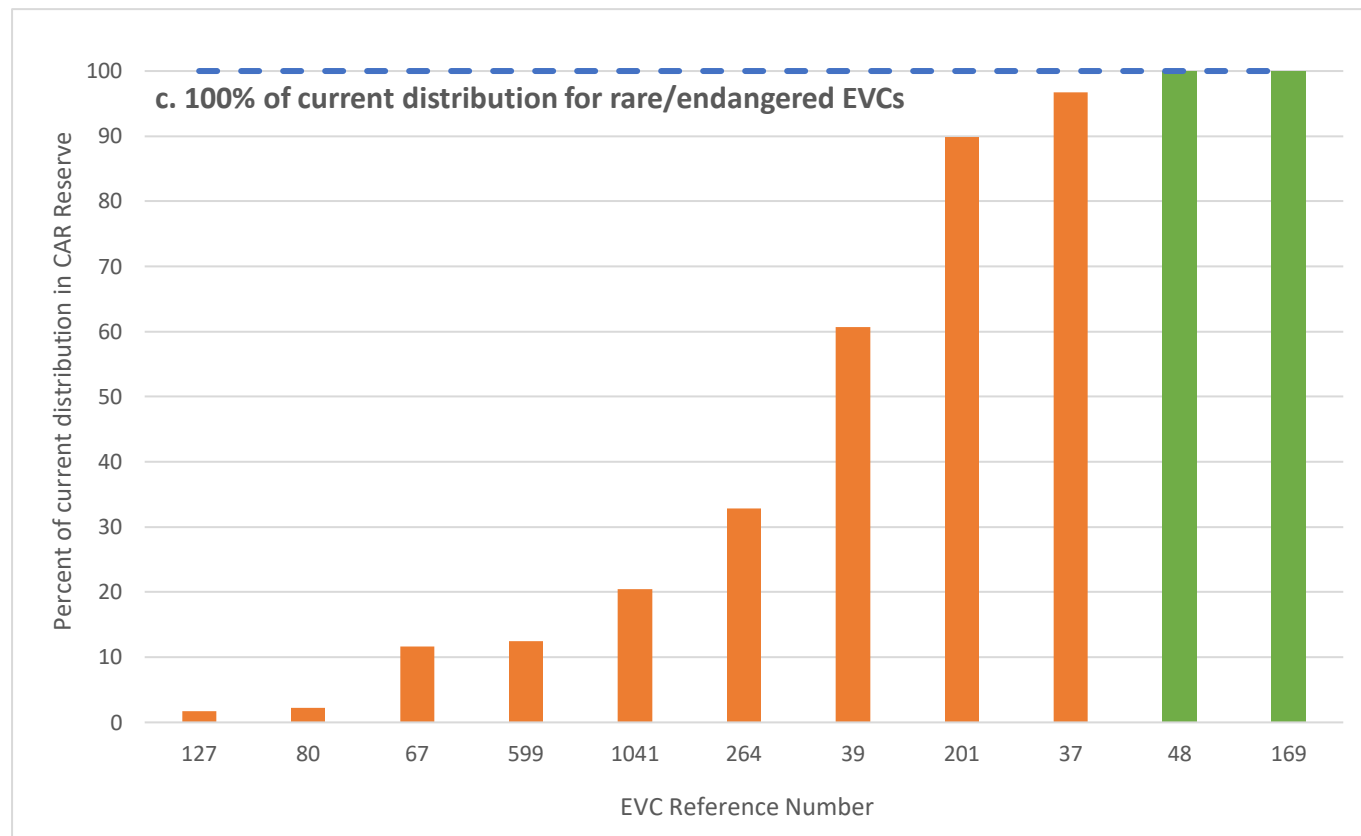
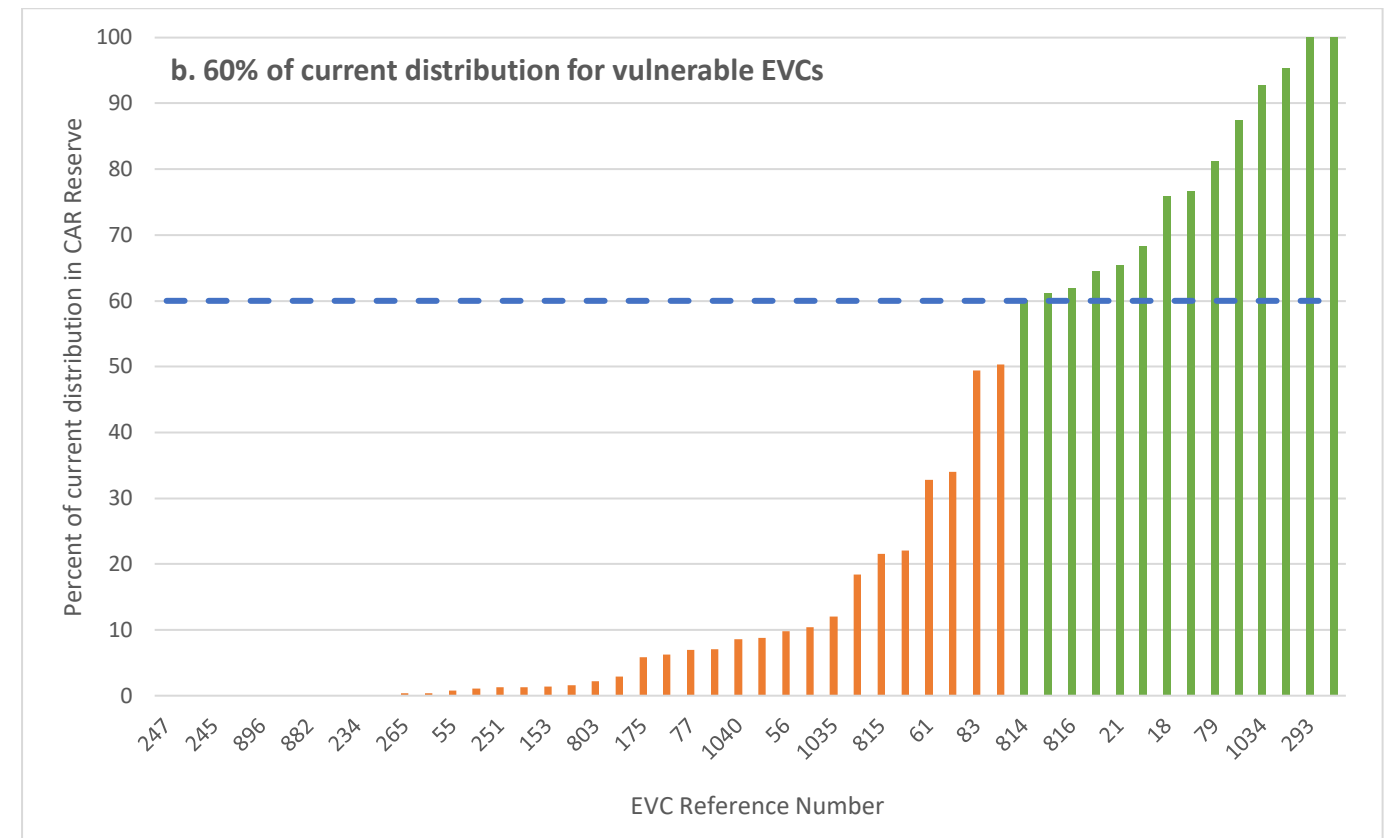
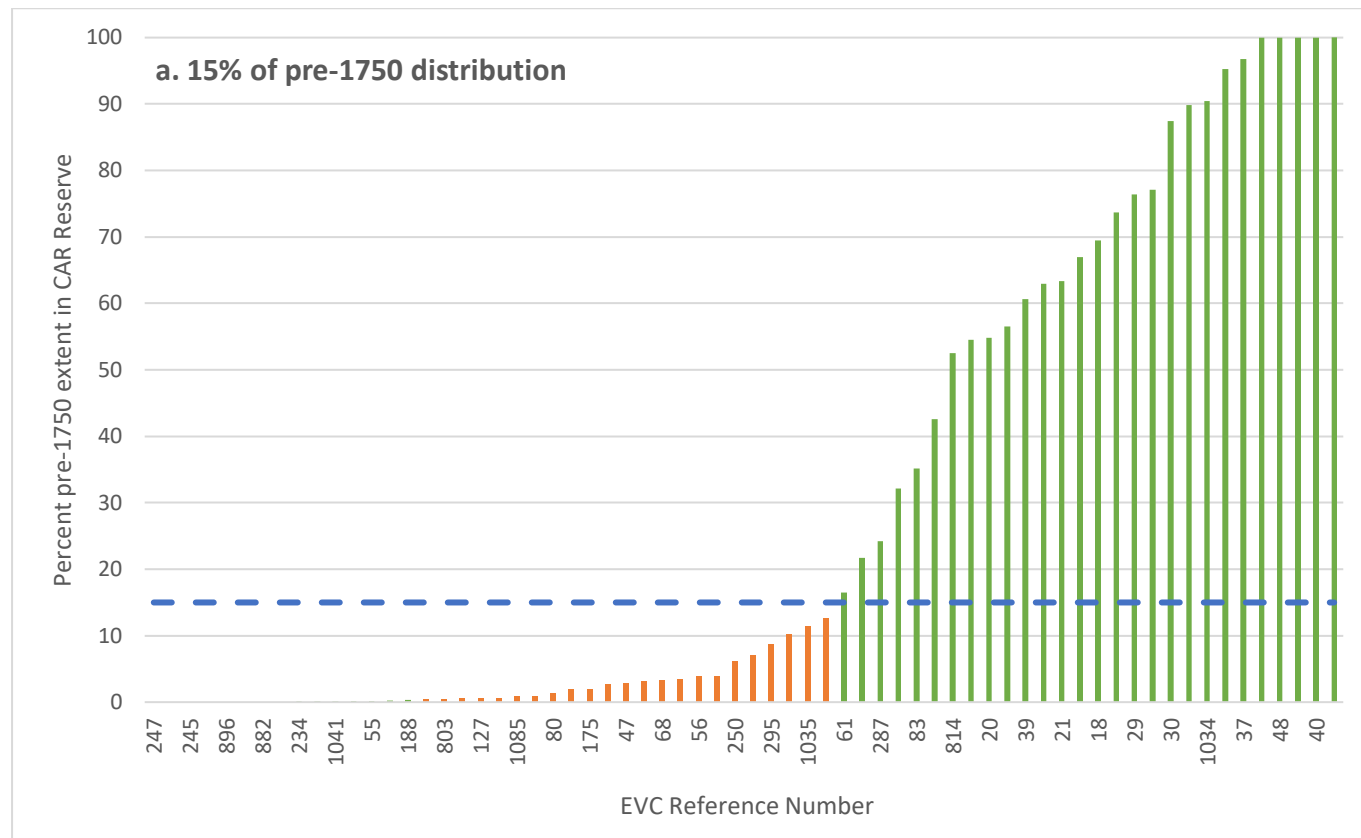


Figure 2-5: North East RFA Region - Performance of individual EVCs against the key JANIS criteria. EVCs that meet the threshold (dashed line) are shown in green, those that do not are shown in orange.

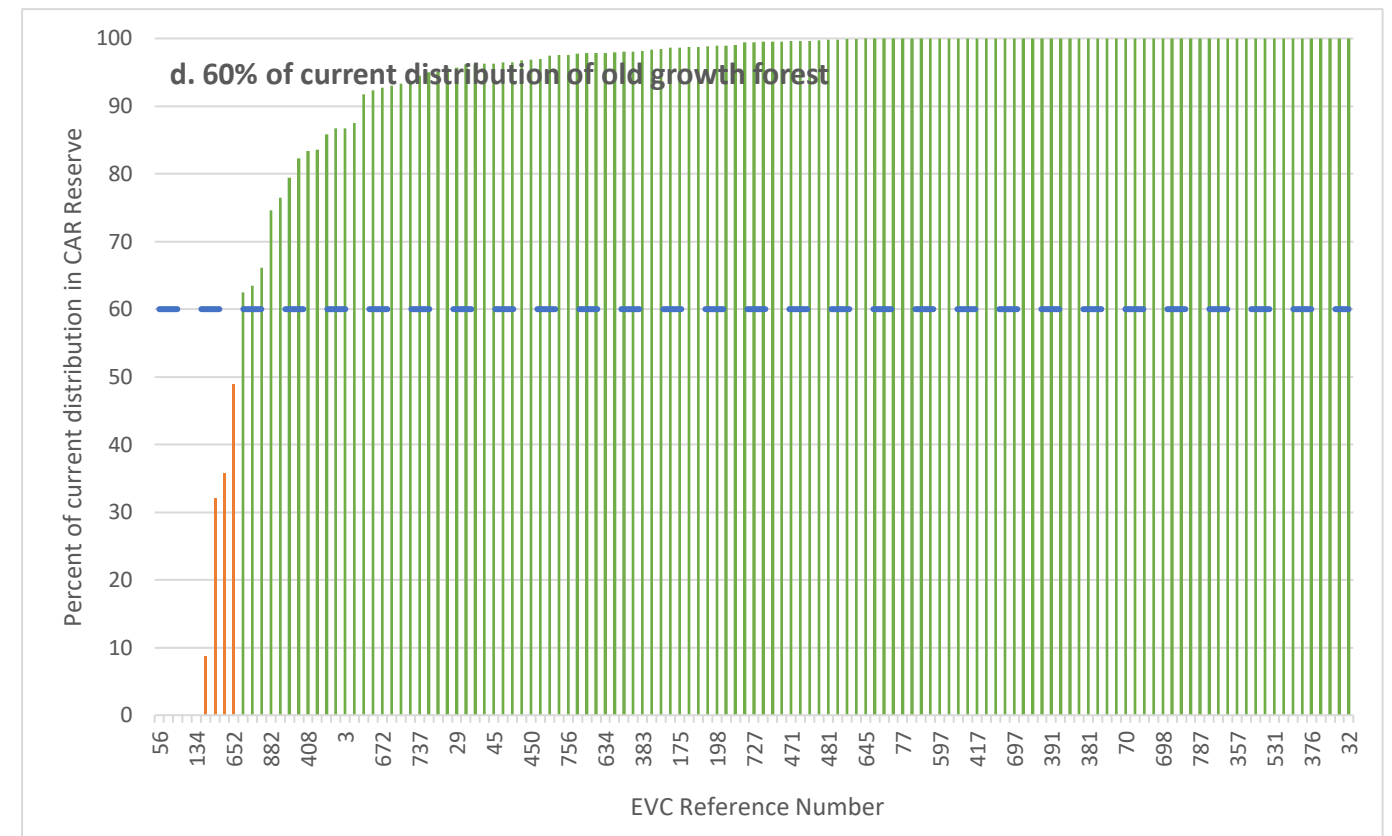
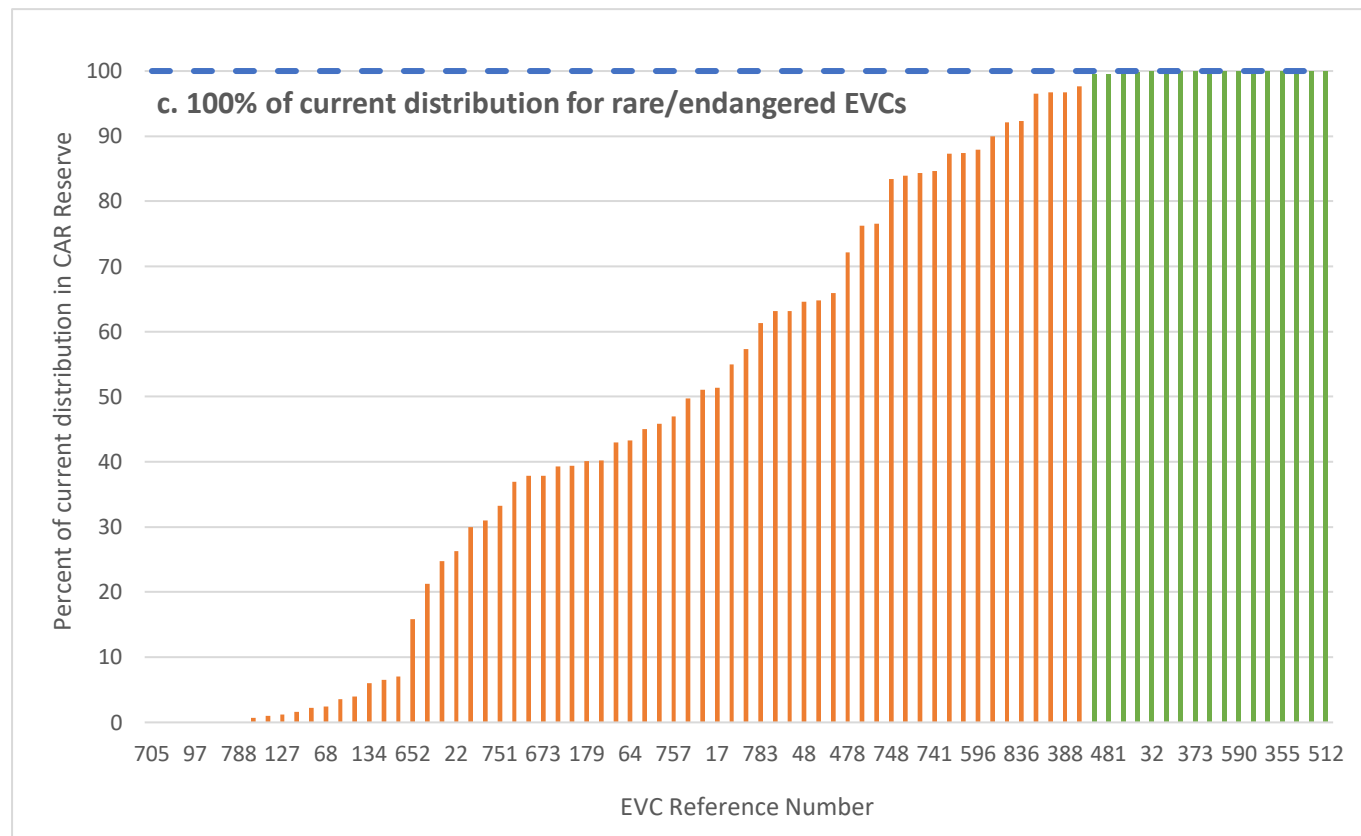
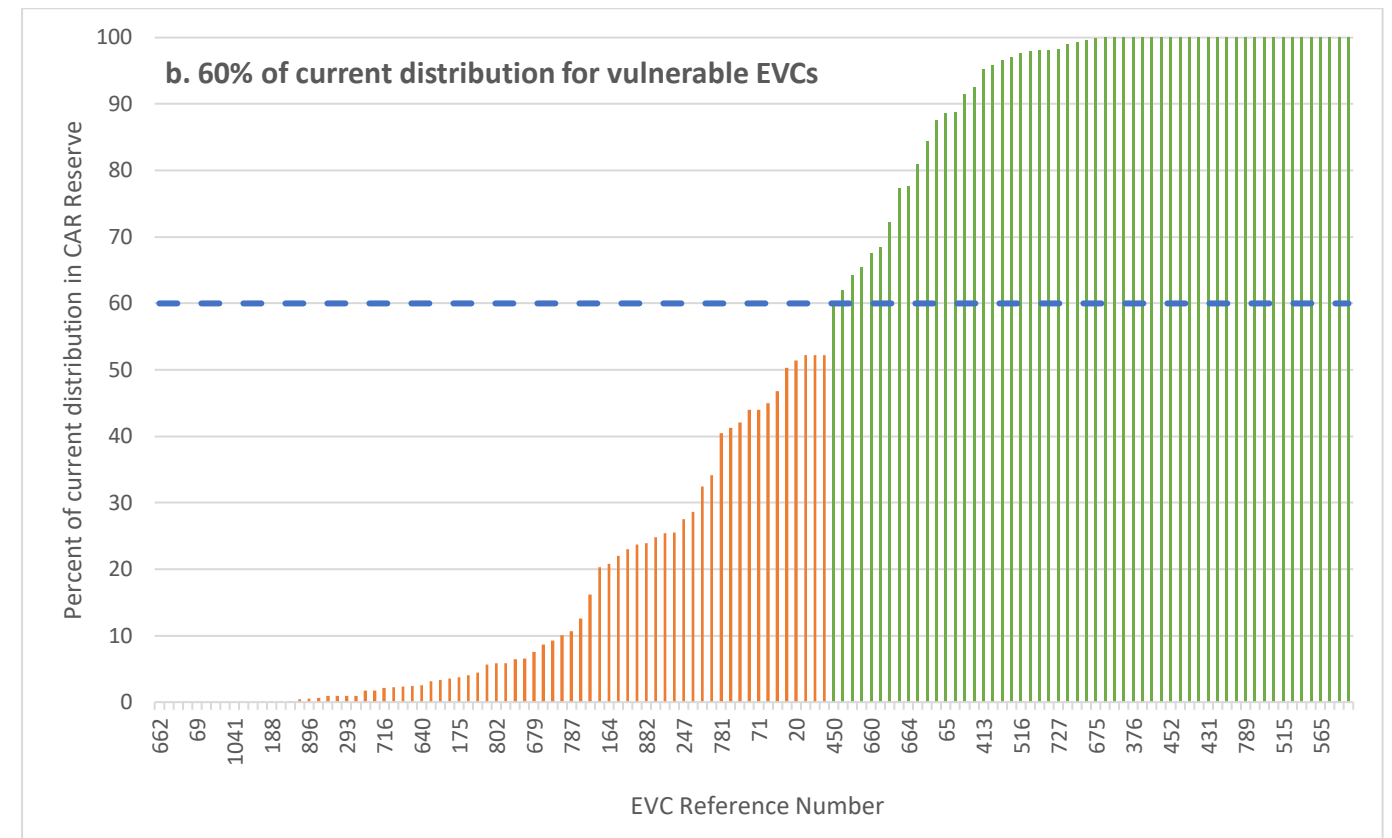
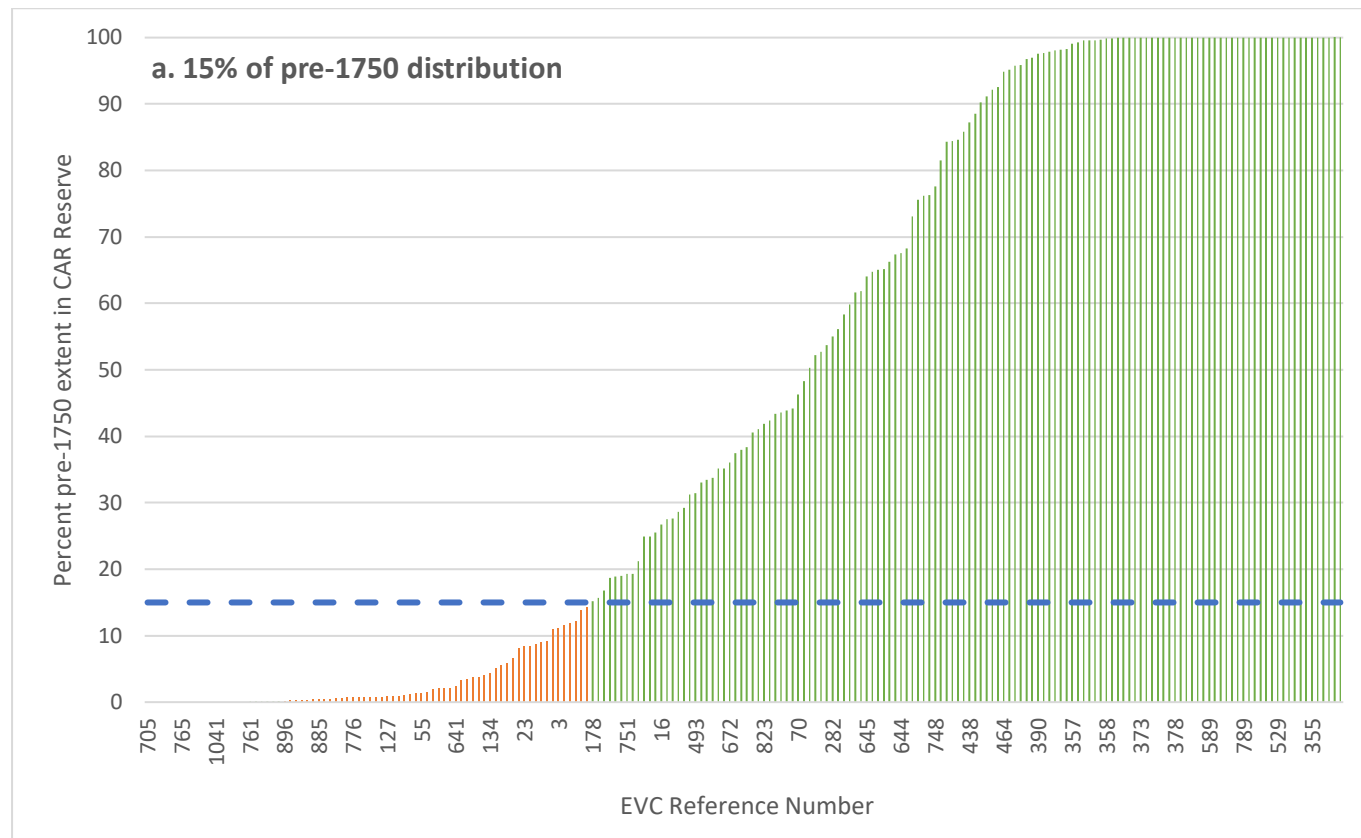


Figure 2-6: West RFA Region - Performance of individual EVCs against the key JANIS criteria. EVCs that meet the threshold (dashed line) are shown in green, those that do not are shown in orange.

2.1.4 BROADER JANIS CRITERIA

As noted earlier, the assessments presented here have focused on the 'quantitative' JANIS criteria. A complete report on the reserve system performance would require assessment of the system against the other six JANIS criteria that we have described as 'qualitative'.

Five of these additional criteria relate to the biodiversity performance of the reserve system. In summary, they focus on:

- Ensuring the reserve system is resilient in the face of climate change or other large-scale shocks
- Habitat quality and specific needs
- Genetic diversity and population viability.

The additional criteria for old-growth forest focuses on protecting 'viable' areas of old-growth.

Assessing the reserve system against these criteria would be complex and data intensive. The immediate challenge would be to define a methodology for assessing each criterion. In some cases, this might be relatively clear and there may be a body of previous work to inform the process, but in others this would be very challenging and could require novel or leading-edge analyses.

Another challenge for this part of an assessment is that some of the criteria themselves are multi-faceted and it could be difficult to determine when that criterion has been met. For example, one of the criterion states that reserves should be 'large enough to sustain the viability, quality and integrity of populations. While for some species it may be possible to define the area needed for viability, defining appropriate quality and integrity is far less clear.

The challenges described here are not insurmountable. There is an excellent body of knowledge on the native vegetation in the reserve system, and there is capacity to complete complex analyses of that data, e.g. measures of fragmentation, patch size, connectivity, areas of high biodiversity/endemism, understandings of the specific habitat requirements and metapopulation dynamics of rare and threatened species and those with specific needs (e.g. migratory species). However, in order to conduct a more complete assessment of the reserve system, there would need to be significant time and knowledge dedicated to defining how to go about measuring performance against these criteria. Some options for initial steps in this process are discussed in section 3.2.

2.2 PRIORITY SPECIES & WIDER FOREST VALUES

2.2.1 PRIORITY SPECIES

Habitat distribution modelling was used to assess the proportion of modelled habitat extent included within the CAR Reserve for a list of high priority vulnerable, endangered and critically endangered species (Figure 2-7). The JANIS criteria do not describe a specific minimum proportion of habitat that should be protected for these species.

However, the analysis highlighted a wide range in the level of protection (across species in all categories of conservation status), with less than 50% of the modelled habitat protected in the CAR Reserve for several species. Of most significant concern, this included four critically endangered species (regent honeyeater, helmeted honeyeater, swift parrot, Booroolong tree frog).

As above, it is important to note that for some species, a significant proportion of the modelled habitat distribution outside the CAR Reserve falls on private land where mechanisms for protection are limited.

2.2.2 WIDER FOREST VALUES

Although the 'CAR values' (as described in the JANIS criteria and RFA agreements) are focused primarily on the conservation of biodiversity and forest ecosystems, there are (increasingly) expectations that the reserve network should also protect a wider set of values that forests provide including recreation, cultural heritage, carbon sequestration, water quality, and flood protection to name a few. These broader objectives are articulated within the RFA agreements.

A detailed assessment of the extent to which the CAR Reserve System protects these wider values was not within the scope of this review, but this could be considered in a more holistic review in future. Such an assessment would be aided by the development of clearly articulated criteria (analogous to the JANIS criteria for biodiversity, old-growth forest and wilderness) to underpin a repeatable review process. Given the issues noted about some of the JANIS criteria (section 2.1.4), a robust method for measuring and evaluating performance against these criteria would also be critical.

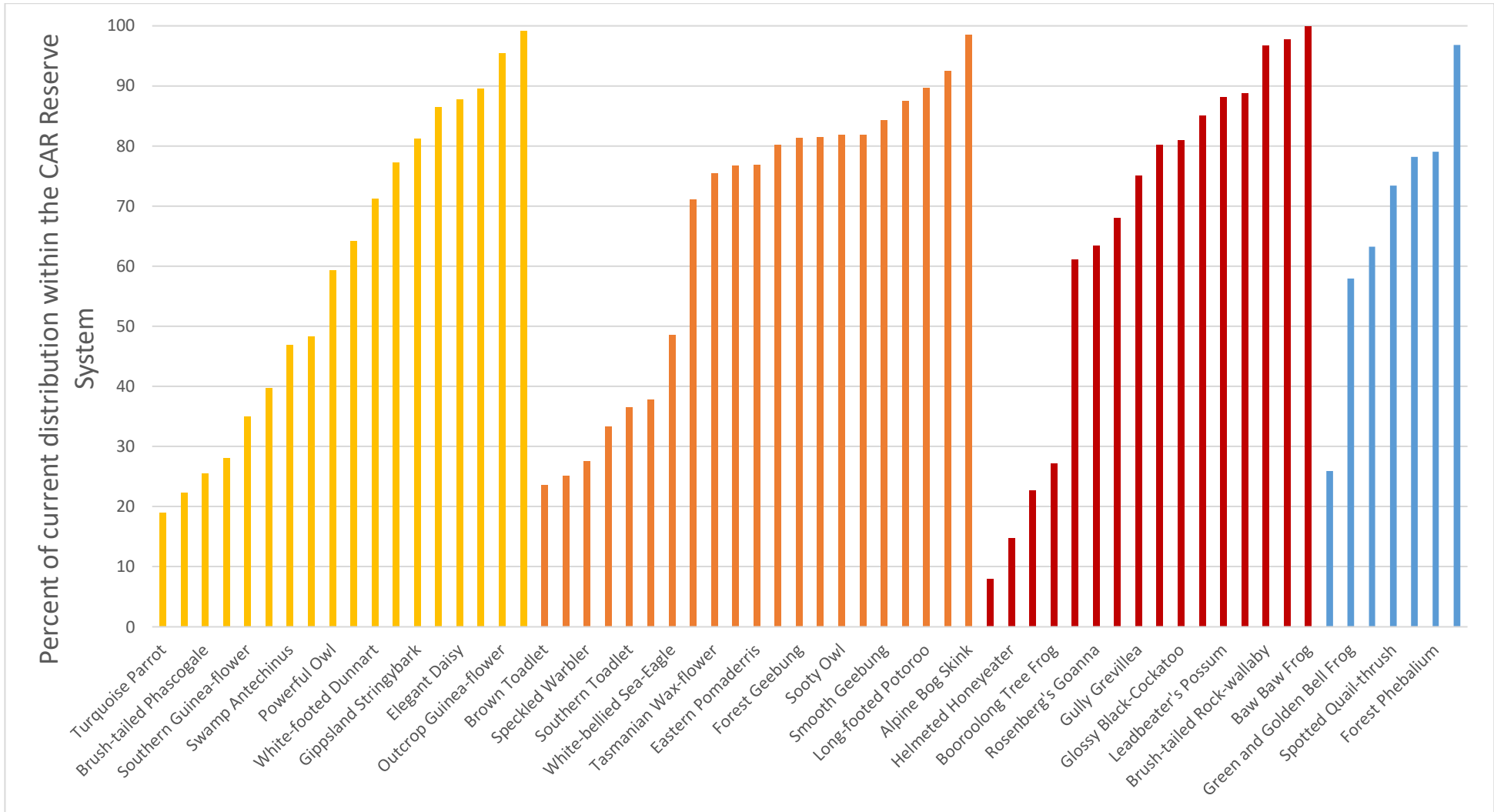


Figure 2-7: Protection of high priority species within CAR Reserve System. Figure shows percent of current habitat distribution protected within CAR Reserve System for vulnerable (yellow), endangered (orange) and critically endangered (red) species (based on Victorian status under the Flora & Fauna Guarantee Act (1988), as well as those listed as endangered under the Environment Protection and Biodiversity Conservation Act (blue).

2.3 FOREST ECOSYSTEMS VULNERABLE TO CLIMATE CHANGE

This review has also considered climate change impacts on the performance of the CAR Reserve System. Two distinct components have been examined:

1. **The protection of species and forest ecosystems vulnerable to climate change.** This analysis focuses specifically on the extent to which climate vulnerable EVCs are currently protected, and the likely impact of shifting climatic conditions on climate vulnerable species (drawing on climate modelling undertaken by the University of Melbourne).
2. **The impact of major events (bushfires) on forest ecosystems within the CAR Reserve** (drawing on the findings of the Victorian RFAs Major Event Review of the 2019/20 bushfires).

The key findings for each of these components are described in Sections 2.3.1 and 2.3.2 respectively.

2.3.1 PROTECTION OF BIODIVERSITY VULNERABLE TO CLIMATE CHANGE

Current Protection

Twenty-two Victorian forest EVCs have been identified as ‘highly vulnerable to climate change’ (based on work undertaken by DELWP as part of this review). Modelling completed as part of this review identified what proportion of the current distribution of these 22 EVCs falls within the CAR Reserve (across all RFAs combined). This assessment revealed a wide range in the proportions of these EVCs that are protected (Figure 2-8). Of particular note are the five EVCs identified as vulnerable to climate change that have less than 10% of their current distribution protected within the CAR Reserve across the RFA regions. These five EVCs – Creekline Grassy Woodland, Plains Grassy Woodland, Plains Woodland, Floodplain Riparian Woodland, and Riverine Chenopod Woodland – appear to be the most vulnerable to climate change.

Future Climate Change

Whilst this analysis focuses on the extent to which climate vulnerable EVCs are currently represented in the CAR Reserve System, further analysis undertaken by the University of Melbourne (UoM) as part of this review focused on forecasting future impacts of climate change on key species and EVCs. In this study, UoM modellers used ‘LANDIS-II’, a mechanistic, process-based landscape vegetation dynamics model, to evaluate future forest development under climate change and assess the strengths and weaknesses of the CAR Reserve System in the protection of climate vulnerable ecosystems.

Another useful feature of landscape simulation models like LANDIS-II, is that they integrate mechanistic models of ecological processes, and in so doing, provide opportunities to predict potential future species distributions under climate change. LANDIS-II directly includes the abiotic and biotic factors influencing species distributions and allows for the inclusion of stochastic elements, such as variability in weather and fire. This UoM study addressed two specific questions:

1. How will select species ranges change over the next century?
2. What are the strengths and weaknesses of the CAR Reserve System in the protection of key flora within climate vulnerable ecosystems?

The analysis concludes that “*the CAR Reserve System performed well and will continue to be comprehensive, adequate, representative for most of the selected species and EVCs into the future. However, for two species (E. delegatensis [Alpine Ash] and E. pauciflora [Snow Gum]) represented primarily within three EVCs (Sub-alpine woodlands, Montane Damp Forest, and Montane Dry Woodlands), climate change presents a significant risk in the near future*”. This finding is perhaps unsurprising given that these EVCs are largely restricted to montane and sub-alpine areas, so opportunities for range shift are likely to be limited.

This analysis and these findings again point to areas where climate change presents particular threats. However, it is important to note that this study only examined a sample of forest species, so a more comprehensive assessment could identify additional species at risk.

2.3.2 VULNERABILITY TO EXTREME EVENTS

As part of this review, it is important to consider the impacts of extreme events on the CAR Reserve System. The risks posed by extreme events are considered in the JANIS criteria and reflected in criteria 4 which focuses on the importance of reserve areas being replicated as "insurance" against the losses that can arise as a result of events such as fire. For this assessment, the Victorian Regional Forest Agreements Major Event Review of the 2019-20 bushfires provided some timely analysis.

Unfortunately, detailed data on the impacts of the 2019-20 bushfires on EVC extent and condition was not available for this analysis. Data that was available focused on fire extent and severity. While large scale, high severity fires are more likely to have transformational impacts on EVCs, the extant fire regime is the key determinant of the impact of fires. Fire regime includes frequency, season, and pattern, in addition to intensity. To understand the true impacts of fire on EVCs it is necessary to consider all of these factors. (For instance, a fire of moderate intensity could still have a major impact on a particular EVC because it follows a succession of fires in that same area.)

However, even in the absence of this detail, data on two factors would be instructive - the spatial distribution of impacts (inside and outside the CAR Reserve) would help to identify which particular EVCs and habitats are affected and, secondly, information on the fire sensitivity of species, EVCs and habitat features would help to understand the magnitude of fire impacts. These two factors – impacts in relation to EVCs and habitat, and sensitivity of the EVC or habitat to the particular event – are applicable beyond just bushfire (i.e. to floods, drought, disease or pest incursion).

Whilst it is clear that the CAR Reserve System does not protect an EVC or habitat against the impacts of extreme events such as landscape scale bushfire (e.g. black summer fire), having a reserve network that meets the CAR principles will likely increase the resilience of forest species and ecosystems to such disturbances. A clearly articulated and repeatable approach to quantifying the impacts of individual major events on forest ecosystems would enable a more complete, robust and timely assessment of the impacts that such events have on the CAR Reserve.

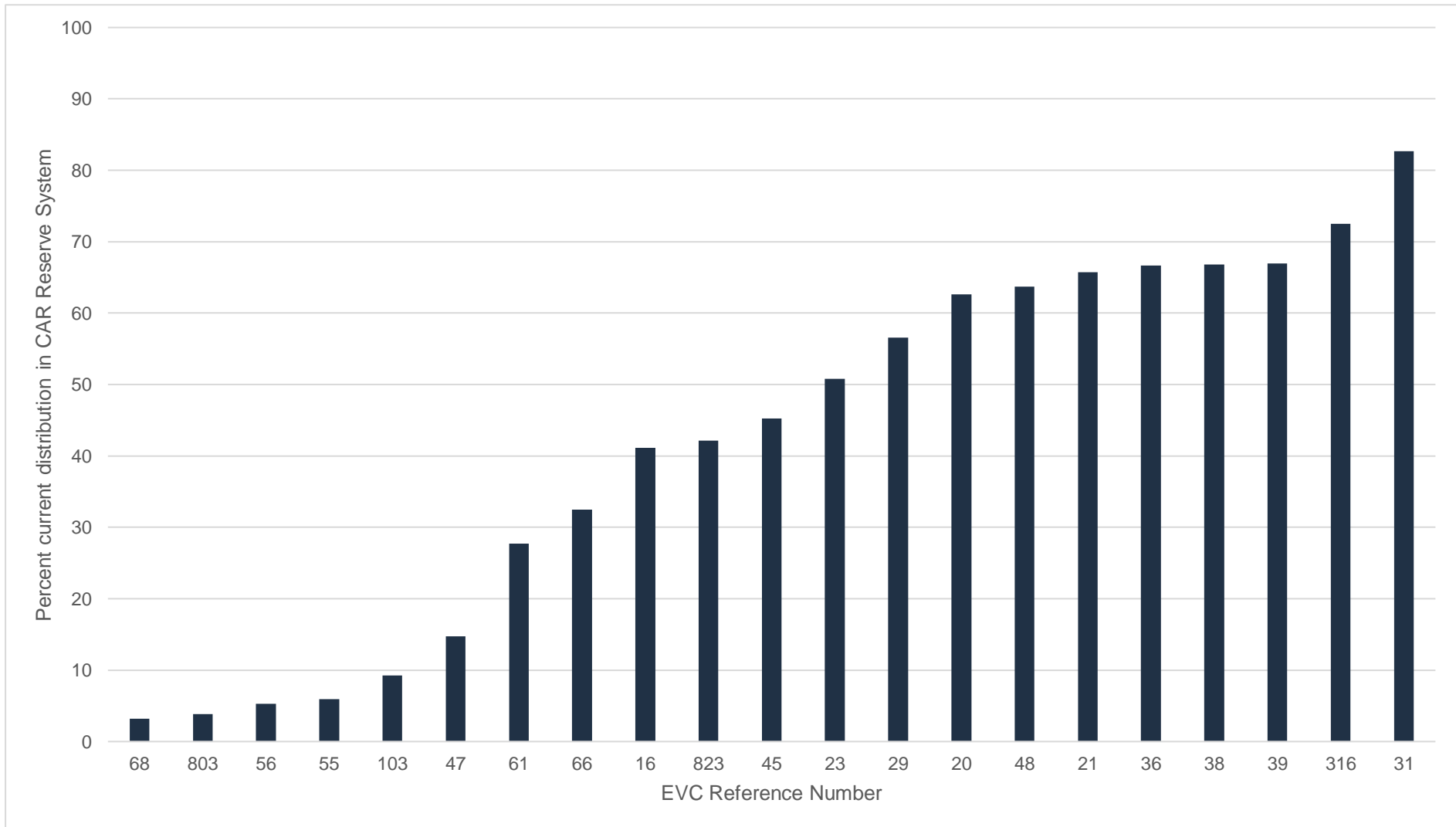


Figure 2-8: Protection of EVCs identified as ‘highly vulnerable to climate change’

3 Future priorities

This section focuses on taking the results and findings from the assessment and identifying their implications for:

- Future management of forests
- Improving assessments in future (data gaps and improvements).

3.1 FOREST MANAGEMENT

3.1.1 OPTIONS FOR IMPROVING CAR RESERVE SYSTEM PERFORMANCE

This component of the review is intended to present the range of (theoretical) options for improving the protection of Victorian EVCs within the CAR Reserve System. This is a high-level assessment focusing primarily on EVC extent and land tenure. Significant further work (beyond the scope of this review) would be required to consider:

- Appropriate mechanisms for protection (e.g. zoning, management prescriptions etc)
- How competing uses for forests can be accommodated (e.g. timber harvesting).

The options presented here focus on EVCs in two categories:

- Those EVCs where there were notable shortfalls for the three 'quantitative' JANIS criteria (15% of pre-1750 distribution, 60% of current distribution for vulnerable EVCs, 100% of current distribution for rare/endangered EVCs). The analysis focuses only on those EVCs that fall short of the thresholds and, for the purposes of this high-level analysis, data are pooled across RFA regions.
- The 22 EVCs identified as being vulnerable to climate change¹².

More specific further work (beyond the scope of this review) would be required, including spatial analysis within individual RFA regions, to further develop these options.

15% Pre-1750 Distribution

For the 104 EVCs that did not meet the JANIS criteria threshold of 15% of pre-1750 distribution within the CAR Reserve, data on potential future management options are shown in Figure 3-1. Key implications from this data include:

- For 16 EVCs, it would be impossible to meet the JANIS criteria threshold within the RFA regions as less than 15% of their pre-1750 distribution exists in total.
- The performance of two EVCs (164 - Creekline Herb-rich Woodland, and 67 - Alluvia Terraces Herb-Rich Woodland) could be improved if the areas currently protected by policy (e.g. through Immediate Protection Areas or other VEAC protection mechanisms) were incorporated into the CAR Reserve System. However, both would still be slightly below the 15% threshold.
- A further three EVCs (498 - Plains Grassy Woodland/Sand Heathland Mosaic, 882 – Shallow Sands Woodland, and 151 – Plains Grassy Forest) would meet or be very close to meeting the 15% threshold if areas of currently unprotected State Forest (in the General Management Zone, GMZ, and Special Management Zone, SMZ) were incorporated into the CAR Reserve.

¹² Based on the DELWP internal assessment as part of this review process, and the work by the University of Melbourne.

- For around 15 EVCs, there is an option to meet the 15% threshold by incorporating a combination of public land types into the CAR Reserve, including areas protected by policy, unprotected State Forest and other public land (including Commonwealth land).
- However, for most of the 104 'shortfall EVCs', a majority of their currently unprotected extent is on private land. Mechanisms for protection of this land are somewhat limited (conservation covenants) and must be agreed with individual landholders.

60% of Current Distribution for Vulnerable EVCs

For the 106 EVCs that did not meet the JANIS criteria threshold of 60% of current distribution within the CAR Reserve for vulnerable EVCs, data on potential future management options are shown in Figure 3-2. Key implications from this data include:

- Three EVCs (29 - Damp Forest, 30 - Wet Forest, and 48 - Heathy Woodland) could meet (or very nearly meet) the 60% threshold if areas currently protected through policy (IPAs and VEAC) were incorporated into the CAR Reserve.
- The performance of a further 69 EVCs could be improved if unprotected State Forest land (GMZ, SMZ) were included in the CAR Reserve. Of those, 11 could meet the 60% threshold.
- Again, for most of the 106 'shortfall EVCs', a majority of their currently unprotected extent is on private land. Mechanisms for protection of this land are somewhat limited (conservation covenants) and must be agreed with individual landholders.

100% of Current Distribution for Rare/Endangered EVCs

For the 71 EVCs that did not meet the JANIS criteria threshold of 100% of current distribution within the CAR Reserve or rare/endangered EVCs, data on potential future management options are shown in Figure 3-3. Key implications from this data include:

- One EVC (859 - Montane Grassy Woodland/Rocky Outcrop Shrubland Mosaic) could meet the 100% threshold if areas currently protected through policy (IPAs and VEAC) were incorporated into the CAR Reserve. The performance of a further eight could be improved but would not meet the threshold.
- The performance of a further 17 EVCs could be improved if unprotected State Forest land (GMZ, SMZ) were included in the CAR Reserve. However, none could meet the 100% threshold.
- Again, for most of the 71 'shortfall EVCs', a majority of their currently unprotected extent is on private land. Mechanisms for protection of this land are somewhat limited (conservation covenants) and must be agreed with individual landholders.

Climate-Vulnerable EVCs

For the 22 EVCs identified as being vulnerable to climate change, data on potential future management options are shown in Figure 3-4. Although there is no set numeric target for protection for these EVCs, key implications from this data include:

- Only one climate vulnerable EVC has a significant area currently protected by policy (IPAs and VEAC): 45 – Shrubby Foothill Forest (17.3% under policy protection). Incorporation of this area into the CAR Reserve would increase the protection of this EVC from 45.2% to 62.5%.
- The level of protection for 20/22 EVCs could be improved through the incorporation of unprotected State Forest land (GMZ, SMZ) into the CAR Reserve. For eight of the EVCs, this could see an increase of >20% from current levels of protection.
- Around half the climate vulnerable EVCs have a significant proportion of their current extent on private land.

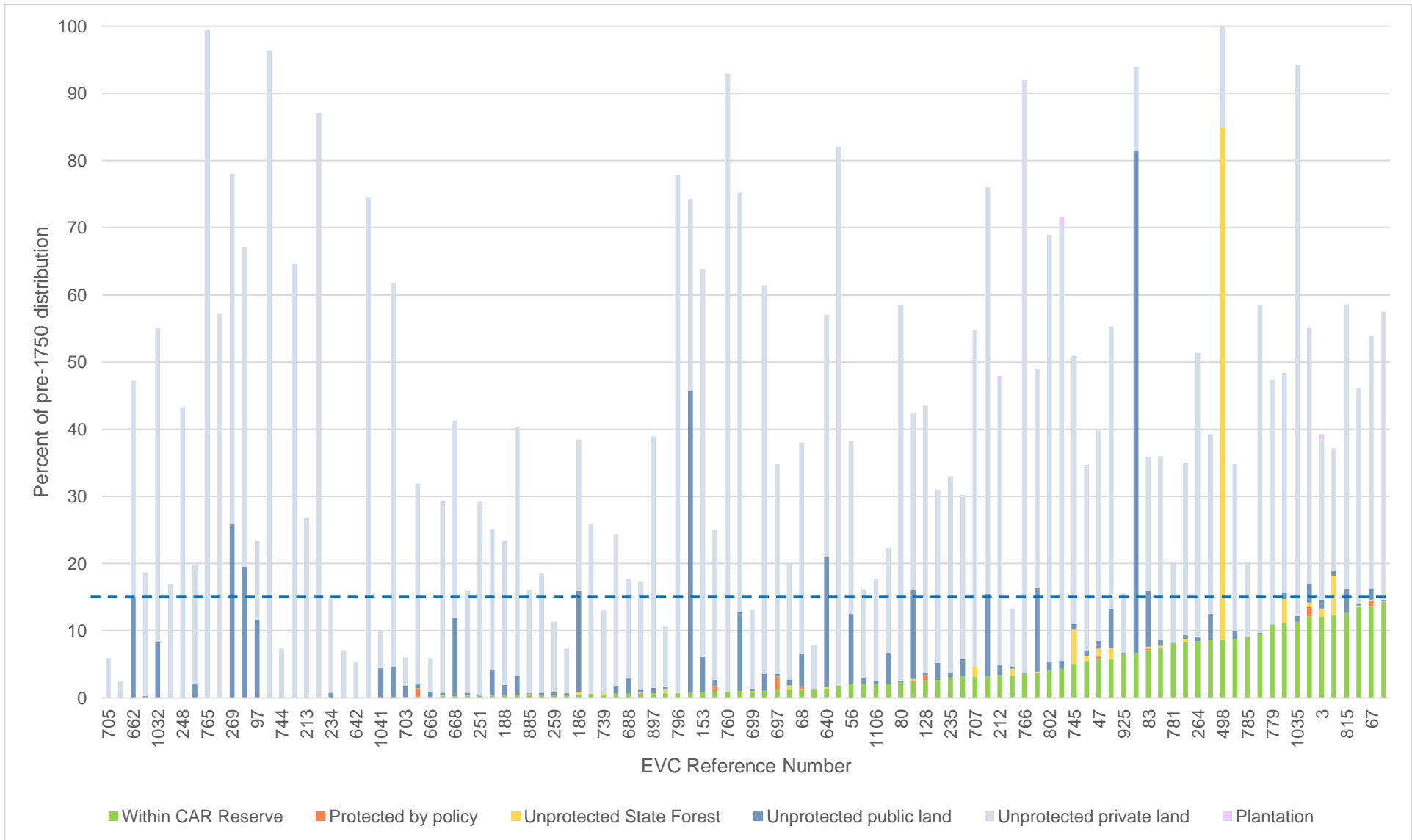


Figure 3-1: Improving performance against JANIS criteria - pre-1750 distribution. Figure shows potential future forest management options to increase the proportion of EVC extent within the CAR Reserve for the 104 EVCs that did not meet the JANIS criteria threshold of 15% (dashed line).

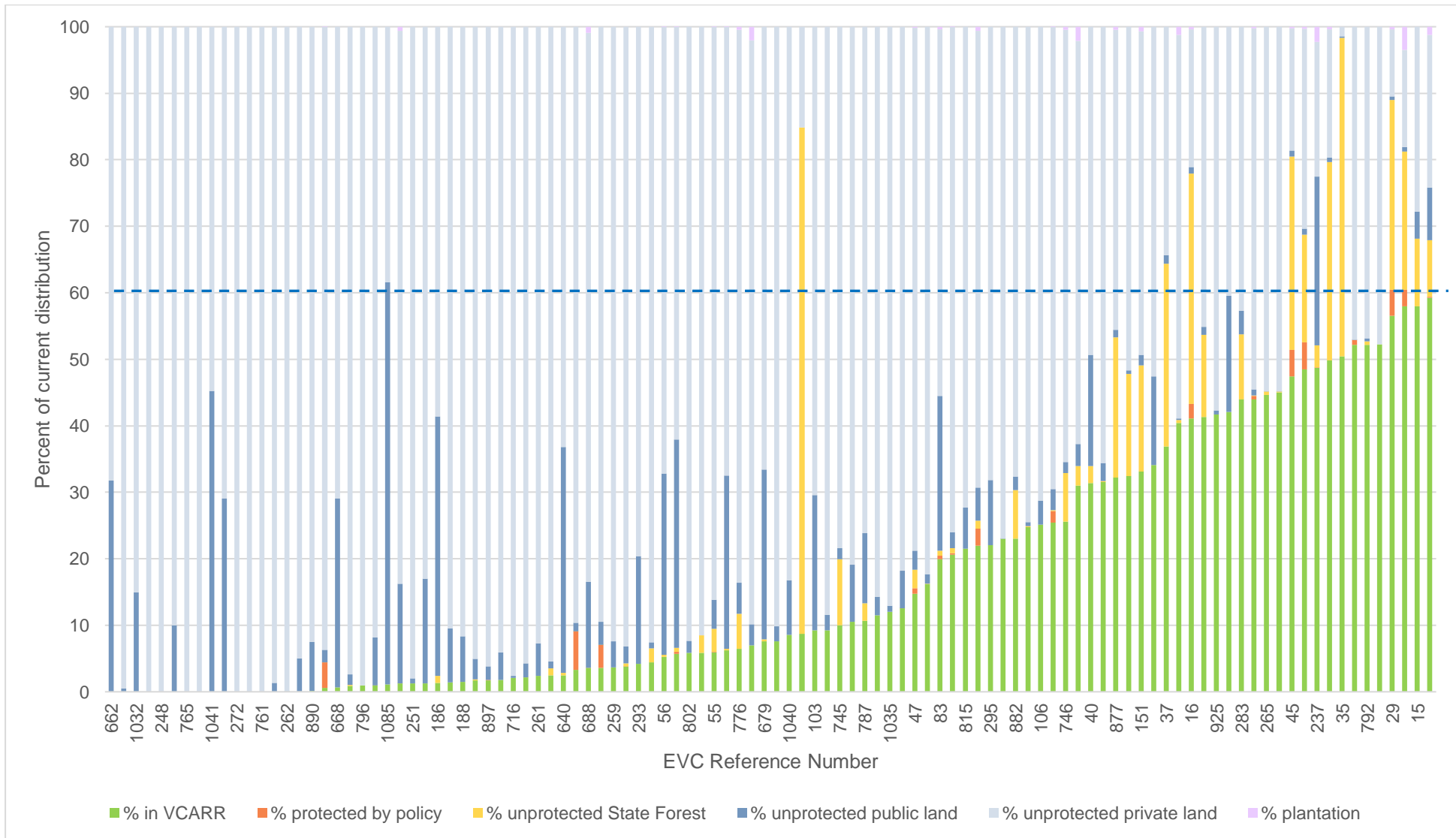


Figure 3-2: Improving performance against JANIS criteria – vulnerable EVCs. Figure shows potential future forest management options to increase the proportion of EVC extent within the CAR Reserve for the 106 EVCs that did not meet the JANIS criteria threshold of 60% (dashed line).

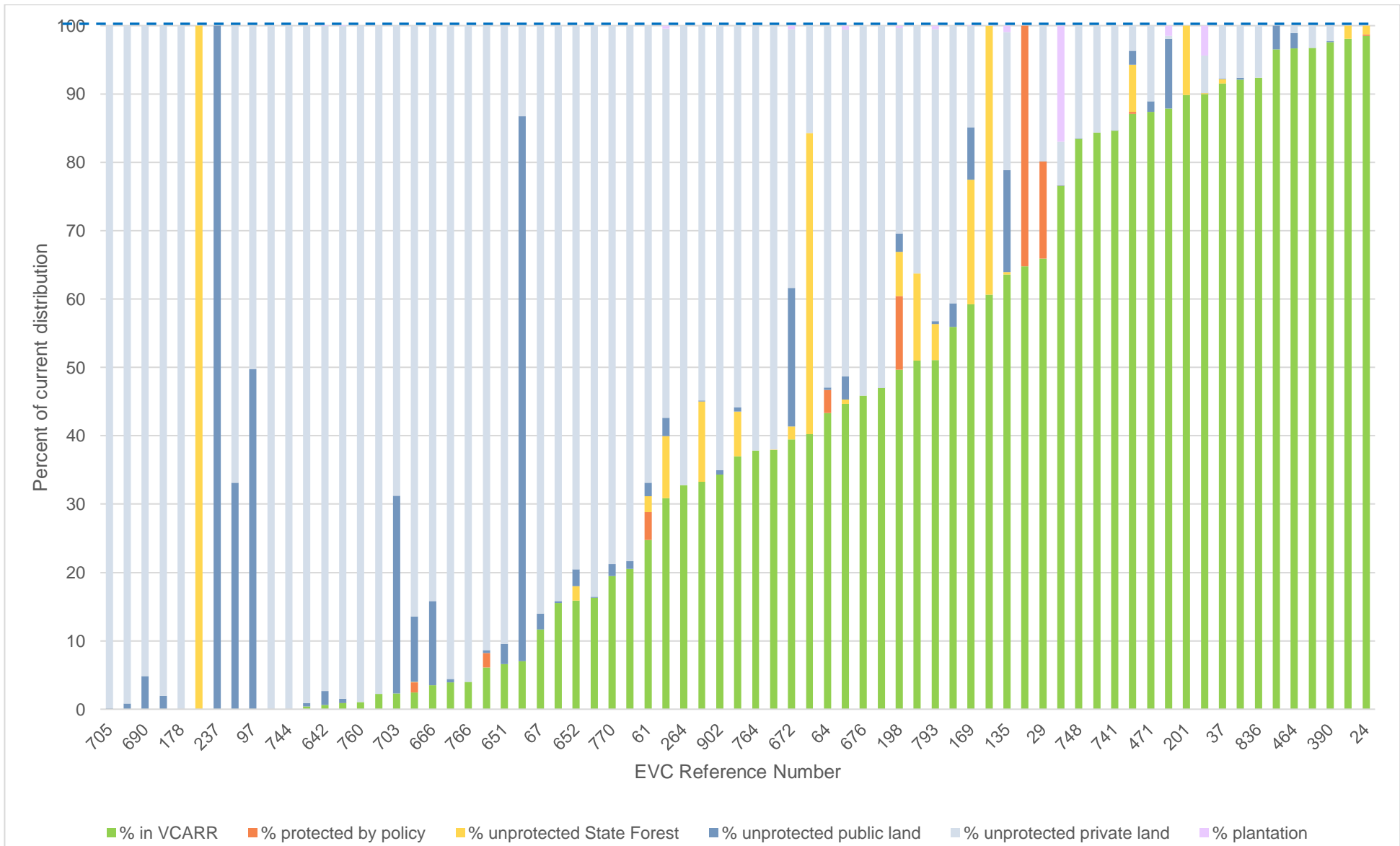


Figure 3-3: Improving performance against JANIS criteria – rare/endorsed EVCs. Figure shows potential future forest management options to increase the proportion of EVC extent within the CAR Reserve for the 71 EVCs that did not meet the JANIS criteria threshold of 100% (dashed line).

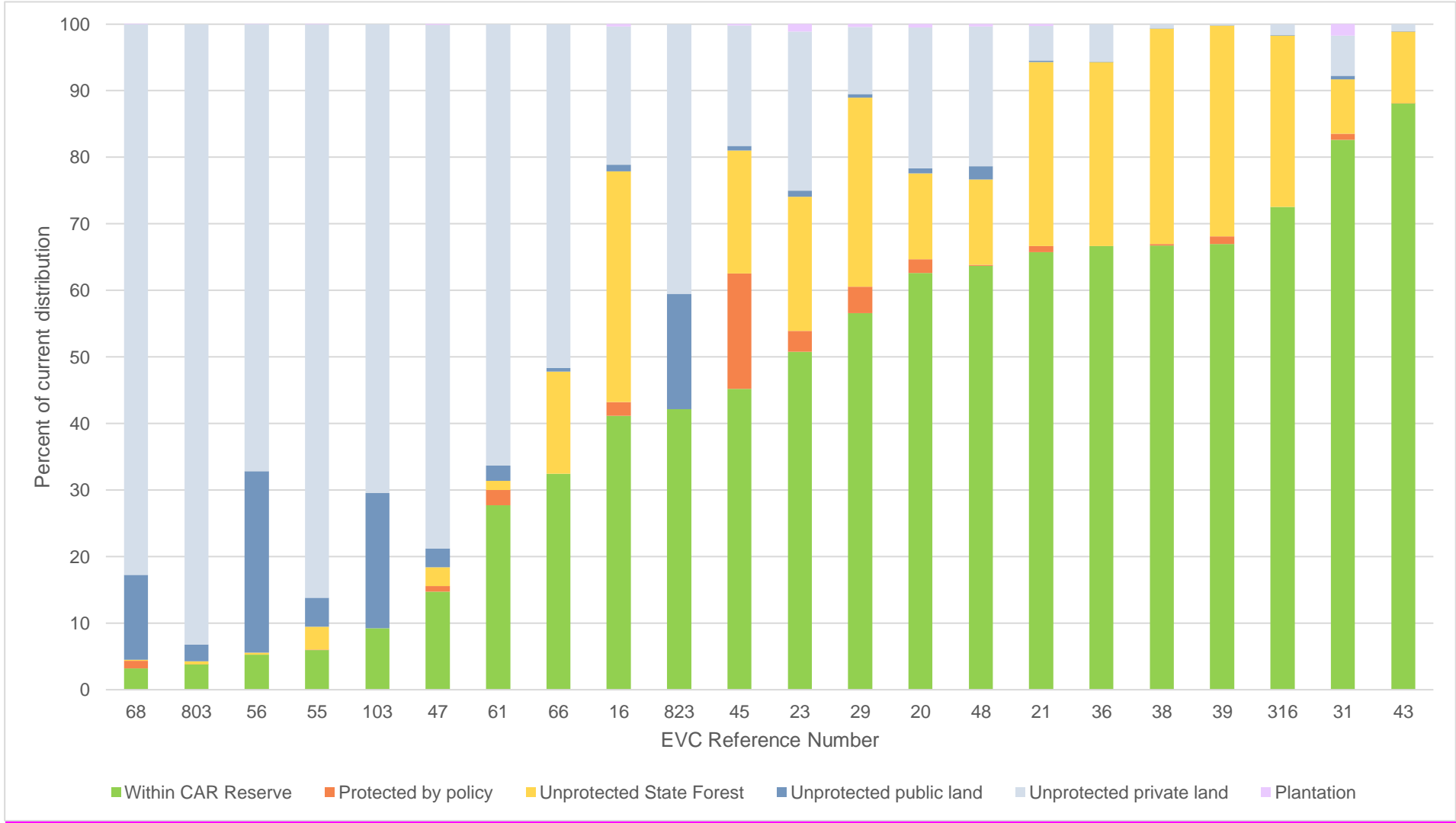


Figure 3-4: Improving performance against JANIS criteria – climate vulnerable EVCs. Figure shows potential future forest management options to increase the proportion of EVC extent within the CAR Reserve for the 22 EVCs that were identified as being vulnerable to climate change.

3.1.2 WIDER CONSIDERATIONS

In section 2.2.2 additional values of state forests (i.e. in addition to native biodiversity protection) were noted. One of those that is particularly significant is the need to meet timber harvesting objectives. Options to improve CAR Reserve System performance should, if possible, take into account these other objectives.

One of those that has been examined is the ability to meet timber harvesting objectives while improving the CAR Reserve System performance. Further spatial analysis would be necessary to assess whether this is achievable. For example, would areas of State Forest that are not priorities for meeting timber harvesting objectives contribute towards improved protections of 'shortfall' EVCs if they were incorporated into the CAR Reserve?

3.1.3 SUMMARY OF OPTIONS FOR FOREST MANAGEMENT

- For a small number of EVCs, the performance against the JANIS criteria could be improved by formally incorporating areas that are currently protected through policy (IPAs, VEAC) into the CAR Reserve System to enable more permanent protection.
- For some EVCs, there are options to improve performance against the JANIS criteria by incorporating currently unprotected State Forest land (GMZ, SMZ) into the CAR Reserve (see summary in Figure 3-5). However, only a relatively small proportion of these would be able to actually meet the threshold.
- Assessment of future management options requires consideration of other stated objectives of the RFA agreements, particularly in relation to timber harvesting. For example, there may be some opportunities to improve CAR Reserve System performance by incorporating State Forest land without significantly impacting timber harvesting objectives. Further work, including detailed spatial analysis, would be necessary to explore these options and understand associated trade-offs.
- For a significant majority of EVCs that fall short of the JANIS criteria thresholds, much of their currently unprotected extent falls on private land. Here, there are fewer mechanisms to enable protection as part of the CAR Reserve System (only through private land conservation covenants). This mechanism relies on agreement of individual landholders.
- Options for pursuing improved CAR Reserve coverage on private land could include specific targeting of private land conservation investment to EVCs that are currently under-represented in the CAR Reserve. Any such efforts should particularly prioritise shortfall EVCs that are rare or endangered.
- Further analysis could provide insights into potential opportunities/challenges in this area, including understanding the number of landholders that would need to be engaged to improve performance for individual target EVCs.

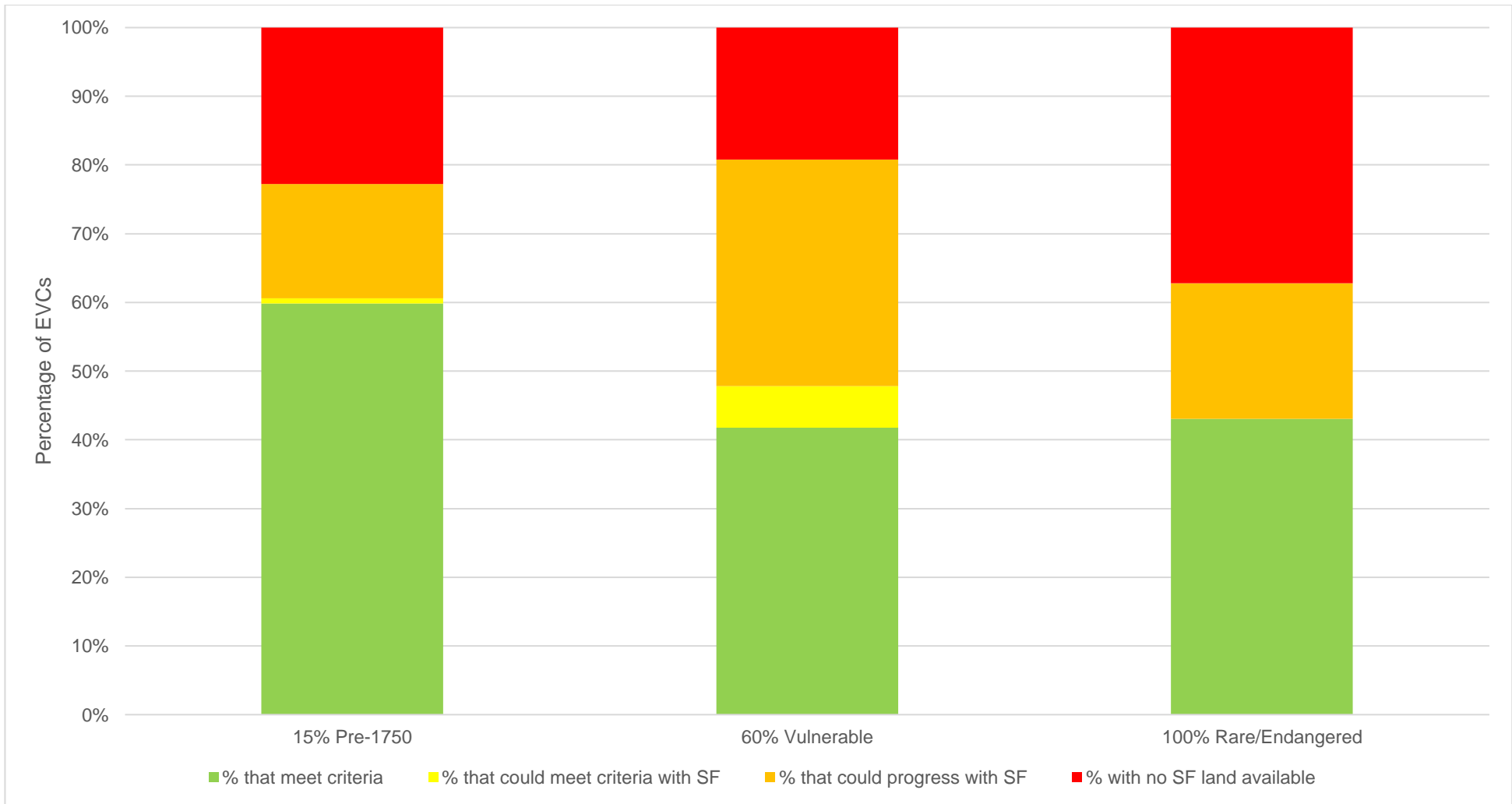


Figure 3-5: Summary of options to improve performance against key JANIS criteria. Figure shows the percentage of EVCs that (1) currently meet the criteria (green), (2) could meet the criteria if currently unprotected State Forest areas were incorporated into the CAR Reserve, (3) could make progress, but not meet the criteria with incorporation of State Forest land, and (4) have 0% of current distribution on unprotected State Forest land., and therefore require an alternative approach (e.g. protection of private land).

3.2 ADDRESSING DATA GAPS AND IMPROVING EVALUATION

This synthesis report has highlighted the following key data challenges that, if addressed, would enable better evaluation and monitoring of the performance of the CAR Reserve System in future:

1. **Incorporating data on EVC condition:** the approach taken in this review (in line with the JANIS criteria) focuses primarily on vegetation extent. A more robust assessment of the CAR Reserve System would also take into account habitat condition, structure and function. This would improve understanding of the functionality of the ecosystems that are included within the reserve network and help to identify priority areas for habitat improvement activities (i.e. increase condition rather than (only) extent).
2. **Incorporating data on bushfire impacts:** the ability to conduct a timely assessment of the impact of bushfires on EVCs within the CAR Reserve (and thereby assess the state of the CAR Reserve System itself) would be a critical step forward. In particular, this would require clearly articulated protocol for integrating bushfire data with EVC/MOG data, including fire tolerance information for individual EVCs. By overlaying this type of data on mapped bushfire extent/intensity, it would be possible to identify EVCs (and MOG areas) within the CAR Reserve that have likely been significantly impacted by fire.
3. Addressing 'mapping units' in the EVC data (areas classified as 'complexes', 'mosaics', 'aggregates' and 'niches') - these are 'mapping units' (typically combinations of two EVC types) requiring an appropriate EVC to be determined and assigned on site. There would be significant value in revisiting this analysis once more reliable site-based classifications have been completed.
4. **Testing key assumptions:** the assessment presented here is contingent on a number of key assumptions. Chief among them is that the underlying data on EVC/MOG extent are accurate and reliable, and that the management of all CAR Reserve System components (formal and informal reserves, areas managed by prescription and covenanted private land) offers sufficient protection of biodiversity values. A targeted process for testing these assumptions could ensure that the conclusions of future reviews are robust.
5. **Review and further development of the JANIS criteria:** the published nationally agreed criteria provide a useful and necessary set of criteria aimed at improving protected area design. However, there is potential to review and further develop these criteria in order to:
 - Set out a clear and repeatable protocol for assessing performance against the full set of criteria (including the 'qualitative' criteria for which numeric thresholds are not provided). Table 3-1 sets out one possible approach to monitoring the 'qualitative' criteria. This approach defines a set of indicators for each criterion. An indicator-based approach like this can provide a pragmatic and practical way to monitor criteria that are technically very challenging (and perhaps impractical) to directly measure. These indicators, ideally identified in consultation with technical experts, need to be based on data that is already available, or is inexpensive to access. Several examples have been suggested in Table 3-1 for illustrative purposes only.
 - Update any defined thresholds to align with more recent national and international policy commitments for protecting terrestrial biodiversity
 - Develop a complimentary set of criteria to include a broader set of values to be incorporated into robust protected area design and evaluation (including e.g. cultural heritage, recreation, and a range of ecosystem services).

Table 3-1 Example monitoring table for 'qualitative' JANIS criteria

JANIS CRITERIA - BIODIVERSITY (‘QUALITATIVE’)	INDICATORS	EXPLANATION/ RATIONALE
<p>Reserved areas should be replicated across the geographic range of the forest ecosystem</p>	<ul style="list-style-type: none"> ▪ Proportion of EVCs with reserves across their full geographic range ▪ Proportion of EVCs that are present in multiple reserves/ RFA regions 	<p>This relies on a spatial analysis of EVC extent overlaid across the CAR Reserve. The aim is to identify those EVCs that are under-represented i.e. only present in a single reserve, or lacking protection across their full range.</p>
<p>The reserve system should maximise the area of high-quality habitat for all known elements of biodiversity wherever practicable, esp. rare, vulnerable and endangered spp.</p>	<ul style="list-style-type: none"> ▪ Proportion of reserves that have rare, vulnerable and endangered species ▪ Proportion of reserves with high quality habitat for those species 	<p>Of the X reserves with endangered species, Y% have high quality habitat for those species. This would highlight reserves where a focus on improving habitat quality would have greatest benefit.</p>
<p>Reserves should be large enough to sustain the viability, quality and integrity of populations.</p>	<ul style="list-style-type: none"> ▪ Size distribution of reserves ▪ Connectivity of reserves for key (nominated) species ▪ [? Proportion of reserves that are considered below ‘viable’ size.] 	<p>The combination of size and connectivity of reserves is a key influence over the viability, quality and integrity of populations. Reserves that are small and isolated would be highlighted.</p>
<p>Reserve system should sample the full range of biological variation within each forest ecosystem – esp. geographic range and successional stages</p>	<ul style="list-style-type: none"> ▪ Proportion of EVCs with reserves across their full geographic range ▪ Distribution of age classes /successional stages for each EVC within the CAR Reserve. 	<p>In addition to the data on spatial extent of EVCs, this would also require spatial data on the age/successional stage of EVCs. This links to timely assessment of the impacts of bushfire on EVC extent and condition.</p>
<p>In fragmented landscapes, remnants that contribute to sampling the full range of biodiversity should be identified and protected as part of regional conservation strategies</p>	<ul style="list-style-type: none"> ▪ Proportion of key corridors or fragments protected within CAR Reserve. 	<p>This would rely on a spatial assessment to identify high priority corridors or habitat fragments that have a major impact on an EVC(s).</p>

4 Conclusions

4.1 EVALUATION FINDINGS

4.1.1 KEY STRENGTHS

Through this assessment, the following key strengths of the Victorian RFA CAR Reserve System have been identified:

- The core components of a CAR Reserve System are well established and operating. This includes:
 - That the CAR principles underpinning protected area design are enshrined in intergovernmental agreements, established through the RFA commitments. These principles are based on sound ecological knowledge and best practice for reserve design.
 - A requirement for regular, timely reviews of the CAR Reserve System, again established through RFA agreements. This includes the role of the JANIS criteria to provide a framework for evaluation.
 - A range of mechanisms for on-ground protections including formal, dedicated reserves; informal reserves protected through zoning; areas managed through prescriptions and private land covenants. This range of mechanisms facilitates a flexible and practical approach to managing the reserve network (noting that the efficacy of each of these mechanisms is outside the scope of this review).
- The performance of the CAR Reserve System is strong in some areas (based on the subset of JANIS criteria for which quantitative assessment was possible as part of this review), including:
 - Protection of old-growth forests (across all regions, the criteria of '60% of old-growth forest included in the CAR Reserve was met for a majority of forest Ecological Vegetation Classes (EVCs)¹³).
 - Protection of wilderness areas (across all regions with designated areas identified as 'high quality wilderness', the 90% protection criteria was effectively met or exceeded).
- For many EVCs, the CAR Reserve System makes good use of available public land, with many EVCs protected to the maximum extent possible within State Forest areas.

4.1.2 AREAS FOR IMPROVEMENT

The assessment also highlighted some areas for improvement in current CAR Reserve System performance. This includes:

- Significant shortfalls in the protection of some EVCs against some of the JANIS criteria. This finding is in line with other assessments e.g. by the [Victorian Environmental Assessment Council \(VEAC\)](#) and as part of the development of the Victorian government's 'Protecting Victoria's Environment – Biodiversity 2037' strategy.
- Low levels of protection for several EVCs that are vulnerable to climate change. Increasing the extent of protection for these EVCs will be important for increasing climate resilience of the reserve network.
- Options for improving protections for some EVCs are limited. For many 'shortfall EVCs', much of the remaining 'unprotected' extent is on private land. Mechanisms for increasing protections for these EVCs are limited (conservation covenants) and rely on reaching agreements with individual private landholders. Targeting of private land conservation investment to priority EVCs will be necessary to address this challenge.
- There are significant areas for improvement in terms of data and evaluation, including a lack of:

¹³ It is important to note that this is based on data that does not incorporate the impacts of the 2019/20 bushfires.

- A robust protocol to evaluate performance against the full set of JANIS criteria
- Integrated data on habitat condition, structure and function
- A protocol for quantifying and incorporating data on the impacts of major events (e.g. bushfires)
- Clear criteria for evaluating performance against the broader objectives of the CAR Reserve System including e.g. cultural heritage and landscape objectives, ecosystem service provision etc.

4.1.3 FUTURE DIRECTIONS TO STRENGTHEN CAR RESERVE SYSTEM

Forest Management

This synthesis report has highlighted some potential options to strengthen the CAR Reserve System performance against the JANIS criteria:

▪ **On Public Land**

For some EVCs, there are options to improve performance against the JANIS criteria by incorporating public land into the CAR Reserve. This includes:

- Formally incorporating areas that are currently protected through policy (Immediate Protection Areas (IPAs), areas protected via VEAC recommendations) into the CAR Reserve System to enable more permanent protection.
- Incorporating currently unprotected State Forest land (General Management Zone (GMZ), Special Management Zone (SMZ)) into the CAR Reserve.

However, only a relatively small proportion of EVCs would be able to meet the JANIS criteria threshold through such additions.

Assessment of such future management options requires consideration of other stated objectives of the RFA agreements, particularly in relation to timber harvesting. Further work, including more detailed spatial analysis, would be necessary to explore these options and understand associated trade-offs.

▪ **Private Land**

For a significant majority of EVCs that fall short of the JANIS criteria thresholds, much of their currently unprotected extent falls on private land. Options for pursuing improved CAR Reserve coverage on private land could include specific targeting of private land conservation investment to EVCs that are currently under-represented in the CAR Reserve System. Any such efforts should particularly prioritise shortfall EVCs that are rare or endangered.

Further analysis could provide insights into potential opportunities/challenges in this area, including understanding the number of landholders that would need to be engaged to improve performance for individual target EVCs.

Data Gaps and Evaluation

This analysis examined opportunities to improve the ability to monitor and evaluate the performance of the CAR Reserve System. Improving the data available for these assessments is a key opportunity. The specific data improvements identified are:

- Incorporating data on EVC condition: current EVC data is focussed on vegetation extent. Including measures of condition, structure and function would enable a more robust assessment of the conservation effectiveness of the Reserve System.
- Incorporating data on bushfire impacts: timely assessment of the impact of bushfire on EVCs within the CAR Reserve would be a critical step forward. In particular, data on fire tolerance for individual EVCs would be a critical element of this improvement. This would make it possible to identify EVCs and (and in particular, old-growth areas) within the CAR Reserve System that have likely been significantly impacted by fire.

- Addressing 'mapping units' in the EVC data (areas classified as 'complexes', 'mosaics', 'aggregates' and 'niches') - these are 'mapping units' (typically combinations of two EVC types) requiring an appropriate EVC to be determined and assigned on site. There would be significant value in revisiting this analysis once more reliable site-based classifications have been completed.
- Testing key assumptions: key assumptions underpinning this analysis are that the data on EVC and Modelled Old-Growth (MOG) extent are accurate and reliable, and that the management of all CAR Reserve components (formal and informal reserves, areas managed by prescription and covenanted private land) offers sufficient protection of biodiversity values. Testing these assumptions would help to ensure future reviews are robust.
- Review and further development of the JANIS criteria:, including:
 - Setting out a clear and repeatable protocol for assessing performance against the full set of criteria (including the 'qualitative' criteria). This could include defining a set of indicators to assess performance against all eleven criteria.
 - Update any defined thresholds to align with more recent national and international policy commitments for protecting terrestrial biodiversity
 - Develop a complimentary set of criteria to include a broader set of values including cultural heritage, recreation, and other ecosystem services.

This report has been prepared by:

RM Consulting Group Pty Ltd trading as RMCG

Level 1 East, 1100-1102 Toorak Road, Camberwell Victoria 3124

(03) 9882 2670 — rmcg.com.au — ABN 73 613 135 247

Offices in Victoria, Tasmania, ACT and NSW

Key RMCG contact

Shayne Annett

0427 679 049 — shaynea@rmcg.com.au



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