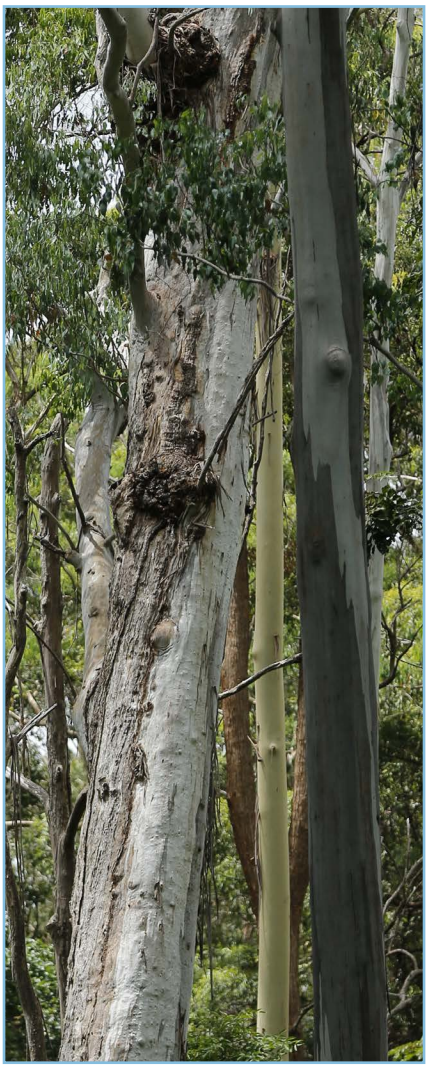
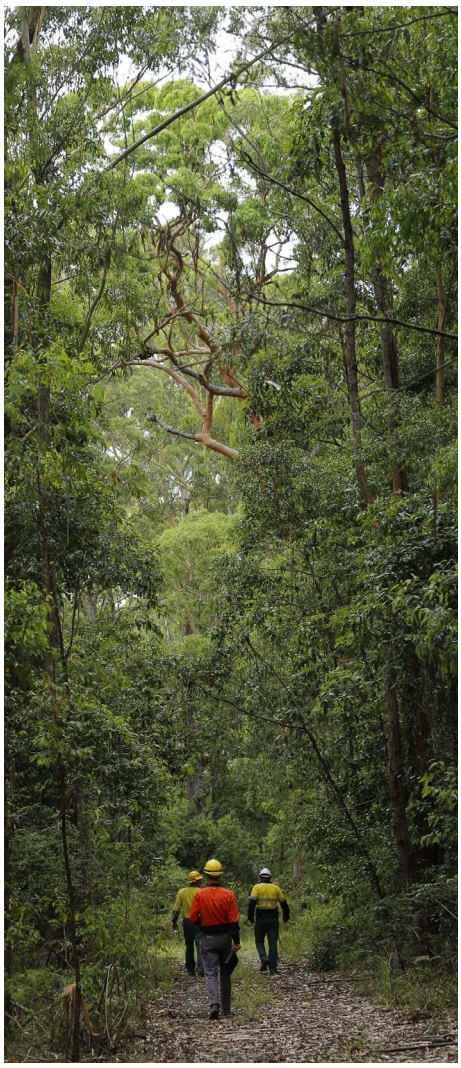
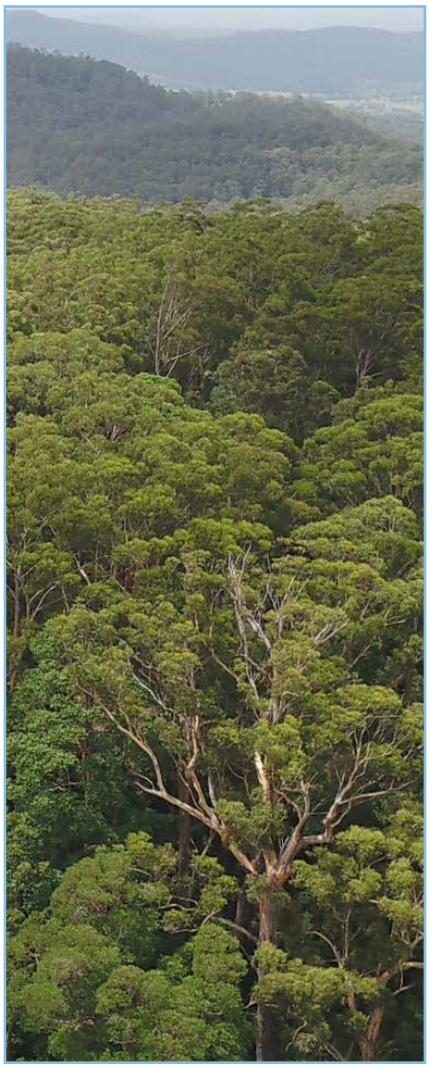
Old Growth Reassessment Framework

PROGRAM SUSPENDED

June 2020







NSW GOVERNMENT

Natural Resources Commission

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List of acronyms

API	Aerial Photographic Interpretation
BAM	NSW Biodiversity Assessment Methodology
BMAD	Bell Miner Associated Dieback
CAR	Comprehensive, adequate and representative
CRA	Comprehensive Regional Assessment
CRAFTI	Comprehensive Regional Assessment Aerial Photograph Interpretation
DBHOB	Diameter at Breast Height Over-bark
EES	Environment, Energy and Science Group under the Department of Planning, Industry and Environment
EPA	NSW Environment Protection Authority
FCNSW	Forestry Corporation of New South Wales
FMZ	Forest Management Zone
FRAMES	Forest Resource and Management Evaluation System
GPS	Global Positioning System
GSU	Growth State Unit
HCVOG	High Conservation Value Old Growth
HQHOG	High Quality Habitat Old Growth
HQL	High Quality Large (sawlogs)
HQS	High Quality Small (sawlogs)
IBRA	Interim Biogeographic Regionalisation for Australia
IFOA	Integrated Forestry Operations Approval
JANIS	Joint ANZECC/MCFFA National Forest Policy Statement Implementation Sub-Committee (generally referring to its Nationally Agreed Criteria for a Comprehensive, Adequate and Representative Reserve System for Forests in Australia
LiDAR	Light Detection and Ranging
NSW	New South Wales
PNF	Private Native Forestry
RFA	Regional Forest Agreement
SMZ	Special Management Zone
TEC	Threatened Ecological Community
The Commission	Natural Resources Commission
The framework	Old Growth Reassessment Framework

Document No. D19/3803

ISBN: 978 1 925204 45 2

The Natural Resource Commission acknowledges and pays respect to all the Traditional Owners and their Nations of the areas covered in this report. The Commission recognises and acknowledges that the Traditional Owners have a deep cultural, social, environmental, spiritual and economic connection to their lands and waters. We recognise their knowledge of natural resource management and the contributions of earlier generations, including the Elders, are valued and respected.

Table of Contents

Summary

Old Growth Reassessment Program suspended

The draft framework contained in this report will not be applied

- The NSW Government has suspended the program to reassess old growth forest mapping on coastal state forests.
- The draft old growth reassessment framework was delivered to the NSW Government in August 2019 for their review prior to community consultation. At that time, the program was temporarily placed on hold to allow Forestry Corporation of NSW to conduct further modelling of total hardwood wood supply, including hardwood plantations.
- Since then, the 2019-20 fires burnt over 5 million hectares of New South Wales, including 890,000 hectares of native state forest. On the NSW north coast, over 100,000 hectares of mapped old growth in state forests was burnt.
- Working with 2Rog Consulting, the Commission looked at the impact of the fires on mapped old growth forest. This assessment used spatial data only, including the Google Earth Engine Burnt Area Map prepared by the Department of Planning, Industry and Environment. We then considered the implications for applying the proposed methods contained in this report.
- You can access our desktop assessment of the 2019-20 fires on mapped old growth forest on the Commission's web site: https://www.nrc.nsw.gov.au/old-growth
- The Commission determined that the draft framework could no longer be implemented in accordance with the timelines and funding under the Premier's terms of reference. This is because the proposed old growth assessment method would have applied remote sensing techniques to assess canopy cover and structural maturity. Where the fires burnt the forest canopy, the remote sensing approach proposed cannot be accurately applied. Our assessment found that over 45 percent of mapped old growth in north coast state forests experienced full or partial canopy burn in the 2019-20 fires.
- The Commission advised the NSW Government we would be unable to continue in accordance with the terms of reference.
- Based on this advice, the NSW Government has now suspended the program and approved the remaining funds being repurposed to the Forest Monitoring and Improvement Program.
- You can find out more about the Forest Monitoring and Improvement Program on the Commission's web site: https://www.nrc.nsw.gov.au/forest-monitoring
- For transparency, the Commission is now making the draft framework available to interested stakeholders, noting the framework has not been released for public consultation or approved by the NSW Government.
- If this draft framework were to be applied in the future it would first need to be released for public consultation, reviewed in light of stakeholder feedback and then approved for implementation by the NSW Government.

The NSW Government introduced a new Coastal Integrated Forestry Operations Approval (IFOA) in 2018 to regulate native forestry operations in coastal state forests. The NSW Government has made 'twin commitments' that the Coastal IFOA will result in:

- **no net change to wood supply** for the native timber industry
- **no erosion of environmental values** at the site or landscape scale in state forests.

The Coastal IFOA contains stronger environmental protections than the previous regulation but a review by the Natural Resources Commission (the Commission) of some of the Coastal IFOA settings found that these protections may reduce wood supply in some regions, which may breach the commitment to no net change in wood supply.[1] This review was conducted prior to the 2019-20 fires.

To address this potential shortfall and ensure the twin commitments could be met, the Premier had asked the Commission to **independently oversee a program to reassess existing old growth forest mapping and associated special environmental values on coastal state forests**.

Experts have previously suggested that the existing mapping is inaccurate, and our 2018 field-based pilot study confirmed this.[2,3] This inaccuracy means that the mapping is potentially not protecting some areas of old growth and also protects some areas that do not meet the definition of old growth. Reassessing areas of old growth that are not currently mapped can ensure they receive appropriate protection. Rezoning areas that are currently incorrectly mapped as old growth to allow harvesting could help address any shortfall in wood supply arising from changes in the Coastal IFOA settings.

The Commission recognises that reassessing old growth mapping is highly contested in the community, especially since the 2019-20 fires burnt substantial areas of mapped old growth forest. Therefore, although the program has now been suspended, the methods that were proposed to conduct the reassessment are presented in this report and clearly explained so they can be understood.

In this report, we present the Commission's **draft** Old Growth Reassessment Framework (the framework) to reassess old growth mapping, which comprises four assessment methods and a set of decision making rules. The framework was developed in collaboration with the Environment, Energy and Science Group's Science Division (EES Science Division) under the Department of Planning, Industry and Environment. The framework was also endorsed by an independent panel of scientists with relevant expertise.[4]

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1 Natural Resources Commission (2018) *Supplementary Advice on Coastal Integrated Forestry Operations Approval Remake Old Growth Forests and Rainforests - North Coast State Forests.* Available at: https://www.nrc.nsw.gov.au/publications.

2 NPWS (1999) *Old-growth Forest Related Projects - UNE / LNE Regions, part of CRA, project number NA 28/EH*. Available at: http://www.agriculture.gov.au/SiteCollectionDocuments/rfa/regions/nsw-north-east/enviroment/nsw_ne_na28eh.pdf.

3 Natural Resources Commission (2018) *Supplementary Advice on Coastal Integrated Forestry Operations Approval Remake Old Growth Forests and Rainforests - North Coast State Forests.* Available at: https://www.nrc.nsw.gov.au/publications.

4 The expert panel members are:
- Professor Jerry Vanclay, Director, Forest Research Centre and the former Head of School of Environment, Science and Engineering, Southern Cross University
- Associate Professor Philip Gibbons, Fenner School of Environment and Society, Australian National University
- Associate Professor Craig Nitschke, Senior Research Fellow, School of Ecosystem and Forest Sciences, University of Melbourne.

The framework was designed to:

- improve the accuracy of old growth mapping
- assess and map areas that may not be old growth but hold special environmental and conservation values requiring protection
- allow the public and NSW agencies to nominate unmapped areas of old growth for protection
- verify any wood supply shortfall arising from Coastal IFOA settings transparently and independently
- reassess areas currently mapped as old growth once there is a verified wood supply shortfall
- ensure any decision to revoke protections is based on a strong evidence base, supported by scientific processes, independent expert review and field validation
- ensure any rezoning of areas currently mapped as old growth is capped at the wood supply volume required to address any verified shortfalls
- help decision-makers ensure that all the evidence is considered before any mapped old growth boundaries are adjusted.

This report:

- provides a high-level introduction to the draft program and framework (**Chapters 1** and **2**)
- sets out the framework's methods in detail (**Chapters 3** to **7**).

1 Introduction and context

In November 2018, the Premier asked the Commission to:

Independently oversee a program to:

- **reassess existing old growth forest mapping and associated special environmental values on coastal state forests**
- **help ensure the NSW Government can meet its commitments to no net change to wood supply and no loss of environmental values under the new Coastal IFOA (the twin commitments)**
- **continue to improve the evidence base of NSW's forest estate.**

To provide important background information, this chapter outlines:

- what we were asked to do (the terms of reference)
- why we were asked to develop the program
- the definition of old growth forest
- the mechanisms that ensure old growth is strongly protected.

Note: Old Growth Reassessment Program suspended

The framework contained in this report will not be applied

1.1 What we were asked to do

The terms of reference from the Premier asked us, as part of the program, to develop an overarching assessment and decision making framework that was to include:

1 **A method and process to identify and reassess areas in state forests** that are:

- currently mapped as containing old growth forests but may not contain old growth forests
- currently not mapped as containing old growth forests but may contain old growth forests.

2 An **old growth reassessment protocol** that takes into account relevant definitions and assessment criteria for old growth.

3 **A framework for assessing special environmental and conservation values** to be applied in circumstances where old growth forests are confirmed absent in the existing mapping.

4 A method to **verify any change in wood supply** on state forests arising from the Coastal IFOA.

5 A method to allow decision makers to **determine the implications for the twin commitments** – at the site and landscape scale – of changing existing reserve boundaries (i.e. old growth mapping boundaries), based on the assessment.

The full terms of reference for the project are available on the Commission's website: https://www.nrc.nsw.gov.au/old-growth.

Note: This program was designed for use on coastal state forests in NSW.

It was not designed for use on plantations, private land or other Crown land outside the state forests covered by the Coastal IFOA.

1.2 Why we were asked to develop the program

In developing the new Coastal IFOA, the NSW Government made commitments that the new regulation would result in no erosion of environmental values and no net change to wood supply (the 'twin commitments'). The new Coastal IFOA contains stronger environmental protections than the previous regulation but our review of some of the Coastal IFOA settings found that these protections may reduce wood supply in some regions, which may breach the wood supply commitment.

The NSW Government asked the Commission to revisit the mapping of old growth forest, which was considered by experts to be inaccurate.[5] Our investigation of a sample area of mapping confirmed these inaccuracies.[6] As well as potentially not protecting some areas that meet the definition of old growth, the existing mapping also protects areas that do not meet the definition of old growth.

Reassessing areas of old growth that are not currently mapped as such can ensure they receive appropriate protection. Rezoning some areas incorrectly mapped as old growth to allow harvesting could have addressed shortfalls in wood supply if they were to have occurred, and thus enabled the NSW Government to meet its commitments. Therefore, the NSW Government had asked us to develop a program to improve old growth mapping in a limited number of areas, with the aim of protecting old growth and rezoning areas that do not meet the definition of old growth only where this would have been required to meet wood supply commitments.

Table 1 provides a timeline of the key events that led to the development of this program.

Table 1: Key events in the history of forest management relevant to this program

Event	Details
1995 – 2005 **Current old growth mapping**	▪ Areas currently protected as old growth were identified and protected over the course of a decade through a complex series of mapping exercises and negotiated decisions regarding forest zoning. ▪ Current protections were established in several stages, with varying rationales and criteria for which areas were protected. However, most areas that are currently protected are based on two sets of spatial data that were developed in the late 1990s.

5 NPWS (1999) *Old-growth Forest Related Projects - UNE / LNE Regions, part of CRA, project number NA 28/EH.* Available at: http://www.agriculture.gov.au/SiteCollectionDocuments/rfa/regions/nsw-north-east/enviroment/nsw_ne_na28eh.pdf.

6 Natural Resources Commission (2018) *Supplementary Advice on Coastal Integrated Forestry Operations Approval Remake Old Growth Forests and Rainforests - North Coast State Forests.* Available at: https://www.nrc.nsw.gov.au/publications.

Event	Details
	- The first is a broader map layer representing 'candidate' old growth that was identified through the CRAFTI[7] mapping project. When developed, this dataset was considered to represent a greater area than the actual extent of genuine old growth. - The second is a subset of this map layer that represents the intersection of 'candidate' old growth with a data layer based on fauna habitat modelling called 'High Quality Habitat Old Growth (HQHOG)'. The resulting layer is known as 'High Conservation Value Old Growth (HCVOG)'. ▪ Expert opinion and the Commission's analysis have found significant inaccuracies in these maps.[8,9] ▪ Experts involved in the development of the datasets acknowledged that they have significant limitations due to map inaccuracies, outdated technology, time and resource constraints at the time of mapping, and limited field validation. ▪ Some stakeholders consider that when the mapping for current protections was negotiated with environment and industry groups, it was agreed that there were areas where old growth was 'under' and 'over' mapped but these errors were accepted by the parties and the NSW Government. The Commission has not found written evidence nor has any such evidence been provided to the Commission to support this statement.
2000 onwards **Implementation of previous IFOAs** **Increased conservation reserves and wood supply issues**	▪ In total, at least 330,000 hectares of state forests in the Coastal IFOA area have been added to the conservation reserve system since the previous IFOAs were first implemented.[10] In addition, just over 100,000 hectares of old growth on state forests has been protected under special management zones established under the *Forestry Act 2012*. ▪ Attempts were made to mitigate the impact of transferring some of this area on wood supply. For example, the transfers under the 2003 'icons' decision (which transferred 65,000 hectares of state forests to the national park estate) were mitigated by amending some IFOA provisions. However, there was increasing pressure to deliver against agreed wood supply contracts, particularly on the North Coast. ▪ In 2013, the NSW Government responded to supply concerns by initiating a buyback of some of the high quality Blackbutt quota. However, concerns remained around supply issues, particularly as issues such as changing fire regimes place additional stress on native forests. ▪ **Figure 1** and **Figure 2** show the changes in the national park and state forests estates, and wood supply from NSW north and south coast regions.

7 CRAFTI stands for the Comprehensive Regional Assessment Aerial Photographic Interpretation project.

8 NPWS (1999) *Old-growth Forest Related Projects - UNE / LNE Regions, part of CRA, project number NA 28/EH*. Available at: http://www.agriculture.gov.au/SiteCollectionDocuments/rfa/regions/nsw-north-east/enviroment/nsw_ne_na28eh.pdf.

9 Natural Resources Commission (2018) *Supplementary Advice on Coastal Integrated Forestry Operations Approval Remake Old Growth Forests and Rainforests - North Coast State Forests.* Available at: https://www.nrc.nsw.gov.au/publications.

10 This figure includes areas that have been transferred from the state forest estate to either national parks or reserves, Aboriginal ownership or state conservation areas or dedicated as flora reserves.

Event	Details
2012 – 2018 **The Coastal IFOA remake and the twin commitments**	▪ The NSW Government committed to a sustainable native forestry industry with a modernised regulatory approach. ▪ A new Coastal IFOA was developed to replace four IFOAs covering the same area. The purpose of the Coastal IFOA is to regulate native forestry operations on state forests in north and south coastal regions of NSW.[11] The NSW Government made twin commitments that the Coastal IFOA will result in no net change to wood supply and no erosion of environmental values. ▪ The Coastal IFOA, while providing for intensive regeneration harvesting, also contains stronger environmental settings than previous regulation (including around protecting threatened ecological communities (TECs), retention clumps and koala browse tree retention).
2016 **The Commission's advice on the Coastal IFOA settings and twin commitments[12]**	▪ The Premier asked the Commission to review outstanding settings for the new Coastal IFOA and provide advice on whether settings could meet the twin commitments. ▪ We recommended settings that came as close as possible to meeting the twin commitments but found there would likely be a shortfall in wood supply as a result of mapping TECs and koala protections.
2018 **The Commission's supplementary advice on reassessing old growth[13]**	▪ In response to our 2016 advice, the Premier asked the Commission whether it was possible to reassess areas considered to be incorrectly mapped as old growth to offset wood supply impacts. ▪ We undertook a rapid, 'proof of concept' pilot to reassess old growth in state forests, based on the Private Native Forestry (PNF) old growth reassessment protocols and found significant errors in current old growth maps. ▪ We recommended that the NSW Government use modern technologies to identify areas that are incorrectly mapped as old growth to meet any verified wood supply shortfall within the Coastal IFOA region but only if: - wood supply shortfalls are verified, and - steps are taken to protect special conservation values and ensure environmental commitments are met. ▪ The NSW Government accepted this recommendation and the November 2018 terms of reference reflect the steps required to develop and implement an old growth reassessment program and framework.
2019-20 fires	▪ The 2019-20 fires burnt more than 5 million hectares of New South Wales including 890,000 hectares of native state forest.

11 NSW Environment Protection Authority (2014) *Remake of the Coastal Integrated Forestry Operations Approvals Discussion paper*. Available at: https://www.epa.nsw.gov.au/your-environment/native-forestry/forestry-regulatory-reforms/coastal-ifoa-remake/coastal-ifoa-public-consultation.

12 Natural Resources Commission (2016) *Advice on Coastal Integrated Forestry Operations Approval Remake.* Available at: https://www.nrc.nsw.gov.au/publications.

13 Natural Resources Commission (2018) *Supplementary Advice on Coastal Integrated Forestry Operations Approval Remake Old Growth Forests and Rainforests - North Coast State Forests.* Available at: https://www.nrc.nsw.gov.au/publications.

Event	Details
2020 **Old Growth Reassessment Program suspended**	▪ The Commission considered the spatial extent of the fires on mapped old growth forest and the implications for applying the proposed methods contained in this report.[14] ▪ On the NSW north coast, over 102,000 hectares of protected old growth in state forests was burnt, with around three quarters of this experiencing full or partial canopy burn. ▪ The Commission determined that the draft framework could no longer be implemented in accordance with the timelines and funding under the Premier's terms of reference and we advised the NSW Government. ▪ Based on this advice, the NSW Government suspended the program and approved the remaining funds being repurposed to the Forest Monitoring and Improvement Program.[15]

[14] 2Rog Consulting and the Natural Resources Commission (2020) *2019-2020 Bushfires -extent of impact on old growth forest - a joint report prepared by 2rog Consulting and the Natural Resources Commission – FINAL*. Available online at https://www.nrc.nsw.gov.au/old-growth

[15] For more information on the Forest Monitoring and Improvement Program visit: https://www.nrc.nsw.gov.au/forest-monitoring

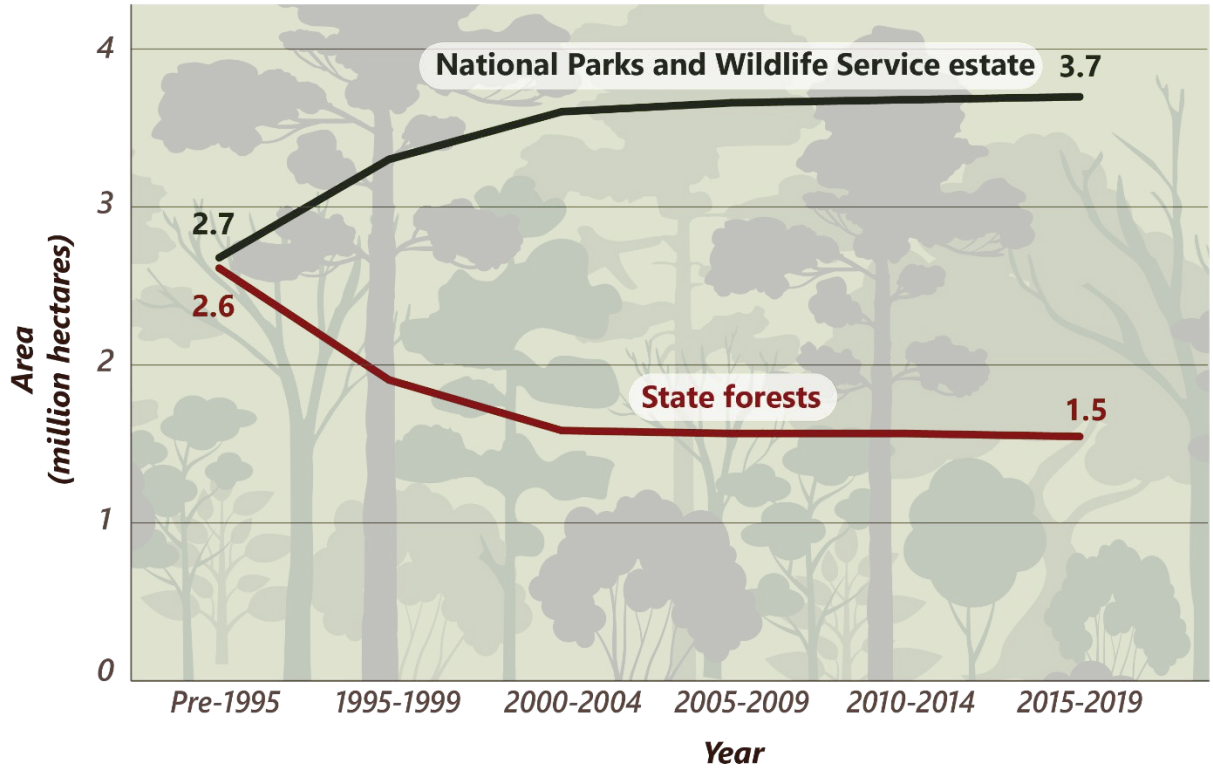

Figure 1: Changes in NSW national parks estate and state forest estate since 1995 in the Coastal IFOA

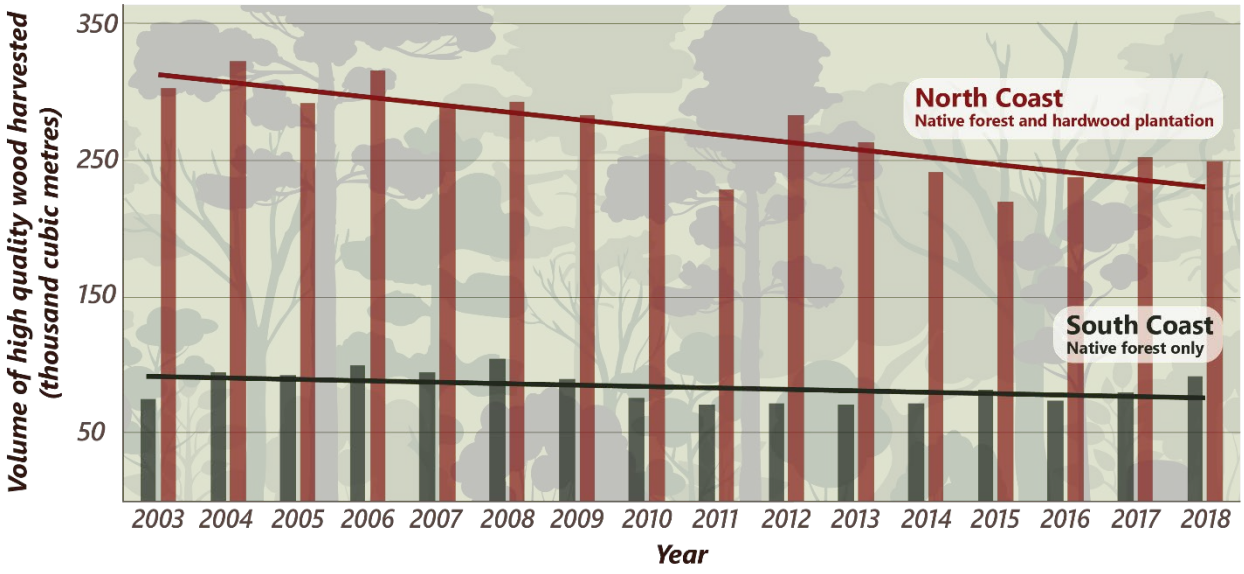

Figure 2: Wood supply from NSW north and south coast regions

1.2.1 Are there other ways to address wood supply shortfalls?

Reassessing and rezoning old growth mapping is one way to address potential wood supply shortfalls arising from Coastal IFOA settings and allow the NSW Government to meet the twin commitments. There are other approaches that the NSW Government could also consider outside of this terms of reference in order to achieve similar outcomes, including:

- Reviewing and updating yield from all coastal hardwood plantations managed by the Forestry Corporation of NSW (FCNSW) and ensure they are included in total wood supply considerations. FCNSW supplies wood to industry from a number of sources, including hardwood plantations, which should be considered in a holistic assessment of wood supply.
- A buy back of high quality sawlog quota to reduce the current pressures on wood supply. This would need to consider commitments under current wood supply agreements and the NSW Government's Forestry Industry Roadmap to provide industry certainty.
- Undertaking a trial to evaluate the benefits, costs, operational constraints and controls of accessing timber on steep slopes in NSW, in order to increase the area under general forest management zones (FMZ) that can be safely accessed for harvesting. Any areas subject to the trial should also be field assessed for the presence of any unmapped old growth within trial areas.

1.3 How old growth is defined

Old growth forest is defined as:

"Ecologically mature forest where the effects of disturbance are now negligible"[16]

This definition was developed by the Joint ANZECC/MCFFA[17] National Forest Policy Statement Implementation Sub-Committee (JANIS). It is an agreed national operational interpretation of the definition from the National Forest Policy Statement and is used in NSW Regional Forest Agreements (RFA) and private native forestry.

Figure 3 shows the attributes of old growth forest under this definition. **Figure 4** illustrates some of the key attributes of 'ecologically mature' forest that would be expected in old growth, including senescing trees[18] and hollows. **Figure 5** provides some examples of disturbance, including regrowth trees, cut stumps and weeds, the extent of which would be assessed to determine whether the effects of disturbance are negligible.

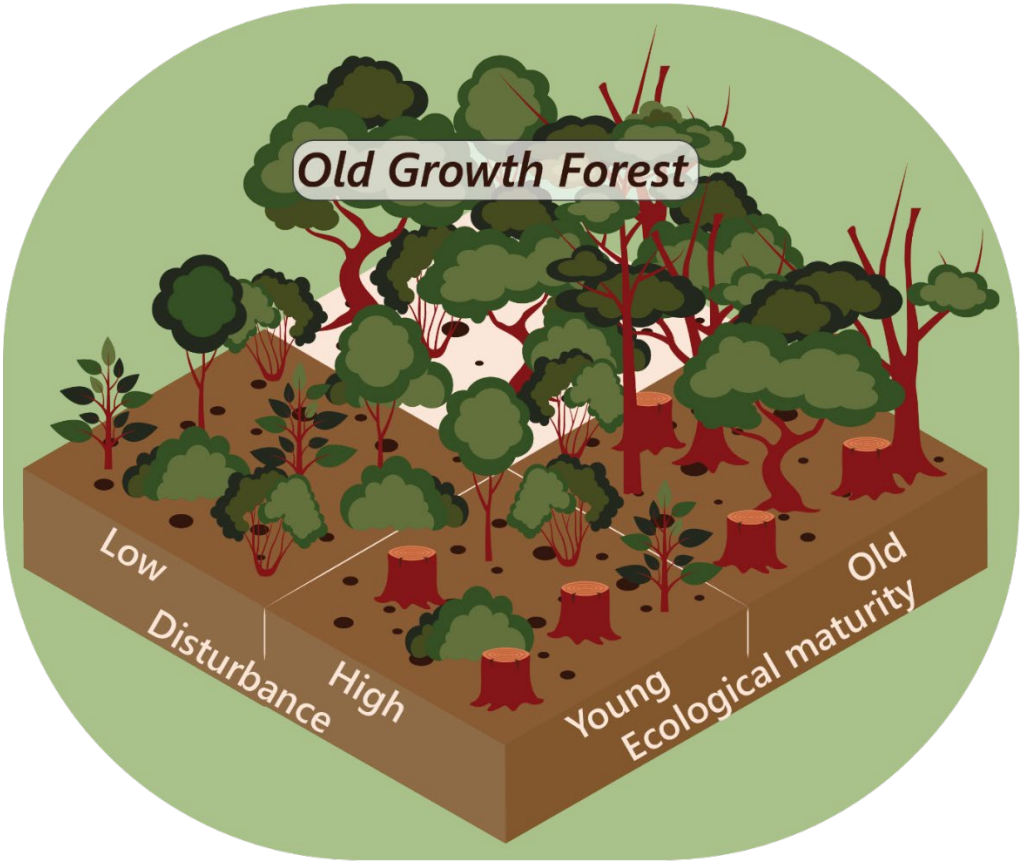

Figure 3: Attributes of old growth forest under the JANIS definition

16 JANIS (1997) *Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia*, p. 14. Available at: http://www.agriculture.gov.au/SiteCollectionDocuments/rfa/publications/nat_nac.pdf.

17 ANZECC - Australian and New Zealand Environment and Conservation Council; MCFFA - Ministerial Council on Forestry, Fisheries and Aquaculture.

18 Plant senescence refers to the processes of aging in plants. For the purposes of this assessment, 'senescence' refers to the old and dying stages of eucalypts.

Figure 4: Example attributes of 'ecologically mature' forest, including senescent trees (left and bottom right) and hollow (top right)

Figure 5: Examples of disturbance types that would be assessed when determining whether disturbance is negligible, including regrowth trees (left), cut stumps (top right) and weeds (bottom right)

1.4 Areas mapped as old growth are strongly protected

The program to reassess existing old growth mapping would not have resulted in any genuine old growth forest being harvested.

Areas currently mapped as old growth are strongly protected through a range of mechanisms:

- Most areas mapped as old growth are declared as **Special Management Zones (SMZ) under the *Forestry Act 2012*.** These zones aim to protect areas of special conservation values in state forests and prohibit forestry operations. Old growth in flora reserves are also declared under the *Forestry Act 2012*.
- The **Coastal IFOA** prohibits forestry operations in areas mapped as old growth forest**,** as they are listed as 'category 2 environmentally significant areas'.[19]
- FCNSW's **FMZ system**[20,21] prohibits forestry operations in FMZ 1, 2 and 3A and limits forestry operations in FMZ 3B. Areas mapped as old growth in coastal state forests are primarily in FMZ 2 and 3A, with smaller areas also in FMZ 1 and 3B.
- The **State Heritage Register** legally protects areas mapped as old growth under the HCVOG layer in the upper north east region as a heritage item under the *Heritage Act 1977*.

Given these protections, it would require parliamentary approval to revoke the old growth status of most areas currently mapped as old growth, or ministerial approval in a small number of cases (for example, in FMZ 3B). Any decision to revoke protections under the above mechanisms would require a strong evidence base, supported by scientific processes, independent expert review and field validation, in line with the draft framework outlines in this report.

If this framework were to be adopted, the process to reassess areas currently mapped as old growth would only be undertaken once a wood supply shortfall had been verified. If a wood supply shortfall were to be verified, reassessment would be limited to the area required to address this shortfall. Reassessment of areas would be limited to the region where the shortfall exists or within regions that are a commercially viable distance for transporting the timber to market. The program would also have allowed for newly identified areas of old growth to be protected by one or more of the mechanisms listed above.

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19 Old growth is referred to as HCVOG under the Coastal IFOA. This includes the HCVOG areas mapped as part of the Comprehensive Regional Assessments (CRAs) in the 1990s in addition to areas of candidate old growth forest that were protected through the 'icons' decision in 2003.

20 The FMZ system is based on nationally agreed reserve system criteria (Commonwealth of Australia (1997) *Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia*, a report by JANIS) and includes protected areas that contribute to the comprehensive, adequate and representative (CAR) reserve system for forests. Report available at: http://www.agriculture.gov.au/SiteCollectionDocuments/rfa/publications/nat_nac.pdf

21 FCNSW (1999) *Managing our forests sustainably: Forest Management Zoning in NSW state forests*. Operational Circular 99/10. Available at: http://www.forestrycorporation.com.au/__data/assets/pdf_file/0003/438402/managing-our-forests-sustainably-forest-mgt-zoning-in-nsw-state-forests.pdf.

2 Draft framework overview

As part of the old growth reassessment program, the Commission (in collaboration with the EES Science Division) developed a draft Old Growth Reassessment Framework. This chapter outlines the draft framework, including:

- its purpose and key design principles
- the four assessment methods and decision making rules that underpin it
- how the framework would be used to reassess and protect currently unmapped old growth, and to reassess and rezone incorrectly mapped old growth
- how the framework would ensure special environmental or conservation values are protected
- how the framework meets existing state and national commitments to protect old growth
- how the framework has been tested and verified
- how stakeholders would be informed and involved.

Note: Old Growth Reassessment Program suspended
The framework contained in this report will not be applied

2.1 The framework's purpose and design principles

Noting the Old Growth Reassessment program has now been suspended, the draft framework was designed to be used for two purposes:

1 **To reassess areas of native forest that *are not* currently protected as old growth**, and protect them if they are found to be old growth (**Section 2.3**).

2 **If a wood supply shortfall was verified, to reassess limited areas of native forest that *are* currently protected as old growth**, and potentially recommend that they be rezoned to allow harvesting only if:
   - the area was not genuine old growth, and
   - the area did not contain special environmental or conservation values (**Section 2.4**).

The framework was designed within the available time, resources and budget to meet the following design principles:

- a two-way approach to maintain the twin commitments
- evidence-based
- scientifically credible
- transparent
- independent
- targeted.

Box 1 provides more detail on these principles.

Box 1: Framework principles

- **A two-way approach to maintain the twin commitments:** The framework is designed to ensure both wood supply and environmental commitments are met. In addition to identifying areas for potential remapping, the framework allows for areas of old growth that are not currently mapped to be nominated for protection.
- **Evidence-based:** The framework ensures the collection of best-available information to inform decision making. A site nominated for reassessment cannot proceed along the reassessment pathway without sufficient evidence. At the end of the pathway, any decision to rezone an area currently protected as old growth must be based on strict criteria and evidence collected under the whole framework.
- **Scientifically credible:** The framework's four assessment methods are based on the latest scientific methods and technologies, as well as field verification. These methods will be applied by suitably qualified agency staff and reviewed by external experts where required.
- **Transparent:** Information about all methods, nominations, reassessments and decisions will be publicly reported online. The key terms in this information will be clearly defined, and any assumptions made will be clearly stated. In some cases, there will also be opportunities for public comment.
- **Independent:** The Commission will independently oversee the program, including reviewing nominations and wood supply assessments. The wood supply assessments will also be reviewed by independent experts.
- **Targeted:** Only a limited number of currently protected areas will be reassessed. If there is a verified wood supply shortfall, only the minimum area required to address it may be rezoned. To best use the available resources, reassessments will be focussed on priority areas required to meet the twin commitments.

2.2 Assessment methods and decision making rules that underpin the framework

The framework is underpinned by four assessment methods, which used the latest scientific approaches and technologies, and field verification. The framework also includes a set of decision making rules to ensure that decision makers consider the evidence collected by these methods and understand any implications for the twin commitments.

Noting the program has been suspended and the framework will not be applied, the methods and decision making rules are summarised below, and discussed in more detail in the chapters that follow:

1 **Wood Supply Shortfall Verification Method (Chapter 3):** A wood supply shortfall must be verified using this method before any nomination or reassessment of sites that ***are*** mapped as old growth can occur. The method is based on best-available information and processes. It includes both a strategic-scale assessment using modelling from FCNSW's Forest Resource and Management Evaluation System (FRAMES) and a tactical-scale field assessment. The assessment uses modelled wood supply, as using actual wood supply data does not provide sufficient information to make accurate and timely decisions. The findings of the assessment will be independently reviewed by experts, and the modelling will be released for public comment during the assessment.

2 **Site Selection Method (Chapter 4)**: Sites would be nominated for reassessment using the two-way process outlined above. For a site that ***is*** currently mapped as old growth to be selected for reassessment, it would need to meet nine criteria primarily designed to protect environmental values. For a site that is ***not*** currently mapped as old growth to be selected for reassessment, it would need to meet eight criteria designed to ensure reassessment is targeted to legitimate and eligible sites. The method is designed to be fair and impartial, transparent, cost-effective, targeted to priority sites and safe for field workers. The number of nominations assessed, sites selected for reassessment and the priority order in which selected sites would be assessed would be linked to their strategic importance and the available resources and timeframes.

3 **Old Growth Reassessment Method (Chapter 5):** Selected sites would be assessed using this method to determine whether they meet the well-accepted definition of old growth set out in **Section 1.3** above. The method uses the best-available mapping technologies, as well as field verification. All areas (either the whole or part of a site) found to meet the definition of old growth and the minimum area requirements would remain or be protected and thus could never be harvested.

4 **Special Environmental and Conservation Values Assessment Method (Chapter 6):** This method would be used to assess areas currently mapped as old growth that are found ***not*** to be old growth to determine whether they have special environment or conservation values that mean they should retain their protected status, despite not being old growth. The method uses best-available methods to test forest structural and functional condition and potential habitat for a suite of forest-dependent threatened fauna species. It also assesses whether the area has Aboriginal cultural values and non-Aboriginal heritage. All areas found to be of special value would remain protected and thus could never be harvested.

5 **Decision Making Rules (Chapter 7):** The Commission would not have been responsible for making any rezoning decisions. Instead, we would provide advice to the NSW Government on areas that could be rezoned based on the outcomes of the framework, guided by the decision rules. The NSW Government would then need to consider this advice and any implications for the twin commitments. Where an area currently mapped as old growth is found not to be old growth nor have special environmental or conservation value, decision makers would need to transparently demonstrate that eight decision rules are met in order to decide to rezone that area to allow harvesting. All decisions to rezone would also be subject to approval by the NSW Parliament. Where an area that is not currently mapped as old growth is found to be old growth, decision makers would need to consider three decision rules do determine whether a general management area in state forests should be rezoned to protect old growth values.

2.3 How the framework would have protected unmapped old growth

In line with its two purposes, the framework has two alternative pathways to reassess native forest for old growth. **Figure 6** shows the first of these pathways, which would be used to reassess and potentially protect areas that are not currently mapped as old growth.

Given the Commission's 2018 confirmation that existing old growth mapping has inaccuracies, all sites included in FCNSW's three-year harvest plan (2020 – 2022[22]) would have been

[22] Provided the program is adopted and implemented in 2020.

automatically assessed for unmapped old growth following this pathway. Any area found to be old growth would have been protected in line with the appropriate FMZ implemented by FCNSW. Areas of native forest not currently mapped as old growth that are nominated by stakeholders would also be reassessed using this pathway.

This part of the framework was only looking to identify unmapped old growth on coastal state forests, not other environmental values. As such, the Special Environmental and Conservation Values Assessment Method is not undertaken for these sites. As this part of the framework is not associated with addressing a wood supply shortfall, this pathway would not have required a wood supply shortfall to be verified in order to proceed.

The three broad stages of this part of the framework would have been independently implemented by the Commission and the EES Science Division over three years. These stages are:

1 **Site Selection Method (Chapter 4):** Members of the public, organisations and NSW agencies could nominate areas of native forest that are not currently protected as old growth if they have evidence that the area could meet the nationally agreed definition of old growth.[23] Nominations would be made through an online or postal form. The Commission would assess whether nominations meet eight criteria designed to ensure reassessment is targeted to legitimate and eligible sites. Vexatious nominations would not be assessed. If an area meets all the criteria it would be selected for reassessment and progress to the next stage.[24]

2 **Old Growth Reassessment Method (Chapter 5):** The EES Science Division would undertake a desktop and field assessment to determine if the selected site contains old growth. First, it would assess forest structure using LiDAR[25] analysis and then use Aerial Photographic Interpretation (API) to refine this assessment and assess indicators of disturbance. If required, this assessment would be verified using a standard field assessment method. Finally, both desktop and field data would be used to determine the forest's ecological maturity and level of disturbance, and whether this meets the definition of old growth. If the site meets the definition of old growth and the minimum area requirements, it would be found to be old growth and proceed to the next stage.

3 **Decision Making Rules (Chapter 7):** The Commission would provide advice to the NSW Government on areas that could be rezoned to protect unmapped old growth based on the outcomes of the framework. Any areas of unmapped old growth will be immediately included in a temporary harvesting exclusion zone. If the NSW Government decides to rezone a site to protect old growth, the site would be rezoned to FMZ 1, 2 or 3A under FCNSW's forest management zoning system. Protecting new areas of old growth could result in an increase in the wood supply shortfall if the nominated area is currently available for harvesting (i.e. where other mapped harvesting exclusions such as steep slopes do not apply). All changes to wood supply as a result of this part of the framework will be assessed, verified and made publicly available.

23 Ecologically mature forest where the effects of disturbance are now negligible.

24 As noted in **Section 2.2**, the Commission would prioritise the selected areas for reassessment, and the number of nominations assessed and sites selected for reassessment would be linked to the available resources.

25 LiDAR stands for Light Detection and Ranging and is a remote sensing method that uses light in the form of a pulsed laser to measure ranges (variable distances) to the Earth.

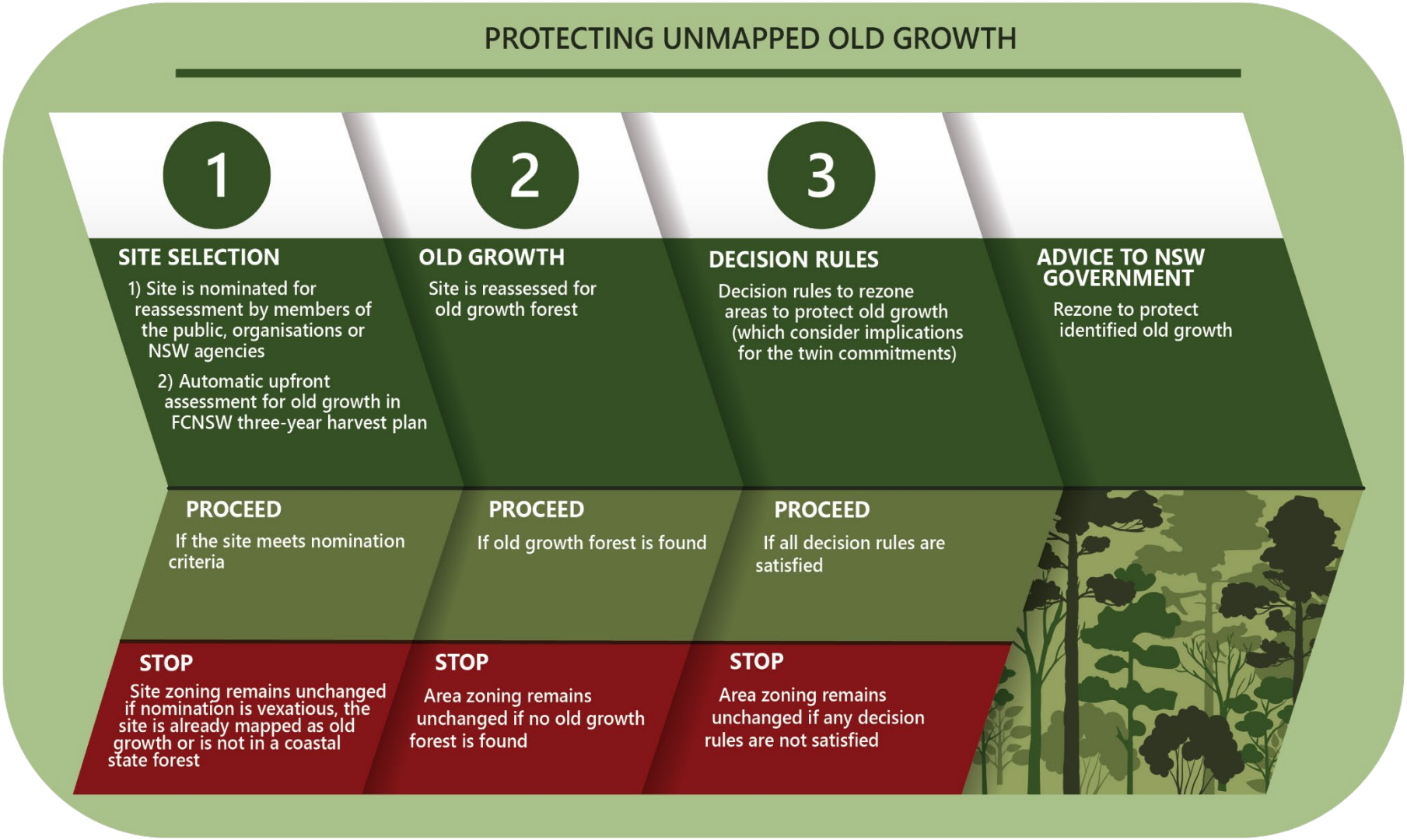


Figure 6: Overview of the part of the framework to reassess areas to protect old growth

2.4 How the framework would have reassessed currently mapped old growth

The framework's second pathway would have been used to reassess and potentially rezone areas of native forest that are currently mapped as old growth, and that were nominated by FCNSW or industry members for reassessment. **Figure 7** provides an overview of this pathway. This pathway has five stages and would also have been implemented by the Commission and the EES Science Division over three years.

Importantly, reassessment could not have occurred until the wood supply shortfall assessment had been verified and had found a wood supply shortfall.

The stages of the framework relative to this pathway are:

1 **Wood Supply Shortfall Verification Method (Chapter 3):** This first stage of the pathway ensures that no reassessment of currently mapped old growth can occur until a wood supply shortfall is assessed and verified. FCNSW would undertake a wood supply assessment to test if a there is a shortfall arising from the new settings in the Coastal IFOA. This assessment would consider the range of FCNSW wood supply sources, including updated yields for all hardwood plantations managed by FCNSW. This assessment would be independently reviewed, and the public would be invited to comment on it. Following this, the wood supply assessment would be revised and finalised. The Commission would then determine if a wood supply shortfall has been verified.

2 **Site Selection Method (Chapter 4):** If a wood supply shortfall is verified, FCNSW and industry members could nominate areas of protected old growth to be reassessed if they have evidence that the area is not old growth forest. The number of nominations assessed and recommended for rezoning would be linked to available resources and the wood supply shortfall that is verified. The Commission would assess whether nominations meet nine criteria that primarily ensure environmental values are protected. The Commission would then prioritise successful nominations for old growth reassessment. All nominations and the results of the Commission's review would be reported on the Commission's webpage.

3 **Old Growth Reassessment Method (Chapter 5):** The EES Science Division would undertake a desktop and field assessment to determine if the selected site contains old growth. First, it would assess forest structure (a key measure of old growth) using LiDAR analysis. Then it would refine this assessment, and identify disturbance, using API. If required, this assessment would also be verified using a standard field assessment method. Finally, both desktop and field data would be used to determine the forest's ecological maturity and level of disturbance, and whether this meet the definition of old growth. If the site meets the definition of old growth, it would remain protected. If the site does not meet this definition, it would proceed to the next stage.

4 **Special Environmental and Conservation Values Assessment Method (Chapter 6):** At the same time as it undertakes the old growth field assessment, the ESS Science Division would collect field data on the site's ecological function and condition, in line with certain components of the NSW Biodiversity Assessment Methodology (BAM). If the site is found not to be old growth, it would evaluate this data, together with modelled data on potential habitat for key threatened species, to determine if the site contains special environmental value. Aboriginal and non-Aboriginal cultural heritage values would also

be identified through register checks and field assessment. If the site is found to have special values, it would remain protected. If not, it would proceed to the next stage.

5 **Decision Making Rules (Chapter 7):** The Commission would provide advice to the NSW Government on areas currently mapped as old growth that could be rezoned for harvesting to meet wood supply shortfalls based on the outcomes of the framework. The NSW Government would then need to consider this advice and any implications for the twin commitments. If the NSW Government decide to rezone a site currently protected as old growth, current protections would need to be revoked by the NSW Parliament. If the site is listed on the State Heritage Register, it will also need to be considered by the Heritage Council of NSW and Minister responsible for the *Heritage Act 1977* prior to having protections revoked by Parliament.

2.4.1 How the framework would have protected environmental or conservation values

Figure 7 shows that there are a number of points at which the process must stop based on the findings of the framework methods. These points were included to ensure that old growth and special environmental or conservation values remain protected and environmental commitments are maintained. They also ensure that reassessment and remapping only occurs when and where it is required to meet the twin commitments. At these points, the process would not proceed and the area would maintain its protected status.

To ensure environmental values and commitments are protected, sites that met any of the following criteria would have been excluded from further reassessment or rezoning and maintained their protection:

- Areas with genuine old growth.
- Areas that contain outstanding examples of forest ecosystems, areas of unique or uncommon biological values and localities or habitats of key threatened and sensitive fauna and flora (identified through the Special Environmental and Conservation Values Method).
- Flora reserves.
- Protected areas required to maintain JANIS reserve targets.
- Any sites that would reduce the remaining area of protected old growth below a patch size of 5 hectares.
- Forest ecosystems at the edge of their mapped geographic range or that are otherwise isolated or unique.
- Known high-value Aboriginal cultural areas not compatible with forestry operations.
- Areas with registered sites or places of Aboriginal or non-Aboriginal heritage or that are found to have sites of very high historical, Aboriginal or non-Aboriginal cultural heritage as part of the Special Environmental and Conservation Values Method.
- Areas with other mapped exclusions under the Coastal IFOA.

Further, all compartments included in FCNSW's three-year harvest plan would have been automatically reassessed upfront for any unmapped old growth, which would have been protected through a harvesting exclusion if found.

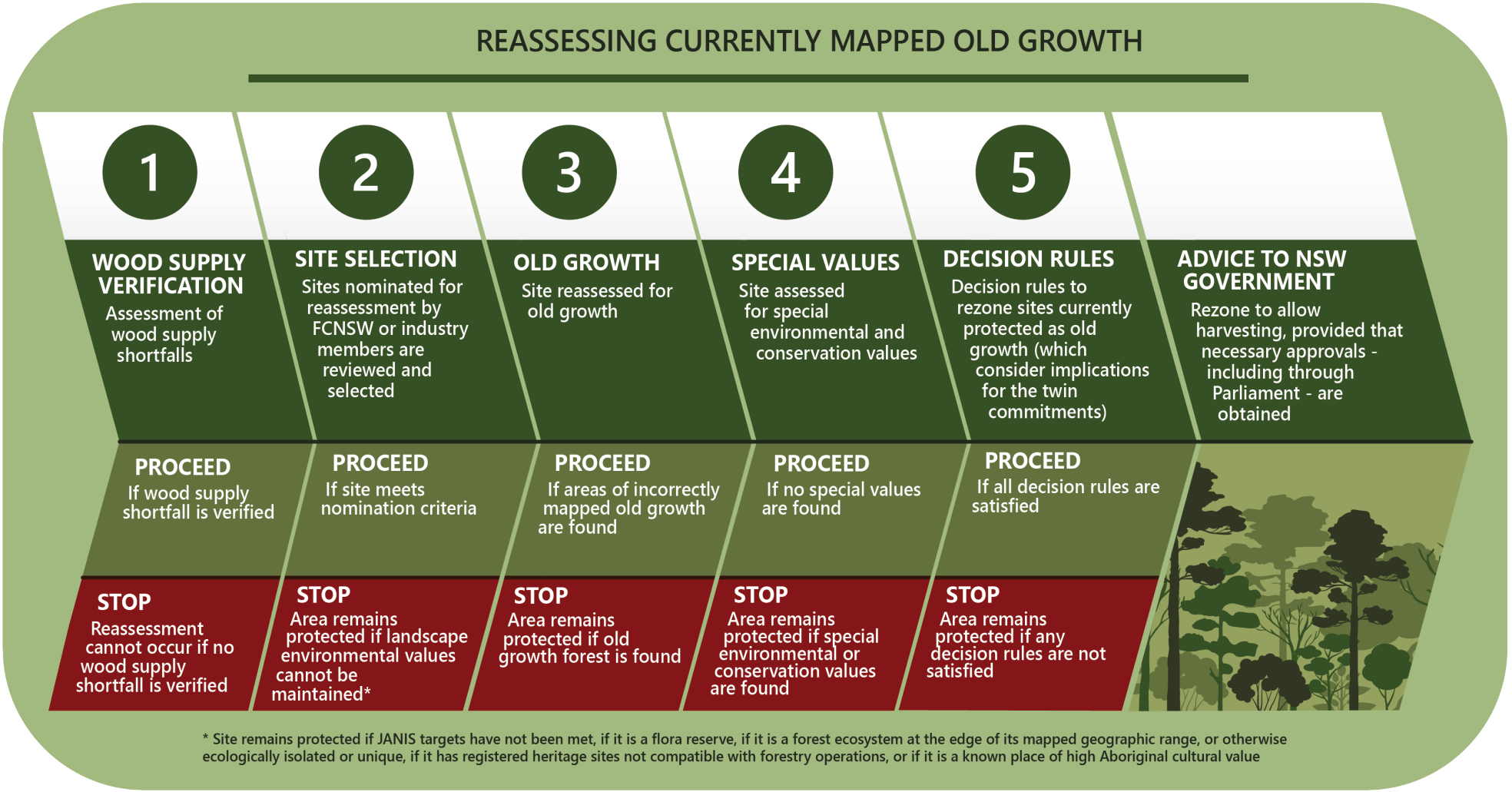


Figure 7: Overview of the part of the framework to reassess areas currently mapped as old growth

2.4.2 How the framework meets existing state and national commitments to protect old growth

The area of forest that could be reassessed cannot be determined until the wood supply shortfall is verified.

The framework ensures that only the minimum area required to balance the twin commitments would potentially be reassessed and only if a wood supply shortfall was verified. Only coastal state forest areas that have met JANIS targets could have been reassessed.

As part of the Site Selection Method we developed a draft approach to assess JANIS targets and determine over-target areas. **Attachment 4.2** in **Chapter 4** provides a detailed overview of the proposed method.

The JANIS targets that were included in the draft approach are:

- 100 percent rare or depleted old growth forest ecosystems
- 60 percent of all other old growth forest ecosystems based on the extent at time of assessment (i.e. candidate old growth forest determined in the 1990s)
- 100 percent of all rare or endangered forest ecosystems
- 100 percent of all vulnerable forest ecosystems (note the target is for 60 percent protection)
- 15 percent of the pre-1750 extent of forest ecosystems.

2.5 How the framework has been verified

The framework was developed by highly qualified scientists and agency staff. We sought independent expert opinion and verification for core framework components and field tested the methods where required.

We sought advice on the framework from a panel of scientists with expertise in the fields of forest and landscape ecology, environmental and disturbance impact assessment, and forest growth modelling and yield projection. The expert panel members are:

- Professor Jerry Vanclay, Director, Forest Research Centre and the former Head of School of Environment, Science and Engineering, Southern Cross University
- Associate Professor Philip Gibbons, Fenner School of Environment and Society, Australian National University
- Associate Professor Craig Nitschke, Senior Research Fellow, School of Ecosystem and Forest Sciences, University of Melbourne.

All five methods under the framework have been developed and/or independently reviewed by agency and external experts.

In 2018, the Commission piloted an early working version of a potential approach to reassess old growth mapping.[26] This was a rapid 'proof of concept' pilot, as there was a limited timeframe available for the review. This framework has used the verification approaches

[26] Natural Resources Commission (2018) *Supplementary advice on the Coastal Integrated Forestry Operations Approval Remake - Old Growth Forests and Rainforests - North Coast State Forests*. Available at: https://www.nrc.nsw.gov.au/ifoa.

described above, as well as community feedback on our previous advice, to develop the framework proposed in this report.

If this framework were to be applied in the future, it would first need to be released for public consultation, revised in light of stakeholder feedback and then approved by the NSW Government to be implemented.

Table 2 provides an overview of how the proposed methods in this report have been improved from the methods piloted in the Commission's 2018 advice.

Table 2: Improvements and comparison between the pilot approach and current framework

Method used in pilot or recommendations from previous advice[27]	Methods proposed for the Old Growth Reassessment Framework
Overarching	
Rainforest and old growth mapping was included in the reassessment.	Only old growth mapping is included in the reassessment.
Recommended NSW Government clarify any legal implications associated with potentially revoking or amending zones for old growth, including state heritage listing.	The method states that an Act of Parliament would be required to revoke or amend zones for most protected old growth, including addressing any *Heritage Act 1977* requirements, if relevant.
Recommended implementing a framework to ensure transparency and accountability.	The framework is developed with transparency and accountability at its core, including independent reviews, public register of nominations and assessment outcomes, public exhibition, and annual reporting to the NSW Government on the implications for the twin commitments.
Wood Supply Shortfall Verification Method	
Recommended remapping and rezoning would only occur in targeted locations linked to a verified wood supply shortfall.	Remapping and rezoning of currently protected old growth would only occur in targeted locations linked to a verified wood supply shortfall. Sites will only be assessed if they are nominated from within the shortfall region or within a region that is a commercially viable distance for transporting the timber to market.
FCNSW estimated the wood supply shortfall from the Coastal IFOA settings. The Commission recommended that the wood supply shortfall be verified if a framework is developed.	FCNSW will estimate the wood supply shortfall using a rigorous multiscale approach applying all settings in the Coastal IFOA. The assessment will be independently reviewed, publicly released and the findings and public submissions used to inform finalising the wood supply assessment.
Old Growth Reassessment Method	
Applied PNF old growth assessment protocol. ▪ Applied JANIS definition for old growth '*ecologically mature forest where the effects of disturbance are now negligible.*' ▪ API used to assess forest stand structural maturity - growth stages (regrowth, mature	Proposes a new approach building from CRAFTI approaches, and considers the latest remote sensing data and analysis techniques: ▪ Applies JANIS definition for old growth '*ecologically mature forest where the effects of disturbance are now negligible.*'

27 *Ibid.*

Method used in pilot or recommendations from previous advice[27]	Methods proposed for the Old Growth Reassessment Framework
or senescing) determined by assessing crown form characteristics of individual trees, groups of trees and the forest stand. ▪ Applied two CRAFTI crown form codes[28] used to determine an ecologically mature forest - includes crown forms exhibiting characteristics associated with tA and tB only (that is, less than 10 percent regrowth, and either more than 30 percent or 10–30 percent senescence). ▪ Field validation of each growth stage required by sampling a minimum of 10 points with a 50 metre spacing along a straight line transect, sampling a 30 metre radius at each point. ▪ API also used to look for disturbance indicators. ▪ Field assessment of disturbance was measured at each of the 10 sampling points along each transect. The presence of disturbance indicators did not have to be associated with evidence of canopy structural impact at that site (for example a stump does not have to have an overhead canopy gap or regrowth trees in association with it). ▪ At least 50 percent of sampled sites needed to show disturbance for the site to be considered disturbed.	▪ LiDAR used to assess forest stand structural maturity and assigned to one of three Growth Stage Units (GSUs), which indicate forest structural maturity (with GSU 1 being the highest level of maturity and GSU 3 having the lowest). ▪ API used to refine LiDAR analysis of forest growth stage and identify any areas of obvious disturbance. ▪ Applies four CRAFTI crown form codes used to determine an ecologically mature forest - includes crown forms exhibiting characteristics associated with tA, tB, tC, which are forests with low levels of regrowth and sA, which are forests with a high proportion of senescence. ▪ Field validation of each growth stage required. Five sampling points are used along 300 metre transects within each of the GSU mapped within the site. The number of sampling points within each GSU will depend on its area. Sampling points are 30 metre radial plots that are quartered (point-centred quarter plot) in order to accurately assess the cover of senescing, mature and regrowth eucalypts. Uses a point-to-plant approach. ▪ Field assessment of disturbance measured at each sampling point. Disturbance indicators must be associated with evidence of canopy structural impact (for example, a stump must be associated with two regrowth trees and a canopy gap). ▪ At least 40 percent of sampled sites must show disturbance for the site to be considered disturbed. ▪ Disturbance indicators are consistent with the CRAFTI disturbance indicators.
Recommended reducing the minimum area of old growth that can be protected (from 5 to 2 hectares).	Method has reduced the minimum area of old growth that can be protected from 5 to 2 hectares for unmapped old growth. Method requires that for areas currently mapped as old growth, any reduction in size cannot allow the residual area of genuine old growth to drop below 5 hectares.
Recommended that LiDAR be used in a future framework.	Method applies LiDAR.
Special Environmental and Conservation Values Assessment Method	
Pilot study did not include an assessment of special environmental and conservation values but recommended that these should be addressed if a framework were to be developed.	Includes field sampling for ecological structure and function based on the NSW BAM and applies Comprehensive Regional Assessment (CRA) fauna distribution modelled outputs that have been weighted for uniqueness of the area (i.e. a weighted endemism approach).

28 Crown form codes are a measure of forest structural maturity based on the proportion of senescing, mature and regrowth trees.

Method used in pilot or recommendations from previous advice[27]	Methods proposed for the Old Growth Reassessment Framework
Recommended that this method will only be applied in instances where currently mapped old growth is found not to contain old growth.	Only applies this method in instances where mapped old growth is found not to contain old growth.
Site Selection Method	
Applies JANIS targets for old growth only (i.e. 60 percent of assessed area of old growth at time of assessment to be protected and 100 percent of rare or depleted old growth forest ecosystems).	Also applies JANIS targets for biodiversity (15 percent of pre-1750 extent of forest ecosystem protected, and 100 percent of rare, vulnerable and endangered forest ecosystems protected).
Recommended capping annual nominations under each nomination pathway at 10-20 per year.	Does not cap annual nominations but includes a prioritisation process based on priority additions to the Comprehensive, Adequate and Representative (CAR) reserve system, available resources, and those nominations that best meet addressing the twin commitments.
Recommended a two-way approach to site selection: ▪ a process to nominate any areas that are currently not mapped as old growth forest ▪ a process to nominate incorrectly mapped old growth forest.	Includes a two-way approach to site selection as recommended and also includes an upfront assessment of the FCNSW three-year plan of harvesting operations to minimise risks that unmapped old growth could be harvested and to avoid delays to harvesting operations.
Decision Making Rules	
Recommended maintaining environmental commitments (for example, JANIS old growth targets).	Maintains environmental commitments, including JANIS old growth and biodiversity targets.
Recommended that the NSW Government would need to ensure that environmental impacts are managed, and that environmental values are maintained at a site and regional scale, and over time.	Methods consider site and regional environmental values, environmental commitments and the role of the Coastal IFOA in managing and maintaining environmental values in areas where harvesting operations are permitted.
Recommended that the Commission assess the implications for the twin commitments.	Provides a method to consider the implications for the twin commitments using the results of the assessment.

2.5.1 Testing field methods

In the Commission's previous advice on old growth mapping, we (alongside the former Office of Environment and Heritage) developed and tested a pilot method to reassess old growth that was based on the field assessment component of the PNF protocols. This was because the PNF protocols were the only field assessment method available at the time and it was not possible to develop a new field method in the time provided for the review.

As part of this review, the EES Science Division (with oversight by the Commission and with independent expert advice) was able to develop and test new field methods for the old growth and special values assessments that are better suited to framework requirements. **Table 2** above provides an overview of how the proposed field methods have been improved from the methods piloted in the Commission's previous advice.

Alongside the EES Science Division, we field tested these new methods in 12 North Coast forest compartments that were assessed in the Commission's 2018 advice on old growth mapping.[29,30] As noted in our 2018 advice, the compartments that were field tested were nominated by FCNSW and the Environment Protection Authority (EPA). As such, the results of field testing represent a small, unrepresentative sample of all state forest compartments in north-east NSW, and contain several assumptions. Caution should be taken when considering the results of field testing due to bias in the sampling.

Field testing only assessed the Old Growth Reassessment Method and the assessment of special environmental values under the Special Environmental and Conservation Values Method. The results of this testing do not include processes that would occur under other methods in the framework, including the Wood Supply Verification and Site Selection methods.

Field testing involved assessing forest structure and disturbance levels as well as conducting the special environmental values assessment field component.

Table 3 at the end of this chapter gives an overview of the results of the 2018 pilot study and 2019 field testing.

Field testing of the Old Growth Reassessment Method assessed an area of 2,061 hectares, including 875 hectares of forest currently mapped as old growth.

Attachment 2.1 provides the maps produced by the field testing assessments. Mapped harvesting exclusions, such as rainforest or TECs, are not shown on these maps. These areas are not available for harvesting operations. The maps show areas that could not have their old growth status verified as they were inaccessible (labelled as 'requires further assessment'). As per the framework, these areas retain their current status and would be excluded from harvesting until they can be reassessed on a case-by-case basis.

Field testing found that:

- A total of 2,061 hectares were assessed across eleven compartments in the NSW North Coast.
- The testing area included 875 hectares of currently mapped old growth. Of the 875 hectares, 270 hectares (31 percent) would remain protected under the framework:
  - 39 hectares would retain its current old growth status
  - 199 hectares that was found not to be old growth was found to hold special environmental and conservation values and would be protected under the framework
  - 32 hectares that could not be accessed would require further assessment under the framework.

[29] Natural Resources Commission (2018) *Supplementary advice on the Coastal Integrated Forestry Operations Approval Remake - Old Growth Forests and Rainforests - North Coast State Forests*. Available at: https://www.nrc.nsw.gov.au/ifoa.

[30] The compartments assessed were Clouds Creek (124 and 167), Dalmorton (406), Ewingar (637), Girard (52), Irishman (205), Kangaroo River (234), Kippara (18), Lower Bucca (600), Nambucca (620 and 621) and Wild Cattle Creek (115). Note: The results for the Irishman State Forest compartment were removed from the final results, as the area was largely inaccessible and an inadequate number of plots were conducted. As such, results could not be used as part of the development of the method and thresholds.

- Outside of currently mapped old growth, 134 hectares of forest was found to be old growth and could be protected. An additional 42 hectares that could not be accessed would require further assessment under the framework.
- 605 hectares (69 percent) of currently mapped old growth were found to be neither old growth nor hold special environmental value. Under the framework, these areas may be eligible for rezoning, subject to any verified wood supply shortfall, requirements to maintain reservation targets and any other exclusions associated with the Coastal IFOA.

The 2018 pilot study assessed 15 compartments in North Coast state forests. The pilot method differed from the current field testing as it only field assessed areas of currently mapped old growth and only used API to determine mapping boundaries. The pilot study found that:

- Across compartments demonstrating a decrease in mapped old growth[31], there was a total decrease in mapped old growth of 819 hectares (of 934 hectares of currently mapped old growth, 115 hectares was assessed to be old growth).
- Across compartments demonstrating an increase in old growth[32], there was a total increase in mapped old growth of 37 hectares (bringing the 67 hectares of existing mapped old growth to a total of 104 hectares).
- Across all compartments assessed, there was an overall decrease in mapped old growth of 782 hectares, or 78 percent.

While there are several changes from the 2018 pilot study (as outlined in **Table 2** above), the primary cause of the difference between the 2018 pilot results and the 2019 field testing is the assessment of special environmental values in the 2019 field testing.

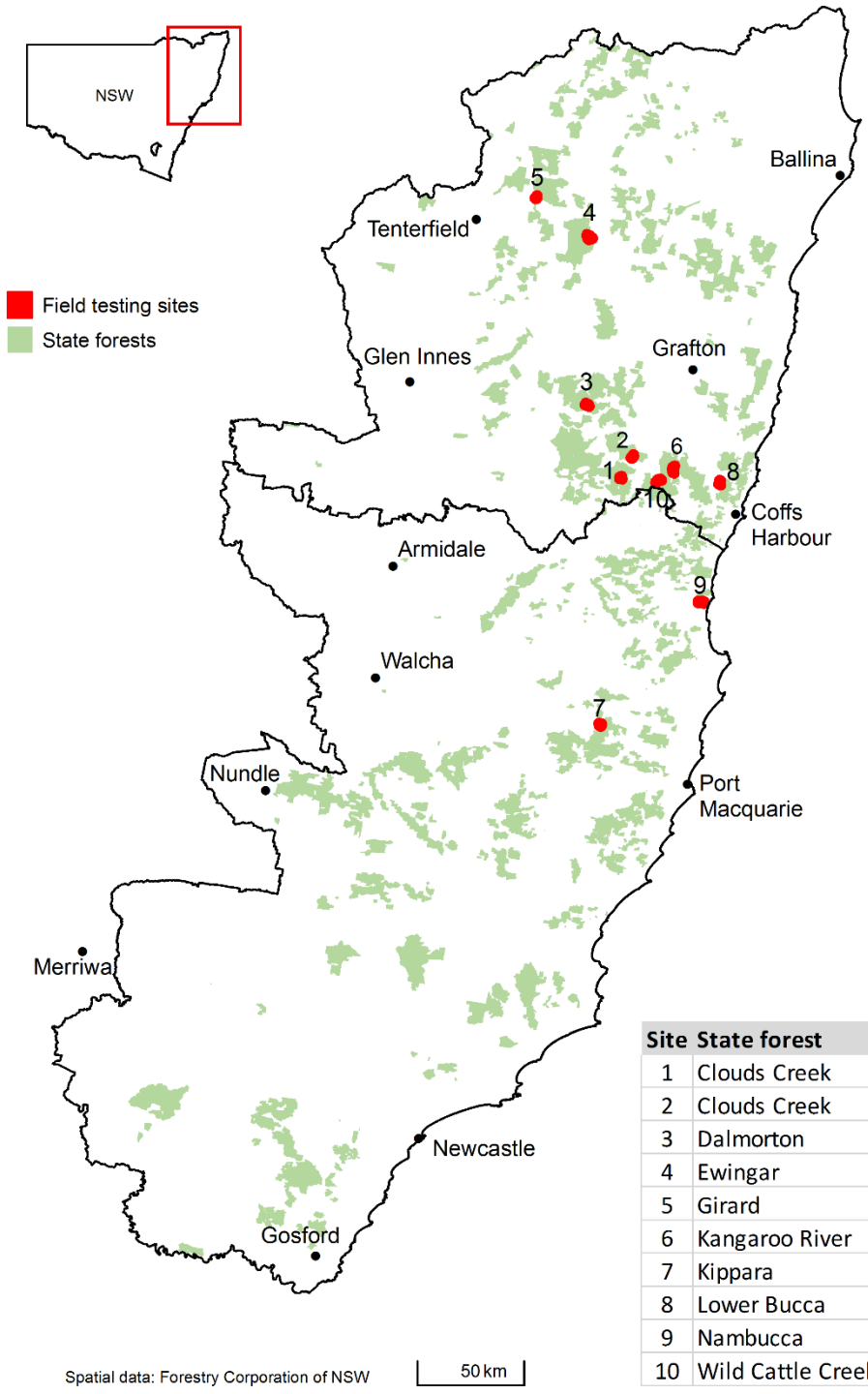
31 Bellangry (11), Clouds Creek (124), Clouds Creek (167), Dalmorton (406), Ewingar (635, 637), Lower Bucca (600), Mistake (341), Nambucca (320, 321) and Wild Cattle Creek (515).

32 Girard (52), Irishman (205), Kangaroo River (234), Kippara (18).

Table 3: Overview of the results of the 2018 pilot study and 2019 field testing

State Forest	Compartment number	Area of compartment (ha)	Area of protected old growth (ha)	2018 pilot remapping retained old growth (ha)	2019 field testing retained old growth (ha)	2019 field testing new old growth (ha)	2019 special environmental values (ha)	2019 field testing total old growth and special environmental values (ha)	2019 field testing requires further consideration	2018 pilot remapping reservation change (ha)	2019 field testing net reservation change (ha)
	Sites demonstrating a decrease in protected old growth										
Clouds Creek	124	149	91	12	0	0	79	85	**8**	**-79**	**-6**
Clouds Creek	167	132	102	0	29	5	68	102	**0**	**-102**	**0**
Dalmorton	406	186	75	56	0	0	0	3	**39**	**-53**	**-36**
Ewingar	637	363	234	47	0	0	0	24	**25**	**-187**	**-210**
Lower Bucca	600	184	86	0	0	0	0	0	**0**	**-86**	**-86**
Nambucca	320 & 321	296	130	0	0	0	0	0	**0**	**-130**	**-130**
Wild Cattle Creek	515	246	112	0	1	0	52	54	**3**	**-112**	**-65**
Total aggregated		**1,556**	**830**	**115**	**30**	**5**	**199**	**268**	**75**	**-749**	**-533**
	Sites demonstrating an increase in protected old growth										
Girard	52	109	0	7	0	44	0	44	**0**	**+7**	**+44**
Kangaroo River	234	214	7	20	0	19	0	19	**0**	**+13**	**+13**
Kippara	18	182	38	44	9	66	0	75	**0**	**+6**	**+37**
Total aggregated		**505**	**45**	**71**	**9**	**129**	**0**	**138**	**0**	**+26**	**+94**
Total for all sites		**2,061**	**875**	**186**	**105**	**134**	**199**	**406**	**75**	**-723**	**-471**

Attachment 2.1 – Old growth assessment maps from field testing



Site	State forest	Cpt
1	Clouds Creek	124
2	Clouds Creek	167
3	Dalmorton	406
4	Ewingar	637
5	Girard	52
6	Kangaroo River	234
7	Kippara	18
8	Lower Bucca	600
9	Nambucca	320, 321
10	Wild Cattle Creek	515

3 Wood Supply Verification Method

- This stage of the framework addresses the component of the terms of reference that asks the Commission to:

Develop a method to verify any change in wood supply arising from state forests arising from implementing the settings in the new Coastal IFOA

- This method defines wood supply as:

The volume, species and grade of native forest high quality logs (large and small) that can be economically and sustainably supplied to the forestry industry from a given region over the short to medium term, while maintaining forest landscape values (as reflected in ecologically sustainable forest management principles under the RFAs) over the medium to long term.

- This method has been developed to determine if native forest wood supply from state forests will be impacted by implementing the new Coastal IFOA.
- The method will be used when FCNSW identifies regions or sub-regions where they consider wood supply will be reduced by the Coastal IFOA, and advises the Commission in writing.
- The method must be applied, and a verified wood supply shortfall must be determined to exist, before any areas currently mapped as old growth can be reassessed under the framework.
- The method contains five steps (**Figure 8**):
  - **Step 1:** Baseline wood supply assessment to determine the wood supply before the Coastal IFOA.
  - **Step 2:** Projected wood supply assessment to determine the wood supply after the Coastal IFOA is implemented.
  - **Step 3:** Independent review and public exhibition of wood supply assessment.
  - **Step 4:** Finalise wood supply assessment.
  - **Step 5:** Commission determines wood supply shortfall.
- **Section 3.1** gives an overview of key steps in this method and the following sections describe each step in more detail.

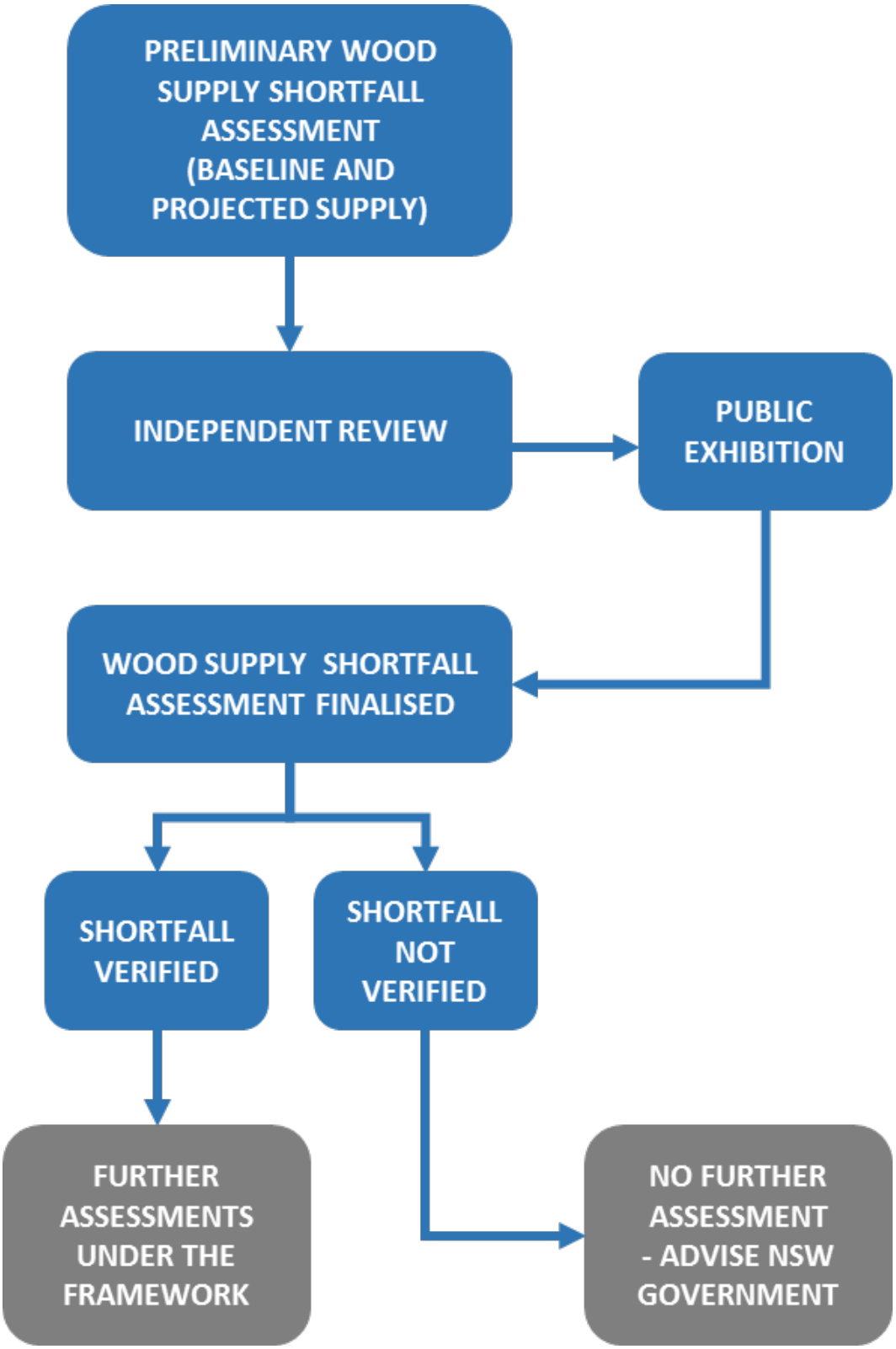


Figure 8: Overview of the Wood Supply Verification Method

A note on using modelled wood supply rather than actual wood supply

- The draft Wood Supply Verification Method uses modelled estimates of wood supply to assess potential changes in wood supply in state forests arising from the implementation of the new Coastal IFOA.
- Some stakeholders have raised concerns about the use of modelled wood supply instead of actual wood supply volumes.
- Using actual wood supply volumes to derive a shortfall is not suitable for the purposes of this framework, particularly given the available timeframes. Developing an adequate evidence base to determine the wood supply before and after the Coastal IFOA is implemented requires several years of data under stable regulatory settings.
- There are limited years of wood supply data before the Coastal IFOA was implemented that could be considered indicative of 'stable' forestry regulation settings. This is due to key events prior to the Coastal IFOA, including the shift to heavy single tree selection in 2007, the Boral buyback in 2014 and the introduction of TEC mapping in 2016.
- If the framework is approved by the NSW Government, the Commission will have three years to reassess old growth mapping. In this time it would not be possible to robustly confirm actual wood supply changes for the following reasons:
  - Although released in November 2018, the new Coastal IFOA settings are being implemented in stages over a 12-month period.
  - The volume of wood harvested in any one year can vary due to weather and market conditions. Under the Coastal IFOA annual harvest volumes are allowed to vary by up to 25 percent from annual limits.
  - In the short to medium term, FCNSW can reschedule and bring forward harvesting operations to meet contractual obligations, effectively masking short-term wood supply impacts by shifting them to medium- or longer-term impacts.
- **Figure 9 and Figure 10** illustrates the variability over time in annual high quality log production volumes from the North Coast and South Coast areas in the Coastal IFOA.
- Relying on actual wood supply data would result in delays in identifying and addressing wood supply shortfalls, which could result in harvesting above sustainable levels to meet short-term wood supply obligations. This could compromise sustainability and forest values (including environmental and productivity values) in the medium to long term.

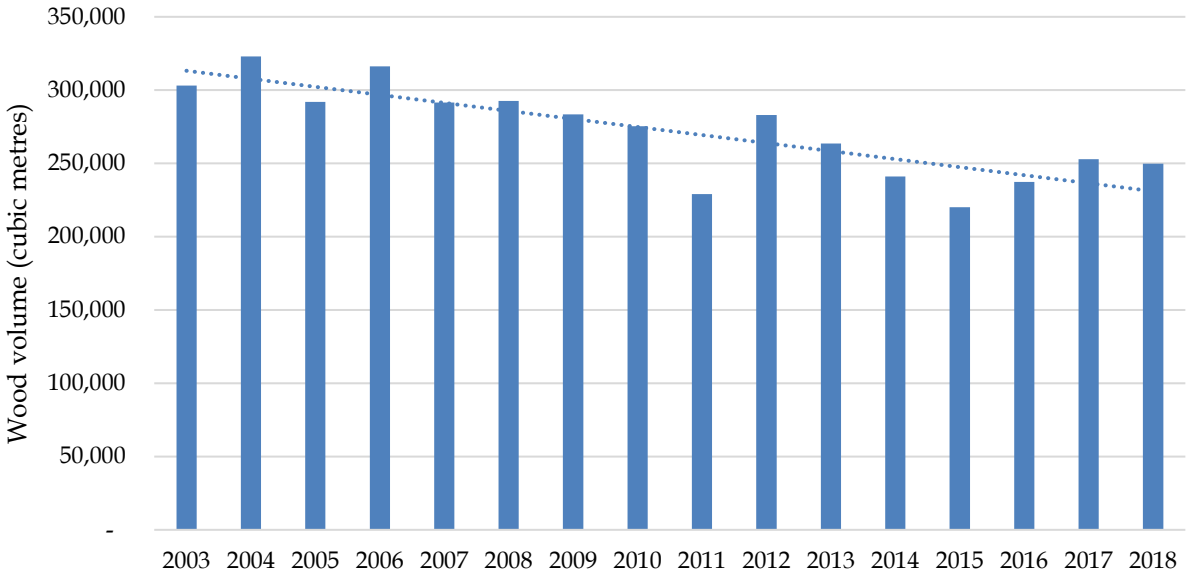


Figure 9: High-quality log production in North Coast wood supply zones (native forest and hardwood plantation)[33]

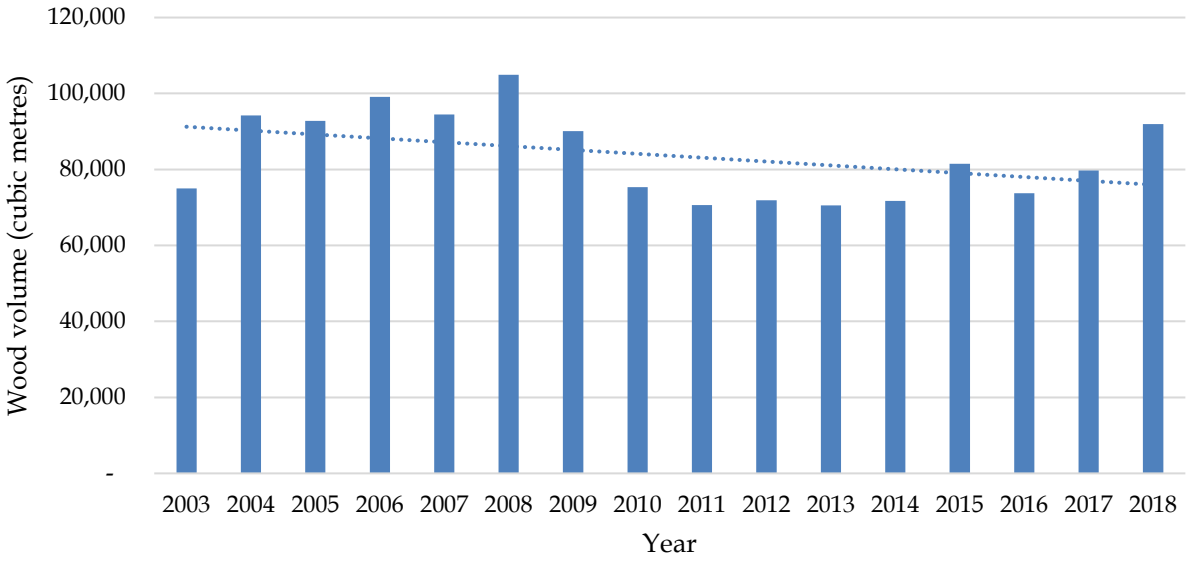


Figure 10: High-quality log production in South Coast wood supply zones (native forest)[34]

33 Data supplied by FCNSW.
34 Data supplied by FCNSW.

3.1 Overview of key steps

Step	Overview
Step 1: **Baseline wood supply assessment to determine the wood supply before the Coastal IFOA**	▪ FCNSW prepares a preliminary baseline wood supply assessment to determine wood supply under the previous IFOAs. ▪ This is assessed using two techniques: – **Strategic modelling** conducted at the regional scale using FRAMES. This is used to quantify wood supply under previous IFOA settings at the regional and sub-regional scales, such as price or supply zones. – **Tactical planning** conducted on a multi-year plan of harvesting operations that represents the compartments that would have been selected for harvesting under previous IFOA settings and the first four or five years of yield data (wood volumes) from the baseline supply model. This will provide field validation of the strategic modelling results under previous IFOA settings at the Local Landscape Area and compartment scale. ▪ Baseline supply modelling parameters will be revised if yield estimates are not realised in the tactical planning assessment.
Step 2: **Projected wood supply assessment to determine the wood supply after the Coastal IFOA is implemented**	▪ FCNSW prepares a preliminary baseline wood supply assessment to determine wood supply under the Coastal IFOA. ▪ This assessment uses the same techniques as **Step 1**, noting that the compartments selected for the tactical planning assessment do not change: – FRAMES strategic modelling is used to quantify wood supply under new settings in the Coastal IFOA at the regional and sub-regional scales. – Tactical planning will test the impacts of new settings at the Local Landscape Area and compartment scales. ▪ Together, the baseline and projected wood supply assessments will be used by FCNSW to demonstrate if a wood supply shortfall exists (i.e. is there is a reduction in wood supply following the implementation of the Coastal IFOA). The FRAMES outputs from the two modelling scenarios (baseline and projected supply) are used to quantify the impacts arising from the new settings in the Coastal IFOA.
Step 3: **Independent review and public exhibition of wood supply assessment**	▪ FCNSW submits the preliminary wood supply shortfall assessment to the Commission. ▪ The Commission oversees an external independent review of FCNSW's preliminary wood supply shortfall assessment. ▪ FCNSW's assessment and a report by the independent reviewer will be released for public comment.
Step 4: **Finalise wood supply assessment**	▪ The Commission collates and considers the recommendations of the independent review and feedback from public submissions. ▪ The Commission prepares directions for FCNSW to finalise the wood supply assessment. ▪ FCNSW finalises and submits wood supply shortfall assessment to the Commission.

Step	Overview
Step 5: **Commission determines wood supply shortfall**	▪ The Commission determines whether a wood supply shortfall has been verified and advise the NSW Government on the implications for the twin commitments.

3.2 Step 1: Baseline wood supply assessment

- Under this step, FCNSW will prepare a baseline assessment of the native forest wood supply (by species and grade, supply zone and price zone, and average distance between harvest and supply nodes) that could have been sustainably supplied (based on FRAMES estimate of yields) prior to the remake of the Coastal IFOA to maintain Wood Supply Agreements.
- This assessment has two components:
  - Strategic modelling using FRAMES
  - Tactical planning at the compartment level.
- FRAMES is a strategic wood supply model that simulates future timber harvesting, growth and regeneration in native forest at a regional scale. It is used by FCNSW to estimate timber yields (harvest volumes) and provides the basis for volume allocations to industry at the strategic level. FRAMES was developed in the 1990s to support the establishment of the RFAs for NSW and has been periodically updated and reviewed since its inception.[35]
- The strategic modelling using FRAMES provides information on long-term wood supply at the regional scale. Tactical planning provides estimates of wood supply within compartments and price zones, which are the scales at which wood supply impacts are likely to occur.
- Tactical planning is used to test and refine the wood supply or yield estimates from FRAMES. The yield estimates from FRAMES must align with the tactical planning yield volumes over the same four- to five-year time period. If they do not align, the modelling parameters in FRAMES will be adjusted and refined so that the modelled yield aligns with the tactical planning yield.
- **Table 4** provides detail on the tasks involved in the preparation of the baseline wood supply assessment. The key tasks are:
  - **Task 1.1:** FCNSW prepare baseline supply strategic model with pre-Coastal IFOA settings
  - **Task 1.2:** FCNSW produce schedule of modelled baseline wood supply
  - **Task 1.3:** FCNSW test whether baseline strategic model shows no erosion of growing stock over long term
  - **Task 1.4:** FCNSW conduct sensitivity analysis of key inputs affecting yields and use results to inform a field verification sampling plan for tactical planning
  - **Task 1.5:** FCNSW select harvesting compartments for tactical planning
  - **Task 1.6:** FCNSW estimate harvest volumes for the tactical planning compartments
  - **Task 1.7:** FCNSW reconcile harvest volumes from tactical planning with baseline supply strategic modelling outputs and revise modelling parameters if required.

35 Forestry Corporation of NSW (2016) *Forest Resource and Management Evaluation System (FRAMES) A Report on its Development and Implementation to 30 June 2016.* Available at: http://www.forestrycorporation.com.au/__data/assets/pdf_file/0016/702007/frames-development-and-implementation.pdf

Table 4: Key tasks for assessing baseline wood supply

Task	Description
Task 1.1: FCNSW prepare baseline supply strategic model with pre-Coastal IFOA settings	▪ FCNSW prepare baseline supply strategic model with pre-Coastal IFOA settings with the following parameters: **Primary parameters (for baseline and projected wood supply assessments)** – **Primary modelling objective:** maximise high-quality log production across the region to reflect FCNSW's management intent within its charter for ecological sustainable forest management of state forest areas. – **Industry supply commitments:** As reflected in current Wood Supply Agreements. – **Latest remote sensing data:** LiDAR for predicting the location of steep terrain and drainage features, as well as inventory estimates and other yield estimates. – **Current inventory data:** native forests and plantation forests, noting that all hardwood plantation areas must be included with up-to-date inventory. **Baseline-specific parameters (for baseline wood supply assessment only)** – Previous IFOA settings only, noting that 2016 TEC mapping should not be included. – Current net mapped area without 2016 TEC mapping exclusions.[36] – Current net harvest area modifiers[37]. – Strike rate modifiers[38] that have not been adjusted for either the 2016 TEC mapping or koala protections, or any other new settings in the Coastal IFOA. ▪ These primary parameters will use the most up-to-date data available to provide more accurate information. Keeping these parameters constant will establish a consistent approach for both modelling scenarios. ▪ In this method, the volume of hardwood plantation log yields is applied consistently in both modelling scenarios to recognise the plantation resource is important to meet supply commitments but is not the resource regulated by Coastal IFOA settings.

36 Net mapped area is calculated by reducing the gross area of compartments by removing mapped, non-harvestable features including: Coastal IFOA mapped exclusions including filter strips and wetlands, rainforest, protected old growth forest (or high conservation value old growth forest), riparian buffers, wetlands, heaths and rocky outcrops, steep slopes, and mapped species-specific habitat; and FCNSW exclusions for non-commercial forest, including physically and economically inaccessible areas.

37 Modifiers used by FCNSW in its strategic modelling to account for unmapped drainage lines and buffers, steep areas and inaccessible areas.

38 Strike rate modifiers are used by FCNSW in its strategic modelling and tactical assessments to account for a percentage reduction in harvestable area arising from the impact of unmapped Threatened Species Licence conditions and derived from the outcomes of threatened species surveys in recently completed pre-harvest planning.

Task	Description
	▪ **Attachment 3.1** outlines the key principles reflected in these primary parameters, and their application to the primary modelling objective, constraints and goals.
Task 1.2: FCNSW produce schedule of modelled baseline wood supply	▪ Run baseline supply strategic model to prepare a wood supply schedule of available volumes of high quality logs by: – Log grade and size (high-quality large (HQL)[39] and high-quality small (HQS)[40]) – species or species grouping – supply zone and price zone – average distance to supply nodes[41] – period, over 100 years. ▪ Relevant species and species groupings are provided in **Section 3.2.1**.
Task 1.3: FCNSW test whether the baseline strategic model shows an erosion of growing stock over long term	▪ Review the profile of native forest growing stock by species/species grouping and log grade (HQL and HQS), and by period to check growing stock is not diminished over time: – check growing stock around the mid-point and the end of the strategic assessment timeframe (i.e. approximately 50 years and 100 years respectively) is not less than the stock at the first modelled period – check growing stock does not decline markedly in any modelling period,[42] as a rapid change in growing stock (e.g. >10 percent in that period) could suggest an impact on the productive capacity of the forest and therefore an impact on sustainability.[43]

39 Logs meeting FCNSW's log specifications for HQL, including a centre diameter under bark of ≥40 centimetres, estimated as equivalent to ≥35 centimetres small end diameter under bark.

40 Logs meeting FCNSW's log specifications for HQS, including a small end diameter under bark of ≥25 centimetres.

41 To enable strategic level modelling of delivered log costs and financial impacts, FCNSW has identified a set of centralised supply nodes across its regions. These supply nodes represent the centralised location of industry demand for FCNSW log products within and across the regions. Supply nodes enable the strategic level modelling to calculate an average haulage distance for logs directed to those nodes, with implications for harvesting and haulage costs. Changes in the average haulage distance to supply nodes can reflect impacts on wood supply.

42 Depending on the model setup, FRAMES has between 20 to 25 modelling periods - each of either a four or five year duration - over the 100 year modelling horizon.

43 Relevant supporting references:

- Australian Forestry Standard Ltd (2013) *Australian Standard AS4708–2013: Sustainable Forest Management - Economic, social, environmental and cultural criteria and requirements*. Yarralumla, ACT.
- Ferguson, I. (2013) Assessing sustainability in certification schemes, *Australian Forestry*, 76:3-4, 183-193, DOI: 10.1080/00049158.2013.848509.
- Forestry Tasmania (2014) *Sustainable high-quality eucalypt sawlog supply from Tasmania's Permanent Timber Production Zone Land*. Review No. 4, March 2014, Hobart, Tasmania.

Task	Description
	▪ If these tests provide reasonable assurance that FCNSW's strategic wood flow modelling is based on ecologically sustainable forest management applied over a long-term horizon (100 years) (i.e. the two checks above are satisfied), proceed to **Task 1.4**. ▪ If these tests do not provide reasonable assurance, revert to **Task 1.1**, to review and reset the primary parameters in the strategic modelling, to ensure it incorporates objectives and constraints that maintain growing stock (by species and log grade), over the long term (100 years).
Task 1.4: FCNSW conduct sensitivity analysis of key inputs affecting yields	▪ Test inputs and assumptions affecting yield and determine which have the highest risk of impacting yield estimates. ▪ Use results of sensitivity analysis to inform the field sampling plan to be prepared under **Task 1.6**.
Task 1.5: FCNSW select harvesting compartments for tactical planning	▪ Extract yield data for the first FRAMES modelling period (for example, 2020-2024), to inform tactical planning. ▪ Operational settings in the IFOA influence where in the landscape FCNSW selects compartments for harvesting: – The compartments that FCNSW would select for harvesting under the previous IFOA settings will change, in whole or in part, if FCNSW were to select compartments for harvesting under Coastal IFOA settings. Some compartments may be selected under both IFOA settings, but there are some compartments that would only be selected for harvesting under previous or new settings. – To test the impact of new Coastal IFOA settings at the compartment scale, FCNSW will select compartments to create a hypothetical multi-year plan of harvesting operations considering only the previous IFOA settings. The same compartments will be used to estimate the forest areas and volumes that could be harvested under the previous IFOA settings and also under Coastal IFOA settings. ▪ FCNSW identify the forest compartments for the next four to five years that would have been harvested if previous IFOA settings were in operation. ▪ This list of compartments forms the plan of operations that will be used for the tactical planning assessment under this method. ▪ Note that potential harvest volumes for the forest compartments selected must be aligned with the yield estimate from FRAMES for the first modelling period of the baseline supply strategic model, i.e. the first four to five years output (refer **Task 1.7**).
Task 1.6: FCNSW estimate harvest volumes for all compartments in	▪ Prepare pre-harvest yield estimates to capture data on potential harvest volumes of high-quality logs by species by log grade (HQL and HQS) using:

Task	Description
the plan of operations	– current LiDAR, strategic inventory and plot imputation data[44] (i.e. the same data as used for the primary parameters under the baseline supply strategic model) – current strike rate modifier, which has not been adjusted for new settings in the Coastal IFOA – only previous IFOA settings. ▪ Conduct field assessments for a representative sample of compartments in the plan of operations, based on a sampling approach developed by a qualified and independent biometrician, using tactical planners and ecological expertise as required, to validate pre-harvest yield estimates and desktop mapping of harvest exclusion areas. ▪ Note that under **Step 3** of this method, FCNSW will be required to submit the following documentation to the Commission for independent review and public exhibition: – The list of compartments selected for the plan of operations. – The pre-harvest yield estimates under previous IFOA settings for all compartments in the plan of operations. – The sampling plan prepared by the biometrician. – The compartments and associated data from field assessments conducted to validate the pre-harvest estimates. – Maps showing the results of the field assessments.
Task 1.7: FCNSW reconcile harvest volumes from tactical planning with baseline supply strategic modelling outputs and revise modelling parameters if required	▪ Calculate the potential native forest harvest volumes, by species and log grade (HQL and HQS), for each compartment in the plan of operations. ▪ Sum the potential native forest harvest volumes and calculate the wood supply expected under the plan of operations, by species and log grade, at supply zone and price zone level, with average log delivery distances to supply nodes. ▪ Compare potential harvest volumes from the plan of operations with the FRAMES baseline supply strategic model yields from **Task 1.2**; specifically, compare the total volume of high-quality logs (by species and log grade) in the plan to the total volume of high quality logs, (by species and log grade) from the FRAMES output for the same supply zones and price zones. The values should approximately align (i.e. within 15 percent in any one year over the four-year period, or within 5 percent for the total of the four- or five-year period). ▪ If the wood supply volumes for the four- to five-year period are not aligned, revise the baseline supply strategic model to ensure alignment.

[44] FCNSW uses LiDAR-based plot imputation assessments in FRAMES to provide more spatially-explicit information to enhance yield estimates and support tactical and operational planning. Source: FCNSW (2016) *Forest Resource and Management Evaluation System (FRAMES) - A Report on its Development and Implementation to 30 June 2016*.

3.2.1 Key hardwood species and species groupings for wood supply

- The following tables list the key species and species groupings used in this method.[45]

Table 5: Species and groupings in the Upper North East and Lower North East regions

#	Species or grouping	Species in groupings
1	Blackbutt	Blackbutt (*Eucalyptus pilularis*).
2	Spotted gum	Spotted gum (*Corymbia maculata*).
3	Big 3 Hardwoods	Blue gum (*E. saligna*), tallowwood (*E. microcorys)* and brush box (*Lophostemon confertus*).
4	New England Hardwoods	High quality log species that occur in association in tablelands forests across northern NSW, including New England blackbutt (*E. campanulata*), messmate (*E. obliqua*), ribbon gum (*E. nobilis*), brown barrel (*E. fastigata*), peppermints (e.g. *E. radiata* and *E. dives*) and various stringybark species (e.g. *E. laveopinea* and *E. cameronii*).
5	Other Hardwoods	All other species not covered in the previous groups.

Table 6: Species and groupings in the Southern region

#	Species or grouping	Species in groupings
1	Spotted gum	Spotted gum (*C. maculata).*
2	Alpine ash	Alpine ash (*E. delegatensis*).
3	Brown barrel	Brown barrel (*E. fastigata*).
4	Other hardwoods	Includes blackbutt (*E. pilularis*), bluegum (*E. saligna*) and the ironbark (e.g. *E. fibrosa* and *E. crebra)* and stringybark species groups (e.g. *E. laveopinea* and *E. cameronii*), which typically make up remaining minor components.

Table 7: Species and groupings in the Eden region

#	Species or grouping	Species in groupings
1	Silvertop ash	Silvertop ash (*E. sieberi*).
2	Brown barrel	Brown barrel (*E. fastigata*).
3	Other hardwoods	Includes stringybark/gum forest types (e.g. *E. muellerana* and *E. cypellocarpa* amongst others) in the coastal and foothills forests, which typically make up remaining minor components.

[45] NSW Department of Primary Industries (2018) *Sustainable Yield in New South Wales Regional Forest Agreement regions*. Available at: https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0004/842098/sustainable-yield-in-NSW-RFA-regions.pdf.

3.3 Step 2: Projected wood supply assessment

- Under this step, FCNSW prepares a preliminary projected wood supply assessment, which provides the estimated volume (by species and grade, supply zone and price zone and average distance to supply nodes) that can be sustainably supplied under the new settings in the Coastal IFOA.
- This assessment has two components:
  - Strategic modelling using FRAMES.
  - Tactical planning at the compartment level.
- The strategic modelling under this step will be conducted using FRAMES, over the same 100-year period, incorporating the same primary parameters and hardwood plantation yield volumes used for the baseline supply strategic model.
- **Table 8** shows the tasks involved in the preparation of the baseline wood supply assessment. The key tasks are:
  - **Task 2.1:** FCNSW prepare projected supply strategic model with Coastal IFOA settings.
  - **Task 2.2:** FCNSW produce schedule of modelled projected wood supply.
  - **Task 2.3:** FCNSW test whether the projected supply strategic model shows no erosion of growing stock over the long term.
  - **Task 2.4:** FCNSW test robustness of yield estimates to assumptions underpinning FRAMES inputs or parameters through sensitivity analysis.
  - **Task 2.5:** FCNSW assess changes in wood supply between baseline model and projected supply strategic model.
  - **Task 2.6:** FCNSW apply Coastal IFOA settings to the tactical planning compartments.
  - **Task 2.7:** FCNSW calculate wood supply expected under the Coastal IFOA for the compartments in the plan of operations.
  - **Task 2.8:** FCNSW calculate change in wood supply for the tactical planning compartments under previous IFOA and Coastal IFOA settings.
  - **Task 2.9:** FCNSW compare impacts identified in strategic modelling with impacts identified through tactical planning.

Table 8: Key tasks for assessing projected wood supply

Task	Description
Task 2.1: FCNSW prepare projected supply strategic model with Coastal IFOA settings	▪ FCNSW prepare projected supply strategic model with Coastal IFOA settings with the following parameters: **Primary parameters (for baseline and projected wood supply assessments)** – **Primary modelling objective:** maximise high quality log production across the region to reflect FCNSW's management intent within its charter for ecological sustainable forest management of state forest areas. – **Industry supply commitments:** As reflected in current Wood Supply Agreements. – **Latest remote sensing data:** LiDAR for predicting the location of steep terrain and drainage features, as well as inventory estimates and other yield estimates. – **Current inventory data:** native forests and plantation forests, noting that all hardwood plantation areas must be included with up-to-date inventory. **Projected supply-specific parameters (for projected supply wood supply assessment only)** – Revise net harvest area modifier to address all new settings in the Coastal IFOA, including 2016 TEC mapping* – Revise strike rate modifier to address all new settings in the Coastal IFOA – Finalise projected supply strategic model by incorporating any Coastal IFOA-specific parameters arising from the new setting in the Coastal IFOA ▪ Note: all adjustments to modifiers must be based on data derived from implementing the new settings in the Coastal IFOA or substantial field testing. ▪ Any adjustments to modifiers or FRAMES inputs arising from new settings in the Coastal IFOA, including any assumptions related to these adjustments, must be documented and supplied to the Commission for independent review and public exhibition. ***Why is 2016 TEC mapping included in the projected wood supply assessment?** ▪ In the previous IFOAs, the impact of forestry operations on TECs was not covered, as these were not listed when they were signed. The impacts on threatened species were covered by a threatened species licence. During the development of the new Coastal IFOA, the EPA proposed that protection measures for TECs should be included in the threatened species licence to provide another level of general landscape protection. This was accepted and incorporated into the Coastal IFOA. In 2016, the EPA released mapping to improve the recognition, management and regulation of TECs in native forestry areas in NSW. The Coastal IFOA covers TECs and provides mapped harvesting exclusion areas.

Task	Description
Task 2.2: FCNSW produce schedule of modelled projected wood supply	▪ FCNSW run projected supply strategic model to prepare a wood supply schedule of available volumes by: – Log grade and size (HQS and HQL) – species or species groupings (species grouping are provided in **Section 3.2.1**. – supply zone and price zone level – average log delivery distances to supply nodes, by period, over 100 years.
Task 2.3: FCNSW test whether the projected supply strategic model shows no erosion of growing stock over the long term	▪ Review the profile of native forest growing stock by species or species groupings, log grade (HQL and HQS), and period to check growing stock is not diminished over time: – check growing stock around the mid-point and the end of the strategic assessment timeframe (i.e. approximately 50 years and 100 years respectively) is not less than the stock at the first modelled period; and – check growing stock does not decline markedly in any modelling period, as a rapid change in growing stock (for example, less than 10 percent in that period) could suggest an impact on the productive capacity of the forest and therefore an impact on sustainability.[46] ▪ These tests provide an indication that FCNSW's strategic wood flow modelling is based on ecologically sustainable forest management applied over a long-term horizon (100 years). If these tests fail, it indicates that ecologically sustainable forest management may not be realised under the Coastal IFOA settings and wood supply commitments. ▪ If these tests do not provide a reasonable assurance, this could potentially provide supporting evidence for a shortfall arising from settings in the Coastal IFOA.
Task 2.4: FCNSW test robustness of yield estimates to assumptions underpinning FRAMES inputs or	▪ Sensitivity analysis will be used to identify which FRAMES inputs result in uncertainty in the modelled yield estimates. The results may be used to focus further work, including field validation, to improve certainty in inputs and increase the robustness of yield estimates. ▪ Conduct a sensitivity analysis on key assumptions and inputs that have the highest potential to impact modelled wood supply. This should include at a minimum sensitivity analysis of the net harvest area modifier and the strike rate modifier.

[46] Relevant supporting references comprise:
- Australian Forestry Standard Ltd (2013) *Australian Standard AS4708–2013: Sustainable Forest Management - Economic, social, environmental and cultural criteria and requirements*. Yarralumla, ACT.
- Ferguson, I. (2013) Assessing sustainability in certification schemes, *Australian Forestry*, 76:3-4, 183-193, DOI: 10.1080/00049158.2013.848509.
- Forestry Tasmania (2014) *Sustainable high-quality eucalypt sawlog supply from Tasmania's Permanent Timber Production Zone Land*. Review No. 4, March 2014, Hobart, Tasmania.

Task	Description
parameters through sensitivity analysis	▪ Use an appropriate range around the key assumptions (indicatively -5 percent and +5 percent); applied to the projected supply strategic model only ▪ Determine the extent to which the key assumptions have the potential to impact yield generated by the projected supply strategic model ▪ Prepare documentation for the Commission, independent review and public exhibition, which sets out the rationale for the selection of key assumptions that were tested through the sensitivity analysis and the results of the analysis that show the level of sensitivity of modelled wood supply to these assumptions.
Task 2.5: FCNSW assess changes in wood supply between baseline model and projected supply strategic model	▪ Including volumes by species and species groupings, log grade (HQL or HQS), supply zone and price zone, by modelling period, over the longer term (i.e. over 100 years). ▪ Identify price zones where there is an impact on wood supply, as reflected in impacts on volumes, any specific species or species groupings, or log grade (HQL or HQS), or a change in average haulage distance to designated supply nodes. ▪ Consider the extent to which these impacts on modelled wood supply represent a material change for FCNSW or the industry. ▪ Note: under this method, a material change in wood supply includes any change observed in the outputs of the strategic assessment including the species, grade, price zone, and the timing of the impact (i.e. whether the impact is in the near term or longer term).
Task 2.6: FCNSW apply Coastal IFOA settings to the tactical planning compartments	▪ Apply the Coastal IFOA settings to the same compartments used for tactical planning for the baseline wood supply assessment, noting that the Coastal IFOA settings include some new settings and revisions of pre-existing settings under the previous IFOA. ▪ Revise the net mapped area for each compartment in the plan of operations. ▪ Apply a revised strike rate modifier to address all new settings in the Coastal IFOA. ▪ Create maps of each compartment to clearly show any changes from the net mapped area determined under baseline tactical planning. ▪ Conduct field assessments based on a sampling approach that has been developed by an independent qualified biometrician, using tactical planning and ecological expertise as required, to validate the impacts on potential native forest harvest volumes for a representative sample of compartments from the plan of operations. The field assessments will validate impacts on harvest exclusion areas and realisable volumes in the plan of operations (including validation of species and log grades). ▪ FCNSW will be required to submit the following to the Commission for independent review and public exhibition: – The pre-harvest yield estimates under Coastal IFOA settings for all compartments in the plan of operations. – The sampling plan prepared by the biometrician.

Task	Description
	– The compartments and associated data from field assessments conducted to validate the pre-harvest estimates under Coastal IFOA settings. – Maps showing the results of the field assessments under Coastal IFOA settings.
Task 2.7: FCNSW calculate wood supply expected under the Coastal IFOA for the compartments in the plan of operations	▪ Calculate the potential native forest harvest volumes associated with Coastal IFOA settings for each compartment. ▪ Re-sum the potential native forest wood supply by species, grade (HQL and HQS) and average distance to supply nodes for the plan of operations under new Coastal IFOA settings. ▪ Present wood supply expected under the Coastal IFOA for the plan, through a schedule showing the total volume of high quality logs by: – log grade (HQL and HQS) – species or species groupings – supply zone and price zone – average distance to supply nodes.
Task 2.8: FCNSW calculate change in wood supply for compartments in the plan of operations	▪ Compare the harvest volumes expected under the tactical planning, under both the previous- IFOA (baseline) and the Coastal IFOA (projected supply) settings. ▪ Calculate the changes in the forecast wood supply, in absolute and percentage terms, by: – species or species groupings – log grade (HQL and HQS) – supply zone – price zone.
Task 2.9: FCNSW compare impacts identified in strategic modelling with impacts identified through tactical planning	▪ Compare the direction and size of wood supply impacts arising from new settings in the Coastal IFOA determined by the strategic modelling and tactical planning. This comparison should consider: – respective volumes by species and log grade, supply zone and price zone, in the first period of reporting (measured in cubic metres) – average log delivery distances to supply nodes, by species, log grade, supply zone and price zone, in the first period of reporting (measured in kilometres).

3.4 Step 3: Independent review and public exhibition of wood supply assessment

- FCNSW will be required to submit a report and accompanying data on the results of the preliminary wood supply assessment to the Commission.
- The report will include a:
  - summary of the assessments conducted in accordance with this method
  - consolidated set of analyses from the strategic assessment, comprising tabular summaries and graphs of outputs from the baseline model and the projected supply strategic model, including the results of sensitivity analyses
  - consolidated set of analyses from the tactical planning, comprising tabular summaries and graphs of outputs, including the results of field assessments conducted to validate the strategic model at the tactical level
  - set of findings and a detailed description of the claimed shortfall arising
- Accompanying data will include all model output data (i.e. model run outputs), field assessment data, or any other data that constitutes primary data underpinning the wood supply assessment and summaries
- A checklist of documentation that FCNSW is required be submit to the Commission is set out in **Table 9**.
- The Commission will appoint an independent reviewer or a panel of independent experts to review FCNSW's preliminary wood supply shortfall assessment.
- The independent reviewer or panel of experts will have two months to review the assessment and prepare the independent review report.
- The independent review report will determine if the preliminary wood supply shortfall assessment has:
  - been conducted in accordance with the Wood Supply Verification Method
  - complies with current industry good practice for determining wood supply and changes in wood supply
  - adequately and robustly demonstrated changes in wood supply from state forests arising from settings in the Coastal IFOA (changes in wood supply could include changes in volumes, species, log grades or distances between harvest and supply nodes)
  - for the strategic assessment using FRAMES, demonstrated a:
    - shortfall in wood supply within any modelling period between 2020 – 2040; or
    - shortfall in total wood supply over the next 20 years; or
    - longer-term decline in growing stock
  - for the tactical planning, demonstrated alignment in yields with strategic modelling outputs
  - provided a body of evidence in the strategic modelling and tactical planning to support a position that there is or will be a wood supply shortfall within the designated region as a direct result of the Coastal IFOA settings.

- The independent review report will also make recommendations for improvements, if required, in the wood supply shortfall assessment undertaken.
- The Commission will release the independent review report and the preliminary wood supply shortfall assessment for public exhibition for a minimum of four weeks.
- The Commission will then consider the findings of the independent reviewer and public submissions received and:
  - prepare and publicly release a submissions report documenting and summarising the public submissions received
  - provide instructions for FCNSW in how to finalise the wood supply shortfall assessment in the form of a report and publicly release this document.

Table 9: List of information FCNSW is required to supply to the Commission

Step	Information requirements
Baseline strategic assessment	**Task 2:** For the tactical planning – submit to the Commission: ▪ Baseline supply schedule of available volume of high quality logs, by species, supply zone and price zone, average distance to supply nodes, and period, over 100 years. ▪ All model output data constituting primary data for the assessment, including sensitivity analysis.
Establish baseline tactical planning	**Task 5**: For the tactical planning – submit to the Commission: ▪ a complete list of compartments used for tactical planning ▪ biometrician's advice on survey design for field validation ▪ a schedule of harvest plans for the compartments in which field assessments have been conducted to validate the wood supply estimates ▪ a set of maps showing the results of its field assessments, including any adjustments to prepared harvest plans, for consideration under this method.
Build projected strategic assessment	**Task 2:** For the projected strategic assessment – submit to the Commission: ▪ A projected supply schedule of available volume of high quality logs, by species, supply zone and price zone, average distance to supply nodes, and period, over 100 years. ▪ all model output data constituting primary data for the assessment, including sensitivity analysis ▪ documentation of all assumptions, the data they are based on, and the level of confidence (e.g. low, medium or high) in them as predictors, so they can be tested when more extensive Coastal IFOA implementation data becomes available.

Step	Information requirements
Test impact of Coastal IFOA settings at tactical level	**Task 6:** For each compartment used for tactical planning submit: ▪ a schedule of harvest plans for the compartments in which field assessments have been conducted to validate the adjustments to wood supply estimates ▪ a set of maps showing the results of field assessments, including any adjustments to prepared harvest plans, for consideration under this method.
Assess potential impacts using strategic modelling	**Task 9:** Supply to the Commission as Wood Supply Assessment Report, with supporting information comprising a: ▪ consolidated set of analyses from the strategic assessment, comprising tabular summaries and graphs of outputs from the baseline model and the projected supply strategic model, including the results of sensitivity analyses ▪ consolidated set of analyses from tactical planning, comprising tabular summaries and graphs of outputs, , including the results of field assessments conducted to validate the tactical planning harvest volumes under Coastal IFOA settings ▪ detailed description of the potential shortfall arising.

3.5 Step 4: Wood supply shortfall assessment finalised

- FCNSW will revise and finalise the wood supply shortfall assessment as instructed by the Commission and submit the final wood supply assessment report and associated data to the Commission, noting any changes from the preliminary wood supply shortfall assessment results.

3.6 Step 5: Commission verifies wood supply shortfall

- Under this step, Commission will verify if a wood supply shortfall has been demonstrated by considering the finalised wood supply assessment, outcomes of the independent review, and any public submissions received.
- The Commission may choose to engage independent experts to provide further advice on the final wood supply shortfall assessment.
- Following this, the Commission will advise the NSW Government if a wood supply shortfall has been verified, along with implications for the twin commitments.
- The Commission's wood supply shortfall determination will be publicly released.

Attachment 3.1: Key principles for strategic modelling

- The strategic assessment will use FRAMES to assess wood supply within the context of ecologically sustainable forest management principles, considering growing stock and wood flows, at the regional scale, over the long-term. FRAMES inputs require a detailed set of parameters for objectives, constraints and goals, i.e.:
  - *Primary modelling objective* - the basis on which the modelling is optimised.
  - *Constraints* – outcomes that are binding.
  - *Goals* - outcomes that are not binding.
- The key principles to be incorporated in this method are set out below.

Table A3.1.1 Modelling components and key principles for strategic modelling of wood supply

Modelling components	Key principles
Primary modelling objective	▪ Maximise high-quality logs over the longer term (i.e. 100 years).
Key constraints (binding obligations)	*For the term of current Wood Supply Agreements:* ▪ Meet high-quality supply commitments under current wood supply agreements, through to 2023 for most customers and 2028 for some customers. ▪ Meet current wood supply agreements that have species-specific requirements and specific log grade requirements. *Note*: the current wood supply agreements require the production of minimum supply volumes for specific species in some specific regions; for example, blackbutt, spotted gum and the (other) 'Big 3 Hardwoods' in the Upper North East and Lower North East regions. The minimum supply volumes for these key species and species groupings vary across supply zones and modelling periods. Key species and species groupings are provided in **Section 3.2.1**. ▪ Meet low-quality and other log grade supply commitments under current wood supply agreements. *For the period beyond the term of current wood supply agreements:* ▪ After the current wood supply agreements have expired, constraints for the minimum supply volumes for industry are released. However, the model continues to maintain constraints based on the principles of ecologically sustainable forest management and wood supply, including notably: – Maintain high quality wood supply in each of the price zones and supply zones within specified upper and lower thresholds, to maintain supply across the region, and – Set upper limits on wood supply, by species, in the short to medium term, to 'constrain' the model in a way that supports sustainable supply over the longer term.
Key goals (non-binding targets)	▪ Smooth log volumes, by species, over the longer term. ▪ Ensure the growing stock in 50 years and 100 years is not less than current standing stock, i.e. growing stock is generally maintained or increased over a 100-year period.

4 Site Selection Method

- This stage of the framework addresses the component of the terms of reference that asks the Commission to:

Develop a method and process to identify areas in state forests that:

- **are currently mapped as containing old growth forests but may not contain old growth forests**
- **are currently not mapped as containing old growth forests but may contain old growth forests**

- This method contains three steps:
  - **Step 1:** Sites are nominated by industry and the public for old growth mapping reassessment.
  - **Step 2:** The Commission checks nominated sites through a desktop assessment, prioritises the order of nominations that meet nomination criteria and advises EES Science Division on selected sites and the priority order.
  - **Step 3:** Nominations and the outcomes of the Commission's assessments are listed on a public register.
- **Figure 11** and **Section 4.1** give an overview of key steps in this method and the following sections describe each step in more detail.
- This method has been designed to reflect the following principles:

1. **Fair and impartial**: All parties have a simple and accessible means to make nominations. Nominations are not unfairly constrained. Reassessments and remapping occur in a reasonable and timely manner. Nominations are assessed against nomination criteria and approved processes.
2. **Legitimate**: Only legitimate claims would be nominated. Intentionally vexatious nominations waste resources and legitimate business operations and vexatious nominations (and the parties making them) will not be accepted for reassessment.
3. **Transparent**: Nominations, and the subsequent results of any reassessment and remapping, would be reported publicly.
4. **Cost-effective**: The nomination process would use available public resources in an efficient and cost-effective manner by prioritising sites of greatest environmental risk or highest strategic importance.
5. **Safety**: Field testing would not occur at nominated sites where personal safety would be at risk, for example areas with steep slopes.

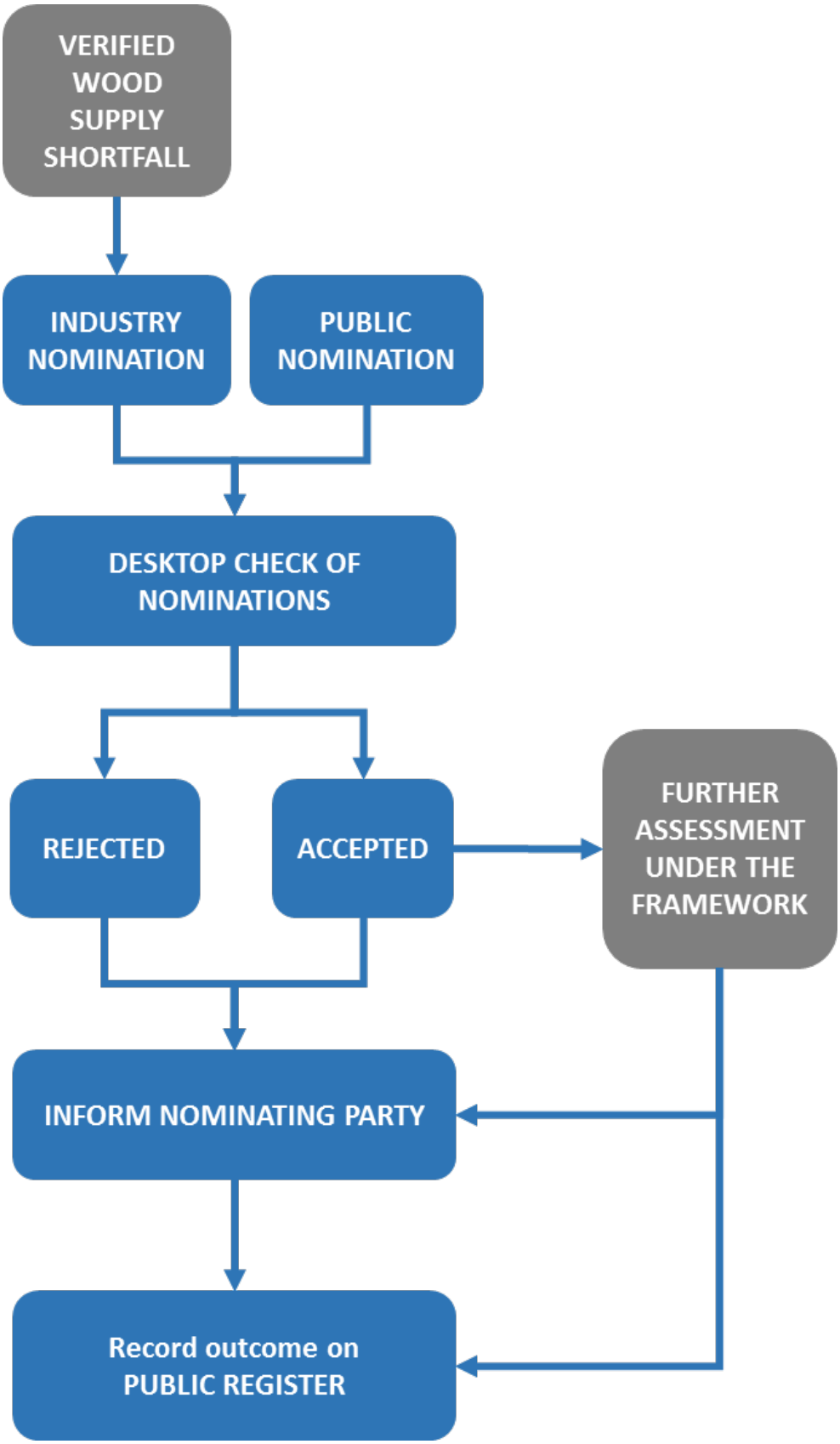


Figure 11: Overview of the Site Selection Method

4.1 Overview of key steps

Step	Overview
Step 1: **Sites are nominated by industry and the public for old growth mapping reassessment**	▪ To manage any risk that unmapped old growth forest could be harvested, areas included in FCNSW's forward three-year plan of harvesting operations will be assessed upfront under the Old Growth Reassessment Method. Sites with a high risk of old growth will be prioritised for assessment six months before scheduled harvesting. ▪ Sites can be nominated in two ways: - **Industry nominations:** FCNSW and industry members can nominate areas of protected old growth to be reassessed if they have evidence that the area is not old growth. - **Public nominations:** members of the public, organisations or NSW agencies can nominate areas of native forest that aren't currently mapped as old growth if they have evidence that the area could be old growth. ▪ Restrictions apply to where parties can make nominations. Nominations can only be made in native forests in state forests in the area covered by the Coastal IFOA (**Figure 12**). Other Crown land and private land will not be considered under the framework. ▪ Guidelines will provide clear information on how to make nominations, and criteria that the nominating parties must be address for each nomination.
Step 2: **The Commission undertakes a desktop assessment of nominations**	▪ The Commission will: - check that each nomination has addressed the relevant nomination criteria - prioritise the order in which nominations that meet the criteria will be scheduled for further assessment by the EES Science Division within available resources - advise the EES Science Division on the nominations accepted for further assessment and the priority order for this assessment. - advise each nominating party on the outcomes of the desktop assessment.
Step 3: **Nominations and the outcomes of the Commission's assessments are listed on a public register**	▪ The public register will be used to: - record all nominations received and the outcomes of each assessment - ensure transparent and timely communication of assessment outcomes.

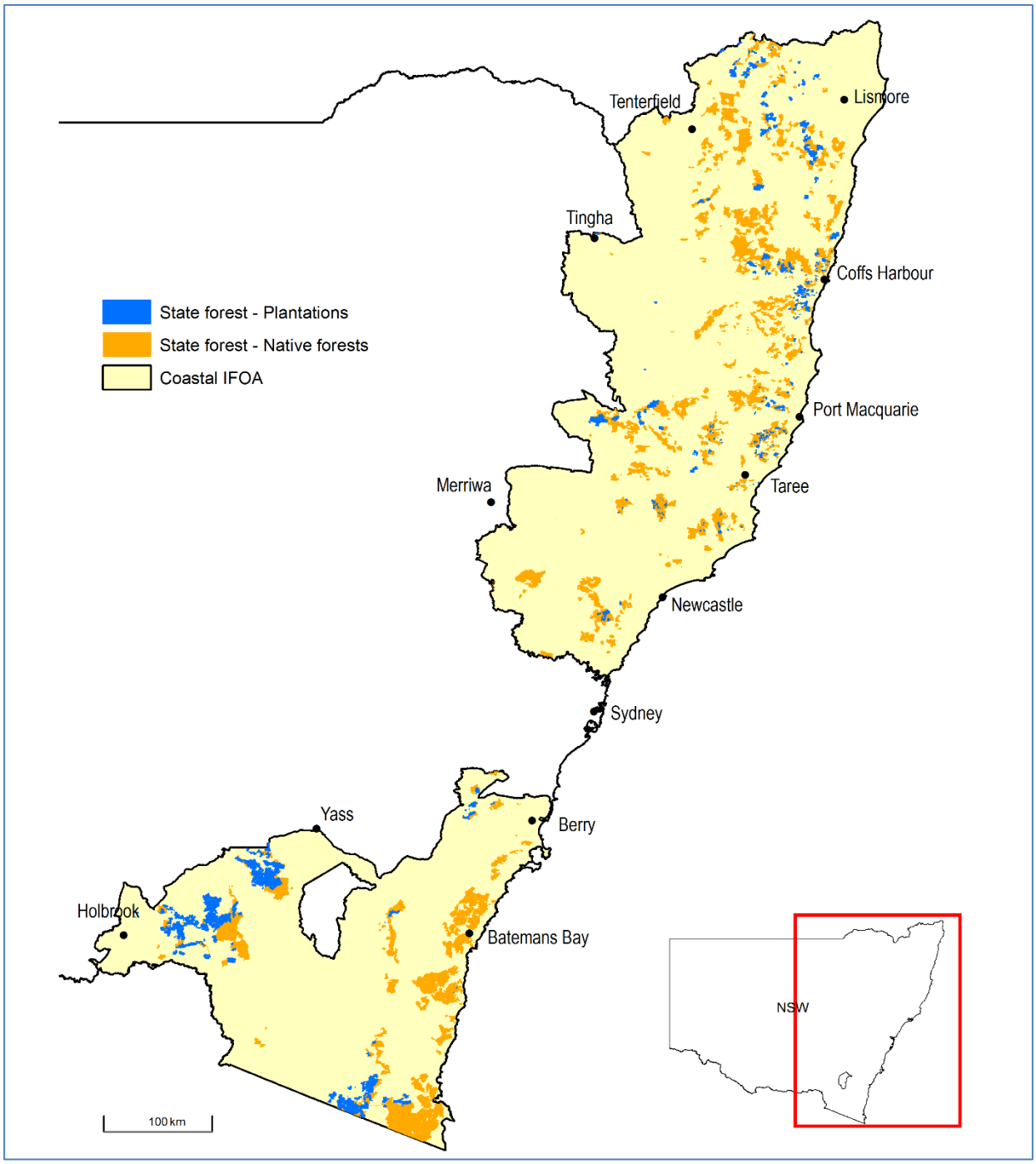


Figure 12: State forests in the Coastal IFOA area

4.2 Step 1: Site nomination

4.2.1 Upfront assessment of three-year harvest plan

- To manage any risk that unmapped old growth forest could be harvested, the EES Science Division will undertake an upfront assessment of FCNSW's forward three-year plan of harvesting operations.
- The assessment will be in accordance with **steps 1** and **2** of the Old Growth Reassessment Method using LiDAR and API.
- This assessment will highlight high-risk areas that require field assessment under **Step 3** of the Old Growth Reassessment Method. High-risk areas are areas of state forest that potentially have mature to over-mature ecological structure that are:
  - located in the general management zone (FMZ 4)
  - not protected by mapped harvesting exclusions under the Coastal IFOA
  - greater than or equal to 2 hectares in size.
- High-risk areas will be prioritised for field assessment at least six months prior to the scheduled harvesting operation.

4.2.2 Industry nomination pathway

- This pathway is open to FCNSW and forestry industry members.
- Under this pathway, FCNSW or industry members can nominate areas currently mapped and protected as old growth to be reassessed if they have clear evidence that the mapped area is **not** old growth, that is, that it does **not** meet the nationally agreed definition of an '*ecologically mature forest where the effects of disturbance are now negligible*.'[47]
- The Commission will accept industry nominations at the following specific times:
  - **FCNSW nominations:** February of each year the project is funded
  - **Industry member nominations:** January and February, and then July and August of each year the project is funded.
- Industry nominations must comply with the nomination criteria in **Table 10**.
- Guidelines on the nomination process will be made available on the Commission's website, including:
  - who can make a nomination
  - how to make a nomination
  - nomination criteria
  - how the nomination will be assessed
  - how the Commission will communicate with the nominating party throughout the assessment process
  - how nominations will be prioritised if more nominations are received than can be assessed in one calendar year.

[47] Commonwealth of Australia (1997) *Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia.* A report by JANIS.

Table 10: Industry nomination criteria

Industry nomination criteria:	
1	Industry nominations can only be made in coastal state forests where the Coastal IFOA operates.
2	Industry nominations cannot be made in certain state forest areas as documented in **Table 11**.
3	Industry nominations can be made in old growth forest ecosystems that have met JANIS targets but only up to the assessable area. The Commission will supply a list of over-target old growth forest ecosystems and the area of these that could be nominated and rezoned while maintaining targets. **Attachment 4.1** provides the proposed approach to update and determine the area of over-target old growth forest ecosystems in coastal state forests.
4	A nominated area must be a contiguous area of forest.
5	An industry nomination cannot reduce the remaining area of protected old growth forest below a patch size of 5 hectares.
6	Industry nominations by industry members (not including FCNSW) must be submitted on the public nomination form (**Attachment 4.2**), which can be submitted via email or mail.
7	For efficiency, FCNSW will submit their nominations for reassessment to the Commission in a database (the nomination database) with an accompanying spatial layer (the nomination spatial layer) and metadata.
8	The FCNSW nomination database must be provided in Excel format and for each nominated area provide: 8.1 a unique identifier that cross-references the nominated area to the corresponding polygon in the nomination spatial layer 8.2 location information including the state forest name and compartment number 8.3 reasons for the nomination, including any evidence to support why FCNSW believe the area is not old growth forest meeting the nationally agreed definition of '*ecologically mature forest where the effects of disturbance are now negligible*' 8.4 the estimated merchantable volume of wood including by species, noting the merchantable volume of wood will be verified by an independent reviewer under the Wood Supply Verification Method 8.5 a statement on the presence of any known high value Aboriginal cultural areas, or listed items on heritage registers (including the State Heritage Register, Aboriginal Heritage Information Management System, and FCNSW heritage database) and the compatibility of forestry operations with those items or areas 8.6 photographs, imagery or remote sensing data to support the nomination, if available 8.7 FCNSW suggested priority order for assessment under the framework.
9	FCNSW will supply a nomination spatial layer in an agreed geographic information system format, which will: 9.1 accurately show the boundary of each area nominated for assessment 9.2 identify each nominated area using the unique identifier provided in the nomination database 9.3 be provided with metadata.

Table 11: Areas where industry nominations cannot be made

Industry nominations cannot be made in:	
1	Protected areas required to maintain JANIS reserve targets, which include: 1.1 100 percent rare or depleted old growth forest ecosystems 1.2 60 percent of all other old growth forest ecosystems based on the extent at time of assessment (i.e. candidate old growth forest determined in the 1990s) 1.3 100 percent of all rare or endangered forest ecosystems 1.4 100 percent of all vulnerable forest ecosystems (noting the target is for 60% protection) 1.5 15 percent of the pre-1750 extent of forest ecosystems The proposed approach to update the current status of JANIS targets is included in **Attachment 4.1**. The Commission will supply a list of old growth forest ecosystems that have met or exceeded all of these targets. The list will include the area that could be reassessed in each of these old growth forest ecosystems while still maintaining JANIS targets.
2	Flora reserves.
3	Forest ecosystems at the edge of their mapped geographic range.
4	Forest ecosystems that are otherwise notably isolated or unique within a Local Landscape Area context[48], considering adjacent protected areas or harvesting exclusions, surrounding land use and surrounding forest ecosystem types.
5	Known high-value Aboriginal cultural areas where those values are not compatible with forestry operations.
6	Areas containing registered sites or places of Aboriginal or non-Aboriginal heritage where those sites or places are incompatible with forestry operations in accordance with approved due diligence guidelines for management of heritage.
7	Areas where other mapped exclusions under the Coastal IFOA would apply.

[48] Within a Local Landscape Area, the Commission will consider the landscape context of the nominated area on a case by case basis to determine the uniqueness or isolation of the nominated area. This will include considering adjacency of other protected areas or exclusions, and surrounding land use and forest ecosystem types.

4.2.3 Public nomination pathway

- This pathway is open to members of the public, organisations and NSW agencies and is referred to as 'public nominations.'
- Under this pathway, members of the public, organisations or NSW agencies can nominate areas of coastal state forest that are not currently protected as old growth, if they have evidence that the area may be old growth meeting the nationally agreed definition of '*ecologically mature forest where the effects of disturbance are now negligible*.'[49]
- Public nominations must comply with all nomination criteria as detailed in **Table 12**.
- In each year the project is funded for, the Commission will accept public nominations in:
  - January and February
  - July and August.
- The Commission will only assess public nominations received at the end of each two month nomination period.
- The Commission will accept public nominations submitted via email or mail.
- Where a duplicate nomination is received the second nominating party will be notified and directed to the earlier nominations' listing on the public register. This includes:
  - where another party has already nominated the area
  - where the area is within FCNSW's three-year harvest plan, which means that it would automatically be assessed upfront for unmapped old growth (see **Section 4.2.1**).
- The Commission will provide guidelines on the Commission's website that detail:
  - who can make a nomination
  - how to make a nomination
  - nomination criteria
  - how the nomination will be assessed
  - how the Commission will communicate with the nominating party throughout the assessment process
  - how nominations will be prioritised if more nominations are received than can be assessed in one calendar year.

[49] Commonwealth of Australia (1997) *Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia.* A report by JANIS.

Table 12: Nomination criteria that public nominations must comply with

Public nomination criteria	
1	Public nominations must be located in native forest in state forests covered by the Coastal IFOA (**Figure 12**).
2	Public nominations cannot be made on plantations, private land or Crown land outside the state forests covered by the Coastal IFOA (for example, national parks or other parts of NSW).
3	Public nominations cannot be made in areas already mapped and protected as old growth.
4	The nominating party must provide evidence or reasons for why the nominated areas meet the nationally agreed definition for old growth of '*ecologically mature forest where the effects of disturbance are now negligible*.'
5	Individual nominated areas (i.e. contiguous areas of forest) must not be smaller than 2 hectares.[50] Nominated areas that do not meet this minimum size requirement will not be accepted.
6	One nomination form can be used to cover multiple nominated areas if those areas are located within one compartment or adjacent compartments.
7	The total area nominated in one nomination must not exceed 250 hectares, which is equivalent to the average size of a compartment.
8	Public nominations must be made using the public nomination form (**Attachment 4.2**) and the nominating party must supply all information that has been requested.

[50] For rezoning, forest with a crown form code 'tC', which has a high proportion of mature forest, with low senescence and low regrowth, must have a minimum area of 25 hectares, not 2 hectares. Please refer to the Old Growth Reassessment Method for further information on crown form codes.

4.3 Step 2: Desktop assessment of nominations for further assessment

- The desktop assessment will include:
  - **A consistency check with nomination criteria:** If the nomination has not addressed relevant nomination criteria it will be rejected and returned to the nominating party with advice on why it was not accepted.
  - **A check for vexatious nominations:** Vexatious nominations include those designed to delay harvesting operations or waste limited resources on spurious claims. If the Commission considers the nomination to be deliberately vexatious, it will return the nomination to the nominating party and advise them of the particular concerns. The Commission will request the nominating party address the concerns raised and resubmit the nomination within two weeks of the request being made. If the nominating party refuses to address the Commission's concerns or continues to make deliberately vexatious nominations, the Commission will not accept any further nominations from that party. The Commission will seek to minimise the time spent considering vexatious nominations and will prioritise resources to ensure genuine nominations are assessed as a matter of priority.
- The Commission will communicate the outcomes of the desktop assessment with the nominating party and record the outcomes on the public register.

4.3.1 Prioritising sites

- The number of nominations EES Science Division are able to field assess in each year will be limited by the available resources.
- If the Commission receives more nominations than can be assessed in one year, the Commission, in collaboration with EES Science Division, will prioritise the sites to be assessed within four weeks of the close of the nomination period.
- The prioritisation process for both types of nominations will consider:
  - the status of the NSW Government's twin commitments to no net change in wood supply and no erosion of environmental values
  - a balance between assessing FCNSW and public nominations
  - efficiency in undertaking and scheduling field assessments
  - accessibility of the nominated area and the safety of field assessors (inaccessible or unsafe locations will not be recommended for field assessment)
  - comments received during public consultation on the proposed areas for reassessment.
- For industry nominations, the Commission will also consider:
  - the suggested priority order provided by FCNSW for nominations made by FCNSW
  - the estimate of the merchantable volume of timber on nominated areas, where a higher volume to area ratio will be considered a higher priority for reassessment.
- For public nominations, the Commission will also consider:

- current zoning (areas in FMZ 4 (general management) and 3B (special prescriptions) – where forestry operations may be permitted – would be high priority for further assessment)
- if mapped harvesting exclusions are present in the same location as the nomination, which would make them a lower priority for further assessment
- the status of the CAR reserve system in RFA regions, with high priority given to under-target forest ecosystems and under-target old growth forest ecosystems
- the status of the National Reserve System, with high priority given to under-target IBRA bioregions[51] and sub-regions or NSW Landscapes not sampled in under-target bioregions or sub-regions.

4.4 Step 3: Record nominations and assessment outcomes on a public register

- The Commission will list all nominations received on a public register, which will be made available on the Commission's website.
- Each listing on the public register will have a unique identifier.
- For each listing, the public register will provide:
  - the nominating parties organisation, if the nominating party belongs to a NSW agency, FCNSW or a non-government organisation
  - the nominating party's name if the nominating party is an individual and has given permission for their details to be publicly released
  - a unique identifier if the nominating party is an individual and has requested to remain anonymous for privacy reasons
  - links to a map showing where nominations have been made
  - information on duplicate nominations and the details of all nominating parties for duplicated nominations
  - the outcomes of each individual assessment stage for each nomination, including links to detailed reports on the outcomes
  - the ultimate outcome of the overall assessment, i.e. whether the nominated area was found to be old growth or not old growth
  - if relevant, information on whether a nominated area was found to have special environmental or conservation values.
- **Table 13** shows the proposed layout of the public register.
- The information in the public register will be reported to the NSW Government annually. This reporting will include the:
  - number of nominations received (public/industry)
  - number of nominations selected and rejected based on the information supplied in the form

[51] The Interim Biogeographic Regionalisation for Australia (IBRA) is a biogeographic regionalisation of Australia developed by the Australian Government's Department of Sustainability, Environment, Water, Population and Communities for use as a planning tool.

- number of nominations selected and rejected at the desktop assessment stage
- number nominations selected and rejected at the field assessment stage
- number of nominations recommended for field assessment
- number sites found to be incorrectly mapped old growth without special values
- area of incorrectly mapped old growth (including maps showing locations of confirmed incorrectly mapped old growth)
- estimated volume of high-quality wood in confirmed incorrectly mapped old growth
- number of sites found to be incorrectly mapped old growth with special values
- number of sites found to be unmapped old growth
- area of unmapped old growth (including maps of newly identified old growth)
- number of complaints received
- number of duplicate nominations received.

- **Table 14** shows the communications protocols for the framework. These will be used to guide how the Commission communicates with nominating parties during the site selection process, as well as at relevant points throughout the whole framework.

Table 13: Proposed layout of public register

Unique identifier	Location	Nominating party	Assessment stage	Stage finding	Assessment outcome
X[52]	Description Hyperlink to location map	Organisation, NSW agency, FCNSW, individual[1] or unique identifier. List of nominating parties if duplicate nominations received:	Nomination received.	Accepted or rejected.	Reason why accepted or rejected.
			Desktop assessment.	Rejected or field assessment recommended.	Reason why rejected or recommended for field assessment.
			Field assessment.[53]	Old growth confirmed or not confirmed. Special values confirmed or not confirmed.	Old growth forest. Not old growth forest but has special values.[54] Not old growth forest.

52 For public nominations, personal details will only be listed on the public register if the nominating party provides consent for their personal information to be made publicly available. If the nominating party belongs to a group, the associated group name will be listed. If the nominating party requests their personal. information not to be made publicly available, their nomination will be referenced by a unique identifier only.

53 This will provide a hyperlink to a detailed assessment report including field results and imagery and discussion on why the finding has been made.

54 The special values test is only part of the FCNSW nomination and assessment process.

Table 14: Communications protocols for the framework[55]

Activity	Protocols	Suggested response time[1]
On receipt of nomination	▪ Advise the nominating party that the nomination has been received. ▪ Include nomination on the public register.	▪ 2 days ▪ 7 days
After completion of site selection desktop assessment	▪ Advise the nominating party if nomination has been accepted, rejected or if further information is required. ▪ Include outcome of desktop assessment on the public register.	▪ 5 days ▪ 5 days
After completion of prioritisation process	▪ Advise applicant if nominated area is to be prioritised for field assessment in this financial year. ▪ For public nominations, advise FCNSW if the nominated area is in a general management zone where forestry operations are permitted (i.e. FMZ 4) and that it will be required to ensure the area is appropriately managed ahead of field verification. ▪ Include outcome of prioritisation process on the public register.	▪ Within three weeks of the close of nomination period
Old Growth Reassessment Method desktop assessment	▪ Advise the nominating party if nomination has been accepted, rejected or if further information is required. ▪ Include outcome of desktop assessment on the public register.	▪ 5 days ▪ 5 days
After completion of field assessment	▪ Advise nominating party on the findings of the field assessment ▪ Advise FCNSW and the EPA on the presence of confirmed old growth forest in FMZ 4. ▪ Include outcome of field assessment on the public register.	▪ 7 days ▪ 2 days ▪ 5 days
On receipt of a request for further information	▪ Provide further information or advise nominating party where to obtain further information.	▪ 5 days
On receipt of a complaint from the public	▪ Advise complainant that their complaint has been received. ▪ Provide formal response to the complainant.	▪ 2 days ▪ 3 weeks
On receipt of a duplicate public nomination	▪ Advise the nominating party that a nomination for the area has already been received and is being or has been assessed. ▪ Refer the nominating party to the relevant listing on the public register	▪ 5 days ▪ 5 days

[55] 'Days' refers to 'business days' and excludes weekends, public holidays, or shut down periods for government agencies responsible for implementation.

Attachment 4.1: Determining over-target old growth forest ecosystems

- The Commission has developed a proposed approach to update and determine the area of over-target old growth forest ecosystems in coastal state forests, which would be undertaken by a suitably qualified spatial data analyst.
- The approach is based on applying JANIS criteria and targets under the Nationally-Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia.[56]
- The approach has been informed by the approaches used in the NSW RFAs to determine the status of the CAR reserve system and JANIS targets. The approach was also informed by the approach used in Australia's State of the Forest Report.[57]
- The following JANIS old growth forest and biodiversity protection targets are applied:
  - 100 percent rare or depleted old growth forest ecosystems
  - 60 percent of all other old growth forest ecosystems identified at the time of assessment (this is the candidate old growth forest determined in the CRAs undertaken in the 1990s)
  - 100 percent of all rare or endangered forest ecosystems
  - 100 percent of all vulnerable forest ecosystems (noting the JANIS target is for 60 percent protection but the assessment proposes to use a 100 percent protection target)
  - 15 percent of the pre-1750 extent of forest ecosystems.
- The approach has five steps which are outlined in **Table 15**.
- Before determining the status of JANIS targets, the current area of the CAR reserve system must be determined (**Step 1**). The CAR reserve system has four components:
  - dedicated reserves
  - informal reserves
  - values protected by prescription
  - private land.
- **Table 16** outlines protected areas that are proposed to contribute to each component of the CAR reserve system under this approach. **Table 17** describes and outlines the datasets to be used in the proposed approach.

56 Commonwealth of Australia (1997) *Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia.* A Report by JANIS. Available at: http://www.agriculture.gov.au/SiteCollectionDocuments/rfa/publications/nat_nac.pdf.

57 Australian Bureau of Agricultural and Resource Economics and Sciences (2018) *Australia's State of the Forests Report 2018*. Available at: http://www.agriculture.gov.au/abares/forestsaustralia/Documents/SOFR_2018/Web%20accessible%20PDFs/SOFR_2018_Prelim_section_web.pdf.

Table 15: Proposed steps to determine the extent to which over-target old growth forest ecosystems exceed JANIS targets

Step	Description	What will this step do?
1	Determine the current extent of the CAR reserve system for each of the following RFA regions: ▪ Upper north east ▪ Lower north east ▪ Southern ▪ Eden.	Spatial analysis will be used to work out the current extent of the CAR reserve system on public and private land (**Table 16**).
2	Determine the area and proportion of each candidate old growth forest ecosystem type[58] in each component of the CAR reserve system in each RFA region.	Spatial analysis will be used to determine how much candidate old growth forest is within the current extent of the CAR reserve system. This information will be used to assess the status of the JANIS old growth forest target to protect 60 percent of old growth forest ecosystems identified at the time of assessment (as documented at RFA signing).
3	Determine the area of each forest ecosystem type in each component of the CAR reserve system in each RFA region and compare with the pre-1750 extent of that forest ecosystem.	Spatial analysis will be used to work out how much of the extant distribution (as documented at RFA signing) of each forest ecosystem type is within the current extent of the CAR reserve system. This information will be used to assess the status of the JANIS biodiversity target to protect 15 percent of the pre-1750 extent[59] of each forest ecosystem type.
4	Determine the current status of JANIS old growth forest and biodiversity targets in each RFA region. Note: biodiversity targets apply to forest ecosystems. Each old growth forest ecosystem is part of a broader forest ecosystem type. It is important to consider targets for the protection of forest ecosystems to work out if its old growth component is required to meet biodiversity targets.	The outputs of the spatial analysis from **steps 2 and 3** will be used to work out the current status of JANIS targets for each old growth forest ecosystem, including: ▪ the percentage achievement of targets for each old growth forest ecosystem and forest ecosystem ▪ a statement on whether each target has been achieved or not achieved.

58 Candidate old growth forest ecosystems were determined through the CRAs undertaken prior to signing the RFA. They are located across public and private land tenures.

59 The pre-1750 extent of forest ecosystems was determined under the CRAs and is used for JANIS biodiversity targets.

Step	Description	What will this step do?
5	Calculate the area of each old growth forest ecosystem that is above all JANIS targets and that could be reassessed (subject to a verified wood supply shortfall) without compromising any of the JANIS targets.	This step applies only to old growth forest ecosystem where all targets have been achieved. The analysis will provide: ▪ a list of over-target old growth forest ecosystems in each RFA region ▪ the area of each over-target old growth forest ecosystem that could potentially be reassessed without compromising the achievement of JANIS old growth forest or biodiversity targets.

Table 16: Components of the CAR reserve system on public and private land

Public land						Private land
Public land category	**Dedicated reserves**		**Informal reserves**		**Other areas where values protected by prescription**	
Conservation estate	▪ National parks. ▪ Nature reserves.		▪ State conservation areas. ▪ Regional parks.		▪ Not applicable.	Private land conservation agreements must be legally binding and in-perpetuity to be considered part of the CAR reserve system. These include: ▪ registered property agreements[60] ▪ conservation agreements[61] ▪ BioBanking agreements[62] ▪ Nature Conservation Trust conservation land covenants[63] ▪ Indigenous protected areas.
State forest estate	▪ Flora reserves (FMZ 1).		▪ Areas of FMZ 2 greater than 40 hectares and wider than 200 metres or that are adjacent to a dedicated reserve.[1]		▪ Areas of FMZ 2 smaller than 40 hectares and less than 200 metres wide. ▪ FMZ 3A.[64] ▪ FMZ 3B. ▪ Other mapped exclusions.[65]	
Other Crown land	▪ Not applicable.		▪ Crown reserves managed for the conservation of biodiversity. ▪ Australian Government Department of Defence managed lands (includes Singleton Army Training Area in the Lower North East and Beecroft Weapons Range in the Southern RFA region).		▪ Not applicable.	

60 Not all registered property agreements or conservation agreements are in-perpetuity (exclude fixed term contracts).
61 Not all registered property agreements or conservation agreements are in-perpetuity (exclude fixed term contracts).
62 BioBanking has been replaced by the Biodiversity Offsets Scheme.
63 Nature Conservation Trust conservation land covenants have been replaced by the Biodiversity Conservation Trust revolving fund.
64 Includes areas of the SMZs declared under s. 18 of the *Forestry Act 2012*, including high conservation old growth.
65 Other mapped exclusions include environmentally significant areas under the Coastal IFOA.

Table 17: Description of datasets and data custodians

Description	Type of data	Custodian
Candidate old growth forest ecosystems as determined and mapped during the CRAs and documented in RFAs	Spatial	EES
Rare or depleted old growth forest ecosystems as at RFA signing, calculated using candidate old growth forest and forest ecosystem extant distributions, as determined during the CRAs	Tabular data	RFAs
Forest ecosystems pre-1750 extent, as determined during CRAs	Tabular data	RFAs
Forest ecosystems extant distribution at RFA signing, as determined during CRAs	Tabular data	RFAs
Rare, endangered or vulnerable forest ecosystem types, as determined during CRAs	Tabular data	RFAs
Current conservation estate reserve boundaries	Spatial	EES
Current state forest estate and forest management zones	Spatial	FCNSW
Current mapped exclusions under the Coastal IFOA: ▪ HCVOG* ▪ heath and scrub ▪ large forest owl landscapes ▪ mapped inherent hazard level 4 ▪ mapped wetlands ▪ rare forest ▪ ridge and headwater habitat ▪ rock outcrop and cliff features ▪ TECs ▪ class 1 aquatic habitat ▪ threatened species ▪ carry-over exclusions * Note: the Coastal IFOA HCVOG layer is protected old growth in coastal state forests	Spatial	EPA
Current Crown reserves with biodiversity conservation as primary reserve purpose	Spatial	Crownlands
Current NSW private land conservation estate where the conservation agreement is legally binding and in-perpetuity	Spatial	EES
Australian Government held datasets: ▪ Indigenous protected areas on private land (Department of Prime Minister and Cabinet) ▪ Department of Defence managed land	Spatial	Australian Government agencies

Attachment 4.2: Public and industry member nomination form

All sections of this form must be completed in full or the nomination will not be accepted.

Please return the completed form with the subject heading '**Old Growth Reassessment Nomination**' to:

Email: nrc@nrc.nsw.gov.au

Mail: Old Growth Reassessment Nomination
Natural Resources Commission
GPO Box 5341
Sydney NSW 2001

1 Applicant contact details

Surname:	Other names:
Address (residential):	
Address (postal):	
Phone:	Email:
Associated institution or body (if applicable):	

2 Land to which this nomination relates

State forest name and compartment number:
Other location details (e.g. roads or GPS coordinates): Size of nominated area(s) for assessment of old growth values in hectares: Please attach a map showing your nominated area for reassessment
Other information you consider important: Is the area currently protected old growth forest? Yes / No

3 Reason for nomination

Please describe any investigations or observations you have undertaken on the nominated site prior to lodging this nomination. This may include recorded observations, photographs, maps and/or imagery. Attach these to your completed nomination form.

Investigations or observations: Describe how the nominated site **meets (or does not meet)** the nationally agreed definition for **old growth forest** of *ecologically mature forest where the effects of disturbance are now negligible*:

3 Privacy

Nominations will be displayed on a public register on the Commission's website.

Do you consent to your name being displayed on the public register?
YES □ **NO** □

If you answer 'NO' a unique identifier will be assigned to your nomination.

Note - nominations made by organisations will be listed on the public register under the organisation's name.

5 Old Growth Reassessment Method

- This stage of the framework addresses the component of the terms of reference that asks the EES Science Division to:

Develop an old growth reassessment protocol taking into account relevant definitions and assessment criteria for old growth.

- This method is applied to nominated sites that have been selected by the Commission through the desktop assessment undertaken as part of the Site Selection Method (**Chapter 4**).
- It will be implemented by the EES Science Division and independently overseen by the Commission.
- It provides a definition of old growth forest and principles for the application of this definition. This information is provided in **Section 5.1**.
- To determine old growth status, the method uses desktop and field-based assessments of ecological maturity and disturbance. It contains four steps (**Figure 13**):
  - **Step 1:** Identify areas of structural diversity as an indicator of likely ecological maturity using LiDAR desktop assessment.
  - **Step 2:** Refine ecological maturity and identify obvious signs of disturbance using API desktop assessment.
  - **Step 3:** Conduct a field assessment to assess ecological maturity and presence of disturbance.
  - **Step 4:** Make decision on old growth status based on analysis of desktop and field assessments.
- **Section 5.2** provides an overview of key steps in the method and the following sections describe each step in more detail.
- The method has been designed to reflect the following principles:

1. **Apply nationally-agreed approaches for old growth identification:** This method adopts four of the nationally-agreed definition for old growth. It also adopts the forest crown form codes and disturbance codes that were used to determine candidate old growth forest under the CRAs.
2. **Best available mapping technologies**: This method uses modern analysis and mapping techniques (LiDAR) in addition to API to produce high resolution maps of the structural diversity of a forest using the latest remote sensing technology.
3. **Field verification:** Old growth status must be verified based on field assessment before any decision to change its reservation status.

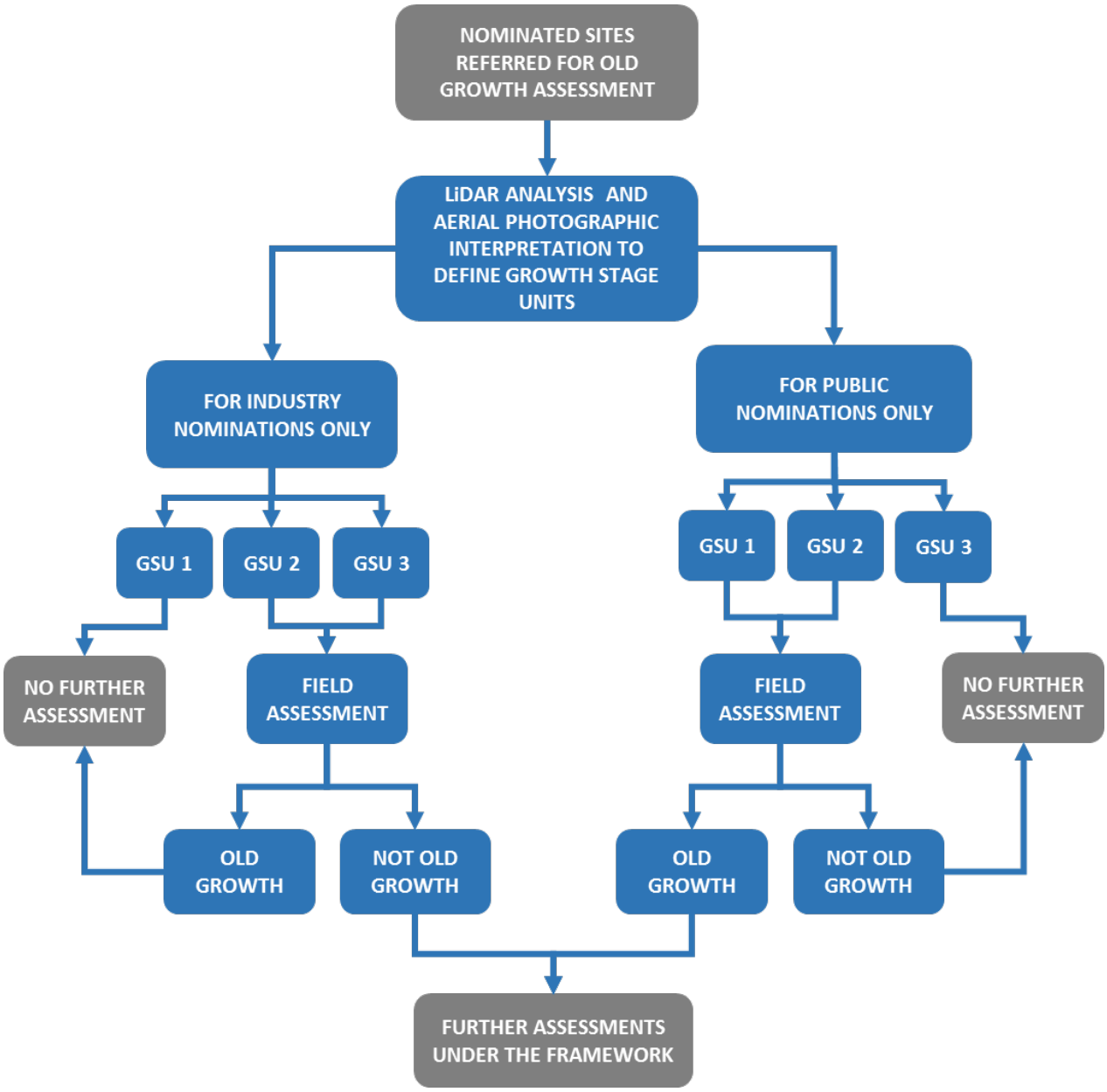


Figure 13: Overview of the Old Growth Reassessment Method

5.1 Definition of old growth forest

- The protocol uses the definition of old growth provided by JANIS and which was used as part of the CRAs:

> Old growth forest is defined as:
>
> **"Ecologically mature forest where the effects of disturbances are now negligible"**[66,67]

- When applying this definition:
  - 'Ecological maturity' is defined by the characteristics and relative proportions of the older growth stages of eucalypt trees (mature or over-mature).
  - Ecological maturity is assessed using data on the structural, floristic and functional qualities that characterise an ecologically mature forest ecosystem, where available.
  - Both evidence of a past disturbance, including disturbance from logging activities and weeds, and the persistence of the impact from that disturbance is considered when assessing old growth.
- In most forests, a significant proportion of trees with age-related features (a characteristic of the ecologically mature forest ecosystem) will show negligible disturbance effects.[68]

66 JANIS (1997) *Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia*, p. 14. Available at: http://www.agriculture.gov.au/SiteCollectionDocuments/rfa/publications/nat_nac.pdf.

67 This definition is an agreed national operational interpretation of the definition from the National Forest Policy Statement and is used in NSW RFAs and private native forestry.

68 JANIS (1997) *Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia*, p. 14. Available at: http://www.agriculture.gov.au/SiteCollectionDocuments/rfa/publications/nat_nac.pdf.

5.2 Overview of key steps

Step	Overview
Step 1: **Identify areas of structural diversity as an indicator of likely ecological maturity using LiDAR desktop assessment**	**Assessing ecological maturity** ▪ To inform the sampling approach in the field assessment in **Step 3**, a desktop assessment is undertaken to classify sites based on their likely level of ecological maturity. ▪ Sites are classified into three Growth Stage Units (GSUs) which indicate whether an area is likely to be structurally mature or not (which is a strong indicator of ecological maturity). The GSUs are: - **GSU 1:** Low regrowth mature to senescing forest (these areas have the highest likelihood of being ecologically mature). - **GSU 2:** Mature forest with low senescence and low regrowth or forest with high senescence with high regrowth (these areas have a moderate likelihood of being ecologically mature). - **GSU 3:** Young mature and/or regrowth forest (these areas have the lowest likelihood of being ecologically mature). ▪ LiDAR is used initially to produce a map of indicative GSUs that will be further refined using API in **Step 2**. ▪ To identify indicative GSUs, the following attributes in LiDAR maps are assessed: - variation in tree crown heights to identify possible areas of regrowth and more structurally diverse mature forest - locations of tall trees - clusters of tall trees. ▪ This step only classifies areas based on their likely level of ecological maturity. It does not identify any areas of possible old growth.
Step 2: **Refine ecological maturity and identify obvious signs of disturbance using API desktop assessment**	**Assessing ecological maturity** ▪ This step uses API with 3D planar technology to further identify features of ecological maturity (such as senescing trees) and refine the analysis of GSUs developed from **Step 1.** ▪ The final product of the API analysis will be used to inform the field assessment in **Step 3**. **Assessing disturbance** ▪ This step also identifies any visible evidence of disturbance, for example, snig tracks and crown gaps.
Step 3: **Conduct a field assessment to assess ecological maturity and presence of disturbance**	**Assessing ecological maturity** ▪ This step collects field data to help determine the final old growth status of an area (which occurs in **Step 4**). ▪ To help determine ecological maturity, the field assessment collects data on the percentage cover of senescing, mature and regrowth eucalypts. ▪ Sample sites are stratified using the GSU areas mapped in **steps 1 and 2**.

	▪ Sampling occurs along approximately 300 metre transects, with five sampling points each. At each point, sampling occurs using a 30 metre radial plot. The number of transects (and sampling points) within each GSU will depend on its area. ▪ The transect is a directional guide for field staff and no other data is collected along the transect other than that collected in the sampling points. **Assessing disturbance** ▪ Disturbance is assessed within each 30 metre radial plot. ▪ The disturbance type must be obvious and still effecting the forest structure in that plot.
Step 4: **Make decision on old growth status based on analysis of desktop and field assessments**	▪ This final step evaluates the data collected in **steps 1- 3**. ▪ This step determines whether the field verified GSU meet the requirements of an old growth forest based on the crown form codes used in the original CRAFTI old growth mapping assessments and presence of disturbance that is still having an effect on that forest. ▪ To be considered old growth: - **The GSU must be mature or senescing:** This method uses CRAFTI crown form codes to determine if the forest is ecologically mature. Ecologically mature forests need to have a crown form code of either tA, tB, tC, which are forests with low levels of regrowth or sA, which are forests with a high proportion of senescence. - **The GSU must have a level of disturbance that is negligible:** GSUs that meet this criteria will have equal to or less than 40 percent of field survey plots showing obvious signs of disturbance.

5.3 Step 1: Identifying forest structure using LiDAR desktop assessment

- Forest with mature ecological values is traditionally mapped by visual interpretation of stereo digital aerial photography (API). However, this is considered to have issues with accuracy. Using LiDAR to target API interpretation can improve the consistency and reliability of the identification of mature forest by reducing differences in interpretation. Using LiDAR analysis initially can highlight areas with mature forest values that would otherwise have been missed and will help target the areas for more detailed scrutiny and field work.
- In this step, LiDAR analysis will be used to inform the sampling approach of the field assessment in **Step 3** by classifying sites based on their likely level of ecological maturity. Areas classified using LiDAR will be subject to further fine-scale assessment of ecological maturity and identification of obvious disturbance through API in **Step 2**.
- This step only classifies areas based on their likely level of ecological maturity. It does not identify any areas of possible old growth.
- EES Science Division is developing a suite of layers from analysis of LiDAR data provided by FCNSW that will help identify attributes that provide a strong indication of ecological maturity, including:
  - variation in tree crown heights to identify possible areas of regrowth and more diverse mature forest
  - locations of tall trees
  - clusters of tall trees.
- By targeting a broad category of LiDAR data – representing mature forests and tall trees – the LiDAR model captures any potential for presence of mature and over mature forest.
- **Table 18** illustrates the LiDAR datasets that will be used in this method.
- Using these layers, sites are classified into three GSUs which indicate whether an area is likely to be structurally mature or not (which is a strong indicator of ecological maturity). The GSUs are:
  - **GSU 1:** Low regrowth mature to senescing forest (these areas have the highest likelihood of being ecologically mature)
  - **GSU 2:** Mature forest with low senescence and low regrowth or forest with high senescence with high regrowth (these areas have a moderate likelihood of being ecologically mature)
  - **GSU 3:** Young mature and/or regrowth forest (these areas have the lowest likelihood of being ecologically mature).
- **Figure 18** shows an example of the final map of GSUs that will be developed in this step.

Table 18: LiDAR components for this assessment and their application

LiDAR component	Description
ADS40 50cm imagery	Leica ADS40/80 RGB NIR digital aerial photography Ecologically mature forest is traditionally mapped using visual interpretation of stereo digital aerial photography. **Figure 14** shows an example of this kind of image.
ADS40 50cm enhanced imagery	ADS40/80 imagery enhanced to maximise spectral separability of crowns This enhances ADS40 imagery to maximise spectral separability of crowns. **Figure 15** shows an example of this kind of image.
LiDAR digital elevation model	Shaded relief to identify snig tracks
LiDAR canopy height model	The first return minus the digital surface model
Tall trees (max)	Smoothed LiDAR canopy height model (3-pixel circular maximum) representing trees over 40 metres. The tall tree map uses a smoothed LiDAR canopy height model to indicate the location of tall trees, often characteristic of mature forest. **Figure 16** shows an example of this kind of image.
Canopy height squared	Transforms the canopy heights to differentiate tall trees
Lidar Structure Index (Sum of canopy height squared)	Moving window focal sum of canopy height (sum circular 100 metre) delineates patches of tall trees. The LiDAR Structure Index uses the variation in tree crown height to map the heterogeneous canopy of mature forest. **Figure 17** shows an example of this kind of image.
Standard deviation of canopy height squared	Moving window focal sum of canopy height (circular 25 pixel) identifies canopy homogeneity to identify tall even age regrowth.
Multiscale sum of canopy height squared	Normalised average of 25, 50 and 100 sum circular 25 pixel. Provided in 10 classes.
Canopy cover	The number of vegetation returns (no ground returns) divided by the number of all returns
Tree crown size	Individual tree crown delineation to provide measurement of crown width and area
Irregular tree crown detection	Individual tree crown delineation of large crowns (shape criterion)

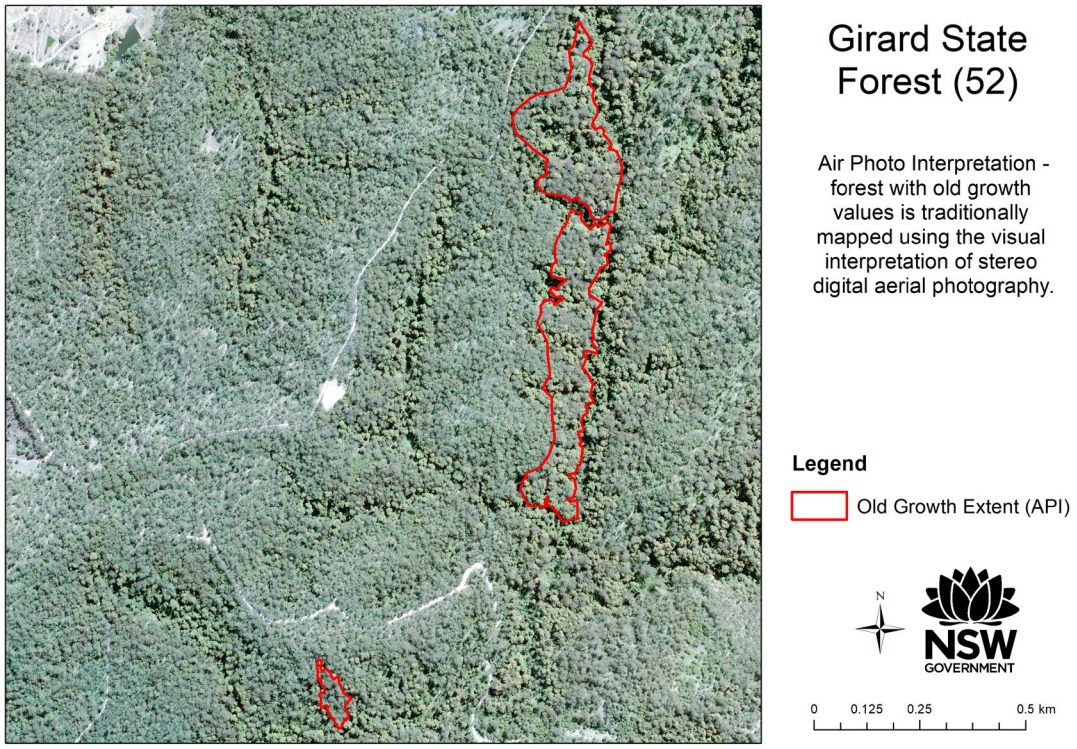


Figure 14: Stereo digital aerial photography

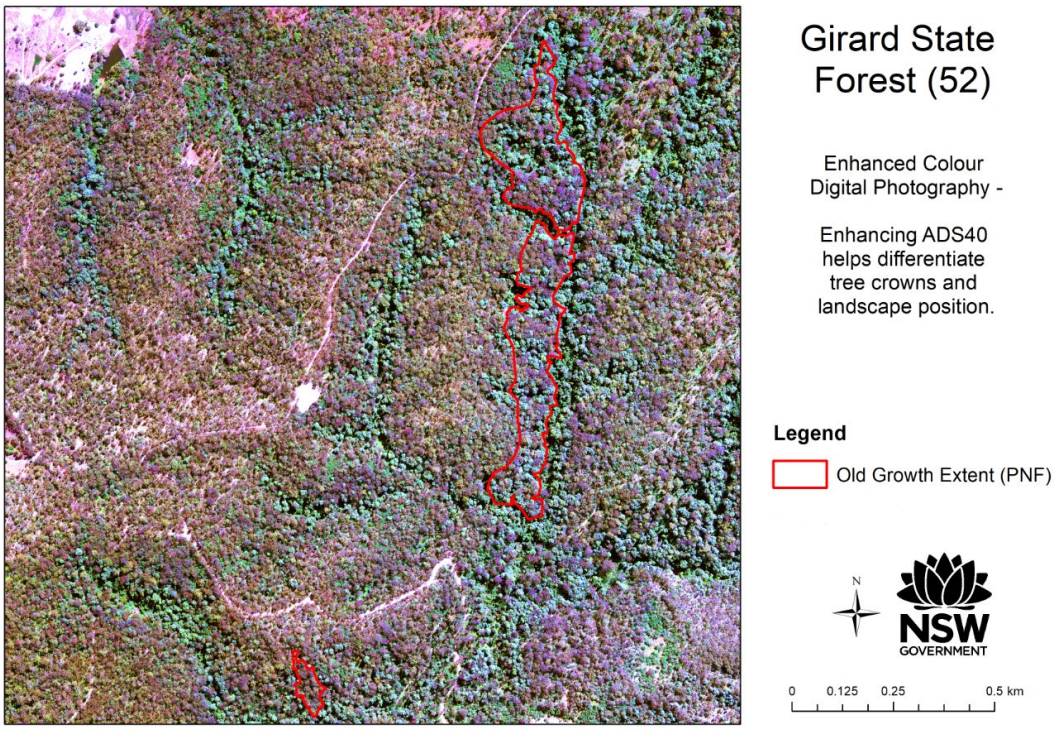


Figure 15: Enhance colour digital photography

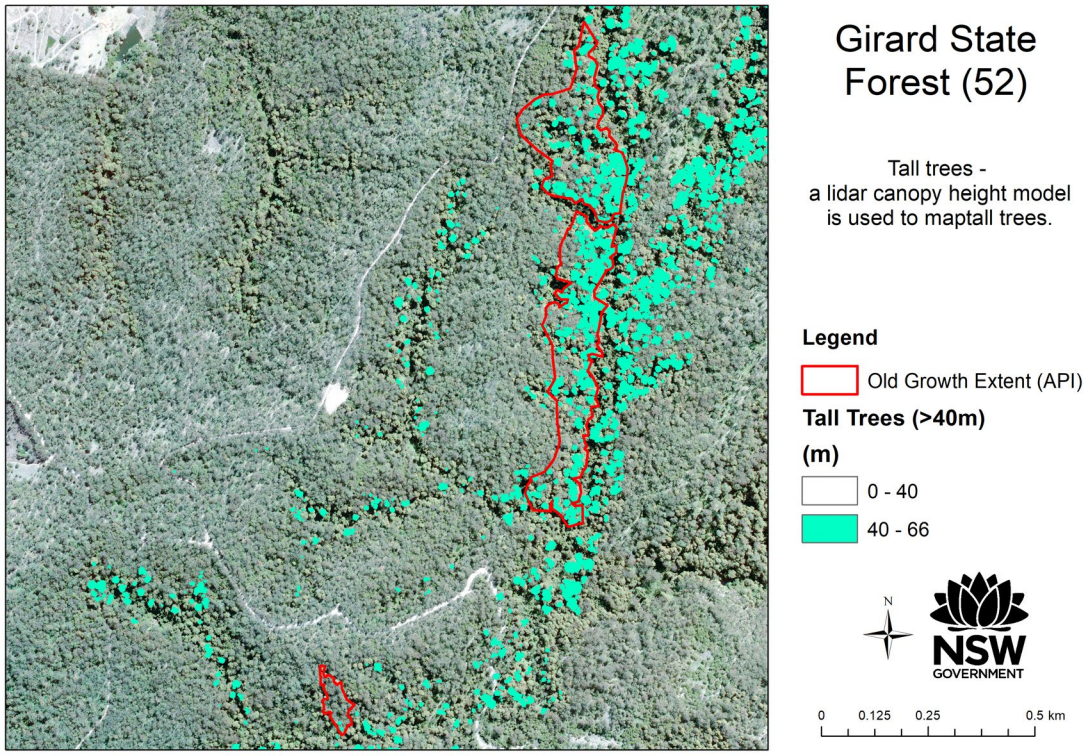


Figure 16: Tall trees

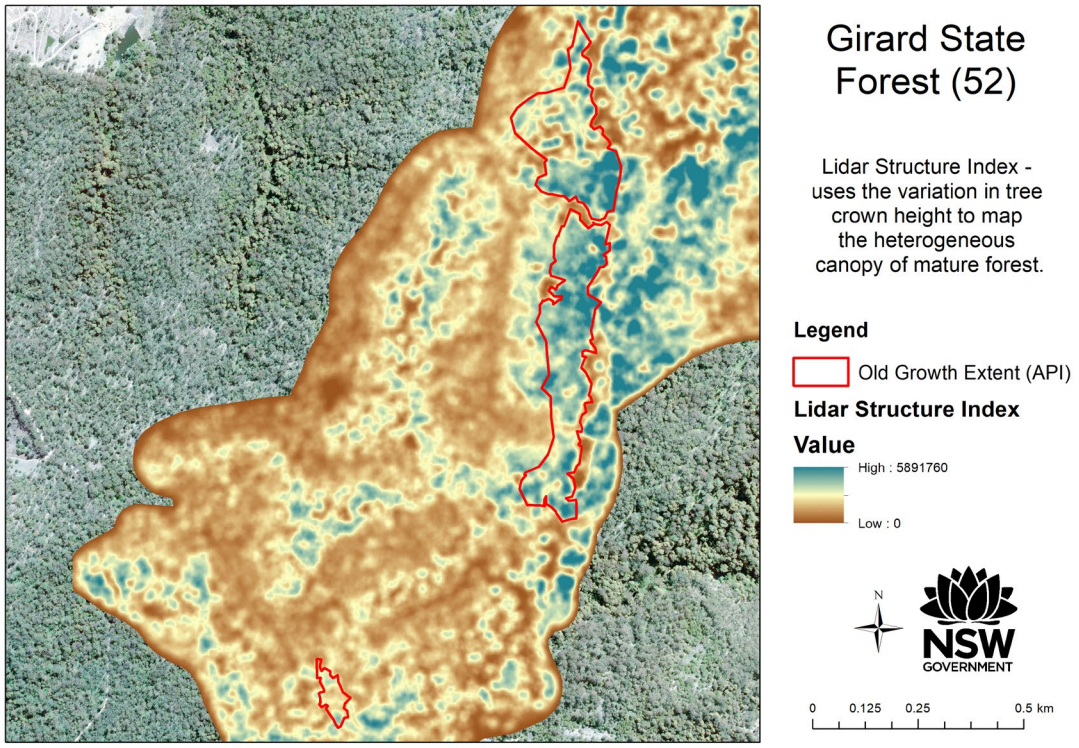


Figure 17: LiDAR structure index

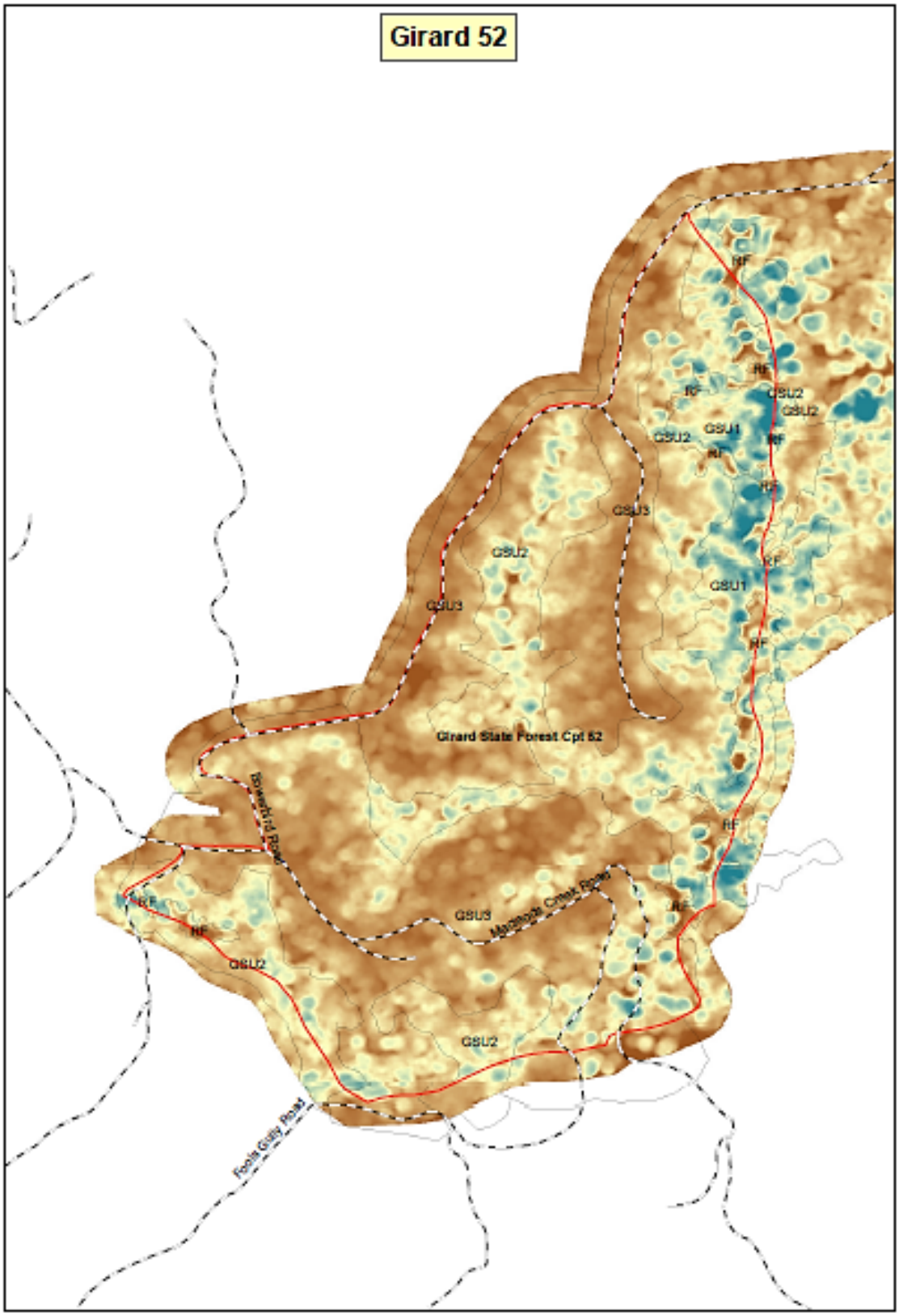


Figure 18: Final map layer showing GSU areas from LiDAR analysis

5.4 Step 2: Aerial photographic interpretation

- The layers produced in **Step 1** highlight areas that have been classified into GSU categories based on indicative features of ecologically mature forest.
- Further, fine-scale assessment is required to identify old growth features. API is the first step in this finer-scale assessment, which assesses both indicative ecological maturity and disturbance.
- The API analysis is undertaken using a stereoscopic viewer that uses ArcGIS software and the StereoAnalyst extension.

Assessing ecological maturity

- The API process aims to visually identify ecological maturity.
- The following visual cues are used to identify and digitise potential areas that may contain ecologically mature forest (note: these cues are dependent on tree species and not all tree species will present with these characteristics):
  - **Senescent trees:** large open crowns with visible large dead or dying branches, crown is no longer rounded and may be distorted in shape, as tall as mature trees.
  - **Mature trees:** full, regularly shaped rounded crown, usually healthy limbs (no dead or dying branches), higher than regrowth trees (note: mature trees can be affected by drought, insects and wind and may give the appearance of senescence. However, this is often able to be determined from API.)
  - **Regrowth trees**: Small, pointed crowns, no dead or dying branches, may be associated with canopy gaps, of lower height than the surrounding mature forest.

Assessing disturbance

- To determine disturbance, this method uses the same disturbance criteria for tA, tB, tC and sA crown form codes that were used as part of the original CRAFTI assessment that was used in the original old growth mapping process (see **Section 1.2** for more detail on the history of old growth mapping). These crown form codes have the same disturbance criteria, which are listed in **Table 19**.
- The following visual cues are used to identify and digitize areas that may have disturbance:
  - A very clear road, snig track and log dump network due to recent logging.
  - If the stand is composed of much greater than 10-30 percent regrowth, for example due to recovery after fire or clearing.
  - If the stand is composed of clearly environmentally damaged regrowth and/or mature trees due to dieback, storm damage or drought.
- Disturbance indicators must be widespread and beyond doubt to exclude the site from further assessment for old growth.
- In situations where the disturbance contribution is minimal and either regrowth or senescence percentage cover is borderline, the steepness of the slope is considered as a surrogate dataset for ecological maturity as, given the difficult terrain, it is unlikely to have been logged historically.

Table 19: Disturbance types for API assessment

Disturbance code	Description of code
X	There is evidence of recent logging. Recent logging is represented by an obvious pattern on aerial photographs when regrowth after logging is not yet visible, but the following features are visible: bare and disturbed ground, snig tracks, log dumps, canopy removal.
C	There is evidence of older logging in the form of snig tracks, and log dumps are still apparent in the aerial photographs, but regrowth of trees and understorey has obscured some or most of the logging evidence.
GZ	There are irregular clusters of crown gaps in the tallest canopy stratum, and regrowth is more or less present in the gaps at a lower height than the canopy. There may be a high proportion of uneven crown heights (two or more distinct strata with a significant height difference that is apparent from an aerial perspective).
GA	There are irregular clusters of crown gaps in the tallest canopy stratum, with thick regeneration of pioneers, such as acacias, callicoma and tobacco bush, apparent.
GW	There are irregular clusters of crown gaps in the tallest canopy stratum, with thick regeneration of exotic pioneers, such as lantana, privet and camphor laurel, apparent.
W	There are high proportions of other exotic weeds, such as privet.
L	Lantana is visible in patches on the photography; it may be viewed as a point source or in the understorey over at least 50 percent of the canopy.
S	There is a high proportion (>5 per hectare) of dead standing trees or stags in the canopy. Their presence may be due to ringbarking, fire, prolonged drought or other environmental stresses.
D	Dieback is visible, being manifest by sparse foliage on otherwise dense stands, dead branches and dead trees.
P	There is evidence of grazing, such as reduction of crown cover/partial clearing, pasture improvement and infrastructure construction such as dams, tracks and yards. More than one such feature must be present.
B	Landslips.
O	Evidence of past clearing, now regenerated, such as windrows, tracks and shaped vegetation patterns.
J	Particularly used for constructed tracks, transmission lines and evidence of disturbance in non-forest areas, but also for other forms of disturbance not listed.
e	Erosion.
m	Mining, including mine sites, tailing dumps, top soil removal.
R	Rural residential subdivisions.

5.4.1 Final API product and areas excluded from field verification

- This step will result in a more refined map of GSUs than the product derived from LiDAR analysis in **Step 1**. Once the API assessment is complete, the GSUs are delineated and polygons created to prepare a draft map for field verification.
- Based on this map, the following areas will be identified that are excluded from field verification:
  - Public nominations in unmapped areas assessed to be in GSU 3 (young mature and/or regrowth forest) will not be considered to meet the definition for old growth forest and will remain under their current management status.
  - Areas with a slope greater than 30 degrees or other inaccessible sites (for example, with extremely dense undergrowth) will not have a field assessment due to health and safety issues. These sites will retain their current status (as old growth or not old growth) until they can be treated on a case-by-case basis. For example, a public nomination made in an inaccessible location, if the LiDAR and API analysis in **steps 1** and **2** provide reasonable assurance that the site is structurally over-mature, the Commission may recommend the nominated area be protected as old growth forest without field verification.

5.5 Step 3: Field Assessment

- Field assessment is undertaken to verify attributes of ecological maturity in the desktop assessment in **steps 1** and **2**, as well as identify presence of disturbances.

5.5.1 Selecting sample sites

- Sampling occurs along one or more 300 metre transects in each of the three GSUs identified as part of the desktop assessments in **steps 1** and **2**. As noted in **Section 5.4.1**, the following areas will be excluded from field sampling:
  - Public nominations in unmapped areas assessed to be in GSU 3 (young mature and/or regrowth forest) will not be considered to meet the definition for old growth forest and will remain under their current management status.
  - Areas with a slope greater than 30 degrees or other inaccessible sites (for example, with extremely dense undergrowth) will not have a field assessment due to health and safety issues.
- Each transect will include five points that are spaced 75 metres apart, including a point at both the transect start-point and end-point.
- **Table 20** shows the minimum number of transects and sampling points that are proposed for each GSU.
- These sample points are pre-located with GPS.
- **Figure 21** shows an example of the transect and sampling point layout for a hypothetical state forest site that is 200 hectares in area and mapped into the three GSUs. In this example, 60 points would be sampled to adequately capture representative data for the mapped area of each GSU. These points would occur along 12 transects, including:
  - Three transects in GSU 1: senescing forest (15 sample points)
  - Five transects in GSU 2: mature forest (25 sample points)
  - Four transects in GSU 3: regrowth and disturbed mature forest (20 sample points).
- This sampling process is different from the sampling processes used as part of the PNF old growth protocols, which were used as part of the Commission's 'proof of concept' old growth reassessment pilot in 2018. The differences are that the proposed approach:
  - uses five sampling points instead of ten, which reduces overall sampling time but allows a larger proportion of forest to be assessed.
  - employs a separation distance of 75 metres between points instead of 50 metres, which ensures there is no spatial overlap between adjacent 30 metre radial plots.

Table 20: Minimum number of sampling points per mapped GSU

Area of GSU (hectares)	Old growth assessment requirements	
	Number of sampling points	Number of transects[69]
2-5	5	1
>5-20	10	2
>20-50	15	3
>50-100	20	4
>100-250	20	4
>250-1,000	25	5
>1,000	30	6

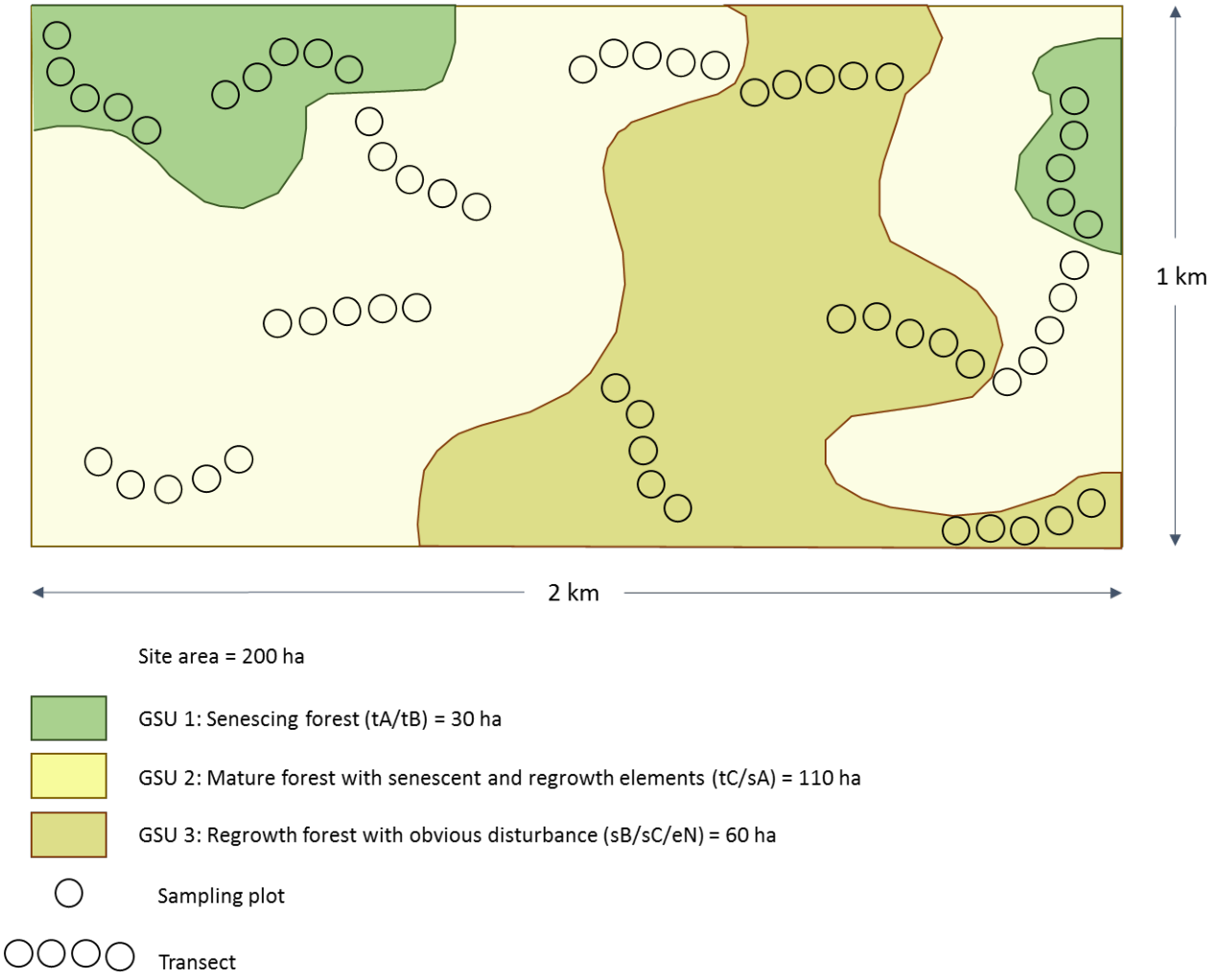


Figure 19: Example transect and sampling plot layout with three GSUs at a hypothetical 200 hectare site on state forest

69 Each transect contains five sample points.

5.5.2 Plot layout

- Sampling at each point occurs in a 30 metre radial plot (**Figure 20**).
- Within this plot, a 'point-centred quarter' plot layout is used to measure the percent cover of senescing, mature and regrowth trees (**Figure 21**). The distance to the nearest senescing, mature and regrowth trees in each quarter is collected, which is used to determine the density of these features in **Step 4** (a 'point-to-plant' assessment).
- The point-centred quarter approach is also used to collect data on cut stumps (a measure of disturbance). To count as a disturbance, the cut stump must be associated with a canopy gap that is clearly the result of tree harvesting and at least two regrowth trees.
- The percentage cover of weeds, and the presence of canopy gaps and vehicle tracks are measured in the plot using the centre point as a reference.

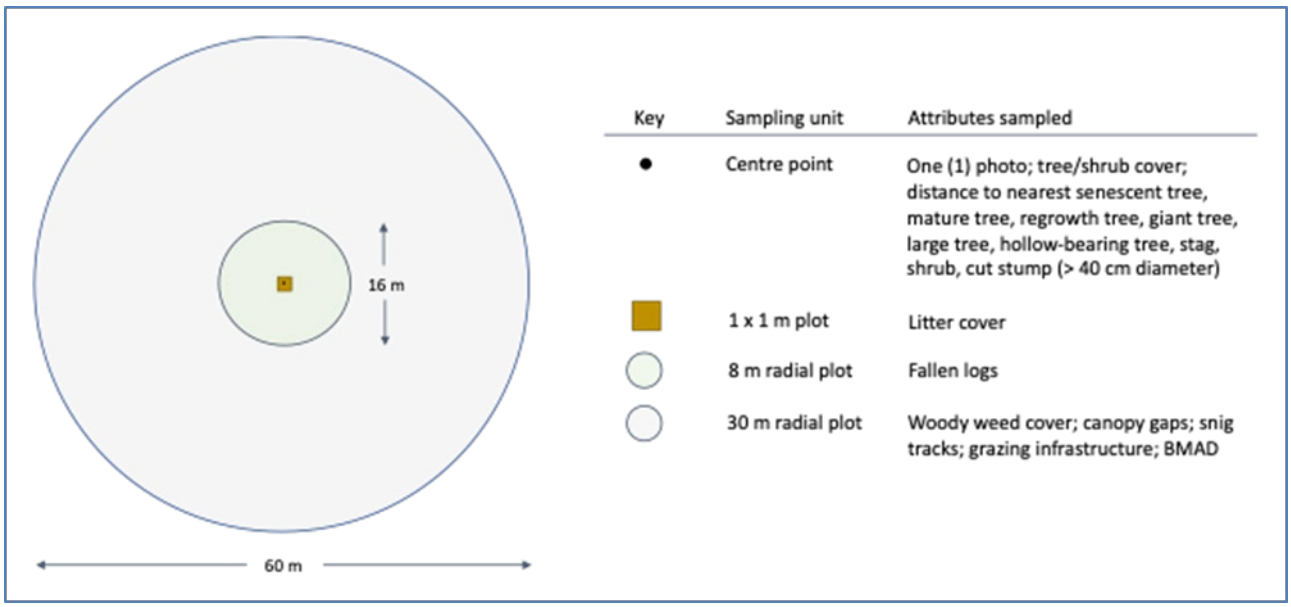


Figure 20: Plot layout to be used at each sampling point (Note: the 1 x 1 metre and 8 metre radial plot are not used as part of the old growth reassessment. They are used for the Special Environmental and Conservation Values Assessment Method outlined in Chapter 6).

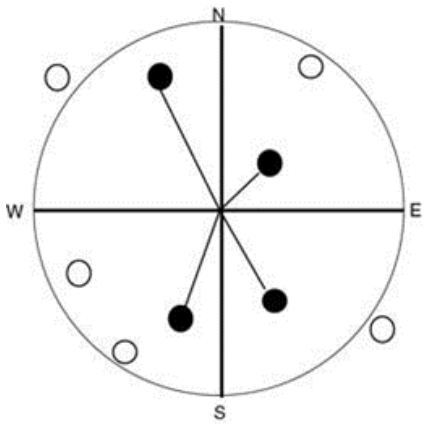


Figure 21: Point-centred quarter radial plot

5.5.3 Field attributes collected

- **Table 21** outlines the field attributes collected in this method to measure ecological maturity and disturbance and their sampling approaches.

Table 21: Proposed field attributes

Field attribute	Sampling unit	Sampling approach	Old growth component
Tree growth stages (n.ha^{-1}; crown radius)	Point-centred quarter; radial plot	Measure the distance (metres) to the nearest senescent, mature and regrowth tree from the sample point, in each quarter, to a maximum distance of 30 metres, and measure the canopy radius of each.	Ecological maturity
Weeds (percentage coverage)	Radial plot	Estimate the percentage of a 30 metre radial plot (with sample point at the centre) that comprises weed cover (measure to the nearest 10 percent).	Disturbance
Canopy gaps	Radial plot	Using the 30 metre radial plot with sample point at the centre, note any obvious gaps in the canopy that have clearly arisen as a result of past timber cutting (only record when there is also evidence of cut stumps and/or ringbarking).	Disturbance
Vehicle tracks	Radial plot	Using the 30 metre radial plot with sample point at the centre, note any clear evidence of constructed tracks including snig tracks.	Disturbance
Grazing infrastructure	Radial plot.	Using the 30 metre radial plot with sample point at the centre, note any evidence of grazing infrastructure (for example, fences or yards).	Disturbance
Bell Miner Associated Dieback (BMAD)	Radial plot.	Using the 30 metre radial plot with sample point at the centre, note any evidence of BMAD or other crown dieback.	Disturbance

5.5.4 Sampling pathway

- **Table 22** shows the recommended sampling pathway for the team assessing old growth field attributes at each sample point.

Table 22: Sampling pathway for assessing old growth field attributes

Step	Task	Attributes measured
1	Locate centre point using GPS	-
2	Capture one image	One photographic image of forest structure captured from centre point (choose a viewpoint that best typifies the surrounding forest: north, east, west or south).
3	Record dominant species	Record the dominant native plant species in each stratum (overstorey, midstorey, understorey) – three to five species for each stratum.
4	Identify broad vegetation class	Use Keith class descriptors to identify the broad vegetation class.
5	Point-centred quarter sampling	Measure the distance to the nearest senescent, mature and regrowth tree and nearest shrub in each quarter, ensuring that no trees are double counted in different quarters.
6	Crown radius measurements	Estimate the crown radius of the nearest mature and regrowth tree and nearest shrub sampled in each quarter.
7	Tree and shrub cover	Estimate tree crown cover by calculating the combined stocking density of senescent and mature trees, and multiplying that by their average crown area. Estimate shrub crown cover using the same process.
8	Radial plot sampling	Estimate percent cover of weeds; record evidence of past logging including stumps, ringbarking, gaps, and snig tracks; record any evidence of grazing infrastructure; record any evidence of BMAD or other canopy dieback.

5.6 Step 4: Data analysis and old growth status assignment

- This step evaluates the data collected in **steps 1- 3** to determine whether the GSUs meet the requirements of old growth.
- In line with the definition of old growth forest by JANIS ("*ecologically mature forest where the effects of disturbances are now negligible*"), the final evaluation tests two criteria that must **both** be met for a GSU to be considered old growth:
  - **The GSU must be mature or senescing:** This method uses CRAFTI crown form codes to determine if the forest is ecologically mature. Ecologically mature forests need to have a crown form code of either tA, tB, tC, which are forests with low levels of regrowth, or sA, which are forests with a high proportion of senescence.
  - **The GSU must have a level of disturbance that is negligible:** GSUs that meet this criteria will have equal to or less than 40 percent of field survey plots showing obvious signs of disturbance.

5.6.1 Testing for ecological maturity

- To determine if a GSU is ecologically mature or sensing, the field data collected in **Step 3** (using the point-to-plant assessment) is analysed to determine the relative crown cover percentage of regrowth, mature and senescing trees.
- These proportions are then used to identify the CRAFTI crown form code for that GSU, which determines whether the forest is ecologically mature.
- Using the data collected in the point-centred quarter plot on the distance to the nearest regrowth, mature and senescent trees, the following is calculated:
  - The **average stocking density** (N) in trees per hectare in the GSU (see **Box 2**)
  - The **average crown area** (A) in metres squared in the GSU (crown area A of each tree in the GSU is estimated using the equation $= \pi r^2$, where r is crown radius).
  - The **total crown area per hectare** by multiplying the average stocking density (N) by the average crown area (A).
  - The **proportional contribution of regrowth, mature and senescent trees to total crown area**. This is the relative crown cover percentage of each growth stage.
  - The **crown cover for each growth stage** is calculated by multiplying the proportional cover by the average crown area for each growth stage. This number allows the GSU to be allocated a CRAFTI crown form code.
- **Table 23** contains the CRAFTI crown code criteria used in this assessment. Ecologically mature forests need to have a crown form code of either tA, tB, tC, which are forests with low levels of regrowth, or sA, which are forests with a high proportion of senescence.

Box 2: Calculating average stocking density

- The average stocking density of senescent, mature and regrowth trees is calculated using the following equation:

$$N = 10{,}000 \times \frac{16n^2}{\left(\sum_{i=1}^{n}\sum_{j=1}^{4} d_{ij}\right)^2}$$

where:
N = Average density (units.ha^{-1}) within the GSU
n = number of points sampled within the GSU
i = point i along the series of transects within the GSU
j = quarter j within each point
d_{ij} = distance (m) to nearest plant at point i in quarter j within the GSU

- In this equation, density is calculated for each sampling point and then averaged across all points. It is incorrect to average distance (D) across all points then undertake a single density calculation as this will result in a significant under-estimation of stocking density.
- Where a particular feature does not occur within any quarter, a null score (denoted by 'n') is recorded.

Table 23: Ecological maturity assessment

GSU	Ecologically mature?	CRAFTI crown form code	Regrowth (%)	Senescence (%)	Mature (%)*	Min. size (ha)
GSU 1	**Yes**	**tA**	0-10	30-100	0-70	>2
		tB	0-10	10-30	60-90	>2
GSU 2	**Yes**	**tC**	0-10	0-10	80-100	>2
		sA	10-30	30-100	0-60	>2
GSU 3	**No**	**sB**	10-30	10-30	40-80	NA
		sC	10-30	0-10	60-90	NA
		eN	30-100	0-70	0-70	NA

5.6.2 Testing for disturbance

- The test for disturbance aims to be consistent with the JANIS definition of old growth by assessing disturbance using the same disturbance indicators for the tA, tB, tC and sA crown form codes used during the original CRAFTI assessment.
- The test also aims to establish what is 'negligible' in terms of those disturbances. The test for 'negligible' disturbance must be objective and repeatable.
- Six disturbance factors are calculated for each GSU when testing disturbance:
  - **1** The proportion of radial plots that show clear evidence of gapping associated with past logging (cut stumps and/or ringbarked trees).
  - **2** The proportion of radial plots that show clear evidence of vehicle tracks, including snig tracks.
  - **3** The proportion of radial plots that show clear evidence of grazing infrastructure.
  - **4** The proportion of radial plots that show clear evidence of BMAD.
  - **5** The proportion of radial plots that contain weeds.
  - **6** The total cover of weeds as an average of weed cover at each radial plot.

Determining disturbance thresholds

- In determining disturbance thresholds the Commission considered the JANIS definition of old growth, which also defines the concept of 'ecological integrity' as:

'An ecosystem with ecological integrity is one which possesses those structural and compositional elements that indicate the ecosystem is functioning within the bounds of a natural disturbance regime i.e. not subject to human induced disturbance such as logging, treatment, grazing impacts and/or prescribed burning.'[70]

- In line with this, where structural maturity is reduced (i.e. dominated by younger growth stage trees) when disturbance is present, it can be assumed that the disturbance is still having a residual effect on forest structure.
- During the testing of this method, a range of different thresholds for negligible disturbance were explored. **Table 24** shows the count of mature and non-mature GSUs that occurred under each of the different disturbance thresholds.
- The results indicated that disturbance has a continuing effect on the ecological integrity of a forest when disturbance occurs in more than 40 percent of plots. In other words, GSUs with more than 40 percent of plots showing disturbance had an increasing proportion of younger maturity stands (i.e. crown form codes other than tA, tB, tC or sA).

70 JANIS (1997) *Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia*, p. 14. Available at: http://www.agriculture.gov.au/SiteCollectionDocuments/rfa/publications/nat_nac.pdf.

Table 24: Disturbance threshold test

Structural maturity	Number of GSUs under disturbance threshold (percent plots disturbed)							
	100 %	80 %	60 %	50 %	40 %	30 %	27 %	0 %
Not mature	9	3	3	2	1	0	0	0
Mature	18	16	7	7	5	4	3	2

5.6.3 Old growth status assignment

- The tests above are used to determine whether a site meets the following two criteria for old growth:
  - **The GSU must be ecologically mature.**
  - **The GSU must have a level of disturbance that is negligible.**
- There are a number of possible assessment outcomes, based on the assessment of these criteria. **Table 25** shows the possible assessment outcomes and the old growth status that would be assigned based on these outcomes.
- For all public nominations, if the forest area is assessed under the Old Growth Reassessment Method and found to contain old growth meeting minimum area requirements, the area will be mapped as a temporary exclusion zone until such time that the NSW Government makes a rezoning decision.

Table 25: Possible assessment outcome and old growth status assignment

Assessment Outcome	Old Growth Status
The proportional contribution of senescent, mature and regrowth trees to total crown area is within one of the old growth crown form codes (i.e. tA, tB, tC or sA). Disturbance is absent or below 40 percent of plots.	Old growth
For public nominations only: LiDAR and API assessments determine the area to be a GSU 3. *Note: This is determined in steps 1 and 2.*	Not old growth
The proportional contribution of senescent, mature and regrowth trees to total crown area is within one of the old growth crown form codes (i.e. tA, tB, tC or sA). Disturbance is present and above 40 percent of plots	Not old growth
Proportional contribution of senescent, mature and regrowth trees to total crown area is not within one of the old growth crown form codes (i.e. tA, tB, tC or sA).	Not old growth

6 Special Environmental and Conservation Values Method

- This stage of the framework addresses the component of the terms of reference that asks the:

> **EES Science group to develop a framework for assessing the special environmental and conservation values to be applied in circumstances where old growth forests are confirmed absent in the existing mapping.**
>
> **The Commission to oversee the Office of Environment and Heritage [now EES Science Division] development and implementation of a framework for assessing the special environmental and conservation values of potential sites.**

- This step only occurs when an area currently mapped as old growth is reassessed and found to not contain old growth. This method aims to ensure areas with special environmental and conservation values remain protected, even if they are not old growth.
- This method defines special environmental and conservation values as:

> **Areas [that] contain outstanding examples of forest ecosystems, areas of unique or uncommon biological values and localities or habitats of key threatened and sensitive fauna and flora. Areas also contain sites of very high historical, Aboriginal or non-Aboriginal cultural heritage.**[71]

- This method contains four steps (**Figure 22**):
  - **Step 1:** Field assessment for special environmental values
  - **Step 2:** Desktop assessment of potential habitat for key mature forest dependent threatened species
  - **Step 3:** Special environmental values evaluation based on field and desktop assessment
  - **Step 4:** Assessment of special cultural values
- **Section 6.1** gives an overview of key steps in this method and the following sections describe each step in more detail.

[71] This definition is based on the definition of special environmental and conservation values from FCNSW's FMZ 1 and 2, as well as the JANIS definition for biodiversity criteria.

6.1 Overview of key steps

Step	Overview
Step 1: **Field assessment for special environmental values**	▪ This step assesses the ecological condition of an area using specific components of the NSW BAM.
Step 2: **Desktop assessment of potential habitat key mature forest dependent threatened species**	▪ This step identifies potential habitat for key threatened mature forest-dependent species CRA modelled species distribution maps updated with new records. ▪ The species that have been selected are species that are solely reliant on features provided by an ecologically mature forest like dense canopy, hollows, fallen logs and leaf litter. ▪ This step undertakes a 'weighted endemism' desktop assessment, which is based on the distributions of 42 key threatened mature forest-dependent fauna species and two endangered populations. ▪ A weighted endemism score is used to identify truly unique areas by applying greater value to species with a restricted distribution.
Step 3: **Final test of special environmental values Evaluation based on field and desktop assessment**	▪ This step uses the results from the field assessment and the combined weighted endemism score for all species to determine which areas hold 'special' environmental values. ▪ A site will be determined as having special environmental values if it: - meets all BAM structure and function benchmarks, *and,* - has a weighted endemism score greater than 83 percent.
Step 4: **Assessment of special cultural values**	▪ This step assesses Aboriginal cultural and heritage values in the field. ▪ This step also assesses non-Aboriginal heritage in the field if there are strong indicators for the presence of unlisted heritage sites. ▪ The assessment determines if any identified heritage values are compatible with forestry operations.

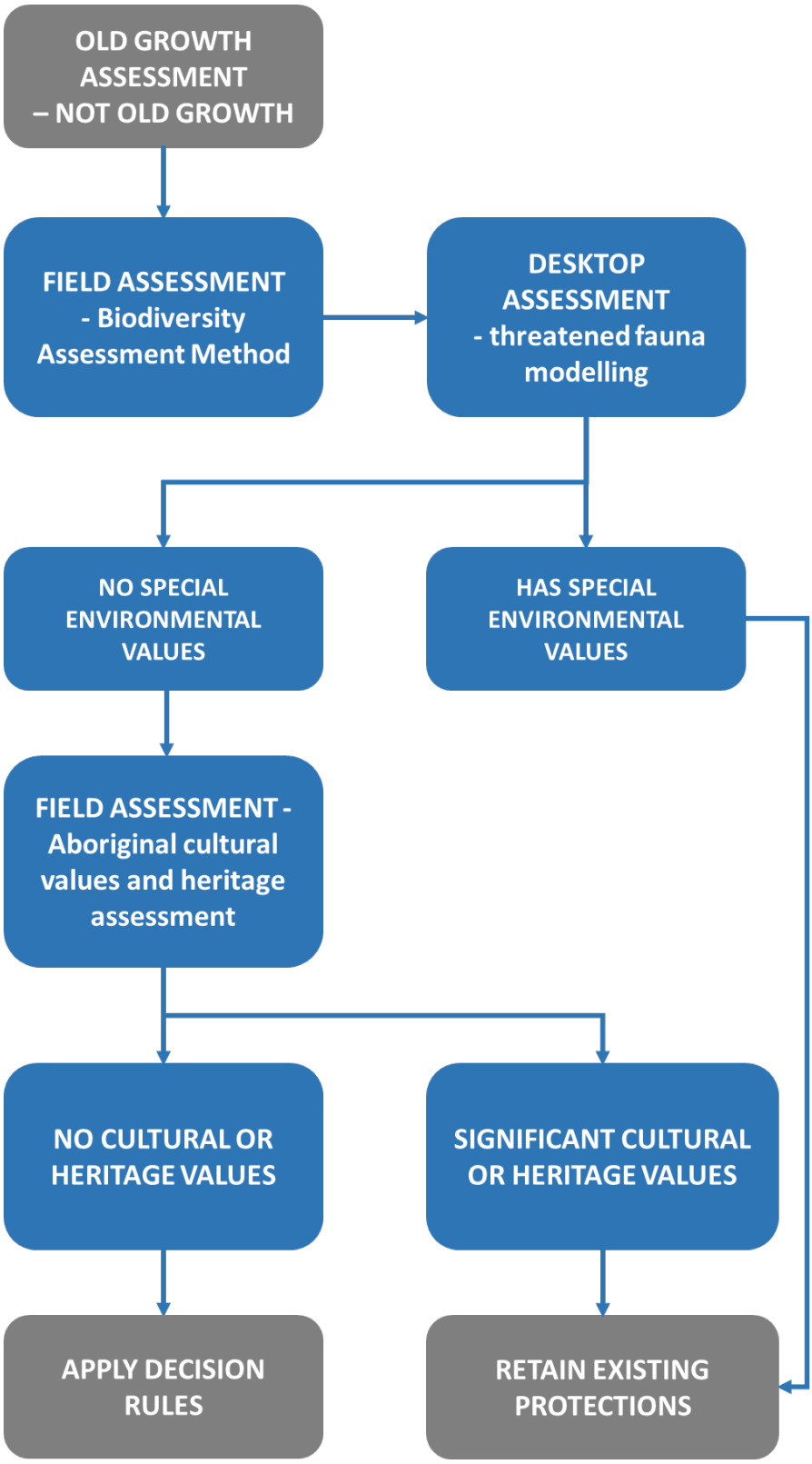


Figure 22: Overview of the Special Environmental and Conservation Values Assessment Method

6.2 Step 1: Field assessment for special environmental values

- The field assessment uses the structure and function components of the BAM to establish the ecological condition of an area.[72] High BAM scores indicate whether the site has good ecological function and may hold special environmental values. Conversely, low BAM scores indicate a site is unlikely to hold special environmental value.
- The BAM assessment is conducted at the same time as the field assessment for the Old Growth Reassessment Method (**Chapter 5**). Information is collected on the following structure and function attributes relating to the requirements of threatened species that are exclusively reliant on the following features provided by mature forests:
  - Crown cover (trees and shrubs) measured as a percentage.
  - Giant trees (number per hectare).
  - The number of large living trees[73], where large tree diameters are specified for each vegetation class (number per hectare).
  - The total length of fallen logs with a diameter >10 centimetres and >50 centimetres (length per hectare).
  - Litter cover (percent).
  - Stags (number per hectare).
- Measurements of these attributes are then compared to BAM benchmark values for the relevant vegetation class and IBRA subregion[74] for the area. Benchmark values represent the 'best-attainable' condition of that vegetation class, acknowledging that native vegetation has been subject to both natural and human-induced disturbance.[75]

6.2.1 Plot layout

- This method uses the 30 metre radial plots at each sampling point established as part of field assessment for the Old Growth Reassessment Method. Field assessments for this method are conducted at the same time as the old growth reassessment.
- For this assessment, a 30 metre radial plot is established. **Table 27** shows the minimum plot requirements for each GSU.
- **Figure 23** shows the plot layout to be used at each sampling point.
- **Table 26** shows the attributes that will be collected to inform the special environmental values assessment that area based on the key fauna habitat features provided by an ecologically mature forest.
- Within the radial plot, tree and shrub cover and the density of large living trees and stages is measured using a point-centred quarter plot layout (**Figure 24**).

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72 The BAM is comprised of three assessments 1) Composition, 2) Structure and 3) Function. These all provide a vegetation integrity score for an assessment plant community type.

73 Under BAM, large living trees are used as a surrogate for hollow-bearing trees.

74 The Interim Biogeographic Regionalisation for Australia (IBRA) is a biogeographic regionalisation of Australia developed by the Australian Government's Department of Sustainability, Environment, Water, Population and Communities for use as a planning tool.

75 Office of Environment and Heritage (2017) *NSW Biodiversity Assessment Method*. Available at: https://www.environment.nsw.gov.au/resources/bcact/biodiversity-assessment-method-170206.pdf.

- Litter as a percentage cover, fallen logs (as metres per hectare), as well as the count of all senescent trees, giant trees and stags are also measured in the plot using the centre point as a reference.
- This method also uses the GSUs identified as part of the Old Growth Reassessment Method as a guide to the ecological maturity of that area.

Table 26: Proposed field attributes collected and sampling approach

Field attribute	Sampling unit	Sampling approach
Tree and shrub cover (percent)	Point-centre quarter (radial plot)	Calculated from point-to-plant distance (metre) and crown radius measurements in each quarter for trees and shrubs (considers the projection of entire crowns rather than foliage).
Giant trees[76] (no./hectare)	Radial plot	Count all giant trees in 30 metre radial plot, and record species and a diameter at breast height over-bark (DBHOB) for each.
Large trees[77] (no./hectare)	Radial plot	Count all large trees in 30 metre radial plot.
Fallen logs (m/hectare)	8 metre radial plot	Establish an 8 metre radial plot at the centre of the 30 metre plot. Count the combined length (metre) of all sections of fallen timber > 10 centimetres diameter and > 50 centimetres diameter within the plot.
Litter cover (percent)	1 metre x 1 metre plot	Establish a 1 x 1 metre plot at the sample point and record the proportion of the plot's surface area that is litter (dead plant material that is not attached to the ground including leaves, branches, logs and fallen tree trunks).
Stags[78] (no.ha^{-1})	Radial plot	Count all stags in 30 metre radial plot.

76 Under the Coastal IFOA, giant trees in north-east NSW have a DBHOB of 160 centimetres if they are Coastal Blackbutt (*Eucalyptus pilularis*) or 140 centimetres for all other species. All giant trees are assumed to be hollow-bearing trees.

77 Large trees are living trees with a minimum threshold DBHOB of either 50 centimetres or 80 centimetres depending on vegetation class. Large trees act as a surrogate for hollow-bearing trees in order to remove the bias of missed hollows.

78 Stags must have diameter > 50 centimetres and height > 5 metres.

Table 27: Minimum number of points per mapped stratum

Area of stratum (hectares)	Minimum special environmental values assessment requirements	
	No. sampling points	No. equivalent BAM plots
2-5	5	1
>5-20	10	2
>20-50	15	3
>50-100	20	4
>100-250	20	4
>250-1,000	25	5
>1,000	30	6

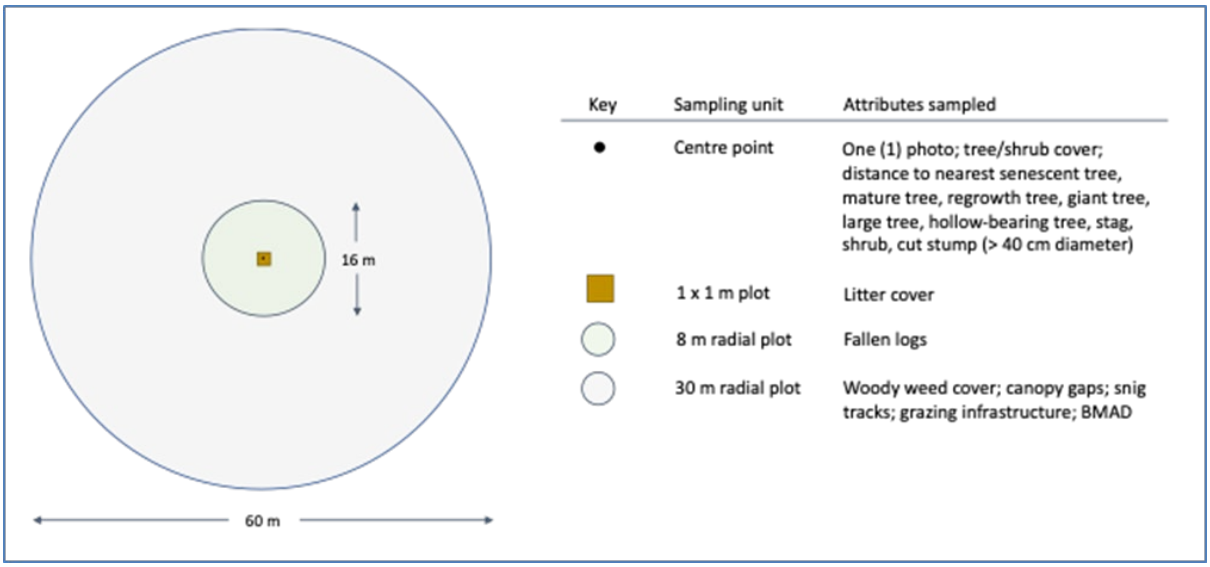

Figure 23: Field assessment plot layout

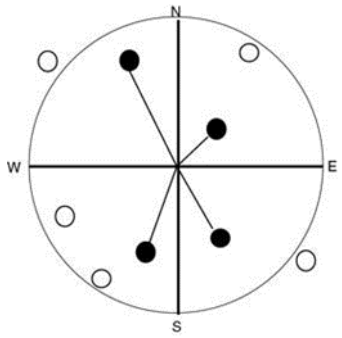

Figure 24: Point-centred quarter of radial plot

6.3 Step 2: Desktop assessment of habitat for key threatened species

- This step complements the field assessment undertaken in **Step 1**. It uses the latest available species distribution models to identify areas of high interest for conservation for a range of key threatened forest dependent species predicted for each nominated area.
- Forty-two fauna species and two endangered populations are considered to rely on the features associated with ecologically mature forest in the regions covered by the Coastal IFOA. These species will be used in species distribution models for this method. **Attachment 6.2** provides a list of these species and their threatened.
- Species distribution modelling is considered important for the special environmental values assessment because:
  - biodiversity is a key part of the JANIS criteria for establishing a CAR reserve system
  - fauna distribution models were used to inform the delineation of HCVOG that in turn became protected old growth.
- Modelled species distributions for species dependent on ecologically mature forest are merged into a raster layer and expressed as a 'weighted endemism' coverage.
- Weighted endemism captures the number of species likely to occupy a patch of forest (richness), as well as the geographic spread of the species in question. For example, a patch of forest that is predicted to support 10 threatened species that are widespread throughout the landscape will have a lower 'weighted endemism' than a patch that supports 10 threatened species that have a more confined geographical range.
- Weighted endemism spatial layers will be created, which combine species models into four guilds:
  - Species dependent on hollow-bearing trees.
  - Species dependent on fallen logs.
  - Species dependent on moist leaf litter.
  - Species dependent on dense canopy.
- An all-species weighted endemism spatial layer will also be created combining all species models.
- When testing this method, the range of available species distribution models were reviewed by EES in April 2019. A total of 35 CRA models[79], one Macquarie University model[80] and one expert derived model were selected for use in this method.
- The Macquarie University model is for Davis' tree frog, as there are no CRA models for this species.[81] While broad in resolution, EES considered that the Macquarie University model was sufficiently aligned with the distribution of Davies' tree frog records.

79 NPWS (1999) Modelling areas of habitat significance for vertebrate fauna and vascular flora in north east NSW. A project undertaken as part of the NSW Comprehensive Regional Assessments. Project number NA 23/EH. April 1999.

80 OEH (2018) Saving Our Species: Landscape-managed threatened species pilot modelling project. Final report. NSW Office of Environment and Heritage in collaboration with University of New England and Macquarie University. November 2018.

81 Other Macquarie University models were not considered appropriate for this project due to their broad resolution, lack of consideration of vegetation floristic or structural data or secondary data derived from vegetation and over-prediction of species habitat distribution in some cases (such as the marble frogmouth).

- The expert model is for Clarence River cod (also called the Eastern Freshwater Cod) and was generated by selecting hydro-lines identified by the NSW Department of Primary Industries (DPI Fisheries).[82]
- The fauna models proposed for this method and their specifications are shown in **Table 28**.
- If the NSW Government adopts the framework, the fauna distribution layers from the CRA models will be checked against the additional 20 years of species and endangered populations records across the Coastal IFOA region, and updated or amended if required. There will also be an annual review during framework implementation to update fauna distribution spatial layers with new records or information on species extent.
- If new and better fauna distribution models become available during framework implementation (2020 to 2022), these will replace any previous models.

Table 28: Fauna models used to test the method

Organisation	Number of models available	Species	Specifications
Macquarie University	1	Davies' Tree Frog	Presence only using Maxent with a resolution of the model at 1,000 metres. CRA model not available for this species
EES	35	Albert's Lyrebird; Brush-tailed Phascogale; Eastern False Pipistrelle; Eastern Freetail-bat; Fleay's Barred Frog; Gang-gang Cockatoo; Giant Barred Frog; Glandular Frog; Glossy Black Cockatoo; Golden-tipped Bat; Greater Broad-nosed Bat; Greater Glider; Green-thighed Frog; Hastings River Mouse; Loveridge's Frog; Marbled Frogmouth; Masked Owl; Mountain Frog; Pale-headed Snake; Pouched Frog; Powerful Owl; Red-legged Pademelon; Rufous Bettong; Rufous Scrub-bird; Sooty Owl; Sphagnum Frog; Spotted-tailed Quoll; Squirrel Glider; Stephen's Banded Snake; Stuttering Frog; Three-toed Snake-tooth Skink; White-crowned Snake; Yellow-bellied Glider; *Philora pughi*; *Philoria richmondensis*.	Each species represented by either a presence/absence generalised additive model or presence-only generalised additive model. Used a multitude of predictive layers including geo-graphic, biotic, abiotic, terrain and habitat. Habitat layers included fine and coarse litter index, decorticating bark index, and hollow index. Each model presented in 4 classes: ▪ 0 = non habitat ▪ 1 = marginal quality habitat ▪ 2 = moderate quality habitat ▪ 3 = high-quality habitat

82 NSW Department of Primary Industries (2017) *Eastern Freshwater Cod (*Maccullochella ikei). Available at: https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0006/448926/Primefact-178-Eastern-cod.pdf.

Organisation	Number of models available	Species	Specifications
Expert model	1	Clarence River Cod	Distribution was captured directly from the expert map: https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0006/448926/Primefact-178-Eastern-cod.pdf

6.3.1 Developing weighted endemism models

- To develop weighted endemism models, each species listed in **Attachment 6.1** is assigned to one or more of the following 'guilds' depending on its primary ecological dependencies:
  - Hollow-bearing trees.
  - Large fallen logs.
  - Leaf litter.
  - Dense canopy.
- **Table 29 s**hows the species allocated to each guild based on their primary ecological dependency.
- A weighted endemism score is then derived for each guild by combining the individual distribution models of all species in the guild. Some species are dependent on more than one forest attribute and are represented in more than one coverage of weighted endemism.
- The weighted endemism value threshold for this method was developed by using three reference sites. The weighted endemism values within North Coast state forests were referenced against values generated in HCVOG areas in the Kumbatine, Nymbioda and Nymboi-Bindery National Parks, which are situated adjacent to the field testing sites. These reference sites were selected as they were close to the field testing sites and are likely to have very similar ecological communities. In addition, these reference sites were cross-checked against the median weighted endemism score generated for all nature reserves in the north coast region.
- The reference sites suggest the median weighted endemism score in adjacent national parks and all nature reserves (the value where half the area of the national park or nature reserve was under and half was over) was 83 percent.
- For the purposes of the final threshold test, all species guild models are combined to create the all-species weighted distribution model.
- **Figure 25** shows the model for the NSW North Coast region and the reference sites used to benchmark the weighted endemism threshold used in the final test for special environmental values.

Table 29: Species used to derive four weighted endemism models

Guild	Species models combined
Species dependent on hollow-bearing trees (large trees)	Brush-tailed Phascogale; Eastern False Pipistrelle; Eastern Free-tailed Bat; Gang-gang Cockatoo; Glossy Black-Cockatoo; Greater Broad-nosed Bat; Golden-tipped Bat; Greater Glider; Masked Owl; Northern Free-tailed Bat; Pale-headed Snake; Powerful Owl; Red-tailed Black-Cockatoo (coastal subspecies); Sooty Owl; Spotted-tailed Quoll; Squirrel Glider; Stephen's Banded Snake; Yellow-bellied Glider.
Species dependent on large fallen logs	Albert's Lyrebird; Atlas Rainforest Ground-beetle; Clarence River Cod; Davies' Tree Frog; Fleay's Barred Frog; Glandular Frog; Green-thighed Frog; Hastings River Mouse; Pouched Frog; Rufous Bettong; Rufous Scrub-bird; Sphagnum Frog; Spotted-tailed Quoll; Three-toed Snake-tooth Skink; White-crowned Snake.
Species dependent on moist leaf litter	Albert's Lyrebird; Atlas Rainforest Ground-beetle; Davies' Tree Frog; Fleay's Barred Frog; Giant Barred Frog; Glandular Frog; Green-thighed Frog; Loveridge's Frog, Mountain Frog; Pouched Frog; Rufous Scrub-bird; Sphagnum Frog; Stuttering Frog; Three-toed Snake-tooth Skink; White-crowned Snake; *Philoria pughii*; *Philoria richmondensis.*
Species dependent on dense canopy	Clarence River Cod; Golden-tipped Bat; Green-thighed Frog; Hastings River Mouse; Red-legged Pademelon; Loveridge's Frog, Marbled Frogmouth; Mountain Frog; Sphagnum Frog; Spotted-tailed Quoll; Stuttering Frog; *Philoria pughii*; *Philoria richmondensis.*

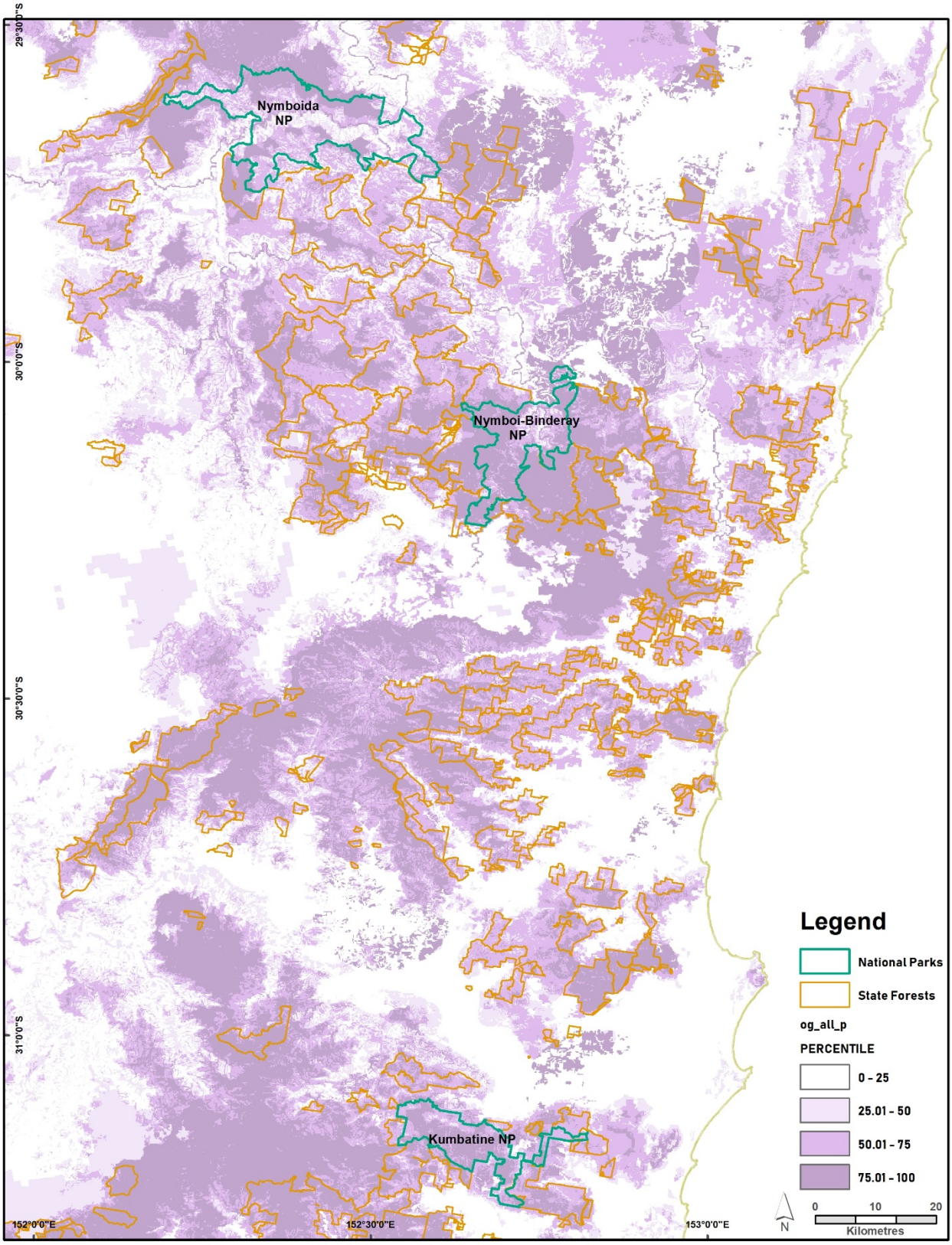

Figure 25: All species weighted distribution model for the north coast region showing state forests and reference national parks

6.4 Step 3: Final test of special environmental values

- This step is the final test for special environmental values in GSUs in areas currently mapped as old growth but that were found to be not old growth under the Old Growth Reassessment Method.
- Using data from the assessments conducted in **steps 1** and **2,** the final test considers:
  - whether the forest contains the necessary habitat features and is of a condition to support key threatened and sensitive fauna species, *and if so,*
  - whether the area has unique or uncommon biological values.
- The final test for special environmental value that makes use of field attributes collected and the weighted endemism models. For a GSU to meet the requirements of special environmental value it must satisfy **both** of the following criteria:
  - The condition score of **all** field attributes must meet the BAM benchmark (i.e. be above 95 percent) for the vegetation class present.
  - The distribution for all species in the GSU must have a weighted endemism score equal to or greater than 83 percent.
- If a GSU meets both these criteria, it will be recommended to remain as a protected area.
- The weighted endemism score is determined as part of **Step 2** of this method (**Section 6.3**). For any areas that meet BAM benchmark values but do not meet the weighted endemism threshold score will be checked prior to any rezoning decision. The most up-to-date models at the time of decision will be used as a final check that the special environmental value status has not changed.
- The development of the condition score and benchmarking of the field attributes for a GSU is described in the following section.

6.4.1 Benchmarking field attributes

Analysing field attribute data

- To inform the condition score used in benchmarking, field data collected in **Step 1** is analysed to determine the following attributes in the GSU:
  - The **average density** (***N***) **of large living trees** (large living tree diameter is determined against the vegetation class) using the equation in **Box 3**.
  - The **average tree crown and shrub crown cover** from all sampling points in the GSU. The percent cover of all trees is multiplied by the average crown area of all trees (from measures of crown radius) to estimate the projected crown cover. The percent cover of mid-storey shrubs is multiplied by the average crown area of shrubs (from measures of crown radius) to estimate projected crown cover.
  - The **average litter cover** is estimated as a simple average percent cover from all 1 metre x 1 metre plots.
  - The **total length of fallen logs** (> 10 centimetres and > 50 centimetres diameter sections) using the equation in **Box 4**.

Box 3: Calculating average density

- The average density of large living trees is calculated using the following equation:

$$N = 10{,}000 \times \frac{16n^2}{\left(\sum_{i=1}^{n}\sum_{j=1}^{4} d_{ij}\right)^2}$$

where:
N = Average density (units.ha^{-1}) within the GSU
n = number of points sampled within the GSU
i = point i along the series of transects within the GSU
j = quarter j within each point
d_{ij} = distance (metres) to nearest plant at point i in quarter j within the GSU

- Where a particular feature does not occur within any quarter, a null score (denoted by 'n') is recorded.

Box 4: Calculating total length of large fallen logs

- Fallen logs measured within the 8 metre radial plots (where 50 plots are equivalent to an area of 1 hectare). The total length (metres) of fallen logs (> 10 metres and > 50 metres) within each GSU is estimated using the following equation:

$$\boldsymbol{L = \frac{50}{P} \times \sum_{i=1}^{P} l_i}$$

Where:
L = Length (metres per hectare) of dead fallen logs within the GSU
P = number of 8m radial plots sampled within the GSU
i = plot i along the series of transects within the GSU
l_i = Length (metres) of dead fallen logs at plot i within the GSU

Condition Score

- The condition score for each attribute in the GSU (which compares the field attribute value to a BAM benchmark) is calculated using the following equation (based on the Weibull distribution):

$$\boldsymbol{CS = 100.68 \times \left(1 - e^{-5\left(N/B\right)^{2.5}}\right)}$$

Where:
$\boldsymbol{CS}$ = unweighted condition score
N = average value recorded in the field
B = benchmark value

- For an attribute to meet the BAM benchmark, the condition score must be above 95 percent.

6.5 Step 4: Field assessment of special cultural values

- Desktop assessments of listed heritage sites (for both Aboriginal and non-Aboriginal heritage) are undertaken as part of the Site Selection Method.
- The assessment of heritage values in this method are designed to capture sites or places that have *not* been previously recorded on heritage registers.
- The field assessment for Aboriginal and non-Aboriginal cultural values and heritage is only required if the nominated area is found not to contain old growth or special environmental values.

6.5.1 Aboriginal cultural values and heritage field assessment

- The FCNSW Aboriginal Partnerships Liaison Team will engage the relevant local Aboriginal groups and knowledge holders to undertake a field assessment of cultural values in the nominated area and prepare a report on the findings.
- The FCNSW Aboriginal Partnerships Liaison will facilitate and attend all visits to nominated areas and will ensure all newly identified sites and places are included on the NSW Aboriginal Heritage Information Management System.
- The Commission will oversee this process, including attending visits to nominated areas.
- The local Aboriginal groups and knowledge holders who undertake the assessment will prepare a report on the findings of the assessment and the FCNSW Aboriginal Partnerships Team Leader will sign off on this report. The report will then be submitted to the Commission.

6.5.2 Non-Aboriginal heritage field assessment

- If there are strong indications that there may be unregistered sites or places of non-Aboriginal heritage in the nominated area (for example, if there are items or sites discovered during field work under the old growth assessment method), EES will organise an assessment of heritage values and prepare a report, which will be submitted to the Commission.

6.5.3 Considering a nominated areas heritage values

- The Commission will consult with heritage experts and – along with the findings of the desktop and field assessments undertaken under the framework – consider whether the identified heritage values are compatible with forestry operations.
- From this, the Commission will make one of the following recommendations to decision makers on rezoning:
  - The nominated area contains no heritage sites or places.
  - What the impact of rezoning would have.
  - The nominated area contains heritage sites or places that can be protected during forestry operations by applying existing guidelines approved under heritage laws.
  - The nominated area contains outstanding examples of heritage sites or places that are not compatible with forestry operations and the area is not recommended for rezoning.

Attachment 6.1: Species included in species modelling

Scientific Name	Common Name	Threat status		Key habitat elements
		C'wealth[83]	NSW[84]	
Amphibians				
Assa darlingtoni	Pouched Frog	Not listed	Vulnerable	Damp leaf litter, or under rocks and rotten logs
Litoria brevipalmata	Green-thighed Frog	Not listed	Vulnerable	Leaf litter, fallen logs, dense canopy
Litoria daviesae	Davies' Tree Frog	Not listed	Vulnerable	Leaf litter, fallen logs
Litoria subglandulosa	Glandular Frog	Not listed	Vulnerable	Leaf litter, fallen logs
Mixophyes balbus	Stuttering Frog	Vulnerable	Endangered	Leaf litter, dense vegetation (high cover)
Mixophyes fleayi	Fleay's Barred Frog	Endangered	Endangered	Deep leaf litter around streams, fallen logs
Mixophyes iteratus	Giant Barred Frog	Endangered	Endangered	Leaf litter
Philoria kundagungan	Mountain Frog	Not listed	Endangered	Leaf litter, high foliage cover, soaks and seeps
Philoria loveridgei	Loveridge's Frog	Not listed	Endangered	Leaf litter adjacent to streams, high foliage cover, soaks and seeps
Philoria pughi		Not listed	Endangered	Leaf litter, moss or mud adjacent to streams, high foliage cover, soaks and seeps.
Philoria richmondensis		Not listed	Endangered	Leaf litter, moss or mud adjacent to streams, high foliage cover, soaks and seeps.
Philoria sphagnicolus	Sphagnum Frog	Not listed	Vulnerable	Leaf litter, fallen logs, foliage cover
Bats				
Falsistrellus tasmaniensis	Eastern False Pipistrelle	Not listed	Vulnerable	Hollows-bearing trees; forest structural heterogeneity
Kerivoula papuensis	Golden-tipped Bat	Not listed	Vulnerable	Hollows-bearing trees; dense understorey vegetation
Mormopterus lumsdenae	Northern Free-tailed Bat	Not listed	Vulnerable	Hollow-bearing trees
Mormopterus norfolkensis	Eastern Freetail-bat	Not listed	Vulnerable	Hollow-bearing trees
Scoteanax rueppellii	Greater Broad-nosed Bat	Not listed	Vulnerable	Hollow-bearing trees
Birds				

83 *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth).
84 *Biodiversity Conservation Act 2016* (NSW).

Scientific Name	Common Name	Threat status		Key habitat elements
		C'wealth[83]	NSW[84]	
Atrichornis rufescens	Rufous Scrub-bird	Not listed	Vulnerable	Litter, fallen logs, dense understorey
Callocephalon fimbriatum	Gang-gang Cockatoo	Not listed	Vulnerable	Hollow-bearing trees
Calyptorhynchus banksii banksii	Red-tailed Black-Cockatoo (coastal subspecies)	Not listed	Critically Endangered	Hollow-bearing trees
Calyptorhynchus lathami	Glossy Black-Cockatoo	Not listed	Vulnerable	Hollow-bearing trees.
Menura alberti	Albert's Lyrebird	Not listed	Vulnerable	Litter, fallen logs
Ninox strenua	Powerful Owl	Not listed	Vulnerable	Hollow-bearing trees
Podargus ocellatus	Marbled Frogmouth	Not listed	Vulnerable	Dense canopy cover
Petroica rodinogaster	Pink Robin	Not listed	Vulnerable	Dense canopy cover
Tyto novaehollandiae	Masked Owl	Not listed	Vulnerable	Hollow-bearing trees
Tyto tenebricosa	Sooty Owl	Not listed	Vulnerable	Hollow-bearing trees
Fish				
Maccullochella ikei	Clarence River Cod	Endangered	Endangered	Dense canopy cover, dead fallen logs
Invertebrates				
Nurus atlas	Atlas Rainforest Ground-beetle	Not listed	Endangered	Litter, fallen logs
Mammals				
Aepyprymnus rufescens	Rufous Bettong	Not listed	Vulnerable	Tussocky grass layer, fallen logs
Dasyurus maculatus	Spotted-tailed Quoll	Endangered	Vulnerable	Dense canopy cover along creeklines; hollow-bearing trees; fallen logs
Petaurus australis	Yellow-bellied Glider	Not listed	Vulnerable	Hollow-bearing trees
	Yellow-bellied Glider population of Bago Plateau	Not listed	Endangered population	Hollow-bearing trees
Petaurus norfolcensis	Squirrel Glider	Not listed	Vulnerable	Hollow-bearing trees
Petauroides volans	Greater Glider	Vulnerable	Not listed	Hollow-bearing trees
	Greater Glider population of Eurobodalla Shire	Not listed	Endangered population	Hollow-bearing trees
Phascogale tapoatafa	Brush-tailed Phascogale	Not listed	Vulnerable	Hollow-bearing trees
Potorous longipes	Long-footed Potoroo	Endangered	Critically Endangered	Dense canopy cover
Pseudomys oralis	Hastings River Mouse	Endangered	Endangered	Canopy cover, dead fallen logs
Thylogale stigmatica	Red-legged Pademelon	Not listed	Vulnerable	Dense canopy cover, dense undergrowth

Scientific Name	Common Name	Threat status		Key habitat elements
		C'wealth[83]	NSW[84]	
Reptiles				
Cacophis harriettae	White-crowned Snake	Not listed	Vulnerable	Leaf litter, fallen logs
Coeranoscincus reticulatus	Three-toed Snake-tooth Skink	Not listed	Vulnerable	Leaf litter, fallen logs
Hoplocephalus bitorquatus	Pale-headed Snake	Not listed	Vulnerable	Hollow-bearing trees
Hoplocephalus stephensii	Stephen's Banded Snake	Not listed	Vulnerable	Large stags, hollow-bearing trees, understorey vegetation

7 Decision Making Rules

7.1 Summary of approach

- This stage of the framework addresses the component of the terms of reference that asks the Commission to:

Develop a methodology to allow decision makers to determine the implications for the twin commitments – at the site and management area scale – of changing existing reserve boundaries (i.e. old growth mapping boundaries), based on the assessment

Every year until 2022 – reassess and remap old growth areas and provide advice to the NSW Government about implications for the twin commitments at the site and landscape scale

- Changing existing old growth mapping boundaries (i.e. rezoning areas) can potentially impact the NSW Government's ability to meet its twin commitments to no net change in wood supply and no erosion of environmental values at the site and landscape scale.
- Only the NSW Government can make rezoning decisions regarding old growth mapping boundaries after considering all relevant laws.
- The Commission is not responsible for any rezoning decisions. After undertaking assessments using the methods outlined in **Chapters 3 to 6** as required, the Commission would provide advice to the NSW Government on areas that could be rezoned. The NSW Government would then need to consider this advice and any implications for the twin commitments.
- The methods under the framework have been designed to provide decision makers with the evidence to determine whether or not an area may be suitable for reassessment and remapping and understand potential implications of rezoning decisions for the twin commitments. The framework has various 'stop points' at which the process cannot proceed without adequate evidence. These points have been included to ensure that old growth and special environmental or conservation values remain protected and environmental commitments are maintained. They also ensure that reassessment and remapping only occurs when and where it is required to meet the twin commitments.
- For example, the methods provide the following evidence to help understand the impacts of decisions on the twin commitments:
    - **No erosion of environmental values at the landscape scale**: This is addressed, for example, by considering the status of JANIS reserve system targets upfront as part of the Site Selection Method. This process restricts where industry can make nominations for reassessment of old growth mapping to ensure that areas that are required to maintain the NSW Government's commitments to landscape-scale conservation targets. Other landscape scale environmental values are protected by not allowing nominations in flora reserves (part of the National Reserve System) or in forest ecosystems at the edge of their geographic range.
    - **No erosion of environmental values at the site scale**: To avoid erosion of site-scale environmental values, no genuine old growth can have its protected status removed. This is assessed by the EES Science Division through the desktop and field-based Old Growth Reassessment Method. If the area is found not to contain old growth forest, another desktop and field-based assessment for special

environmental and conservation values is conducted. Any areas found to contain special environmental and conservation values will remain protected (i.e. harvesting will **not** be allowed).

- **No net change in wood supply:** Wood supply impacts at the site and landscape scales are assessed through the Wood Supply Verification Method, Site Selection Method and through independent checks conducted under this method. These methods assess and verify potential wood supply that may be secured through industry nominations or potential increases in wood supply shortfalls from public nominations. All assessments of wood supply change will be made publically available.

- This section provides a framework to help decision makers use the results of the assessments under the methods to understand whether changing a particular reserve boundary allows the NSW Government to meet the twin commitments and, from this, to decide whether a particular reserve boundary should be changed.
- This chapter provides:
  - an overview of what decisions need to be made based on the outcomes of the assessments in the methods outlined in **Chapters 3 to 6** (referred to as decision pathways)
  - a set of decision rules to ensure decision makers have fully considered and satisfied implications for the twin commitments
    - Importantly, these rules include checking the wood harvest volumes on areas that have been recommended for rezoning and ensuring that these volumes meet but do not exceed the verified wood supply shortfall. By doing this, decision makers can ensure that rezoning only occurs when and where it is required to meet the twin commitments.
    - These rules consider protections under this framework for environmental values, broader site- and landscape-scale protections under the Coastal IFOA and the amount of wood supply shortfall that has been verified.
  - a reporting framework to the NSW Government ensure decisions are made transparently.
- **Figure 26** provides an overview of how the decision making rules are applied.
- The key assumption underpinning this method is that the Coastal IFOA manages and maintains site and landscape environmental values in state forest where harvesting activities are permitted. If an area of protected old growth is found not to contain old growth forest, not to have special environmental and conservation values, and the assessment satisfies all of the decision rules in this method, then the Coastal IFOA will manage and maintain the site and landscape environmental values of that area.

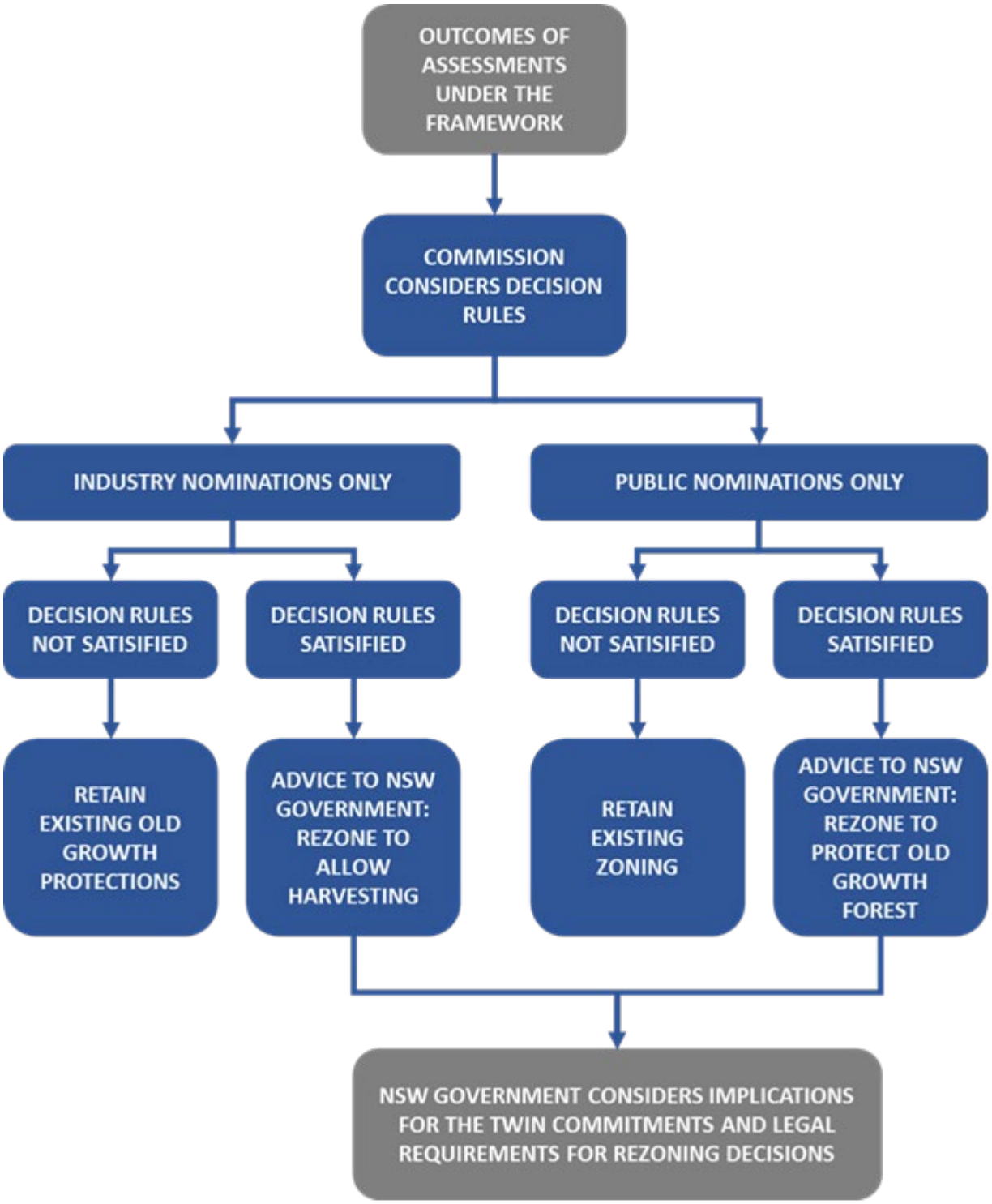

Figure 26: Overview of the process to apply the decision making rules

7.2 What decisions need to be made based on the outcomes of the framework?

- The Commission will provide advice on the outcomes of the framework methods. Using this advice and the decision rules in this method the decision maker needs to consider:
  - **Implications for the twin commitments**: If an area is rezoned, would there be a positive or negative impact on wood supply? Would there be an erosion of environmental values?
  - **Whether to rezone an area based on the results of the framework assessment:** Do the outcomes of the Old Growth Reassessment Method and, if required, the Special Environmental and Conservation Values Assessment Method, and the information discovered through the Site Selection Method and application of the Wood Supply Verification Method support a decision to rezone an area?
- **Figure 27** outlines the two broad decision pathways for this framework, based on the two key framework components (introduced in **Sections 2.3 and 2.4**):
  - Should an area mapped as protected old growth forest be rezoned to allow harvesting?
  - Should an area **not** mapped as protected old growth forest be rezoned to prohibit harvesting and protect old growth values?

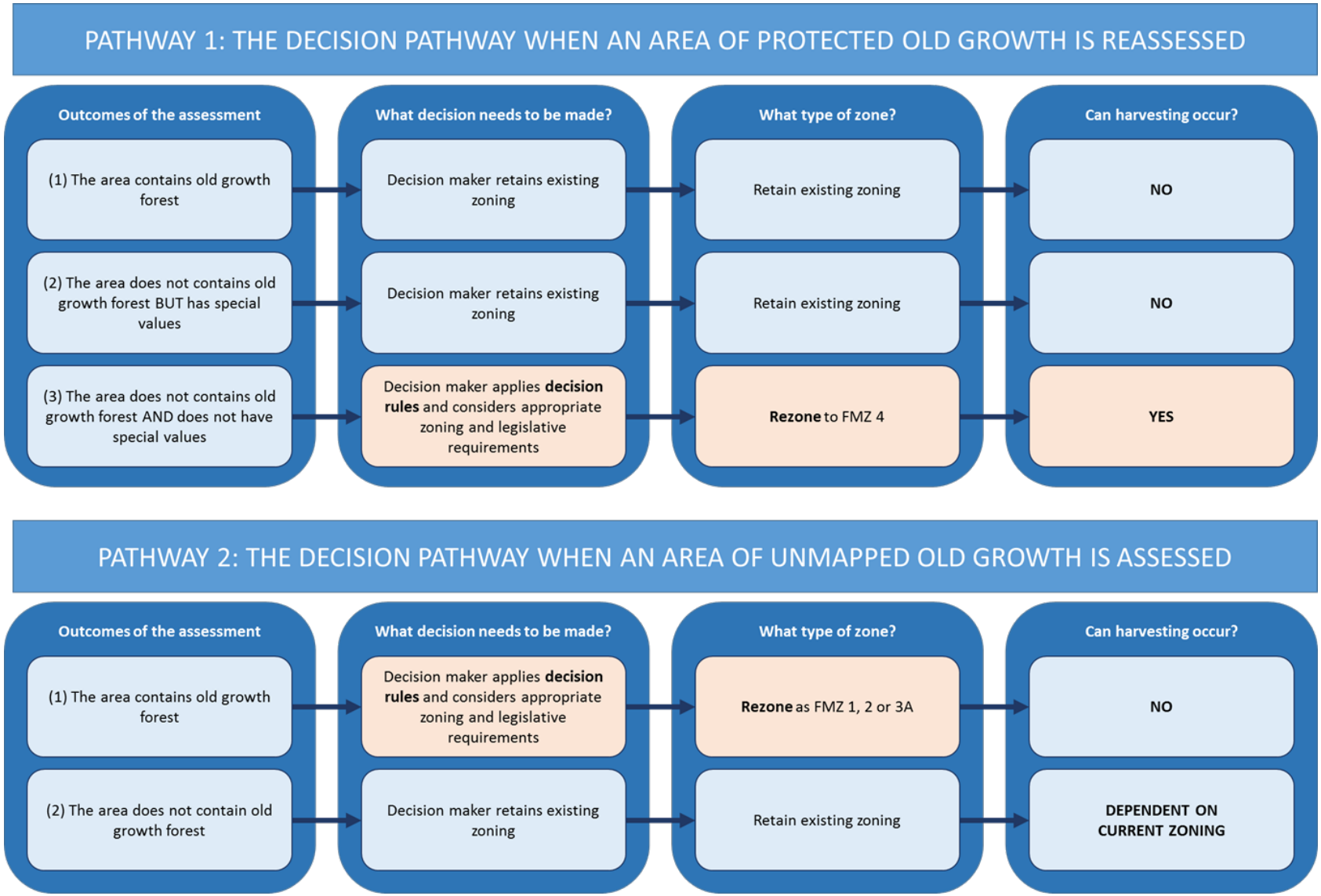

Figure 27: The decision pathways for the framework, based on the two key framework components

7.3 Rules for deciding if an area currently mapped as old growth is rezoned to allow harvesting

- **Table 30** outlines the eight decision rules that need to be met for a decision to rezone an area currently mapped as old growth to allow harvesting. The table shows the method under the framework that assesses this rule.
- All decision rules must be satisfied (answered 'yes') ahead of a decision to rezone.
- If **all** decision rules in **Table 30** are satisfied, the decision maker would consider rezoning to allow forestry operations in accordance with the settings in the Coastal IFOA. These considerations will need to address heritage and other legal requirements and will be subject to Ministerial and Parliamentary approvals.
- Decision makers should **not rezone** if one or more of the decision rules in **Table 30** are **not** satisfied. In these cases, the existing old growth protections at the site must be retained or amended to protect the special environmental and conservation values present.

Table 30: Decision rules to consider rezoning to allow harvesting

Decision rules	Relevant part of framework where rule is addressed
1. Has a wood supply shortfall been verified?	**Wood Supply Verification Method** – check at time of decision/rezoning
2. Have JANIS reserve targets under the relevant Regional Forest Agreement been maintained?	**Site Selection Method** – desktop assessment to restrict nomination areas
3. Is the site OUTSIDE of areas designated as flora reserves?	**Site Selection Method** – desktop assessment to restrict nomination areas
4. Is the site NOT at the edge of the forest ecosystem's geographic range or otherwise notably isolated or unique?[85]	**Site Selection Method** – desktop assessments on a case by case basis after nomination received
5. Has the site been assessed and found NOT to contain old growth forest?	**Old Growth Reassessment Method** – application of method
6. Has the site been assessed and found NOT contain special environmental or conservation values?	**Special Environmental and Conservation Values Assessment Method** – application of method
7. Does the merchantable volume of wood in reassessed and rezoned areas contribute to meeting but not	**Wood Supply Verification Method** – method verifies wood supply impacts and if a shortfall exists

[85] Note: this criterion is linked to JANIS biodiversity criteria 4, 7 and 8 in Commonwealth of Australia (1997) *Nationally Agreed Criteria for the Establishment of a CAR Reserve System for Forests in Australia*, A Report by JANIS, pp13-14

Decision rules	Relevant part of framework where rule is addressed
exceed the verified wood supply shortfall?	**Site Selection Method** – estimate supplied by FCNSW or industry in their nomination **Decision making rules** – independent review of FCNSW or industry estimate of merchantable volume of wood, with public release of the review; desktop comparison of merchantable volume of wood in reassessed areas and contribution to verified wood supply shortfall **Annual Reporting** – annual update on estimated merchantable volume of timber in reassessed areas
8. Is the Coastal IFOA (or equivalent) in force and does it apply to the reassessed site?	Check at time of decision/rezoning

7.4 Rules for deciding if an area not currently protected old growth should be rezoned to protect old growth values

- **Table 31** outlines the three decision rules that need to be met to rezone an area **not** currently protected old growth to prohibit harvesting and protect old growth values. The table shows the method under the framework that assesses this rule.
- All decision rules must be satisfied (answered 'yes') ahead of a decision to rezone.
- If all decision rules in **Table 31** are satisfied:
  - the decision maker rezones the area to prohibit forestry operations and protect old growth values
  - FCNSW estimates the volume of merchantable timber no longer available for harvesting, taking into consideration current harvesting exclusions that would apply
  - the Commission appoints an independent reviewer to verify the FCNSW estimate of the volume of merchantable timber no longer available for harvesting
  - if verified, the Commission adds the volume of merchantable timber no longer available for harvesting to the verified wood supply shortfall
  - the Commission then publicly releases the FCNSW estimates and the results of the independent review.
- Decision makers should **not rezone** if one or more of the decision rules in **Table 31** are **not** satisfied. In these cases, existing site zoning and harvesting permissions are retained.

Table 31: Decision rules to consider rezoning to protect old growth forest

Decision rules	Relevant part of framework where rule is addressed
1. Has the nomination been made in native forest located in a coastal state forest and satisfied all nomination criteria?	**Site Selection Method –** desktop assessment to restrict nominations
2. Has the site been assessed as old growth forest under the Old Growth Assessment Method with a minimum area of 2 hectares?	**Old Growth Reassessment Method** – application of method
3. Has the merchantable volume of timber on the site been verified and, if required, added to the verified wood supply shortfall?	**Decision Making Rules -** independent review of FCNSW or industry estimate of merchantable volume of wood conducted

7.5 Reporting annually to the NSW Government

- The Commission will prepare and submit an annual report to the NSW Government in the following August of each year of the framework's implementation. The report will provide:
  - a statement on the **area of coastal state forest** that has been reassessed including the:
    - total number and area of nominations
    - total area reassessed (desktop and field assessments)
    - area recommended to be rezoned to allow forestry operations (subject to approvals)
    - area recommended to be rezoned to protect old growth
    - net change in harvestable area and protected area as a result of the reassessment if rezoning were to occur.
  - a statement on the estimated merchantable volume of timber:
    - in sites that are recommended to be rezoned to allow forestry operations
    - in sites that are recommended to be rezoned to protect old growth
    - net change in volume of merchantable timber as compared to the verified wood supply shortfall if rezoning were to occur.
  - a statement on the implications for the twin commitments.