NCECONOMICS

Regulatory Impact Statement for 2019 amendments to the Code of Practice for Timber Production 2014

8 August 2019

Document history

Revision

Revision no.	06
Author/s	Lili Pechey (NCE) Dr Buyani Thomy (NCE) Blair Freeman (Indufor)
Checked	Dr Neil Byron (NCE) Andrew Morton (Indufor)
Approved	Jim Binney

Disclaimer

Citation

Natural Capital Economics (2019). RIS for 2019 updates to the Code of Practice for Timber Production 2014.

Project number: 0919055

Contact

Jim Binney

Director

Natural Capital Economics

jim.binney@nceconomics.com

EXECUTIVE SUMMARY

Background

Timber harvesting in Victoria is governed by a wide range of Commonwealth and State legislation, regulations, policies and codes. The Code of Practice for Timber Production 2014 (the Code) addresses the legal obligations that timber harvesting managers, harvesting entities and operators must consider in addition to existing relevant law. For each forest type (i.e. State forest, private native forest or plantation), the Code provides guidance on principles, operational goals and mandatory actions that are reflective of the Code's intended outcomes and the mechanisms by which they are to be achieved.

Problems to be addressed and objectives of change

Context for the problems

The management of Victorian native forests has undergone significant reviews. These reviews have investigated the regulation of timber production, the sustainability of the native production and the protection of biodiversity. Together these reviews provide the background to the problem that are discussed in greater detail in section 2.1 of this document.

Problems with the Code

DELWP conducted a review of the Code and its incorporated documents: the Management Standards and Procedures for timber harvesting operations in Victoria's State forests 2014 (the MSPs) and the Planning Standards for timber harvesting operations in Victoria's State Forests 2014 (Appendix 5) to the MSPs. The DELWP Code review was focussed on the application of the Code to timber harvesting in State forests, noting that some defined terms within the Code are applicable to private native forests and plantation forests.

The Code review made findings in relation to the following issues:

- Clarity: The Code is not easy to understand and lacks clarity about the roles and responsibilities of regulatory authorities.
- Accuracy: The Code lacks accuracy due to administrative errors that undermine the integrity of the Code.
- Enforceability: Elements of the Code are not enforceable due to prescriptions being poorly worded and open to misinterpretation.
- Contemporaneous: The Code is not contemporary with Victorian Government policies, strategies, action statements, regulations, or agreements to manage forest biodiversity values. This may result in risks to Victorian Government environmental objectives.

The Code review identified two environmental values (the Large Brown Tree Frogs and Large Trees) where a significant amendment to the Code would be required to ensure the Code is contemporary with scientific advice, policies, strategies, regulations or agreements to manage biodiversity values.

Objectives of action

In response to the problems, DELWP aims to revise the Code to ensure it:

- Incorporates and accurately represents current government policy, commitments and strategies at end June 2019.
- Is free of errors, inconsistencies and ambiguities, including correct referencing to other regulatory instruments, clarified definitions and correct names of entities.
- Clarifies boundaries of the roles of the regulator and all regulated parties.

In addition, the revised Code aims to provide:

- Ecological integrity – protection of habitat for threatened species and ecological communities (particularly Greater Glider, Large Brown Tree Frog, and Large Trees) within native forests, so that those species and communities will persist in the future.
- Certainty for industry - through a more transparent and efficient regulatory regime with low regulatory costs that will not unnecessarily affect the timber industry or communities who rely on it, and a consistent, unambiguous, transparent and reliable framework for regulatory decision-making.
- Community benefits – including opportunities for recreational uses of Victoria's native forests, and confidence that community values will be maintained in the future.

Approach

Following targeted stakeholder consultation with biodiversity experts, forest industry professionals and regulatory bodies, the proposed 2019 Code variations were split into two impact categories:

- Variations assessed as likely to impose significant additional regulatory burden.
- Variations assessed as likely to impose insignificant additional regulatory burden.

A proportional approach has been taken as part of this RIS to assess and estimate the impacts, with greater focus on impacts likely to result in significant additional regulatory burden. Less focus has been given to impacts likely to result in insignificant additional regulatory burden because they are considered to clarify rather than change the regulatory intent.

Options for addressing the problems

Options were identified, scoped and assessed in relation to the objective to incorporate and current government policy, commitments and strategies at end June 2019 – specifically in relation to the significant variations required for the Large Brown Tree Frogs and Large Trees

1. One option was assessed for the protection of specific habitat for Large Brown Tree Frogs. This option is consistent with the existing Action Statement no. 255 (published 2014) and relates to the protection of areas where these species are detected in State Forest.
   - Large Brown Tree Frog: If a Large Brown Tree Frog is detected in State Forest, establish a 28-ha protected area by creating a Special Protection Zone (SPZ) that includes the detection site.
2. Two options were assessed for the protection of large trees; (Large Tree (no Buffer) and Large Tree (with buffer). Improving the protections for large trees will provide quality habitat for a

range of hollow-dependent fauna including the Greater Glider, Leadbeater's Possum, Yellow-bellied Glider, Mountain Brush-tailed Possum, Masked Owl, Sooty Owl and Powerful Owl. This would be achieved through changes to practices that prohibit the felling of those trees and modifications to management around those trees.

- Large Tree (no Buffer): VicForests must retain all living trees equal to or greater than 2.5 m DBHOB and protect them from the direct effects of timber harvesting operations and regeneration burning. This includes not deliberately felling, falling into, or damaging large trees during harvest, and ensuring slash is not permitted to accumulate within 3 metres of the base of large trees immediately prior to regeneration burns. Where possible, incorporate large trees in retained patches or expanded buffers or exclusion areas.
- Large Tree (with buffer): VicForests must retain all living trees equal to or greater than 2.5 m DBHOB and protect them from the direct effects of timber harvesting operations and regeneration burning using a 20 metre (m) buffer and where possible, incorporate large trees in retained patches or expanded buffers or exclusion areas.

Summary of key findings

- Large Trees and Large Brown Tree Frog habitat are now rare in Victoria's State forests. This highlights the importance of immediate action to protect these ecosystem assets.
- Although VicForests protects Large Trees voluntarily recent reviews have highlighted that the protection of forest biodiversity must be enforceable to ensure that community, government and industry can be certain that environmental outcomes will be achieved.
- In the context of prescribing actions to protect large trees, the objective is to ensure large trees are protected from the direct effects of timber harvesting and regeneration burns.
- The preferred Large Tree (no Buffer) option will achieve this objective by requiring the protection of large trees from the direct effects of timber harvesting operations and regeneration burning and, where possible ensuring that large trees are incorporated in retained patches or expanded buffers or exclusion areas.
- Buffers are an alternative mechanism sometimes used to protect forest values from the direct effects of timber harvesting and regeneration burns however provide less operational flexibility.
- The RIS therefore investigates the alternative option: Large Tree (with buffer) to test if a 20-meter buffer would achieve this outcome but also generate significant co-benefits for threatened forest-dependent flora and fauna that would justify this implementation option.
- The analysis found that the predicted 50-year biodiversity benefits of the additional buffers is low. By way of comparison, the biodiversity benefit provided by the buffer represents 0.2% of the maximum theoretical benefit that could be achieved if the threat of timber harvesting was entirely mitigated in all eastern Forest Management Areas.
- Quantifying future biodiversity benefits for highly dispersed and rare forest assets is inherently difficult and a qualitative assessment of biodiversity benefits was required for the Large Tree (no Buffer) option.
- This uncertainty in biodiversity benefits should not detract from the imperative of protecting these remaining values. It does however highlight the importance of selecting an implementation option that achieves the intended regulatory objective (protecting large trees) without imposing an unreasonable economic and social burden.

- For Large Brown Tree Frog and Large Tree (no Buffer), the reductions in wood supply are negligible. This is because the prescriptions under these options are voluntarily implemented and have already been incorporated into VicForests wood supply calculations.
- In contrast to this, the costs of the Large Tree (with buffer) option are significant highlighting that a buffer is exceptionally restrictive to timber harvesting operations and that these impacts flow through the supply chain.
- The additional buffer would result in a $39 million impact over ten-year analysis period. This would include: $17.75 million in costs to the State (VicForests), $11.25 million in cost to the State associated with pulp log shortfalls to Australia Paper, $9.45 million in costs to sawmill operators, and $0.86 million in cost to harvest and haulage operators.
- These costs are significant in the context of the total of $1.2 million (post tax) profit report by VicForests in 2017-18 annual report and the limited opportunities for some elements of the supply chain such as sawmills to offset the reduced revenue that is associated with a loss of throughput.
- In this context the cost-effectiveness of the biodiversity gains must be investigated closely. The RIS found that cost effectiveness of the additional buffer was low. By way of comparison, a similar ($39 million) investment in fox and cat control over 10 years would be expected to secure a seven-fold increase in biodiversity benefits compared to the Large Tree (with buffer) option.
- The RIS therefore puts forward Large Brown Tree Frog and Large Tree (no Buffer) as the preferred option.

Costs of the options

Detailed assessment of the biophysical impacts (biodiversity and wood supply) of these options was undertaken by DELWP and VicForests.

Much of the direct additional regulatory burden is attributable to changes in wood supply with each of the options. For example:

- Large Tree (with buffer) results in the greatest reduction in ash wood supplies (down 7 per cent compared to the base case), with only a negligible impact on mixed species. This is partly a function of ash species dominating the large trees in the landscape.
- For Large Brown Tree Frog and Large Tree (no Buffer), the reductions in wood supply are negligible. This is because the prescriptions under these options have already largely been incorporated into VicForests wood supply calculations.
- This biophysical analysis informed the estimate of the change in producer surplus (or economic cost) of the potential options using a regulatory burden approach. The analysis estimated the present value (PV) of costs (i.e. the regulatory burden) associated with each option relative to the base case for the assessment period 2019-20 to 2029-30. These impacts are shown in Figure ES1.

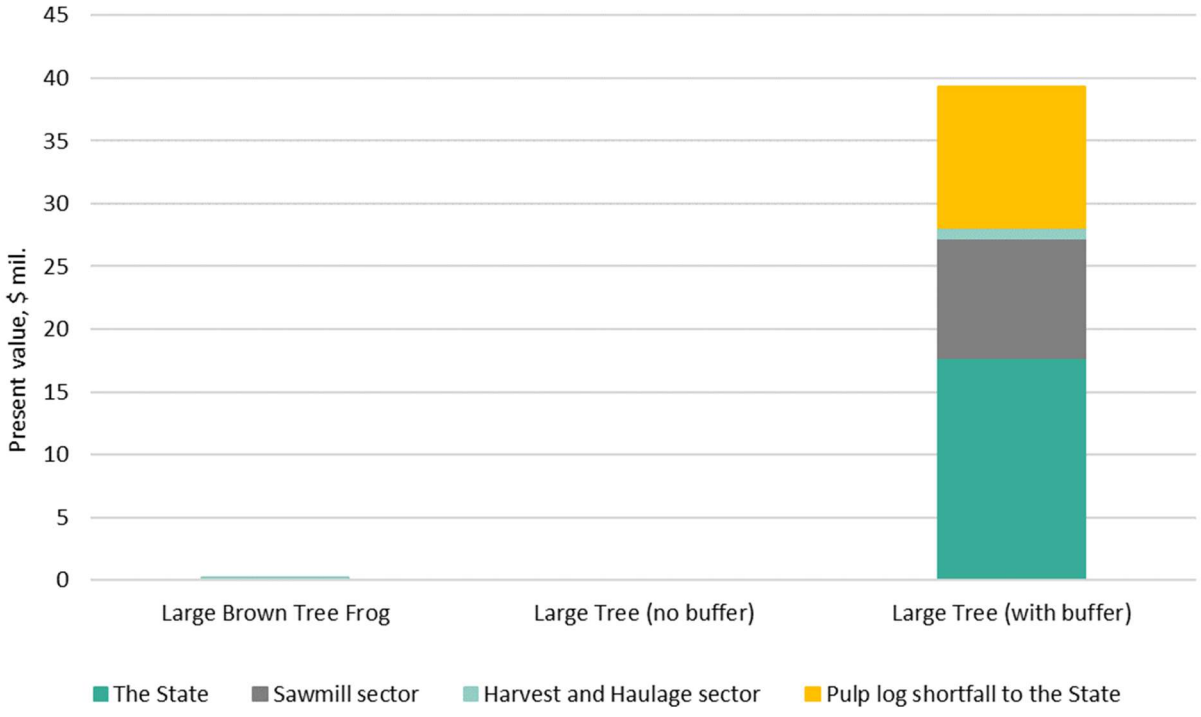


Figure ES1. Estimated present value costs for each option at State level, relative to base case ($ Million)

Key points to note include:

- The costs vary across options over the assessment period depending on the estimated change in wood supply.

- The option with the greatest estimated cost over the period is Large Tree (with buffer) (approximately $39 million in present value terms). The estimated cost of Large Tree (with buffer) is equivalent to an annual impact of approximately $4 million or 6 per cent of the estimated value add from VicForests and contractors.[1]
- The Large Tree (with buffer) option has a significantly greater impact than the Large Tree (no buffer) option ($0) that is already implemented voluntarily by VicForest and therefore considered part of the status quo.
- The Large Brown Tree Frog intervention is estimated to have a low ($88,000) impact due to the small geographic distribution of this species and therefore small impact on timber harvesting.
- The distribution of costs across the supply chain also differs significantly. Because the costs to harvest and haulage operators have been assumed to be 'passed through' to VicForests, the impacts to this segment of the supply chain under Large Tree (with buffer) are estimated to be relatively negligible, but nonetheless reflects a potential reduction in supply. The extent to which this results in a net reduction in supply (across native forest and plantation forests) has not been investigated as part of this RIS. However, if supply substitution does not occur, the current number of operators would not be supported. This is particularly the case for harvest operators where there is constrained scope for equipment to be utilised in other parts of the economy.
- Under Large Tree (with buffer), impacts on sawmill operators could be relatively significant as the loss in throughput and associated revenue cannot be offset by reducing costs. Opportunities to reduce this burden by accessing alternative timber supplies have not been modelled.
- The shortfall in pulp log that would be supplied under each of the options has also been estimated. Large Tree (with buffer) is estimated to result in shortfalls that would need to be met, given existing contractual arrangements between the Victorian government and Australian Paper. These costs have assumed to be met by the Victorian Government under existing supply arrangements. These costs should be considered indicative because the actual costs will be highly influenced by the location and method of harvesting operations through the period up to 2030. For this reason, they are reported separately to other costs to the State, for which there is more certainty.

Benefits of the options

The various options are estimated to deliver different benefits, particularly with respect to delivering an increase in suitable habitat for a range of forest-dependent threatened species. Table ES1 contains the estimated Change in Suitable Habitat (CSH) (for relevant VEAC[2] forest-dependent threatened species (excluding Greater Glider) and Greater Glider alone, for the period 2019-20 to 2029-30 for each of the options.

[1] Based on Deloitte (2017) estimated annual value add of VicForests and contractors of $70 million, calculated in 2015-16.

[2] Expected biodiversity benefit achieved from ceasing timber harvesting has been assessed for 66 forest dependent threatened and non-threatened species that occur in the intervention area(s). These species were identified by expert biologists as part of the Victorian Environmental Assessment Council (VEAC) 2017 report 'Conservation values of State Forests' and includes birds, amphibians, reptiles, plants and mammals. Benefit is only reported for species that have a modelled distribution and expected benefit within the intervention area

The CSH measure is the additional biodiversity benefit for these species within an area due to removing the threat of timber harvesting at that location, and therefore maintaining the persistence of key ecological features (e.g. Large Trees and Large Brown Tree Frog habitat).

Biodiversity benefits have been itemised to quantify the co-benefits that could be provided to recently listed threatened species such as the Greater Glider.

In addition to presenting the CSH estimates, Table ES1 presents each option's contribution to CSH relative to the theoretical maximum CSH that could be achieved if harvesting was immediately stopped in all eastern Forest Management Areas (FMAs).

Table ES1. Estimated increase in suitable habitat by option within the analysis area

		Greater Glider Benefit		VEAC Fauna and Flora [3] Excl. Greater Glider Benefit	
Option	**Net harvestable area impacted (hectares)** Timber production area expected to be impacted by option	**Change in Suitable Habitat (CSH) hectares** Improvement in biodiversity benefit	**CSH as % of maximum protection** Comparison to stop harvest benefit in all eastern FMAs	**Change in Suitable Habitat (CSH) hectares** Improvement in biodiversity benefit	**CSH as % of maximum protection** Comparison to stop harvest benefit in all eastern FMAs
Large Brown Tree Frog	23 ha (East Gippsland only)	7 CSH ha.	0.0 %*	1 CSH ha.	0.0 %*%
Large Tree (no Buffer)	It has not been possible to assess the Large Tree options using the CSH methodology as the area that this applies to is not spatially explicit. Instead the following description has been prepared by the DELWP Biodiversity Division: The protection of large, living trees represents a significant, long-term benefit for hollow dependent mammals such as Leadbeater's Possum and the Greater Glider, as well as hollow nesting and roosting birds such as the Sooty Owl. The degree of benefit relies on the large trees surviving the timber harvesting, regeneration and regrowth phases, during which mechanical damage, fire and windthrow might lead to damage or loss. The degree of benefit and the longevity of the tree in the landscape varies according to the density of large trees and the extent of their occurrence across the local landscape. Each hollow-dependent species will prefer certain large tree densities and habitat patch sizes. In addition to the local landscape considerations, the benefit will be amplified by the degree to which it recurs at a broader landscape or regional scale, i.e. the benefit will be greater if there are more large trees detected and therefore more large trees that are standing in the landscape over a greater area to create a general pattern of retained standing trees.				
Large Tree (with Buffer)	1,897 ha (across the seven FMAs)	628 CSH ha.	0.2 %*	845 CSH ha.	0.2 %*

* Estimates have been rounded.

The key points to note include:

- The modelled biodiversity benefits are relatively low given the existence of these values across the broader forested landscape. However, the benefits modelled may reflect only a portion of the range of benefits that could be expected.

[3] see Appendix F for the full list of forest-dependent species.

- The Large Brown Tree Frog option is anticipated to affect the provision of suitable habitat in only one FMA (East Gippsland) due to the limited distribution of the species. The option is estimated to result in an increase in suitable habitat hectares of one (for all species excluding Greater Gliders) and seven (for Greater Gliders).
- The Large Tree (with Buffer) option is anticipated to affect the provision of suitable habitat in a number of FMAs. The option is estimated to result in an increase in suitable habitat hectares of 845 (for all species excluding Greater Gliders) and 628 (for Greater Gliders).
- It is currently not possible to estimate the change in suitable habitat contribution of Large Tree (no Buffer) option which limits the extent to which the benefits of this option can be assessed relative to other options. However, as it results in a smaller area being excluded from harvesting (relative to Large Tree (with buffer)), it is anticipated to result in a appreciably smaller contribution to the CSH hectares.

Changes to ecosystem services such as water yields were estimated quantitatively. However, it should be noted that these benefits are secondary considerations and their estimation should be treated with caution due to data constraints. Changes to ecosystem services associated with carbon sequestration and forest-based recreation and tourism were assessed qualitatively. It should also be noted, that to the degree that the Code variations result in shift in harvest activity to other timber sources, then the impacts on water yield (and carbon sequestration and forest-based recreation and tourism) services may be negligible (i.e. whatever is gained through the proposed Code variations is likely to be at least partially offset by harvesting elsewhere).

The preferred option

Cost-effectiveness analysis (CEA) was undertaken for Large Brown Tree Frog and Large Tree (with buffer) to ascertain which option is the most cost-effective at achieving changes in suitable habitat hectares. The use of CEA enables the tradeoffs between costs and benefits (measured as changes in suitable habitat hectare) to be assessed relative to each option being considered. The results of the CEA are shown in Table ES2. It reflects the costs associated with gaining a suitable habitat hectare under the options. A lower number reflects a lower cost option for achieving a one hectare change in suitable habitat.

Table ES2. Summary results for each option

Option	Summary results
Large Brown Tree Frog	
Change in suitable habitat	Anticipated to apply to 23 hectares within the Net Harvestable Area within East Gippsland FMA. It is estimated to result in an increase in suitable habitat hectares of one (for all species excluding Greater Gliders) and 7 (for Greater Gliders)
Cost-effectiveness	An estimated cost-effectiveness of $12,200 / suitable habitat hectare gained for Greater Gliders and $133,100 / suitable habitat hectare gained for all species excluding Greater Gliders, which is a function of the relatively small change in suitable habitat for all species excluding Greater Gliders.
Implementation	Implementation of this option is detection-based and will require: • DELWP to update its compliance processes and procedures to incorporate the preferred options in the scope of its Forest Audit Program and surveillance checks conducted by the Timber Harvesting Compliance Unit.

Option	Summary results
	• VicForests to amend its operational procedures and internal compliance checks and to communicate this to its harvest and haulage contractors. However, this is not considered to be onerous as this is already incorporated in VicForests activities.
Large Tree (no buffer)	
Change in suitable habitat	It has not been possible to assess this option using the CHS methodology as the area that this applies is not spatially explicit. The protection of large, living trees represents a significant, long-term benefit for hollow dependent mammals such as Leadbeater's Possum and the Greater Glider, as well as hollow nesting and roosting birds such as the Sooty Owl. The degree of benefit relies on the large trees surviving the timber harvesting, regeneration and regrowth phases, during which mechanical damage, fire and windthrow might lead to damage or loss. The degree of benefit and the longevity of the tree in the landscape varies according to the density of large trees and the extent of their occurrence across the local landscape. Each hollow-dependent species will prefer certain large tree densities and habitat patch sizes. In addition to the local landscape considerations, the benefit will be amplified by the degree to which it recurs at a broader landscape or regional scale.
Cost-effectiveness	Anticipated to be highly cost-effective, as this option formalises measures already adopted by VicForests, therefore the regulatory burden is negligible.
Implementation	Implementation of this option is detection-based and will require: • Clarity around how compliance will be determined. For example, the requirement for exclusion areas around Large Trees reserves, "to be incorporated into retained patches or within expanded exclusion areas, where practicable" (NCE emphasis), will require clarification and potentially some field testing by DELWP and VicForests. • DELWP to update its compliance processes and procedures to incorporate the preferred options in the scope of its Forest Audit Program and surveillance checks conducted by the Timber Harvesting Compliance Unit. • VicForests to amend its operational procedures and internal compliance checks and to communicate this to its harvest and haulage contractors. However, this is not considered to be onerous as this is already incorporated in VicForests activities.
Large Tree (with buffer)	
Change in suitable habitat	Anticipated to affect the provision of suitable habitat in all seven FMAs in eastern Victoria. The option is estimated to result in an increase in suitable habitat hectares of 845 (for all species excluding Greater Gliders) and 628 (for Greater Gliders).
Cost-effectiveness	An estimated cost-effectiveness of $62,600 / suitable habitat hectare gained for Greater Gliders and $46,500 / suitable habitat hectare gained for all species excluding Greater Gliders, which is a function of the high regulatory burden relative to the increase in suitable habitat hectares.
Implementation	Implementation of this option is detection-based and will require: • Clarity around how compliance will be determined. For example, the requirement for exclusion areas around Large Trees reserves, "to be incorporated into retained patches or within expanded exclusion areas, where practicable" (NCE emphasis), will require clarification and potentially some field testing by DELWP and VicForests.

Option	Summary results
	• DELWP to update its compliance processes and procedures to incorporate the preferred options in the scope of its Forest Audit Program and surveillance checks conducted by the Timber Harvesting Compliance Unit. • VicForests to amend its operational procedures and internal compliance checks and to communicate this to its harvest and haulage contractors. • VicForests to update its wood flow modelling and Resource Outlooks to reflect the wood supply impacts associated with this option as it is not currently considered.

Based on the summary presented in Table ES2 the preferred option is Large Brown Tree Frog. It is anticipated to provide protection of an important species and codifies the prescriptions contained in Statement no. 255 (published 2014). It is anticipated to apply to 23 hectares within the Net Harvestable Area within East Gippsland FMA.

Large Tree (no Buffer) is also considered a preferred option. This is because Large Tree (no buffer) is anticipated achieve the regulatory objective and in doing so provide important habitat characteristics, whilst minimising the regulatory burden experienced by the forestry sector. It should be noted that it has not been possible to assess this option using the CSH methodology as the area that this applies is not spatially explicit.

The combination of Large Brown Tree Frog and Large Tree (no buffer) is anticipated to:

- Contribute to the protection of important habitat characteristics that are important for many threatened forest and species, including Large Brown Tree Frogs and Greater Gliders.
- Deliver greater regulatory certainty to the timber industry and community.

Large Tree (with buffer) is considered to provide marginal additional protection, relative to Large Tree (no buffer), however it is also estimated to result in significantly higher regulatory burden.

In addition to these major changes, it is recommended that the proposed minor changes (see Table 23, Appendix E) are adopted. They will correct minor errors, creating less ambiguity within the Code. The regulatory burden of these changes will be minor, involving once-off transition costs associated with editing the Code.

Uncertainty with economic impacts

Table ES3 contains an overview of the limitations that should be considered when interpreting the results. All estimated impacts should be considered indicative of the order of magnitude and are intended to provide guidance on the relative impacts of each option.

Table ES3. Limitations and implications associated with the current assessment

Limitation element	Description / implication
Impact on the State	The assessment relies on wood supply modelling from VicForests. For options that are spatially defined (e.g. Large Brown Tree Frog), the estimates of the reduction in wood supply are considered to have relatively high accuracy. However, for detection-based options or options that are not spatially defined (that is, Large Tree (no buffer), Large Tree (with buffer)), a range of assumptions have been made to facilitate the estimation of the impact on wood supply. There is lower accuracy associated with these options.

Limitation element	Description / implication
	In addition, the estimates of the change in variable costs associated with each of the options are high level estimates, and have not been calculated using a 'bottom – up' approach to individual cost items; however, sensitivity testing of this parameter has been undertaken. The sensitivity testing indicates that, depending on the option, VicForests costs, harvest and haulage costs that are passed on to VicForests by contractors, and the additional costs associated with each option, have the highest effect on the variability of the estimated impacts.
Impact on harvest and haulage operators	The assessment relies on publicly available information about harvest and haulage operators, supplemented by interviews of VicForests. The assumptions, including the assumed margin received, have not been confirmed with harvest and haulage operators; however, sensitivity testing of key input parameters has been undertaken. The sensitivity testing indicates that the harvest and haulage contractors' margins have the highest effect on the variability of the estimated impacts.
Impact on sawmill operators	There is a lack of recent publicly available financial data on the Victorian sawmilling industry. Therefore, the impact on sawmill operators relies on information from the NSW native forest sector, adjusted to reflect an 'average' Victorian sawmill, in consultation with VicForests. Detailed 'bottom-up' modelling of individual sawmill operations has not been attempted. Nor have the assumptions been confirmed with sawmill operators; however, sensitivity testing of key input parameters has been undertaken. The sensitivity tests indicate that the sawmill operators' margins have the highest effect on the variability of the estimated impacts.
Impact of pulp log shortfall	A high-level assessment of the potential costs associated with being unable to meet supply obligations between Australian Paper and the Victorian government has been provided based on sourcing alternative pulp log supply. These costs have assumed to be met by the Victorian Government under existing supply arrangements. These costs should be considered indicative, because the actual costs will be highly influenced by the location and method of harvesting operations through the period up to 2030.
Timeframe of assessment	The assessment only considers the period to 2030. In practice, the planning horizon for VicForests is considerably longer, with wood flow modelling conducted over a 100-year period. The results do not include consideration of the residual value of State native forest beyond 2030. However, it is important to note that the base case, and the wood supply forecast for each of the options, are based on a model of sustainable yield that extends over the long term. This approach reflects the assumption that VicForests and the hardwood timber industry will continue to operate after 2030; and the volume of wood supply available in 2029-30 will be available thereafter; i.e. VicForests continues to operate, albeit at lower annual harvest volumes than under the base case. Ideally, the period of the analysis for the RIS would reflect the period of the impacts. However, extending the analysis would introduce a new set of data uncertainty (e.g. assumptions and inputs for economic and other parameters beyond the 10 years). Similarly, suitable habitat hectares are estimated assuming the attainment of this CSH outcome at a 50-year time horizon. As such, the estimates presented assume that gains will be achieved over a shorter time. This is typical of state and transition models[4] used in ecological analysis.
Consideration of fire	Neither the wood supply model nor the change in suitable habitat model include assumptions about major bushfire events occurring in the future. Depending on the location and extent of the fire, it may be possible to source alternative wood supply from elsewhere in the forest estate such that, in a given year, the combination of the Code variations and fire may have negligible impact on wood supply. However, the biodiversity benefits (i.e. change in suitable habitat) of the Code

[4] State and transition models help understand complex systems, with multiple interactive drivers for changes (e.g. competition, precipitation, and response to management actions) that operate at different intensities, frequencies, and durations across different scales of time and space.

Limitation element	Description / implication
	variations would be undermined by fire. The extent to which this results in a reduction in the biodiversity benefit would depend on the location and extent of the fire.

NCECONOMICS

CONTENTS

FIGURES

TABLES

GLOSSARY

Term	Definition used in this document
Biodiversity	The natural diversity of all life: the sum of all our native species of flora and fauna, the genetic variation within them, their habitats, and the ecosystems of which they are an integral part.
Basal Area	The sum of the cross-sectional areas measured at breast height (1.3m) of the trees in a given stand (or plot). Usually expressed as square metres per hectare (m2/ha).
Code	The Code of Practice for Timber Production 2014
Fauna	Any native animal including reptiles, birds, mammals, marsupials and fish
Flora	Any native type of plant
General Management Zone/s (GMZ)	Within the Forest Management Zoning Scheme, GMZ are zones managed for a range of uses and values, but timber harvesting operations have a higher priority. Source: Code of Practice for Timber Production 2014.
Habitat tree	A tree identified and protected from harvesting to provide habitat or future habitat for wildlife. A habitat tree may be living or dead, and often contains hollows that are suitable shelter and/or nesting sites for animals such as possums and parrots.
Harvesting entity	An organisation or person responsible for conducting a timber harvesting operation. In State forest the harvesting entity is either VicForests or the holder of a licence granted under section 52 of the *Forests Act 1958*.
High conservation value areas	A concept established by the Forest Stewardship Council for classifying forests with outstanding biological, ecological, social, or cultural values; for example those that contain endemic species or sacred sites.
Large old tree	A large tree is defined as a living tree of any species that has a diameter at breast height over bark (DBHOB) equal to or greater than 2.5 metres.
Modelled Old Growth (MOG2009)	The modelled spatial representation of the approximate location and extent of old growth forest stands in eastern Victoria. The data layer containing old growth boundaries is called Modelled Old Growth and the latest official version of this layer is MOG2009.
Native forest	An area originally naturally occurring, that is dominated by trees having usually a single stem and a mature or potentially mature stand height exceeding two metres and with existing or potential crown cover of overstorey strata about equal to or greater than 20 per cent. This definition includes areas of trees that are sometimes described as woodlands, but does not include plantations (which may exhibit the characteristics of a native forest but are established for commercial purposes). Source: Code of Practice for Timber Production 2014.
Old growth forest	Old-growth means forest which contains significant amounts of its oldest growth stage – usually senescent trees – in the upper stratum and has been subjected to any disturbance, the effect of which is now negligible. For a stand to qualify as old-growth, the regrowth growth stages, if present, must be sparse (less than 10 per cent of the total crown cover of the stand). Negligibly disturbed forest is that in which disturbance is known to have occurred, but the disturbance is unlikely to have altered the structure (growth stage and crown cover) or the usual species composition which characterises a given vegetation class; or if the alteration did occur in the past, it is no longer measurable

Term	Definition used in this document
Operator	A person who conducts a timber harvesting operation. Typically, a machine or chainsaw operator.
Pulpwood	Wood that is used for the production of high-quality paper-based products and packaging.
Regeneration	The renewal or re-establishment of native forest flora by natural or artificial means following disturbance such as a timber harvesting operation or fire.
Regional forest agreement	Twenty-year agreements between the State of Victoria and the Commonwealth for the conservation and sustainable management of native forests.
Selective harvesting	A silvicultural system used to harvest and regenerate particular forest types. Trees are harvested either singly or in small groups at intervals indefinitely. Regeneration is established continually in the gaps produced and an uneven-aged stand is maintained.
Special Management Zone (SMZ)	SMZs are managed to conserve specific features, while catering for timber harvesting operations under special conditions specified in SMZ plans
Special Protection Zone (SPZ)	SPZs are managed for particular conservation values, forming a network designed to complement the formal conservation reserve system
Stand	A group of trees in a forest that can be distinguished from other groups on the basis of age, species composition, condition, etc. Usually at least 1 hectare in size.
State forest	State forest comprises publicly owned land which is managed for the conservation of flora and fauna; for the protection of water catchments and water quality; for the provision of timber and other forest products on a sustainable basis; for the protection of landscape, archaeological, historical and other cultural values; and to provide recreational and educational opportunities.
Suitable habitat	A 3-dimensional species-specific measure of the amount of habitat that is suitable to be occupied by that species. Suitable habitat = relative suitability of habitat X actual area of habitat. Relative suitability is based on environmental type/location and presence of key habitat features – this is represented as a SH habitat value per pixel and informed by the Habitat Distribution Model for a species.
Change in suitable habitat (CSH)	A purpose-built, scientific measure developed in 2016 by the Victorian Department of Environment, Land, Water and Planning to assess the most effective options for improving the future of native species across the state under climate change. Change in Suitable Habitat (CSH) considers the type, extent and configuration of habitat for a species, and the factors that influence how much a species can make use of this habitat. CSH is the increase in likelihood that a species will still exist at a location at a future time (50 years) in response to sustained management of relevant threats. It is expressed as the percentage increase in likelihood when comparing sustained management to no management.
Timber	A general term used to describe standing trees or felled logs before processing into wood products. This includes timber from trees or parts of trees which are specified as available for timber harvesting operations, but does not include firewood collected for domestic use.
Timber harvesting operation / timber production	Any of the following kinds of activities carried out by any person or body for the purposes of sale or processing and sale — (a) felling or cutting of trees or parts of trees; (b) taking or removing timber;

Term	Definition used in this document
	(c) delivering timber to a buyer or transporting timber to a place for collection by a buyer or sale to a buyer; (d) any works, including road works, site preparation, planting and regeneration, ancillary to any of the activities referred to in paragraphs (a) to (c)— but does not include— (e) the collection or production of firewood for domestic use. Source: Code of Practice for Timber Production 2014.

1 INTRODUCTION

1.1 Background to this RIS

Natural Capital Economics Pty Ltd (NCE), in partnership with Indufor Asia Pacific (Australia) Pty Ltd (Indufor), has been engaged by the Department of Environment, Land, Water and Planning (DELWP) to develop a Regulatory Impact Statement (RIS) for a suite of proposed variations to the *Code of Practice for Timber Production 2014* (the Code).

1.2 Approach to preparing this document

This document has been prepared in consultation with members of the DELWP Forest Policy, Forest Regulation, Environmental Compliance, Biodiversity and Economics teams, and VicForests. This has included face-to-face meetings and a series of project workshops to discuss the broad framework for the RIS and the specific impacts that will be analysed through this RIS. Feedback has been sought from the Office of the Commissioner of Better Regulation (OCBR) over the course of the project, to confirm that it addresses the requirements for regulatory impact statements.

Scope of the 2019 Code Variations

DELWP has conducted a review of the Code and its incorporated documents: the Management Standards and Procedures for timber harvesting operations in Victoria's State forests 2014 (the MSPs) and the Planning Standards for timber harvesting operations in Victoria's State Forests 2014 (Appendix 5) to the MSPs. This review has only focussed on the application of the Code to timber harvesting in State forests noting that some defined terms within the Code are applicable to private native forests and plantation forests.

The 2019 Code review has taken into consideration the following policies, strategies, reports, and assessments to identify candidate regulatory issues that can be resolved through proposed variations to the Code or its incorporated document:

- Independent Review of the Timber Harvesting Regulation Report.
- Independent Consultation Paper 'Modernising the Victorian Regional Forest Agreements'.
- Relevant legislation.
- Relevant FFG Act Action Statements.
- Field Guideline – Identification and Protection of Large Trees.
- Reports made to the DELWP Timber Harvesting Compliance Unit.
- DELWP Forest Audit Program.

The goals of the 2019 Code review are to ensure the Code is:

- **Clear**: The Code is easy to understand for all members of the community.
- **Accurate**: The Code is free of administrative errors.
- **Enforceable**: The Code can be used effectively for compliance activities.
- **Contemporary**: The Code is aligned to relevant policy and regulatory settings.

Table 23 (Appendix E) contains the full list of proposed variations to the Code to address the findings from the 2019 Code review.

1.3 Consultation on this RIS

DELWP had planned a consultation phased to engage stakeholders and the Victorian community on the proposed variations to the Code. This consultation will be coordinated with DELWP engagement on the modernisation of Victoria's Regional Forest Agreements.

Consultation is now open on the proposed changes to the Code of Practice for Timber Production 2014 (draft Code), and its incorporated document the Management Standards and Procedures for timber harvesting operations in Victoria's state forests (draft MSPs).

This consultation is supported by this *Regulatory Impact Statement for 2019 Updates to the Code of Practice for Timber Production*. These documents can be downloaded at **https://engage.vic.gov.au/future-of-our-forests/code-of-practice** .

The public consultation phase will close on the 29 September, 2019. During this time, you are invited to provide feedback on the targeted consultation questions or by uploading a submission.

Consultation questions related specifically to the RIS.

During consultation DELWP would particularly like to receive feedback on the following questions:

1. (In relation to potential impacts of the proposed 2019 Code updates to primary processors within Victoria): To what extent would the proposed 2019 Code updates result in an increase in the costs of production associated with sawmilling operations?
2. (In relation to potential impacts of the proposed 2019 Code updates to secondary processors within Victoria): To what extent do Victorian secondary processors (defined as furniture manufacture or paper and packaging manufacture) rely on inputs from Victorian native forests relative to other inputs?
3. (In relation to potential impacts of the proposed 2019 Code updates to harvest and haulage operators within Victoria): To what extent can harvest equipment be utilised for harvesting of plantation and private native forest wood supply in Victoria?
4. (In relation to potential impacts of the proposed 2019 Code updates to commercial firewood collectors within Victoria): To what extent would the proposed 2019 Code updates result in an increase in the costs of production associated with firewood collecting operations?

1.4 Scope of analysis undertaken in the RIS

Approach

Following consultation with key stakeholders, potential 2019 Code variations were split into two impact categories: Variations assessed as likely to impose significant additional regulatory burden and those likely to impose insignificant regulatory burden.

A proportional approach has been taken to assessing and estimating the impacts, with greater focus on impacts likely to result in significant additional regulatory burden. Less focus has been given to impacts likely to result in insignificant additional regulatory burden because they are considered to clarify rather than change the regulatory intent or effect. Those items are not considered further in this RIS, but are summarised in Table 26, Appendix E.

Other considerations identified as being outside the scope of this RIS include assessing the full regulatory impact of the existing 2014 Code and the complementarity of exiting environmental protections of the 2014 Code.

1.5 Overview of the existing regulatory framework

Existing regulatory framework for timber harvesting

Timber harvesting in Victoria is governed by a wide range of commonwealth and state legislation, regulations, policies and codes. The Code addresses the legal obligations that timber harvesting managers, harvesting entities and operators must consider in addition to existing relevant law[5]. Figure 1 depicts the role of the Code within the Victorian forest timber harvesting regulatory framework.

[5] see Section 1.2.4 of the Code.

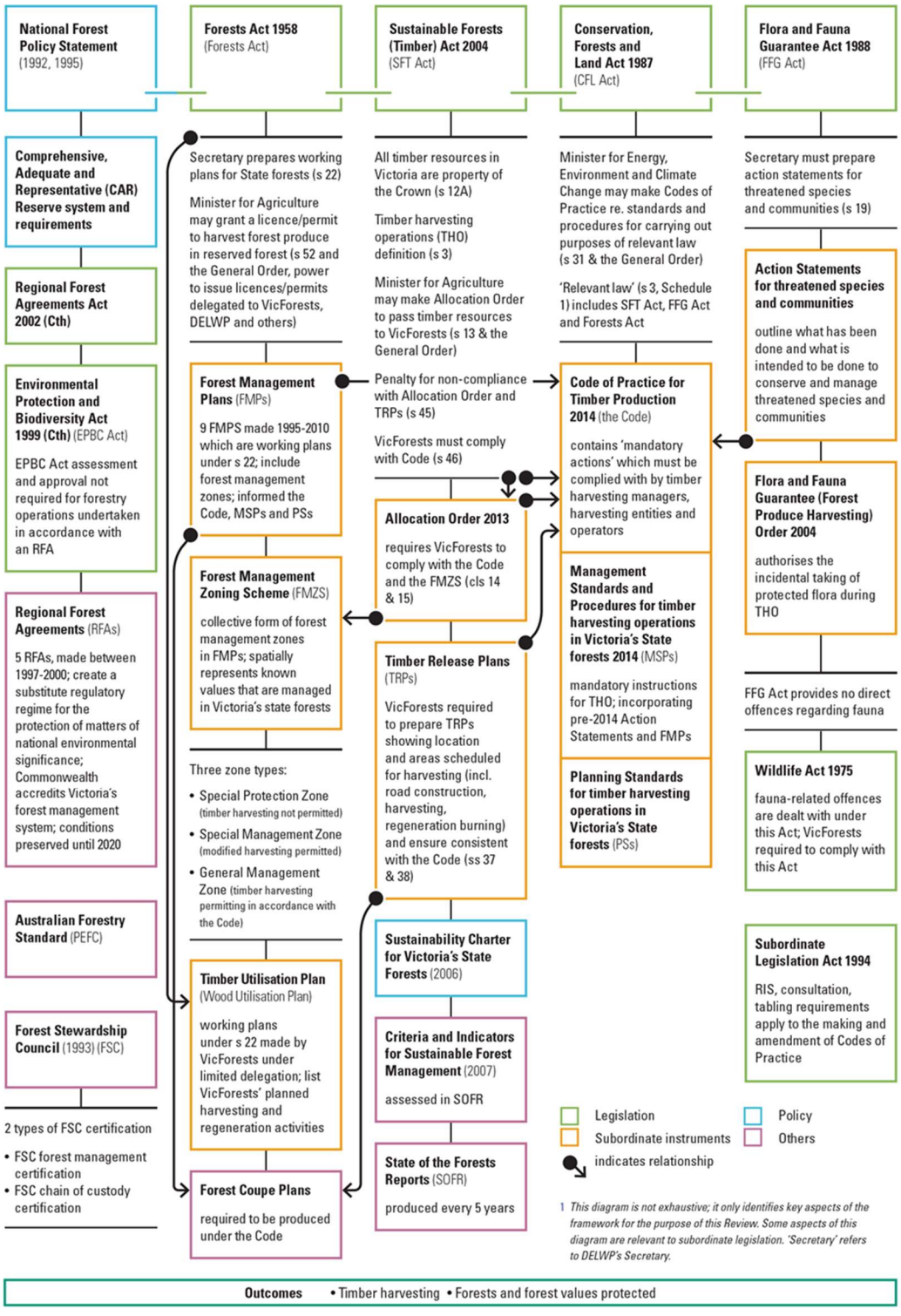


Figure 1. Role of the Code in the State forest timber harvesting regulatory framework

Source: Brockington, et al. (2018).

Changes in regulatory requirements relevant to timber harvesting operations

In some instances, regulatory requirements outside the regulatory framework for timber harvesting have changed since the Code was last reviewed, for example, the requirements of the *Aboriginal Heritage Act 2006* (Vic), *Aboriginal Heritage Regulations 2017* (Vic), and *Heritage Act 2017* (Vic). The 2019 Code review seeks to remove any duplication with such regulations. These changes do not change the regulatory burden already in place, rather direct timber harvesting authorities to the relevant requirements. As such, these matters are not analysed further in this RIS.

Current regulatory requirements

The Code applies to the planning and conducting of all commercial timber production and timber harvesting operations on both public and private land in Victoria. In State forests, the responsible managing authority is VicForests, which is responsible for the operational planning and conduct of timber harvesting operations within Victoria's native State forests. VicForests discharges some of its obligations under the Code to the harvest and haulage contractors that it engages.

The purpose of the Code is to provide direction to timber harvesting managers, harvesting entities and operators across Victoria. The Code seeks to support the achievement of environmental performance outcomes for the planning and conduct of commercial timber harvesting operations in a way that:

- Permits an economically viable, internationally competitive and sustainable timber industry.
- Is compatible with the conservation of the wide range of environmental, social and cultural values associate with forests expected by the community.
- Provides for the ecologically sustainable management of native forests proposed by cyclical timber harvesting operations.
- Enhances public confidence in the management of timber production in Victoria's forests and plantations.

The Code is based on six principles developed from the internationally recognised Montreal Process criteria. The principles are consistent with the objectives of the Sustainability Charter for Victoria's State forests. The principles are:

- Biological diversity and the ecological characteristics of native flora and fauna within forests are maintained.
- The ecologically sustainable long-term timber harvesting capacity of forests managed for timber harvesting is maintained or enhanced.
- Forest ecosystem health and vitality is monitored and managed to reduce pest and weed impacts.
- Soil and water assets within forests are conserved. River health is maintained or improved.
- Cultural heritage values within forests are protected and respected.
- Planning is conducted in a way that meets all legal obligations and operational requirements.

For each forest type (i.e. State forest, private native forest or plantation), the Code provides guidance on principles, operational goals and mandatory actions that are reflective of the Code's intended outcomes and the mechanisms by which they are to be achieved.

The specific regulatory requirements of the Code are not reproduced here, however, an overview of the scope of the prescriptions that are addressed in the Code are listed in Table 1.

Table 1. Scope of Code prescriptions for State forests, private native forests and plantations

State Forests	Private Native Forests	Plantations
Forest management planning	Forest planning	Plantation planning and design
Environmental values in State forests	Environmental values in private native forests	Environmental values in plantations
Operational planning and record keeping	-	-
Roading for timber harvesting operations	Roading for timber production	Plantation roading
Timber harvesting	Timber harvesting	Timber harvesting
Forest regeneration and management	Forest regeneration and management	

Source: DEPI (2014a).

Mandatory actions are practices or activities that must be undertaken to achieve each operational goal. Timber harvesting managers, harvesting entities and operators must undertake all relevant mandatory actions to be compliant with the Code.

Ultimately the Code is intended to ensure that commercial timber harvesting does not result in unintended adverse impacts on priority environmental objectives (including loss of habitat for key species) while permitting such harvesting and processing to remain viable and sustainable in the long-term.

Flora and Fauna Guarantee Act 1988 Action Statements

Action Statements prepared under the *Flora and Fauna Guarantee Act 1988* (FFG Act) outline what has been done to conserve and manage a species or community or threatening process. Actions Statements also outline what is intended to be done or what needs to be done to conserve the species. These proposed actions aim to help secure populations and enable the long-term persistence of a species. Action Statements often call for research to improve our understanding of an item's biology and the impacts of any threats. The proposed actions can be implemented by a range of organisations including government agencies, universities, environmental Non-Governmental Organisations (NGO) and community groups.

Prescriptions regarding timber harvesting in Action Statements in existence at the time of making the *Code of Practice for Timber Production 2014* were incorporated into the Code or its incorporated Management Standards and Procedures. Previously, the Allocation Order required VicForests to comply with Action Statements made under the FFG Act. Under the Allocation Order 2013, VicForests is no longer expressly required to comply with Action Statements. Under the Code the operational prescriptions for Action Statements which existed at the time of its making were incorporated into the MSPs and Planning Standards. There have, however, been Action Statements made since 2014 for which there is no prescriptive requirement incorporated into the Code.

In some instances, VicForests may voluntarily incorporate prescriptions into their standard operating procedures without these being given regulatory effect, e.g. the recommended management actions responding to detections of Large Brown Tree Frog.

2 PROBLEM ANALYSIS

2.1 Background to the problem

Significant reviews have been undertaken in relation to the management of native forests for multiple uses including timber production and biodiversity. Together these reviews provide the background to the problem. Whilst the proposed regulatory changes do not seek to address all contextual issues it is important they are considered in the determination of the preferred option. Key themes identified include:

- Advances in scientific understanding: New advances biodiversity and forest management science have highlighted threats to forest biodiversity values and potential solutions for how these threats can be managed.
- Changing community expectations: Community awareness and understanding relating to the environmental and social costs of timber production has changed such that there is pressure to revisit the mix of goods and services derived from State native forests (e.g. conservation versus production goods and services).
- Regulatory failure: The current regulations guiding State native forest harvesting incorporates unclear requirements, which reduces its effectiveness in regulating industry activities.
- Forest sector employment and training: Data suggests that decline in direct employment in the forest industry is accelerating which is accompanied by few opportunities for training.

These themes are discussed in more detail in this section.

Background to the problem - Overview of forest health

The Victorian State of the Forests Report 2018 highlights some of the key background issues for the forest management in Victoria across several categories including:

- Conservation of biological integrity.
- Maintenance of the productive capacity of forest ecosystems.
- Maintenance of the ecosystem health and vitality.
- Conservation and maintenance of soil and water resources.
- Maintenance of forest contribution to global carbon cycles.
- Maintenance and enhancement of long term multiple socio-economic benefits to meet the needs of societies.

Further to this, the Victorian Environmental Assessment Council (VEAC) *Conservation Values of State Forests Assessment* report (VEAC, 2017) undertook an assessment of State forests in Victoria. The purpose of the assessment was to:

- Identify the biodiversity and ecological values in the specified area.
- Identify the current and likely future threats to these values.
- Report on public land use and management.

The assessment found that there is a strong overlap between the limited distribution of forest-dependent species and the key resources for timber production.

Background to the problem - Overview of the timber production industry

Overview of the national forest sector

Australian forest industry log production data is shown in Figure 2. It highlights the variability in log production between 2007-08 to 2016-17. Total production initially declined until 2012-13, where it then began to steadily increase rising above the 2007-08 production levels (ABARES, 2018[6]).

The increase in production has also resulted in a greater contribution to the national economy, growing from $1,500M to $2,500M in five years. Across the country there has been a significant decline in proportion attributable to native hardwood production from about 32 per cent to 12 per cent. Softwood has remained steady at around 55 to 60 per cent and hardwood plantations has increased from 15 to 34 per cent.

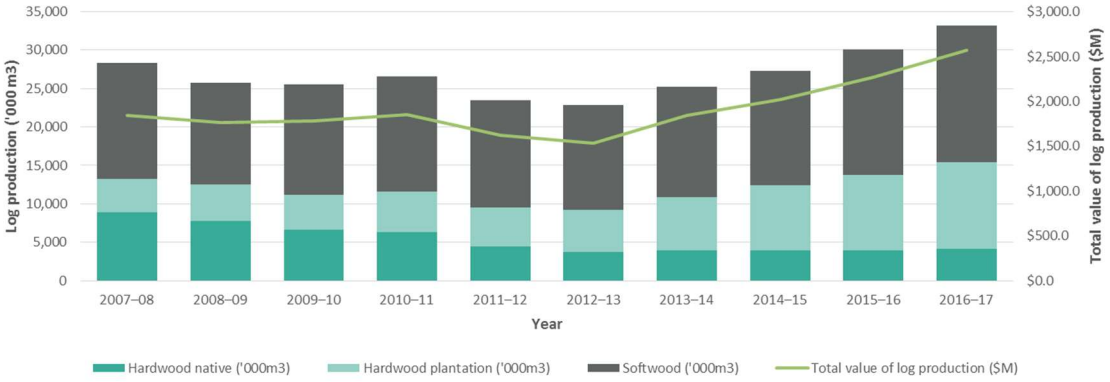
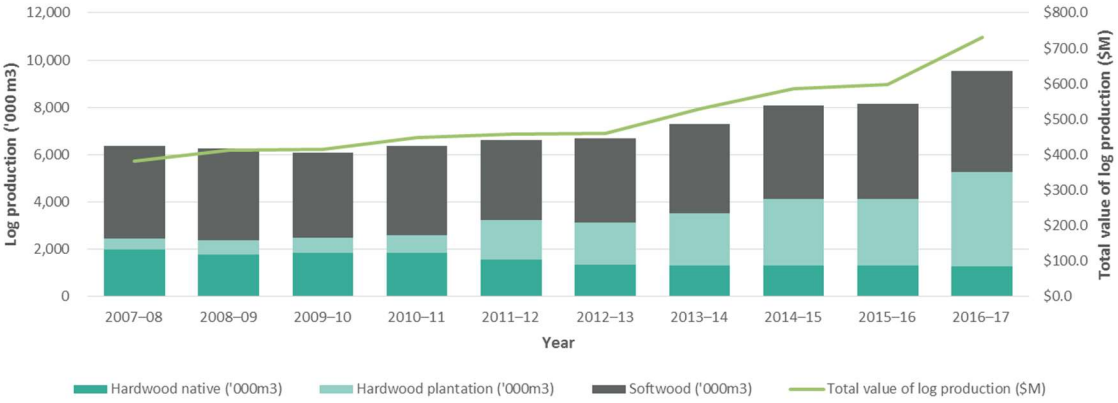


Figure 2. Australian log production ('000 m^3) and value ($M)

Source: ABARES (2018).

Overview of the Victorian sector

Victoria is the biggest log-producing State nationally, adding almost 30 per cent of the total value of log production annually over the last five years. Victoria has shown fairly steady growth within the sector over the last five years, providing approximately 9.5 million cubic metres of harvested logs in 2016-2017 (as shown in Figure 3).



[6] Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES, 2018). Accessed at <http://www.agriculture.gov.au/abares/research-topics/forests/forest-data#australian-forest-and-wood-products-statistics> on 05/04/2019

Figure 3. Victorian log production ('000 m^3) and value ($M)

Source: ABARES (2018).

The proportions of native hardwood, plantation hardwood and softwood within Victoria have followed a similar trend to that occurring nationally. Victoria has seen increases in hardwood plantations, decreases in native hardwood production and relatively steady softwood production over the last ten years of data. However, Victoria's production is fundamentally different to New South Wales and Queensland, where the contribution of hardwood plantations is negligible. Softwood production is by far the biggest contributor across all three states, specifically in NSW where it often contributes more than 80 per cent of State's total production.

Victoria's native hardwood sawlog production is based on two main eucalypt species groups: ash species and mixed species. VicForests' 2016-2017 Resource Outlook (VicForests, 2017) forecasts a supply level of 153,000 m^3 of ash sawlog per annum from eastern Victoria in the short term, decreasing to 130,000m^3 from 2020-21[7]. For mixed species sawlogs, the Resource Outlook (VicForests, 2017) forecasts an annual supply from forests in eastern Victoria in the range of 100,000m^3 to 115,000 m^3 for the medium term. In its annual report VicForests reported a $1.2 million (post tax) profit during 2017-18.

Modelled harvest levels within Victorian native forests have declined and has been reduced by more than 50 per cent over the past decade (VEAC, 2017)[8]. The reductions are primarily the result of unexpected events such as bushfires and the discovery of Leadbeater's Possum colonies. VEAC (2017) predicts that future bushfires and discoveries have the potential to reduce the harvestable area of 1939 ash regrowth by about 20 per cent, which would likely lead to a reduction of between 25–35 per cent in wood supply over the assessment period of this report.

Supply chain composition

Victoria's forest sector includes wood and fibre production based on native forests, hardwood plantations and softwood plantations grown within the state, as well as the processing of timber imported from other states and countries.

The supply chain comprises three parts: primary production, primary processing, and secondary processing. In the first two parts native forest and plantations are grown and harvested and logs are processed into primary products such as sawntimber, woodchips and firewood. Secondary processing involves primary wood and fibre products being further processed into a range of products (e.g. cabinets, furniture, and, pulp and paper and packaging products).

Primary production and primary processing in Victoria are almost entirely dependent on wood and fibre from native forest and plantations grown in Victoria, with only small volumes of logs imported for processing from nearby locations in bordering states. Secondary processing in Victoria uses wood or fibre source either from Victorian-grown wood and fibre or from wood and fibre that has been grown and undergone primary processing in other parts of Australia or other countries (Schirmer et al., 2018).

An assessment undertaken by the Victorian Environmental Assessment Council (VEAC, 2017) summarised VicForests' harvest and haulage commitments in eastern Victoria (see Table 2, for an excerpt). Across eastern Victoria there are 34 harvest and 34 haulage contractors with almost 350 associated employees. The majority (71 per cent) of the contracts for harvest and haulage are within

[7] VicForest's Resource Outlook is a forecast that indicates how much sawlog timber can be commercially supplied from the State forests in eastern Victorian in the medium term on a sustainable basis.

[8] VEAC (2017) focused on State forests within eastern Victoria with regional forest agreements: Central Highlands, North East, Gippsland and East Gippsland.

the Central Highlands region with over 250 full-time equivalent staff working to meet the contract obligations in this region.

Table 2. Summary of VicForests harvest and haulage commitments

VicForests contracts	Central Highlands	Other	Total
Number of harvest contracts	24	10	34
Number of haulage contracts	24	10	34
Employment (full-time equivalents)	253	96	349

Source: VEAC (2017).

This RIS focusses on the impact of the proposed variations to the Code to the primary production and primary processing elements of the supply chain. Secondary processing (e.g. furniture manufacture or paper and packaging manufacture) in Victoria uses wood or fibre sources either from Victorian-grown wood and fibre or from wood and fibre that has been grown and undergone primary processing in other parts of Australia or other countries (Schirmer et al., 2018). Further secondary processors within Victoria rely on wood and fibre from both native forests and hardwood and softwood plantations. The scope of the proposed variations to the Code relate only to native forests so only a portion of the wood and fibre used by secondary processors will be impacted. Given this, DELWP assumes secondary processors already rely on, or can readily adapt to rely on, interstate or international supplies of timber and so would be insulated from changes in the availability of Victorian timber. Assessing the impact of alternative (i.e. non-Victorian public forests) sources of timber for Victorian secondary processors is beyond the scope of this analysis.

Background to the problem - Regulatory effectiveness

Independent Review of Timber Harvesting Regulations in Victoria

In 2018, at the request of the Minister for Energy, Environment and Climate Change, DELWP commissioned the *Independent Review of Timber Harvesting Regulations in Victoria* (Brockington et. al., 2018). The review panel developed a report outlining 14 recommendations, all accepted by DELWP. Recommendation 10 outlined the need to improve regulatory tools, including by engaging with stakeholders to develop a common understanding of the Code and where there is any disagreement on interpretation engage expert and/or legal advice to develop guidance. The independent review found that DELWP as a regulator of timber harvesting has maintained its impartiality and is not captured by either industry or conservation interests. The review found that despite this, external perceptions run both ways. In response to the review, DELWP established the Office of the Conservation Regulatory and interim Chief Conservation Regulator to ensure a coherent and consistent regulatory approach.

Modernising the Victorian Regional Forest Agreements, by Dr William Jackson

In 2019 DELWP commissioned the Independent Consultation Paper *'Modernising the Victorian Regional Forest Agreements'* by Dr William Jackson (Jackson, 2019). The goal was to provide an explanation of what the Victorian RFAs are, how they operate, and how effective they have been. The report noted that "the Code of Practice for Timber Production 2014 incorporates good practice. However, further effort is required to improve transparency in the application of the Code".

2.2 Nature and extent of the problem

Problems associated with the Code that are assessed by the RIS

DELWP's 2019 internal review of the Code found four primary issues with the Code. The review found that the Code is not clear, accurate, enforceable or contemporary (see Table 3).

Table 3. Key findings from DELWP's internal review of the Code

Issue	Detail
Clear:	The internal review found the code is not easy to understand and lacks clarity about the roles and responsibilities of regulatory authorities.
Accurate:	The internal review found that the Code lacks accuracy due to administrative errors that undermine the integrity of the Code.
Enforceable:	The internal review found that elements of the Code are not enforceable due to prescriptions being poorly worded and open to misinterpretation.
Contemporary:	The internal review found that the Code is not contemporary with Victorian Government policies, strategies, action statements, regulations, or agreements to manage forest biodiversity values. This may result in risks to Victorian Government environmental objectives (see Table 4).

The problems identified in the review pose risks to State environment objectives, communities, government and industry as summarised in Table 4.

Many of the issues identified by the review have been addresses as part of minor variations to the Code that seek to clarify rather than change the regulatory intent and do not apply new regulatory burden or trigger the need to prepare a RIS however have been included for completeness. A full list of minor amendments is provided in Appendix E.

The review identified two cases where a major variation to the Code would be required to incorporate new protections for a species or landscape where the Code is no-longer based on contemporary scientific advice, policies, strategies, regulations or agreements to manage biodiversity values.

- Large Trees: The Victorian Government announced a large tree protection policy in March 2018 accompanied by the DELWP Field Guideline – Identification and Protection of Large Trees.
- Large Brown Tree Frog: The Large Brown Tree Frog (*Litoria littlejohni*) Action Statement No. 255 - DSE 2014 includes management actions and prescriptions were not included in the 2014 Code review.

Nature of the problem: Large Trees

Large trees are rare, often singular ecosystem assets that are likely to provide multiple ecosystem services due to their age and size. Key ecosystem services include significant carbon sequestration and water purification. Large Trees are particularly important as they are often hollow-bearing trees, providing habitat for threatened forest-dependent fauna, e.g. Greater Glider and Leadbeater's Possum. Large trees are also valued by the community for their existence.

The consideration of appropriate management measures for protection of large and giant trees needs to align with the risks they face. Beyond expected aging and mortality of older trees, the key risks that can expedite the aging of large and giant trees in tall wet forests of Victoria include the following:

- Mortality or damage resulting from bushfires;
- Accidental damage to large trees during harvesting activity, caused by falling of adjacent trees, and potentially the compaction of soils within the root zone;
- Mortality or damage resulting from regeneration burns and planned burning; and
- Windthrow (trees uprooted or broken by wind).

Large and giant trees are not uniformly protected across the public land estate. For example, in East Gippsland FMA and Tambo FMA, the Code requires (Clause 5.4.1.1 - 5.4.1.3) the protection of all living trees equal to or greater than 4 m Diameter at Breast Height over Bark (DBHOB, giant trees) from the direct effects of timber harvesting operations and regeneration burning. Where possible giant trees should be incorporated into retained habitat patches. Furthermore, giant trees should be retained if they are in the Gippsland Giant Tree Register maintained by DELWP. Habitat retention requirements of the Code (Cause 4.1.1.1- 4.1.10.3) and associated habitat tree prescriptions (MSP Appendix 3, Table 12) also require the protection of larger trees often at a per hectare rate prioritising hollow-bearing trees. Furthermore, the Code requires the protection of pre-1900 trees in the Central Highlands FMA some of which would be classified as Large Trees. The degree to which other prescriptions in the Code may inadvertently protect Large Trees is not possible to quantify.

The Victorian Government announced a Large Tree protection policy in March 2018 accompanied by the DELWP Field Guideline – *Identification and Protection of Large Trees*. The Large Tree protection policy declared that at a statewide level, all living trees of any species with a diameter at breast height (1.3m above ground) equal to or greater than 2.5 meters over bark would be protected. This represents an intent to increase the protection for these ecosystem assets by lowering the diameter threshold and ensuring that all trees are protected statewide.

Because the Code does not provide for the State-wide protection of Large Trees, it is currently not in-step with contemporary Victorian Government policies, strategies, regulations or agreements to manage natural forest values.

Consequence of inaction: Without adequate protection, this tree size cohort may be lost/ or partially lost from the land available to be harvested given typical rotations (60-120 year) for timber harvesting cycles. This might potentially compromise the achievement of Code and State environmental objectives (see Table 4).

Nature of the problem: Large Brown Tree Frog

Within Victoria, the Large Brown Tree Frog (*Litoria littlejohni*) is listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. The Large Brown Tree Frog is listed as threatened under the *Flora and Fauna Guarantee Act 1988*. It is also listed as endangered according to the Advisory List of Threatened Vertebrate Fauna in Victoria – 2013 (DEPI, 2014b). Timber harvesting is one of several threats to the Large Brown Tree Frogs that is a threatened species valued by the community for its existence.

Timber harvesting may adversely impact Large Brown Tree Frog populations by causing habitat degradation, temporary removal of vegetative habitat and fragmentation. Timber harvesting may also indirectly affect this species by reducing availability and viability of breeding habitat, affecting availability of food, increasing predation rates by removing or altering vegetation, altering habitat (e.g., light penetration, soil moisture, thermal regime.) and isolating populations.

The Action Statement for this species sets out scientifically accepted management actions including a detection-based prescription - establishing a 28ha buffer around verified Large Brown Tree Frog records affords interim protection to potential sites of conservation significance. 28 ha is

approximately equal to the area of a circle with a radius of 300 m; a distance estimated as an average terrestrial buffer from breeding sites adequate to protect a range of amphibian species. This detection-based prescription was not included in the 2014 Code review, however the approach has been implemented on a voluntary basis by the managing authority – VicForests.

Because the Code does not provide for the State-wide protection of Large Brown Tree Frogs, it is currently not in-step with contemporary Victorian Government policies, strategies, regulations or agreements to manage natural forest values.

Consequence of inaction: Without adequate protection the species may change from threatened to critically endangered status, and potentially compromise the achievement of State environmental objectives (see Table 4).

Risks associated with the problems

Table 4 presents specific risks associated with not taking action to address the problems.

Table 4. Risks associated with the underlying problems

Risk	Description
Risks to State environment objectives	
Code objective not achieved: *Biological diversity and the ecological characteristics of native flora and fauna within forests are maintained*	A guiding principle of the Code is that biological diversity and the ecological characteristics of native flora and fauna within forests are maintained. Code prescriptions that protect important habitat characteristics are a primary mechanism for ensuring the maintenance and adequate representation of fauna and flora across forests. The continued decline of important habitats is understood to be a critical risk to forest-dependent species. The 2017 VEAC report identified key forest dependent species that are at greatest risk and require urgent consideration. These include many *FFG Act* listed species. Within Victoria, there are 427 forest-dependent species listed under the Threatened Species Advisory List (DELWP), the *FFG Act* and/or the *Environment Protection and Biodiversity Conservation Act* (Commonwealth). Listed species are species which are in a demonstratable state of decline, likely to lead to extinction, are prone to future threats and or the threats are operating and are expected to continue to operate in the future at a level likely to lead to extinction and/or the species is narrowly defined because of its taxonomic composition, environmental conditions or geography and there is a special need to conserve it. Timber harvesting adversely impacts forest-dependent threatened species by causing habitat degradation, temporary habitat removal and fragmentation. Certain habitat characteristics that are important to many forest dependent species are now under-represented in the landscape due to a range of impactors. Habitat hollows provided by habitat trees, large trees and old growth trees have been identified as being vital for many forest-dependent fauna. Relative to an undisturbed multi-aged forest, the number of new hollows formed will be reduced in non-selectively harvested areas (i.e. clearfall and seedtree systems) because fewer trees grow on and replace old trees as they proceed through various stages of decay and eventual collapse. The loss of hollow-bearing trees from Victorian native forests and woodlands is listed as a Potentially Threatening Process under the *Flora and Fauna Guarantee Act 1988*. Timber harvesting may indirectly affect species by reducing availability and viability of breeding habitat, affecting availability of food, increasing predation rates by removing or altering vegetation, altering habitat (e.g., light penetration, soil moisture, thermal regime) and isolating populations.

Risk	Description
	Timber harvesting can create a a landscape-scale mosaic of forest age classes and structures, and in some cases accelerate the production of larger diameter trees capable of supporting hollowswithin the forest that may enhance certain species, e.g. provision of cover and food sources for the Leadbeater's Possum.
State Biodiversity Plan targets are not met	Victoria's biodiversity plan, *Protecting Victoria's Environment – Biodiversity 2037*[9] sets a 20-year target of: *A net improvement in the outlook across all species by 2037, as measured by Change in Suitable Habitat*. The plan sets outcomes associated with this target: • No vulnerable* or near-threatened species will have become endangered. • All critically endangered* and endangered species will have at least one option available for being conserved ex situ or re-established in the wild (where feasible under climate change) should they need it. • A net gain of the overall extent and condition of habitats across terrestrial, waterway and marine environments. Not undertaking interventions that protect key forest habitats for endangered, vulnerable or near-threatened species puts the goals and targets of *Protecting Victoria's Environment – Biodiversity 2037* at risk.
Risks to communities	
Recourse to legal action to resolve disputes	Uncertainties or ambiguities in the regulations guiding State native forest harvesting increase the likelihood of legal action to resolve uncertainties.
Unnecessary conflict with State native forest industry and DELWP as the regulator	Lack of clarity relating to State native forest harvesting regulatory requirements increases the likelihood of conflict between communities and the State native forest industry. In the 2017 calendar year, DELWP received 86 forest reports detailing 178 threatened species and allegations of breaches of the Code (DELWP, unpublished data). Several of these allegations were shown to be unsubstantiated by the DELWP Timber Harvesting Compliance Unit. This volume of allegations highlights the significant time and cost implications to community groups and DELWP when the regulatory framework is not clear.
Loss of ecosystem services	Potential for benefits that communities derive from State native forests to be reduced (e.g. amenity, recreation, tourism, cultural and spiritual values) because the regulations guiding State native forest harvesting does not adequately protect these values.
Risks to Government	
DELWP's forest stewardship role undermined by a lack of transparency and regulatory effectiveness	In 2018, at the request of the Minister for Energy, Environment and Climate Change, DELWP commissioned the Independent Review of Timber Harvesting Regulations in Victoria (Brockington et. al., 2018). The review panel developed a report outlining 14 recommendations, all accepted by DELWP. Recommendation 10 outlined the need to improve regulatory tools, including by engaging with stakeholders to develop a common understanding of the Code and where there is any disagreement on interpretation engage expert and/or legal advice to develop guidance. The independent review found that DELWP as a regulator of timber harvesting has maintained its impartiality and is not captured by either industry or conservation interests. The review found that despite this, external perceptions run both ways. In response to the review, DELWP established the Office of the Conservation Regulatory and interim Chief Conservation Regula to ensure a coherent and consistent regulatory approach

[9] See <https://www.environment.vic.gov.au/__data/assets/pdf_file/0022/51259/Protecting-Victorias-Environment-Biodiversity-2037.pdf>. Accessed 13/06/19

Risk	Description
	In 2019 DELWP commissioned the Independent Consultation Paper 'Modernising the Victorian Regional Forest Agreements' by Dr William Jackson (Jackson, 2019). The goal was to provide an explanation of what the Victorian RFAs are, how they operate, and how effective they have been. In the paper, Dr Jackson made recommendations of areas for improvement to Victorian RFAs. The report noted that the performance of the current legislative framework for Victoria's forests is comprehensive and that the Code of Practice for Timber Production 2014 incorporates good practice. However, the report noted that further effort is required to improve transparency in the application of the Code.
Victorian Government agencies exposed to increased costs	Over the past decade DELWP has responded to over 14,000 correspondences related to apparent community concern about timber harvesting, forest health, or specific species such as Leadbeater's possum, Greater Glider, Large Trees, Old Growth. (DELWP unpublished data). In the 2017 calendar year, DELWP received 86 forest reports detailing 178 threatened species and allegations of breaches of the Code (DELWP, unpublished data). DELWP Timber Harvesting Compliance Unit evaluated each allegation and, where necessary, conducted field investigations. The lack of transparency and regulatory effectiveness leads to low community trust and exposes Government to significant administrative costs.
Risks to the native forest industry	
Lack of certainty regarding regulatory requirements	Uncertainties or ambiguities in the regulations guiding State native forest harvesting make operational decision-making difficult and create investment risk.
Recourse to legal action to resolve disputes	Uncertainties or ambiguities in regulations guiding State native forest harvesting increase the likelihood of legal action to resolve uncertainties.
Conflict with communities	Lack of clarity relating to regulations guiding State native forest harvesting requirements increases the likelihood of conflict between the State native forest industry and some members of the communities in which it operates.
Lack of clarity regarding roles and responsibilities	Unclear boundaries between the regulator (DELWP) and the regulated entities (e.g. VicForests) may undermine regulatory effectiveness.

2.3 Rationale for government intervention

The rationale for the Government intervention is to ensure that commercial timber harvesting in State native forests does not result in unintended adverse impacts on priority environmental objectives (including loss of habitat for key species) while permitting such harvesting and processing to remain viable and sustainable in the long-term. Such intervention be summarised as the need to reduce:

- **Risks to State environmental objectives**: Section 2.2 highlighted that both the extent and condition of forests with high conservation values are in decline. Changes are required to support the achievement of environmental outcomes that are more consistent with Government policies and community expectations. Changes to current State native forest harvesting practices will address externalities associated with current forest practices by protecting habitat for key species that are currently under-protected.
- **Risks to communities**: Changes are required to reduce conflict between community members and industry in relation to the protection of habitat for forest-dependent species.

- **Risks to Government:** Changes are required to enhance the efficiency of regulatory oversight by DELWP, reducing transaction and planning costs to both industry and the regulator, while also reducing the likelihood of breaches of regulatory requirements and disputes.
- **Risks to the native forest timber industry in Victoria**: The Victorian native forest timber industry requires a reduction in ambiguity and uncertainty with respect to the access to timber and the planning and implementation of harvest operations. This will help to address the risks and costs currently experience by the industry.

3 FEASIBLE OPTIONS

This section describes the feasible options for updating the Code to better address the problems identified in Section 2.

3.1 Options

Overview of options

Native forests provide important habitat and biodiversity values. The identified need to protect critical habitat can be delivered via improving the extent and condition of native forests.

There are a range of potential tools available for managing native forests to address the problems identified in Section 2. Measures considered included:

1. Education: e.g. programs to increase the level of understanding within the community and forestry sector (e.g. harvest operators) to support approved harvesting practices.
2. Communication and engagement; to communicate to the wider community the measures taken by the forestry sector to manage forests for multiple values.
3. Voluntary measures and independently assessed systems that promote improved practice. An example of this are:
    - Responsible Wood Standard which has been specifically developed for Australia's forests and is endorsed and internationally recognised by PEFC.
    - Forests Stewardship Council (FSC) certification[10]: which could provide independent certification of VicForests operations in native forests, in accordance with the FSC's ten principles and criteria for responsibly managed forests.
4. Regulatory approaches, such as updating the Code: to increase the ability of Code to support the protection of key species and habitats.

While DELWP considers measures 1 – 2 to be useful, they are considered to only partially address the problems identified in Section 2 as they will not fully achieve ecological integrity and certainty for industry. DELWP considers that measure 3 would make an important contribution to addressing some of the challenges noting that, voluntary certification measures may not provide the confidence that community values will be maintained in the future.

DELWP considers that regulation (via amendments to the Code) is the most feasible option given the nature of the problems identified in Section 2. This is because the existence of the Code provides a mechanism for making the proposed changes and obtaining the desired outcomes that is already used to manage externalities associated with harvesting in State native forests. Furthermore, recent reviews into Victoria's regulatory framework for timber production (see Section 2.1) have found that the framework lacks clarity and enforceability. This highlights the need to drive outcomes via changes to the Code rather than, information and persuasion approaches which may have uncertain outcomes.

Within the framework of the Code, a range of options have been developed by DELWP to understand the implications of different approaches to conserving Large Brown Tree Frogs and large trees.

[10] The Forest Stewardship Council (FSC) is a global not-for-profit organization that sets the standards for environmental and socially responsible forest management. FSC certified forests are certified to have met best practice standards for responsible forest management according to the FSC's 10 principles and criteria.

For the large tree option, two mutually exclusive variations, which have been proposed (Large Trees 1 and Large Trees (with buffer) and are designed to understand the impact of differing levels of conservation. Only one of these variations would be introduced.

Only one option has been contemplated for the protection of Large Brown Tree Frogs, in line with existing prescriptions contained within Action Statement (no. 255).

Data availability has implications for the approach to specifying the prescription associated with each of the options. For example, the option relating to Large Brown Tree Frogs is based on detection of a species / feature during harvest planning activities. Other options, such as large trees, would need to be implemented using field assessment conducted during harvest planning activities.

Table 5 contains an overview of the feasible options. Appendix A provides further detail, including the data and approach to modelling the impact of each option.

Table 5. Overview of feasible options

Option name	Details
Large Brown Tree Frog	
Title	Protection of Large Brown Tree Frog habitat
Rationale	This is the State-wide prescription that is currently contained in Action Statement no. 255 (published 2014). This prescription is based on scientific evidence and is designed to afford interim protection to potential sites of conservation significance while further research is being carried out.
Prescription	Detection based prescription: If a Large Brown Tree Frog is detected in State Forest, establish a 28-ha protected area by creating a Special Protection Zone (SPZ) that includes the detection site. 28 ha is approximately equal to the area of a circle with a radius of 300m; a distance estimated as an average terrestrial buffer from breeding sites adequate to protect a range of amphibian species. As far as possible, the SPZ boundaries should follow recognizable landscape features such as ridges, spurs, watercourses or roads, but must not be less than 300 m wide at any point. The new SPZ may include areas of pre-existing Special Management Zone (SMZ), SPZ or areas otherwise unavailable for harvesting. The new SPZ may be smaller than 28 ha where a detection is adjacent to an existing park or reserve and the total 28 ha protected area is comprised of both SPZ and park and reserve.
Large Trees (no buffer)	
Title	Protection of all large trees
Rationale	This is aligned with the State-wide protection measure announced by the Minister in March 2018. Improving the protections for large trees will provide habitat for a range of hollow-dependant fauna including the Greater Glider, Leadbeater's Possum, Yellow-bellied Glider, Mountain Brush-tailed Possum, Masked Owl, Sooty Owl and Powerful Owl. Implementation has been initially through a voluntary agreement with VicForests, but this option seeks to formalise the agreement via the regulatory framework.
Prescription	Field assessment-based prescription: VicForests must retain all living trees equal to or greater than 2.5 m DBHOB and protect them from the direct effects of timber harvesting operations and regeneration burning. This includes not deliberately felling, falling into, or damaging large trees during harvest, and ensuring slash is not permitted to accumulate within 3 metres of the base of large trees immediately prior to regeneration burns. Where possible, incorporate large trees in retained patches or expanded buffers or exclusion areas.

Option name	Details
Large Tree (with buffer)	
Title:	Protection of all large trees, with 20m buffer and connectivity
Rationale:	The State-wide protection measure relates to protecting trees only, not the creation of buffers or connectivity; although it does state that where practicable, large trees are to be incorporated into retained patches or within expanded exclusion areas. Improving the protections for large trees to include surrounding forest buffer will provide benefits to a range of hollow-dependant fauna including the Greater Glider, Leadbeater's Possum, Yellow-bellied Glider, Mountain Brush-tailed Possum, Masked Owl, Sooty Owl and Powerful Owl. This buffer will increase the potential habitat value of the large tree, increasing the likely use of the retained trees. In addition, a buffer will increase the probability of extending the life of the large tree, compared to retaining a single individual tree. This option seeks to formalise the creation of buffers and connectivity as this is considered to support greater conservation outcomes. Connectivity is a well-established approach to nature conservation as it provides refuge for the movement of fauna across the landscape.
Prescription:	Field assessment-based prescription: Large Tree (with buffer): VicForests must retain all living trees equal to or greater than 2.5 m DBHOB and protect them from the direct effects of timber harvesting operations and regeneration burning using a 20 metre (m) buffer and where possible, incorporate large trees in retained patches or expanded buffers or exclusion areas.

4 IMPACT ANALYSIS

This section provides the results of the economic assessment of impacts associated with the proposed variations to the Code. It provides an overview of the approach used to assess the impacts and the results for each option considered.

4.1 Overview of approach to assessing impacts

When implemented, the proposed changes to the Code will result in changes to the area available for timber harvesting within Victoria's State native forests, relative to timber harvesting that is currently occurring. This has cost implications for the timber harvesting and primary processing supply chain. Within this RIS, the additional impacts of implementing the proposed changes to the Code have been assessed in relation to the primary production and primary processing industries of the supply chain (i.e. VicForests, harvest and haulage operators, sawmill operators and the pulpmill operator). Operators within this portion of the supply chain are almost entirely dependent on wood and fibre from native forest and plantations grown in Victoria, with only small volumes of logs imported for processing from nearby locations in bordering states (Schirmer et al., 2018).

Secondary processing (e.g. furniture manufacture or paper and packaging manufacture) in Victoria uses wood or fibre source either from Victorian-grown wood and fibre or from wood and fibre that has been grown and undergone primary processing in other parts of Australia or other countries (Schirmer et al., 2018). As such, the impacts to secondary processors are assumed to be less material.

The areas of forest that are no longer available for harvesting under each of the options protect biodiversity values and will provide a range of other ecosystem services which create benefits to the Victorian economy and the community. The ecosystem service impacts that have been considered include water supply and carbon storage. These ecosystem services were considered to be most materially impacted by the proposed changes to the Code and for which methodologies exist for estimating the value of the changes in monetary terms.

To understand the impact of the implementation of the proposed changes to the Code, the biophysical changes that each option would result in were first estimated. The two metrics used are:

- Change in wood supply – estimated as the volume of wood products (ash and mixed species sawlogs and pulplogs) that would be available following the implementation of the options, relative to the wood supply base case (or 'do nothing' case). This impact was used to determine the economic costs over the assessment period.
- Change in suitable habitat – the additional improvement in habitat suitability (measured in Suitable Habitat Hectares) that would be available in 50 years following the implementation of the options (stopping harvesting within a defined area), relative to the base case (or 'do nothing) provision of suitable habitat (see Box 1 for an overview of the concept and measurement of suitable habitat). This was used to determine many of the benefits that are largely non-market values. Change in suitable habitat has been estimated for VEAC[11] Fauna and Flora (excluding Greater Gliders) and for Greater Gliders. Change in suitable habitat is a physical

[11] Expected biodiversity benefit achieved from ceasing timber harvesting has been assessed for 66 forest dependent threatened and non-threatened species that occur in the intervention area(s). These species were identified by expert biologists as part of the Victorian Environmental Assessment Council (VEAC) 2017 report 'Conservation values of State Forests' and includes birds, amphibians, reptiles, plants and mammals. Benefit is only reported for species that have a modelled distribution and expected benefit within the intervention area.

measure only. It is not an economic measure, and hence a cost-benefit analysis has not been undertaken.

Box 1. Overview of suitable habitat

'Change in suitable habitat' (CSH) is a measure for estimating the benefit to a species or suite of species present at a location. It is a composite measure, which reflects how the quality as well as the extent of habitat will improve over a 50-year timeframe.

It is a key metric used within the Victorian Government's Strategic Management Prospects (SMP) tool - a decision-support tool that uses spatial models on species distributions, information on key biodiversity threats, cost information for key management actions which address those threats and expert elicited response models for thousands of species to different management actions.

'Change in suitable habitat' (CSH) is also the unit of measurement used to measure progress towards the Victorian biodiversity plan: *Protecting Victoria's Environment – Biodiversity 2037*.

Drawing on the results of the change in wood supply, a cost-effectiveness analysis (CEA) was undertaken. The CEA provides estimates of the direct costs[12] (or regulatory burden) that will be experienced by the timber harvesting and primary processing supply chain to obtain an additional suitable habitat hectare. This approach enables an assessment of each of the options to determine which one provides gains in CSH at the lowest unit cost ($/CSH), and hence, which option is most economically efficient at achieving the biodiversity protection objectives.

Within the CEA, costs have been calculated based on the forgone net revenue related to harvest activities, relative to the base case. The base case is defined as the area available for timber production, the silvicultural practices, and the forecast future harvest volumes, wood supply and mix of species and revenue anticipated by VicForests over the period 2019 – 2030, without the implementation of any of the options.

The results have been calculated at two levels: State and the forest management area (FMA). Further detail regarding the methodology used to undertake the assessment is contained in Appendix B.

4.2 Objective of revising the Code

In response to the problems described in Section 2, DELWP aims to revise the Code to ensure it:

- Incorporates and accurately represents current government policy, commitments and intent at end June 2019.
- Is free of errors, inconsistencies and ambiguities, including correct referencing to other regulatory instruments, clarified definitions and correct names of entities.
- Clarifies boundaries of the roles of the regulator and all regulated parties.

By resolving these problems and updating the Code, DELWP aims to support the following longer-term objectives:

- Ecological integrity – protection of habitat for threatened species and ecological communities (particularly Greater Glider, Large Brown Tree Frog, and Large Trees) within native forests, so that those species and communities will persist in the future.

[12] Direct (or first-round) costs are those that would be borne by the operators in the supply chain. Indirect (or second round) costs are the costs that would flow from this, for example reduced expenditure on inputs, wages and salaries.

- Certainty for industry – low regulatory costs that will not unnecessarily affect the timber industry or communities who rely on it, and a consistent, unambiguous and reliable framework for regulatory decision-making
- Community benefits – including opportunities for recreational uses of Victoria's native forests, and confidence that community values will be maintained in the future.

A framework for describing the objectives of the changes is summarised in Figure 4. Top-most layer outlines the outcome the Code revisions are intended to achieve (i.e. sustainable management of Victoria's native forests for a broad range of ecosystem services and community values.

- The next layer outlines broad objectives for the key stakeholder interests (i.e. environment, industry, community).
- The bottom-most layer outlines the intermediate indicators to support the measurement of success.

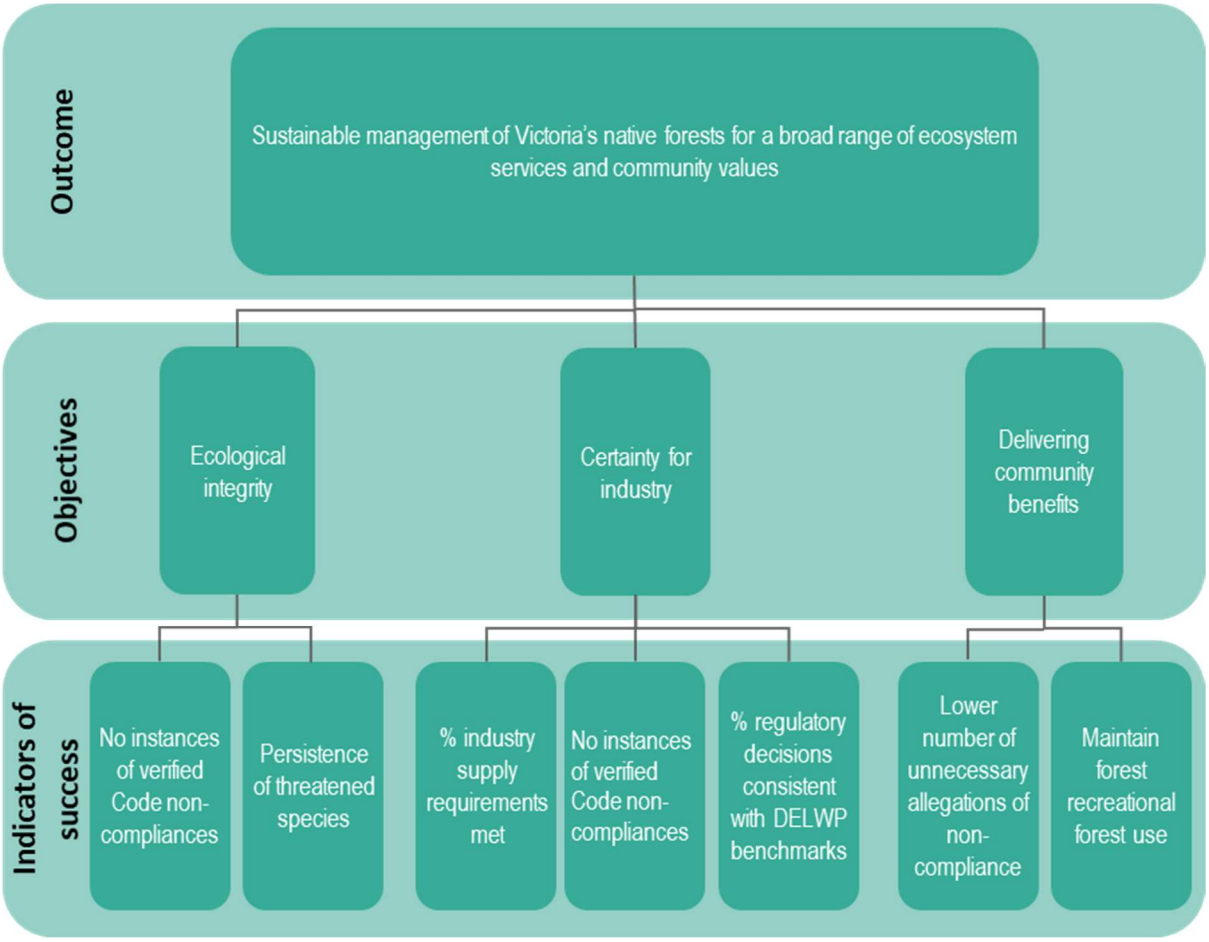


Figure 4. Framework for Code revisions: outcomes, objectives, and indicators of success

4.3 State level biophysical results

This section briefly outlines information and data relating to the biophysical changes attributable to each of the options. This information underpins the economic analysis outlined in Section 5.3.

Change in wood supply

The base case for wood supply is VicForests' 2017 Resource Outlook (VicForests, 2017), or RO 2017. This forecast indicates how much sawlog timber (defined as being D+ sawlogs which is log grades D, C and B) can be commercially supplied from the State forests in eastern Victoria in the medium term on a sustainable basis. It is based on a wood supply model that is used to evaluate supply over a 100-year time horizon. The RO 2017 separates the species groups of timber supplied by VicForests to the hardwood timber industry into two categories – ash and mixed species. Further detail regarding the base case for wood supply is provided in Appendix A.

Table 6 contains the estimated change in wood supply (for ash and mixed species) for the period 2019-20 to 2029-30 for each of the options as a percentage of the base case. It indicates that there is no change in wood supply anticipated under the Large Brown Tree Frogs and Large Tree (no buffer) options. The low wood supply impacts are due to a combination of: the options having a relatively low impact on areas where harvesting would otherwise be permitted, VicForest's ability to harvest in other areas, if a given area is protected under the options, and, the options formalising measures already voluntarily adopted by VicForests and incorporated within RO2017.

Table 6. Estimated change in wood supply by option (2019-20 – 2029-30)

	Reduction in ash species wood supply - all grades	Reduction in mixed species wood supply – all grades
Large Brown Tree Frog	0%	0%
Large Tree (no buffer)	0%	0%
Large Tree (with buffer)	7%	0%

Change in suitable habitat

The proposed forest management prescriptions proposed under each of the options results in an area of forest being conserved that could otherwise have been harvested. This area of conserved forest has biodiversity value that would be gained through the implementation of the options.

For this project, the baseline of biodiversity values is defined as the suitable habitat in 50 years provided by the area of forest not subject to timber harvesting (i.e. the parks and reserves system and areas of the General Management Zone (GMZ) where timber harvesting will not occur).

This RIS considers the Change in Suitable Habitat (CSH) achieved under each of the options relative to the baseline. It is the CSH that is the primary ecological benefit of the proposed changes to the Code i.e. the increase in likelihood that a species will still exist at a location at a future time (50 years) in response to removing the threat of timber harvesting within the analysis area over a 50-year period.

CSH is measured over a 50-year time period, with the assumption that the management change proposed under the various options in this RIS will be sustained over 50 years. This is due to the time lag for ecological response to a management intervention. While the RIS considers benefits over a 10-year timeframe, the figures presented here provide an indication of likely improvement and are appropriate to be used to inform decision-making under the assumption that the proposed regulatory changes continue for a 50-year timeframe.

The baseline extent of the area not subject to timber harvesting was assessed as at August 2018. Further detail regarding the base case for suitable habitat is provided in Appendix A.

Table 7 contains the estimated change in suitable habitat (for Greater Gliders and for relevant VEAC Species excluding Greater Gliders) for the period 2019-20 to 2029-30 for each of the options. Appendix F contains a full list of these species. The change in suitable habitat has been estimated / presented in two ways:

- In absolute terms (i.e. change in the area of suitable habitat provided as a result of removing the threat of timber harvesting).
- Relative to the theoretical maximum CSH that could be achieved if harvesting was immediately stopped in all eastern Forest Management Areas (FMAs).

Table 7. Estimated change in suitable habitat by option

		Greater Glider Benefit		VEAC Fauna and Flora* Excl. GG Benefit	
Option	**Net harvestable area impacted (hectares)** Timber production area expected to be impacted by option	**Change in Suitable Habitat (CSH) hectares** Improvement in biodiversity benefit	**CSH as % of maximum protection** Comparison to stop harvest benefit in all eastern FMAs	**Change in Suitable Habitat (CSH) hectares** Improvement in biodiversity benefit	**CSH as % of maximum protection** Comparison to stop harvest benefit in all eastern FMAs
Large Brown Tree Frog	23 ha (East Gippsland only)	7 CSH ha	0.0 %*	1 CSH ha	0.0 %*
Large Tree (no buffer)	It has not been possible to assess the Large Tree options using the CHS methodology as the area that this applies is not spatially explicit. The protection of large, living trees represents a significant, long-term benefit for hollow dependent mammals such as Leadbeater's Possum and the Greater Glider, as well as hollow nesting and roosting birds such as the Sooty Owl. The degree of benefit relies on the large trees surviving the timber harvesting, regeneration and regrowth phases, during which mechanical damage, fire and windthrow might lead to damage or loss. The degree of benefit and the longevity of the tree in the landscape varies according to the density of large trees and the extent of their occurrence across the local landscape. Each hollow-dependent species will prefer certain large tree densities and habitat patch sizes. In addition to the local landscape considerations, the benefit will be amplified by the degree to which it recurs at a broader landscape or regional scale i.e. the benefit will be greater if there are more large trees detected and therefore more large trees that are standing in the landscape over a greater area - rather than the alternative of seed tree retention - to create a general pattern of retained standing trees).				
Large Tree (with buffer)	1,897	628 CSH ha	0.2 %*	845 CSH ha	0.2 %*

* Estimates have been rounded.

The key points to note include:

- The modelled biodiversity benefits are relatively low given the existence of these values across the broader forested landscape. However, the benefits modelled may and reflect only a portion of the range of benefits that could be expected.
- The Large Brown Tree Frog option is anticipated to affect the provision of suitable habitat in only one FMA (East Gippsland) due to the limited distribution of this species. The option is estimated to result in an increase in suitable habitat hectares of one (for all species excluding Greater Gliders) and seven (for Greater Gliders).
- The Large Tree (with buffer) option is anticipated to affect the provision of suitable habitat in all seven FMAs in eastern Victoria. The option is estimated to result in an increase in suitable habitat hectares of 845 (for all species excluding Greater Gliders) and 628 (for Greater Gliders).
- It is currently not possible to estimate the change in suitable habitat contribution of Large Tree (no buffer) which limits the extent to which the benefits of this option can be assessed relative to other options. However, as it results in a smaller area being excluded from the disturbance of harvesting (relative to Large Tree (with buffer)), it is anticipated to result in a smaller contribution to the change in suitable habitat hectares.
- For comparison, a similar ($39 M): An investment in on-ground biodiversity action of a similar scale (e.g. $39 million invested in fox and cat control over 10 years across 26 000ha) would secure 7 times greater (10,641 CSH) gain compared to the Large Tree (buffer) option (summed across relevant VEAC (2017) forest dependent species). Noting that:
    - Hollow-bearing trees are typically greater than 100-150 years old; there are no effective options to substitute them at a landscape scale in the short-term. In the absence of adequate hollow-bearing trees, hollow-dependent arboreal species are not likely to persist.
    - CSH figures represented here are derived from a model that assumes 50 years of sustained intervention to achieve these benefits and therefore the actual investment to achieve these benefits at a site would require 5 times the dollar figures reported here.
    - The benefits of fox and cat control are not directly comparable to the protection of large trees with buffer as these interventions benefit different groups of species (i.e. the protection of structural habitat for hollow-dependent arboreal species as opposed to reduced predation of mainly ground-dwelling species).

Uncertainty with biophysical impacts

The biophysical analysis of the Change in Suitable Habitat provided by the DELWP Biodiversity Division has been taken as a given in this economic analysis. However, it should be noted that there is uncertainty within the biophysical impacts. These relate to:

- Spatial delineation – there is a level of uncertainty associated with how the respective values are mapped or can be accurately located on a map and in the field. For example, the option may specify a clearly defined polygon that aligns with biophysical features and is readily mapped and observed in the field, for which there would be a relatively low level of uncertainty; or the option may be based on modelling of forest characteristics and the use of non-spatial frequency factors for occurrence of large trees or detection of threatened species, in which case the level of uncertainty will be relatively higher.

- Time to realise the benefits – the level of uncertainty associated with benefits that may take considerable time (e.g. years or decades) to realise the impacts in terms of benefits. For example, the impact on suitable habitat will depend on when harvest operations would have occurred over a time horizon of 50 years.
- Management control and influence – the extent to which there is any uncertainty around the established management arrangements (e.g. DELWP or VicForests' operations) to control or influence the desired impact through implementation of the proposed option, i.e. how easily can it be implemented on the ground.
- Lack of habitat age and disturbance and occupancy data – the SMP results are based on habitat distribution models that currently do not account for existing forest age, forest disturbance or habitat occupancy by a species. This means that SMP models may predict the theoretical presence of suitable habitat in recently disturbed landscapes that may not actually be suitable in the near-term or conversely a change in habitat where the landscape is relatively undisturbed.

While there are uncertainties, the biophysical change is based on the best available information and expert elicitation and is sufficient to inform decisions of the scale being explored in the RIS.

4.4 State level economic impacts

This section provides the results of the economic analysis at the State level. All results are presented in 2019 dollars and present value calculations have been derived using a four per cent real discount rate, in line with Victorian Department of Treasury and Finance (DTF, 2013) guidance. Further detail regarding the methodology for calculating the results is contained in Appendix C.

Regulatory burden

Figure 5 presents the present value (PV) costs (i.e. the regulatory burden) associated with each option relative to the base case for the period 2019-20 to 2029-30.

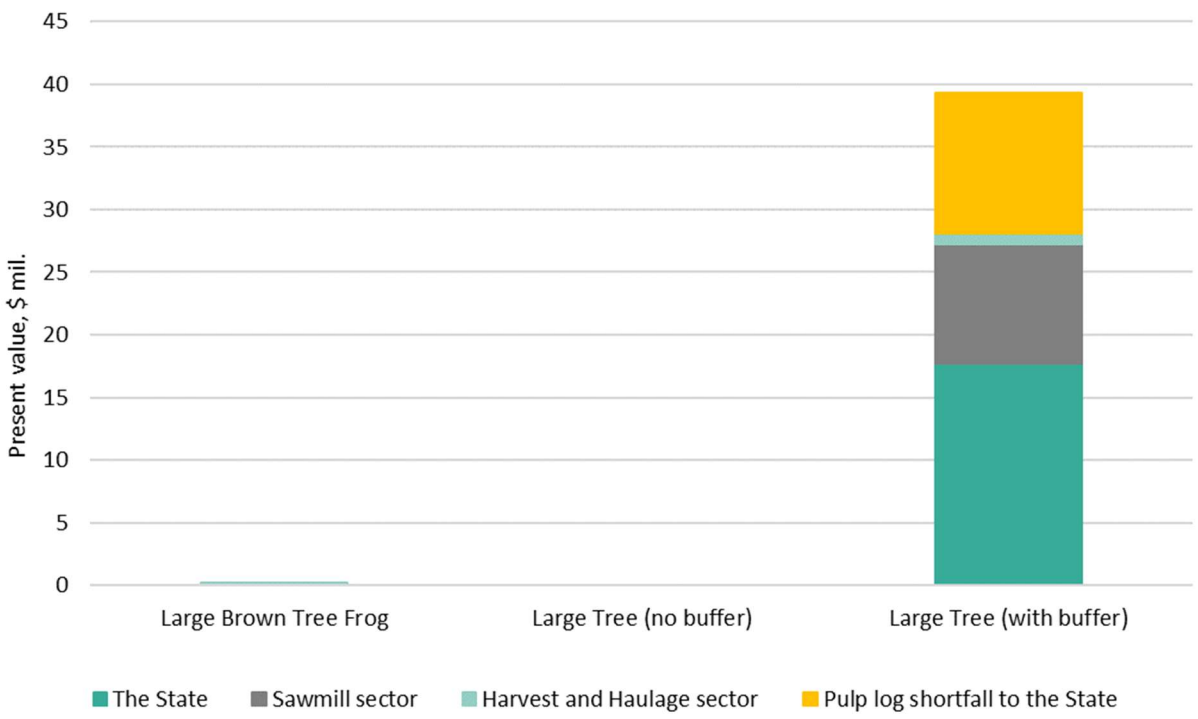


Figure 5. Estimated present value costs for each option at State level, relative to base case ($ Million)

Key points to note include:

- The costs vary across options over the assessment period. Within each year of the assessment, costs also vary, depending on the estimated change in wood supply.
- The option with the greatest estimated cost over the period is Large Tree (with buffer) (approximately $39 million), significantly more than other options. This is because Large Tree (with buffer), requires the greatest area of forest to be excluded from harvest. This is equivalent to an annual impact of approximately $4 million or 6 per cent of the estimated value add from VicForests and contractors.[13]
- The distribution of costs across the supply chain also differs significantly. Because the costs to harvest and haulage operators have been assumed to be 'passed through' to VicForests, the impacts to this segment of the supply chain is estimated to be relatively negligible, but

[13] Based on Deloitte (2017) estimated annual value add of VicForests and contractors of $70 million, calculated in 2015-16.

nonetheless reflects a potential reduction in supply, which may have implications for the number of operators that could be supported. Further detailed analysis of the financial performance of operators, as well as the potential for input substitution (i.e. the supply of plantation and private native forest) is required to estimate the impact on harvest and haulage operators. This is particularly the case in relation to harvest operators for which there is limited scope for equipment to be utilised in other sectors.

- Impacts on sawmill operators could be relatively significant as the loss in throughput and associated revenue cannot be offset by reducing costs. Opportunities to reduce this burden by accessing alternative timber supplies have not been modelled.
- The estimated shortfall in pulp log that would be supplied under each of the options has also been estimated. Large Tree (with buffer) is estimated to result in shortfalls that have been assumed to be met, given existing contractual arrangements between the Victorian government and Australian Paper. These costs have assumed to be met by the Victorian government under existing supply arrangements.

Table 8 provides the same estimates, including the variability associated with the estimate based on evaluation of the 5th and 95th percentile, which are shown in parentheses. All estimates have been rounded to two decimal places. The wide range of estimates is a reflection of the variability in input data used in the economic analysis. Further information relating to sensitivity testing is contained in Appendix C.

Table 8. Estimated present value costs of each option at State level, relative to base case ($ Million) (range in parenthesis)

	The State	Harvest &Haulage operators	Sawmill operators	Pulp log shortfall	Total cost
Option					
Large Brown Tree Frog	0.04 (0.04, 0.04)	0.01 (0.01, 0.01)	0.04 (0.03, 0.07)	0 (0, 0)	0.09 (0.08, 0.12)
Large Tree (no buffer)	0 (0, 0)	0 (0, 0)	0 (0, 0)	0 (0, 0)	0 (0, 0)
Large Tree (with buffer)	17.75 (14.21, 21.30)	0.86 (0.66, 1.05)	9.45 (7.52, 16.78)	11.24 (10.93, 11.55)	39.30 (33.32, 50.68)

Cost-effectiveness analysis

The use of cost-effectiveness analysis (CEA) enables the trade-offs between costs and benefits (measured as changes in suitable habitat hectares) to be assessed relative to each option being considered. Table 9 presents the cost-effectiveness of each option relative to each other for the period 2019-20 to 2029-30. It reflects the costs associated with gaining a suitable habitat hectare under the options. A lower number reflects a lower cost option for achieving the change in suitable habitat.

Table 9. Estimated cost-effectiveness of each option at State level ($ per change in suitable habitat)

	Greater Glider Cost-effectiveness ($/ suitable habitat hectare gained)	All species excluding Greater Gliders Cost-effectiveness ($/suitable habitat hectare gained)
Option		
Large Brown Tree Frog	$12,200	$133,100
Large Tree (no buffer)	Likely to be cost-effective, as this option formalises measures already adopted by VicForests.	Likely to be cost-effective, as this option formalises measures already adopted by VicForests.
Large Tree (with buffer)	$62,600	$46,500

Key points to note include:

- The Large Brown Tree Frog cost-effectiveness estimates are a consequence of very low change in suitable habitat values. The Large Brown Tree Frog change in suitable habitat is estimated to be 1 suitable habitat hectares for all species excluding Greater Gliders and 7 suitable habitat hectares for Greater Gliders.
- The Large Tree (with buffer) cost-effectiveness estimates are a consequence of high regulatory burden relative to the change in suitable habitat, which is estimated to be 845 suitable habitat hectares for all species excluding Greater Gliders and 628 suitable habitat hectares for Greater Gliders.
- Owing to a lack of data to support the estimation of the change in suitable habitat associated with Large Tree (no buffer), it has not been possible to estimate the cost-effectiveness of this option. However, Large Tree (no buffer) is likely to be cost-effectiveness relative to Large Tree (with buffer), because it involves formalising measures already adopted by VicForests coupled with a smaller area excluded from harvesting (relative to Large Tree (with buffer)).

Uncertainty with economic impacts

Table 10 contains an overview of the limitations that should be considered when interpreting the results. All estimated impacts should be considered indicative of the order of magnitude and are intended to provide guidance on the relative impacts of each option.

Table 10. Limitations and implications associated with the current assessment

Limitation element	Description / implication
Impact on the State	The assessment relies on wood supply modelling from VicForests. For options that are spatially defined (e.g. Large Brown Tree Frog), the estimates of the reduction in wood supply are considered to have relatively high accuracy. However, for detection-based options or options that are not spatially defined (that is, Large Tree (with buffer)), a range of assumptions have been made to facilitate the estimation of the impact on wood supply. There is lower accuracy associated with these options. In addition, the estimates of the change in variable costs associated with each of the options are high level estimates, and have not been calculated using a 'bottom – up' approach to individual cost items; however, sensitivity testing of this parameter has been undertaken. The sensitivity testing

Limitation element	Description / implication
	indicates that, depending on the option, VicForests costs, harvest and haulage costs that are passed on to VicForests by contractors, and the additional costs associated with each option, have the highest effect on the variability of the estimated impacts.
Impact on harvest and haulage operators	The assessment relies on publicly available information about harvest and haulage operators, supplemented by interviews of VicForests. The assumptions, including the assumed margin received, have not been confirmed with harvest and haulage operators; however, sensitivity testing of key input parameters has been undertaken. The sensitivity testing indicates that the harvest and haulage contractors' margins have the highest effect on the variability of the estimated impacts.
Impact on sawmill operators	There is a lack of recent publicly available financial data on the Victorian sawmilling industry. Therefore, the impact on sawmill operators relies on information from the NSW native forest sector, adjusted to reflect an 'average' Victorian sawmill, in consultation with VicForests. Detailed 'bottom-up' modelling of individual sawmill operations has not been attempted. Nor have the assumptions been confirmed with sawmill operators; however, sensitivity testing of key input parameters has been undertaken. The sensitivity tests indicate that the sawmill operators' margins have the highest effect on the variability of the estimated impacts.
Impact of pulp log shortfall	A high-level assessment of the potential costs associated with being unable to meet supply obligations between Australian Paper and the Victorian government has been provided based on sourcing alternative pulp log supply. These costs have assumed to be met by the Victorian Government given existing supply arrangements. These costs should be considered indicative, because the actual costs will be highly influenced by the location and method of harvesting operations through the period up to 2030.
Timeframe of assessment	The assessment only considers the period to 2030. In practice, the planning horizon for VicForests is considerably longer, with wood flow modelling conducted over a 100-year period. The results do not include consideration of the residual value of State native forest beyond 2030. However, it is important to note that the base case, and the wood supply forecast for each of the options, are based on a model of sustainable yield that extends over the long term. This approach reflects the assumption that VicForests and the hardwood timber industry will continue to operate after 2030; and the volume of wood supply available in 2029-30 will be available thereafter; i.e. VicForests continues to operate, albeit at lower annual harvest volumes than under the base case. Ideally, the period of the analysis for the RIS would reflect the period of the impacts. However, extending the analysis would introduce a new set of data certainty (e.g. assumptions and inputs for economic and other parameters beyond the 10 years). Similarly, suitable habitat hectares are estimated assuming the attainment of this CSH outcome at a 50-year time horizon. As such, the estimates presented assume that gains will be achieved over a shorter time. This is typical of state and transition models[14] used in ecological analysis.
Consideration of fire	Neither the wood supply model or the change in suitable habitat model include assumptions about major bushfire events occurring in the future. Depending on the location and extent of the fire, it may be possible to source alternative wood supply from elsewhere in the forest estate such that, in a given year, the combination of the Code variations and fire may have negligible impact on wood supply or suitable habitat.

[14] State and transition models help understand complex systems, with multiple interactive drivers for changes (e.g. competition, precipitation, and response to management actions) that operate at different intensities, frequencies, and durations across different scales of time and space.

4.5 Ecosystem service impacts

This section describes the ecosystem service benefits and trade-offs that may result from the implementation of the proposed changes to the Code.

The benefits of the Code variations relate to impacts that are not traded in markets and therefore their valuation is complex. Nevertheless, the changes to the Code are expected to lead to a number of outcomes that benefit the community. An ecosystem services approach was used to identify and scope the potential benefits.

In consultation with DELWP, the impact on the following ecosystem services have been considered:

- Water supply.
- Carbon storage and sequestration.
- Nature-based tourism / recreation.

There are other ecosystem services that may be impacted (such as cultural and spiritual value), but they have not been considered within the RIS because the required data to support valuation was not available, or was not sufficiently robust.

Defining ecosystem services

Ecosystem services are the benefits that people derive from the natural environment (MEA, 2005). MEA (2005) outlines four main ecosystem services. These include the following:

- Provisioning services, consisting of all the products obtained from ecosystems (e.g. food, water, raw materials).
- Regulating services, capturing the impact of regulating ecosystem processes (e.g. climate change regulation).
- Cultural services, relating to non-material benefits (e.g. recreation, tourism, spiritual).
- Supporting services, providing the basis for the remaining categories (e.g. photosynthesis, nutrient recycling).

Forest landscapes provide a range of ecosystem services and there is the potential to increase the provision of these services through the exclusion of harvesting in certain areas within State forests (that are proposed under the options).

Water supply

Forests play an important part of the water cycle. Trees absorb rainwater from the soils through their root system, which maintains their health and encourages them to grow and reproduce. Water travels through the tree trunk and branches, and is then transpired via its leaves. Therefore, forests influence the amount of water supplied to storages within a catchment (referred to as water yield). Water yield within a forest is a function of a number of components, including: the age of the forest, the density of the vegetation, soil moisture, the species within the forest, and the harvest patterns.

Typically, younger forests utilise a greater amount of water relative to established forests as they grow at a faster rate. Keith et al. (2017) (referring to a study undertaken by Kuczera (1987)) provides a graphic (see Figure 6) that highlights the proportional change in water yield over time for a montane ash forest once it has been disturbed (e.g. harvested or burned). The graphic also differentiates between old growth and regrowth forests. Figure 6 shows that during the first few years from planting there is an immediate increase in water yield as the recently planted forest has a smaller capacity for water uptake. However, over the long-term, there is a significant and prolonged decrease in water yield as the forest regrows (and the capacity for water uptake increases). The greatest reduction in

water yield peaks at around 25 years with a proportional change in water yield of approximately 30 per cent where harvesting occurred of regrowth forest and 50 per cent where harvesting of old growth forests occurs. The model shows that water yield is not fully restored to pre-disturbance levels until about 80 years (regrowth forest) have passed.

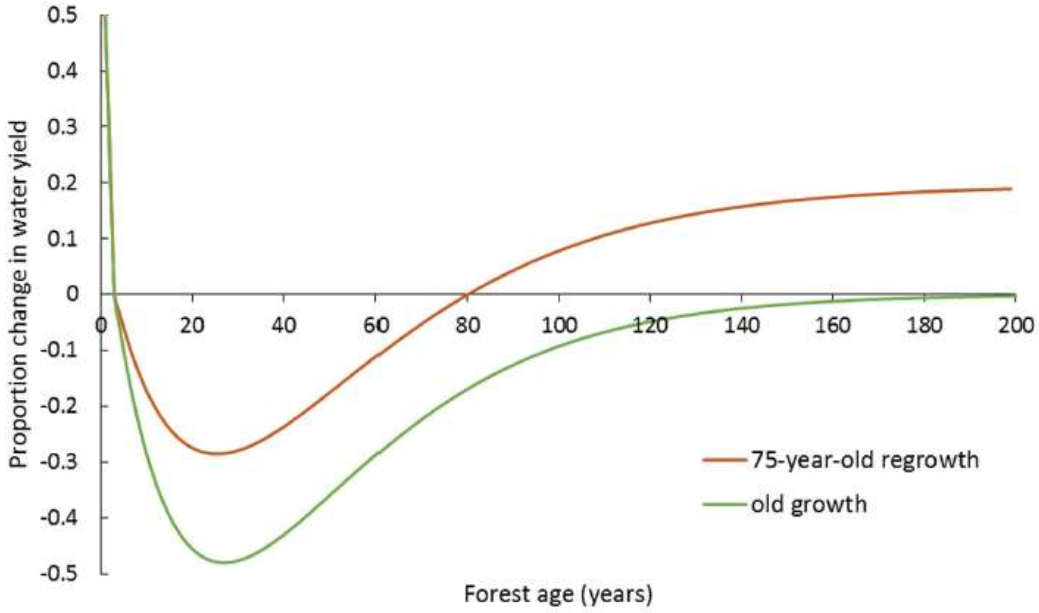


Figure 6. Reduction in water yield in montane ash forest after disturbance

Source: Keith et al. (2017).

Approach

The approach outlined in Keith et al. (2017) has been used to estimate the change in the provision of water yield from catchments that provide inflow into storages under each of the options. Because the bulk of the vegetation in the options assessed is either old growth or large trees in regrowth areas (typically 80+ years old), water use is significantly lower than recent replanting, and the Code will result in avoiding a loss in water yields. That is, there is a water supply benefit from retaining old growth and large trees.

The assessment compares the water yield differences between a forest excluded from harvesting and a disturbed (harvested) forest. The biophysical modelling information of water yield in Keith et al. (2017) is not reported in a way that can be readily applied to, or generalised for use in this RIS assessment. This is because water yield in each of the land cover and age classes in the study area depends on the area of land in each class, the precipitation and evaporation in the area, and the effect of the land cover on runoff. These elements are not 'unpacked' in Keith et al. (2017) to provide baseline yields (per ha). However, Keith et al. (2017) benchmark biophysical results against other studies that have investigated the impacts of forest disturbance events on water yields. The most applicable study undertaken modelled the reduction in water yield from the Maroondah catchment following wildfire (Vertessy et al., 1998).

From this assessment Vertessy et al., (2017c) concluded a reduction of 1 to 6 ML per ha per year 20 years post-fire across the catchment[15]. For this RIS assessment, the biophysical results from Vertessy et al. (1998) were combined with the time profile information from Keith et al. (2017). Water supply replacement cost information (via transfer of water from other regions or desalination) is provided in Keith et al. (2017), which has been used to derive unit values[16]. The key estimates are summarised in Table 11.

Table 11. Water supply unit value estimates

Estimates	Value
Reduction in yield (ML/ha/year) – low estimate	0.07
Reduction in yield (ML/ha/year) – high estimate	0.42
Value of water (2018$/ML) – low estimate (based on water transfer data)	$257
Value of water (2018$/ML) – high estimate (based on desalination)	$1,658

Source: Derived from Keith et al. (2017) and Vertessy et al. (1998).

Results

The estimated present values of the benefit of water supplied over the study period under each of the options is summarised in in Table 12[17]. There is considerable variation across the options, ranging from a low of approximately $1,300 (for Large Brown Tree Frog) to a maximum estimate of $1.2 million (for Large Tree (with buffer)). The Large Tree (with buffer) option is expected to provide the greatest value because it results in the largest area of forest excluded from harvesting and in these areas there will be no impact to water yields. The value for Large Tree (no buffer) is $0, as there is effectively no change in current practice in the area of forest protected under this option.

It should be noted, that to the degree that the Code variations result in shift in harvest activity to other timber sources, the impacts on water ecosystem services may be negligible (i.e. whatever is gained through the proposed Code variations is likely to be at least partially offset by harvesting elsewhere).

Table 12. Estimated net present values for water supply from 2020 - 2030, given changes to the Code

Options	Total area (ha) excluded from harvesting over the assessment period	Value (Present Value)	
		Lower estimate (total)	Higher estimate (total)
Large Brown Tree Frog	79	$1,314	$50,862

[15] The information provided by Vertessy et al. (1998) and Keith et al. (2017) focuses on ash forests. The relationship between forest age/type and change in water yield from these studies has been applied in this RIS for both ash species and mixed species. This assumption was made because there is limited research on water yield from mixed species forests following disturbance.

[16] The use of a replacement cost indicates the cost (in $/ML) at which water could be replaced and assumes that consumers would be willing to pay the specified value.

[17] The lower estimate was based on the low estimate for the reduction in yield and the low estimate for the value of water. The high estimate was based on the high estimate for the reduction in yield and the high estimate for the value of water.

Options	Total area (ha) excluded from harvesting over the assessment period	Value (Present Value)	
		Lower estimate (total)	Higher estimate (total)
Large Tree (no buffer)[18]	0	$0	$0
Large Tree (with buffer)	1,895	$31,519	$1,220,046

Limitations

A number of assumptions and limitations are associated with the estimated results. These include:

- It was assumed that all areas excluded from harvesting under the options are within water catchment areas. Harvesting in Victoria state forests occurs predominantly outside water catchment areas thus the results provide the highest upper-bound estimate of water yield impacts.
- It was assumed that fire does not affect baseline water yields (i.e. the baseline assumes no change to water yield arising from non-harvesting perturbations).
- The analysis does not differentiate between, age class, density of forests throughout the State, which are important considerations in estimating water yield.
- The climate post-wildfire in Victoria (in 1939) was not assessed to determine how this might influence the findings in relation to this ecosystem service.
- The studies used to undertake this analysis examined montane ash species, which have been assumed to apply to both ash and mixed species forests. The extent to which this research is applicable to ash and mixed species has not been investigated.
- Keith et al. (2017) highlight that water supplied to the economy is the result of significant investment in delivery infrastructure (e.g. mains, pumps, storages) and therefore there is a difference between water supply and water provisioning. This means that the actual economic benefit of forests excluded from harvesting will be lower than the value of the water because of the additional investment required to supply water to customers.
- Keith et al. (2017) recommend caution in relation to the price of water supplied, highlighting that the price of water in Victoria is regulated by the Essential Services Commission and varies widely across regions and for different uses. In this respect, the price of water does not necessarily reflect its value.

Carbon storage and sequestration

Forests provide a regulating ecosystem service by storing and sequestering atmospheric carbon dioxide (CO_2). They perform this through photosynthesis and storing carbon as above-ground and below-ground biomass (Nowak et al. 2013). More specifically, carbon is "...absorbed and assimilated by tree foliage and is stored as carbon-rich organic compounds... mostly in secondary woody tissues in tree boles and in large roots, as well as in foliage, branches and fine roots" (Unwin and Kriedemann, 2000). Trees sequester carbon as they grow and store carbon until they rot or are destroyed (e.g. by fire or pulp production). The store and sink dynamics of CO_2 of a forest changes through their natural

[18] No further area is predicted to be excluded for Large Tree (no buffer) from changes to the Code because this option is already effectively business as usual for VicForests

lifecycle (Nowak et al., 2013). Nonetheless, management factors of forests, (i.e. the way in which timber harvested) also significantly influence the effectiveness of carbon storage and sequestration (Unwin and Kriedemann, 2000). Carbon also accumulates in forest derived products such as timber house frames, floorboards, and tables. Carbon remains 'locked' in these products until the end of their useful lives.

There is ongoing analysis in relation to carbon accumulation rates within forests and forest derived products where these forests are subject to on-going timber harvesting. Further, the degree to which any monetary benefit from carbon sequestration is dependent upon Commonwealth Government Climate Change settings. Therefore, the carbon sequestration benefits associated with the proposed changes to the Code have not been quantitatively assessed.

Forest-based recreation and tourism

Impacts to forest-based recreation and tourism were not quantified as part of this assessment. The primary reason for this is that changes to the Code are not expected to result in considerable additional benefit. For example, a buffer resulting from the discovery of a Large Brown Tree Frog may only exist within a small area away from recreational or tourism activities; thereby, not leading to increased visitation. Further, without incorporating facilities or increasing access, there may be no changes to use. Nonetheless, information has been provided immediately below to contextualise the ecosystem service.

Forests provide the opportunity for nature-based recreation and tourism. They are used for a range of reasons, including for physical activities (e.g. running, riding, hiking) and non-physical activities (e.g. picnics, spiritual connections, community gatherings). Forest-based recreation and tourism provide cultural ecosystem services. Varcoe et al. (2015) explain that Victoria's parks provide diverse opportunities for engagement. They highlight that the direct benefits are personal enjoyment and appreciation of nature, providing health and economic benefits obtained by visitors to parks. Varcoe et al. (2015) elaborate further indicating that there is "…a large and increasing body of evidence showing that contact with nature and parks provide a wide range of physical and mental benefits." They explain that other studies on the topic assert that access to parks can encourage physical activity and being close to green space is associated with reduced depression, anxiety and other related conditions.

Nevertheless, similar to water supply and carbon storage and sequestration, management decisions concerning forest-based recreation and tourism involves trade-offs with alternative uses (e.g. harvesting) (Ahtikoski et al., 2011). Ahtikoski et al. (2011) assert that forestry has the potential to significantly impact the quality of nature-based recreation and tourism in forests, explaining that studies show that traditional forestry management practices (in particular regeneration practices) have substantial impacts on landscape values. Yet, Ahtikoski et al. (2011) also recognises that changes to management practices may cause loss in timber values.

In forest-based recreation and tourism the quality of the environment needs to meet the expectations of the (potential) visitor. Visitors may look elsewhere if the forested area is not visually appealing. For example, it is reasonable to expect that forest-based recreation and tourism would decline in an area that was harvested. However, harvest patterns are not the only factor that encourages (or discourages) enjoyment. Other factors include; ease of access, destination facilities (e.g. picnic facilities, water supply, bathrooms) and park maintenance.

4.6 Other impacts

There are additional impacts associated with the options for which qualitative estimates have been considered. These are:

Costs to DELWP	It is anticipated that DELWP will incur the following additional costs to implement the options: administrative costs; pre-harvest survey costs; and monitoring and compliance costs. In consultation with DELWP it was determined that these activities could be undertaken with existing resources and, as such, the impact is considered negligible.
Costs to commercial firewood collectors	There are approximately 30 commercial firewood collectors currently operating in Victoria. The options have the potential to increase the costs of production associated with their operations, owing to reduced supply within each FMA. Publicly available information on these costs are not available. In consultation with VicForests, it is assumed that the impact would be negligible.

4.7 Forest management area impacts

The impacts of the proposed changes to the Code have been estimated at the Forest Management Area (FMA) level. The FMAs that have been included in this assessment are those in eastern Victoria, which is where the majority of the State's native forest resource is located (see Figure 7). They are:

- Benalla-Mansfield
- Central
- Central Gippsland
- East Gippsland
- Dandenong
- North-east
- Tambo

Figure 7. Victorian forest management areas

Source: DELWP

Change in wood supply

Appendix D contains the estimated change in wood supply (for ash and mixed species) at the FMA level for the period 2019-20 to 2029-30 for each of the options as a percentage of the base case.

The results indicate that:

- *East Gippsland FMA* would experience a 0.2 per cent reduction in mixed species under the Large Brown Tree Frog option. No other region is estimated to experience a reduction in either mixed species or ash species under the Large Brown Tree Frog option.
- Large Tree (no buffer) is not estimated to result in a reduction in ash or mixed species in any FMA.
- The largest reduction in ash and mixed species under Large Tree (with buffer) is estimated to occur in *Dandenong FMA* (approximately 24 per cent, or 4,960 m^3 and a 0.8 per cent or 233 m^3 reduction for all log grades per annum, respectively). The next greatest reduction in ash species is estimated to occur in the *Central FMA*, where the reduction is approximately 9 per cent (or 24,665 m^3) for all log grades per annum.

Change in suitable habitat

Table 21 in Appendix D contains the estimated change in suitable habitat (CSH) (in absolute terms and as a percentage of the theoretical maximum CSH that could be achieved if harvesting was immediately stopped in all eastern Forest Management Areas (FMAs). for each of the options.

The results indicate that:

- CSH is dependent on the area that the option will be applied within that area i.e. dependent on the extent of Large Brown Tree Frog within that FMA. Within some FMAs the options do not apply (i.e. the extent of the option/value does not occur there) or there is an assumption that field verification will not result in the value being found there.
- The Large Brown Tree Frog option is estimated to result in an increase for Greater Gliders in *East Gippsland FMA* of approximately seven suitable habitat hectares and approximately one suitable habitat hectare for all other species.
- Large Tree (with buffer) is estimated to result in the greatest increase in suitable habitat hectares for Greater Gliders in *Central FMA* of 328 and an increase of 400 suitable habitat hectares for all species excluding Greater Gliders, also in the *Central FMA*. The next greatest increase in suitable habit for Greater Gliders (and all species excluding Greater Gliders) is estimated to occur in *East Gippsland FMA* (80 and 170 habitat hectares, respectively).

Forest management area economic results

Estimating the cost-effectiveness of the options at the FMA level provides limited insight into the impacts of the proposed variations to the Code. This is because:

- There are many FMAs in which the Large Brown Tree Frog option would not apply and there is therefore no change in suitable habitat. It is therefore not possible to calculate cost-effectiveness for these FMAs.
- Under the Large Brown Tree Frog option, cost-effectiveness has been calculated for very few FMAs, which makes comparisons limited.
- Under the Large Tree (with buffer) option, the estimated cost-effectiveness for all species excluding Greater Gliders ranges from approximately $1,500 – $54,200 (for *East Gippsland FMA* and *North East FMA*, respectively). The estimated cost-effectiveness for Greater Gliders ranges from approximately $3,100 – $86,400 (for *East Gippsland and North East FMAs* and *Central Gippsland FMA*, respectively).

For completeness, the results of the FMA cost-effectiveness analysis are contained in Appendix D.

5 PREFERRED OPTION

This section draws on the previous analysis to identify the preferred option, including a summary of competition effects.

5.1 Preferred option analysis

Summary results

Table 13 contains summary results for each option in relation to estimated change in suitable habitat, cost-effectiveness and implementation considerations.

Based on the summary presented in Table 13, the preferred option is Large Brown Tree Frog. It is anticipated to provide protection of an important species and codifies the prescriptions contained in Statement no. 255 (published 2014). It is anticipated to apply to 23 hectares within the Net Harvestable Area within East Gippsland FMA.

Large Tree (no buffer) is also considered a preferred option. This is because Large Tree (no buffer) is anticipated to provide protection of important habitat characteristics, whilst minimising the regulatory burden experienced by the forestry sector. It should be noted that it has not been possible to assess this option using the CSH methodology as the area that this applies is not spatially explicit.

Combined these options are anticipated to:

- Contribute to the protection of important habitat characteristics and species, including Large Brown Tree Frogs and Greater Gliders.
- Deliver greater regulatory certainty to the timber industry and community.

Large Tree (with buffer) is considered to provide additional protection, relative to Large Tree (no buffer), however it is also estimated to result in significantly higher regulatory burden.

In addition to these major changes, it is recommended that the proposed minor changes (see Table 23) are adopted. They will correct minor errors, creating less ambiguity within the Code. The regulatory burden of these changes will be minor, involving once-off transition costs associated with editing the Code.

Table 13. Summary results for each option

Option	Summary results
Large Brown Tree Frog (preferred option)	
Change in suitable habitat	Anticipated to apply to 23 hectares within the Net Harvestable Area within East Gippsland FMA. It is estimated to result in an increase in suitable habitat hectares of one (for all species excluding Greater Gliders) and 7 (for Greater Gliders).
Cost-effectiveness	An estimated cost-effectiveness of $12,200 / suitable habitat hectare gained for Greater Gliders and $133,100 / suitable habitat hectare gained for all species excluding Greater Gliders, which is a function of the relatively small change in suitable habitat for all species excluding Greater Gliders.
Implementation	Implementation of this option is detection-based and will require: • DELWP to update its compliance processes and procedures to incorporate the preferred options in the scope of its Forest Audit Program and surveillance checks conducted by the Timber Harvesting Compliance Unit.

Option	Summary results
	• VicForests to amend its operational procedures and internal compliance checks and to communicate this to its harvest and haulage contractors. However, this is not considered to be onerous as the required amendments to operational procedures and internal compliance checks are already incorporated in VicForests activities.
Large Tree (no buffer) (preferred option)	
Change in suitable habitat	It has not been possible to assess this option using the CSH methodology as the area that this applies is not spatially explicit. The protection of large, living trees represents a significant, long-term benefit for hollow dependent mammals such as Leadbeater's Possum and the Greater Glider, as well as hollow nesting and roosting birds such as the Sooty Owl. The degree of benefit relies on the large trees surviving the timber harvesting, regeneration and regrowth phases, during which mechanical damage, fire and windthrow might lead to damage or loss. The degree of benefit and the longevity of the tree in the landscape varies according to the density of large trees and the extent of their occurrence across the local landscape. Each hollow-dependent species prefer certain large tree densities and habitat patch sizes. In addition to the local landscape considerations, the benefit will be amplified by the degree to which it recurs at a broader landscape or regional scale.
Cost-effectiveness	Anticipated to be highly cost-effective, as this option formalises measures already adopted by VicForests, therefore the regulatory burden is negligible.
Implementation	The target compliance rate is no verified instances of non-compliance with the option prescription. Implementation of this option is detection-based and will require: • Clarity around how compliance will be determined. For example, the requirement for exclusion areas around Large Trees reserves, "to be incorporated into retained patches or within expanded exclusion areas, where practicable" (NCE emphasis), will require clarification and potentially some field testing by DELWP and VicForests. • DELWP to update its compliance processes and procedures to incorporate the preferred options in the scope of its Forest Audit Program and surveillance checks conducted by the Timber Harvesting Compliance Unit. • VicForests to amend its operational procedures and internal compliance checks and to communicate this to its harvest and haulage contractors. However, this is not considered to be onerous as this is already incorporated in VicForests activities.
Large Tree (with buffer)	
Change in suitable habitat	Anticipated to affect the provision of suitable habitat in all seven FMAs in eastern Victoria. The option is estimated to result in an increase in suitable habitat hectares of 845 (for all species excluding Greater Gliders) and 628 (for Greater Gliders).
Cost-effectiveness	An estimated cost-effectiveness of $62,600/ suitable habitat hectare gained for Greater Gliders and $46,500 / suitable habitat hectare gained for all species excluding Greater Gliders, which is a function of the high regulatory burden relative to the increase in suitable habitat hectares.
Risk of duplication	Mandatory buffer may duplicate exiting habitat retention requirements of the Code as noted in section 2.2 Nature of the Problem.
Implementation	The target compliance rate is no verified instances of non-compliance with the option prescription. Implementation of this option is detection-based and will require:

Option	Summary results
	• Clarity around how compliance will be determined. For example, the requirement for exclusion areas around Large Trees reserves, "to be incorporated into retained patches or within expanded exclusion areas, where practicable" (NCE emphasis), will require clarification and potentially some field testing by DELWP and VicForests. • DELWP to update its compliance processes and procedures to incorporate the preferred options in the scope of its Forest Audit Program and surveillance checks conducted by the Timber Harvesting Compliance Unit. • VicForests to amend its operational procedures and internal compliance checks and to communicate this to its harvest and haulage contractors. • VicForests to update its wood flow modelling and Resource Outlooks to reflect the wood supply impacts associated with this option as it is not currently considered.

Competition effects

Victoria is party to the Council of Australian Governments Competition Principles Agreement, therefore the analysis of all regulatory proposals must consider whether those proposals will reduce competition. If so, the analysis must also demonstrate (1) that Government's objectives can only be achieved by restricting competition and (2) that the benefits of the restriction outweigh the costs.

The OECD Competition Assessment Toolkit (OECD, 2011) provides a checklist for identifying potentially significant negative competition effects within the context of the introduction or amendment of regulations. The checklist includes the following questions:

- Does the proposed regulation limit the number or range of suppliers?
- Does the proposed regulation limit the ability of suppliers to compete?
- Does the proposed regulation limit to the incentives for suppliers to compete?
- Does the proposed regulation limit the choices and information available to consumers?

Implementation of the preferred options is not anticipated to reduce the number or range of operators within the timber harvesting and primary processing supply chain. This is because the preferred options are anticipated to have a negligible impact on producer surplus (profit) relative to other pressures faced by the primary processing supply chain.

The anticipated competition effects for the timber harvesting and primary processing supply chain include:

The State	VicForests has access to harvest the State's native forests. The preferred options will result in a small reduction in revenue, but will not result in any competition effects as it is the predominant supplier of the State's native forest hardwood sawlogs and pulp logs.
Harvest and haulage operators:	Harvest and haulage operators are anticipated to experience a small net increase in the costs of production / reduced productivity. It is anticipated that this increase in cost would be largely passed on to VicForests.
Sawmill operators:	Sawmill operators are effectively dependent on VicForests as a source of fibre for their operations. Sawmill operators are anticipated to experience a small net increase in the cost of production / reduction in productivity that is not likely to be

	able to be passed on because Victorian sawmill operators are price takers[19] within the national hardwood sawlog market. However, the impact of the preferred options is anticipated to be negligible because they have effectively been voluntarily adopted by the industry. Therefore, competition effects are anticipated to be negligible.
Pulpmill operator:	The preferred option is not anticipated to result in a significant impact on supply for the Australian Paper pulpmill

[19] A price-taker is a company that lacks the market share to influence market price on its own. Therefore, it must accept the prevailing prices.

6 IMPLEMENTATION PLAN

This section describes the approach to implementing the preferred option.

6.1 Approach to implementation

As the department responsible for regulation of Victorian forests, DELWP has ultimate responsibility for developing the implementation plan for the preferred options.

Implementation of the preferred options will occur within the context of a broader regulatory reform process currently underway within DELWP. This process has resulted in the creation of an Office of the Conservation Regulator, presided over by the Chief Conservation Regulator.

Implementation of the preferred options will primarily involve:

- DELWP – responsible for making the variations to the Code on behalf of the Minister for Energy, Environment and Climate Change, communicating the changes (internally and to VicForests), and undertaking compliance and monitoring activities.
- VicForests – responsible for following and demonstrating compliance with the variations to the Code.

Implementation framework

The preferred options represent the formalisation of measures that are already being voluntarily undertaken by VicForests. Given this, implementation is not anticipated to require measures significantly different to current practices. Table 14 contains an overview of the key elements of the implementation plan and includes broader measures that are currently being introduced by DELWP to support the Office of the Conservation Regulator.

A detailed implementation plan will be developed prior to the implementation of the preferred options.

Table 14. Overview of key elements of the implementation plan

Implementation activity	Description
Regulatory approach	• As part of a broader regulatory reform, DELWP has created an integrated and effective regulator within the Department by creating the office of the Chief Conservation Regulator. The Chief Conservation Regulator will oversee the implementation of the preferred options.
Compliance monitoring	• In line with current practices, DELWP Timber Harvesting Compliance Unit will continue to investigate specific allegations of non-compliance with the Code, including non-compliance in relation to the preferred option. • DELWP has committed to publishing an annual Compliance Plan – at the regional and State level – that identifies regulatory priorities to address the areas of highest risk of harm to the environment. This plan will be used to monitor compliance with the specification of preferred options. • In line with current practices, broader forest health will continue to be monitored and reported within the Victorian State of Forests Report. This will help to determine the effectiveness of the implementation of the preferred options in achieving the desired outcomes.
Enforcement	• DELWP has committed to publishing a Compliance and Enforcement Policy that provides clarity to the Victorian community, regulated entities and their staff about how it will apply the law and exercise its judgement and discretion around compliance and enforcement. Enforcement of the prescriptions contained in the preferred options will be consistent with the Compliance and Enforcement Policy.

Implementation activity	Description
	• DELWP has committed to finalising an updated Prosecutions Policy - an internal policy document to guide Authorised Officers and prosecutors on procedural requirements and decision-making for the prosecution of offences through the courts. Enforcement of the prescriptions contained in the preferred option will be consistent with the Prosecutions Policy.
Consultation and communication strategy	• DELWP has committed to developing and publishing a Regulatory Framework document that provides an effective framework for the performance of its regulatory functions. It will clearly and transparently set out how the Department will take a risk-based and intelligence-led approach to regulation – informing organisational improvement and better engagement with the community and stakeholders. The main audiences for this framework are the Victorian community, regulated entities and staff in the Office of the Conservation Regulator. • DELWP has committed to publishing a Statement of Intent for key areas that it has direct responsibility for environmental regulation. These statements will make it clear why it regulates, what it regulates and how it will regulate – including the enforcement powers and tools that it has. The Statements will also have performance measures and targets that will be publicly reported against. The first Statement of Regulatory Intent to be published will be for timber harvesting and will communicate the intent of the variations to the Code. • DELWP will continue to put 'community at the centre' of its regulatory practice. A Communications and Engagement Strategy will be developed as a public commitment to what community, stakeholders and regulated entities can expect from the Office of the Conservation Regulator. This will include outlining our approach and making commitments to publishing information products and holding community open days, so people can directly interact with staff and gain a better understanding of the work that they do. The communication of the variations to the Code will be consistent with the Communications and Engagement Strategy.
Risk management	• Implementation risks associated with the 2019 Code variations will be managed by ongoing DELWP engagement with VicForests and the Victorian community. This will lead to the early identification and collaborative resolution of implementation challenges.
Training requirements	• DELWP will work with VicForests to determine if specific field guidance documentation will be required to ensure consistent implementation of the regulatory changes. • DELWP has committed to undertake a Regulatory Capability Assessment to identify enhancements to people, process, technology and infrastructure for delivering regulatory services. This assessment will inform a capability development plan for the Office of the Conservation Regulator. • If necessary, DELWP will deliver additional training for VicForests to support the implementation of the preferred options. This training would occur within the first 6 months.
Governance	• DELWP has appointed the Chief Conservation Regulator, a senior executive that has accountability and independent regulatory decision-making authority for all environmental regulation undertaken by the Department, including the variations to the Code. • To support the Chief Conservation Regulator, DELWP will establish the Office of the Conservation Regulator, bringing together the parts of the Department with regulatory responsibilities into a single division that is focused on best-practice regulation. • DELWP will establish an Independent Regulatory Assurance Panel, comprising relevant experts who can provide advice and support to the Chief Conservation Regulator. • DELWP will appoint a Stakeholder Reference Group to enable regular discussion and debate on environmental regulation with an informed and diverse group of stakeholders. The group's focus will primarily be forward looking, providing advice on the policies, strategies and processes that frame DELWP's regulatory work. • DELWP will create a Regulation Sub-committee of its Senior Executive Team (SET). This Sub-committee will be responsible for monitoring the performance of DELWP as a regulator, including the implementation of 14 recommendations made by the independent review panel. The Sub-committee will report to the SET, which is chaired by the DELWP Secretary and comprises the Department's Deputy Secretaries.

Implementation considerations

Key considerations in relation to the implementation of the preferred options include:

- The need for clarity around how compliance will be determined. For example, the requirement for exclusion areas around Large Trees reserves, "to be incorporated into retained patches or within expanded exclusion areas, *where practicable*" (NCE emphasis), will require clarification and potentially some field testing by DELWP and VicForests. DELWP and VicForest will develop field guidance to support compliance with the new requirement.
- The need for DELWP to update its compliance processes and procedures to incorporate the preferred options in the scope of its Forest Audit Program and surveillance checks conducted by the Timber Harvesting Compliance Unit. DELWPs newly established Office of the Conservation Regulator will be consulted so that regulatory guidance can be disseminated to DELWP compliance staff.
- VicForests to amend its operational procedures and internal compliance checks and to communicate this to its harvest and haulage contractors. This is unlikely to involve significant resources but will need to be considered as part of implementation. DELWP's newly established Office of the Conservation Regulator will support VicForests to comply with any new regulations through the provision of relevant guidance materials.

7 EVALUATION STRATEGY

This section describes a high-level evaluation plan to assess the effectiveness of the implementation of the preferred option.

7.1 Approach to evaluation

Objective of evaluation

The objective of the evaluation is to understand the effectiveness of variations to the Code and, if necessary, to revise the Code to better address the problems the proposed changes are intended to achieve.

The proposed changes to the Code will be evaluated ten years after implementation. However, in keeping with Victorian Government guidance (Commissioner for Better Regulation, 2016) more frequent monitoring is proposed because there is uncertainty about the expected benefits and costs of the preferred options. For example, in relation to the protection of Large Brown Tree Frogs (because the prescription is detection-based) and Large Tree (no buffer) (because the location of these trees is based on modelled results).

The scope of the evaluation will include the preferred options as well as the proposed minor amendments.

Relevant evaluation approaches include:

- Participatory evaluation - A range of approaches that engage stakeholders (especially intended beneficiaries) in conducting the evaluation and/or making decisions about the evaluation.
- Beneficiary assessment - An approach that assesses the value of an intervention as perceived by the (intended) beneficiaries, thereby aiming to give voice to their priorities and concerns. In this case, beneficiary could be extended to include evidence that the desired conservation outcomes have been achieved.

Evaluation framework

Table 15 contains an overview of the key elements of the proposed evaluation plan. A detailed evaluation plan will be developed prior to the implementation of the preferred option. Consistent with the Victorian government guidance (Commissioner for Better Regulation, 2016), the development of the evaluation strategy will be based on the proportionality principle.

Table 15. Overview of key elements of the evaluation plan

Evaluation element	Description

Evaluation questions and indicators	• The evaluation will address both the process by which the variations to the Code have been implemented and outcome of the implementation of the Code.
	• Key evaluation questions will be developed to cover:
	  • Appropriateness – e.g. to what extent do the variations to the Code address the identified problems?
	  • Effectiveness – e.g. to what extent are the variations to the Code achieving the intended outcomes, in the short, medium and long term? To what extent are the variations to the Code contributing to the achievement of ecological integrity, certainty for industry, and community benefits?

Evaluation element	Description
	• Efficiency – e.g. do the outcomes of the variations to the Code represent value for money? To what extent is the relationship between inputs and outputs timely, cost-effective and to expected standards? • Indicators of success will include: – Number of instances of verified Code non-compliances – Persistence of threatened species – % of industry supply requirements met – % regulatory decisions consistent with DELWP benchmarks – % reduction in the number of unnecessary allegations of non-compliance
Evaluation frequency	• Evaluation frequency of the Code is intended to change to an annual basis once a Standard Operating Procedure (SOP) for the annual review has been developed. • Near-term reviews of the Code, including a full scientific review of the Code are also being investigated by DELWP. • The effectiveness of the variations to the Code will be reviewed by the DELWP's Chief Conservation Regulator after a period of ten years to compare outcomes to those projected by this Regulatory Impact Statement.
Data collection methods	• Data will be collected by VicForests, DELWP and third parties and recoded in the Victorian Biodiversity Atlas (VBA). Programs such as the Victorian Forest Protection Survey Program will be used to increase the data available for monitoring the efficacy of the variations to the Code.
Responsible parties	• DELWP's Chief Conservation Regulator will have ultimate accountability for reviewing the effectiveness of these reforms and the general performance of Victoria's regulatory framework for timber production.
Evaluation participants	• The evaluation plan will be developed to incorporate consideration of the impact of the Code variations on relevant parties such as representatives of the industry supply chain, DELWP Timber Harvesting Compliance Unit, Chief Conservation Regulator, and Stakeholder Reference Group.

8 REFERENCES

Agriculture Victoria (not specified). *Trees: For Farm Health*. Accessed at <http://agriculture.vic.gov.au/agriculture/weather-and-climate/understanding-carbon-and-emissions/carbon-and-emissions-trees> on 01/04/2019.

Ahtikoski, A., Tuulentie, S. and V. Hallikainen (2011). Potential Trade-Offs Between Nature-Based Tourism and Forestry, a Case Study in Northern Finland. *Forests 2(4)*: 894-912.

Brockington, J., Finegan, N., and Rozen, P., (2018) Panel Report to the Secretary of the Department of Environment, Land, Water and Planning. Accessed at < https://www.forestsandreserves.vic.gov.au/__data/assets/pdf_file/0021/414165/Independent-Review-of-Timber-Harvesting-Regulation-Report.pdf> on 17/05/2019.

Commissioner for Better Regulation (2016) Victorian Guide to Regulations: a handbook for policy-makers in Victoria.

Commissioner for Environmental Sustainability Victoria (2018) State of the Forests Report 2018. Accessed at < https://www.ces.vic.gov.au/reports/state-forests-2018> on 17/05/19.

Deloitte Access Economics (2017) The Economic Impact of VicForests on the Victorian Community. Accessed at <http://www.vicforests.com.au/about-vicforests/economic-report> 12/04/2019.

Department of Environment and Primary Industries (DEPI) (2014a) Code of Practice for Timber Production 2014.

Department of Environment and Primary Industries (DEPI) (2014b) Action Statement No. 255. Large Brown Tree Frog *Litoria littlejohni Flora and Fauna Guarantee Act 1988*.

Department of Treasury and Finance (DTF), (2013) Economic Evaluation for Business Cases Technical guidelines August 2013. Accessed at <https://www.dtf.vic.gov.au/investment-lifecycle-and-high-value-high-risk-guidelines/technical-guides> on 09/06/19.

IPCC (2014) Working Group III Contribution to the Fifth Assessment Report, Climate Change 2014—Mitigation, Cambridge University Press, Cambridge, Figure 6-21, p.450.

Jackson, W. (2019) Independent Consultation Paper – Modernisation of the Victorian Regional Forests Agreements. Accessed at < https://www2.delwp.vic.gov.au/__data/assets/pdf_file/0029/417818/Independent-Consultation-Paper-Modernisation-of-the-Victorian-RFAs-May-2019.pdf> on 17/05/2019.

Keith, H., Vardon, M., Stein, J., Stein, J. and D. Lindenmayer (2017). Experimental Ecosystem Accounts for the Central Highlands of Victoria: Final Report. Accessed at < http://www.nespthreatenedspecies.edu.au/Ecosystem%20Complete%20Report_V5_highest%20quality.pdf> on 14/03/2019.

Kuczera G. (1985). Prediction of water yield reductions following a bushfire in ash – mixed species eucalypt forest. *Journal of Hydrology 94(3-4):* 215-236.

Melbourne Metropolitan Board of Works, Report No. MMBW-W-0014.

Millennium Ecosystem Assessment [MEA] (2005). Ecosystems and Human Well-being: Synthesis [1]. Island Press, Washington. Accessed at < https://www.millenniumassessment.org/documents/document.356.aspx.pdf> on 05/04/2019.

North Carolina Climate Office (not specified). *The Water Cycle*. Accessed at < https://climate.ncsu.edu/edu/WaterCycle> on 01/04/2019.

Nowak, D. J., Greenfield, E. J., Hoehn, R., E. & E. Lapoint (2013). Carbon storage and sequestration by trees in urban and community areas of the United States. *Environmental Pollution 178*: 229 – 236.

Organisation for Economic Co-operation and Development (OECD) (2011) Competition Assessment Toolkit. Volume 1: Principles. Paris, 2011.

Schirmer, J., Mylek, M., Magnusson, A., Yabsley, B., and Morison, J. (2018) Socio-economic impacts of the forest industry. Victoria (exc. the Green Triangle). Consultant report for Forest & wood Products Australia.

Unwin, G., L. & P. E. Kriedemann (2000). *Principles and Processes of Carbon Sequestration by Trees*. Research and Development Division State Forests of New South Wales. Technical Paper No. 64. Accessed at <https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0006/389859/Principles-and-Processes-of-Carbon-Sequestration-by-Trees.pdf> on 01/04/2019.

Varcoe, T., Betts O'Shea, H. & Z. Contreras (2015). *Valuing Victoria's Parks – accounting for ecosystems and valuing their benefits: report of first phase findings*. Department of Environment, Land, Water and Planning, Melbourne. Accessed at < https://parkweb.vic.gov.au/__data/assets/pdf_file/0010/695764/Valuing-Victorias-Parks-Report-Accounting-for-ecosystems-and-valuing-their-benefits.pdf> on 01/04/2019.

Vertessy R, Watson F, O'Sullivan S, Davis S, Campbell R, Benyon R, Haydon S (1998). *Predicting water yield from Mountain Ash forest catchments*. Cooperative Research Centre for Catchment Hydrology (Industry Report 98/4), Melbourne. Accessed at <http://ewater.org.au/archive/crcch/archive/pubs/pdfs/industry199804.pdf> on 14/03/2019.

VicForests (2017) 2016-17 Resource Outlook. Accessed at <http://www.vicforests.com.au/planning-1/resource-outlook-2017 >

VicForests (no date) *Victoria's Old Growth Forests*. Accessed at < ttp://www.vicforests.com.au/static/uploads/files/fs-oldgrowth-web-wfwatxskgxne.pdf.> 12/04/2019.

Victorian Environmental Assessment Council (2017). Fibre and wood supply assessment report. East Melbourne, Australia.

Ximenes, F., Huiquan, B., Cameron, N., Coburn, R., Maclean, M. (eds.). (2016). *Carbon stocks and flows in native forests and harvested wood products in SE Australia*. Prepared for Forest & Wood Products Australia. Accessed at < https://www.fwpa.com.au/images/resources/Amended_Final_report_C_native_forests_PNC285-1112.pdf > on 05/04/2019.

APPENDIX A: DESCRIPTION OF OPTIONS

This appendix provides a summary of options currently under consideration for variations to the Code of Practice for Timber Production 2014 (the Code) is set out below.

Baseline positions

At the outset, it is important to confirm the baseline for consideration of these options, i.e. the biophysical base lines for wood supply (comprising both the Net Harvestable Area and wood flows over time) and biodiversity values within State forests. These baseline positions are outlined below.

Wood supply

For this project, VicForests and DELWP agreed to use VicForests' 2017 Resource Outlook (RO 2017), as the basis for the wood supply baseline. VicForests' RO 2017 is made publicly available and published online. The analysis was also undertaken using the Forest Management Zones that were relevant and current between August 2018 and May 2019.

VicForests' RO 2017 is a forecast of future wood supply that indicates how much sawlog timber (as defined as being D+ sawlogs which is log grades D, C and B) can be supplied from the available State forests in eastern Victoria in the medium term on a sustainable basis. It is based on a wood supply model that is used to evaluate supply over a 100-year time horizon. The model is updated regularly to account for changes in the resource base (including changes to the forest management zoning scheme or land tenure) as well as changes to market conditions (e.g. log specifications), and the results are used to inform future sales and guide harvesting in the landscape.

The RO 2017 separates the species groups of timber supplied by VicForests to the hardwood timber industry into two categories – ash and mixed species.

The RO 2017 is shared with industry, government and other stakeholders to provide information about Victoria's State-owned timber resources. In this way it is used by VicForests to guide the volume of timber VicForests makes available to the market.

For this project, VicForests has provided baseline data based on its RO 2017, reflecting modelling of wood supply and future wood flows over a 100-year period; while noting the RIS economic analysis of benefits and costs associated with variations to the Code will be based on a 10-year period from 2020 to 2030. The relation of the RO 2017 D+ modelling and arisings of E grade and pulp log grade was provided by VicForests.

This baseline data is underpinned by VicForests' spatial layer for 'Net Harvestable Area', which is the linework that delineates the areas of State forest in eastern Victoria) in which VicForests can operate as determined by the Code of Practice for Timber Production (2014) and Management Standards and Procedures and in accordance with the Allocation Order. It is the area considered by VicForests to be suitable for timber production over time, e.g. in harvest cycles of indicatively 80-120+ years, with spatial and temporal impacts over that period.

The Net Harvestable Area excludes all the formal and informal reserves established through the Regional Forest Agreement (RFA) process and subsequent processes of intra-governmental review. These reserves, comprising formal (e.g. National parks and State reserves) and informal reserves (e.g. SPZs), constitute a connected system of areas in which no timber harvesting will occur. VicForests' Net Harvestable Area spatial layer was created in December 2015 and it used the FMZ100 layer that was current in November 2015. VicForests conducted extensive wood supply modelling through 2016,

which culminated in RO 2017. Therefore, the VicForests Net Harvestable Area does not include subsequent additions of SPZs (2016-2018) or the Kuark Protection Area (2018) in East Gippsland.

Other key notes on the wood supply baseline:

- Leadbeater's Possum (LBP) detections: VicForests is obliged under State regulations to protect identified colonies with a 200-metre buffer around the detection site. VicForests reassessed the potential impact of LBP detections (including anticipated future detections) after the strategic wood supply modelling for the RO 2017 was conducted. However, the RO 2017 and its Operable Inventory was adjusted to incorporate the forecast future impact of LBP colony detections (discussed in further detail in Box 2). Therefore, the anticipated impacts of future LBP detections were incorporated in the RO 2017; at the time that RO 2017 was prepared (i.e. 2017); and these estimates of future LBP detections.
- Ash stands originating prior to 1900: The Code (through its incorporated Management Standards and Procedures) requires the exclusion of timber harvesting from all Ash forests originating prior to 1900 in the Central Highlands Forest Management Area (FMA); but this exclusion applies to this FMA only. VicForests has extended this exclusion by implementing progressively through 2019 a company policy of excluding timber harvesting from pre-1900 Ash forests across all FMAs. The RO 2017 incorporates this exclusion and therefore all pre-1900 Ash forests are excluded from wood supply in the project baseline.
- Additional area constraints or exclusions: VicForests has also adjusted its RO 2017 Operable Inventory to net out several areas within water catchments and post-bushfire salvage area that are designated as available for timber harvesting. These areas are assumed to be unavailable for harvest due to community concerns and include parts of Cement Creek, Armstrong Creek, the Little Yarra blocks and the Ada blocks – most of which are in the Dandenong FMA. These areas are not included in the RO 2017 Operable Inventory.
- Impacts of future bushfires excluded from modelling: It is important to note that VicForests' strategic wood supply model does not include assumptions about major bushfire events occurring in the future; however, if major fire events occur and impact on the growing stock, the strategic wood supply model would be adjusted accordingly and hence the release to the market of resource would also adjusted. Depending on the location and extent of the fire, it may be possible to source alternative supply from elsewhere in the forest estate such that overall output in a given year is not adversely affected.

Box 2. Estimates of future detections of Leadbeater's Possum colonies included in baseline

The project baseline for wood supply incorporates VicForests' estimates of future detections of LBP colonies in the baseline; based on the extent of colony detection and VicForests' understanding of LBP habitat and detection trends in 2016/17. It is important to highlight that there have been many more colony detections since that time, and VicForests' understanding of LBP habitat and detection trends – as well as future estimates - have changed significantly since that time.

The 2016-2017 Resource Outlook forecasts that 130 000m^3 per annum of ash sawlog can be supplied from the available State forest in the medium term. This is a reduction of 88 000m^3 per year when compared to the 2013 Resource Outlook.

Initially, VicForests' wood supply model took account of adjustments based on excluding areas of high community interest, areas where there is a high concentration of Leadbeater's Possum, increased Special Protection Zone (SPZ) area and old growth. As set out in the RO 2017, these adjustments included:

- A 10,000 m^3/annum reduction in Ash D+ sawlog on account of "areas outside the Leadbeater's colony protection zones that VicForests believes will no longer be accessible due to fragmentation of the remaining available forest caused by the high density of colonies; and

- A 7,000 m³/annum General Management Zone changes to SPZ due to Leadbeater's Possum detections updated to November 2015. Note this includes those zones within the high concentration area above.
- These reductions, plus further reductions amounting to 28,000 m³ /annum in total due to community and/or market concerns (11,000 m³/annum), updates to the Forest Management Zoning scheme (5,000 m³/annum) and exclusions of all pre-1900 ash stands in all FMAs (12,000 m³/annum), resulted in a total reduction in Ash D+ sawlog within the model of 45,000 m³/annum (VicForests, 2017) .
- This adjustment of 45 000m³ reduced the original 2013 Resource Outlook of 220 000m³ down to 175 000m³.

VicForests then modelled a forecast of future regulatory impacts on the ash sawlog resource supply. The modelling of future impacts included an equivalent of the recent rate of Leadbeater's possum detections (up to 201617) continuing for 7 years. The subsequent resource impact was applied to the harvest levels for the next 20 years, resulting in an additional 34,000m³/annum reduction in ash sawlog supply. A summary of these future changes was set out in the RO 2017 in Table 16.

Table 16. Potential Future Regulatory Change due to Leadbeater's Possum colonies

Anticipated regulatory impact	Volume reduction (m³/annum)
New Leadbeater's Possum colony reservations	18,000
Resource fragmentation due to colony proximity/density	
Access to timber being restricted by colony location, potentially limiting economic harvest	16,000
Changed harvesting practices/requirements recommended by Leadbeater's Possum Advisory Group to support possum populations and secure market access/social licence	9,000
Total adjustment to modelled forecast	43,000

Source: VicForests Resource Outlook 2016-17

The total reductions for future regulatory change of 43 000m³ reduced the RO 2017 from 175 000m³ to 132 000m³. To assist the industry with the transition to lower levels of ash sawlog supply, it was determined that in the short term the ash sawlog supply levels could be 153 000m³ per annum for the period 2017-18 to 2020-21. The subsequent medium-term supply level beyond 2020-21 was then reduced to 130 000m³ per annum (VicForests, 2017).

Biodiversity values

Baseline for assessing change

For this project, the baseline of biodiversity values was defined as: The Suitable Habitat in 50 years provided by the area of forest not subject to timber harvesting (i.e. the parks and reserves system and areas of GMZ where timber harvesting will not occur).

The baseline extent of the public native forest area within which timber harvesting is excluded was assessed in August 2018 and described in the following datasets from the DELWP corporate library or supplied by VicForests:

- Parks Res
- PLM25_Overlay
- FMZ100 (SPZs at the time of August 2018)

- The inverse of VicForests Net Harvestable Area layer (described as 'ModEx'[20])
- Areas of Pre-1900 Ash forest identified by VicForests in its Net Harvestable Area layer
- Any areas of VicForests' Net Harvestable Area layer (as provided by VicForests) that overlap with SPZs created in the period 2015 – 2018 (the most substantial of these are new LBP colony detections and the Kuark Protection Area in East Gippsland).

These reserves – comprising formal (e.g. national parks and State parks) and informal reserves (e.g. SPZ) – constitute a connected system of areas in which no timber harvesting will occur, and for which DELWP Biodiversity Division (Bio. Div.) can model biodiversity values and benefits.

It is important to note there is some inconsistency between the wood supply baseline, based on VicForests' Resource Outlook 2016-17 (VicForests, 2017), and the baseline for biodiversity values. The notable points of inconsistency are set out in Box 3. NCE and the DELWP project team addressed these points during the development of the RIS and concluded it was not possible within the timeframe for this project to align the baselines entirely. However, most importantly, it was resolved that provided these aspects were acknowledged transparently, they did not unduly compromise or limit the integrity and value of the RIS analysis and the comparative assessment of options, on a relative basis.

Box 3. Alignment of baselines for wood supply and biodiversity values

It is important to note there is some inconsistency between the wood supply baseline, based on VicForests' Resource Outlook 2016-17 (RO 2017), and the baseline for biodiversity values.

The wood supply baseline is based on VicForests' RO 2017 and its Net Harvestable Area from late 2015; and in broad terms, it does not incorporate SPZs created since 2016. In contrast, the baseline for biodiversity values is based on the spatial extent of public land that excludes timber harvesting as at August 2018. This means the baseline for biodiversity values incorporates areas of recent reservations, including the Kuark Protection Area in East Gippsland designated in 2018, which are designated as available for harvesting within VicForests' Net Harvestable Area.

The inconsistency between the spatial layers does not include new Leadbeater's Possum colonies identified and designated for protection between 2016 and 2018. VicForests reassessed the potential impact of LBP detections (including anticipated future detections) after the strategic wood supply modelling for the RO 2017 was conducted; and the RO 2017 and its Operable Inventory was adjusted to incorporate the forecast future impact of LBP colony detections. Therefore, the anticipated impacts of future LBP detections was incorporated in the RO 2017; and are included in the project baseline.

However, DELWP Biodiversity Division (Bio. Div.) has identified approx. 5,500 ha of area that was formerly net harvestable and is now in an SPZ. This represents ~1% of the total Net Harvestable Area layer (approx. 460,000 ha). DELWP Bio. Div. has discounted the benefit of excluding timber harvesting from these overlap areas, as it has used the most current interpretation of the protected area network.

Both DELWP Bio. Div. and VicForests have assessed the potential impact of this level of inconsistency between the baselines and both have concluded it would have a relatively minor impact in the context of the analysis overall – and notably, minimal if not negligible impact in the

[20] '*Modex*' is an abbreviation of 'modelled exclusions' attributable to the Code of Practice for Timber Production and any other regulatory instruments that exclude timber harvesting from State forest areas.

Ash forests. Therefore, it was resolved that this level of inconsistency would not have a significant impact on the overall RIS findings.

Assessing the biodiversity benefits of changes to VicForests' Net Harvestable Area

DELWP Biodiversity Division (Bio. Div.) considered VicForests' Net Harvestable Area as those areas of State forest in which timber production is likely to occur over time, e.g. in harvest cycles of indicatively 80-120+ years, with impacts on biodiversity values over that period.

VicForests' Net Harvestable Area 2015 was provided by VicForests and then adjusted by Bio. Div. to incorporate new SPZs since 2015 i.e. VicForests' Net Harvestable Area was clipped where it overlaps with already protected areas to ensure biodiversity benefits are not counted on areas already protected. These areas were then added to the biodiversity values 'baseline'.

Bio.Div. notes that the level of protection in parks and reserves is different from areas of GMZ not available in VicForests' Net Harvestable Area (i.e. 'ModEx'); and there are implications for the analysis and biodiversity benefit if there were changes to VicForests' Net Harvestable Area that would lead to these areas subsequently being harvested.

In this context, it should be noted that the while the modelled exclusions based on harvesting prescriptions set out in the Code, such as streamside reserves and steep areas, occupy a substantial area overall, their arrangement is ad hoc and likely to be inferior in terms of biodiversity benefit due to a) their fragmentation/high edge to area ratio and b) their non-strategic placement.

Furthermore, DELWP's Bio. Div. baseline reflects assumptions about the intensity of timber production within VicForests' Net Harvestable Area, based on its RO 2017 and associated communications to Government and other stakeholders on the predominant systems for harvest and regeneration over time. For example, DELWP's Bio. Div. baseline position for reviewing the impact of timber production on biodiversity values within most areas of the Central Highlands during 2016-17, would reflect an assumption of VicForests using a clear-felling and seed tree-based harvest and regeneration system. If a Code variation, or a VicForests' policy directive, were to change the prescription for harvesting to a variable retention harvesting system, in which indicatively 40% or more of the pre-harvest basal area is to be retained, then this would represent a substantial change relative to the Resource baseline.

Bio. Div. has noted the key metric for assessing biodiversity benefits, Change in Suitable Habitat, is assessed over a modelling time frame of 50 years. Like the approach for wood supply, it is proposed that Bio. Div. will continue to analyse options against its baseline with this time frame (i.e. 50 years); recognising that the RIS economic analysis of benefits and costs associated with variations to the Code will be based on a shorter period, i.e. 10 years.

Modelling impacts

Building upon the baseline positions, modelling was conducted to assess the impacts on wood supply and biodiversity values. An outline of the approaches used to model these two sets of impacts is set out below. Further information is incorporated in the descriptions for subsequent sections.

Modelling of wood supply impacts

VicForests was engaged by DELWP to conduct the analysis of impacts on wood supply. Indufor and NCE were engaged to conduct an independent review of the VicForests impact results and findings.

In broad terms, the approach taken to modelling impacts of the various options for Code variations incorporated the following process:

1. Establish the baseline based on RO 2017 modelling: VicForests compiled the baseline with two key components:

    a. Delineation of the 'Net Harvestable Area' for wood supply over time: The Net Harvestable Area represents the areas in which VicForests can operate, in accordance with its Allocation Order and the Code, and is considered by VicForests to be suitable for timber production over time, i.e. 100+ years. VicForests provided this spatial layer on 5 February 2019.

    Note VicForests' Net Harvestable Area file (also known as Net Harvest Area) was created in December 2015 and it used the FMZ100 layer that was current in November of that year (2015). VicForests conducted extensive wood supply modelling through 2016, which culminated in RO 2017. Therefore, the VicForests Net Harvestable Area does not include subsequent additions of SPZs (2016-2018) or the Kuark Protection Area (2018) in East Gippsland.

    b. Extraction of the 'Operable Inventory' volume for 2019 to 2030: For the RIS analysis, the Operable Inventory represents the total merchantable volume of D+ sawlogs available in each FMA from 2019 to 2030. VicForests provided DELWP with this data on 13 February 2019.

2. Establish annualised wood flows from 2020 to 2030: VicForests assumed the annual harvesting volume (wood flow) will be an even spread of the Operable Inventory over this period.

    It is important to note VicForests reassessed the potential impact of LBP detections (including anticipated future detections) after the strategic wood supply modelling for the RO 2017 was conducted. However, the RO 2017 and its Operable Inventory was adjusted to incorporate the forecast future impact of LBP colony detections. Therefore, the anticipated impacts of future LBP detections were incorporated in the RO 2017; and are included in the project baseline.

3. Determine area impact of Code variation options: VicForests determined the area impact of the options for Code variations, based on spatial overlays where possible for the respective options with VicForests' Net Harvestable Area, as defined and applicable to the RO 2017; noting that some options are not fully represented spatially, e.g. options relating to protecting Large Trees.

4. Calculate indicative Operable Inventory impacts by FMA: VicForests used D+ yield tables based on average yields, as determined in RO 2017, for each FMA, to determine an indicative estimate of the Operable Inventory that would need to be excluded from harvesting (in full or in part), in each FMA.

5. Calculate indicative Operable Inventory impacts for two broad forest types: VicForests used the indicative estimate of the Operable Inventory that would need to be excluded from harvesting (in full or in part), in each FMA, to determine an Operable Inventory impact for Ash D+ and Mixed species D+, in percentage terms.

6. Apply proportional impact by forest type to annualised wood flows: VicForests used the Operable Inventory impact for Ash D+ and Mixed species D+, in percentage terms, to determine the average annual impact of each option on total wood flows on D+ sawlogs from Ash and Mixed species.

7. Calculate indicative impacts on total log production using D+ ratios: VicForests used the average annual impact on Ash and Mixed species D+ sawlogs to estimate the indicative impact on E grade logs and pulp wood logs.

8. Use recent average log value to calculate the indicative impacts on annual stumpage forgone: VicForests extracted its enterprise data on total recent sales (volumes and revenue), to determine average log values for Ash and Mixed species forest products, across three main log grades (D+, E and pulp wood). These log values comprise stumpage (i.e. the value at the stump) and delivery

charges (comprising harvest and haulage cost charges). The stumpage component of this log value was then applied to the shortfall in forecast log supply to estimate the annual stumpage value for product forgone.

9. Note VicForests' estimate of annual stumpage value for product forgone does not include the costs to industry associated with downstream economic activity, including but not limited to:
    a. Harvesting and haulage costs, which comprise 'delivery' costs.
    b. Downstream processing and value adding of these log products.

Modelling of biodiversity value impacts

DELWP Bio. Div. was requested by DELWP Forest Regulation Unit to conduct the analysis of impacts on biodiversity values; and Indufor and NCE were engaged to conduct an independent review of the impact results and findings.

Modelling application used to assess impacts

Bio. Div. assessed the impacts on biodiversity values using a derivative of DELWP's Strategic Management Prospects (SMP) tool. SMP is a decision-support tool which integrates spatial information on biodiversity values, threats, management actions and indicative benefits and costs across Victoria. The SMP inputs used in this analysis include:

- Habitat Distribution Models (HDMs) - for forest dependent threatened species as described by VEAC (2017). These models indicate the likely locations of habitat for a species using known presence and absence data and relate this to known environmental variables such as soil type, rainfall and topography. These models are 'thresholded' but continuous, i.e. continuous values above the threshold, and zero below threshold.
- Threat models – specifically the model of the threat of native forest harvesting is relevant to this analysis. This is a binary model (i.e. the threat either occurs or it does not occur) and the threat is applied to areas that will potentially be subjected to forest harvesting within State Forest (e.g. merchantable timbers types). Harvesting is excluded as a threat from areas protected by the code of practice and formal conservation reserves.
- Expert elicited response models - for forest dependent threatened species and specific management actions (e.g. stopping harvesting or variable retention harvesting).

Quantifying Biodiversity benefit – Suitable Habitat and Change in Suitable Habitat metrics

Change in Suitable Habitat is a purpose-built, scientific measure developed by DELWP in 2016 to assess the most effective options for improving the future of native species across the state under climate change.

Change in Suitable Habitat considers the type, extent and configuration of habitat for a species, and the factors that influence how much a species can make use of this habitat. Change in Suitable Habitat is the increase in likelihood that a species will still exist at a location at a future time (50 years) in response to sustained management of relevant threats. It is expressed as the percentage increase in likelihood when comparing sustained management to no management.

Suitable Habitat is a three-dimensional (3D) species-specific measure of the amount of habitat that is suitable to be occupied by that species. In this context:

Suitable Habitat effectively equals relative suitability X area

Relative suitability is based on environmental type/location and presence of key habitat features – this is represented as an SH habitat value per pixel and informed by the HDM for a species. An absolute

measure of suitability would require detailed data on health/reproductive success/mortality in populations and on detailed habitat features – this data is not presently available to inform this analysis. SH is currently based on the relative ranking of areas using habitat surrogates.

Change in Suitable Habitat is the increase (e.g. an uplift) in SH above a business as usual (do nothing) scenario over a 50-year period. Change in Suitable Habitat is the incremental change and typically less than the existing Suitable Habitat base e.g. improved management of 1,000 GG Suitable Habitat hectares might yield 100 GG CSH in future. The actual net amount of CSH for a species will vary depending on the initial suitability of the habitat, the management change, and the area over which this applies. Multiple species that benefit from the management at a location will produce an additive CSH result.

Development of CSH values – expert elicitation process:

Response models for forest dependent threatened species were developed by Bio. Div. through a process of expert elicitation where experts on species biology and ecology were asked a series of structured questions about the effectiveness of a management action in certain situations and for different species (scenarios). Each scenario included the species name, a map identifying the location for the species, and some contextual information about the habitat for that location. Experts were asked to imagine the consequences of not acting at a location – how likely is the species to persist at the location for 50 years with no management? Response were obtained by asking experts how many out of 10 identical patches the species were likely to still be present at after 50 years, giving high and low estimates to capture uncertainty. Experts were then asked the same question, but this time considering 50 years of managing the threat at that location.

Spatial analysis and modelling steps

In broad terms, the approach taken to modelling impacts of the various options for Code variations incorporated the following process:

1. Establish the baseline for assessing biodiversity benefits:

In consultation with DELWP's Forest Regulation Unit, and with a view to aligning consistently with the wood flow modelling, DELWP Bio. Div. has assumed the baseline biodiversity value to be the Suitable Habitat in 50 years provided by the protected area network (i.e. formal and informal reserves and areas where timber harvesting is excluded), and any residual SH in areas subject to timber harvesting.

The baseline extent of this protected area network is described in the following datasets from the DELWP corporate library or supplied by VicForests:

a. Parks Res
b. PLM25 Overlay
c. FMZ100 (i.e. SPZs at the time of August 2018)
d. Modelled Code Exclusions.
e. Areas of Pre-1900 Ash forest as advised by VicForests and identified in their VicForests Net Harvestable Area layer
f. Any areas of VicForests' Net Harvestable Area layer that overlap with SPZs created in the period 2015 – 2018 (the most substantial of these being the Kuark Protection Area).

As noted above, the residual habitat (SH values) in the VicForests Net Harvestable Area layer was considered part of the baseline.

FMAs were decided upon as the geographic frame of reference (scale) for assessing change against this baseline. It is important to note that using this frame of reference for assessing benefits has implications for the % uplift for different options when compared to the net amount of SH in the rest

of the FMA. In this project, suitable habitat was assessed using two separate R scripts; both derivatives of the Strategic Management Prospects tool:

   a. Greater Gliders – based on Bio. Div.'s 2018 analysis (not published), incorporating habitat distribution models (HDMs) and expert elicitation; while excluding the impacts of bushfire on biodiversity benefits to align with VicForests' approach and assumptions for wood flow modelling.
   b. VEAC Species Excluding Greater Glider – forest dependent fauna as defined by VEAC 2017 in its assessment of conservation values for State forests; representing the forest dependent species and HDMs prepared for these groupings of species. The Greater Glider was removed from this analysis to ensure that the results could be additional to the Greater Glider exclusive analysis.

2. Prepare GIS Shapefiles (polygons) that represent each area for analysis. Each code variation option was clipped to the extent of VicForests' Net Harvestable Area layer to ensure that only the impact of removing harvesting in these areas was assessed and not a total benefit of the whole extent if there were areas that were already protected. Outputs for the area of the option that overlap with the protected area and ModEx were reported for completeness for all options. This included:

   a. Baseline SH and CSH:
      i. Parks_Res_SPZ_PLM25_overlay
      ii. ModEx – split by FMA
      iii. VFNHA was also analysed by FMA to assess the CSH and SH benefits of removing the threat of timber harvesting across the State to inform subsequent analysis.
   b. Large Brown Tree Frog: buffered points of known Large Brown Tree Frog records were produced using a 300 m radius buffer – approx. 25 sites in total, all of which are in East Gippsland.
   c. Large Tree (no buffer): analysis comprises narrative only, as there was insufficient spatial precision to the modelling of where Large Trees exist in the landscape (beyond those specifically identified and registered), and therefore the location of prescribed buffers to be applied, for Bio. Div. to provide a credible quantitative assessment.
   d. Large Tree (with buffer): The 'efficiency' factor for 'stop harvest' in VFNHA – MOG2009 was used to estimate the approximate benefit in CSH per/ha reserved as a proxy for large trees. The rationale for this was that large trees may be more likely to occur in areas of old growth forest. The efficiency factor is derived for each FMA by dividing CSH stop harvest VFNHA/area. This efficiency factor was then multiplied by the GMZ area impacted consistent with the wood flow modelling. It was not possible to provide estimates of the area of large trees in Parks/Res and Mod Ex.

3. Interpretation of outputs:

   a. Baseline: SH and CSH values were reported for the protected area network (i.e. Parks_Res, SPZ_PLM25_overlay and ModEx); by FMA. CSH figures reported here are a result of recent SPZs where the original modelled threat was assumed to occur and now does not giving zoning changes or more detailed information from VicForests regarding ModEx. Additionally, residual SH values within VicForests' Net Harvestable Area layer were reported and considered in the baseline.
   b. Large Brown Tree Frog: 'Stop Harvest' SH and CSH values reported for East Gippsland FMA only
   c. Large Tree (no buffer): not applicable, as only assessed in qualitative terms; no quantitative assessment of the impact on biodiversity values or CSH.

d. Large Tree (with buffer): CSH estimates provided (i.e. Change in SH from 'Stop Harvest', but it was not possible to provide this in the context of the current SH in the 'landscape' as the area of large trees in Parks/Res and Mod Ex is not available.

4. Determination of the basis for a change ('uplift') in suitable habitat: With the baseline defined above, DELWP determined the basis for assessing changes arising from policy options as the percentage of progress towards maximum protection across eastern Forest Management Areas (FMAs) (i.e. the option's contribution to CSH as a percentage of the CSH that would result from immediately stopping harvesting in all eastern FMAs.

Further to this outline of approaches used to model impacts on wood supply and biodiversity values; more detailed descriptions of the analysis conducted for each of the proposed policy options follow.

1. Large Brown Tree Frog

Title:	Protection of Large Brown Tree Frog habitat
Status:	**Proposed amendment based on Action Statement no. 255 (published 2014)**
Prescription:	*Detection based prescription (per the Action Statement)*: If a Large Brown Tree Frog is detected in State Forest, establish a 28-ha protected area by creating a SPZ that includes the detection site. As far as possible, the SPZ boundaries should follow recognizable landscape features such as ridges, spurs, watercourses or roads but must not be less than 300 m wide at any point. The new SPZ may include areas of pre-existing SMZ, SPZ or areas otherwise unavailable for harvesting. The new SPZ may be smaller than 28 ha where a detection is adjacent to an existing park or reserve and the total 28 ha protected area is comprised of both SPZ and park and reserve.
Rationale:	This is the State-wide prescription that is currently in the Action Statement. This detection-based prescription is designed to afford interim protection to potential sites of conservation significance while further research is being carried out. 28 ha is approx. equal to the area of a circle with a radius of 300 m; a distance estimated as an average terrestrial buffer from breeding sites adequate to protect a range of amphibian species.
Analysis - wood supply impacts:	*Analysis based on buffering of existing detection sites*: 1. Bio. Div. provided a spatial layer comprising detection sites (point data) for the past 10 years, with a 300 m radius buffer – approx. 25 sites in total, all of which are in East Gippsland 2. VicForests calculated the intersect of the Large Brown Tree Frog buffers with its Net Harvestable Area – and found this to be relatively small (~79 ha in East Gippsland) compared to other RIS options. *In relation to potential future detections - given the area of the intersect was found to be relatively small compared to other options; the number of detections has been relatively small to date; and the Large Brown Tree Frog Action Statement is already in place; VicForests considered this option did not warrant detailed estimates or modelling of future detections and impacts.* *If the number of detections in the Net Harvestable Area were to double in the next 10 years, VicForests considers the impact would still be relatively modest and manageable.*

	3. VicForests multiplied the net area impacts by average yields (m^3/ha) for respective forest types (Ash and Mixed species) and FMAs; and reduced its Operable Inventory by the total volume foregone for that FMA. 4. VicForests then estimated impacts on total wood supply levels and stumpage value foregone, using its financial impact analysis.
Analysis – biodiversity benefits:	*Based on the wood supply impacts outlined above*: 1. Bio. Div. created a spatial layer comprising detection sites (point data) for the past 10 years, with a 300 m radius buffer – approx. 25 sites in total, all of which are in East Gippsland. *In relation to potential future detections – like VicForests, Bio. Div. adopted the position that given the number of detections has been relatively small to date; and the Large Brown Tree Frog Action Statement is already in place; this option did not warrant detailed estimates or modelling of future detections and impacts. However, Bio. Div. did observe – in qualitative terms - that there would likely be a greater rate of detection in the next 10 years and a bias towards detection in the GMZ due to the FPSP* 2. Bio. Div. overlaid these LTBF buffers for existing detection sites on VicForests' Net Harvestable Areas within GMZ and calculated the area of impact. 3. Bio. Div. then estimated biodiversity benefits including the Change in Suitable Habitat (CSH) and the specific zoning for LTBF, i.e. to exclude timber harvesting from the buffer area.
Datasets:	• Bio. Div. detection site data • Bio. Div. VBA records incorporating Large Brown Tree Frog detections • VicForests' Net Harvestable Area spatial layer

Limitations:	• VicForests' analysis of wood supply impacts was limited to quantifying the impacts of applying buffers to recorded detection sites only; no modelling of future detections.
	• The constraints on modelling include, as advised by Bio. Div.:
	  ○ There is no spatial distribution available for SMP analysis.
	  ○ Large Brown Tree Frog has low frequency detection in common habitat. This means it is not reasonable to use habitat distribution directly to model occurrence.
	• Therefore, CSH data is available only for existing detection sites, where changes in silvicultural management is applied.

2. Large Tree (no buffer)

Title:	Protection of all large trees
Status:	**Preferred option under this theme**
Prescription:	*Field assessment-based prescription*: In all coupes where timber harvesting is conducted, VicForests must make all reasonable endeavours to *protect* large trees (living trees with diameters >=2.5m DBHOB) *from the direct impacts of timber harvesting and regeneration burning*. Where practicable, large trees are to be incorporated into retained patches or within expanded exclusion areas.
Rationale:	Aligned with State-wide protection measure announced by the Minister in March 2018; with implementation initially through agreement with VicForests prior to formalisation in the regulatory framework.
Analysis - wood supply impacts:	*Analysis based on modelling of potential areas and use of frequency factors for no. of trees in those areas, with non-spatial estimates of the impact of buffers and connectivity to existing reserves:* 1. VicForests reviewed Indufor's previous work for DELWP in 2016 – a report titled *Protection of large and giant trees in Victoria's State forests* (2016), which provided mapping of potential areas and estimates of the numbers of large trees, by region (e.g. Central Highlands and East Gippsland). 2. VicForests tested Indufor's 2016 estimates with updated VicForests Large Trees Register (at Jan 2019): looking at: (i) the spatial distribution of potential areas, and (ii) the frequency factor of trees. 3. Based on the number of trees that VicForests has already identified in Ash and Mixed species forests, VicForests concluded the total number of large trees in Ash forests in GMZ (including those not yet identified) was likely to be at the *upper end* of the range set out in Indufor's 2016 report. This led VicForests to settle on an estimate of 280 large trees in Ash forests within GMZ. This estimate is broadly aligned with Indufor's 2016 estimate of the total number of large trees in GMZ across the State using a frequency factor of 1 large tree for every 60 ha of potential areas; but in this case attributed to Ash forests only. 4. In contrast, VicForests concluded the total number of large trees in Mixed species in GMZ would be at the *lower end* of the range set out in Indufor's 2016 report. This led VicForests to settle on an estimate of 105 large trees in Mixed species forests within GMZ. This estimate is broadly aligned with Indufor's 2016 estimate of the total number of large trees in GMZ across the state using a frequency factor of 1 large tree for every 80 ha of potential areas – but in this case attributed to Mixed species forests only. *5.* A further issue to address was the allocation of the estimates to FMAs, for Ash and Mixed species forests respectively – as Indufor's 2016 report did not provide FMA splits of estimates by forest type. VicForests estimated the splits by FMA, based on its knowledge of the forest resource, and with reference to the distribution of known large trees on its own register. 6. VicForests then used Indufor's 2016 approach to determine the net adjusted buffer to apply to the estimated number of trees. This approach took account of the gross buffer (approx. 3 ha per tree); noting Indufo's 2016 conclusion that *connective protection is unlikely to significantly increase the area of GMZ impacts beyond a 100m buffer option. Therefore, Indufor modelled the*

	impacts on future timber supply and economic activity on the same basis as a 100m buffer, with additional analysis to recognise scope for overlap with existing reserves. After the gross buffer, a reduction factor for the estimated overlap with existing reserves (-25%) is then applied; ahead of another reduction factor the estimated proportion of unsuitable/non-commercial areas (-30%); and then an inflation adjustment to account for the 'operational multiplier effect' (+300%) of limiting access and optimal harvesting configurations etc. The overall result of these adjustments equates to a net buffer impact of approx. 5 ha per tree, compared to the initial 3 ha per tree. *7.* VicForests then multiplied the net area impacts by average yields (m^3/ha) for respective forest types (Ash and Mixed species) and FMAs; and reduced its Operable Inventory by the total volume foregone for that FMA VicForests then estimated impacts on total wood supply levels and stumpage value foregone, using its financial impact analysis model.
Analysis – biodiversity benefits:	1. VicForests advised the aggregate impact of this option on its areas of timber production at FMA level would be minimal. 2. Bio. Div. reviewed its elicitation of biodiversity/ecological benefits from conserving large trees, without buffers. 3. Bio. Div. advised that CSH data (the benefit) can only be generated if a spatial layer showing the areas to be excluded from timber production is available. The alternative was to provide a qualitative description of biodiversity benefit; which can be ascribed to the estimated areas provided by VicForests. Bio. Div. has provided this guidance as a qualitative narrative.
Datasets:	• DELWP 2016 report on protection measures for large trees (2016) and spatial data on mapping of potential areas • VicForests' Large Tree Register (updated 2018)
Limitations	• The analysis of this option has been limited by project time and resources to a qualitative assessment of the impacts on both wood supply and biodiversity benefits. • These qualitative assessments are based on relevant analyses, e.g. the DLWP 2016 report and Bio. Div.'s research on the ecological benefits of conserving large old trees. These analyses carry their own limitations, which are in effect embedded in the qualitative assessments presented by VicForests and Bio. Div.

3. Large Tree (with buffer)

Title:	Protection of all large trees, with 20 metre buffer and connectivity to nearest timber harvesting exclusion areas
Status:	Alternative option (refer Large Tree (no buffer) for preferred option)
Prescription:	*Field assessment-based prescription*: In all coupes where timber harvesting is conducted, VicForests must make all reasonable endeavours to protect large trees (living trees with diameters >=2.5m DBHOB) from the direct impacts of timber harvesting and regeneration burning, using 20m buffers and establishing connectivity to existing reserves comprising formal and informal reserves.
Rationale:	Builds upon and extends the State-wide protection measure announced by the Minister in March 2018; with implementation initially through agreement with VicForests. Note the voluntary protection measure relates to protecting trees only, not buffers or connectivity; although it does state that where practicable, large trees are to be incorporated into retained patches or within expanded exclusion areas.
Analysis - wood supply impacts:	*Analysis based on modelling of potential areas and use of frequency factors for no. of trees in those areas, with non-spatial estimates of the impact of buffers and connectivity to existing reserves*: 1. Review Indufor work from 2016 - mapping of potential areas and estimation of number of large trees, by FMZ 2. Test with updated VicForests Large Trees Register (at Jan 2019): looking at: (i) the spatial distribution of potential areas, and (ii) the frequency factor of trees. *Note: VicForests concluded the spatial distribution of potential areas was reasonable to use for this project, given the 2016 analysis and time limitations of further assessments.* In relation to the frequency factor, VicForests: • maintained Indufor frequency factor for Ash, i.e. 1 Large Tree for every 60 ha of potential areas within Ash forests, and • adjusted it for Mixed Species, i.e. 1 Large Tree for every 160 ha of potential areas in Mixed Species forests. 3. VicForests used Indufor's analysis of tree numbers and area impacts, with adjustments outlined above, to determine estimates of impact on Net Harvestable Area. In relation to modelling the buffers and connectivity, note the assumptions in Indufor's report for DELWP in 2016: [Re: spatial overlays] *Indufor concluded that connective protection is unlikely to significantly increase the area of GMZ impacts beyond a 100m buffer option. Therefore, Indufor modelled the impacts on future timber supply and economic activity on the same basis as a 100m buffer, with additional analysis to recognise scope for overlap with existing reserves.* 4. VicForests multiplied the net area impacts by average yields (m^3/ha) for respective forest types (Ash and Mixed species) and FMAs; and reduced its Operable Inventory by the total volume foregone for that FMA. *5.* VicForests then estimated impacts on total wood supply levels and stumpage value foregone, using its financial impact analysis model.

Analysis – biodiversity benefits:	1. Indufor summarised VicForests' Large Tree (with buffer) analysis of the Net Harvestable Area that would be impacted by Large Tree (with buffer), by FMA, in a tabular format. 2. Indufor provided this tabular data to Bio. Div., to make estimates of the biodiversity benefit arising, from exclusion of timber production from the Large Tree (with buffer) buffers and connectivity. 3. Large Tree (with buffer): The 'efficiency' factor for 'stop harvest' in VFNHA – MOG2009 was used to estimate the approximate benefit in CSH per/ha reserved as a proxy for large trees. The rationale for this was that large trees may be more likely to occur in areas of old growth forest. The efficiency factor is derived for each FMA by dividing CSH stop harvest VFNHA/area. This efficiency factor was then multiplied by the GMZ area impacted consistent with the wood flow modelling. It was not possible to provide estimates of the area of large trees in Parks/Res and Mod Ex.
Datasets:	• DELWP 2016 report on large trees protection • VicForests' Large Tree Register (updated 2018)
Limitations:	• Indufor (2016) definition of large trees does not align exactly with state-wide protection measure (varying diameter thresholds by species) • Also, Indufor's (2016) mapping of potential areas was based on a range of available datasets of variable extents and quality, e.g. no LiDAR available in Tambo or East Gippsland FMAs • The DELWP 2016 report incorporated analysis of buffers and connectivity, but important to note the impacts were based on modelled data of potential areas • Note the level of alignment with VicForests' Large Trees Register provides some assurance the potential areas mapped in 2016 would encompass most large trees within State Forests

APPENDIX B: METHODOLOGY AND ASSUMPTIONS

Overview of methodology

Cost-effectiveness analysis is the primary approach used to assess the impact of variations to the Code. The general procedure for undertaking CEA is shown in Figure 8. The CEA approach will be consistent with the Victorian Department of Treasury and Finance (2014) framework for project assessment and the requirements of the Office of the Commissioner for Better Regulation (OCBR

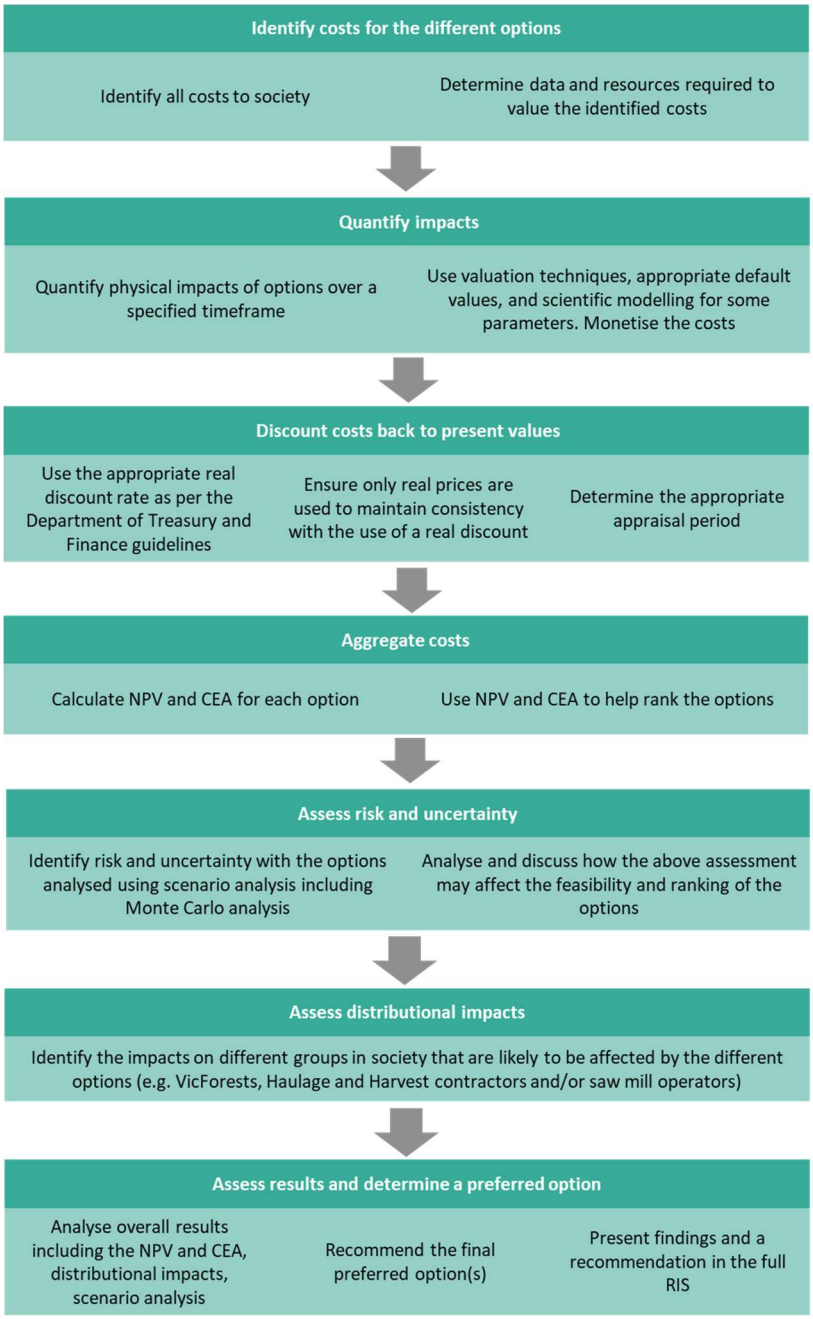


Figure 8: Procedure used for undertaking cost-effectiveness analysis

The following sections describe the methodology and data used to quantify the forestry sector impacts. Only those impacts that are considered to be direct (first-round) and material have been included quantitatively.

The impacts that were identified and incorporated are those that will be experienced by:

- The State, including VicForests and the costs associated with meeting obligations with the pulpmill operator (Australian Paper).
- Harvest and haulage operators.
- Sawmill operators.

The impacted party, impact element, approach and valuation components that have been estimated are presented in Table 17. The assessment incorporates the net costs to each of the key parties impacted by the change to the Code.

Table 17. Cost components included in the assessment, valuation approach and key components

Impacted party	Impact element	Approach	Key valuation components
The State Government	Financial cost	Change in producer surplus[21]	Δ volume of resource harvested (m^3)
			Δ revenue ($/m^3$)
			Δ variable costs ($/m^3$)
			Δ margin ($)
The State Government	Financial cost	Cost to the Victorian Government of meeting supply obligations with Australian Paper.	Δ volume of resource supplied from outside the forest area (m^3)
			Δ in cost of supplying resource from outside the forest area ($/m^3$)
Harvest and haulage operators	Financial cost	Change in producer surplus	Δ volume of resource harvested (m^3)
			Δ revenue ($/m^3$)
			Δ variable costs ($/m^3$)
			Δ margin ($)
Sawmill operators	Financial cost	Change in producer surplus	Δ volume of resource harvested (m^3)
			Δ revenue ($/m^3$)
			Δ variable costs ($/m^3$)
			Δ margin ($)

[21] Producer surplus is equivalent to profit and is calculated by estimating the amount that a producer benefits by selling at a price that is higher than the lowest price they would be willing to sell for. This is approximately equivalent to a producer's (e.g. VicForests, harvest and haulage operator) profit.

In estimating the impacts of the different changes to the Code, there were some options that resulted in impacts of less than one per cent. Where the impacts where less than one per cent, it was assumed that there would be no changes to the costs incurred in. the management and harvesting of the remaining wood supply.

Other impacts

The following impacts have been considered qualitatively within the RIS:

- Commercial firewood operators that are licensed to collect firewood from State forest areas: While these operators may be affected, project discussions with VicForests suggests that the impact is not likely to be material. Confirmation of this view has not been confirmed via consultation with firewood operators.
- DELWP, as the agency responsible for the implementation of the Code: These impacts will take the form of increased administrative costs associated with making the changes to the Code; pre-harvest survey costs; and monitoring and compliance costs. It has been assumed that these additional costs can be absorbed within the workload of current staff and do not require the employment of additional resources.
- Impact on consumers: It is assumed the impact on consumers will be negligible and that State demand can be met by non-native forest and / or interstate supply owing to the existence of a national timber market.

Impacts to the State Government

Impacts to VicForests

The impacts for VicForests that have been identified comprise the following, with the data source provided in parentheses:

- Reduction in harvest area (VicForests estimate)
- Reduction in revenue from sales (VicForests estimates)
- Change in variable costs associated with on-going harvesting activities (VicForests estimate). Variable costs include pre-harvest activities (such as re-estimating the long term resource model, forest protection survey activities, marking out coupes with buffers / exclusion, post-survey planning, and harvest monitoring and compliance), post-harvest activities (such as post-harvesting monitoring and reporting and regeneration activities),
- Change in margin (NCE estimate).

The methodology used for estimating these impacts involved the following:

- Reduction in revenue = (BAU harvest volume – Option harvest volume) * stumpage value ($/m^3)
- Change in variable costs = (Option residual harvest volume * Option additional variable costs).

Impacts related to the pulp log shortfall

Approximately one-third of Australian Paper's (AP's) wood fibre is supplied by VicForests from native forests. under two long-term agreements. These are:

1. the Forests Wood Pulp Agreement, otherwise referred to as the Legislated Agreement (LA), ratified by the *Forests (Wood Pulp Agreement) Act 1996* (FWPA Act), and
2. a commercial supply agreement between VicForests and AP (Timber Supply Agreement/TSA).

AP also sources pulpwood from other suppliers. Significant supplies of pine and eucalypt pulp log are sourced from Hancock Victoria Plantations, and local hardwood sawmills supply a substantial quantity of recovered wood chip fibre. The supply from local sawmills accounts for indicatively eight per cent of AP's total fibre intake (VicForests, pers. comm.), and hence, any significant reduction in sawlog volumes would have a further impact on the supply to AP. Current AP supply volumes have informed this analysis but are not detailed due to commercial in confidence considerations. Under the base case (i.e. current VicForest operations), there is a shortfall in supply under existing arrangements, that will be met into the future from harvesting thinnings operations.

The impacts from pulpwood shortfalls were estimated based on two key assumptions which were developed in consultation with the Department of Environment, Land, Planning and Water (DELWP) and the Department of Jobs, Precincts and Regions (DJPR). Where the option results in a shortfall in pulpwood supply relative to the RO 2017, the shortfall is assumed to be met by a combination of supply, as follows:

- 50 per cent from Silvertop thinnings; and
- 50 per cent from plantation resources (i.e. from western Victoria).

Both approaches would lead to extra costs to the State government through for example increased harvest and haulage costs. In addition, sourcing pulpwood from outside the forest area, would result in the State government incurring lost revenue.

The cost impacts comprise the following, with the data source provided in parentheses:

- Reduction in pulpwood (VicForests estimate)
- Costs of purchasing and delivering pulpwood from an alternative supply (NCE estimate informed by DJPR).

The methodology used for estimating each of these impacts involved the following:

- Reduction in pulpwood = BAU pulpwood volume – option pulpwood volume
- Change in costs = Pulpwood deficit volume * (cost of sourcing and delivering from alternative supply – minus native forest pulpwood delivered cost to AP).

The estimated costs derived from this approach should be considered indicative because the actual costs will be highly influenced by the location and method of harvesting operations through the period up to 2030. For this reason, they are reported separately to other costs to the State, for which there is more certainty.

Impacts on harvest and haulage operators

The wood supply modelling underpinning the estimation of impacts to harvest and haulage operators assumes that existing contract volumes will be met. However, future contracts that would be negotiated during the assessment period are assumed to be issued for smaller aggregate volumes, which is likely to result in reduced revenue and higher operating costs on a cubic metre basis, as some fixed costs cannot be avoided.

The impacts for harvest and haulage operators that have been identified comprise the following, with the data source provided in parentheses:

- Reduction in harvest area (VicForests estimate)
- Reduction in revenue from sales (VicForests estimates)
- Change in variable costs associated with on-going harvesting activities under each option (VicForests estimate). This change is assumed to be 'passed through' to VicForests and therefore not included as an impact to harvest and haulage operators.
- Change in margin (NCE estimate).

The methodology used for estimating these impacts involved the following:

- Reduction in revenue = (BAU harvest volume – Option harvest volume) * (Delivery cost – BAU variable costs ($/m^3)).

Discussions with VicForests' representatives (20/03/19) suggested that while the majority of impacts would be experienced by harvest contractors, these costs would be largely passed on via contract prices. Furthermore, haulage contractors are considered to have greater flexibility to respond to changes in the volume and location of wood supply, and are more likely to be able to gain revenue from operating in other industries. This includes options such as using prime movers across the broader freight transport tasks, rather than being idle.

Impacts on sawmill operators

VicForests currently has contracts to supply D+ and E sawlogs, most of which run until the end of 2019-20. The wood supply modelling underpinning the estimation of impacts to sawmills assumes that these existing contract volumes will be met. However, future contracts that would be negotiated during the assessment period are assumed to be issued for smaller aggregate volumes, which is likely to result in reduced revenue and higher operating costs on a cubic meter basis, as some fixed costs cannot be avoided.

The impacts for sawmill operators that have been identified and estimated comprise the following, with the data source provided in parentheses:

- Reduction in sawlog supply for future contracts (VicForests estimate)
- Reduction in revenue from sales (NCE estimate)
- Change in margin for reduced volume (NCE estimate).

The methodology used for estimating these impacts involved the following:

- Reduction in revenue = (BAU sawlog volume – Option sawlog volume) * BAU margin ($/m^3)

Inputs

Table 18 contains common inputs to the assessment of the options. All values are in real 2019 dollars. Data limitations has resulted in the inputs being based on either actual industry data; assumptions based on consultation with industry representatives; or derived from a combination of consultation / data sources. CiC denotes information that is redacted due to commercial-in-confidence requirements between VicForests and other parties.

Table 18. Inputs to the cost-effectiveness analysis

Input / parameter	Unit	Estimated value – Most likely	Estimated value - Low	Estimated value - High	Basis (Actual / assumption / Derived)	Source
Common to all options						
Assessment period	Years	11	-	-	Assumption (includes year 2020 but physical impacts were adjusted to meet the forecasted wood supply for that year)	OCBR guidance is typically 10 years, but this was increased to 11 years so that 2030 (the year that a number of key wood supply contracts expire) was included in the analysis.
Assessment start year	Year	2019-20	-	-	Assumption	
Assessment end year	Year	2029-30	-	-	Assumption	
Discount rate	%	4			Assumption	As per DTF guidance
Baseline VicForests variable cost	$/m^3	CiC	CiC	CiC	Derived (for most likely value) and Assumed +/- 5% for low and high values	Based on consultation with VicForests
Baseline harvest and haulage operator variable cost	$/m^3	CiC	CiC	CiC	Derived (for most likely value) and Assumed +/- 5% for low and high values	Based on consultation with VicForests

Input / parameter	Unit	Estimated value – Most likely	Estimated value - Low	Estimated value - High	Basis (Actual / assumption / Derived)	Source
Baseline sawmill average production	m^3	CiC	CiC	CiC	Assumption, based on industry total production and number of operators.	Based on ABARES (1999) and consultation with VicForests
Baseline sawmill margin	%	CiC	CiC	CiC	Assumption	Based on consultation with VicForests
Sawmill timber price	$/$m^3$	CiC	CiC	CiC	Assumption	Assumption based on ABARES (1999) and an NCE assumption about the variability (+/- 20%) to reflect uncertainty
Cost of securing additional pulpwood from Silvertop thinnings	$/$m^3$	CiC	CiC	CiC	Derived, based on 2011 estimate and updated to reflect inflation.	VF and DELWP (pers. comm.)
Cost of securing additional pulpwood from plantation resources	$/$m^3$	CiC	CiC	CiC	Derived, based on the price of pulpwood and additional harvest and haulage costs.	DJPR and DELWP (pers. comm.)
Ash sawlog (D+)	$/$m^3$	CiC	CiC	CiC	Actual (for most likely value) and Assumed +/- 5% for low and high values	VicForests modelling
Ash sawlog (E)	$/$m^3$	CiC	CiC	CiC		
Ash pulplog	$/$m^3$	CiC	CiC	CiC		
Mixed species sawlog (D+)	$/$m^3$	CiC	CiC	CiC		
Mixed species sawlog (E)	$/$m^3$	CiC	CiC	CiC		
Mixed species pulplog	$/$m^3$	CiC	CiC	CiC		

Input / parameter	Unit	Estimated value – Most likely	Estimated value - Low	Estimated value - High	Basis (Actual / assumption / Derived)	Source
Baseline harvest and haulage revenue Ash sawlog D+	$/m³	CiC	CiC	CiC		
Baseline harvest and haulage revenue Ash sawlog E	$/m³	CiC	CiC	CiC		
Baseline harvest and haulage revenue Ash pulplog	$/m³	CiC	CiC	CiC		
Baseline harvest and haulage revenue mixed species sawlog D+	$/m³	CiC	CiC	CiC		
Baseline harvest and haulage revenue mixed species sawlog E	$/m³	CiC	CiC	CiC		
Baseline harvest and haulage revenue mixed species pulplog	$/m³	CiC	CiC	CiC		
Baseline harvest contractor margin	%	CiC	CiC	CiC		Based on consultation with VicForests

Table 19 contains the estimated change in variable costs of operation for VicForests and harvest and haulage operators associated with each of the options. VicForests are likely to incur the following additional costs in relation to harvesting operations:

- pre-harvest planning (e.g. re-estimating the long-term resource model)
- forest protection surveys
- marking out coupes with required buffers / exclusions
- harvest monitoring and compliance
- post-harvest survey planning
- roading costs
- post-harvest reporting and monitoring
- regeneration activities

Harvest and haulage operators are likely to incur the following additional costs in relation to harvesting operations:

- crew and equipment planning
- harvesting costs
- loading costs
- haulage costs

It should be noted that these are best estimates, and have not been calculated using a 'bottom – up' approach to individual cost items. All values are in real 2019 dollars.

Table 19. Estimated change in costs of production (VicForests and H&H operators)

Input / parameter	Unit	Estimated value – Most likely	Estimated value - Low	Estimated value - High	Basis (Assumption / Derived)	Source
Change in variable costs (VicForests)						
Large Brown Tree Frog	$/m³	CiC	CiC	CiC	Assumption	Based on consultation with VicForests
Large Tree (no buffer)		CiC	CiC	CiC		
Large Tree (with buffer)		CiC	CiC	CiC		
Change in variable costs (Harvest & Haulage operators)						
Large Brown Tree Frog	$/m³	CiC	CiC	CiC	Assumption	Based on consultation with VicForests
Large Tree (no buffer)		CiC	CiC	CiC		
Large Tree (with buffer)		CiC	CiC	CiC		

APPENDIX C: SENSITIVITY RESULTS

The following provides insight into the sensitivity analyses undertaken in this assessment. Sensitivity analysis results are presented for Central Gippsland FMA, to illustrate the effect of different key uncertain parameters on estimated impacts. Only the results associated with Large Tree (with buffer) option impacts are provided as this option is expected to have a significantly higher industry impact than other options considered in the RIS.

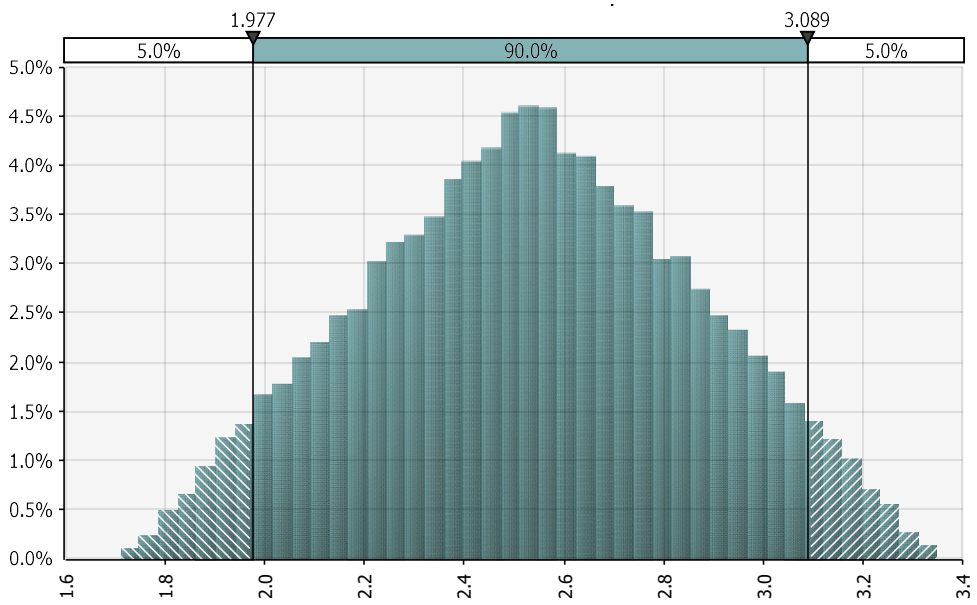


Figure 9. Central Gippsland FMA Large Tree (with buffer) Impacts to State

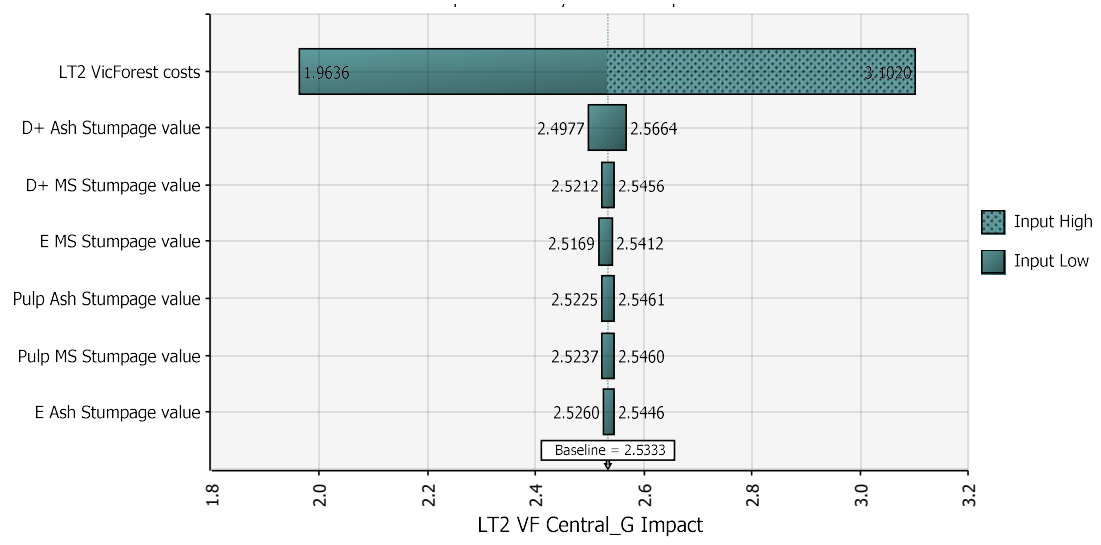


Figure 10. Central Gippsland FMA Large Tree (with buffer)- Inputs ranked by their effect on the variability of the estimated impacts to the State

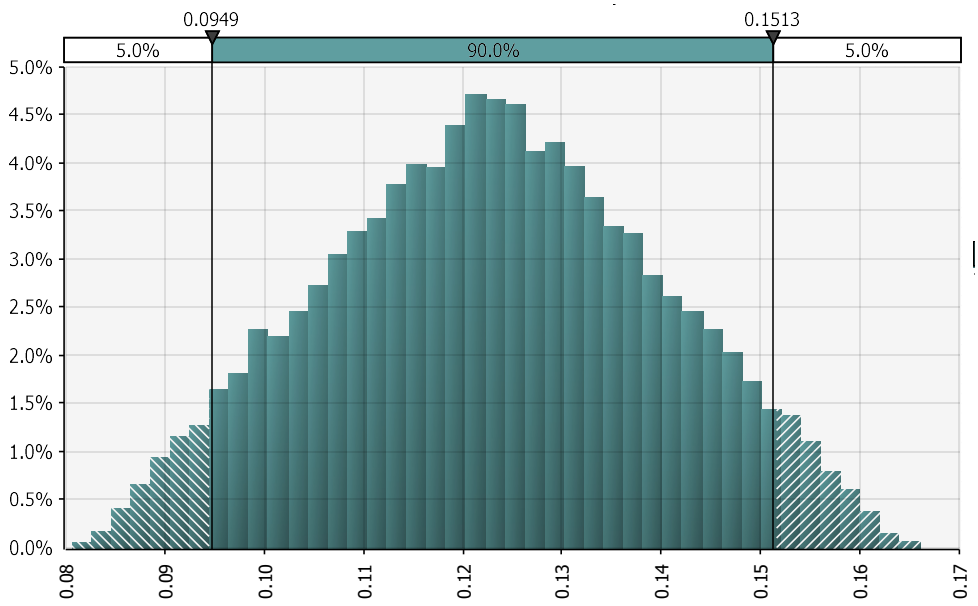


Figure 11. Central Gippsland FMA Large Tree (with buffer)- Impacts to harvest and haulage operators

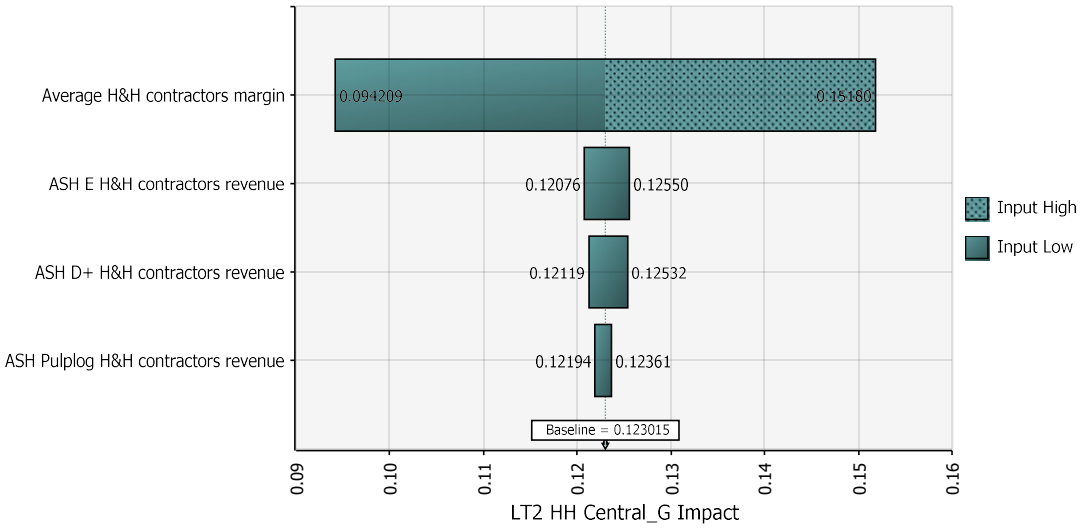


Figure 12. Central Gippsland FMA Large Tree (with buffer)- Inputs ranked by their effect on the variability of the estimated impacts to harvest and haulage operators

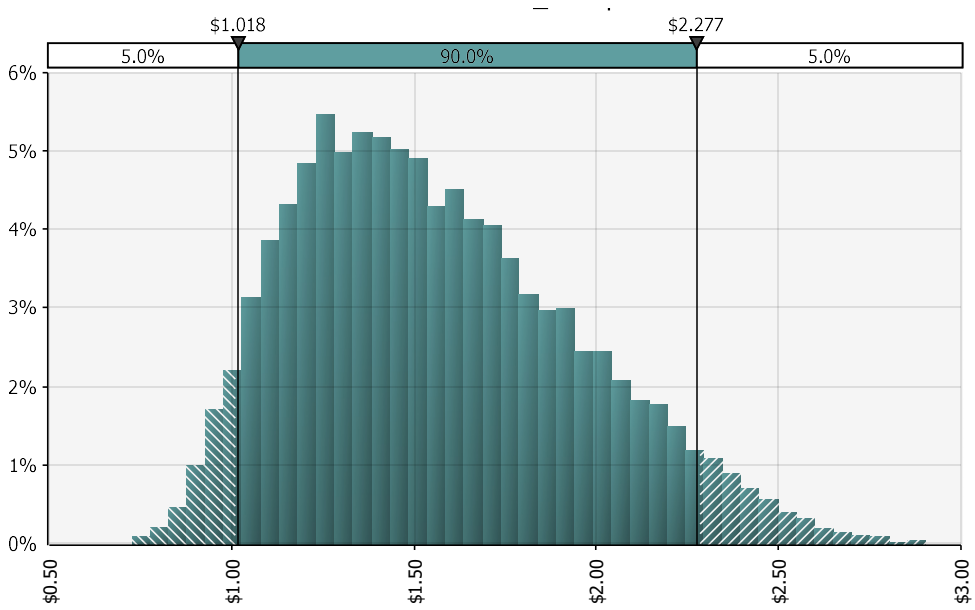


Figure 13. Central Gippsland FMA Large Tree (with buffer) - Impacts to sawmill operators

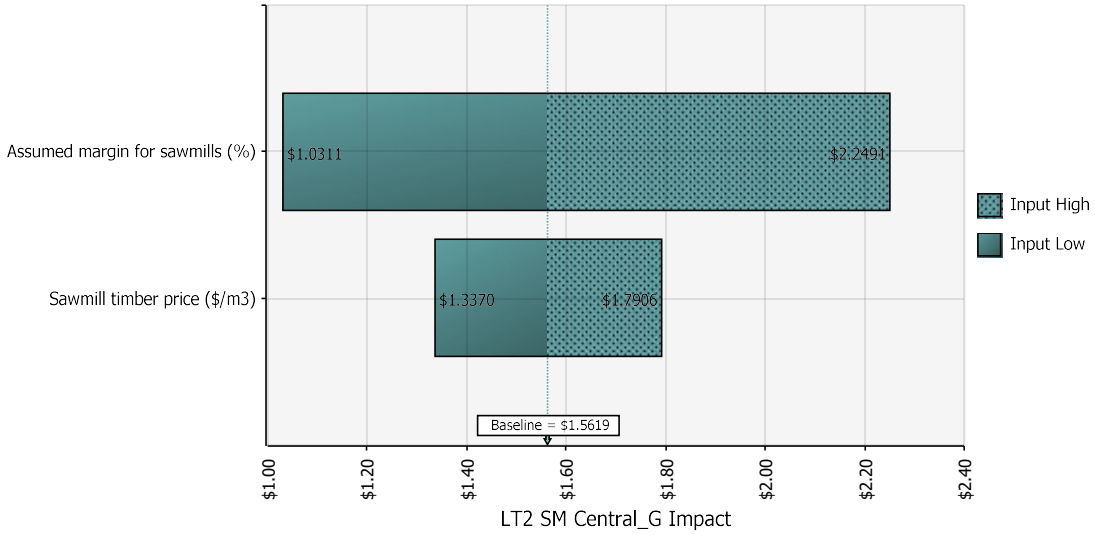


Figure 14. Central Gippsland FMA Large Tree (with buffer)- Inputs ranked by their effect on the variability of the estimated impacts to sawmill operators

APPENDIX D: FMA RESULTS

The following sets out the FMA level results for each of the options for the period 2019-20 to 2029-30. The results cover:

- Change in wood supply.
- Change in suitable habitat.
- Cost-effectiveness.

Change in wood supply

Table 20 contains the estimated change in wood supply (for ash and mixed species) at the FMA level for the period 2019-20 to 2029-30 for each of the options as a percentage of the base case.

Table 20. Estimated FMA change in wood supply by option (2019-20 – 2029-30)

	Reduction in ash species wood supply - all grades	Reduction in mixed species wood supply – all grades
Large Brown Tree Frog		
Benalla Mansfield	0.0%	0.0%
Central	0.0%	0.0%
Central Gippsland	0.0%	0.0%
Dandenong	0.0%	0.0%
East Gippsland	0.0%	0.2%
North East	0.0%	0.0%
Tambo	0.0%	0.0%
Total	0.0%	0.0%
Large Tree (no buffer)		
No impact estimated for any FMA		
Large Tree (with buffer)		
Benalla Mansfield	0.0%	0.5%
Central	9.1%	0.2%
Central Gippsland	3.5%	0.7%
Dandenong	26.7%	0.8%
East Gippsland	0.0%	0.5%

	Reduction in ash species wood supply - all grades	Reduction in mixed species wood supply – all grades
North East	6.2%	0.8%
Tambo	6.1%	0.9%
Total	7.4%	0.5%

Change in suitable habitat

In addition to presenting the CSH estimates for each option at the FMA level, Table 21 presents this change as a proportion of the suitable habitat that is available in all public native forests across the analysis area for this suite of species; i.e. the percentage of the theoretical maximum CSH that could be achieved if harvesting was immediately stopped in all eastern Forest Management Areas (FMAs). for each of the options.

The species considered in the benefits analysis were identified by expert biologists as forest-dependent as part of the 2017 VEAC Conservation Values of State Forests report (see Appendix F). Benefits for this suite of species is assessed as it avoids the analysis being distorted by species that are dependent on other habitats such grasslands, wetlands, coasts and treeless alpine areas.

Table 21. Estimated change in suitable habitat by option

		Greater Glider Benefit		VEAC Fauna and Flora (Excl. Greater Glider) Benefit	
	Net harvestable area impacted (hectares) Timber production area expected to be impacted by option	**Change in Suitable Habitat (CSH) hectares** Improvement in biodiversity benefit	**CSH as % of maximum protection** Comparison to stop harvest benefit in all eastern FMAs	**Change in Suitable Habitat (CSH) hectares** Improvement in biodiversity benefit	**CSH as % of maximum protection** Comparison to stop harvest benefit in all eastern FMAs
Large Brown Tree Frog					
Benalla Mansfield	-	-	-	-	-
Central	-	-	-	-	-
Central Gippsland	-	-	-	-	-
Dandenong	-	-	-	-	-
East Gippsland	23	7	0.0%	1	0.0%
North East	-	-	-	-	-
Tambo	-	-	-	-	-

		Greater Glider Benefit		VEAC Fauna and Flora (Excl. Greater Glider) Benefit	
Large Tree (with buffer)					
Benalla Mansfield	26	8	0.0%	10	0.1%
Central	880	328	1.0%	400	1.4%
Central Gippsland	241	45	0.1%	102	0.2%
Dandenong	164	52	0.5%	92	0.8%
East Gippsland	232	80	0.1%	170	0.1%
North East	164	53	0.1%	23	0.1%
Tambo	190	63	0.1%	48	0.2%

Cost-effectiveness results

Table 22 presents the cost-effectiveness of each option at the FMA level for the period 2019-20 to 2029-30. It reflects the (present value) costs associated with gaining a suitable habitat hectare under the options. A lower number reflects a lower cost option for achieving the change in suitable habitat.

Table 22. Estimated cost-effectiveness of each option at FMA level ($per change in suitable habitat)

	Greater Glider Cost-effectiveness ($/suitable habitat hectare gained)	VEAC Fauna and Flora* Excl. GG Benefit Cost-effectiveness ($/suitable habitat hectare gained)
Large Brown Tree Frog		
Benalla Mansfield	-	
Central	-	-
Central Gippsland	-	-
Dandenong	-	-
East Gippsland	$12,200	$133,100
North East	-	-
Tambo	-	-

	Greater Glider Cost-effectiveness ($/suitable habitat hectare gained)	VEAC Fauna and Flora* Excl. GG Benefit Cost-effectiveness ($/suitable habitat hectare gained)
Large Tree (no buffer)		
	Likely to be cost-effective, as this option formalises measures already adopted by VicForests	Likely to be cost-effective, as this option formalises measures already adopted by VicForests
Large Tree (with buffer)		
Benalla Mansfield	$6,300	$5,100
Central	$43,000	$35,200
Central Gippsland	$86,400	$38,700
Dandenong	$49,400	$27,600
East Gippsland	$3,100	$1,500
North East	$24,000	$54,200
Tambo	$22,600	$29,600

APPENDIX E: PROPOSED MINOR VARIATIONS TO THE CODE

Table 23. Scope of 2019 variations to Code of Practice for Timber Production 2014

Objective	Examples of proposed variations	Code Review Goal	Rationale for change
Variations assessed as likely to impose significant additional regulatory burden			
Ensure the Code is contemporary with Victorian Government policies, strategies, regulations or agreements to manage natural forest values.	**(A)** Addition or updating of management actions or prescriptions, relating to new or existing government commitments or agreements. Examples include: • State-wide protection of Large Trees. • State-wide protection of the Large Brown Tree Frog.	Ensure that the Code is: ✓ **Contemporary** ✓ **Enforceable**	Advances in scientific understanding or societal expectations have resulted in the development of new policies, strategies, regulations or agreements to manage natural forest values. In order for these to be considered enforceable within the timber harvesting regulatory framework and the Code to reflect contemporary policy, these have been proposed as variations to the Code. Variations to the Code will ensure that the objective of these changes can be enforced by the regulatory framework A contemporary regulatory framework will create regulatory certainty and mitigate risks to communities, government and industry. These items are considered in full detail in the body of the report.
Variations assessed as unlikely to impose significant additional regulatory burden			
Clarify Purpose, Scope and Intent of Instrument	**(B)** Update Section 1 of the Code to differentiate responsibilities of Managing Authority and Secretary to DELWP in Forest Management Planning and Zoning	Ensure that the Code is: ✓ **Clear** ✓ **Accurate** ✓ **Enforceable**	There is a lack of understanding amongst stakeholders about the regulatory intent of the Code and its place within the forest management framework evidenced by regular allegations and reports from stakeholders requiring investigation but no basis for compliance enforcement.

Objective	Examples of proposed variations	Code Review Goal	Rationale for change
	(C) Update Section 2.1 of the Code to provide a clearer description of the current regulatory framework and the relationship between the Code, Forest Management Plans and the Forest Management Zoning Scheme.	Ensure that the Code is: ✓ **Clear** ✓ **Accurate** ✓ **Enforceable**	These minor amendments seek to clarify existing requirements more explicitly rather than changing them and are therefore not considered to create new regulatory burden however have been included for completeness.
	(D) Change the DEPI to DELWP across the Code and MSPs	Ensure that the Code is: ✓ **Accurate**	Organisational name changes have occurred since the last Code review. These changes will reflect current governance arrangements improving clarity of the Code. These minor amendments seek to clarify rather than change the regulatory intent and do not apply new regulatory burden however have been included for completeness.
Correct administrative errors	**(E)** Fix incorrect referencing between clauses of the Management Standards and Procedures for Timber Harvesting in Victoria's State Forests 2014 (MSPs). Examples include but are not limited to: • Section 4.4.9.1(d) incorrectly refers to section 3.4.8.2 when it should reference 4.4.9.2).	Ensure that the Code is: ✓ **Clear** ✓ **Accurate** ✓ **Enforceable**	Incorrect referencing in the Code leads to a lack of regulatory certainty and makes the Code difficult to interpret for practitioners and the community. These minor amendments seek to clarify rather than change the regulatory intent and do not apply new regulatory burden however have been included for completeness.
Clarify roles and responsibilities	**(F)** Transfer detection-based zoning actions from Appendix 5 (the Planning Standards) into the MSPs: • for rare or threatened fauna from Table 4 of Appendix 5 into Table 13 of the MSPs • for rare or threatened flora from Table 5 of Appendix 5 into Table 14 of the MSPs • for vegetation communities from Table 7 of Appendix 5 into section 4.4 of the MSPs • for historic places from Table 8 of Appendix 5 into Table 15 of the MSPs	Ensure that the Code is: ✓ **Clear** ✓ **Accurate** ✓ **Enforceable** ✓ **Contemporary**	Currently the MSPs and Planning Standards duplicate advice creating unnecessary complexity to these guidance documents. In some the Code is not contempered with other relevant regulatory instruments (e.g. Aboriginal Heritage Act 2006 Vic.) Furthermore, the Code is a document of directions for timber harvesting managers, harvesting entities and operators. It does not regulate DELWP. Therefore, fixed zoning actions will be removed because they describe conservation and management strategies for forest values within relevant Regional Forest Management Plans or action statements and are non-enforceable actions that have been undertaken by the DELWP Secretary in accordance with the Forest Management Plan.

Objective	Examples of proposed variations	Code Review Goal	Rationale for change
	(G) Remove all fixed-zoning actions from Appendix 5, Examples include but are not limited to: • 3.1 Stream Protection • 3.2 Water Supply protection areas • 3.3 Wetlands • 4.1 Linear Reserves • 4.2 Fixed Zoning for Fauna • 4.4 Fixed Zoning for Flora • 4.6 Vegetation Communities (including section 4.6.4.4 (b): "incorporate into conservation reserves or the SPZ at least 60% of the extent of all other old growth forest EVCs present in 1995.") • 5 Historic Places • 6 Landscape • 7 Recreation • 8 Research	Ensure that the Code is: ✓ **Clear** ✓ **Accurate** ✓ **Enforceable** ✓ **Contemporary**	VicForests' will continue to have a responsibility for identifying and appropriately managing values they detect in-field These minor amendments seek to clarify rather than change the regulatory intent and do not apply new regulatory burden however have been included for completeness.
Clarify permitted activities and exemptions	**(H)** Fix inconsistencies between the Code and MSPs in relation to permitted activities. Examples include but are not limited to: • wet weather controls that were better described in the 2009 Management Procedures • timber harvesting operations may occur in Special Protection Zones subject to allowable exceptions approved by the Minister (page 42 of the Code is inconsistent with page 21 of the MSPs). Clarify circumstances where exemptions can be sought.	Ensure that the Code is: ✓ **Clear** ✓ **Accurate** ✓ **Enforceable**	Some permitted activities are not clear and do not reflect commonly used operational standards. This creates ambiguity within the interpretation of the Code. These minor amendments seek to clarify rather than change the regulatory intent and do not apply new regulatory burden however have been included for completeness.
Ensure completeness of glossary and clarify existing definitions	**(I)** Add missing definitions to the glossary. Example: There is currently no definition for 'Populations'. This is problematic as there are 400 prescriptions which directs action for 'verified populations'. This causes confusion around	Ensure that the Code is: ✓ **Clear** ✓ **Accurate**	Updating the glossary of definitions to be clear and comprehensive will reduce ambiguity within the interpretation of the Code.

Objective	Examples of proposed variations	Code Review Goal	Rationale for change
	whether prescriptions should be applied for individual detections or not. Current proposed definition: 'population' refers to a group (2 or more) of individuals of the same species that are demographically, genetically, or spatially distinct from other groups of individuals. **(J)** Clarify existing glossary definitions. Example: The 'Permanent roads' definition was previously not very specific. An updated definition has been drafted to specify that permanent roads are roads and tracks of class 5D and above, and represent roads which are permanently required for the continuing management of the forest, including timber harvesting operations.	✓ **Enforceable**	These minor amendments seek to clarify existing requirements by providing more detailed guidance rather than changing the regulatory intent. They are intended to enforce current practice and are not considered to create new regulatory burden however have been included for completeness.

APPENDIX F: LIST OF VEAC SPECIES

VEAC Forest Dependent Spices: Common Name		
Alpine Bog Skink	Greater Glider	Southern Toadlet
Barking Owl	Green and Golden Bell Frog	Speckled Warbler
Baw Baw Berry	Grey Goshawk	Spotted Quail-thrush
Baw Baw Frog	Grey-headed Flying-fox	Spotted Tree Frog
Blackfellow's Hemp	Gully Grevillea	Square-tailed Kite
Booroolong Tree Frog	Hooded Robin	Squirrel Glider
Broad-toothed Rat	Lace Monitor	Swamp Antechinus
Brown Guinea-flower	Large Brown Tree Frog	Swamp Skink
Brown Toadlet	Leadbeater's Possum	Swift Parrot
Brown Treecreeper	Leafless Pink-bells	Tall Astelia
Brush-tailed Phascogale	Long-footed Potoroo	Tasmanian Wax-flower
Brush-tailed Rock Wallaby	Long-nosed Potoroo	Toothed Leionema
Chestnut-rumped Heathwren	Masked Owl	Tree Geebung
Colquhoun Grevillea	Outcrop Guinea-flower	Turquoise Parrot
Eastern Horseshoe Bat	Oval Fork-fern	Veined Pomaderris
Eastern Pomaderris	Oval-leaf Grevillea	Velvety Geebung
Eastern She-oak Skink	Powerful Owl	White-bellied Sea-Eagle
Elegant Daisy	Regent Honeyeater	Yellow-bellied Glider
Forest Geebung	Sandfly Zieria	Yellow-bellied Sheathtail Bat
Forest Phebalium	Slender Fork-fern	
Forest Sedge	Small Fork-fern	
Giant Burrowing Frog	Smoky Mouse	
Gippsland Stringybark	Smooth Geebung	
Glossy Black-Cockatoo	Sooty Owl	