Natural Resources Commission

Supplementary Advice on Coastal Integrated Forestry Operations Approval Remake

Old Growth Forests and Rainforests - North Coast State Forests

FINAL

MARCH 2018

NSW GOVERNMENT

Enquiries

List of acronyms

BOGMP	Broad Old Growth Mapping Project
CAR	Comprehensive, adequate and representative
CRA	Comprehensive Regional Assessment
CRAFTI	Comprehensive Regional Assessment Aerial Photograph Interpretation
DPC	Department of Premier and Cabinet
DPI – Forestry	Department of Primary Industries – Forestry
DBH	Diameter at breast height
DSHOB	Diameter at stump height over bark
EPA	NSW Environment Protection Authority
FCNSW	Forestry Corporation of New South Wales
FMZ	Forest Management Zone
HCVOG	High Conservation Value Old Growth
HQHOG	High Quality Habitat Old Growth
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
LNE	Lower north east region
NPWS	NSW National Parks and Wildlife Service
OEH	Office of Environment and Heritage
PNF	Private Native Forestry
RFA	Regional Forest Agreement
UNE	Upper north east region

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Executive summary

The NSW Government has committed to balance the twin commitments of wood supply and environmental values in north coast state forests under the new Coastal Integrated Forestry Operations Approval (Coastal IFOA). Achieving such a balance is a difficult task due to current and historical agreed settings, national agreements, new knowledge, gaps in knowledge, and available wood supply.

In 2016, the Premier asked the Natural Resources Commission (the Commission) to advise on a range of outstanding settings for the new Coastal IFOA under terms of reference. The Commission recommended settings that came as close as possible to meeting the twin commitments. However, the Commission reported there would be an estimated shortfall of 7,600 to 8,600 cubic metres of high quality timber per year, as a result of mapping threatened ecological communities and koala protections.

Under subsequent terms of reference, the Commission was asked to provide supplementary advice on whether the NSW Government could remap and rezone old growth forest and rainforest to offset the impact to wood supply associated with its previous advice. At a workshop attended by cross-government stakeholders, it was agreed to pilot the existing Private Native Forestry (PNF) protocols to remap old growth forest and rainforest in north coast state forests, with some additional considerations to protect environmental values.[1] The Office of Environment and Heritage's (OEH) Native Vegetation Information Science Branch (OEH Science) was engaged to independently apply the PNF protocol. The Commission also worked closely with field staff from the NSW Environment Protection Authority (EPA) and the Forestry Corporation of NSW (FCNSW).

The Commission notes there will be no simple solutions to remapping old growth forest and rainforest in state forests, particularly given their heavily contested values within the community.

Findings

OEH Science staff are professional and skilled independent assessors. **The PNF protocols are objective, makes use of the best available technology and data, and are simple to apply in the field.** All agencies and FCNSW operated in a highly collaborative and professional manner during the field assessments.

The Commission's pilot identified significant errors in current old growth forest (HCVOG[2]) and rainforest (CRAFTI[3]) maps, in terms of forest extent and location.

In six of the 13 sites reviewed, the reassessment found no areas of old growth forest according to the PNF protocol (see **Figure ES1**). In four of the 13 sites, the reassessment identified old growth forest but largely outside the currently mapped areas (see **Figure ES2**). This old growth forest is currently unprotected by zoning. At one site, the reassessment found old growth forest where there is currently none mapped. In the remaining two of the 13 sites, there was old growth forest, but to a much lesser extent than is currently mapped (see **Figure ES3**).

Aggregated across all 13 sites, the reassessment reduced the extent of old growth forest by 78 percent, and rainforest by 35 percent, although the number of hectares involved was

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[1]   Both FCNSW and the EPA nominated sites for remapping to identify over-mapped and under-mapped areas.
[2]   High Conservation Value Old Growth
[3]   Comprehensive Regional Assessment Aerial Photographic Interpretation

significantly smaller. OEH Science has reported similar results on private land, where landholder initiated reassessments reduced the extent of old growth forest by 65 percent, and rainforest by 23 percent.

Before potentially rezoning any areas for harvesting, there needs to be a verified loss of wood supply arising from the Coastal IFOA provisions.

If there is a verified shortfall in wood supply, remapping and rezoning former old growth areas would most likely meet this shortfall and would balance the twin commitments, provided the Commission's associated risk-based recommendations are implemented. The Commission notes that the NSW Government's commitment is to have no net change in wood supply. Any remapping should only occur to the extent required to make up the verified shortfall, and not impinge upon existing NSW Government environmental commitments.

FCNSW estimates there is nearly 9,000 cubic metres of high-quality timber standing in sample sites where the extent of old growth was reduced, and approximately 100 cubic metres where the extent of rainforest was reduced. This, for example, would be sufficient to address one year of the estimated timber supply shortage.

Importantly, if remapping and potential rezoning of old growth forest is restricted to these areas, NSW would continue to **meet its commitment under the North East Regional Forest Agreement (RFA),** by **maintaining each old growth forest ecosystem above the 60 percent reservation targets set out in JANIS[4] criteria.**

There are approximately 1.7 million hectares of old growth forest in the North East RFA region. Under the Commission's proposed approach, **just under 1 percent (14,600 hectares) of what is currently mapped as old growth forest in northern NSW would be subject to remapping and rezoning**, and subsequent potential harvesting over a 20 year period. **Remapping and rezoning will only occur on state forests, and will only occur in targeted locations. The remaining old growth areas on state forests will not be subject to remapping under the Commission's proposed approach, which may mean that they will develop into old growth forest over time, if they are not already at that stage.**

The overall area of reserved old growth forest ecosystems has increased by 10 percent from the baseline since the North East RFA was signed in 2000, with additional formal and informal reservation in the Coastal IFOA region.

Based on the findings on the sample sites, FCNSW (following a request from the Commission) has estimated that the volume of timber that could potentially occur in areas that have old growth forest ecosystems that exceed the committed 60 percent JANIS target. The Commission notes this estimate is based on a small, unrepresentative sample and contains several assumptions, and that forecasts are inherently uncertain. As such, caution should be taken when considering this indicative number.

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[4]   Joint ANZECC/MCFFA National Forest Policy Statement Implementation Sub-Committee Nationally Agreed Criteria for a Comprehensive, Adequate and Representative Reserve System for Forests in Australia

FCNSW estimates:

- There is almost **9,000 cubic metres** of high-quality timber in the net harvestable area of the sample sites, in areas that are no longer mapped as old growth and in ecosystems that still exceed JANIS old growth targets (295 hectares).

- There may be just over **164,000 cubic metres** of high-quality timber from commercially viable forest ecosystems (which contain a majority of commercial timber species) in the net harvestable area across six supply zones, in areas identified as old growth forest and ecosystems that exceed JANIS old growth targets (around 7,600 hectares). Annualised over 20 years, this equates to 8,200 cubic metres per year.

- There may be almost **48,000 cubic metres** of high quality timber from non-commercially viable forest ecosystems (which may contain some commercial timber species) in the net harvestable area across six supply zones, in areas identified as old growth forest and ecosystems that exceed JANIS targets (around 7,000 hectares). Annualised over 20 years, this equates to 2,500 cubic metres per year. The commercial return on this timber is significantly less than for key commercial types.

- There may be more than **90,000 cubic metres** of high-quality timber from commercial species in the net harvestable area across six supply zones, in areas identified as no longer being rainforest (around 4,900 hectares). Annualised over 20 years, this equates to 4,500 cubic metres per year. Accessing timber in these areas would be difficult.

It is important to keep in mind that the **figures above are estimates, with low levels of confidence, and, that any increase in standing stock does not mean there is an increase in wood supply.**

The Commission has proposed an approach to reassess and remap old growth forest and rainforest to **address any verified shortfalls in wood supply, and meet the NSW Government's twin commitments.**

While technically feasible, remapping and rezoning will be challenging. Nearly all north coast old growth forests are protected by Parliament under a 'special management zone' and are also protected under Forest Management Zones (FMZ) 2 and 3a as informal reserves or exclusion zones. Furthermore, old growth forests under the current HCVOG spatial data set for the upper north east region are listed as a state significant heritage item.

Old growth forests are highly valued by the community, and making changes to old growth maps, zones and prescriptions – even if incorrectly mapped originally – is very likely to result in significant community opposition.

Prior to any decision making, it would be prudent for the NSW Government to **clarify any legal implications** of potentially revoking or amending zones for old growth forest, and of **removing the current heritage listing** for the HCVOG data set. The NSW Government should also **engage with the community on the issue**. The NSW Government can then make an informed decision on whether to proceed and, if so, the most appropriate pathway for revoking or amending protections.

If incorrectly mapped old growth areas are managed for timber harvesting, the NSW Government will need to **ensure that environmental impacts are managed**, and that **environmental values are maintained at a site and regional scale, and over time.**

Old growth forest assessment criteria should be revised to **reduce the minimum area of old growth forest that can be protected (from 5 to 2 hectares)**, and compliance with JANIS old growth protection targets should be continuously monitored to ensure the twin and RFA commitments are maintained. Any increase in net harvestable area as a result of rezoning should be factored into overall harvest operations to allow more time for forest regeneration.

Furthermore, any reduction in the informal reserve system as a result of rezoning could be **offset by an equivalent land transfer** from non-commercially viable forest areas, or from covenanted old growth areas associated with private native forestry. Any remapping of old growth forest and rainforest should be used to address verified wood supply shortfalls and should not result in an increase in wood supply under the current wood supply agreements.

As part of the assessment of whether the mapping of old growth forest and rainforest is accurate, there should be a preliminary **assessment of habitat values**. If the preliminary assessment identifies high-quality habitat values, a more comprehensive site assessment should occur. The results of that assessment will determine if forest that is no longer mapped as old growth forest or rainforest should be selectively harvested with prescriptions under FMZ 3b or potentially reserved informally under FMZ 2 or 3a. For forests that are not assessed as old growth forest or rainforest, and which do not have high-quality habitat values, rezoning for harvesting would occur under Coastal IFOA conditions.

Importantly, there needs to be a two-way approach to the reassessment of old growth forest and rainforest. Any areas that are currently not mapped as old growth forest or rainforest but that community representatives or agencies genuinely believe fall under these classifications should be reassessed and if verified, rezoned accordingly.

Forest ecosystems are dynamic. Old growth is a stage of forest development that will change over time with disturbance and as stands mature and reach the old growth stage. As such, **ongoing assessment is justified**. Further, forest management involves a degree of uncertainty, which requires ongoing adaptive management. Establishing trust and overcoming any conflict that arises from the proposed approach will be difficult but important to achieve. It is essential to create an approach that **ensures transparency and allows public engagement and independent oversight**. In particular, an independently run annual forum or 'check-point' should be held to address issues arising from the proposed reassessment process and to monitor outcomes.

Based on the Commission's recommended approach to meeting verified wood supply shortfalls and associated in-built environmental safe guards, the **Commission considers it is possible to meet the NSW Government's commitments of no net change in wood supply and no erosion of environmental values.**

The Commission has undertaken this supplementary review in a rapid manner, using the best available information, to meet the timeframe requested in the terms of reference. While the Commission is satisfied the basis of its advice is sound, this report may contain elements that would benefit from refinement or clarification with more time for detailed review.

Recommendations

As the Commission reported in its advice in November 2016, the agreed approach to the Coastal IFOA is outcomes-based and provides protections for threatened species at multiple scales within forested landscapes. The Commission considers this approach to be best practice, and that it should be adhered to when considering the recommendations of this report.

The NSW Government should:

1   **Adopt the Commission's proposed reassessment framework to identify and reassess targeted sites that are incorrectly mapped as old growth forest or rainforest, to offset verified timber supply shortfalls.**

   a.   The best-available technology should be used to determine the extent of old growth forest and rainforest, including Light Detection and Ranging (LiDAR), and current field monitoring, sampling and modelling approaches.

   b.   Sites to reassess should be identified and nominated by FCNSW during the pre-harvest planning stages. Nominations could be capped annually.

   c.   Old growth forest and rainforest reassessment should be undertaken by OEH Science and based on the amended PNF protocols. Field assessments must follow the desktop mapping assessment for any site where old growth forest or rainforest status may be revoked.

   d.   An additional assessment should be introduced to determine habitat value. OEH Science should undertake an initial assessment and FCNSW ecologists should undertake a comprehensive assessment, if required.

   e.   FCNSW, as the applicant, should fund all reasonable costs of any reassessment incurred by OEH Science and/or other agencies.

2   **Adopt approaches to ensure environmental values are maintained as part of the reassessment framework.**

   a.   Current management zones should only be revoked or amended to allow for harvesting if there is a verified shortfall in wood supply. Wood supply volumes should remain as they currently stand.

   b.   In nominating their sites for reassessment, FCNSW should demonstrate how commercially viable forest ecosystems at the sites will continue to exceed JANIS targets for the RFA region. OEH Science should verify this before old growth forest or rainforest reassessment occurs.

   c.   After a site is assessed to determine if it is old growth forest or rainforest, OEH Science should undertake a preliminary assessment of high-quality habitat values as part of the amended PNF protocols. If reassessed sites do not meet the criteria for old growth forest or rainforest under the PNF protocols but do meet the preliminary assessment of high-quality habitat values, FCNSW ecologists should assess their biodiversity values more comprehensively to inform potential rezoning.

   d.   The Minister for Lands and Forestry – not FCNSW – should determine the zone of any remapped sites, having considered:

   ▪   a shortfall in wood supply as demonstrated by FCNSW

   ▪   the independent desktop and field assessments undertaken by OEH Science

   ▪   the assessment of high quality habitat and biodiversity values

   ▪   forest ecosystem achievement against JANIS old growth targets

   ▪   any public submissions

   ▪   an independent review of the assessment and evaluation against the NSW Government's twin commitments, conducted by the Commission.

e.   If there is a material reduction in the area of informal reserves as a consequence of rezoning, the NSW Government should consider transferring an equivalent area of forest to the formal or informal reserve system to maintain or increase the proportional level of reserves in the relevant bioregion. Potential areas include steep slopes, threatened ecological communities and other non-commercial forest areas.

f.   Criteria for old growth forest remapping should be revised for state forests to reduce the minimum area threshold from 5 hectares to 2 hectares.

g.   A process should be established and implemented so that agencies and the public can nominate currently unmapped sites for reassessment and potential inclusion in old growth forest or rainforest protected areas, either as informal or formal reserves (FMZ 1, 2 or 3a). The process should include measures to mitigate the occurrence of any potentially vexatious nominations.

h.   FCNSW should revise the scheduling of harvest operations and return time across the state forest estate in light of potential additional net harvestable area, to allow more time for forest regeneration.

3   **Prior to any decision making, the NSW Government should clarify any legal implications of potentially revoking or amending zones for old growth forests, and removing the current HCVOG heritage listing. The NSW Government should also seek community input on the issue.**

a.   If the NSW Government proceeds, forest management zoning should be revoked and revised using the most appropriate parliamentary and administrative pathways. This should be done in a timely manner.

b.   Any rezoning decisions should be made by the Minister of Lands and Forestry, in line with the objectives of the current FMZ system and new Coastal IFOA conditions. For example:

- all areas determined to be old growth forest, to have high-quality habitat values and to be of a suitable size could be rezoned to FMZ 1 (flora reserve) to give them enhanced environmental protection under the formal reserve system

- where areas are determined to be non-old growth forest or non-rainforest but to have high-quality habitat values, they could be rezoned as either:

    i.   FMZ 2 or 3a if determined to have high-quality habitat values that cannot be managed under prescription

    ii. FMZ 3b to allow for selective harvesting under proposed Coastal IFOA regulations, to meet current wood supply commitments while maintaining environmental values. Only selective harvesting should occur in this zone, retaining a minimum average basal area of 17 square metres of trees per hectare. Intensive harvesting should be prohibited in this zone.

- areas assessed as non-old growth forest and non-rainforest and without high-quality habitat values could be rezoned as FMZ 4 and managed according to proposed Coastal IFOA conditions.

4   Implement a framework to ensure transparency and accountability.

a.   The Minister for Lands and Forestry should seek and consider independent advice from the Commission prior to potentially revoking any zones or adjusting any boundaries.

b.   There should be a timely public notification and written submission process prior to potential rezoning of FMZs.

c.   Protocols and annual reports of amendments to FMZs resulting from old growth reassessment should be published.

d.   The Commission should conduct independent, on-going monitoring and evaluation to assess how the NSW Government is achieving the twin commitments.

Figure ES1: Map of an example pilot site, demonstrating a compartment where no old growth forest was identified using the PNF protocol, despite areas being mapped as old growth forest under the current HCVOG layer

Commission notes:

- There was a significant difference between the location of originally mapped old growth forest and the currently mapped location.

- 72 hectares of old growth was originally incorrectly mapped.

- 56 hectares of new old growth was identified. Of this, 95 percent is mapped outside special management zone protection.

Legend

- ▲ Wpts_Dalmorton23Nov17
- Old Growth
- Rainforest
- NoOGRF
- Rainforest CRAFTi and RN17
- HCVOG

Old Growth & Rainforest Remapping
Dalmorton State Forest Cpts 406

DatumProjection GCC-GDA 1994
1:8,500 on A3

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Figure ES2: Map of an example pilot site, demonstrating a compartment where old growth forest was identified using the PNF protocol but was largely outside areas currently mapped as being old growth forest

Commission notes:

- There was an 88 percent reduction in the extent of mapped old growth.

- Only 13 percent (12 hectares) of old growth originally mapped was confirmed to exist within the mapped zone.

- Inconsistencies in rainforest mapping locations were identified.

Legend

- CloudsCreek_Wpts_29Jan18
- Old Growth
- Rainforest
- NoOGRF
- Rainforest CRAFT1 and RN17
- HCVOG

Old Growth & Rainforest Remapping
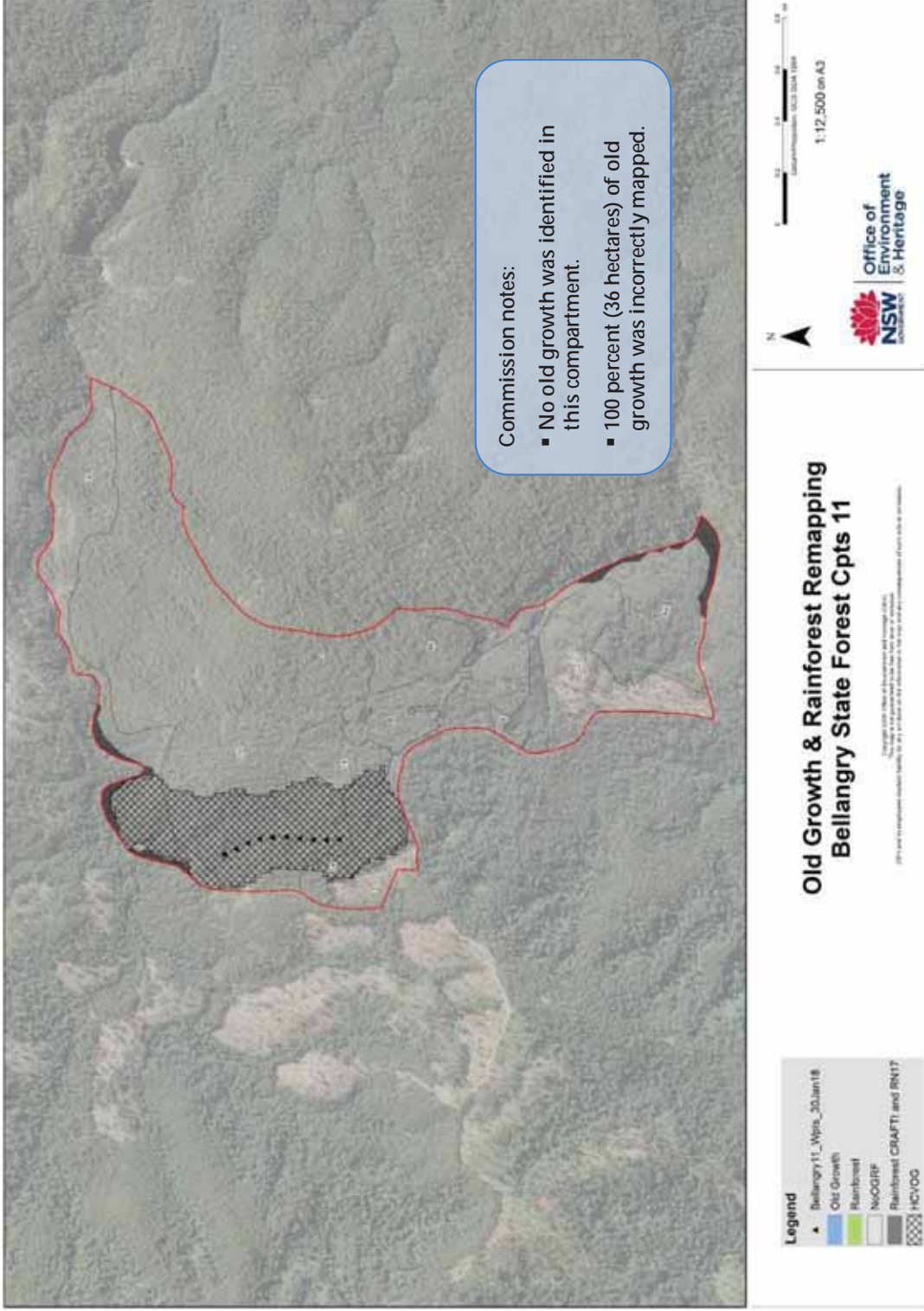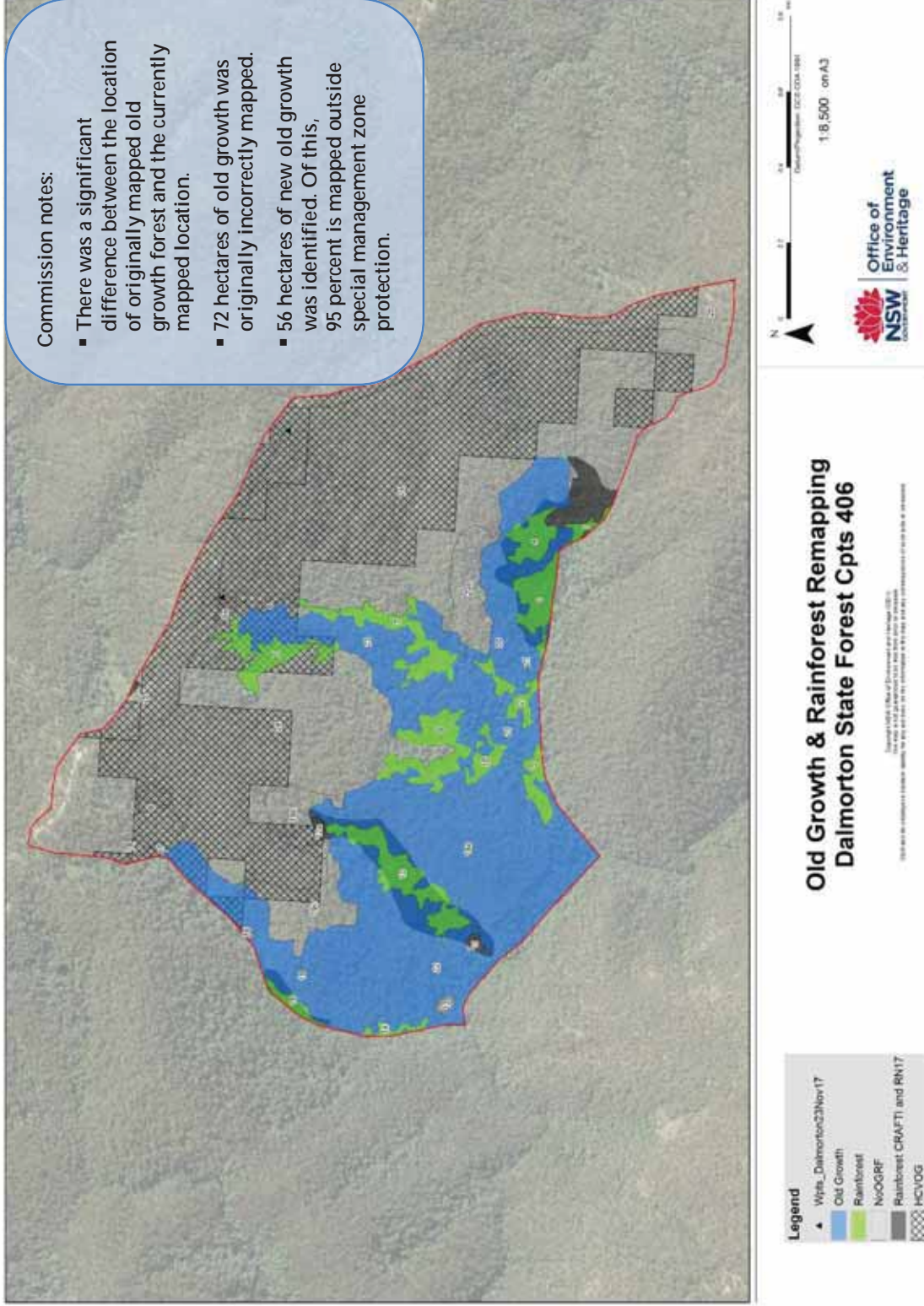Clouds Creek State Forest Cpts 124
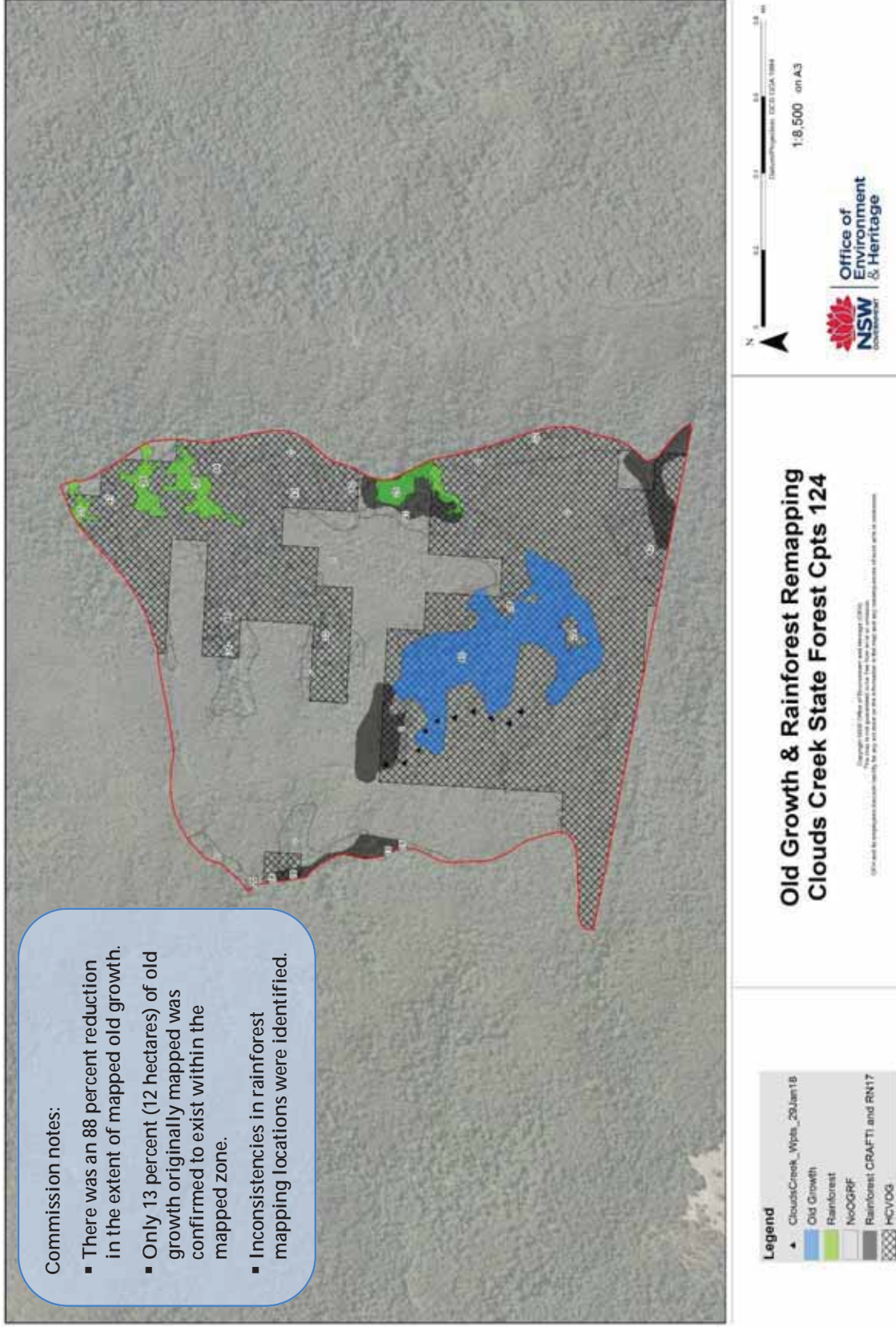
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Figure ES3: Map of an example pilot site, demonstrating a compartment where old growth forest was identified using the PNF protocol but to a much lesser extent than is currently mapped as being old growth forest

1 Introduction

Under the terms of reference, the Premier has requested that the Commission provide advice on how more accurate mapping and re-categorisation of state forest may allow the NSW Government to meet its commitment to make a Coastal IFOA with no net change to wood supply and no erosion of environmental values (**Appendix 1**). In particular, the advice was to make reference to remapping and re-categorising old growth forest and rainforest on the north coast.

1.1 Previous advice

In November 2016, the Premier asked the Commission to review outstanding settings for the new Coastal IFOA, and advise on the extent to which the proposed settings would or would not deliver on the NSW Government's twin commitments.

The Commission's report developed a suite of recommended settings that it considered came as close as possible to meeting the objectives and commitments of the coastal IFOA remake at a state scale. However, the Commission determined that **it was not possible to meet the NSW Government's commitments to environmental values and wood supply** considering the expected cumulative impact of the agreed and recommended settings at the local scale.

Specifically, the Commission's analysis estimated that annual supply of high-quality wood could decrease, primarily in supply zones 1, 2 and 3 on the north coast. Overall, it estimated that wood supply could decrease by between 7,600 and 8,600 cubic metres across the north coast region under recommended settings for the protection of koalas and new mapping for threatened ecological communities.

The Commission emphasised that the predicted wood supply impacts were an estimate, and recommended that provisions for effective monitoring and adaptive management be adopted as part of the new Coastal IFOA. These provisions are essential to continue reducing uncertainty in current decision making, and to ensure a robust evidence base for future decisions and reviews.

Furthermore, the Commission recommended that the Coastal IFOA implement contemporary regulatory measures to improve trust and transparency, and to resolve issues in a timely manner. These measures include periodic independent evaluation of forestry activities and an annual forum or 'check-point' to consider relevant performance information and address ongoing issues.

The Commission's previous advice – including broader recommendations to shift towards an approach that is based more on outcomes and risk and that allows for adaptation – should be considered alongside the recommendations in this report.

1.2 The Commission's review

The Commission has been asked to advise on whether the NSW Government could deploy new mapping data, methods and technology to more precisely identify and map old growth forest and rainforest in state forests on the north coast, as a mechanism for the NSW Government to meet its commitments of no net change in wood supply and no erosion of environmental values.

Figure 1 outlines the stages of the supplementary review. The Commission adopted a 'proof of concept' approach to demonstrate potential mechanisms for reassessing and remapping old growth forest and rainforest in state forests. As per the terms of reference, the reassessment approaches piloted in the review were developed with – and agreed to in a workshop attended by – representatives of the Department of Premier and Cabinet (DPC), EPA, Department of Primary Industries – Forestry (DPI – Forestry), OEH (including OEH Science), and FCNSW.

In particular, it was agreed that the pilot would be based upon the JANIS definition and would use the existing PNF protocol to reassess old growth forests. It was also agreed that the pilot would include rainforest assessment using the existing PNF protocol, and that the feasibility of an environmental values assessment would be explored through desktop and field-based criteria in addition to using the PNF protocols.

The Commission then considered the findings of the 'proof of concept' reassessments along with additional issues outlined in the terms of reference, including:

- the limitations of current mapping

- the impacts of the proposed approach on environmental values, native hardwood timber supply, and the NSW Government's obligations

- the technical constraints of using new or existing data, methods and technology

- the options for additional processes to increase confidence in the predicted impacts of remapping.

The Commission undertook this supplementary review in a rapid manner, using the best available information, to meet the timing requested in the terms of reference. While the Commission is satisfied that the basis of its independent advice is sound, the report may contain some elements that would benefit from refinement or clarification with more time for detailed review. In addition, the Commission understands that the NSW Government has been seeking legal advice on matters addressed in this report, including on revocation processes. The Commission has not been privy to this advice. Nor has the Commission been able to engage with the community or industry in developing its advice to the NSW Government.

The Commission did not undertake comprehensive old growth assessments and did not make decisions about which areas may be harvested.

November 2017	• Workshopped assessment approach and sample sites with agencies • Piloted assessment as 'proof of concept' at sample sites in collaboration with agencies
December 2017	• Documented and shared evidence and interim advice with agencies • Delivered interim advice to NSW Government, including a recommending to extend the pilot
January 2018	• Workshopped the extended pilot with agencies, including improving the approach and adding sample sites • Conducted extended pilot assessment at sample sites in collaboration with agencies
February 2018	• Documented and shared evidence, draft findings and recommendations with agencies • Deliver final advice to NSW Government

Figure 1: The Commission's review process

1.3   Old growth forest

Most old growth forest is found in the lower north east of the NSW north coast IFOA region[5] (**Figure 4** and **Figure 7**).

The Joint ANZECC/MCFFA National Forest Policy Statement Implementation Sub-Committee (JANIS) defines old growth forest as:

> '*Ecologically mature forest where the effects of disturbances are now negligible.*'[6]

This definition is an agreed national operational interpretation of the definition from the National Forest Policy Statement, was used in NSW RFAs, and is currently used in the PNF protocols.

Old growth forest emerged as a widely used term in Australia in the 1980s. It is a stage of forest development, and the old growth status of forest will change over time – for example, due to disturbance or as stands mature and reach the old growth stage. Ecologically, old growth forests have structural diversity and a range of habitat features, such as nesting hollows for native birds and arboreal mammals.[7, 8] They also hold Aboriginal cultural heritage values and social values.[9] While old growth is a concept based on ecological science, it is also a social construct based on forest 'age' and lack of human disturbance.

The JANIS definition provides that old growth forests should demonstrate characteristics of mature age (such as a significant proportion of senescent trees) and evidence of disturbance below a set threshold (**Figure 2** and **Figure 3**). Different social and ecological concepts of what constitutes 'old growth' present a challenge in assessing the presence of old growth. In particular, it can be difficult to apply and interpret thresholds of disturbance in old growth assessments. Evidence of human interaction with forests may be important for social definitions of old growth, but is less important for ecological definitions.[10] Given the history of human interaction with forests on the north coast, it is likely that a number of forests that display structural traits of old growth have been previously disturbed.

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[5]   'North coast IFOA region' refers to both lower north east and upper north east IFOAs

[6]   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.

[7]   Loyn, R.H. and Kennedy, S.J. (2009) Designing old forest for the future: Old trees as habitat for birds in forests of Mountain Ash *Eucalyptus regnans, Forest Ecology and Management* 258 (4) 504-515.

[8]   Gibbons, P. and Lindenmayer, D. (2002) *Tree Hollows and Wildlife Conservation in Australia*. CSIRO Publishing.

[9]   Forest Practices Authority (2017) State of the forests Tasmania 2017. Booklet by the Forest Practices Authority, Hobart.

[10]   Keenan, R.J. and Read, S.M. (2012) Assessment and management of old-growth forests in south eastern Australia, *Plant Biosystems* 146 (1) 214-222.
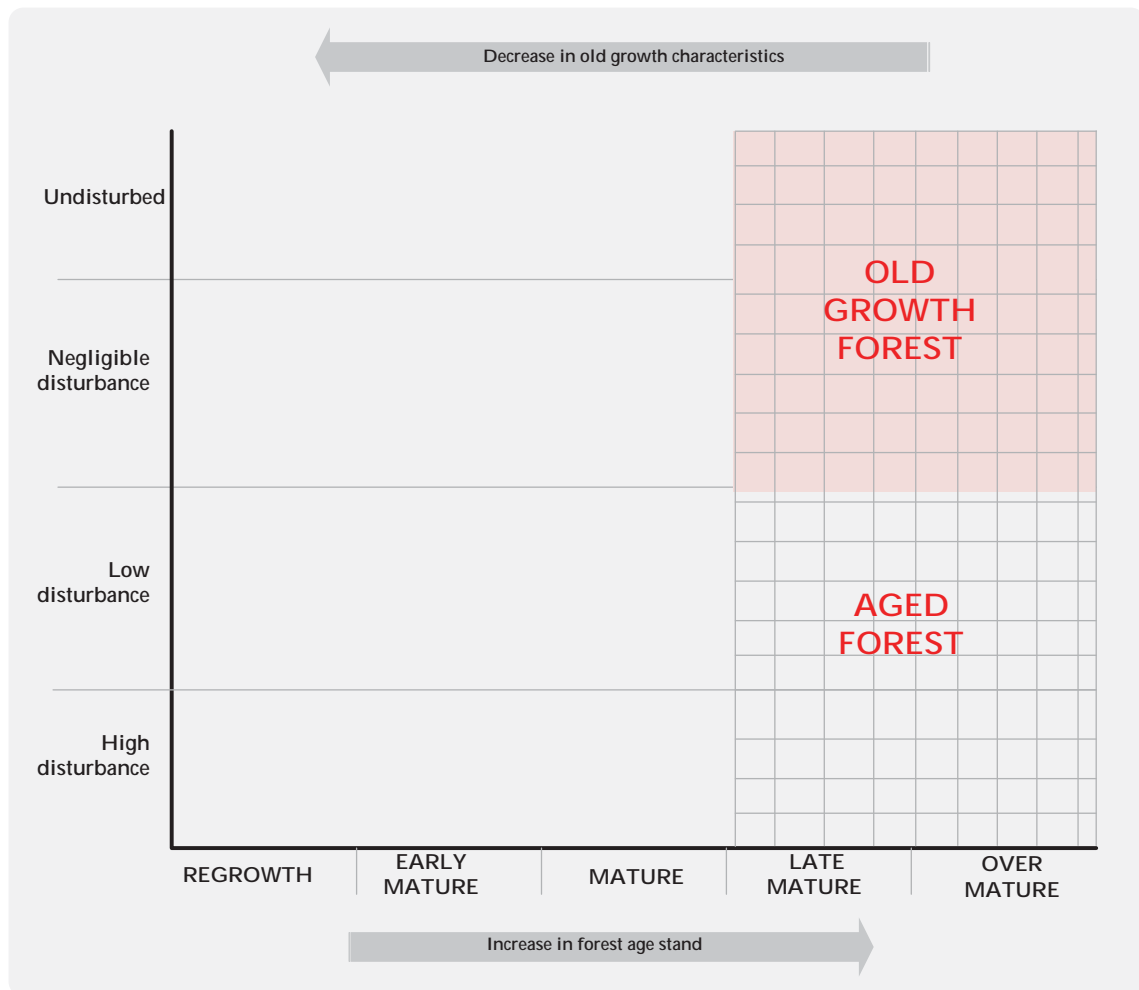
Figure 2: Growth and disturbance characteristics of old growth forest[11]
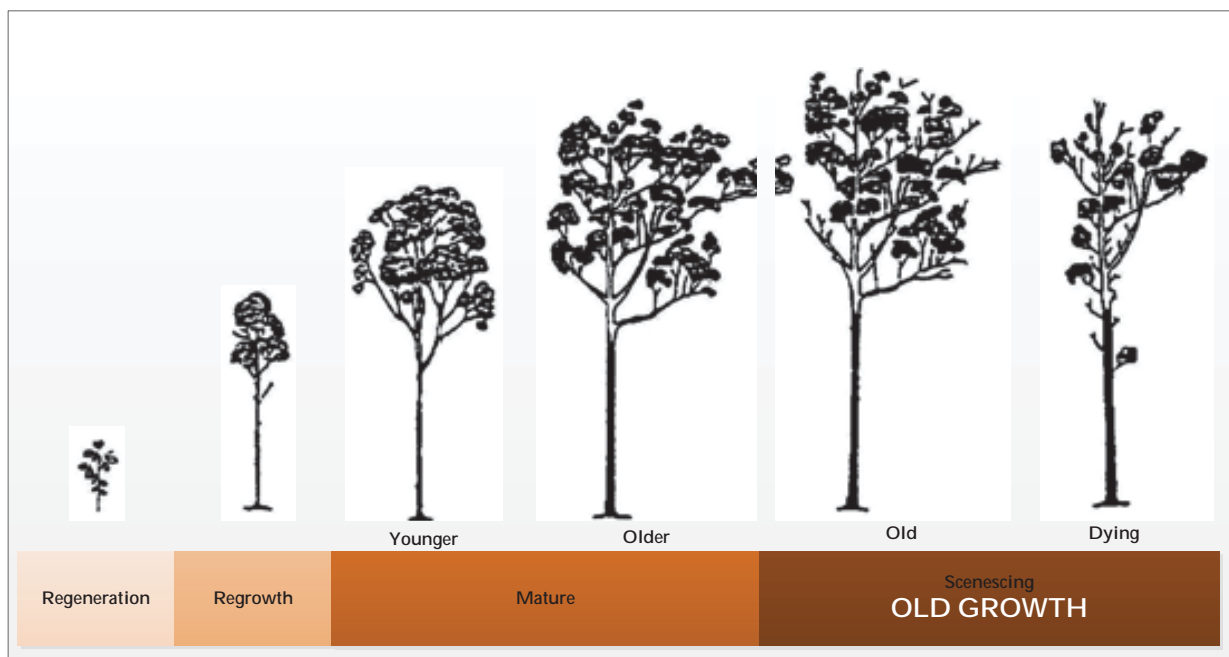
Figure 3: Forest growth stages[12]

1.4   Rainforest

Similar to old growth forest, most rainforest is found in the lower north east of the NSW north coast IFOA region (**Figure 4** and **Figure 8**).

The definition of rainforest has been contested in the past, so various definitions have been used in NSW over time.[13] Broadly speaking, rainforest is defined by the presence of a suite of species with particular ecological requirements, including a closed canopy cover. For example, the current definition of rainforest used in the PNF protocol differs from the one used to identify rainforest in the Comprehensive Regional Assessments (CRAs) undertaken for the RFAs. The primary difference is that the PNF definition excludes areas with emergent non-rainforest species that exceed 30 percent of the upper crown cover. The PNF definition currently uses the following definition of rainforest:

'*Rainforest is tree-dominated vegetation where the tree stratum (over 3 metres in height) which has the greatest crown cover has rainforest species making up 50 percent or more of the crown cover, except where non-rainforest emergent species (including brushbox and turpentine) occur and exceed 30 percent or more of the upper stratum crown cover. Rainforest includes all areas of rainforest mappable at a 1:25,000 scale. Rainforest also includes areas exceeding 0.5 hectares as isolated clumps or linear strips of rainforest trees.*'[14]

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[12]   *Ibid.*

[13]   EPA (2004) *Identification of rainforest – field guide* (Document produced by the then Department of Environment and Conservation). Available at:
https://www.epa.nsw.gov.au/your-environment/native-forestry/about-private-native-forestry/old-growth-forest-rainforest.

[14]   NSW Department of Environment and Climate Change (2007) *Protocol for re-evaluating rainforest on private property.* Available at: https://www.epa.nsw.gov.au/publications/pnf/prrainforest07371.

Region	Old growth (ha)	Rainforest (ha)
Total North East RFA/IFOA	1,684,600	483,140
State forests in North East RFA/IFOA	103,100	84,800
State forests in Lower North East IFOA	41,700	60,300
State forests in Upper North East IFOA	61,400	24,500
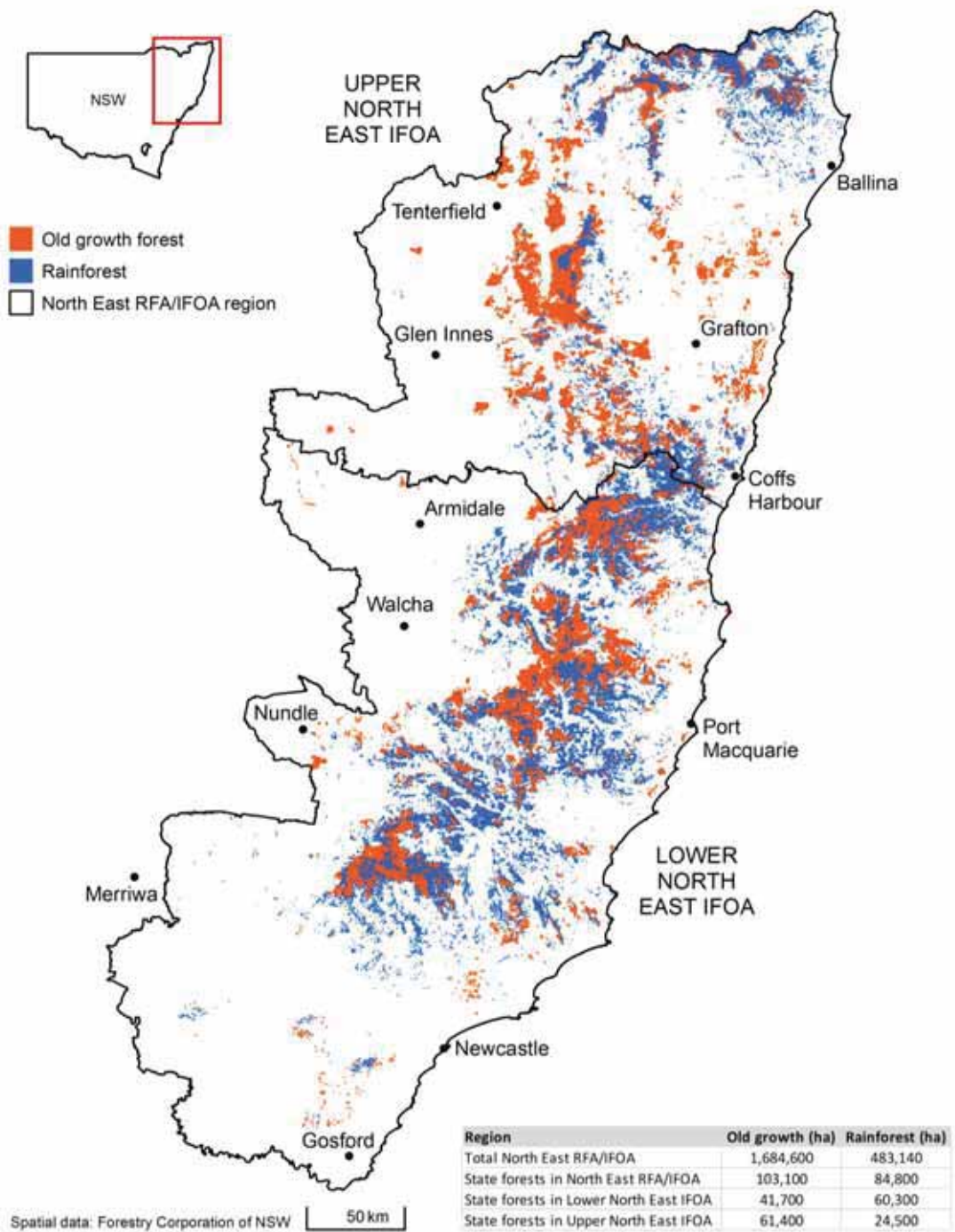
Figure 4: Extent of old growth forest and rainforest

Figure 5: Example of north coast old growth forest

Figure 6: Example of north coast rainforest

Figure 7: Aerial photograph of old growth forest in state forest. All forest shown in the image is currently mapped as old growth (HCVOG). The forest to the right of the yellow line displays characteristics of old growth, including a high proportion of senescent trees (examples of which are shown in red circles). The forest to the left of the line does not appear to display characteristics of old growth.[15]

Figure 8: Aerial photograph of rainforest in state forest. Rainforest is present to the left of the red line. The forest to the right of the line is not rainforest.

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2 Context and key issues

2.1 Government commitments

2.1.1 Regional Forest Agreements

The NSW and Australian governments have committed to the ecologically sustainable management of Australia's native forests through RFAs. The broad objective of the RFAs is to balance the competing environmental, social and economic demands placed on forests. Commitments under the RFAs include: [16]

- providing certainty of resource supply to industry

- managing forests under the principles of ecologically sustainable forest management

- maintaining a comprehensive, adequate and representative (CAR) reserve system, including specific targets for old growth forest and rainforest protections (see **Section 2.1.3**)

- expanding permanently protected areas on the forest conservation estate.

RFAs (and the National Forestry Policy Statement) establish the formal protection of old growth forest and rainforest under the CAR reserve system.

The RFAs for NSW will begin to expire in 2019, with the North East RFA expiring in 2020. The NSW and Australian governments have commenced negotiations for new 20-year RFAs for all regions.

2.1.2 Coastal IFOA remake

IFOAs regulate forestry activities to ensure they are managed under the principles of ecologically sustainable forest management, and provide assurance that the NSW Government's actions align with the *Environment Protection and Biodiversity Conservation Act 1999* (Cth).

A new Coastal IFOA is being developed to modernise NSW's regulatory approach. This is in line with the NSW Government's commitment to a sustainable and viable native forestry industry according to the NSW Forestry Industry Roadmap 2016. Under the Coastal IFOA, the NSW Government has made twin commitments that the Coastal IFOA will result in:

- no net change in wood supply

- no erosion of environmental values.[17]

Under the original terms of reference from the Premier, the Commission previously advised that the Government's twin commitments could not be met under the proposed Coastal IFOA settings due to an estimated annual shortfall in wood supply.[18]

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[16]   Australian Government Department of Agriculture and Water Resources (2017) *Regional Forest Agreements*. Available at: http://www.agriculture.gov.au/forestry/policies/rfa.

[17]   EPA (2014) *Remake of the Coastal Integrated Forestry Operations Approvals: discussion paper*, p.23. Available at: http://www.epa.nsw.gov.au/publications/forestagreements/140209ifoaremakeweb.

[18]   NRC (2016) *Advice on Coastal Integrated Forestry Operations Approval Remake*. November 2016. Natural Resources Commission, Sydney.

Existing old growth forest and rainforest protections were considered an 'agreed' setting when the Commission provided its previous Coastal IFOA advice in December 2016.

In 2014, the EPA released a discussion paper seeking community feedback on key concepts being considered for the Coastal IFOA remake. The paper outlined the scope and objectives of the remake, including:

- not affecting commitments made under the RFAs

- not changing the CAR reserve system

- not reducing FCNSW's ability to meet high quality wood supply commitments

- being focussed on outcomes, supported by monitoring and evidence, and based on risk management principles

- incorporating advances in technology.[19]

The discussion paper also committed to maintaining the protection of old growth forest, rainforest and rare non-commercial forest types and to maintaining the FMZ layer unchanged.[20] The Commission believes the NSW Government can achieve the scope and objectives of the Coastal IFOA by applying a risk management approach and new technology. This will require changing some FMZ layers and cannot occur without effective community consultation.

The agreed approach to the Coastal IFOA is outcomes-based and provides protections for threatened species at multiple scales within landscapes. The Commission considers that this approach is best practice, and that it should be adhered to when considering the recommendations of this report.

The NSW Government has recently taken steps to improve the quality and accuracy of mapping and evidence to inform environmental management. In particular, projects to improve the mapping of threatened ecological communities[21] and koala habitat[22] have ensured that more accurate knowledge is available to protect and manage these values in native forests. However, there is more work to be done in this space, including for old growth forest and rainforest. The NSW Government should continue its commitment to improving the evidence base for environmental management.

2.1.3   Environmental commitments

Old growth forest and rainforest are conserved and managed by a range of NSW and Commonwealth regulations and arrangements. These include the CAR reserve system and targets, the current north coast IFOAs and FMZs under the *Forestry Act 2012* (NSW), and the State Heritage Register.

The conservation and management of old growth forest is a priority under the 1992 National Forestry Policy Statement. The statement commits governments to conserving and managing

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[19]   EPA (2014) *Remake of the Coastal Integrated Forestry Operations Approvals: discussion paper*, p.23. Available at: http://www.epa.nsw.gov.au/publications/forestagreements/140209ifoaremakeweb.

[20]   *Ibid.*

[21]   EPA (2016) *Assessment of threatened ecological communities of the coastal integrated forestry operations approval region.* Environment Protection Authority, Sydney.

[22]   EPA (2016) Koala habitat mapping pilot: NSW state forests. E*nvironment Protection Authority, Sydney. Law et. al. (2017) A predictive habitat model for Koalas* Phascolarctos cinereus *in north-east New South Wales: Assessment and field validation.* NSW Department of Industry – Lands and Forestry.

old growth forests due to their 'very high aesthetic, cultural and nature conservation values and their freedom from disturbance.'[23]

Following the Statement, an intergovernmental committee established specific targets referred to as the JANIS targets (**Box 1**) for protecting old growth forest within the reserve system, which includes:

- formal reserves (including national parks, and flora reserves in state forests)

- informal reserves (including FMZs 2 and 3a in state forests)

- prescriptions in codes of practice, in management plans or identified on maps, including on private land.[24]

Harvesting is not allowed in any rainforest.[25]

Box 1: What are JANIS old growth targets?

The JANIS criteria were established in 1993 by the JANIS Technical Working Group. The group comprised conservation scientists and planners from all states, the Northern Territory and the CSIRO. The criteria are nationally agreed, and form the basis of the CAR reserve system under the RFAs.

Old growth targets are for each RFA region as established under JANIS and require that:[26]

- where old growth forest is rare or depleted within a forest ecosystem (generally less than 10 percent of the total extent of the ecosystem), all areas of old growth forest associated with that forest ecosystem should be protected in the reserve system

- for all other forest ecosystems, 60 percent of the old growth forest identified at the time of assessment should be protected in the reserve system (including via prescriptions).

The JANIS Technical Working Group also recognised that the old growth criteria should be approached in a flexible manner according to regional circumstances.

A total of 63 forest ecosystems in the upper north east and 84 forest ecosystems in the lower north east originally met RFA obligations to protect at least 60 percent of old growth forest in the reserve system. Any reassessment process should ensure these targets are maintained.

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23   Commonwealth of Australia (1992) *National Forest Policy Statement*, p. 10. Available at:
      http://www.agriculture.gov.au/SiteCollectionDocuments/forestry/australias-forest-policies/nat_nfps.pdf.
24   ANZECC Commonwealth of Australia (1997) *Nationally Agreed Criteria for the Establishment of a Comprehensive,
      Adequate and Representative Reserve System for Forests in Australia*, p. 7. Available at:
      http://www.agriculture.gov.au/forestry/policies/rfa/about/protecting-environment.
25   Under the NSW Government's 1982 'rainforest decision'.
26   ANZECC Commonwealth of Australia (1997) *Nationally Agreed Criteria for the Establishment of a Comprehensive,
      Adequate and Representative Reserve System for Forests in Australia*, p. 15. Available at:
      http://www.agriculture.gov.au/forestry/policies/rfa/about/protecting-environment.

2.1.4   Wood supply commitments

Native forestry wood supply agreements will begin to expire in 2019 (on the south coast) and 2023 (on the north coast). Under the NSW Forestry Industry Roadmap 2016, the NSW Government intends to provide greater certainty of resource supply for industry. The NSW Government has committed to a range of actions including an independent review of current wood supply agreements and the renegotiation of new agreements with stakeholders.

2.2   Mapping

2.2.1   Previous mapping of old growth

Old growth forest mapping in NSW has a complicated history, as outlined in detail in **Appendix 2**. In summary:

- **1995–96:** The Broad Old Growth Mapping Project (BOGMP) identified old growth forests in the upper and lower north east regions for the Interim Forest Assessment.[27] It is unclear what criteria were used in the BOGMP assessment.

- **1997–99:** The CRAFTI project updated the BOGMP as part of the RFA's CRA process. This process identified 'candidate' old growth forests, which the project's expert panel considered to represent a greater area than actual old growth extent.[28]

- **1998–99:** Secondary analysis intersected the candidate old growth data layer with additional data layers based on habitat modelling to derive the HCVOG subset. Special management zones for old growth in state forests were based on the HCVOG data subset.

- **2002:** Protected old growth areas in state forests were supplemented with additional areas identified from 'candidate' old growth forests that were not already intersected by the HCVOG data layer. This selection occurred through a stakeholder negotiation process.

NSW's old growth mapping products have significant limitations. A 1999 expert review found that the old growth maps derived in the CRAFTI project were inaccurate, and recommended the data layer be continually reviewed and improved, including through field checking (**Box 2**).[29] It is highly likely that the candidate old growth layer – and subsequently the HCVOG layer – contain significant areas that are not old growth.

The technology of the day used to derive the HCVOG data subset resulted in raster data layers that are spatially coarse. They appear 'blocky' at the site scale and may not align with actual old growth forest boundaries (represented as vector layers in mapping). Time and resource constraints may have also compromised the quality of mapped products. For example, the HCVOG data layer was derived by intersecting the candidate old growth layer with data on habitat modelling and high conservation values. This dataset is not fully underpinned by criteria for assessing old growth forest and was not checked through field validation.[30]

Furthermore, the spatial data originally used to calculate old growth reservation status for each forest ecosystem has changed considerably since 1999. This is due to an increase in the reserve system as a result of the 'icon' decision, other land acquisition by the NSW National Parks and Wildlife Service (NPWS) and additions to the informal reserve system (**Box 3**).

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[27]   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.

[28]   *Ibid.*

[29]   *Ibid.*

[30]   *Ibid.*

Box 2: Expert review of old growth forest related projects for the north east region

As part of the CRA process for defining, identifying and mapping old growth forest, an independent expert panel was formed to provide advice on 'conceptual and operational aspects of the methodology for defining old growth forest.' As a result of time constraints, the expert panel was required to make decisions using datasets with limited field validation and was not able to iteratively review and amend the analysis. As these factors are considered normal practice in modelling projects, the expert panel outlined an extensive set of qualifications for any further analysis or assessment of old growth forest in the north coast region.

The expert panel emphasised that the old growth forest identified by the CRAFTI mapping project is only a 'candidate' for listing as old growth forest. The panel considered that old growth forest identified through a more comprehensive assessment would likely be a subset of the candidate forest layer. Furthermore, some areas currently not listed as candidate old growth may actually support old growth characteristics warranting protection.

The expert panel outlined the following recommendations in light of these limitations:

- In future studies, key primary datasets should be made available to allow sufficient time for detailed analysis and field checking.

- Given the limitations of this process, the resulting areas identified should be termed 'candidate' old growth.

- In all future studies, an indication of the likelihood of disturbance should be included where possible in all old growth classes delineated by the analysis.

- Field checking of candidate old growth forest areas should be conducted prior to any tenure changes based on this attribute, given the considerable uncertainty as to the reliability of the analysis results.

- This process, and all subsequent old growth forest inventories, should be subject to extensive, iterative review based on statistically valid field checking. Such review should be realistically included in initial budget estimates.

- Given the dynamic nature of old growth forest and ongoing disturbances, primary datasets should be updated annually, and the old growth forest analysis process should be rerun, when appropriate.

Box 3: Additions to protected areas since 1999

In 2003, the NSW Parliament passed the National Park Estate (Reservations) Bill, which aimed to protect 65,000 hectares of remaining 'icon' areas of north east NSW (the 'icon' decision), including high conservation value old growth and rainforest. These areas were transferred from the state forest estate to the national park estate. The areas transferred to the national park estate included around 21,000 hectares of old growth forest.

In addition, about 21,000 hectares of rainforest and old growth forest within state forests was added to the informal reserves system, and incorporated into a 'special management zone'.

Significant areas of old growth forest were also added to the reserve system in the north east in 2006, as part of the National Park Estate (Lower Hunter Region Reservations) Bill, and through private land conservation agreements since 1999.

Despite the above additions to the reserve system, this review represents the first time since the original RFA that JANIS criteria have been applied to determine achievement of old growth targets for forest ecosystems in north east NSW.

2.2.2 Previous rainforest mapping

Rainforest was mapped from 1993 to 1997 as part of the CRA. Rainforest was identified using aerial photographic interpretation, following the process developed in the CRAFTI project. Rainforest map layers identify areas interpreted to be rainforest, as well as areas with emergent brush box or eucalyptus. Rainforest disturbance features were also recorded, if observed. Rainforest mapping, though limited in some ways, is generally considered to be more accurate than old growth mapping.

2.2.3 Advancements in vegetation mapping and modelling

Current technology and data have improved our ability to identify, model and map vegetation. For example, our understanding of the distribution of a range of vegetation types has improved through recent mapping of threatened ecological communities in state forests. In addition, remote sensing methods such as LiDAR provide significantly more precise vegetation identification, capturing individual tree canopies and other structural elements within a forest.

As mentioned previously, a 1999 expert review found old growth maps were likely to be spatially inaccurate and recommended improvements. Current mapping does not reflect current growth and harvest data or additions to the formal reserve system since 2000.

Other jurisdictions, including Western Australia and Tasmania, have updated old growth mapping. Western Australia has developed an assessment process and criteria for reviewing old growth amendments.

2.3 Protocols for re-evaluating mapping on private land

For old growth forest and rainforest in particular, new protocols and methods have been developed to improve the interpretation of forest imagery and identification. The PNF protocols were developed in 2007 by the then NSW Department of Environment and Climate Change to

reassess old growth forest[31] and rainforest[32] on private land for private native forestry. The protocols were negotiated by a reference panel with representatives from the timber industry, rural land owners and environment groups. **Appendix 3** provides additional details on the PNF protocols.

The PNF protocols have been independently peer reviewed and improved over time. They advance previous mapping methods, using high-resolution ADS40[33] imagery and on-screen digitisation to interpret imagery more accurately. The protocols include a 'check in doubt' principle to verify desktop interpretations in the field, and produce a map product with better spatial accuracy.

OEH Science has reported to the Commission that it has used the PNF protocols to reassess 667 cases containing private forest currently mapped as old growth forest and rainforest on private land, where landholders initiated reassessments.

This reassessment resulted in a:

▪ **65 percent reduction** in the area of mapped old growth forest (from more than 45,000 hectares to more than 16,000 hectares)

▪ **23 percent reduction** in the mapped area of rainforest (from nearly 18,000 hectares to more than 14,000 hectares).

OEH Science has also applied the PNF protocols on public land. In 2017, the agency completed reassessments for a travelling stock reserve and a state forest compartment in the north east region.

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31   NSW Department of Environment and Climate Change (2007) *Protocol for re-evaluating old-growth forest on private property.* Available at: https://www.epa.nsw.gov.au/publications/pnf/proldgrowth07370.
32   NSW Department of Environment and Climate Change (2007) *Protocol for re-evaluating old-growth forest on private property.* Available at: https://www.epa.nsw.gov.au/publications/pnf/prrainforest07371.
33   Airborne digital sensor.

3   Pilot to reassess old growth forest and rainforest in state forests

As mentioned, the Commission's previous advice on the Coastal IFOA settings found that there would be an estimated shortfall of wood supply. Given this, the work under the current terms of reference piloted a process using the latest technology to remap old growth forest and rainforest in north coast state forests to address wood supply shortfalls and balance the NSW Government's twin commitments. The Commission adopted a risk-based approach and used the best available evidence, while also considering the NSW Government's proposed timeframe for remaking the Coastal IFOA, including allowing for public consultation.

The approach piloted by the Commission is summarised in **Figure 9** and outlined in detail in the following sections. The Commission piloted this process at a limited number of sites in state forests (**Figure 10**).

As per the terms of reference, the reassessment approaches piloted in the review were developed with – and agreed to in a workshop attended by – representatives of DPC, EPA, DPI – Forestry, OEH and OEH Science, and FCNSW.

The Commission notes that the pilot process was designed to test this approach on state forests. The Commission has further improved and developed the proposed approach based on insights and lessons from the pilot application (see **Sections 5** and **6**).
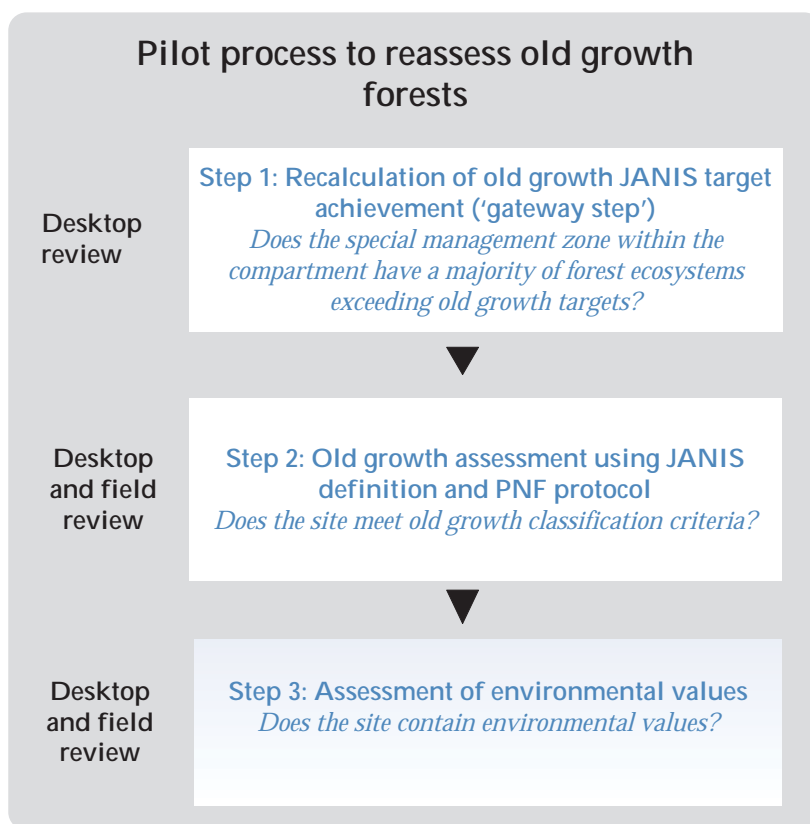
Figure 9: Summary of the Commission's pilot approach

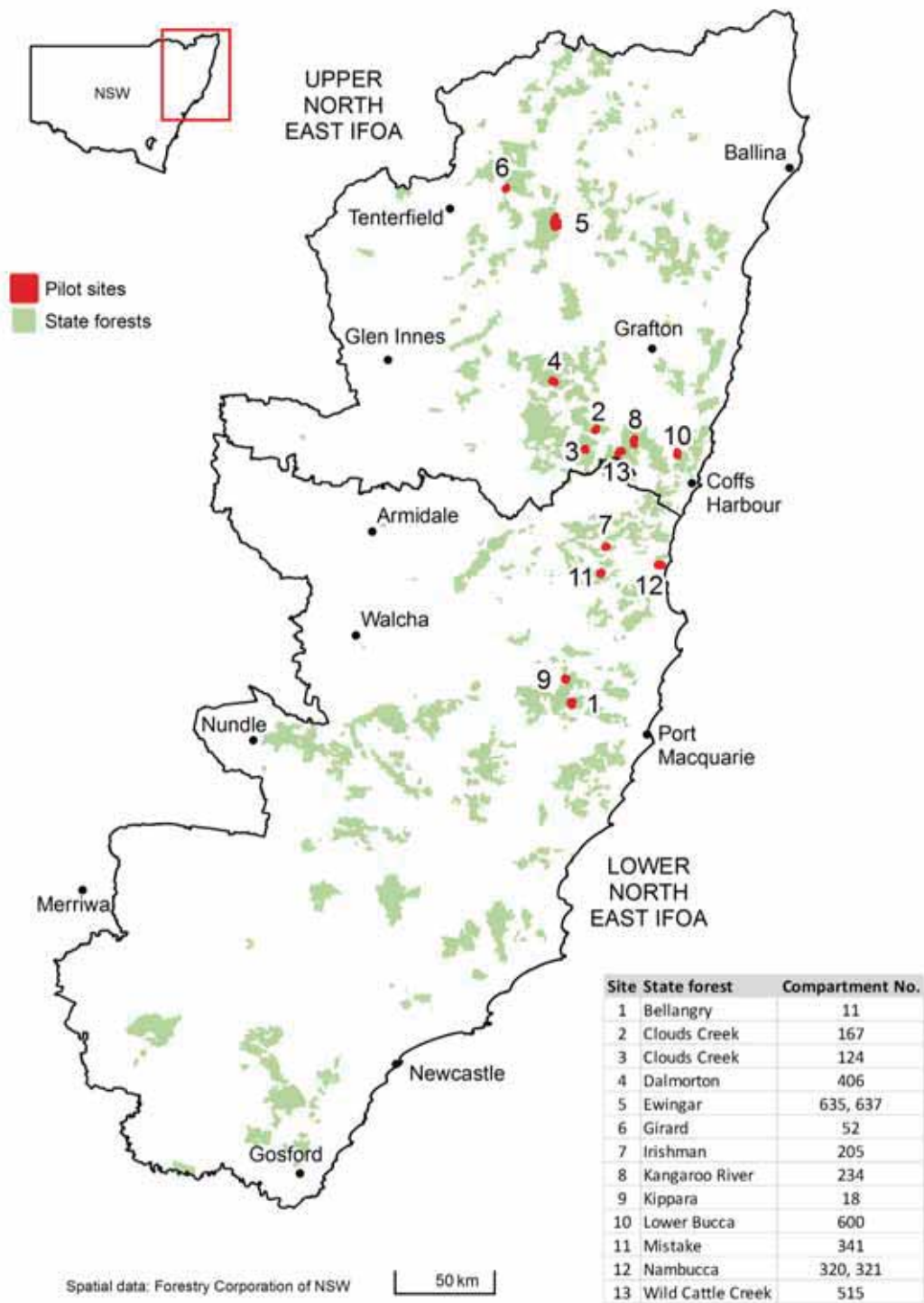| Site	State forest	Compartment No.
1	Bellangry	11
2	Clouds Creek	167
3	Clouds Creek	124
4	Dalmorton	406
5	Ewingar	635, 637
6	Girard	52
7	Irishman	205
8	Kangaroo River	234
9	Kippara	18
10	Lower Bucca	600
11	Mistake	341
12	Nambucca	320, 321
13	Wild Cattle Creek	515

Figure 10: Pilot site locations

3.1 Principles for reassessment

The Commission has identified key principles that should be considered in decision making relating to this matter. Given the range of outcomes sought, there are likely to be significant trade-offs between these principles.

- **Maintenance of twin commitments:** The NSW Government should, in seeking to meet wood supply commitments, ensure that is does not put at risk the targets (including old growth JANIS targets) it currently meets. Any new areas available for harvesting would be subject to conditions in rezoned areas (such as FMZ 3b) and/or in the new Coastal IFOA to protect environmental values.

- **Robust evidence:** Changes in forest management zoning should only occur after reassessment using agreed protocols and criteria.

- **Transparency and engagement:** The NSW Government should routinely issue public reports on the reassessment process, proposed changes and any resulting changes to forest reservation status. Routine monitoring and evaluation should be undertaken to demonstrate the outcomes of this approach. The process should provide for community and agency comment on any decisions to change FMZs.

- **A two-way approach:** In addition to identifying areas for potential remapping, the process should allow for a pathway to manage and protect areas of old growth forest and rainforest that are not currently represented in mapping.

- **Independent oversight:** Periodic independent advice and evaluation should be used to create trust between stakeholders, and to address conflicts and issues in a timely manner.

- **Timely decision making:** Processes to address wood supply issues should be implemented in a timely manner, limiting periods of undersupply of contracted timber.

- **Adaptive management:** The process should provide adequate flexibility to change practices and try new ideas where the results of monitoring and evaluation show outcomes are not being delivered.

3.2 Old growth reassessment

In collaboration with agencies and FCNSW, the Commission developed a process to test an assessment methodology, based on recognising increased areas in the reserve system, existing baseline datasets and existing protocols.

The methodology includes:

1   recognising the increases in the old growth forest protected through additions to formal and informal reserves since 1999

2   identifying priority areas where old growth forest and rainforest reassessment and remapping may provide wood supply without threatening environmental values and commitments (**rapid desktop assessment of JANIS old growth forest targets –** see **Section 3.2.1**)

3   reassessing and remapping identified priority areas using tested and agreed-upon criteria (**targeted assessment of old growth forest –** see **Section 3.2.2**).

The Commission, together with OEH Science, undertook the rapid desktop assessment and a 'proof of concept' pilot at limited sites to test the targeted reassessment stage. All agencies agreed to the methodology used under the terms of reference.

3.2.1 Rapid desktop assessment of JANIS old growth forest targets

A rapid desktop assessment of old growth forest was undertaken for the north coast region to determine progress against JANIS old growth targets, using the best available evidence in the available timeframe. The rapid assessment followed the original process used to derive old growth targets in 1999, although spatial datasets were updated to reflect changes to the reserve system since 1999.

The rapid desktop assessment identified state forest compartments that had protected old growth forest, as well as commercial forest ecosystems that exceeded JANIS old growth targets. These compartments were identified as potential priority areas for remapping old growth forest in state forests. These areas are the most likely to be able to provide wood supply without threatening environmental values and commitments.

JANIS old growth targets call for the protection of 60 percent of old growth in each forest ecosystem identified *at the time of the RFA assessment*. This means that the denominator is locked in as the old growth mapped and reported in 1999, regardless of its accuracy. The expert panel considered that this mapping had captured forest that was not old growth, as it was based on 'candidate' old growth.

However, the numerator of current old growth protected can change for a variety of reasons, including due to more accurate mapping, additional protected areas, previously mature forest having developed into old growth forest with negligible disturbance or for any disturbance within protected old growth that has negatively affected its status. For example, the extra 110,000 hectares of old growth protected as part of the 'icon' decision increases the numerator while the denominator remains the same as it was in the 1999 assessment.

It is important to note that, the Commission's assessment only included some protections on private land since 2000, such as voluntary conservation agreements. However, the spatial layer provided to the Commission did not include old growth areas mapped and protected under PNF Property Vegetation Plans. The Commission understands these areas could be counted towards targets, so there may be considerably more old growth forest protected on private land than is currently counted.[34]

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[34] Under the nationally agreed criteria, a reserve system can include private land that is protected either through a covenant or a code of practice (as in a PNF Code of Practice and Property Vegetation Plan).

3.2.2   Targeted old growth forest assessment

The Commission piloted an approach to reassess priority old growth forest and rainforest in north coast state forests identified in the desktop assessment of JANIS targets.

Assessment methodology

The assessment for old growth was based on the JANIS definition of old growth, using OEH's PNF protocol supplemented by LiDAR data, FCNSW harvesting history and other relevant data sets. The Commission attended site visits, but the PNF protocol was applied in the field by independent assessors from OEH Science, in collaboration with EPA and FCNSW field staff. The OEH Science independent assessors examined the criteria and made the final determination of old growth status. The PNF protocol broadly defines old growth as:

'Ecologically mature forest where the effects of disturbance are now negligible, that have an area of forest greater than 5 hectares, where:

- *the overstorey is in late to over-mature growth stage with the presence of relatively large old trees (many containing hollows and often with the presence of dieback or dead branches in the crown)*

- *the age (growth) structure of the stand measured as relative crown cover consists of less than 10 percent of regeneration and advance growth, and more than 10 percent of late to over-mature (senescent) growth*

- *the effects of unnatural disturbance are now negligible.'* [35]

Due to the complex history of old growth mapping (see **Section 2.2.1**), a number of old growth mapping approaches have been applied to public land. These approaches include the PNF protocol, CRAFTI 'candidate' old growth assessment, and HCVOG assessment. They are all originally based on the JANIS definition of old growth but vary in assessment intent, criteria and methods (details of these differences are provided in **Appendix 4**). The PNF protocol was specifically developed to address recognised limitations in candidate old growth mapping at the local scale – for example, by strengthening field validation requirements and using improved mapping technology. The protocol has been applied to private land to improve the accuracy of candidate old growth mapping at the local scale.

As such, the Commission considers the PNF protocol is an appropriate foundation for remapping old growth forest in state forests, which was partly informed by candidate old growth mapping. In addition to the PNF protocol, the Commission piloted an environmental values assessment to address additional criteria used to develop the HCVOG layer.

Pilot site assessment and selection

The pilot process was applied to 13 sites in total. Three were assessed in December 2017, using both desktop and field validation components. A further 10 sites were assessed in January 2018, seven using both desktop and field components, and three via desktop assessment only, due to access issues, work health and safety considerations, and time constraints.

The PNF protocol only requires a field validation where there is sufficient uncertainty regarding the desktop assessment. For the purposes of this pilot, the Commission undertook field validation at all sites, except at the three sites where the constraints mentioned above did not allow for this. The Commission's insights regarding field validation requirements are outlined in **Section 5.2**. For ongoing old growth reassessment, the Commission considers field

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[35]   NSW Department of Environment and Climate Change (2007) *Protocol for re-evaluating old-growth forest on private property.* Available at: https://www.epa.nsw.gov.au/publications/pnf/proldgrowth07370.

validation should be undertaken for all sites where old growth forest is being reassessed, and where old growth classification may potentially be revoked. The Commission notes that this will add considerable expense to the reassessment.

In December 2017, FCNSW nominated two of the sites visited (Nambucca and Lower Bucca) because they were considered to demonstrate obvious errors in old growth mapping. The additional site visited in December 2017 (Dalmorton) was nominated as it was considered to demonstrate old growth mapping errors, in addition to areas of old growth forest that were currently not classified as such.

FCNSW nominated five of the sites assessed in January 2018 and the EPA nominated the remaining five. The five FCNSW-nominated sites were those:

▪ that had expected errors in old growth mapping

▪ with commercially viable forest ecosystems

▪ with forest ecosystems exceeding JANIS reservation targets for old growth

▪ accessible for harvesting operations.

The five EPA-nominated sites were areas of potential old growth forest that are currently unreserved.

Assessment of environmental values

In addition to assessment (using the PNF protocol) of whether mapped old growth forest aligned with the location of old growth forest under the JANIS definition, the desktop and field inspections also included criteria for assessing additional environmental values.

The environmental values assessment was informed in part by the NSW Government's Biodiversity Assessment Method and in part through consultation with agencies. The Commission adopted criteria based on relevance and feasibility, and included additional criteria based on expert opinion. The criteria include Interim Biogeographic Regionalisation for Australia (IBRA) bioregion and sub-region reservation status, landscape connectivity, and the presence of coarse woody debris and hollow-bearing trees. The rapid field assessment was primarily based on identifying high-quality habitat features.

Appendix 5 lists and outlines the environmental values assessment methodology in more detail.

3.3 Rainforest reassessment

The Commission considers that a process for improving the accuracy of rainforest data sets is valuable as part of a wider program to assess old growth forest. FCNSW has indicated that rainforest mapping is inaccurate in some cases, including for areas where rainforest is not included in current mapping. FCNSW has also informed the Commission that, although any rainforest is protected and excluded from harvesting once it is identified on the ground, there is an opportunity to improve existing datasets.

Improved spatial datasets for rainforest can contribute to better management of environmental values and stronger reporting against environmental commitments. Incorporating rainforest assessment into the old growth remapping process would require limited additional resources.

The Commission piloted a process for reassessing rainforest areas as part of the terms of reference. The process is a modified version of the old growth process outlined in **Figure 9**, based on the existing PNF protocol for assessing rainforest. Rainforest assessment did not include the first step of recalculating achievement of targets, as rainforest is fully protected. There was also no additional assessment of environmental values, as high conservation values outside rainforest characteristics were not an assessment criteria for the current rainforest layer.

4 Results of the pilot

This section outlines the key findings of the Commission's pilot of the proposed interim process and methodology for reassessing old growth forest and rainforest. **Table 1** summarises the Commission's findings.

Table 1: Summary of pilot findings

Assessment element		Findings	Level of confidence
1. JANIS old growth targets	▪	The area of old growth forest ecosystems protected in the reserve system has increased by 110,200 hectares, or 10 percent, since the RFA was agreed. This figure does not include private land protections.	**High**
	▪	This increased area includes 23 commercial old growth forest ecosystems (almost 30,000 hectares) that each exceed the 60 percent JANIS old growth target.	
2. Old growth forest and rainforest mapping	▪	There are significant and extensive errors in old growth forest and rainforest mapping of north coast state forests.	**Very high**
	▪	Old growth forest and rainforest can be more accurately mapped using new methods, technology and data.	
3. Wood supply values	▪	FCNSW further estimates there may be more than 164,000 cubic metres of high quality timber from key commercially viable forest ecosystems that are not old growth forest, and 48,000 cubic metres of high-quality timber from lesser commercial types. This timber is in the estimated accessible net harvestable area across six supply zones, and in forest ecosystems that exceed JANIS old growth targets (around 14,600 hectares).	**High (site scale)** **Low (regional scale)**
	▪	Annualised over 20 years, this equates to an estimated 8,200 cubic metres per year of key commercial timber and a further 2,400 cubic metres of lesser commercial timber.	
	▪	Most of the estimated yield is in supply zone 2, which is also the zone most affected by new mapping of koala habitat and threatened ecological communities.	
	▪	FCNSW estimates there would also be additional yield from remapping rainforest, but accessing these areas would be difficult.	
4. Environmental values	▪	Habitat features are present at all of the sites, including coarse woody debris, dead standing trees (stags) and live hollow-bearing trees.	**High (site scale)** **Low (regional scale)**

Assessment element	Findings	Level of confidence
	▪ One outlier site had high-quality habitat features with high senescence numbers and significant numbers of tree hollows, and was at the edge of its forest type range.	
	▪ More accurate mapping of old growth forest and rainforest will increase the protection of environmental values. Under the existing settings, between 0 percent and 15 percent of old growth forest was protected at some sites, while between 85 percent and 100 percent of actual old growth forest was not protected and therefore potentially harvestable.	
	▪ Revising the minimum area threshold of old growth forest mapping from 5 hectares to 2 hectares may protect a modest amount of additional old growth forest.	
	▪ Although it is time-consuming, field work is required to assess old growth forest and high-quality habitat and environmental values.	
	▪ Field staff assigned to apply the PNF protocol to state forests are capable of undertaking a rapid environmental values assessment.	

4.1 Current old growth protection compared to JANIS targets

The Commission reassessed old growth targets for each forest ecosystem using original data on the extent of old growth forest used to inform the RFA[36], and up-to-date data on the current extent of the reserve system. A more detailed description of the methodology is outlined in **Appendix 6**.

The Commission found that, as a result of additions to the reserve system throughout the north coast, the total area of old growth forest and the number of forest ecosystems exceeding JANIS old growth protection targets had increased since the RFA was agreed.

In terms of the changing number and extent of forest ecosystems reserved and meeting JANIS targets in the north coast RFA region:

▪ the total reserved area of old growth forest is estimated to be more than
1.22 million hectares, an **increase of 10 percent** or 110,200 hectares from the area reserved in the 2000 RFA for the north east region (**Table 2**)

▪ in areas reserved as old growth in north coast state forests, the total extent of old growth forest ecosystems meeting the 60 percent regional targets was:

- **just over 66,600 hectares** for all forest ecosystems, an **increase of 42 percent**, or nearly 20,000 hectares

- **more than 30,000 hectares** for key commercially viable forest ecosystems, an **increase of 80 percent** or more than 13,500 hectares (**Table 3**).

Twenty-three forest ecosystems with commercial species have more than 60 percent of the old growth forest mapped in the current reserve system (**Table 4**). Under the original RFA assessment, 19 forest ecosystems with commercial species met this target.

Most of the commercial old growth forest ecosystems are found in the upper north east area of the RFA region (**Figure 11**). Old growth forests in this region are listed on the NSW Heritage Register (**Section 6.3.1**).

Appendix 6 provides more detailed information for each old growth forest ecosystem including its location and area statistics.

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[36] JANIS states that: 1) Where old growth forest is rare or depleted within a forest ecosystem (which is generally less than 10 percent of the total extent of the ecosystem), all areas of old growth forest associated with that forest ecosystem should be protected in the reserve system; and 2) For all other forest ecosystems, 60 percent of the old growth forest identified at the time of assessment should be protected in the reserve system.

Table 2: Reserved area of old growth forest ecosystems on the north coast before and after the revised JANIS old growth assessment

RFA region	Baseline extent of old growth forest ecosystem (ha)	Extent of old growth forest ecosystem reserved		
		RFA (ha)	Commission analysis (ha)	Increase (ha)
All north coast	1,684,600	1,109,900 *66%*	1,220,100 *72%*	110,200 *10%*
Upper north east region	654,600	371,000 *57%*	431,800 *66%*	60,800 *16%*
Lower north east region	1,030,000	738,900 *72%*	788,300 *77%*	49,400 *7%*

Table 3: Total extent of old growth forest ecosystems meeting 60 percent regional targets in north coast state forest areas reserved as old growth

RFA region	Total extent (ha) of old growth forest ecosystem reserved in state forest ≥ 60% regional target			Total extent (ha) of commercial-type old growth forest ecosystems reserved in state forest ≥ 60% regional target		
	RFA (ha)	Commission analysis (ha)	Increase (ha)	RFA (ha)	FCNSW analysis (ha)	Increase (ha)
All north coast	46,886	66,606	19,720 *42%*	17,037	30,620	13,584 *80%*
Upper north east region	27,249	44,397	17,148 *63%*	12,355	23,472	11,117 *90%*
Lower north east region	19,637	22,209	2,572 *13%*	4,682	7,148	2,466 *53%*

Table 4: Commercially viable forest ecosystems meeting 60 percent regional old growth targets in north coast state forest areas

Forest ecosystem number	Forest ecosystem	Region[37]	Revised achievement of old growth reservation target (%)
158	Wet Spotted Gum-Tallowwood	UNE	98.1
83	Mid-Elevation Wet Blackbutt	LNE/UNE	89.0 / 87.8
84	Mid North Coast Wet Brushbox-Tallowwood-Blue Gum	LNE/UNE	76.0 / 88.2
135	South Coast Tallowwood-Blue Gum	UNE	87.5
146	Tallowwood	UNE	86.4
157	Wet Shrubby Brushbox-Tallowwood	LNE / UNE	63.4 / 86.2
155	Wet Foothills Blackbutt-Turpentine	LNE/UNE	71.9 / 85.7
100	Northern Grassy Sydney Blue Gum	UNE	82.7
104	Northern Wet Tallowwood-Blue Gum	UNE	81.8
67	High-Elevation Ferny Blackbutt	LNE/UNE	77.1 / 81.6
89	Moist Foothills Spotted Gum	UNE	77.6
32	Dry Foothills Blackbutt-Turpentine	UNE	76.7
69	High-Elevation Moist Open Tallowwood-Blue Gum	LNE	76.1
19	Central Mid-Elevation Sydney Blue Gum	LNE/UNE	62.6 / 72.8
34	Dry Grassy Blackbutt-Tallowwood	UNE	72.2
59	Gorge Ironbark-Grey Gum	UNE	70.4
33	Dry Foothills Spotted Gum	UNE	67.2
40	Dry Heathy Sandstone Blackbutt	UNE	67.0
109	Open Shrubby Brushbox-Tallowwood	UNE	66.3
55	Foothills Grey Gum-Spotted Gum	UNE	64.3
153	Wet Coastal Tallowwood-Brushbox	UNE	64.2
70	High-Elevation Open Spotted Gum	UNE	63.9
36	Dry Grassy Tallowwood-Grey Gum	UNE	63.8

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[37]   UNE = upper north east region, LNE = lower north east region.

| Forest ecosystem type |
| Non-commercial (green) |
| Commercial (orange) |

IFOA	Commercial (ha)	Non-commercial (ha)
Upper North East	23,472	21,498
Lower North East	7,148	15,644
Total	30,620	37,142

Spatial data: Forestry Corporation of NSW   50 km
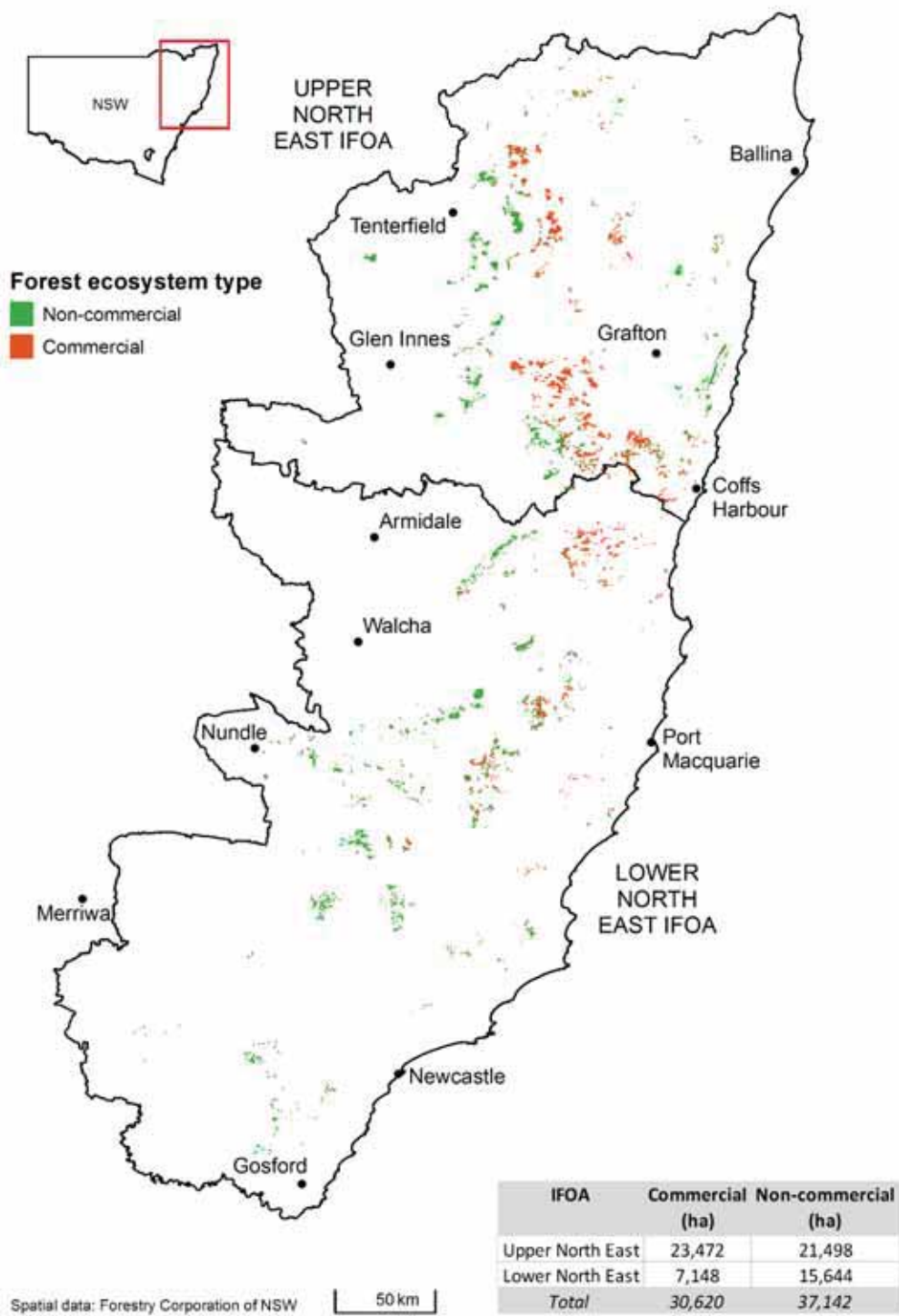
Figure 11: Location of commercial and non-commercial old growth forest ecosystems within north coast state forests that exceed the 60 percent JANIS old growth target

4.2 Pilot study of detailed assessment of old growth forest and rainforest

OEH Science independently applied the PNF protocols at 13 sites across 12 north coast state forests to test whether old growth forest and rainforest can be more accurately mapped. This included desktop analysis of 13 sites and field verification of 11 sites. The results of the assessment are provided in **Appendix 7**.

The Commission notes that the pilot findings represent a small, unrepresentative sample of all state forest compartments in north east NSW, and contain several assumptions. As such, caution should be taken when considering this indicative number due to bias in the sampling. However, the pilot (and PNF remapping) has confirmed there are significant errors in old growth forest and rainforest mapping in the state forest compartments selected, in the extent and location of old growth and rainforest.

4.2.1 Extent of old growth forest and rainforest

Table 5 lists the sample sites and results of reassessing the extent of old growth forest. In line with the Commission's pilot approach, the extent of old growth forest was determined using the current PNF minimum area threshold for old growth (5 hectares).

As part of the pilot, the Commission tested and remapped sample sites using a minimum area threshold of 2 hectares, which slightly increased the area of old growth mapped in some cases. **Section 5.2** provides an overview of this issue and more detailed data.

Overall, the Commission found that:

The extent of old growth forest was reduced in nine of the 13 sites

- **Six sites had no assessed old growth** (a 100 percent reduction in mapped extent). For example, the area of previously mapped old growth forest at the Wild Cattle Creek site (Compartment 515) was reduced by 112 hectares under the PNF protocol assessment (a 100 percent decrease) (**Figure 12**).

- Across all the sites where old growth decreased, the aggregated area of old growth forest **reduced by 88 percent** (a decrease of 819 hectares, from 934 hectares to 115 hectares).

- Using a 2 hectare minimum area threshold only slightly increased the area of old growth forest identified at these sites compared with using the current 5 hectare minimum area (identifying 142 hectares of old growth forest compared with 115 hectares) but the aggregated area of old growth forest was still reduced (by 85 percent).

The extent of old growth forest increased in four of the 13 sites

- Old growth forest was identified at one site where previously no old growth was mapped.

- Across all the sites where old growth increased, the aggregated area of old growth **increased by 54 percent** (an increase of 37 hectares, from 67 hectares to 104 hectares).

- For example, the area of previously mapped old growth forest at the Kangaroo River site (Compartment 234) site increased by 13 hectares under the PNF protocol assessment (a 186 percent increase) (**Figure 13**).

- Using a 2 hectare minimum area threshold only slightly increased the area of old growth forest identified at these sites compared with using the current 5 hectare minimum area

(identifying 112 hectares of old growth forest compared with 104 hectares). Using the 2 hectare minimum area threshold, the aggregated area of old growth forest increased by 67 percent.

There was an overall decrease in the extent of old growth forest mapped

▪ When all sites were aggregated, the total area of old growth forest in the areas remapped in the pilot **decreased by 78 percent** (a decrease of 782 hectares, from 1,001 hectares to 219 hectares).

▪ Using a 2 hectare minimum area threshold slightly increased the total area of old growth forest identified compared with using the 5 hectare minimum area (identifying 254 hectares of old growth forest compared with 219 hectares) but the aggregated area of old growth forest was still reduced (by 75 percent).

Table 6 lists the sample sites and results of reassessing the extent of rainforest. Overall, the Commission found that:

The extent of rainforest was reduced in eight of the 13 sites

▪ Across all the sites where the extent of rainforest was reduced, the aggregated area of rainforest **reduced by 62 percent** (a decrease of 41 hectares, from 66 hectares to 25 hectares).

The extent of rainforest increased in five of the 13 sites

▪ Across all the sites where the extent of rainforest increased, the aggregated area of rainforest **increased by 75 percent** (an increase of 12 hectares, from 16 hectares to 28 hectares).

There was an overall decrease in the extent of rainforest mapped

▪ When all sites were aggregated, the total area of rainforest in the areas remapped in the pilot **decreased by 35 percent** (a decrease of 29 hectares, from 82 hectares to 53 hectares).

OEH Science has reported similar results from 667 PNF reassessments on private land, where the extent of old growth forest reduced by 65 percent and rainforest reduced by 23 percent.

Table 5: Change in the extent of old growth forest at sample sites

State forest (compartment)	Original mapping (ha)	Remapping (ha)	Change (ha)	Change
Sites demonstrating a decrease in old growth				
1. Bellangry (11)	36	0	-36	100% decrease
2. Clouds Creek (124)	91	12	-79	88% decrease
3. Clouds Creek (167)	102	0	-102	100% decrease
4. Dalmorton (406)	75	56	-19	25% decrease
5. Ewingar (635, 637)	300	47	-253	84% decrease
6. Lower Bucca (600)	86	0	-86	100% decrease
7. Mistake (341)	2	0	-2	100% decrease
8. Nambucca (320, 321)	130	0	-130	100% decrease
9. Wild Cattle Creek (515)	112	0	-112	100% decrease
Total aggregated for decreasing sites	**934**	**115**	**-819**	**88% decrease**
Sites demonstrating an increase in old growth				
10. Girard (52)	0	7	7	7 hectare increase[38]
11. Irishman (205)	22	33	11	50% increase
12. Kangaroo River (234)	7	20	13	186% increase
13. Kippara (18)	38	44	6	16% increase
Total aggregated for increasing sites	**67**	**104**	**37**	**54% increase**
Total aggregated for all sites	**1001**	**219**	**-782**	**78% decrease**

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[38] Percentage value cannot be calculated due to a starting value of zero.

Table 6: Change in the extent of rainforest at sample sites

State forest (compartment)	Original mapping (ha)	Remapping (ha)	Change (ha)	Change
Sites demonstrating a decrease in rainforest				
1. Bellangry (11)	5	0	-5	100% decrease
2. Clouds Creek (124)	8	4	-4	50% decrease
3. Ewingar (635, 637)	4	3	-1	25% decrease
4. Irishman (205)	20	6	-14	70% decrease
5. Kangaroo River (234)	7	4	-3	43% decrease
6. Kippara (18)	6	0	-6	100% decrease
7. Nambucca (320, 321)	5	0	-5	100% decrease
8. Wild Cattle Creek (515)	11	8	-3	27% decrease
Total aggregated for decreasing sites	66	25	-41	62% decrease
Sites demonstrating an increase in rainforest				
9. Dalmorton (406)	12	14	2	17% increase
10. Clouds Creek (167)	0	4	4	4 hectare increase[39]
11. Girard (52)	3	5	2	67% increase
12. Lower Bucca (600)	1	4	3	300% increase
13. Mistake (341)	0	1	1	1 hectare increase[40]
Total aggregated for increasing sites	16	28	12	81% increase
Total aggregated for all sites	82	53	-29	35% decrease

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[39]   Percentage value cannot be calculated due to a starting value of zero.
[40]   Percentage value cannot be calculated due to a starting value of zero.
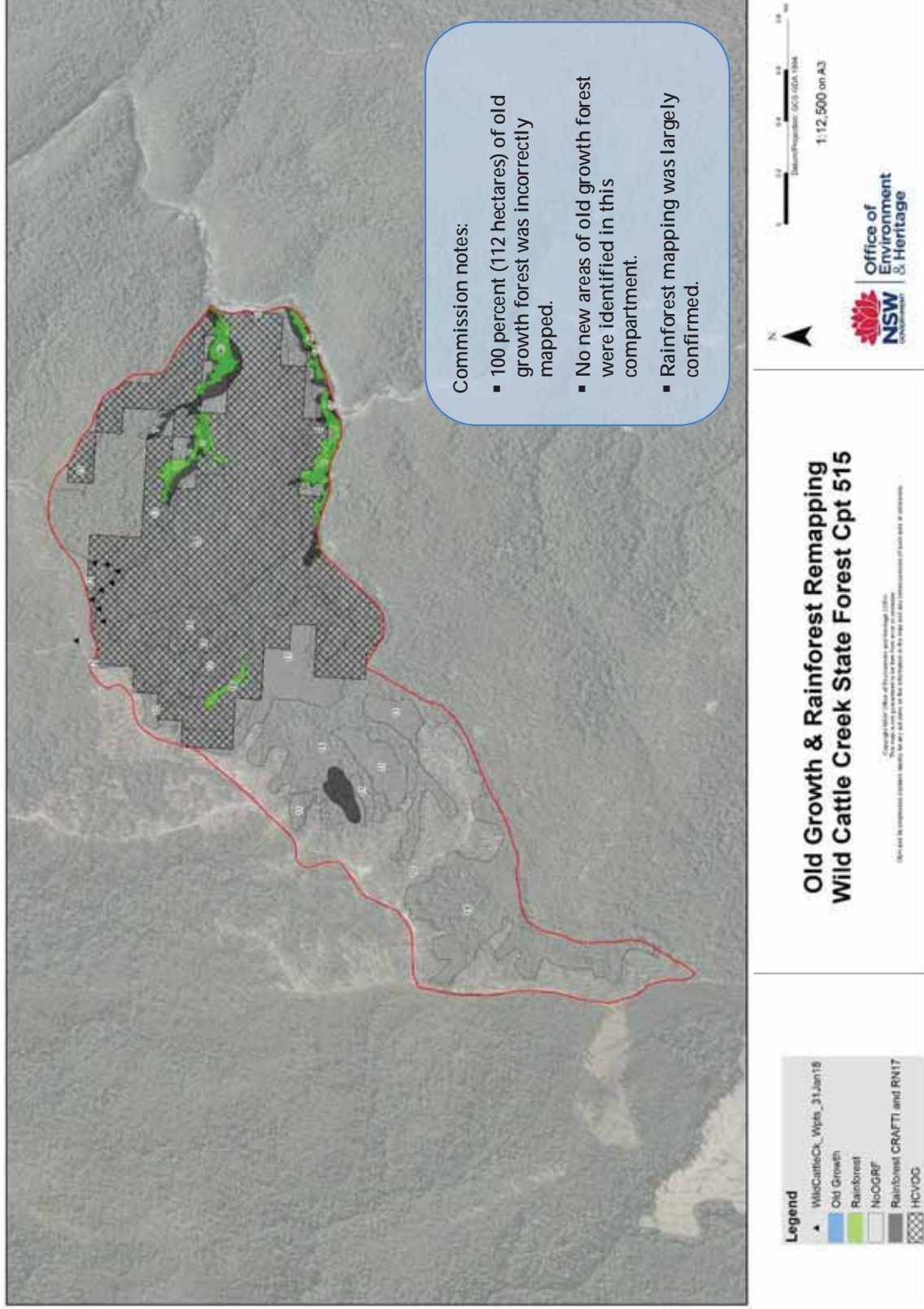
Figure 12: Results of old growth forest and rainforest remapping in Wild Cattle Creek State Forest

Commission notes:

- There was a significant difference between the originally mapped location of old growth forest and the newly mapped location.

- 13 hectares of new old growth forest was identified (blue) (20 hectares in total, a 186 percent increase).

- No newly identified old growth forest is protected under the special management zone.

- Rainforest located in different areas than originally mapped.

Old Growth & Rainforest Remapping
Kangaroo River State Forest Cpt 234

Legend
- Kangaroo R_Wpts_31-Jan18
- Old Growth
- Rainforest
- NoOGRF
- Rainforest CRAFTI and RN17
- HCVOG

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Environment
& Heritage

Figure 13: Results of old growth forest and rainforest remapping in Kangaroo River State Forest

4.2.2   Location of old growth forest and rainforest

In addition to errors in the recorded extent of old growth forest and rainforest, the Commission found significant errors between the location of originally mapped and remapped old growth forests in four of the sample sites.

Table 7 outlines the proportion of overlap between original and new mapping at these sites.

The Commission identified:

▪ 20 hectares of old growth forest at the Kangaroo River site (Compartment 234), **of which none is protected** under the current old growth layer and special management zone.

▪ 56 hectares of old growth forest at the Dalmorton site (Compartment 406), **of which only 5 percent is protected** (**Figure 14**) under the current old growth layer and special management zone. In addition, much of the newly mapped old growth forest is found on slopes greater than 30 degrees, which is already excluded from harvesting. Most of the forest recorded in the HCVOG layer (and which is no longer found to be old growth) is located on areas less than 30 degrees, which might have otherwise been available for harvesting (**Figure 15**).

▪ 44 hectares of old growth forest at the Kippara site (Compartment 18), **of which only 14 percent is protected** (**Figure 16**) under the current old growth layer and special management zone. As with the Dalmorton site (Compartment 406), much of the newly mapped old growth forest is found on slopes greater than 30 degrees (**Figure 17**).

▪ 33 hectares of old growth forest at the Irishman site (Compartment 205), **of which only 15 percent is protected** under the current old growth layer and special management zone.

The old growth forest mapped outside the current old growth layer and the special management zone may not be currently protected under appropriate zoning. Further, the current protection zones are incorrectly applied to some vegetation other than old growth forest.

Table 7: Overlap of original and new mapping on sites with significant location errors

State forest (compartment)	Original mapping (ha)	Remapping (ha)	Area where original mapping and remapping intersect (ha)
Sites demonstrating a decrease in old growth			
1. Dalmorton (406)	75	56	3
Sites demonstrating an increase in old growth			
2. Irishman (205)	22	33	5
3. Kangaroo River (234)	7	20	0
4. Kippara (18)	38	44	6

Commission notes:

▪ There was a significant difference between the location of originally mapped old growth forest and the currently mapped location.

▪ 72 hectares of old growth was originally incorrectly mapped.

▪ 56 hectares of new old growth was identified. Of this, 95 percent is mapped outside special management zone protection.

Old Growth & Rainforest Remapping
Dalmorton State Forest Cpts 406

Legend

▲ Wpts_Dalmorton23Nov17
Old Growth
Rainforest
NoOGRF
Rainforest CRAFTi and RN17
HCVOG

Office of Environment & Heritage

Figure 14: Results of old growth forest and rainforest remapping in Dalmorton State Forest

Figure 15: Results of old growth forest and rainforest remapping in Dalmorton State Forest, showing the location of remapped areas on slopes
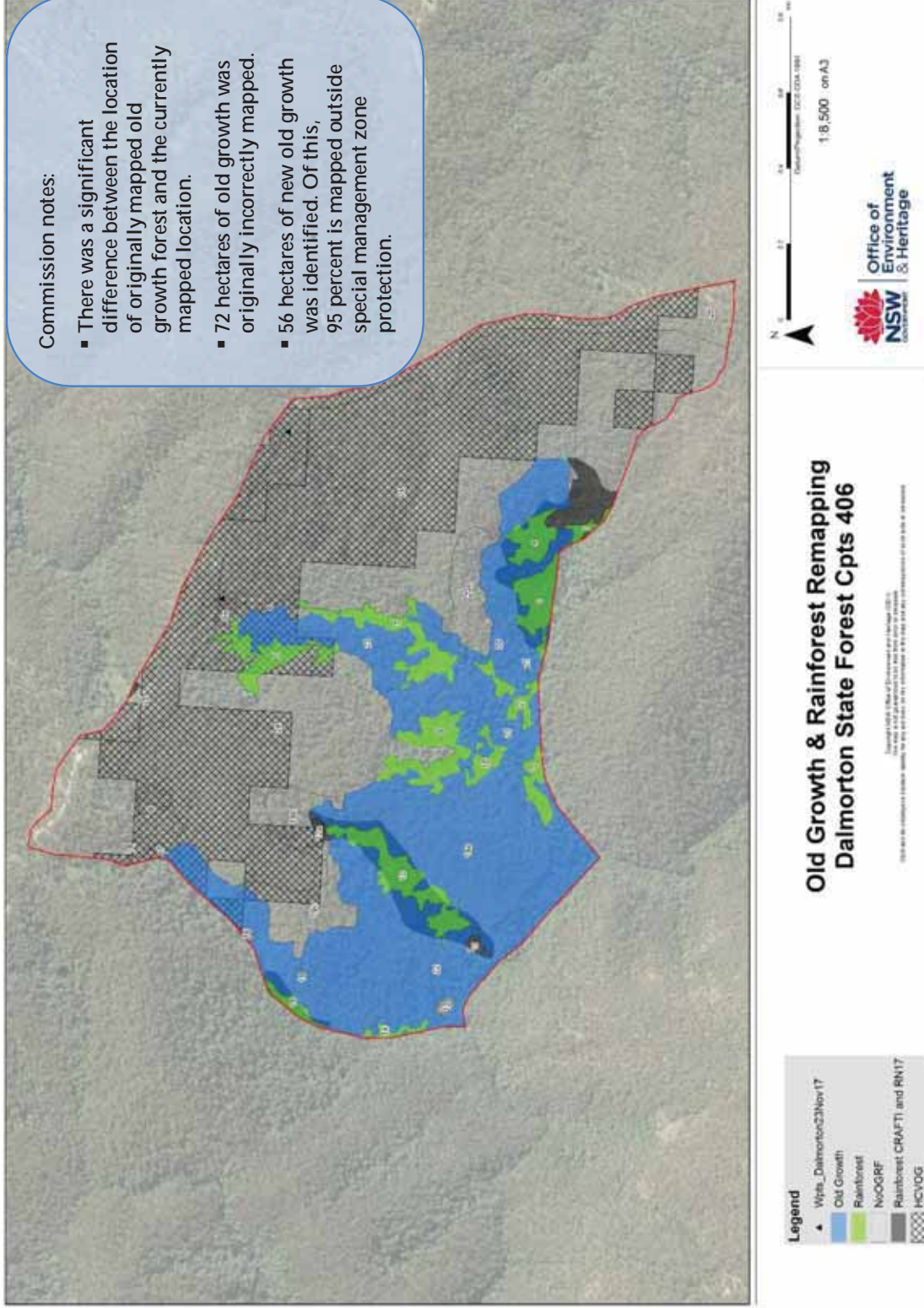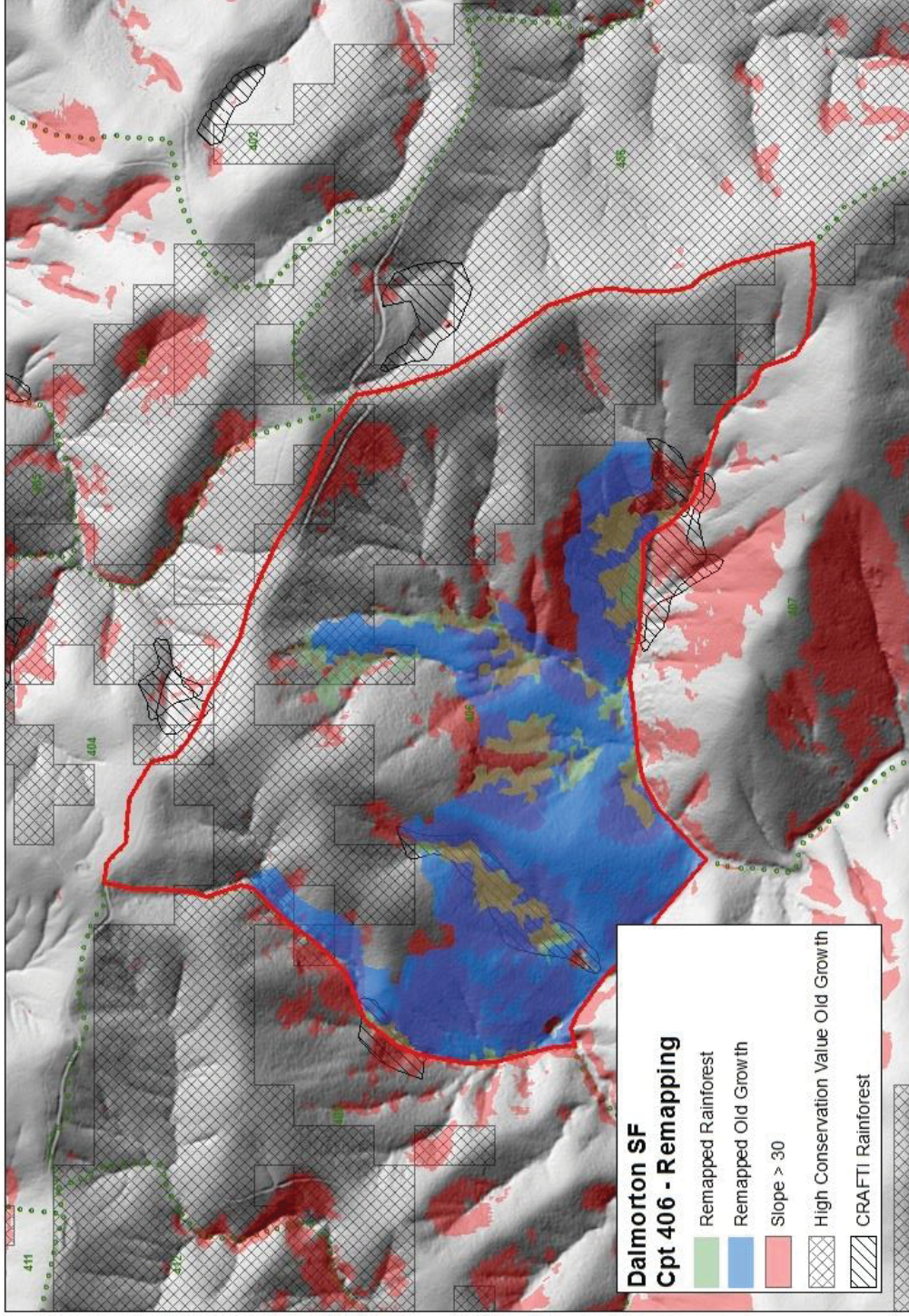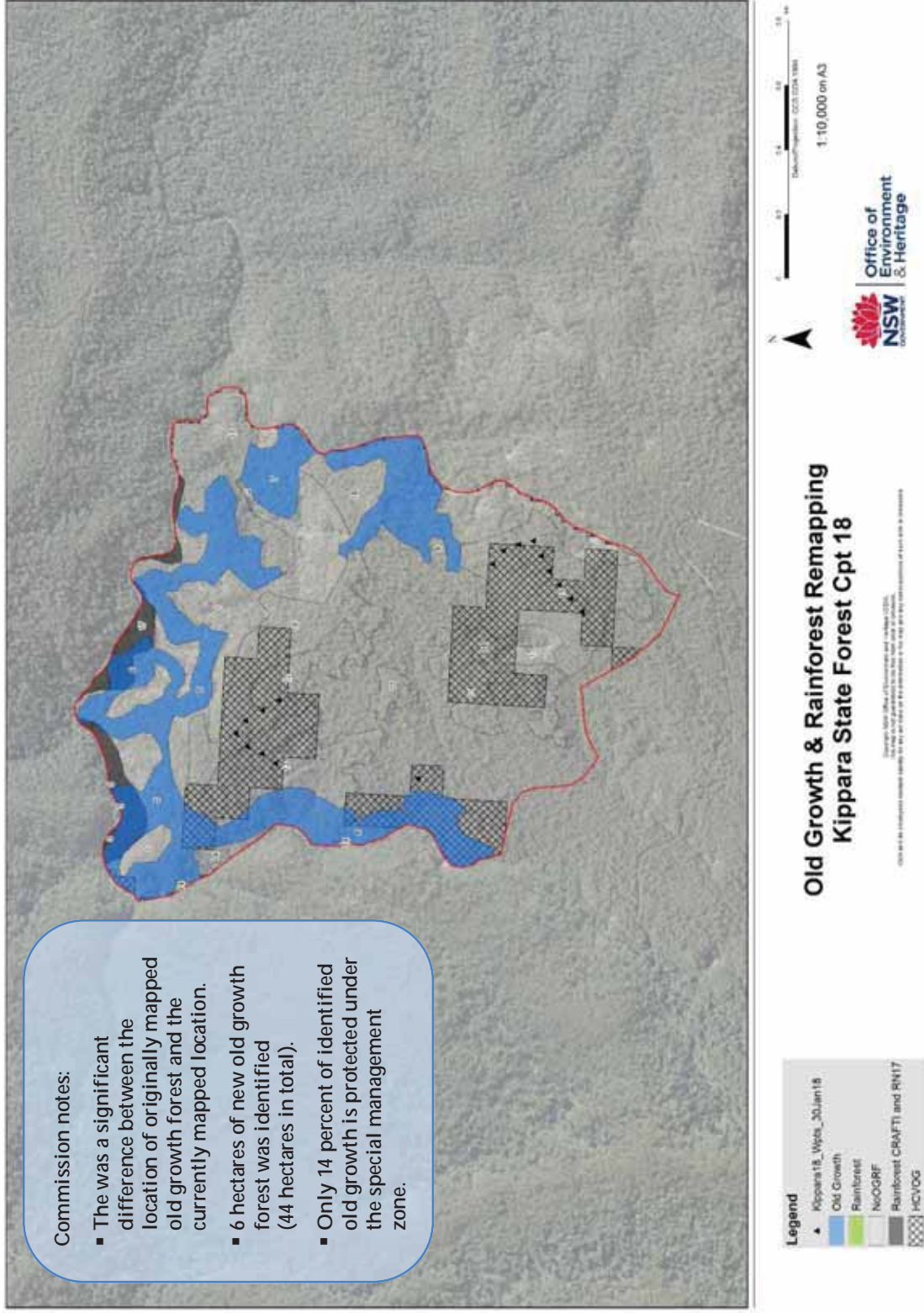
Figure 16: Results of old growth forest and rainforest remapping in Kippara State Forest
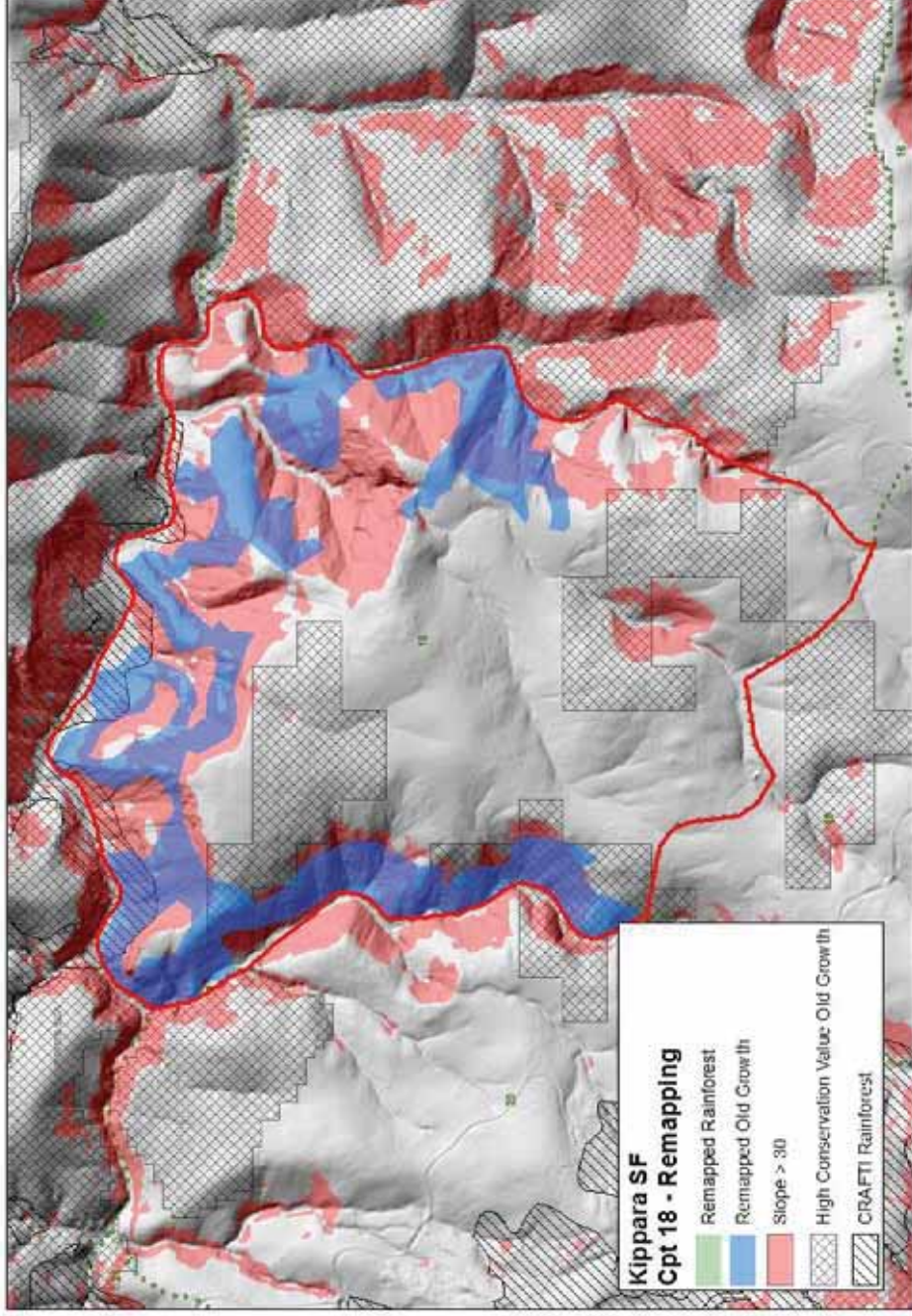
Figure 17: Results of old growth forest and rainforest remapping in Kippara State Forest, showing the location of remapped areas on slopes

4.2.3 Type of old growth forest

Under the RFAs, the NSW Government is committed to protecting 60 percent of old growth forest for all forest ecosystems (that are not rare or depleted). **Appendix 8** provides a more detailed breakdown of all old growth forest ecosystems and whether or not they meet these targets.

Of the 13 sites assessed for this pilot, all but two – Lower Bucca (Compartment 600) and Nambucca (Compartments 329 and 321) – comprised at least 50 percent old growth forest ecosystems (by area in the compartment) that exceeded the 60 percent JANIS reservation target, which would allow them to be subject to an assessment of potential timber production. Conversely, more than 50 percent of the area of old growth forest in the Lower Bucca and Nambucca sites was made up of forest ecosystems that had not met the 60 percent JANIS reservation target, and would be excluded from further consideration for potential timber harvesting.

4.3 Environmental values assessment

In addition to the old growth forest and rainforest assessment, the Commission undertook a secondary assessment of environmental values by conducting fieldwork at seven sample sites within state forests.[41]

The Commission adopted a range of criteria based in part on the NSW Government's Biodiversity Assessment Method, and in part, on consultation with agencies (**Appendix 5**). The Commission and OEH Science, in collaboration with the EPA and FCNSW, undertook the desktop and field assessment concurrently with the old growth forest and rainforest reassessment.

Figure 18 and **Figure 19** summarise the results of the field assessment. **Appendix 5** sets out the results from the desktop assessment.

The Commission found that:

- Habitat features – including coarse woody debris, dead standing trees (stags) and live hollow-bearing trees – were present at all of the sites.

- Senescence was below 10 percent for all sites except Clouds Creek (Compartment 167) and Kangaroo River (Compartment 234). Senescence at Clouds Creek (Compartment 167) was particularly high (39 percent).

- The Clouds Creek site (Compartment 167) was an outlier. In line with its high senescence, it had a very high number of live hollow-bearing trees relative to the other sites (26 per hectare), and also had a giant tallowwood tree (over a 155 centimetre diameter at stump height). Furthermore, the site's forest types were at the outer limits of their geographic range.

The rapid nature of the assessment and the accessibility of the sites meant that data could only be collected from seven of the 13 sample sites, producing a limited sample. From the limited data and time available, the Commission cannot confidently outline a set of rules for

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[41]   Sites: Clouds Creek (Compartment 124), Clouds Creek (Compartment 167), Wild Cattle Creek (Compartment 515), Kangaroo River (Compartment 234), Kippara (Compartment 18), Bellangry (Compartment 11) and Mistake (Compartment 341). Assessment at Irishman (Compartment 205) was not undertaken as steep slopes limited access.

determining the significance of high-quality habitat at the regional scale. The implications of this finding in the Commission's proposed approach are outlined in **Section 5.1**.
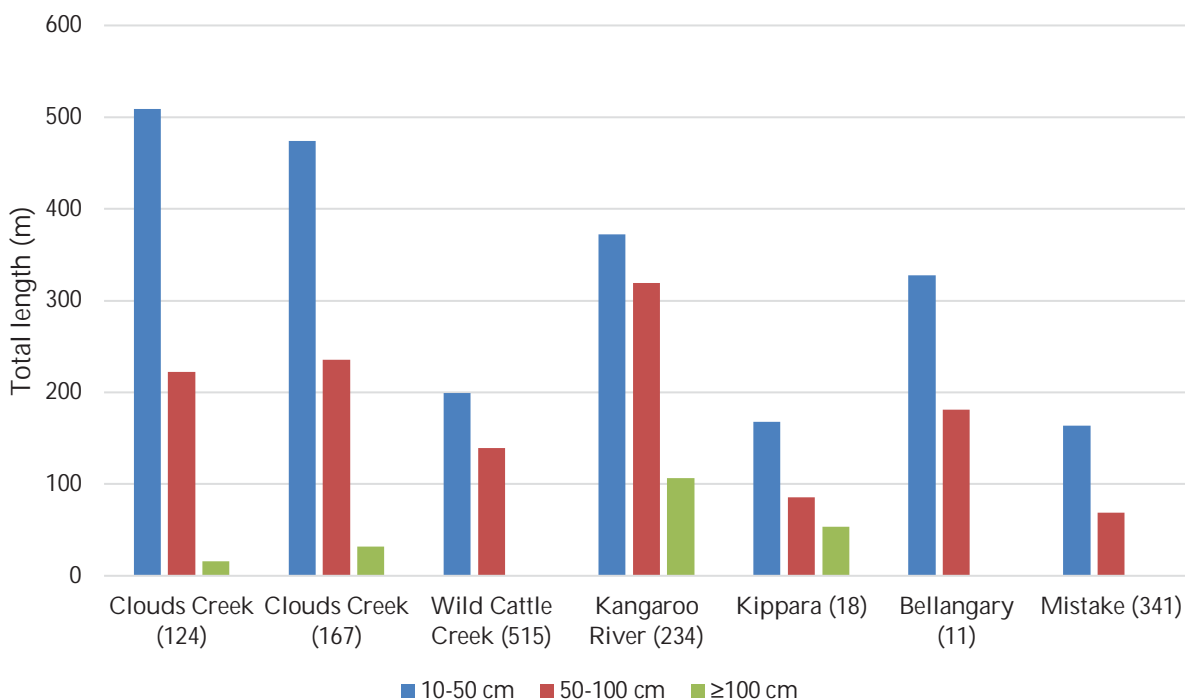
Figure 18: Estimated total length of dead fallen logs (by diameter section) per hectare
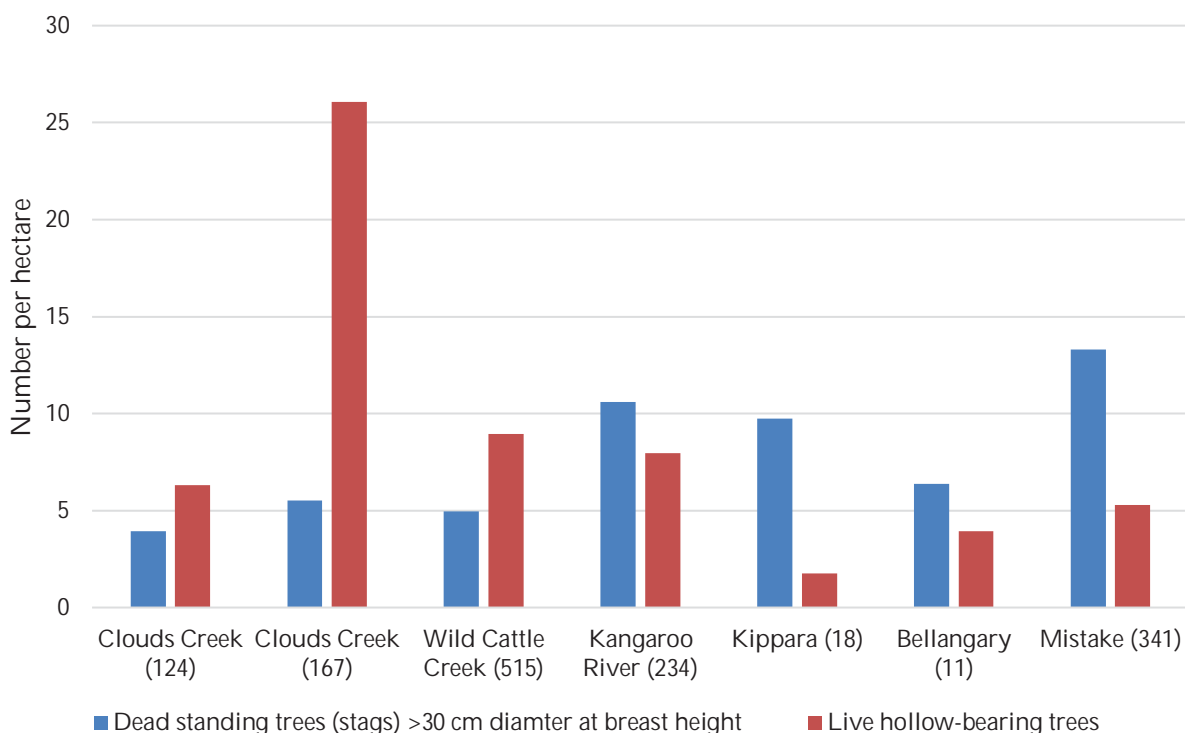
Figure 19: Number of dead standing trees and live hollow-bearing trees per hectare

4.4   Wood supply values

The Commission asked FCNSW to provide four estimates:[42]

▪ the timber volume for the (i) old growth forest and (ii) rainforest sample sites visited

▪ the timber volume for all areas identified as having (iii) commercially viable old growth forest ecosystems that exceed JANIS targets and (iv) rainforest that may be remapped.

The third and fourth estimates are an extrapolation based on the findings from the sample sites. It is important to note this extrapolation is based on a biased sample from the pilot, and may not be representative of all sites affected by incorrect old growth forest and rainforest mapping. Furthermore, the Commission has not independently verified these volume predictions due to time constraints. As such, caution should be taken when considering these numbers.

The Commission notes that estimated wood supply volumes should not be used to indicate a change in wood supply, but rather should be used as an estimate of standing timber availability. The Commission considers that wood supply volumes should remain as they currently stand, and should not be increased.

FCNSW advised the Commission that these estimates are based on FRAMES timber modelling and assume up to 70 percent of currently mapped old growth has been reassessed as non-old growth forest. The estimate also allows for proposed Coastal IFOA provisions, including areas excluded from harvesting operations such as streams, rocks, ridge and headwater habitat, and new areas for habitat and wildlife set aside in the new Coastal IFOA. **Table 8** summarises FCNSW's estimates. Detailed explanations of the estimates (including data assumptions) are provided below.

Appendix 9 explains the approach to extrapolating and estimating wood volumes across the north coast IFOA.

Table 8: Summary of estimated high quality timber volumes

	Estimated volume (m³)	
	Sample sites	North coast
Old growth forest	9,000	164,400 *(commercial types)* 47,900 *(non-commercial types)* 212,300 *(all types)*
Rainforest	100	90,900

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42   The information was provided by FCNSW in good faith on the basis of information believed to be reliable at the time it was prepared. Volume estimates and forecasts are inherently uncertain and actual results are likely to differ from forecasts.

If the results of the pilot are found to apply more broadly to currently mapped areas of old growth forest and rainforest, FCNSW makes the following estimates.

- Almost **9,000 cubic metres** of high-quality timber occurs in the net harvestable area of the sample sites, in areas that are no longer mapped as old growth and that contain ecosystems that exceed JANIS old growth targets (295 hectares) (**Table 9**). This would be sufficient to address one year of estimated timber supply shortage.

  Just over 10,650 cubic metres of non–high quality timber – such as low quality sawlogs and poles – occurs in this area. Three of the sites had no accessible net harvest areas, despite being mapped as non-old growth forest (**Table 10**).[43]

  In the two sites that contained forest ecosystems that currently do not meet JANIS old growth targets, FCNSW estimated they contained over **4,000 cubic metres** of high-quality timber. However, these sites were not included in the above estimates, despite being remapped as non-old growth.

  Only around **100 cubic metres** of high-quality timber occurs in the areas no longer considered rainforest after the remapping.

- **164,400 cubic metres** of high-quality timber from commercially viable forest ecosystems (which contain a majority of commercial timber species) may occur in the net harvestable area across six supply zones, in areas identified as old growth forest and ecosystems that exceed JANIS old growth targets (around 7,500 hectares). Annualised over 20 years, this equates to 8,200 cubic metres per year.

  Around **123,000 cubic metres** of high quality timber occurs in the net harvestable area of supply zones 2 and 3 (more than 4,800 hectares) (**Table 11**). The Commission identified these supply zones as the areas with the potential to be most affected by new mapping of threatened ecological communities and koala habitat (**Table 12**).

- Almost **48,000 cubic metres** of high-quality timber from non–commercially viable forest ecosystems (which can contain some commercial timber species) may occur in the net harvestable area across six supply zones, in areas identified as old growth forest and ecosystems that exceed JANIS targets (around 6,000 hectares). Annualised over 20 years, this equates to 2,500 cubic metres per year. The commercial return on this timber is significantly less than for the key commercial types.

- **90,900 cubic metres** of high quality timber from commercial species may occur in the net harvestable area across six supply zones, in areas no longer identified as being rainforest (around 4,900 hectares). Annualised over 20 years, this equates to 4,500 cubic metres per year. Accessing timber in these areas would be difficult.

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[43] Sites that did not have a field assessment component were not included in these calculations.

Table 9: Estimated timber volumes in areas that contain over-target forest ecosystems and that have been remapped as non-old growth forest

State forest (compartment)	Increase in accessible net harvest area (ha)	High-quality yield (m³/ha)	High-quality volume (m³)	Total volume (m³)	Dominant species
1. Clouds Creek (124)	55	60	**3,300**	7,000	Blackbutt
2. Wild Cattle Creek (515)	70	25	**1,750**	4,000	Blackbutt
3. Dalmorton (406)	65	23	**1,495**	3,500	Spotted Gum
4. Clouds Creek (167)	60	20	**1,200**	3,000	Spotted Gum
5. Bellangry (8)	25	30	**750**	1,250	Blackbutt
6. Kippara (18)	20	20	**400**	800	Blackbutt
7. Kangaroo River (234)	0	0	–	–	Spotted Gum
8. Mistake (341)	0	0	–	–	Blackbutt
9. Irishman (205)	0	0	–	–	Blackbutt
Total	295	19 (average)	**8,895**	19,550	–

Table 10: Estimated timber volumes in areas that contain under-target forest ecosystems and that have been remapped as non-old growth forest

State forest (compartment)	Increase in accessible net harvest area (ha)	High-quality yield (m³/ha)	High-quality volume (m³)	Total volume (m³)	Dominant species
10. Nambucca (320, 321)	85	30	**2,550**	5,000	Blackbutt
11. Lower Bucca (600)	60	30	**1,800**	4,000	Blackbutt
Total	145	30 (average)	**4,350**	9,000	–

Table 11: Estimated timber volumes across supply zones in north coast state forests[44]

Supply zone	Estimated volume (m³)		Total
	Commercial types	Non-commercial types	
1	32,500 (2,300 ha)	10,200 (1,900 ha)	42,700 (4,200 ha)
2	109,200 (4,400 ha)	24,200 (2,200 ha)	133,400 (6,600 ha)
3	13,900 (450 ha)	6,000 (900 ha)	19,900 (1,350 ha)
4	8,800 (350 ha)	7,500 (1,000 ha)	16,300 (1,350 ha)
5/6	0	0	0
Total	164,400 (7,500 ha)	47,900 (6,000 ha)	212,300 (13,500 ha)

Table 12: Estimated timber volumes (commercial types only) compared with the estimated timber volume shortfall in the Commission's November 2016 advice[45]

Supply zone	Estimated volume (m³/per year)	
	Estimated timber volumes from this review	Estimated shortfall from November 2016
1	1,625	2,200–2,600
2	5,460	3,800–4,200
3	695	1,250–1,650
4	440	100–200
5/6	–	–

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44   Estimate by FCNSW. Figures rounded by the Commission.
45   Estimate by FCNSW. Figures rounded by the Commission.

5 Improving the approach

Applying the pilot methodology to sample sites has allowed the Commission to identify significant errors in the current HCVOG old growth layer, as well as in rainforest mapping in the upper and lower north east regions. The pilot confirmed that the PNF protocols are objective, make use of the best available technology and data, and are relatively easy to apply in the field.

The Commission found that OEH Science staff are professional and skilled assessors, and that all agencies and FCNSW operated in a highly collaborative and professional manner during the assessment.

In addition to these key findings, the pilot also brought to light a number of insights and lessons. The Commission considers these are important considerations and has incorporated them into the proposed ongoing approach outlined in **Section 6**.

5.1 Assessment of environmental values

In addition to the old growth forest and rainforest remapping, the Commission piloted a desktop and field-based assessment of environmental values.

The assessment uses, in part, a set of criteria in the NSW Government's Biodiversity Assessment Method. Applying the full Biodiversity Assessment Method in the pilot was not considered appropriate as that method was developed to assess the environmental values lost when native vegetation is permanently removed to provide for a change in land use. It is not applicable in the forestry context as the land use does not change, and the loss of some environmental value is temporary rather than permanent. Furthermore, many environmental impacts can be identified and managed at the coupe scale.

An additional assessment was chosen, consistent with the old growth forest criteria under the NSW Government's agreed-to CAR reserve system, which aims (amongst other things) to increase protection of high-quality habitat for species in old growth forest areas.[46]

Based on lessons from the pilot and the NSW Government's commitment to establish a CAR reserve system, the Commission proposes a two-step environmental assessment in addition to the PNF protocol assessment. **Figure 22** in **Section 6** sets out this process.

The following is a summary of the Commission's proposed approach:

1   OEH Science conducts a rapid preliminary assessment to determine if a site contains indicative high-quality habitat values, while at the same time undertaking the PNF protocol assessment to identify old growth forest. All areas where old growth forest has been remapped should be subject to this dual assessment.

An assessment protocol should be developed and published. The criteria used in the Commission's pilot assessment – such as the presence of tree hollows and course woody debris – could form the basis for this protocol (**Appendix 5**).

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

2 If the preliminary assessment determines that the area contains indicative high-quality habitat values, FCNSW ecologists conduct a more thorough assessment of habitat value.

An assessment protocol and criteria for this process should also be developed and published. It could draw on the nationally agreed biodiversity criteria for the CAR reserve system, to identify areas with:

- conditions that support the special needs of rare, vulnerable or endangered species

- special groups of organisms – for example, species with complex habitat requirements, or migratory or mobile species

- high species diversity, natural refugia for flora and fauna, and centres of endemism

- species whose distributions and habitat requirements are not well correlated with any particular forest ecosystem.[47]

FCNSW would determine the appropriate zoning in line with the objectives of the FMZ system, which are consistent with many of the old growth forest and biodiversity criteria for the CAR reserve system. For example, FMZ 1 can contain:

- outstanding examples of forest ecosystems, areas of known unique or uncommon biological values or areas of high biodiversity

- localities or habitats of key threatened and sensitive fauna and flora.[48]

The value of a secondary environmental values assessment is demonstrated in the pilot sample site at Clouds Creek State Forest (Compartment 167). Applying the PNF protocol reduced the area of old growth forest at this site by 100 percent. However, the site contained a relatively large number of senescent trees (up to 40 percent in some areas, which met the relevant criteria under the protocol) and live hollow-bearing trees (**Figure 20**). In addition, the area containing these values had a relatively large patch size, was located adjacent to a national park and contained three forest types that are at the limit of their natural geographic range.

Under the proposed assessment and the decision framework set out in **Figure 22**, the site would be zoned either FMZ 2 or 3a (where harvesting is excluded) if the comprehensive assessment determined it contained high-quality habitat. Alternatively, if the assessment determined it did not contain high-quality habitat values, the area would be zoned FMZ 3b, where selective harvesting with special prescription could occur.

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[47] *Ibid.*

[48] FCNSW (nd) *Managing our forests sustainably – Forest Management Zoning in NSW State Forests.* 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.
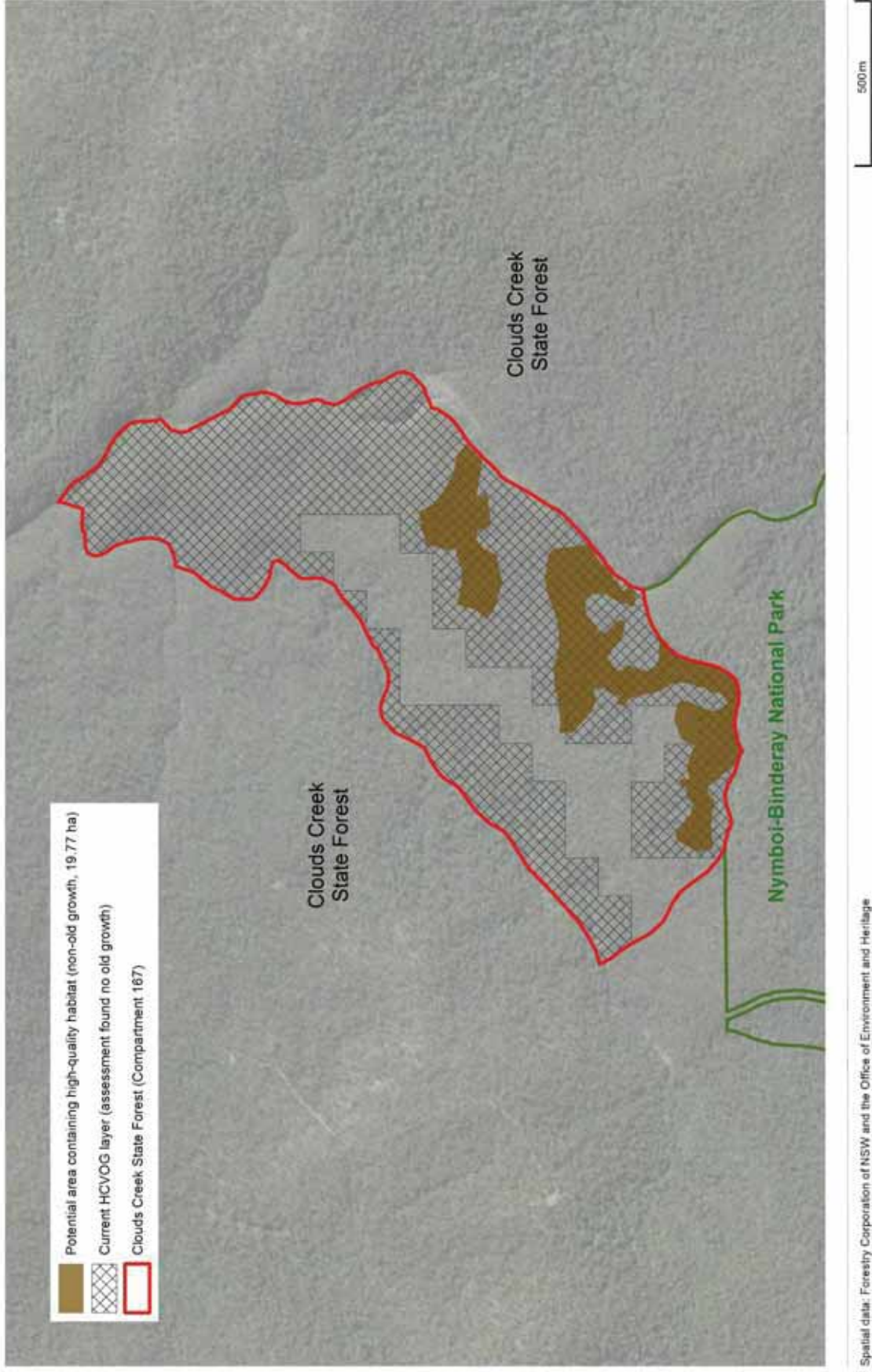
Figure 20: Non-old growth forest, demonstrating relatively large numbers of senescent trees and live hollow-bearing trees in Clouds Creek State Forest

Spatial data: Forestry Corporation of NSW and the Office of Environment and Heritage

5.2 Field verification requirements

OEH Science uses desktop mapping tools when applying the PNF protocol to reassess old growth forest and rainforest on private land. It only follows desktop assessments with field verification if required under the 'when in doubt, check' principle.

This method is appropriate for the current approach to applying the PNF protocol on private land. Current technology and data allows OEH Science to remap old growth forest and rainforest using desktop methods alone, and with a high degree of accuracy and confidence. For example, skilled aerial photographic interpreters can now readily detect evidence and criteria thresholds for senescent trees using desktop assessment alone (**Figure 7**).

Under the Commission's proposed approach, all sites remapped as old growth forest or rainforest with a high degree of confidence would not require field verification. However, all sites nominated by FCNSW for reassessment (and possible rezoning to allow harvesting) should require field assessment (including high-quality habitat assessment) if currently mapped areas were found not to contain old growth forest in the desktop assessment. The Commission considers that this step would provide the necessary assurance to ensure community confidence and the protection of environmental values.

5.3 Area size threshold for old growth

The pilot applied the current PNF protocol to determine the extent of old growth forest at sample sites. Currently, the minimum area threshold for determining the presence of old growth forest is 5 hectares. The origin of this value is unclear, but may reflect mapping accuracy and available technology at the time the protocol was developed in 2007.

The 5 hectare threshold is higher than the threshold currently used in other Australian jurisdictions. For example, the minimum threshold applied to old growth mapping in Western Australia is 2 hectares.[49] In light of this, the Commission requested that OEH Science undertake a remapping exercise using a 2 hectare minimum area threshold. **Table 13** sets out the comparison of outputs when mapping the extent of old growth forest using 5 hectare and 2 hectare minimum area thresholds.

Applying the 2 hectare threshold had no impact on mapping in seven of the 13 sample sites. In the remaining six sites, the area of old growth mapped increased when compared with the current 5 hectare threshold. An example map from the assessment of the Clouds Creek site (Compartment 124) demonstrates this increase (**Figure 21**). Overall, across the 13 sites, applying a 2 hectare minimum threshold increased the extent of mapped old growth by 17 percent (an additional 36 hectares).

The Commission considers that any future application of the PNF protocol to state forests should apply a 2 hectare minimum area threshold.

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[49] Conservation Commission of Western Australia (2005) *Assessment criteria and process for the Conservation Commission review of old-growth amendments.* Available at: https://www.conservation.wa.gov.au/media/1037/Old-GrowthAmmendments2.pdf.

Spatial data: Forestry Corporation of NSW and the Office of Environment and Heritage

500 m
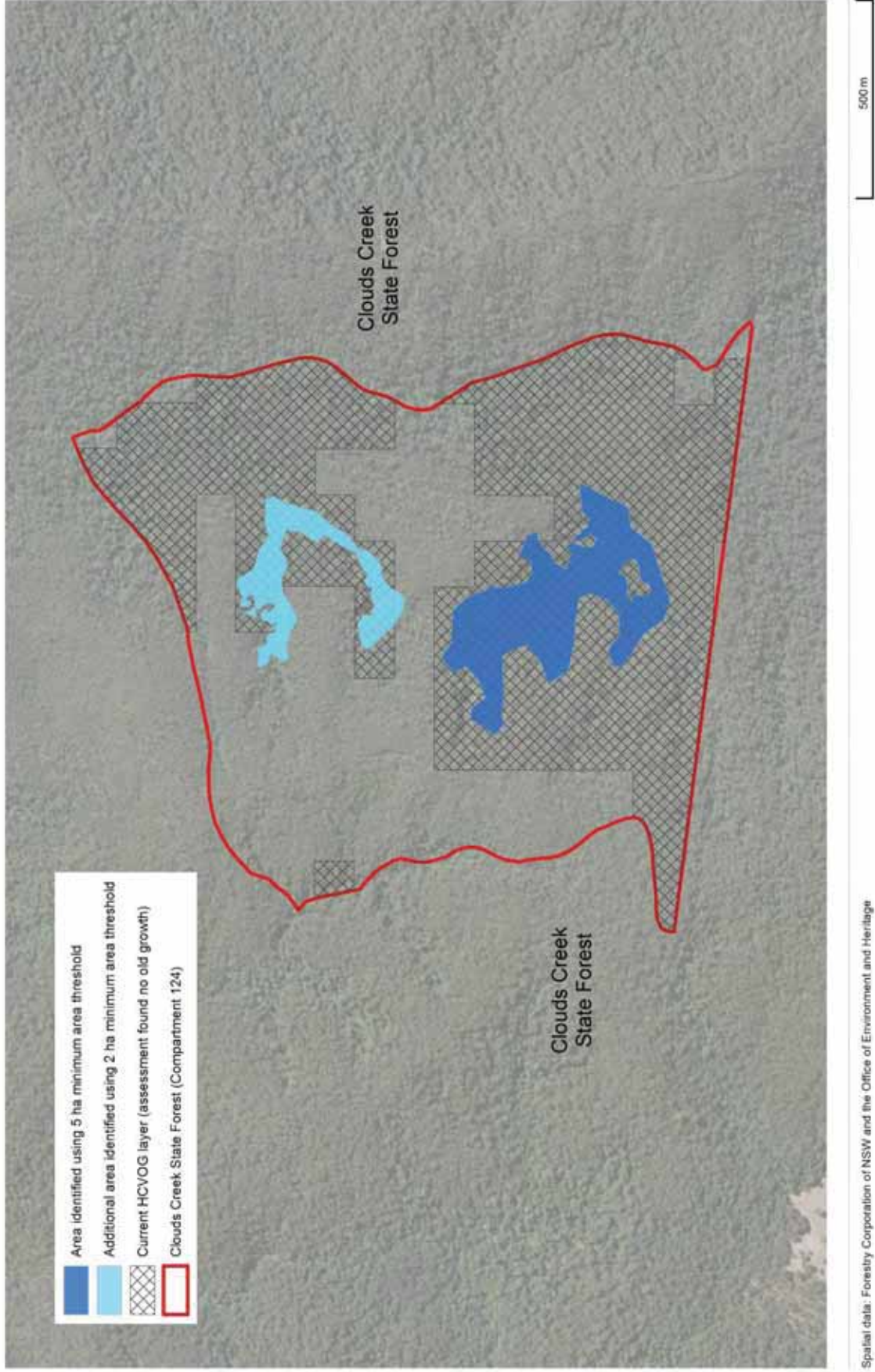
Figure 21: Comparison example between minimum area thresholds (the current threshold in the PNF protocol is 5 hectares)

Legend:
- Area identified using 5 ha minimum area threshold
- Additional area identified using 2 ha minimum area threshold
- Current HCVOG layer (assessment found no old growth)
- Clouds Creek State Forest (Compartment 124)

Clouds Creek State Forest

Clouds Creek State Forest

Table 13: Comparison of old growth remapping using 5 hectare and 2 hectare minimum area thresholds

State forest (compartment)	Pre- assessment (ha)	Post-assessment using >5 hectares (ha)	Post-assessment using old growth >2 hectares (ha)
Sites demonstrating a decrease in old growth			
1. Bellangry (11)	36	0	No change
2. Clouds Creek (124)	91	12	18
3. Clouds Creek (167)	102	0	3
4. Ewingar (635, 637)	300	47	62
5. Dalmorton (406)	75	56	No change
6. Lower Bucca (600)	86	0	No change
7. Mistake (341)	2	0	No change
8. Nambucca (320, 321)	130	0	No change
9. Wild Cattle Creek (515)	112	0	3
Total aggregated for decreasing sites	**934**	**115**	**142**
Difference in 5 ha and 2 ha threshold for decreasing sites		*27 ha (**23% increase**)*	
Sites demonstrating an increase in old growth			
10. Girard (52)	0	7	No change
11. Irishman (205)	22	33	36
7. Kangaroo River (234)	7	20	25
8. Kippara (18)	38	44	No change
Total aggregated for increasing sites	**67**	**104**	**112**
Difference in 5 ha and 2 ha threshold for increasing sites		*8 ha (**8% increase**)*	
Total aggregated for all sites	**1001**	**219**	**254**
Difference in current PNF vs >2 ha threshold for all sites		*35 ha (**16% increase**)*	

5.4   Differences in agency field techniques

During field work, the Commission observed that FCNSW and EPA staff members calculated different slope measures at the same site. While actual differences between the measures were not large, they could have significant consequences when managing compliance.

For example, in one location, one group measured a slope as being less than 30 degrees, while the other measured it as more than 30 degrees. Harvesting on land with a slope of more than 30 degrees would be illegal under the current IFOAs. This example highlights the importance of the operator and regulator working to an agreed common dataset.

The Commission understands the new Coastal IFOA will have a LiDAR-derived layer that delineates the compliance boundary for steep slopes. Even with this layer, operational challenges still exist. For example, harvesting operations must avoid harvesting trees that fall beyond the 30 degree slope, otherwise compliance will be breached. FCNSW usually applies a buffer to manage this risk. In addition, the ability to harvest up to the compliance line depends on the skill of the harvesting operator and the type of machinery used.

6 Remapping old growth forest and rainforest across state forests

The pilot demonstrates that applying new technology and data improves old growth forest and rainforest mapping, and can support improved decision making and achievement of outcomes. This section outlines the Commission's proposed approaches:

▪ for FCNSW to address a verified shortfall in timber supply

▪ for the community to nominate areas of old growth forest or rainforest for remapping and protection.

The approaches differ, as the assessment includes additional environmental safeguards to address the verified shortfall and ensure the twin commitments are maintained.

The pilot provided a number of key lessons and insights that the Commission used to refine and improve the proposed approach.

6.1 Process for remapping old growth forest to offset a verified shortfall in timber supply

To address a demonstrated shortfall in meeting wood supply commitments, the NSW Government should remap and rezone areas that have been incorrectly mapped as old growth forest in north coast state forests, as part of its ongoing monitoring of the twin commitments.

The Commission has set out a process to achieve this (**Figure 22**). Any compartment remapping would include reassessment of rainforest. This process also allows for the identification and protection of areas of old growth forest or rainforest currently not included in current mapping.

In summary:

▪ Before initiating an old growth reassessment, the NSW Government should clarify any legal issues and engage the community during consultation for the Coastal IFOA. The NSW Government should formalise and publish the approach.

▪ If the NSW Government proceeds, FCNSW should nominate sites for reassessment as part of its tactical harvest planning, and OEH Science should assess those sites. To ensure an efficient use of resources, the number of nominations could be capped to address sites most likely to contain significant and obvious errors. This could be indicatively between 10 and 20 sites per year, based on the estimated wood volumes found in the pilot sample sites.

▪ A number of scenarios could occur as a result of the assessment, including an increase in the level of reserve protection for sites that contain both old growth forest and high-quality habitat (**Table 14**).

▪ In scenarios where harvesting could potentially occur (**scenarios 4 and 5**), the Minister for Lands and Forestry should consider:

  - whether FCNSW has demonstrated a wood supply shortfall

  - OEH Science's independent desktop and field assessment

  - FCNSW's assessment of high-quality habitat and biodiversity values

  - forest type achievement against JANIS targets for old growth

- any public submissions

- the Commission's independent review of the assessment and evaluation against the twin commitments.

▪ Boundaries and zones would be formally amended through relevant processes. At this point, the NSW Government should consider offsetting any impacts – for example, transferring an equivalent amount of non-commercial land to the reserve system to offset the loss of area from state forests that contributed to the CAR reserve system (revoking FMZs 2 or 3a).

▪ Consistent with the Commission's earlier advice, there should be ongoing monitoring and evaluation, public reporting on amendments and independent advice and reviews to provide accountability and transparency.

Table 14: Potential scenarios from old growth forest reassessment

Scenario	Assessment outcome	Harvesting allowed?	Zoning	Reserve status
1	▪ Under JANIS target	**No**	Special management zone retained	Informal
2	▪ Old growth ▪ No high-quality habitat	**No**	FMZ 2 or 3a retained	Informal
3	▪ Old growth ▪ High-quality habitat	**No**	FMZ 2 or 3a retained, or rezoned into FMZ 1 depending on size	Informal/formal Increases level of protection in line with CAR
4	▪ No old growth ▪ High-quality habitat	**Potentially**	FMZ 2 or 3a retained, or rezoned into FMZ 3b for selective harvesting	Informal/prescription
5	▪ No old growth ▪ No high-quality habitat	**Yes** (*Intensive/ selective*)	FMZ 4	Nil

In **scenario 4**, where forest is found to be non–old growth and a detailed environmental values assessment identifies high-quality habitat features, the Minister for Lands and Forestry should consider all of the evidence to determine appropriate zoning in line with existing protocols. FMZs 2, 3a and 3b would count towards the CAR reserve system. An FMZ 3b zoning would include permission to undertake selective harvesting. In this case, the Commission considers there should be some prescriptions placed on the selective harvesting, such as an average minimum basal area retention of 17 square metres, in line with the existing IFOA prescription.

Clarify legal issues and engage community

- NSW Government consults public on IFOA, including any proposed approach to remapping and rezoning old growth
- NSW Government clarifies legal issues on revocation and commitments

- NSW Government does not implement on-going process to remap and rezone

- NSW Government proceeds, codifying and publishing an on-going process for remapping and rezoning state forests
- Based on legal advice, NSW Government undertakes most appropriate pathway to revoke special management zones and heritage listing

Potential process to remap and rezone old growth

- FCNSW conducts two-yearly tactical harvest planning
- FCNSW determines new IFOA conditions and exclusions, such as clumps
- FCNSW nominates and funds an independent OEH Science reassessment of mapped HCVOG, including additional assessment of high-quality habitat

- Minister for Lands and Forestry seeks and considers public submissions
- Minister formally amends boundaries if satisfied

Potential rezoning and no harvesting (see scenarios in following diagram)

Potential rezoning and harvesting (see scenarios in following diagram)

- Where potential harvesting could occur, the Minister for Lands and Forestry considers (i) wood supply shortfall demonstrated by FCNSW, (ii) the independent desktop and field assessment from OEH Science, (iii) FCNSW's assessment of high-quality habitat and biodiversity values, (iv) forest type achievement against JANIS targets for old growth, (v) any public submissions, (vi) the Commission's independent review of the assessment, and evaluation against the twin commitments

- NSW Government and Minister for Lands and Forestry formally amend boundaries and zones using relevant processes
- NSW Government considers offsetting any impacts including transfers of non-commercially viable forest to the reserve system

- Boundaries adjusted and new FMZ in spatial layer
- JANIS targets for old growth forest ecosystem types updated
- FCNSW harvests in new area under IFOA prescriptions

- Website (e.g. the NSW Environmental Data Portal) is updated to reflect the location and extent of old growth
- FCNSW reports rezoning and boundary adjustments annually
- The Commission conducts independent oversight and reviews
- The EPA provides ongoing compliance monitoring, and DPI – Forest Science and FCNSW monitor ecologically sustainable forest management'
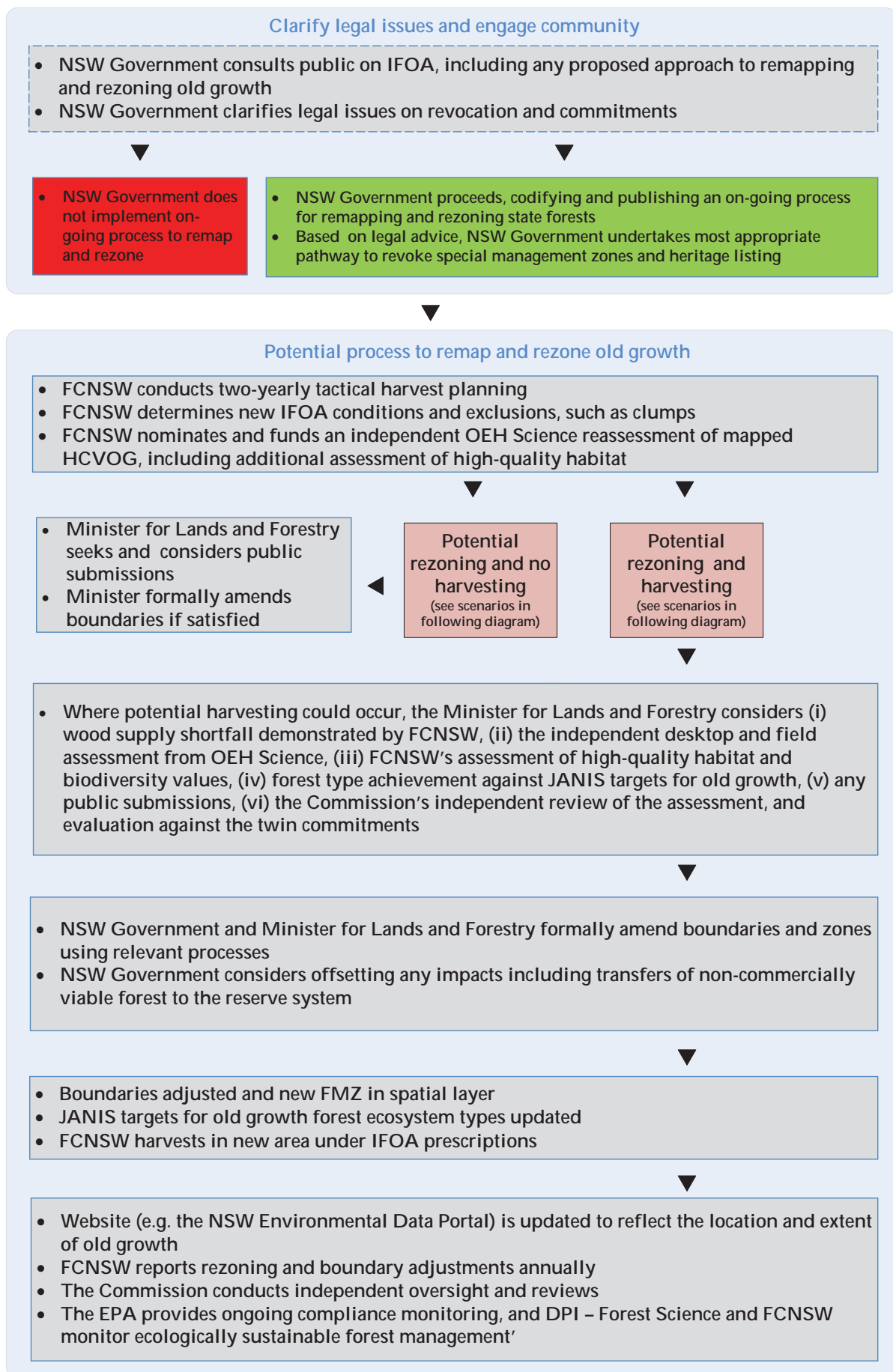
Figure 22: Proposed implementation approach for old growth reassessment and potential re-zoning
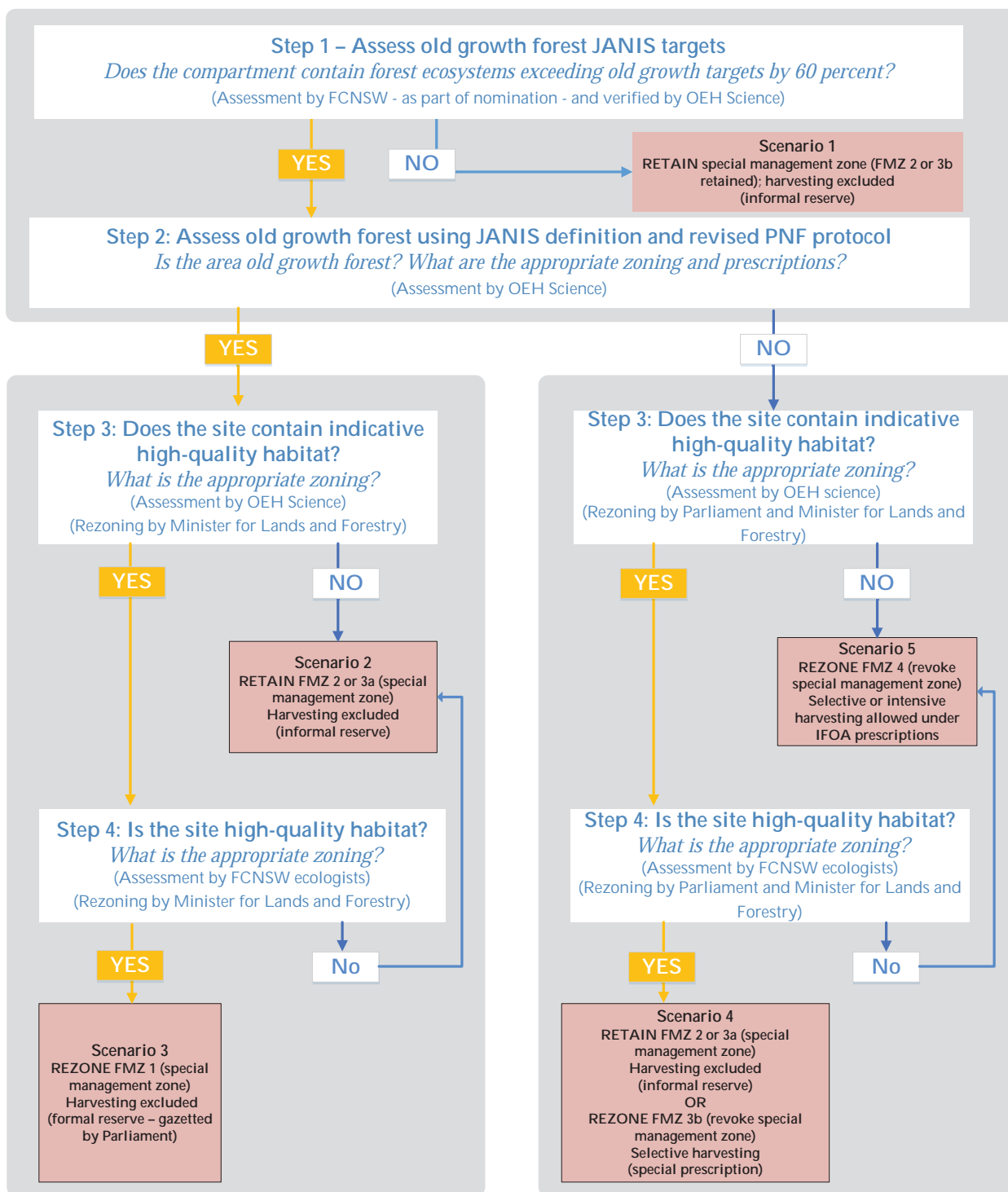
Figure 22 (cont.): Proposed implementation approach for old growth reassessment and potential re-zoning

6.2 Process for including new areas of old growth forest and rainforest

The Commission proposes an additional pathway for managing and protecting areas of old growth forest and rainforest that have not been included in current mapping and protections (**Figure 23**). This pathway will be open to the community and agencies such as the EPA. For this process to be successful, it needs to be accessible, evidence based, transparent and timely, and must include mechanisms to mitigate the occurrence of any potential vexatious nominations.

The process has been informed by the current old growth forest reassessment process in Western Australia (**Box 4**).

As a first step, the community needs to be effectively engaged to confirm the process, and determine what sets of rules will enable the community to nominate sites that are most likely to meet the criteria. This will require joint effort by OEH Science, the EPA and FCNSW.

The Commission considers that there should be an annual limit on the number of sites subject to reassessment, similar to the 10- to 20-site threshold recommended for FCNSW. Any nomination of a site should occur before or during the pre-harvest planning stage, rather than during operational stages. If the site is clearly found to be non–old growth, nominees could fund the assessment to ensure only genuine and well-evidenced nominations were put forward.

Unlike the reassessment process for addressing verified wood supply shortfalls, this process is more open and streamlined:

- Any genuine nomination should be considered, regardless of the status of JANIS targets for the forest ecosystem types in the area.

- There should be no automatic requirement for field assessment. Fieldwork would be undertaken based on the 'if in doubt, check' principle, similar to the existing PNF protocol.

- There should be no need for a secondary comprehensive environmental values assessment.

On-going process for including new areas of old growth forest and rainforest

- Website (e.g. NSW Environmental Data Portal) provides a map showing the location and extent of old growth, and the contribution to JANIS targets

▼

- The public or agency nominates candidate old growth forest and rainforest sites that were not previously mapped

▼

- OEH Science independently assesses sites using the PNF protocol for state forests
- Fieldwork is only undertaken 'if in doubt', as per the PNF protocol

▼

- If nominated sites determined to be old growth forest or rainforest, Minister for Lands and Forestry assigns FMZ 1, 2 or 3a, or harvesting exclusion after public and inter-agency consultation
- Website is updated
- FCNSW reports rezoning and boundary adjustments annually
- The Commission conducts independent oversight and reviews
- The EPA provides ongoing compliance monitoring, and the Department of Primary Industries – Forest Science and FCNSW monitor outcomes
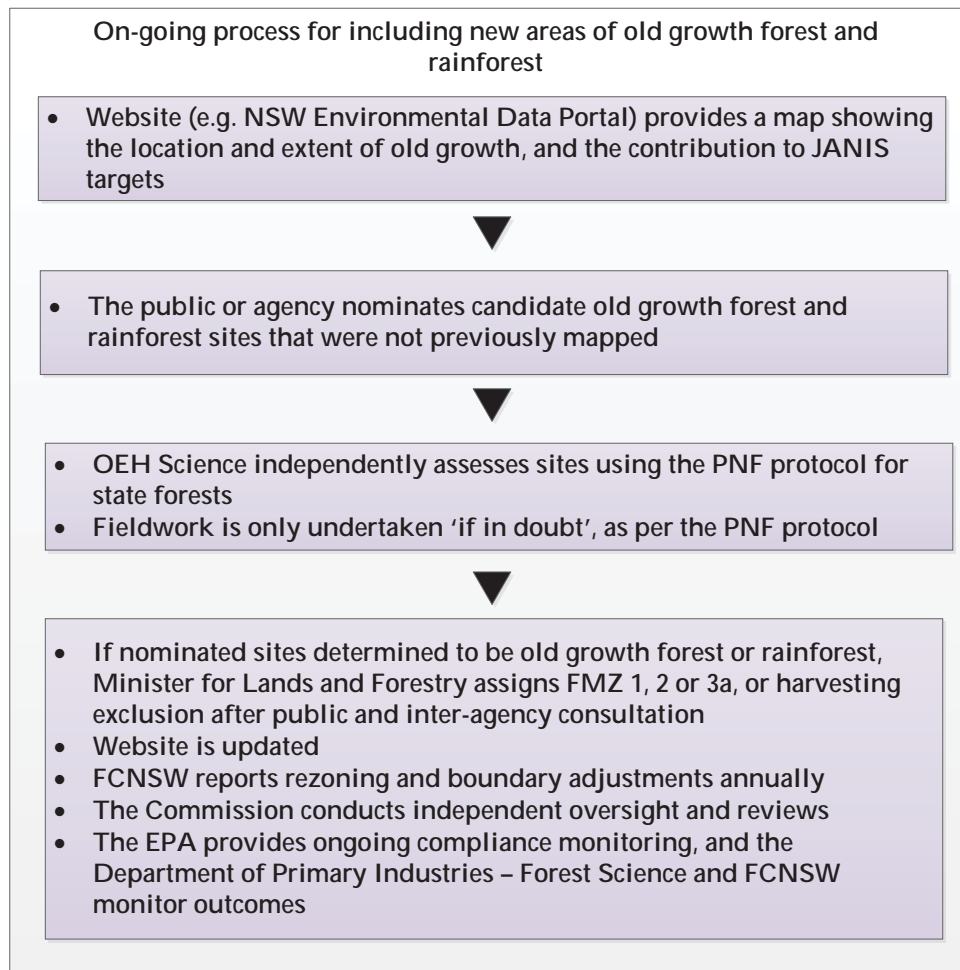
Figure 23: Proposed approach for under-mapped old growth forests and rainforest

> **Box 4: Nominating old growth forests in Western Australia**
>
> In 2005, the then Conservation Commission of Western Australia developed a process to provide transparency in old growth forest assessments. This process involves full public consultation and reporting, enabling members of the public to request that the Conservation and Parks Commission assess whether areas on the indicative timber harvesting plan should be classified as old growth forest.
>
> The 2013–22 Forestry Management Plan transferred the public nomination process for the assessment of unmapped old growth forest from the Conservation and Parks Commission to the Department of Biodiversity, Conservation and Attractions.
>
> According to this process:
>
> - The Western Australia Parks and Wildlife Service website provides a map of the current location and extent of old growth forests. The map is updated annually, and also identifies any changes in the extent of old growth forest status.
>
> - Members of the public can use an online form to nominate sites for review.
>
> - If a nomination is accepted and old growth forest identified, it is added to the estate. Reports on each review are posted on the website.

6.3   Issues and opportunities

Improved mapping and field validation will improve the evidence base for decision making, and support the achievement of the twin commitments. However, there remain a number of issues and opportunities for the NSW Government to consider before implementing – or as part of – such a program.

6.3.1   Clarifying legal implications

FCNSW is only permitted to harvest timber in certain FMZs in state forests (primarily FMZ 4). However, of the areas currently defined and mapped as old growth forest, more than 90 percent are found within a designated '**special management zone**' arising from the *National Parks Estate Reservations Act 2002* (NSW)[50] (**Table 15**). This zone covers gazetted areas that contribute to NSW's reserve system.

Timber harvesting cannot occur in these areas, regardless of whether or not they are defined as old growth forest or rainforest. This zone only applies to the north coast IFOA region.

Given the significant limitations identified in the HCVOG in this assessment, as well as limitations in the candidate old growth data layers that informed the location of the special management zone, the Commission considers that the zone is unlikely to accurately or adequately reflect areas of old growth or significant environmental value. Furthermore, all areas protected under the special management zone are already excluded from harvesting by pre-existing forest management protections that also contribute to the reserve system (mostly FMZs 2 and 3a).

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[50]   Section 7

For currently mapped areas that are found not to be old growth, the Commission understands that rezoning of those areas to allow timber harvesting involves:

1   the NSW Government firstly seeking parliamentary approval to revoke a special management zone

2   following this, FCNSW amending the boundaries of or rezoning the underlying FMZ 2 or 3a.

Given the likely public concern surrounding this issue, the Minister for Lands and Forestry should oversee any rezoning of incorrectly mapped old growth forest and rainforest areas, in line with the objectives of the current FMZ system and new Coastal IFOA conditions. For example:

▪   All areas determined as being old growth forest, having high-quality habitat values and being a suitable size could be rezoned to FMZ 1 (flora reserve) to give enhanced environmental protection under the formal reserve system.

▪   Where areas are determined to be non–old growth forest or non-rainforest, but considered to have high-quality habitat they could be rezoned either:

   -    FMZ 2 or 3a if determined to have high-quality habitat values that cannot be managed under prescription

   -    FMZ 3b to allow for selective harvesting under proposed Coastal IFOA regulations, to meet current wood supply commitments while maintaining environmental values. Only selective harvesting occurs in this zone, retaining a minimum average basal area of 17 square metres of trees per hectare. Intensive harvesting should be prohibited in this zone.

▪   Areas assessed as non–old growth and non-rainforest and without high-quality habitat values could be rezoned to FMZ 4 and managed according to the proposed Coastal IFOA conditions.

The HCVOG forest spatial layer is also listed as a state-significant heritage item on **NSW's Heritage Register**. The heritage-listed data set includes sites in 15 local government areas in the upper north east forest region. HCVOG forests were listed based on their historical and aesthetic significance, research potential and rarity.[51]

However, the Commission notes that the *Heritage Act 1977* (NSW) provides for exemptions from the effect of the listing to allow for forestry activities.[52] The HCVOG heritage listing exempts activities that are authorised under IFOAs, as well as those consistent with approved management plans and forestry agreements.[53]

To avoid a lengthy delisting process, the new Coastal IFOA remake could include a clause that authorises forestry and associated activities within areas of the HCVOG layer that are determined to be non–old growth forest. Prior to any decision making, the NSW Government should clarify any legal implications of revoking or amending zones for old growth forests, and of removing the current HCVOG heritage listing.

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[51]   OEH (2017) *Heritage items and places: high conservation value old growth forests*. Available at: http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=5051503

[52]   Section 57(2).

[53]   Consistent with the provisions and obligations of approved Plans of Management under the *National Parks and Wildlife Act 1974* (NSW), the *Forestry and National Parks Estate Act 1998* (NSW) and the resultant Forest Agreements, and the terms of the subsequent NSW and Commonwealth governments' joint North East RFA.

6.3.2 Extending the reserve system

The NSW Government may seek to offset areas if there is any reduction in the area of forest contained in informal reserves as a result of the revocation outlined above. For example, the NSW Government could consider increasing the protection status for an equivalent area of forest by:

▪ rezoning areas currently mapped as threatened ecological communities to either FMZ 1 or 2, to count towards targets in the CAR reserve system. Currently, harvesting is prohibited in mapped threatened ecological vegetation communities

▪ transferring non-commercial areas of state forests into formal reserve categories, particularly if they are adjacent to a current national park (for example, state forests in the far north coast and tableland regions may no longer be commercially viable due to the extent of threatened ecological community mapping, and cost impacts due to geographic location)

▪ elevating the level of protection for existing informal reserves in state forests to FMZ 1 (flora reserve), depending on their values and size, which would afford parliamentary protection.

Table 15: HCVOG forest by FMZ (FY17)[54]

FMZ	Timber harvesting	Lower north east (ha)	Upper north east (ha)	Total (ha)	Area outside special management zone (ha)	Area inside special management zone (ha)
Zone 1 – Special Protection Zone	Excluded	844	345	1,189	770	419
Zone 2 – Special Management Zone	**Excluded**	**19,533**	**22,775**	**42,308**	**3,318**	**38,990**
Zone 3a – Harvesting Exclusions Zone	**Excluded**	**24,024**	**41,379**	**65,403**	**4,838**	**60,565**
Zone 3b – Special Prescription Zone	Permitted	35	0	35	35	0
Zone 4 – General Management Zone	Permitted	0	0	0	0	0
Zone 5 – Hardwood Plantations Zone	Permitted*	11	537	548	47	501
Zone 6 – Softwood Plantations Zone	Permitted*	66	396	462	35	427
Zone 7 – Non Forestry Use Zone	Excluded	21	106	127	70	57
Zone 8 – Areas for further assessment	Awaiting assessment	0	?	0	0	0
No zone	n/a	1	8	9	9	0
Total		**44,535**	**65,546**	**110,081**	**9,122**	**100,959**

* Harvesting is excluded in special management zones.

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[54]   Data supplied by FCNSW.

6.3.3   Improving transparency and engagement

Ensuring transparency and engagement is a key principle of the Commission's proposed approach. This is consistent with the Commission's previous advice on the Coastal IFOA remake and the NSW Forestry Industry Roadmap 2016, which highlights a need for transparency in forest management. The reassessment process should ensure there are sufficient measures to allow for transparency. Key opportunities to ensure adequate transparency and engagement include:

- **Public consultation on the approach:** The NSW Government will soon commence public consultation regarding the Coastal IFOA remake. The results of the pilot study, policy implications and proposed implementation approach could be released publicly as part of this consultation, noting there will likely be strong interest from stakeholders. The final protocols and criteria underpinning the approach should also be published, similar to the current PNF protocols.

- **Building public and inter-agency consultation into the approach:** There should be opportunities for agencies and the public to comment on any proposed revocations, boundary amendments or new declarations. The Minister for Lands and Forestry should consider any submissions when determining whether proposals will maintain the NSW Government's twin commitments.

- **Annual reporting of outcomes:** Timely reporting on any activities that occur under the proposed approach would help build trust within the community. In Western Australia, where there is an ongoing program to assess and remap 'candidate' old growth forest, information about the location and extent of old growth forest is available online. This data is updated annually, and any changes to the extent of old growth forest status are reported publicly.

6.3.4   Seeking independent advice

The Commission has previously identified that the lack of external and independent oversight in forest management and regulation poses a significant risk to successful forest management.[55] Forest resource management is often characterised by value-based conflicts, and there is currently considerable mistrust among various stakeholders. It is important to establish trust and deal with any conflict that arises from the proposed approach.

The Commission's proposed approach outlines where independent oversight would benefit the implementation. As outlined in the Commission's 2016 advice on the Coastal IFOA remake, periodic independent evaluation can help create the trust between various stakeholders. This is a necessary part of moving forward and successfully implementing forest management, and supports continuous improvement. Independent advice could also be sought when determining impacts on wood supply and the twin commitments.

Agency workshops held to inform the Commission's 2016 advice indicated that an independently run annual forum or 'check-point' may help resolve issues arising from implementing the Coastal IFOA. Such a forum could also be used to address issues arising from the proposed reassessment process.

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[55]   NRC (2016) *Advice on Coastal Integrated Forestry Operations Approval Remake.* November 2016. Natural Resources Commission, Sydney.

This forum could also provide appropriate connections to the various review and remake processes that are scheduled to occur over the next five years under the NSW Forest Agreements and joint Australian and NSW government RFAs. An annual checkpoint could encourage cohesion throughout these processes, streamlining the collation of relevant data and minimising duplication of effort and resourcing.

A summary of the discussion could also be made public to further improve transparency and community understanding of the reassessment process.

6.3.5   Resourcing

The Commission's proposed approach will require minimal resourcing. Under the approach described in **Section 6.1**, FCNSW would pay for:

▪   OEH Science's reassessment of nominated old growth forest and rainforest, and indicative habitat on a fee-for-service basis

▪   a comprehensive habitat assessment undertaken by FCNSW's own staff.

Based on the costs of the pilot process, the Commission estimates the proposed approach would cost more than $5,500 per site – around $55,000 on average if 10 sites are reassessed per year. However, the Commission considers that this cost may drop if implementation becomes more efficient based on lessons from the pilot.

Relevant agencies would also need sufficient and appropriate resources to undertake any remapping initiated by members of the community.

The Commission understands that the EPA and OEH have prepared a significant, multi-year funding proposal to comprehensively remap old growth forest and rainforest on private land in the north coast IFOA region using the PNF protocol. OEH has indicated to the Commission that there would be economies of scale if the proposal was expanded to include remapping on public land. If undertaken, this would considerably improve the evidence base for future decision making.

7 Can the NSW Government meet its twin commitments?

In its November 2016 advice, the Commission recommended a range of outstanding settings that came as close as possible to meeting the twin commitments at the state scale. However, due to an estimated wood supply shortfall, the Commission determined that it was not possible for the NSW Government to meet its commitments to both environmental values and wood supply.

In this review, the Commission was asked to provide supplementary advice on whether the NSW Government could remap and rezone old growth forest and rainforests to offset timber supply impacts associated with its previous advice.

Based on the advice set out in this report, the **Commission considers it is possible for the NSW Government to meet its commitments to both environmental values and wood supply**.

7.1 No net change to wood supply values

In 2016, the Commission reported there would be an estimated shortfall of 7,600 to 8,600 cubic metres of timber per annum, mostly in wood supply zones 2 and 3 over 20 years as a result of mapping threatened ecological communities and koala habitat.

FCNSW estimated that almost **9,000 cubic metres** of high-quality timber in the remapped old growth sample sites would be sufficient to address estimated shortfalls for one year. FCNSW's projected estimate of **164,400 cubic metres** (more than 8,200 cubic metres per year over 20 years) of high-quality timber from commercially viable forest ecosystems (which contain a majority of key commercial timber species) could continue to address any demonstrated shortfalls in the longer term.

Furthermore, the Commission notes that estimated wood supply volumes should not be used to indicate a change in wood supply; rather, they represent an estimate of standing timber availability. The Commission considers that wood supply volumes should remain as they currently stand and should not be increased.

Accurate re-mapping could increase the resource base at the compartment scale, reducing pressure on the current resource base and providing more flexibility for harvesting operations through space and time. This would also allow more time for forest regeneration and future wood supply.

7.2 No erosion of environmental values

In 2016, the Commission considered that the NSW Government's intended outcomes-based approach to the Coastal IFOA reflected current best practice. The agreed multi-scale landscape approach, with enhanced protections for threatened species at a range of spatial scales, would build on existing IFOA environment protections and complement the formal reserve system.

The Commission advised that the agreed and proposed settings were designed to maintain environment values. All settings had been assessed as posing a low to moderate risk to environmental values, which was considered manageable with the proposed improvements to the regulatory framework.

This current advice is also designed to not erode environmental values. Specifically, it offers:

- **More accurate protection for old growth forest and rainforest:** Mapping should be reviewed and updated to make protections more accurate, as the PNF assessment in the pilot identified areas where old growth forest is potentially subject to harvesting.

- **A two-way approach:** The NSW Government should provide an additional pathway for managing and protecting areas of old growth forest and rainforest, by establishing a mechanism for the public and agencies to nominate sites for old growth forest and rainforest remapping.

- **Remapping for selected areas**: The Commission proposes that FCNSW should only nominate sites for remapping if they are old growth forest ecosystems in areas that currently exceed JANIS old growth targets. This will maintain existing commitments to JANIS old growth targets.

   Under the Commission's proposed approach, under-target forest ecosystems would be effectively quarantined from remapping and potential harvesting. This allows 'candidate' old growth areas to transition to old growth forest over time, in the likely case that many areas are currently not old growth forest by definition.

- **Habitat protection:** Special conditions should apply in those areas that are no longer classed as old growth forest but that show some elements of important habitat, such as a high proportion of senescent trees. Appropriate zoning (such as FMZ 3b) and special prescriptions (such as selective harvesting with minimum basal area retention) should apply when managing these important ecological features.

- **Protection for greater areas of remapped old growth forest:** The criteria for remapping old growth forest should be revised to reduce the minimum area threshold from 5 hectares to 2 hectares. This will capture a larger gross area of old growth forest in compartments where it exists. Furthermore, the pilot identified that remapping to a minimum of 2 hectares is likely to identify and protect areas of old growth forest currently not mapped.

- **Offsets for any loss:** The NSW Government could consider offsetting any reduction in the area of forest contained in informal reserves by transferring equivalent land to the formal reserve system.

- **Elevated protection status:** Areas containing old growth forest and high-quality habitat should be rezoned from informal to formal reserves (such as FMZ 1) to provide a higher level of security.

Appendix 1 – Terms of reference

Supplementary advice about a coastal IFOA

Purpose:

The Natural Resources Commission (NRC) is to provide advice about how remapping and re-categorising of areas in State Forest may allow Government to meet its commitment to make a coastal Integrated Forestry Operations Approval (IFOA) with no net change to wood supply and no erosion of environmental values. This will supplement NRC's previous advice about making a coastal IFOA.

Task:

Provide advice on whether Government could deploy new mapping data, methods and technology to more precisely identify, map and re-categorise old growth forests and rainforests in State Forests on the north coast. The NRC should provide advice on how more accurate mapping and re-categorisation may allow Government to meet its commitment to make a coastal IFOA with no net change to wood supply and no erosion of environmental values.

In delivering its advice, NRC should consider, within the limitations of time and available information:

▪ the definitions, method and accuracy of previous old growth and rainforest mapping and associated limitations,

▪ the impacts new protocols, mapping and land categorisation might have for native hardwood timber supply,

▪ any impacts this process might have for environmental values, including:

- NSW's obligations under the Regional Forest Agreements and NSW Forest Agreements (including forest management zoning) to maintain a comprehensive adequate and representative reserve system,

- the likelihood that areas not originally mapped as old growth or rainforest would now be identified as old growth or rainforest,

- any impacts that have become apparent since the Regional Forest Agreements were signed,

▪ the level of confidence about the potential impacts of this process on timber supply and environmental values,

▪ any technical, administrative, policy or legislative constraints of using new or existing data, methods and technology.

If considered necessary or desirable, NRC should also comment on options to increase the level of confidence in the maps and categorisation of land.

Scope of advice:

In formulating its advice, NRC may also consider any materials it considers relevant, including:
▪ the results of desktop and field assessments of sites that may be 'over-mapped' or 'under-mapped' for old growth or rainforest
▪ input NRC requests from the Department of Primary Industries-Forestry, Forestry Corporation of NSW, the Office of Environment and Heritage (including its Native Vegetation Information Science Branch) and the Environment Protection Authority.

Timeframes:

NRC should provide its advice to the Premier, the Minister for Lands and Forestry and the Minister for Environment as soon as possible. DPC may request NRC to provide additional supplementary advice, based on further desktop and field assessments.

Confidentiality:
All information presented to NRC, as well as its advice, should be treated as Cabinet-in-Confidence unless determined otherwise by the Premier.

Appendix 2 – History of old growth and rainforest mapping

Broad Old Growth Mapping Project (BOGMP)

Between 1995 and 1996, the BOGMP identified old growth forests in the upper and lower north east regions.[1] This process was undertaken as part of the Interim Assessment Process, which was a first step towards implementing the National Forestry Policy Statement and developing the CAR reserve system. The criteria used in this assessment are unclear.

Candidate old growth mapping

The CRAFTI project was undertaken from 1997 to 1999 as part of the RFA's CRA process.[2]

It updated the BOGMP data by identifying old growth forest consistent with the definitions in the National Forest Policy Statement and JANIS reservation criteria.[3] Old growth forest in the upper and lower north east regions was mapped using aerial photographic interpretation to delineating the relative proportion of three predominant 'growth stages' (senescent, mature and regrowth) and the magnitude of disturbance factors (harvesting, roading and grazing). CRAFTI data was not available for the lower north east region in time for the RFA negotiations, so an interim 'old growth' layer was derived from a modified version of the original BOGMP layer.[4]

A 1999 expert review found that the old growth maps derived in the CRAFTI project were spatially inaccurate and recommended the data layer be continually reviewed and improved, including through field checking.[5] As a result, the data layer was considered to only represent 'candidate' old growth forest, not actual old growth. The mapped area of old growth forest was considered likely to represent a greater area than the actual extent of old growth forest.

Identification of old growth for special management zones

Due to these inaccuracies, a secondary analysis was undertaken between 1998 and 1999. The secondary analysis integrated the candidate old growth data layer with additional data layers based on fauna habitat modelling to derive three additional old growth products used in the CRA negotiations. These layers were:

- High Quality Habitat Old Growth (HQHOG): This was derived by integrating the candidate old growth layer with the union of the core modelled habitat of a range of fauna species recommended by experts to be reliant on old growth forest (Table A2.1).

- High Conservation Value Old Growth (HCVOG): The total extent of HQHOG, plus all other old growth with a total irreplaceability score greater than or equal to 5 (using the C-Plan database dated 22 September 1998).

- Protected HCVOG: All HCVOG exhibiting a minimum patch size of 10 hectares in the regrowth zone and 25 hectares in the non-regrowth zone, for forest ecosystems that met conservation targets; or a minimum patch size of 5 hectares in the regrowth zone and 10 hectares in the non-regrowth zone, for forest ecosystems that did not meet conservation targets.

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[1]   NPWS (1999) - *UNE / LNE Regions, A project undertaken as part of the NSW Comprehensive Regional Assessments*, project number NA 28/EH. Available at:
http://www.agriculture.gov.au/SiteCollectionDocuments/rfa/regions/nsw-north-east/enviroment/nsw_ne_na28eh.pdf.

[2]   *Ibid.*

[3]   *Ibid.*

[4]   *Ibid.*

[5]   *Ibid.*

The protected HCVOG layer formed the basis of the special management zones for old growth in state forests. This was added to the CAR reserve system as part of the 'informal reserve' estate to meet JANIS targets.

Table A2.1: Species used to generate the HQHOG layer

Scientific name	Common name
Atrichornis rufescens	Rufous scrub-bird
Cautula zia	Rainforest cool-skink
Coeranoscincus reticulatus	Three-toed snake-tooth skink
Dasyurus maculatus	Spotted-tailed quoll
Eulamprus tenuis	Bar-sided forest skink
Eulamprus tryoni	Border Ranges blue-spectacled skink
Hoplocephalus stephensii	Stephen's banded snake
Mixophyes balbus	Stuttering frog
Mixophyes fleayi	Fleay's barred frog
Ninox strenua	Powerful owl
Petauroides volans	Greater glider
Petaurus australis	Yellow-bellied glider
Philoria kundagungan	Mountain frog
Philoria loveridgei	Loveridge's frog
Philoria pughi	–
Philoria richmondensis	–
Philoria sphagnicolus	Sphagnum frog
Podargus ocellatus	Marbled frogmouth
Pseudomys oralis	Hastings River mouse
Ptiloris paradiseus	Paradise riflebird
Thylogale stigmatica	Red-legged pademelon

Additions under the *National Parks Estate Reservations Act 2002*

Protected old growth areas identified by the protected HCVOG data layer were supplemented in 2002 with the addition of the Special Management Zone Old Growth (SMZOG) forest layer. These areas were negotiated as part of an IFOA review and protected through the *National Parks Estate (Reservations) Act 2002*. Additional areas were identified from the candidate old growth forest data layer that were not already included in the protected HCVOG data layer. These areas were selected through a stakeholder negotiation process.

Appendix 3 – Overview of PNF protocols

Protocol for re-evaluating old growth forest

This appendix summarises the agreed protocol for identifying and evaluating old growth forest on private land.[6] The protocol is based on the criteria and process used in the CRA. As part of this process, aerial photographic interpretation was used to map forest growth stages in most of the upper north east and lower north east regions and southern CRA areas, on public and private land.

The CRA used the JANIS definition for old growth forest: 'Ecologically mature forest where the effects of disturbances are now negligible'.[7]

When applying this interpretation to an area of forest, the following principles apply:

- ecological maturity is defined by the characteristics and relative proportions of the older growth stages (mature or over-mature)

- where data is available on the structural, floristic and functional qualities that characterise an ecologically mature forest ecosystem, this data should be used to assess the maturity of the stand

- both evidence of a past disturbance, 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.

Table A3.1 outlines the three main components of the protocol, namely:

1   assessment of ecological maturity

2   assessment of disturbance level

3   determination of old growth status (as a combination of the first 2).

As part of the ecological maturity and disturbance components, the protocol sets out:

- the process for mapping old growth and disturbance characteristics using aerial photographic interpretation

- the process for validating aerial photographic interpretation in the field.

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[6]   NSW Department of Environment and Climate Change (2007) *Protocol for re-evaluating old-growth forest on private property*. Available at: https://www.epa.nsw.gov.au/publications/pnf/proldgrowth07370.

[7]   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 A3.1: Overview of the PNF protocol process for old growth

1. Determine ecological maturity

Aerial photographic interpretation
Forest stands are assessed using a measure of structural maturity assigned based on aerial photographic interpretation of crown forms.

- Growth stages are determined as regrowth, mature or senescing by assessing crown form characteristics of individual trees, groups of trees and the forest stand. This uses the latest-available colour, 1:25,000 scale aerial photos.

Field validation
Mapped polygon boundaries are revised and the new delineated area of old growth forest is subject to field validation.

- Growth stage and canopy are measured within the revised polygon area using aerial photographic interpretation to locate the starting point and provide an unbiased sample of forest stand variation within the polygon.

- A minimum of 10 points with a 50 metre spacing along a straight line transect are used to sample the polygon, sampling a 30 metre radius at each point.

- Site inspection tests the previously assessed aerial photographic interpretation growth stage ratios of regrowth, mature and senescent trees.

2. Assign disturbance level

Aerial photographic interpretation
CRAFTI aerial photographic interpretation mapping disturbance indicators (listed in Table A3.2) are used to assign a disturbance significance level (negligible or significant).

Field validation
Site disturbance is validated through a field assessment.

- Disturbance criteria are assessed by measuring the extent of disturbance indicators at each of the 10 transect points in the polygon.

- Site assessment considers the type and extent of disturbance on old growth characteristics, as well as the intensity and duration of the impact, and the trajectory of forest recovery.

- For a forest stand to be removed from old growth forest categorisation, it must be demonstrated that at least 50 percent of the overall stand has been affected by localised disturbances, and that both old growth structure and function have been compromised.

- If any disturbance indicators are recorded in six out of 10 or eight out of 15 sampling points, the surveyed forest area/mapped polygon is downgraded to 'degraded old-growth forest'.

3. Assess old growth status

Old growth status is assigned using structural maturity and assessed disturbance level, also taking into account the spatial extent of any rainforest present or any site disturbance after the aerial photographs were taken.

Table A3.2: Site disturbance indicators for old growth forest

Disturbance indicator	Description
Recent logging	Evidence of recent logging activity within the last 10 years is denoted by bare earth, snig tracks, log dumps, logging debris, little or no regrowth, large open areas and associated canopy gaps.
Older logging	There is visible evidence of older logging activity such as stumps, log dumps and constructed snig tracks. Older logging could be evident in the form of very lightly logged forest, or stands logged more heavily and often. Evidence of historic logging does not necessarily mean there is a significant impact on the structure and floristics of the forest stand. Quantitative assessment classifies stumps more than 40 centimetres in diameter as 'older logging' only if there is visible disturbance to the canopy in the form of canopy gaps plus regrowth clusters or native pioneers or woody weeds. This indicator therefore must be a combination of stumps over 40 centimetres in diameter as well as canopy gaps and clusters, regrowth or thick regeneration of native pioneers or weeds.
Exotic woody weeds	There is more than 30 percent spatial cover within a 30-metre radius of exotic woody weeds such as blackberry, privet and camphor laurel.
Ringbarked or dead standing trees	This includes ringbarked trees and trees affected by dieback or bell bird activity. These dead trees will generally be more than 40 centimetres in diameter and will not have died from natural causes.
Grazing infrastructure	This includes the presence of fence lines, yards, dams or other watering points, and does not include only the presence of cattle, their tracks or camps. There must be a noticeable and significant impact on the structure (in the form of presence of gaps and regrowth) and floristics of the forest stand in question.
Constructed tracks	This includes constructed tracks that have required the removal of canopy trees, resulting in linear strips of regrowth of native pioneers or woody weeds. It does not include temporary farm or bush tracks.

Protocol for re-evaluating rainforest

This section summarises the agreed protocol for identifying and evaluating rainforest on private land.[8] As with old growth, the protocol is based on the criteria and processes used in the CRA process, which created a rainforest map layer for north east NSW.

CRAFTI mapping of rainforest on private lands was derived primarily through aerial photographic interpretation. However, as aerial photographic interpretation was undertaken at a regional scale rather than at an individual property scale, any re-evaluation under the protocol is to be undertaken by an aerial photographic interpretation specialist using the most recent aerial photography technology to map the actual extent of rainforest on the property. Fieldwork may be required for further validation.

The protocol defines rainforest as:

'tree-dominated vegetation where the tree stratum (over 3 metres in height) which has the greatest crown cover has rainforest species making up 50% or more of the crown cover, except where non rainforest emergent species (including brushbox and turpentine) occur and exceed 30% or more of the upper stratum crown cover.

Rainforest includes all areas of rainforest mappable at a 1:25000 scale. Rainforest also includes areas exceeding 0.5 hectares occurring as isolated clumps or lineal strips of rainforest trees.'

The above definition means that areas will be classified as moist eucalypt forest rather than rainforest if there is:

- a mainly closed understorey of rainforest plants greater than 3 metres tall (that is, areas with more than 50 percent crown cover)
- emergent non-rainforest species – including eucalypts, brushbox and turpentine – with a combined crown cover of 3 percent or more.

The protocol describes how rainforest is identified and mapped on private land. **Table A3.3** summarises key elements of this process.

Table A3.3: Site disturbance indicators for old growth forest

1. Re-evaluation through aerial photography

The most recent aerial photography is used to map the extent of rainforest.

- The presence and extent of rainforest is reassessed using CRA criteria, and new boundaries are delineated.

2. Field assessment where further validation is required

Field transects are designed to verify the rainforest boundary.

- A cruise sampling technique is used together with a hierarchical system of assessing and confirming the area of rainforest, consistent with the standard definition of 'rainforest'.
- Rainforest is delineated and mapped to a minimum area of 0.5 hectares.

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8   NSW Department of Environment and Climate Change (2007) *Protocol for re-evaluating rainforest on private property*. Available at: https://www.epa.nsw.gov.au/publications/pnf/prrainforest07371.

Appendix 4 – Comparison of old growth forest mapping approaches

Table A4.1: Comparison of old growth forest mapping approaches

Definition	CRAFTI 'candidate' old growth	HCVOG	PNF protocol	Key differences
	▪ Adopts the JANIS definition: 'An old growth forest is an ecologically mature forest where the effects of disturbances are now negligible'.	▪ Uses the CRAFTI layer, based on the JANIS definition.	▪ Adopts the JANIS definition: 'An old growth forest is an ecologically mature forest where the effects of disturbances are now negligible'.	▪ CRAFTI and PNF capture old growth forest that satisfies required growth stage and disturbance characteristics.
	▪ This is the same definition as used in NSW RFAs.	▪ Adds old growth function to the definition by including habitat requirements of old growth–dependent species.	▪ Provides specific structure and disturbance criteria for defining old growth forest.	▪ In contrast, HCVOG discounts old growth forest that is not likely to support threatened hollow-dependent fauna species, and conversely includes forest that does not meet structural and disturbance criteria but has predicted habitat value.
	▪ Maps the relative proportion of three predominant growth stages (senescent, mature and regrowth), as well as the magnitude of disturbance factors.	▪ The NSW heritage listing HCVOG status is defined as 'ecologically mature eucalypt forest showing few signs of human disturbance, where the upper canopy trees are no longer growing in height or spreading their crowns, and show signs of old age'.		
	▪ Mapped areas are identified as 'candidate' old growth forest, requiring review and verification.	▪ The listing states that 'HCVOG forest represents the best remaining examples of old growth forests'.		

	CRAFTI 'candidate' old growth	HCVOG	PNF protocol	Key differences
Intent	▪ Used to map old growth forest using growth stages, relative stand density and disturbance indicators across the forest estate in the upper and lower north east regions. ▪ Used to derive candidate old growth forest, rainforest and other data sets, to facilitate negotiation of RFAs in the upper and lower north east regions.	▪ Developed as a spatial model for the upper and lower north east regions. It used the predicted distribution of threatened hollow-dependent fauna species to refine candidate old growth mapping captured by CRAFTI. ▪ Used during CRA negotiations to determine harvest exclusion zones for old growth forest in state forests. These zones then formed part of the IFOA for the upper and lower north east regions.	▪ Regulated in NSW under Part 5C of the Forestry Act 2012, under which operations must be in accordance with the PNF Code of Practice, including the exclusion of operations in old growth forest mapped on private land. ▪ Used to accurately map old growth forest on private land, establishing an exclusion zone for timber harvesting on private land.	▪ CRAFTI and HCVOG were derived for the purpose of providing strategic region-scale data sets for CRA negotiations, and may be unreliable when applied at the local scale. ▪ In contrast, the PNF protocol was developed to better map old growth at the local scale, and provide a more robust and reliable data set at the property or portion scale.
Criteria	▪ Interpreters assessed the proportion of senescent and regrowth canopy, the relative stand density, and the level of disturbance. These all dictated whether a structural polygon was classed as 'candidate' old growth forest or not.	▪ Candidate old growth forest that was derived via CRAFTI mapping provided the foundation for the HCVOG layer in the upper north east. Old growth mapping derived for the BOGMP provided the foundation for the HCVOG layer in lower north east region. ▪ Model thresholds that ultimately informed the reduced HCVOG extent have not been sourced, and may no longer be available.	▪ PNF old growth is a subset of CRAFTI candidate old growth, and is limited to map polygons exhibiting codes 'tA' and 'tB' (that is, less than 10 percent regrowth, and either more than 30 percent or 10–30 percent senescence). ▪ The code allows for the revision of original old growth mapping if a clear presence of more than 10 percent regrowth or more than 50 percent disturbance	▪ Similar growth stage and disturbance criteria were used to map old growth, although the inclusion of fauna distribution meant the extent of HCVOG was mapped less.

	CRAFTI 'candidate' old growth	HCVOG	PNF protocol	Key differences
			can be observed by 3D aerial photographic interpretation.	
Methods	• Involved capturing crown structure and disturbance information via aerial photograph interpretation. • Each forest pattern was assigned one of six regrowth classes, one of three senescence classes, one of four 'relative stand density' classes, and one or more of 20 disturbance classes. • Limited ground verification was undertaken to test the classification of mapped polygons.	• Derived as a grid-cell layer by intersecting CRAFTI old growth polygons with fauna habitat requirement models derived for each of 21 old growth–reliant species, including the powerful owl, greater glider, spotted-tailed quoll and others.	• Old growth attributes were less than 10 percent regrowth, more than 10 percent senescence and less than 50 percent disturbance, all satisfied via aerial photographic interpretation. • Where these cannot be verified via aerial photographic interpretation, field reconnaissance is undertaken to verify old growth using a 'point to plant' technique.	• Aerial photograph interpretation was the basis of all data sets. • During map production, HCVOG involved no field checking and CRAFTI involved limited field checking. • In contrast, PNF mapping included a comprehensive field checking component that increases data reliability.
Technology	• Employed aerial photographic interpretation, requiring 3D observation of vegetation patterns against full-colour, 1:25,000-scale aerial photographs using a stereoscope. • Polygons were drawn around different vegetation patterns, using an ink pen on a photo overlay. • A code string was recorded for each polygon, denoting its structural characteristics. • Once complete, the overlay was removed, then scanned and	• General additive modelling was used to create a habitat model for each of 21 old growth–reliant species. Models were generated based on species records available at the time (up until 1998), and various climatic and geographic layers (for example, rainfall, temperature, elevation, solar radiation, ruggedness and landscape position).	• Aerial photographic interpretation uses more sophisticated and streamlined technology, employing a planar system attached to a computer that allows the interpreter (using stereo glasses) to view pre-rectified ADS40 imagery directly on screen in 3D, and to digitise vegetative patterns.	• The CRAFTI and HCVOG products are based on a traditional approach to aerial photographic interpretation that required use of stereoscopes, and which captured polygon information via scanning and spatial rectification of images. This led to spatial inaccuracies of up to 100 metres. • In contrast, PNF uses more advanced on-screen mapping technology that ensures greater positional accuracy of mapped lines (to 10 metres), and more

	CRAFTI 'candidate' old growth	HCVOG	PNF protocol	Key differences
	ortho-rectified within a geographic information system.			confidence in the delineation of old growth. ▪ With LiDAR now also available, the desktop assessment will be more precise.
Strengths	▪ CRAFTI contributed to the development of a number of key regional-scale mapping data sets in eastern NSW. These data sets supported the strategic assessment of the forested landscape to facilitate negotiation of a CAR reserve system and associated RFAs. ▪ The major strength of CRAFTI was its application to large regions and its effectiveness in deriving a number of landscape-scale spatial data sets that fed into the RFA negotiation process.	▪ The HCVOG data was a spatial product that served a specific need during the CRA negotiation process.	▪ Modern technology increases the capacity of the interpreter and facilitates the capture of line-work that has a far superior positional accuracy than CRAFTI or HCVOG. ▪ The opportunity to check and potentially review mapping with a relatively high level of resourcing enables PNF mapping to deliver robust outcomes at the property scale, and to improve the overall accuracy of the product at the landscape scale.	▪ CRAFTI and HCVOG provided strategic data sets, but neither were designed for use at the local scale. ▪ PNF provides a robust data set for application at the local scale.

	CRAFTI 'candidate' old growth	HCVOG	PNF protocol	Key differences
Limitations	• Short time frames, changing rules, delays in receipt of key data sets, lower photographic quality, and differences in interpreter experience and skill have all affected the reliability of outputs at the local scale. • Post-CRAFTI accuracy assessments undertaken by the NSW Government have found significant attributional and spatial inaccuracies, with old growth generally being over-mapped. • The data capture and ortho-rectification process resulted in spatial inaccuracy of up to 100 metres. • Aerial photos used during the CRAFTI process were collected between 1991 and 1997, often five or more years before mapping commenced. • Given this time lag, it is probable that, in some areas, forest characteristics at the time of mapping differed from those captured in the photos. • The CRAFTI project involved limited field verification.	• Converting vector data (such as that produced by CRAFTI) into raster data reduces spatial accuracy, with resultant errors in area, perimeter, shape, structure, position and attributes. • The layer is coarse (100 by 100 metre grid-cells), so it appears blocky and inaccurate at the local scale. • Accuracy limitations associated with the foundation CRAFTI mapping were carried through to the HCVOG data set. • The data set was produced rapidly during negotiations, so is likely to contain errors associated with fauna models. • No field verification was undertaken.	• Limiting old growth to 'tA' and 'tB' codes risks potential loss of old growth forests to private forestry operations. For example, 'sA' could feasibly incorporate areas where regrowth represents 15 percent of canopy cover while old senescing trees represent up to 85 percent of canopy cover. • Some areas of old growth forest on private land may also be forfeited to timber extraction, given the minimum 5 hectare rule.	• The major limitation of CRAFTI and HCVOG is uncertainty about the original old growth delineation as a result of technological limitations and other factors. • If PNF defaults to using 'tA' or 'tB' codes for private land, as originally captured by CRAFTI, this problem will carry through. • Where PNF undertakes to remap old growth on private land (or other tenure), accuracy limitations may be addressed.

Appendix 5 – Environmental values assessment

Table A5.1: Overview of piloted environmental values assessment methodology

Criteria	How/when	Pilot approach	Who
1. IBRA bioregion and sub-region reservation status	▪ Desktop review ▪ After old growth assessment	▪ Determine the percentage area of the CAR reserve system within the relevant bioregion/sub-region. ▪ Assess and discuss potential impacts/implications.	▪ Commission analysis ▪ Data supplied from agencies
2. Landscape connectivity	▪ Desktop review ▪ After old growth assessment	▪ Visually assess the compartment against imagery. ▪ Assess and discuss potential impacts/implications, such as movement of forest species across the landscape.	▪ Commission analysis ▪ Data supplied from agencies
3. Old growth ecosystem targets	▪ Desktop review ▪ Before old growth assessment	▪ Apply the previous method used for RFA to a new protected area network. ▪ Reassess areas where old growth targets are clearly exceeded.	▪ Commission analysis ▪ Data supplied from agencies
5. Relationship to geographic range	▪ Desktop review ▪ After old growth assessment	▪ Identify forest ecosystems that are at the edge of their geographic range, or otherwise notably isolated from the main footprint of the forest ecosystem distribution. ▪ Assess and discuss potential impacts/implications.	▪ Commission analysis ▪ Data supplied from agencies
6. Patch size	▪ Desktop review ▪ After old growth assessment	▪ Identify the size of the patch using imagery from where the compartment is located (e.g. less than 1,000 ha; 1,000–5,000 ha; 5,000–10,000 ha; or more than 10,000 ha). ▪ Note whether the forest ecosystem is immediately adjacent to a dedicated reserve (national park, nature reserve or flora reserve). ▪ Assess and discuss potential impacts/implications.	▪ Commission analysis ▪ Data supplied from agencies
7. Coarse woody debris	▪ Field sampling	▪ Measure the length (m) of three diameter classes of dead fallen logs (10–50 cm;	▪ Commission/ OEH

Criteria	How/when	Pilot approach	Who
	▪ During old growth assessment	50–100 cm; and more than 100 cm) within a 10 metre radius of each sampling point along the transect.	▪ Commission data capture ▪ Field input from EPA/FCNSW
8. Dead standing trees	▪ Field sampling ▪ During old growth assessment	▪ Count dead standing trees (more than 30 cm DBH[9]) within a 20 metre radius of each sampling point along the transect.	▪ Commission/ OEH ▪ Commission data capture ▪ Field input from EPA/FCNSW
9. Hollow-bearing trees	▪ Field sampling ▪ During old growth assessment	▪ Count living hollow-bearing trees within a 20 metre radius of each sampling point along the transect.	▪ Commission/ OEH ▪ Commission data capture ▪ Field input from EPA/FCNSW
10. Giant trees	▪ Field sampling ▪ During old growth assessment	▪ Record the species and DSHOB[10] of any giant tree within a 20 metre radius of each sampling point along the transect.	▪ Commission/ OEH ▪ Commission data capture ▪ Field input from EPA/FCNSW
11. Special habitat features	▪ Field sampling ▪ During old growth assessment	▪ Note any special habitat features (such as rock fields, caves and cliff-lines) and any threatened species at each sampling point along the transect.	▪ Commission/ OEH ▪ Commission data capture ▪ Field input from EPA/FCNSW

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[9] Diameter at breast height.
[10] Diameter at stump height over bark (measured 70 centimetres above ground level, on the uphill side of the tree). Giant trees have a minimum 160 centimetres DSHOB for blackbutt, and 140 centimetres DSHOB for all other species.

Table A5.2: Results of environmental values desktop assessment

State forest (compartment)	Bioregion	Reserved in bioregion (%)	Sub-region	Reserved in sub-region (%)	Landscape connectivity	Commercial types at >60% target	Geographic range implications	Patch size (ha)	Adjacent to NPWS land	Senescence (%)
Bellangry (11)	NSW North Coast	24.85	Macleay Hastings	13.69	No impact	32, 67, 155	Does not include outliers	>10,000	No	2.7
Clouds Creek (124)	NSW North Coast	24.85	Chaelundi	25.4	No impact	67, 69, 84, 157	Does not include outliers	>10,000	No	5.4
Clouds Creek (167)	NSW North Coast	24.85	Dalmorton	23.81	No impact	19, 33, 59, 69, 89, 100, 135	FE19 northern limit of range; FE59 southern limit of range; FE100 south-eastern limit of range	>10,000	Yes	39.3
Dalmorton (406)	NSW North Coast	24.85	Dalmorton	23.81	No impact	33, 89, 103, 157	Does not include outliers	>10,000	No	No data
Irishman (205)	NSW North Coast	24.85	Coffs Coast and Escarpment	39.12	No impact	36, 67, 83, 155	Does not include outliers	>10,000	No	No data
Kangaroo River (234)	NSW North Coast	24.85	Dalmorton	23.81	No impact	n/a (EPA site)	n/a	>10,000	No	18.2
Kippara (18)	NSW North Coast	24.85	Macleay Hastings	13.69	No impact	32, 67, 155	Does not include outliers	>10,000	No	0.6
Lower Bucca (600)	NSW North Coast	24.85	Coffs Coast and Escarpment	39.12	No impact	89, 135, 153	Does not include outliers	5,000–10,000	No	0.9
Mistake (341)	NSW North Coast	24.85	Coffs Coast and Escarpment	39.12	No impact	n/a (EPA site)	n/a	>10,000	No	2
Nambucca (320, 321)	NSW North Coast	24.85	Macleay Hastings	13.69	No impact	34	Does not include outliers	1,000–5,000	No	2
Wild Cattle Creek (515)	NSW North Coast	24.85	Chaelundi	25.4	No impact	67, 84, 105, 135, 157	Does not include outliers	>10,000	No	4.3

NB: Field assessment was not undertaken on Girard and Ewingar state forests due to issues with access or work health and safety.

Table A5.3: Environmental values site assessment for Bellangry (11)

Transect point	Estimated total length (m) of dead fallen logs (by diameter section)			Number of dead standing trees (stags) > 30 cm DBH	Number of live hollow-bearing trees
	10–50 cm	50–100 cm	≥100 cm		
1	10	7	0	2	0
2	12	12	0	1	0
3	12	6	0	1	0
4	11	4	0	1	1
5	15	4	0	0	0
6	8	0	0	1	2
7	20	14	0	0	1
8	4	6	0	1	0
9	6	4	0	0	0
10	5	0	0	1	1
Total	103	57	0	8	5
Total per hectare	327.54	181.26	0	6.37	3.95

Date	30 January 2018
Data recorder	Natural Resources Commission
Transect	1
Total plot area for total length of logs	3,142 m² or 0.314 ha
Total plot area for stags and hollow-bearing trees	12,566 m² or 1.257 ha
Giant trees	None
Transect notes	▪ Used 10 m radius around each point to sample dead fallen logs, and 20 m radius around each point to sample all other structural attributes ▪ Masses of casuarina debris at points 1, 3, 8 ▪ Masses of debris cut – forestry at point 7 ▪ > 30 degree slope at point 10

Table A5.4: Environmental values site assessment for Clouds Creek (124)

	Estimated total length (m) of dead fallen logs (by diameter section)			Number of dead standing trees (stags) > 30 cm DBH	Number of live hollow-bearing trees
Transect point	10–50 cm	50–100 cm	≥100 cm		
1	20	0	0	0	0
2	10	15	0	0	0
3	25	5	0	1	0
4	10	5	0	0	1
5	15	15	0	2	3
6	30	0	0	2	2
7	10	0	0	0	0
8	10	5	0	0	0
9	20	5	5	0	2
10	10	20	0	0	0
Total	160	70	5	5	8
Total per hectare	508.8	222.6	15.9	3.95	6.32

Date	29 January 2018
Data recorder	Natural Resources Commission
Transect	1
Total plot area for total length of logs	3,142 m² or 0.314 ha
Total plot area for stags and hollow-bearing trees	12,566 m² or 1.257 ha
Giant trees	None
Transect notes	Used 10 m radius around each point to sample dead fallen logs, and 20 m radius around each point to sample all other structural attributes

Table A5.5: Environmental values site assessment for Clouds Creek (167)

	Estimated total length (m) of dead fallen logs (by diameter section)			Number of dead standing trees (stags) > 30 cm DBH	Number of live hollow-bearing trees
Transect point	10–50 cm	50–100 cm	≥100 cm		
1	10	0	0	1	6
2	8	10	0	1	3
3	16	20	0	0	3
4	20	10	0	0	3
5	30	4	0	0	2
6	20	0	0	1	3
7	5	10	10	1	6
8	15	10	0	1	5
9	10	10	0	0	0
10	15	0	0	2	2
Total	149	74	10	7	33
Total per hectare	473.82	235.32	31.8	5.53	26.07

Date	29 January 2018
Data recorder	Natural Resources Commission
Transect	1
Total plot area for total length of logs	3,142 m² or 0.314 ha
Total plot area for stags and hollow-bearing trees	12,566 m² or 1.257 ha
Giant trees	Tallowwood with DSHOB of 155 cm at point 3
Transect notes	▪ Used 10 m radius around each point to sample dead fallen logs, and 20 m radius around each point to sample all other structural attributes ▪ Intact understorey at points 1,3,4 ▪ Rainforest understorey at points 2,5 ▪ Glossy black cockatoo at point 6

Table A5.6: Environmental values site assessment for Kangaroo River (234)

Transect point	Estimated total length (m) of dead fallen logs (by diameter section)			Number of dead standing trees (stags) > 30 cm DBH	Number of live hollow-bearing trees
	10–50 cm	50–100 cm	≥100 cm		
1	15	0	0	1	1
2	20	10	0	2	1
3	0	20	10	1	1
4	–	–	–	–	–
5	–	–	–	–	–
6	–	–	–	–	–
7	–	–	–	–	–
8	–	–	–	–	–
9	–	–	–	–	–
10	–	–	–	–	–
Total	35	30	10	4	3
Total per hectare	372.34	319.2	106.4	10.6	7.95

Date	31 January 2018
Data recorder	Natural Resources Commission
Transect	1
Total plot area for total length of logs	942 m² or 0.094 ha
Total plot area for stags and hollow-bearing trees	3,769.8 m² or 0.377 ha
Giant trees	None
Transect notes	Used 10 m radius around each point to sample dead fallen logs, and 20 m radius around each point to sample all other structural attributes

Table A5.7: Environmental values site assessment for Kippara (18)

Transect point	Estimated total length (m) of dead fallen logs (by diameter section)			Number of dead standing trees (stags) > 30 cm DBH	Number of live hollow-bearing trees
	10–50 cm	50–100 cm	≥100 cm		
1	10	8	5	1	0
2	4	2	0	1	0
3	4	4	0	2	1
4	10	5	4	3	0
5	2	2	4	1	1
6	5	1	0	1	0
7	0	0	2	0	0
8	6	2	0	0	0
9	6	0	0	2	0
10	-	-	-	-	-
Total	47	24	15	11	2
Total per hectare	167.85	85.71	53.55	9.73	1.76

Date	30 January 2018
Data recorder	Natural Resources Commission
Transect	1
Total plot area for total length of logs	2,872.4 m² or 0.28 ha
Total plot area for stags and hollow-bearing trees	11,309.8 m² or 1.13 ha
Giant trees	None
Transect notes	▪ Used 10 m radius around each point to sample dead fallen logs, and 20 m radius around each point to sample all other structural attributes ▪ Glossy black cockatoo feed tree at point 1 ▪ Rocky outcrop at point 8

Table A5.8: Environmental values site assessment for Mistake (341)

Transect point	Estimated total length (m) of dead fallen logs (by diameter section)			Number of dead standing trees (stags) > 30 cm DBH	Number of live hollow-bearing trees
	10–50 cm	50–100 cm	≥100 cm		
1	1	0	0	2	1
2	18	0	0	3	1
3	6	2	0	3	0
4	3	1	0	0	0
5	1	10	0	1	2
6	2	0	0	1	0
7	–	–	–	–	–
8	–	–	–	–	–
9	–	–	–	–	–
10	–	–	–	–	–
Total	31	13	0	10	4
Total per hectare	164	68.77	0	13.3	5.3

Date	31 January 2018
Data recorder	Natural Resources Commission
Transect	1
Total plot area for total length of logs	1,887.6 m² or 0.189 ha
Total plot area for stags and hollow-bearing trees	7,539.84 m² or 0.754 ha
Giant trees	None
Transect notes	▪ Used 10 m radius around each point to sample dead fallen logs, and 20 m radius around each point to sample all other structural attributes ▪ Severe lantana at points 1, 2

Table A5.9: Environmental values site assessment for Wild Cattle Creek (515)

Transect point	Estimated total length (m) of dead fallen logs (by diameter section)			Number of dead standing trees (stags) > 30 cm DBH	Number of live hollow-bearing trees
	10–50 cm	50–100 cm	≥100 cm		
1	10	0	0	2	0
2	10	0	0	0	0
3	10	10	0	0	1
4	0	5	0	1	1
5	15	0	0	1	3
6	0	0	0	0	3
7	0	15	0	1	1
8	5	5	0	0	0
9	–	–	–	–	–
10	–	–	–	–	–
Total	50	35	0	5	9
Total per hectare	199	139.3	0	4.97	8.95

Date	31 January 2018
Data recorder	Natural Resources Commission
Transect	1
Total plot area for total length of logs	2,512 m² or 0.251 ha
Total plot area for stags and hollow-bearing trees	10,053 m² or 1.005 ha
Giant trees	None
Transect notes	▪ Used 10 m radius around each point to sample dead fallen logs, and 20 m radius around each point to sample all other structural attributes ▪ Rocky ground at point 8

Table A5.10: Environmental values comparison for all sites (per hectare)

Site (compartment)	Estimated total length (m) of dead fallen logs (by diameter section) per hectare			Number of dead standing trees (stags) > 30 cm DBH per hectare	Number of live hollow-bearing trees per hectare
	10–50 cm	50–100 cm	≥100 cm		
Bellangry (11)	327.54	181.26	0	6.37	3.95
Clouds Creek (124)	508.8	222.6	15.9	3.95	6.32
Clouds Creek (167)	473.82	235.32	31.8	5.53	26.07
Kangaroo River (234)	372.34	319.2	106.4	10.6	7.95
Kippara (18)	167.85	85.71	53.55	9.73	1.76
Mistake (341)	164	68.77	0	13.3	5.3
Wild Cattle Creek (515)	199	139.3	0	4.97	8.95

Appendix 6 – Pilot JANIS reassessment method and additional data

Methodology

The approach used to re-calculate old growth targets for forests ecosystems in the upper and lower north east regions is as follows.

1 Compile original extent data for old growth forest ecosystems (in hectares) in the upper north east and lower north east regions, as listed in the RFA.

2 Source updated spatial data representing the current reserve system. This includes:

   ▪ updated NPWS-managed reserves

   ▪ formal and informal reserves and areas managed under prescription in state forests

   ▪ Crown reserves with a clear biodiversity protection intent

   ▪ conservation agreements or regional property agreements on private land.

3 Calculate the extent of old growth forest in each forest ecosystem (in hectares) in the current reserve system.

4 Calculate the percentage of old growth forest in each forest ecosystem represented in the current reserve system.

5 For forest ecosystems with a 60 percent reservation target (as listed in the original RFA), identify the subset of 'over-target' ecosystems (those with more than 60 percent of their old growth within the current reserve system, as calculated in **step 4**).

6 Calculate the 'surplus' area of old growth for each 'over-target' forest ecosystem (that is, the extent of old growth forest ecosystem that goes above the 60 percent threshold).

7 Calculate the extent of old growth in each 'over-target' forest ecosystem within the 'special management zone' and other protected old growth in state forests.

8 Calculate the potential area of each ecosystem available in the special management zone and other protected old growth in state forests (in hectares). This is the area that could be harvested in state forests without forfeiting the 60 percent target achievement. It is calculated as the lesser value of **steps 6 and 7**.

Table A6. 1: Forest ecosystems in the upper north east region that exceed the 60 percent old growth target

Forest ecosystem number	Forest ecosystem	Original extent of old growth (ha)	Revised extent of old growth reserved (ha)	Percentage of old growth reserved (%)	Total area in protected old growth in state forest (ha)	Area in excess of old growth target (ha)	Potential area available in protected old growth in state forest (ha)
	Commercially viable forest ecosystem types						
33	Dry Foothills Spotted Gum	39,933	26,832	67.2	8,336	2,872	2,872
89	Moist Foothills Spotted Gum	14,111	10,945	77.6	3,562	2,478	2,478
59	Gorge Ironbark-Grey Gum	27,179	19,131	70.4	1,520	2,824	1,520
84	Mid North Coast Wet Brushbox-Tallowwood-Blue Gum	3,152	27,79	88.2	902	888	888
104	Northern Wet Tallowwood-Blue Gum	9,766	7,987	81.8	873	2,127	873
70	High-Elevation Open Spotted Gum	15,622	9,976	63.9	1,445	603	603
40	Dry Heathy Sandstone Blackbutt	7,877	5,275	67.0	853	549	549
100	Northern Grassy Sydney Blue Gum	3,263	2,699	82.7	514	741	514
157	Wet Shrubby Brushbox-Tallowwood	2,339	2,017	86.2	463	614	463
109	Open Shrubby Brushbox-Tallowwood	7,011	4,647	66.3	1,140	440	440
67	High-Elevation Ferny Blackbutt	1,990	1,624	81.6	718	430	430
135	South Coast Tallowwood-Blue Gum	1,283	1,122	87.5	332	352	332
155	Wet Foothills Blackbutt-Turpentine	1,196	1,025	85.7	492	307	307
32	Dry Foothills Blackbutt-Turpentine	1,043	800	76.7	252	174	174
158	Wet Spotted Gum-Tallowwood	800	785	98.1	166	305	166
19	Central Mid-Elevation Sydney Blue Gum	1,131	823	72.8	224	144	144
34	Dry Grassy Blackbutt-Tallowwood	1,148	829	72.2	278	140	140
55	Foothills Grey Gum-Spotted Gum	1,495	961	64.3	511	64	64
83	Mid-Elevation Wet Blackbutt	222	195	87.8	98	62	62
146	Tallowwood	5,278	4,559	86.4	38	1,392	38
36	Dry Grassy Tallowwood-Grey Gum	572	365	63.8	94	22	22
153	Wet Coastal Tallowwood-Brushbox	187	113	64.2	88	8	8
	All commercial types				22,899[1]	17,536	13,087

1   The small variation between this value and the final value provided in Table 3 in the main report is due to minor historical anomalies between Geographic Information System data layers used for analysis.

Non-commercially viable forest ecosystem types

Forest ecosystem number	Forest ecosystem	Original extent of old growth (ha)	Revised extent of old growth reserved (ha)	Percentage of old growth reserved (%)	Total area in protected old growth in state forest (ha)	Area in excess of old growth target (ha)	Potential area available in protected old growth in state forest (ha)
60	Grassy New England Blackbutt-Tallowwood-Blue Gum	19,176	15,285	79.7	3,606	3,779	3,606
41	Dry Open New England Blackbutt	52,268	33,948	64.9	4,895	2,587	2,587
20	Clarence Lowland Needlebark Stringybark	5,847	4,824	82.5	1,365	1,316	1,316
35	Dry Grassy Stringybark	40,951	29,285	71.5	1,127	4,714	1,127
90	Moist Messmate-Gum	10,627	9,067	85.3	1,120	2,691	1,120
97	Needlebark Stringybark-Large Fruited Blackbutt	5,360	3,948	73.7	911	732	732
103	Northern Wet Brushbox	4,740	3,668	77.4	626	824	626
29	Corkwood-Crabapple and Mixed Stringybarks	2,891	2,413	83.5	602	678	602
123	Roundleaved Gum	6,929	4,838	69.8	569	681	569
196	Broad-Leaved Stringybark-Apple Box	4,326	3,145	72.7	950	549	549
38	Dry Heathy New England Blackbutt	2,762	2,203	79.8	574	546	546
111	Open Silvertop Stringybark-Tallowwood	2,144	1,754	81.8	519	468	468
98	New England Peppermint	1,459	1,393	95.5	340	518	340
106	Open Coastal Brushbox	1,860	1,440	77.4	702	324	324
48	Escarpment Scribbly Gum-Apple	3,205	2,707	84.5	252	784	252
46	Eastern Red Gums	1,436	1,114	77.6	738	252	252
105	Nymboida Tallowwood-Turpentine	1,284	1,246	97.0	218	476	218
23	Coast Range Bloodwood-Mahogany	1,951	1,413	72.4	214	242	214
69	High-Elevation Moist Open Tallowwood-Blue Gum	1,513	1,245	82.3	196	337	196
122	Rough-Barked Apples	900	853	94.8	195	313	195
92	Moist Shrubby Stringybark-Gum	1,314	1,149	87.4	185	361	185
65	Heathy Scribbly Gum	3,179	2,722	85.6	162	815	162
63	Grey Gum-Stringybark	9,212	7,064	76.7	152	1,537	152
88	Moist Escarpment New England Blackbutt	7,451	7,173	96.3	141	2,702	141
26	Coastal Flooded Gum	2,108	1,816	86.1	134	551	134

Forest ecosystem number	Forest ecosystem	Original extent of old growth (ha)	Revised extent of old growth reserved (ha)	Percentage of old growth reserved (%)	Total area in protected old growth in state forest (ha)	Area in excess of old growth target (ha)	Potential area available in protected old growth in state forest (ha)
3	Baileys Stringybark	21,733	15,100	69.5	122	2,060	122
86	Mixed New England Stringybarks	1,096	779	71.1	314	121	121
150	Washpool Brushbox-Tallowwood	5,047	4,859	96.3	98	1,831	98
91	Moist Open Escarpment White Mahogany	807	696	86.2	97	212	97
110	Open Silvertop Stringybark-Blue Gum	1,885	1,601	84.9	79	470	79
50	Wet Bangalow-Brushbox	3,452	2,356	68.3	56	285	56
113	Peppermint	2,693	1,930	71.7	54	314	54
74	Lowlands Scribbly Gum*	1,396	1,214	87.0	35	376	35
95	Northern Moist Blackbutt	1,585	979	61.8	30	28	28
2	Alpine Gum	251	178	70.9	34	27	27
78	Mann River Wet New England Blackbutt	4,280	4,087	95.5	20	1,519	20
53	Gorge Grey Box	8,325	6,955	83.5	14	1,960	14
147	Turpentine	338	217	64.2	29	14	14
43	Dry Silvertop Stringybark-Apple	9,893	7,954	80.4	10	2,018	10
27	Coastal Sands Blackbutt	2,240	2,164	96.6	5	820	5
132	Snow Gum-Mountain/Manna Gum	1,860	1,179	63.4	5	63	5
99	New England Stringybark-Blakelys Red Gum	6,653	4,698	70.6	2	706	2
58	Gorge Grey Gum	4,198	3,350	79.8	3	831	1
	All non-commercial types				21,498	42,432	17,401

Table A6. 2: Forest ecosystems in lower north east region that exceed the 60 percent old growth target

Forest ecosystem number	Forest ecosystem	Original extent of old growth (ha)	Revised extent of old growth reserved (ha)	Percentage of old growth reserved (%)	Total area in protected old growth in state forest (ha)	Area in excess of old growth target (ha)	Potential area available in protected old growth in state forest (ha)
Commercially viable forest ecosystem types							
84	Mid North Coast Wet Brushbox-Tallowwood-Blue Gum	9,850	7,490	76.0	1,143	1,580	1,143
67	High-Elevation Ferny Blackbutt	11,441	8,816	77.1	1,016	1,951	1,016
155	Wet Foothills Blackbutt-Turpentine	8,282	5,951	71.9	1,502	982	982
69	High-Elevation Moist Open Tallowwood-Blue Gum	11,698	8,901	76.1	537	1,882	537
83	Mid-Elevation Wet Blackbutt	2,058	1,832	89.0	484	597	484
157	Wet Shrubby Brushbox-Tallowwood	13,214	8,373	63.4	1,224	445	445
19	Central Mid-Elevation Sydney Blue Gum	5,775	3,615	62.6	659	150	150
	All commercial types				6,565[2]	7,587	4,757
Non-commercially viable forest ecosystem types							
108	Open Ribbon Gum	8,987	7,129	79.3	2,239	1,737	1,737
49	Escarpment Tallowwood-Bloodwood	21,998	14,798	67.3	2,025	1,599	1,599
110	Open Silvertop Stringybark-Blue Gum	12,786	9,684	75.7	1,415	2,012	1,421
30	Diehard Stringybark-New England Blackbutt	24,726	21,136	85.5	1,318	6,300	1,319
88	Moist Escarpment New England Blackbutt	12,954	11,798	91.1	1,160	4,026	1,159
60	Grassy New England Blackbutt-Tallowwood-Blue Gum	15,722	12,022	76.5	1,065	2,589	1,067
91	Moist Open Escarpment White Mahogany	19,026	14,493	76.2	894	3,077	898
156	Wet New England Blackbutt-Silvertop Stringybark	4,437	3,646	82.2	438	984	438
71	Ironbark	29,876	24,613	82.4	400	6,687	401
68	High-Elevation Messmate-Brown Barrell	1,538	1,251	81.3	369	328	328
137	Southern Wet Sydney Blue Gum	6,613	42,74	64.6	958	306	306
63	Grey Gum-Stringybark	10,768	7,349	68.2	253	888	271
139	Stringybark-Apple	39,882	25,469	63.9	233	1,540	254

2 The small variation between this value and the final value provided in Table 3 in the main report is due to minor historical anomalies between Geographic Information System data layers used for analysis.

Forest ecosystem number	Forest ecosystem	Original extent of old growth (ha)	Revised extent of old growth reserved (ha)	Percentage of old growth reserved (%)	Total area in protected old growth in state forest (ha)	Area in excess of old growth target (ha)	Potential area available in protected old growth in state forest (ha)
65	Heathy Scribbly Gum	8,960	8,799	98.2	213	3,423	233
107	Open Messmate-New England Blackbutt	3,302	3,033	91.9	271	1,052	215
234	Grey Gum-Grey Myrtle	17,002	16,878	99.3	187	6,677	187
231	Watagan Blue Gum	524	502	95.8	171	188	171
81	Messmate	1,912	1,325	69.3	153	178	153
148	Very Wet New England Blackbutt-Tallowwood	1,596	1,525	95.6	149	567	153
230	Watagan Blackbutt-Blue Gum	605	532	87.9	132	169	133
87	Mixed Tableland Stringybark-Gum Open Forest	1,259	948	75.3	129	193	131
206	Apple-Grey Gum-Turpentine	12,030	11,894	98.9	116	4,676	116
15	Brown Barrell-Gum	1,775	1,168	65.8	126	103	103
43	Dry Silvertop Stringybark-Apple	9,497	6,648	70.0	89	950	89
6	Barrington Dry Shrubby New England Blackbutt-Blue Gum	1,676	1,087	64.9	164	81	81
129	Smoothbarked Apple	1,412	1,356	96.0	70	509	70
227	Turpentine-Myrtle	10,115	10,088	99.7	69	4,019	69
28	Cool Moist Messmate	901	701	77.8	67	160	68
37	Dry Heathy Blackbutt-Bloodwood	1,144	841	73.5	62	155	62
145	Sydney Peppermint-Stringybark	9,225	8,652	93.8	59	3,117	59
82	Messmate-Mountain Gum Forest	1,416	1,278	90.3	54	428	54
221	Apple-Red Bloodwood-Peppermint-Turpentine	14,168	141,20	99.7	44	5,619	50
131	Snow Gum	2,035	1,947	95.7	42	726	49
99	New England Stringybark-Blakelys Red Gum	12,469	7,805	62.6	50	324	44
80	Manna Gum	557	379	68.0	49	45	41
2	Alpine Gum	932	705	75.6	41	146	34
202	Peppermint-Apple-Turpentine	23,654	23,480	99.3	33	9,288	33
53	Gorge Grey Box	5,156	3,665	71.1	33	571	30
232	Watagan Spotted Gum-Ironbark-White Mahogany	202	186	92.1	30	65	27
74	Lowlands Scribbly Gum	4,881	4,764	97.6	27	1,835	26

Forest ecosystem number	Forest ecosystem	Original extent of old growth (ha)	Revised extent of old growth reserved (ha)	Percentage of old growth reserved (%)	Total area in protected old growth in state forest (ha)	Area in excess of old growth target (ha)	Potential area available in protected old growth in state forest (ha)
233	Roundleaved Gum-Turpentine	1,922	1,906	99.2	26	753	25
203	Grey Gum-Stringybark-Apple	27,511	27,243	99.0	25	10,736	19
29	Corkwood-Crabapple and Mixed Stringybarks	872	758	86.9	19	235	17
247	Coastal Bastard Mahogany Forest	2,677	2,657	99.3	18	1,051	17
250	Banksia Heath-Scribbly Gum-Apple	94	92	97.9	17	36	14
209	Yellow Bloodwood-Stringybark	29,118	28,674	98.5	13	11,203	13
210	Yellow Bloodwood-Ironbark	14,733	14,706	99.8	14	5,866	11
225	Wyong Apple-Scribbly Gum	27	27	100.0	11	11	11
248	Apple-Forest Oak	1,863	1,849	99.2	26	731	11
204	Grey Gum-Scribbly Gum	15,587	15,565	99.9	11	6,213	9
228	Turpentine-Oak-Myrtle	8,658	7,328	84.6	9	2,133	8
229	Roughbarked Apple-Forest Oak	17,641	17,184	97.4	8	6,599	8
226	Mahogany-Banksia Heath	5,312	5,301	99.8	8	2,114	7
212	Yellow Bloodwood-Narrowleaved Apple	37,582	37,482	99.7	7	14,933	6
211	Apple-Turpentine	14,990	14,955	99.8	6	5,961	5
54	Grey Box-Red Gum-Grey Ironbark	7,837	7,100	90.6	5	2,398	4
213	Stringybark-Scribbly Gum Woodland	7,814	7,807	99.9	4	3,119	4
222	Stringybark-Mallee Woodland	5,940	5,939	100.0	4	2,375	4
111	Open Silvertop Stringybark-Tallowwood	727	582	80.1	4	146	3
21	Lowlands Grey Box	740	516	69.7	1	72	1
48	Escarpment Scribbly Gum-Apple	3,174	2,448	77.1	3	544	1
93	Montane Stringybark-Gum	480	346	72.1	1	58	1
	All non-commercial types				15,644	154,624	13,878

Appendix 7 – PNF protocol assessment data sheets and site maps

State forest (compartment)	PNF protocol assessment	
	Aerial photographic interpretation?	Field assessment?
1. **Bellangry (11)**	YES	YES
2. **Clouds Creek (124)**	YES	YES
3. **Clouds Creek (167)**	YES	YES
4. **Dalmorton (406)**	YES	NO (Access or work health and safety issues)
5. **Ewingar (635, 637)**	YES	NO (Access or work health and safety issues)
6. **Lower Bucca (600)**	YES	YES
7. **Mistake (341)**	YES	YES
8. **Nambucca (320, 321)**	YES	YES
9. **Wild Cattle Creek (515)**	YES	YES
10. **Girard (52)**	YES	NO (Access or work health and safety issues)
11. **Irishman (205)**	YES	NO (Access or work health and safety issues)
12. **Kangaroo River (234)**	YES	YES
13. **Kippara (18)**	YES	YES

Bellangry Compartment 11

Data recorder: OEH Science

PNF Old Growth Field Transect Data Sheet (Revised 17 April 2012 with expanded instructions in header row)
Enter data in grey shaded cells. Enter distance (D) to nearest tree and average radius of crown (r) in metres. For null records (tree not present within 30m) enter lower case 'n' in D column. Record presence of disturbance with upper case 'Y'
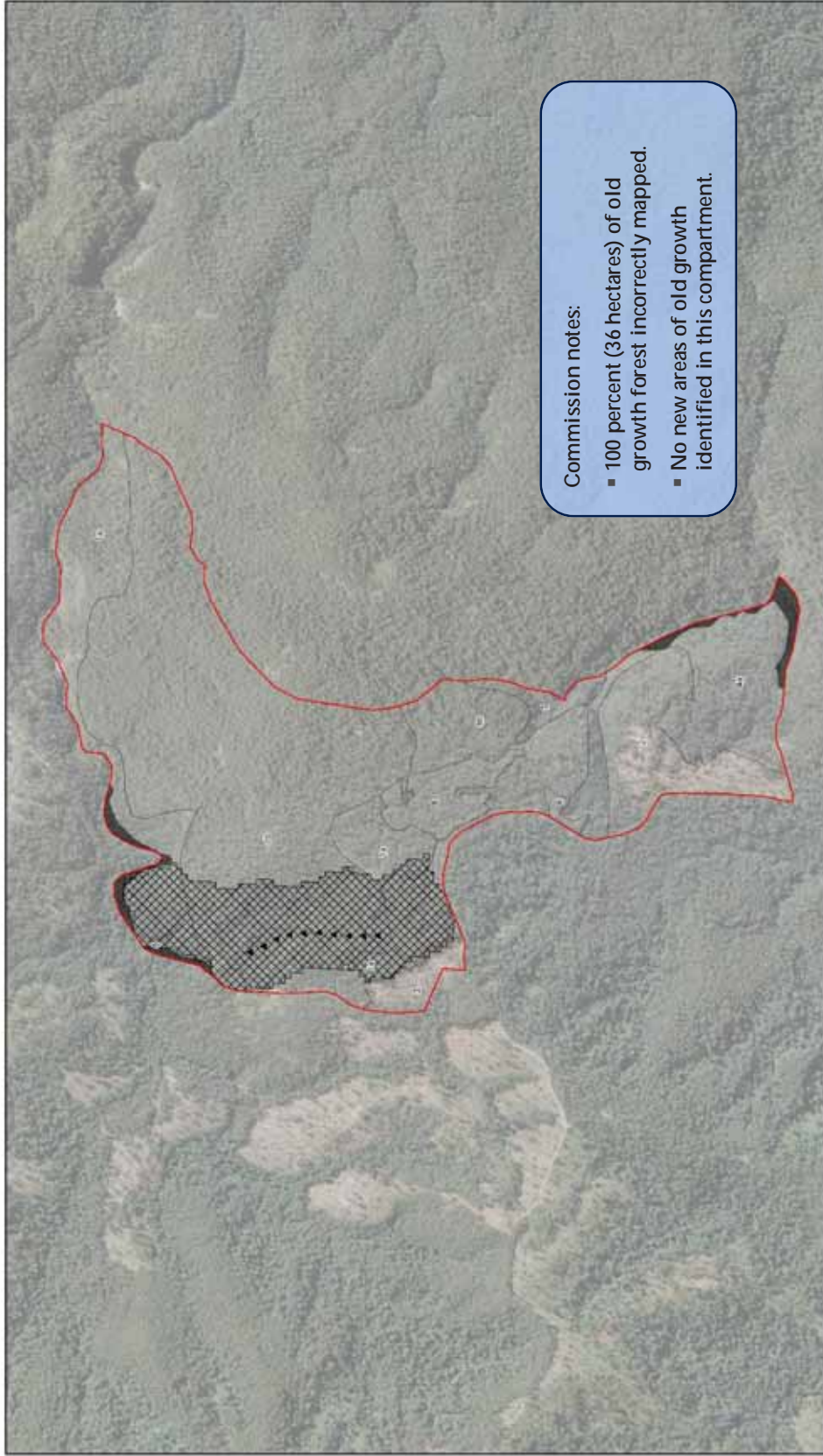
	TRANSECT: T1			REQUEST: Bellangry SF CPT1			DATE: 30/01/2018			s(OEH), N. Piercy(EPA), J. Bell(NRC), J. Williams			
Point	Regrowth			Mature			Senescent			Disturbance Indicators (Y/N)			
										1. Recent or Older Logging or Constructed Tracks	2. Exotic woody weeds	3. Stags or dieback	4. Grazing infra.
	D (n for null)	r	Area	D (n for null)	r	Area	D (n for null)	r	Area				
1	8	1	3.14	8	7	153.94	n		0.00	y			
2	12	1	3.14	6	6	113.10	n		0.00	y			
3	7	1	3.14	11	4	50.27	29	10	314.16	y			
4	17	1.5	7.07	5	4.5	63.62	16	10	314.16	y			
5	13	1.5	7.07	4	6	113.10	n		0.00	y			
6	9	0.5	0.79	8	6	113.10	n		0.00	y			
7	3	0.5	0.79	7	5	78.54	n		0.00	y			
8	3	0.5	0.79	6	4	50.27	n		0.00	y			
9	7	3	28.27	6	9	254.47	n		0.00	y			
10	10	0.5	0.79	2	4.5	63.62	n		0.00	y			
11			0.00			0.00			0.00				
12			0.00			0.00			0.00				
13			0.00			0.00			0.00				
14			0.00			0.00			0.00				
15			0.00			0.00			0.00				
Sample Size	10			10			10			Total	Total	Total	Total
Average	8.9		5.5	6.3		105.4	22.5		314.2	10	0	0	0
Null Scores	0			0			8			%Disturb	%Disturb	%Disturb	%Disturb
Non Null Scores	10			10			2			100	0	0	0
Null Score ratio	0			0			0.8			Sign't	Not Sign't	Not Sign't	Not Sign't
Conv Factor	#N/A			#N/A			0.12						

RESULTS

Old Growth at Transect:	No
Regrowth %:	2.5
Senescence %:	2.7
Disturbance >50%:	Yes

CALCULATIONS

Step2ab				
Reg.	2D	17.80	N	31.56
Step2ab_Mat.	2D	12.60	N	62.99
Step2ab_Sen.	2D	45.00	N	4.94

	Re-growth	Mature	Sen-escing	Total
Step2c	32	63	1	95
Step 3a	5.50	105.40	314.16	
Step 3b	174	6639	186	6999
Step 3c	2.5	94.9	2.7	100.0

Old Growth & Rainforest Remapping
Bellangry State Forest Cpts 11

Commission notes:

- 100 percent (36 hectares) of old growth forest incorrectly mapped.

- No new areas of old growth identified in this compartment.

Legend

▲ Bellangry11_Wpts_30Jan18
  Old Growth
  Rainforest
  NoOGRF
  Rainforest CRAFTi and RN17
  HCVOG

1:12,500 on A3

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& Heritage

Clouds Creek Compartment 124
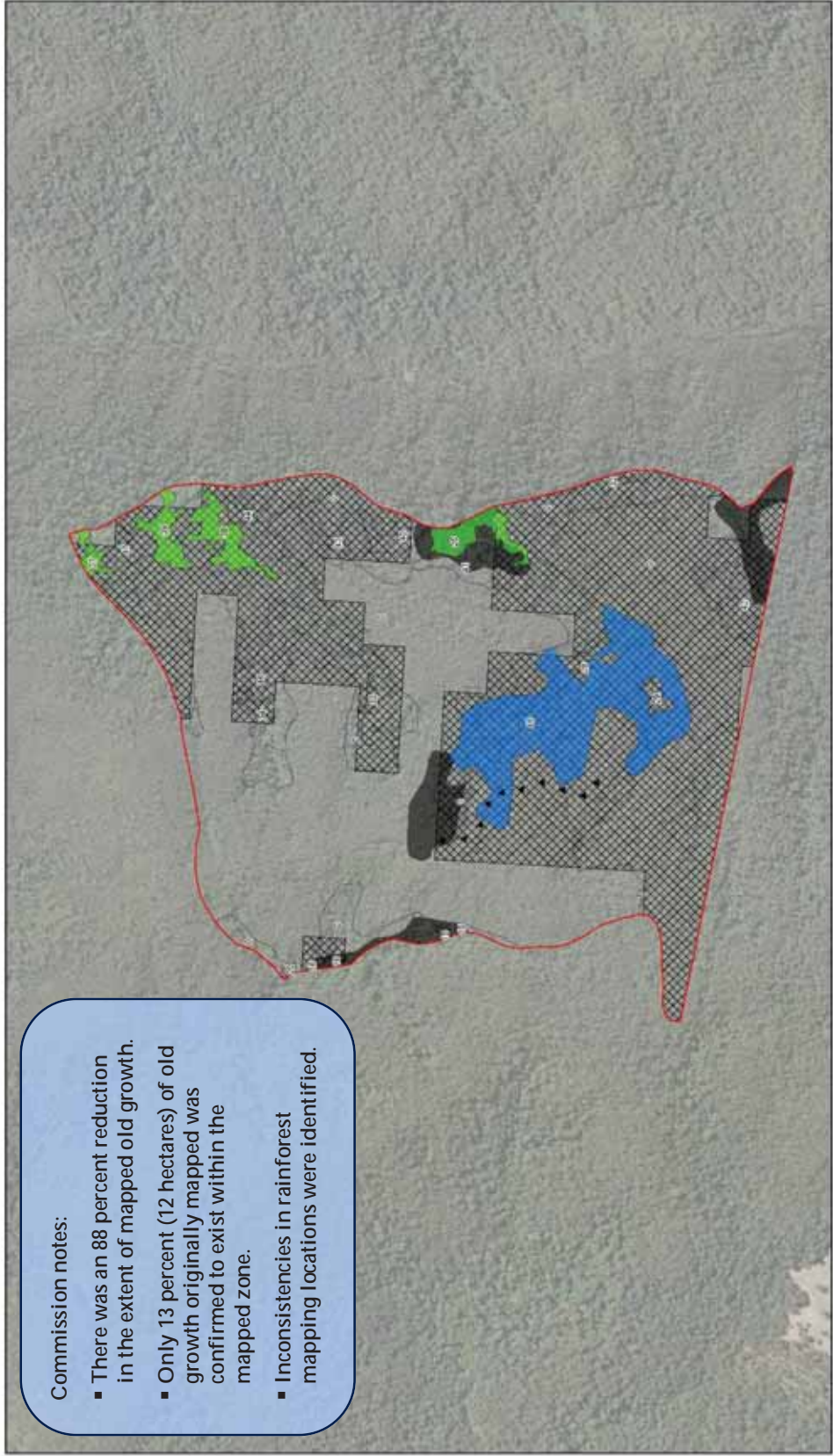
Data recorder: OEH Science

PNF Old Growth Field Transect Data Sheet (Revised 17 April 2012 with expanded instructions in header row)
Enter data in grey shaded cells. Enter distance (D) to nearest tree and average radius of crown (r) in metres. For null records (tree not present within 50m) enter lower case 'n' in D column. Record presence of disturbance with upper case 'Y'

	TRANSECT: 2			REQUEST: Clouds Creek Cpt 124			DATE: 29/01/2018			N.Westman, K.Christiansen, R.Lloyd, J.Well, B.Wilde			
Point	Regrowth			Mature			Senescent			Disturbance Indicators (Y/N)			
	D (n for null)	r	Area	D (n for null)	r	Area	D (n for null)	r	Area	1. Recent or Older Logging or Constructed Tracks	2. Exotic woody weeds	3. Stags or dieback	4. Grazing infra.
11	9	1	3.14	3	4.5	63.62	n		0.00	y			
12	2.5	3.5	38.48	4	2.5	19.63	n		0.00	y			
13	n		0.00	3.5	6.5	132.73	n		0.00				
14	8	3.5	38.48	8.5	7	153.94	23	10	314.16				
15	20	3	28.27	9	5.5	95.03	23	7.5	176.71	y			
16	10.5	3	28.27	2	4.5	63.62	26	12	452.39	y			
17	0.5	2.5	19.63	5	5	78.54	n		0.00	y		y	
18	1	2	12.57	4.5	3.5	38.48	18	3	28.27	y		y	
19	17.5	2.5	19.63	6.5	5	78.54	12	10	314.16	y			
20	4.5	1.5	7.07	3	5.5	95.03	n		0.00	y			
			0.00			0.00			0.00				
			0.00			0.00			0.00				
			0.00			0.00			0.00				
			0.00			0.00			0.00				
			0.00			0.00			0.00				
			0.00			0.00			0.00				
Sample Size	10			10			10			Total	Total	Total	Total
Average	8.2		21.7	4.9		81.9	20.4		257.1	8	0	2	0
Null Scores	1			0			5			%Disturb	%Disturb	%Disturb	%Disturb
Non Null Scores	9			10			5			80	0	20	0
Null Score ratio	0.1			0			0.5			Sign't	Not Sign't	Not Sign't	Not Sign't
Conv Factor	0.78			#N/A			0.34						

RESULTS

Old Growth at Transect:	No
Regrowth %:	6.6
Senescence %:	5.4
Disturbance >50%:	Yes

CALCULATIONS

Step2ab Reg.	2D	16.33 N	37.48
Step2ab_Mat.	2D	9.80 N	104.12
Step2ab_Sen.	2D	40.80 N	6.01

	Re-growth	Mature	Sen-escing	Total
Step2c	29	104	2	135
Step 3a	21.73	81.92	257.14	
Step 3b	635	8530	525	9690
Step 3c	6.6	88.0	5.4	100.0

Old Growth & Rainforest Remapping
Clouds Creek State Forest Cpts 124

Commission notes:

- There was an 88 percent reduction in the extent of mapped old growth.

- Only 13 percent (12 hectares) of old growth originally mapped was confirmed to exist within the mapped zone.

- Inconsistencies in rainforest mapping locations were identified.

Legend

- ▲ CloudsCreek_Wpts_29Jan18
- Old Growth
- Rainforest
- NoOGRF
- Rainforest CRAFT1 and RN17
- HCVOG

Office of Environment & Heritage

1:8,500 on A3

Datum/Projection GCS GDA 1994

Clouds Creek Compartment 167

Data recorder: OEH Science

PNF Old Growth Field Transect Data Sheet (Revised 17 April 2012 with expanded instructions in header row)
Enter data in grey shaded cells. Enter distance (D) to nearest tree and average radius of crown (r) in metres. For null records (tree not present within 30m) enter lower case 'n' in D column. Record presence of disturbance with upper case 'Y'

Point	TRANSECT: 1 Regrowth D (n for null)	r	Area	REQUEST: 167 Mature D (n for null)	r	Area	Clouds Creek Cpt DATE: 29/01/2018 Senescent D (n for null)	r	Area	N.Westman, K.Christiansen, R.Lloyd, J.Well, B.Wilde Disturbance Indicators (Y/N) 1. Recent or Older Logging or Constructed Tracks	2. Exotic woody weeds	3. Stags or dieback	4. Grazing infra.
1	3.5	1.75	9.62	2	4.5	63.62	12	8	201.06	y			
2	n		0.00	15.5	8	201.06	12	5	78.54				
3	20	2	12.57	3	1.5	7.07	5	5	78.54				
4	1.5	1.5	7.07	8	4	50.27	21	8.5	226.98	y			
5	13	2	12.57	10	8.5	226.98	23.5	12	452.39	y			
6	9	1.5	7.07	11.5	5	78.54	6	7	153.94	y			
7	2	2	12.57	15.4	4.5	63.62	10.5	7	153.94	y			
8	14	2.75	23.76	3	4	50.27	7	7.5	176.71				
9	1	1.5	7.07	9	4	50.27	n		0.00	y			
10	12	2.5	19.63	2	7.5	176.71	6	6	113.10	y			
			0.00			0.00			0.00				
			0.00			0.00			0.00				
			0.00			0.00			0.00				
			0.00			0.00			0.00				
			0.00			0.00			0.00				
Sample Size	10			10			10			Total	Total	Total	Total
Average	8.4		12.4	7.9		96.8	11.4		181.7	7	0	0	0
Null Scores	1			0			1			%Disturb	%Disturb	%Disturb	%Disturb
Non Null Scores	9			10			9			70	0	0	0
Null Score ratio	0.1			0			0.1			Sign't	Not Sign't	Not Sign't	Not Sign't
Conv Factor	0.78			#N/A			0.78						

RESULTS

Old Growth at Transect:	No
Regrowth %:	4.9
Senescence %:	39.3
Disturbance >50%:	Yes

CALCULATIONS

Step2ab Reg.	2D	16.89 N	35.06
Step2ab_Mat.	2D	15.88 N	39.66
Step2ab_Sen.	2D	22.89 N	19.09

	Re-growth	Mature	Sen-escing	Total
Step2c	27	40	15	82
Step 3a	12.44	96.84	181.69	
Step 3b	340	3840	2705	6885
Step 3c	4.9	55.8	39.3	100.0

Old Growth & Rainforest Remapping
Clouds Creek State Forest Cpts 167
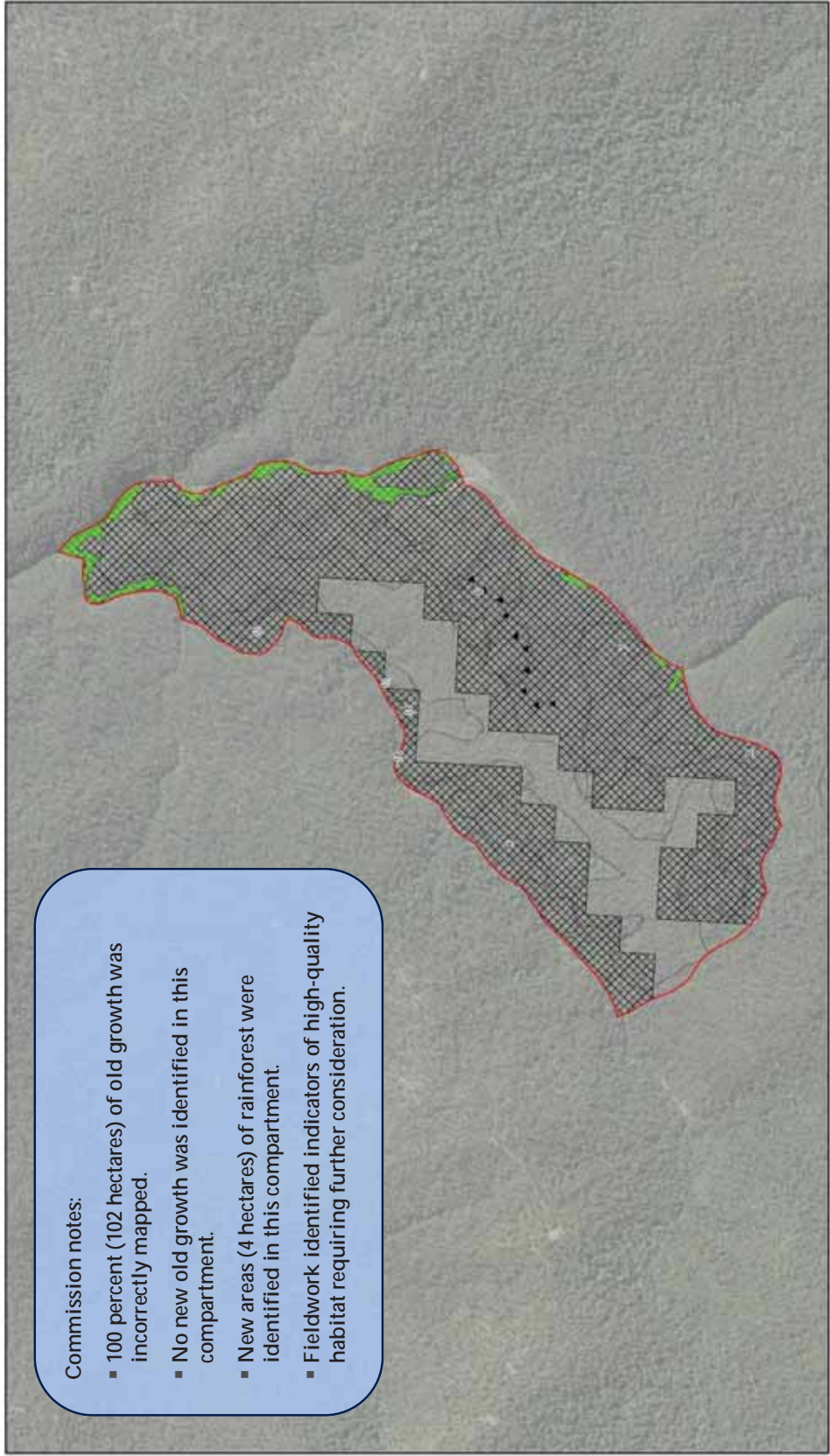
Commission notes:

- 100 percent (102 hectares) of old growth was incorrectly mapped.

- No new old growth was identified in this compartment.

- New areas (4 hectares) of rainforest were identified in this compartment.

- Fieldwork identified indicators of high-quality habitat requiring further consideration.

Legend

- CloudsCreek_Wpts_29Jan18
- Old Growth
- Rainforest
- NoOGRF
- Rainforest CRAFTi and RN17
- HCVOG

1:10,000 on A3

Datum/Projection GCS GDA 1994

Office of Environment & Heritage

NSW GOVERNMENT

Dalmorton Compartment 406

Field inspection notes:

- An assessment team visited the site; however, the compartment was quite inaccessible due to the slope being more than 35 degrees with a thick *Macrozamia* understorey, both of which posed safety issues.

- As such, observations could only be made from waypoints taken along roads or where access allowed walking. The compartment was very typical of the more inaccessible PNF areas commonly inspected by OEH staff.

- Due to these circumstances, the accuracy of this mapping relies heavily on quality aerial photographic interpretation by experienced operators. Decision support tools such as LiDAR and unmanned aerial vehicles (drones) are the only means of safely and accurately remapping these areas.

Commission notes:

- There was a significant difference between the location of originally mapped old growth forest and the currently mapped location.

- 72 hectares of old growth was originally incorrectly mapped.

- 56 hectares of new old growth was identified. Of this, 95 percent is mapped outside special management zone protection.

Old Growth & Rainforest Remapping
Dalmorton State Forest Cpts 406

1:8,500 on A3

Office of
Environment
& Heritage

NSW
GOVERNMENT

Legend

- Wpts_Dalmorton23Nov17
- Old Growth
- Rainforest
- NoOGRF
- Rainforest CRAFT1 and RN17
- HCVOG

Ewingar Compartment 635 & 637 (Desktop assessment only; no site visit conducted. The area was difficult to access and/or involved work health and safety issues. No field data sheets are available.)

Commission notes:

- There was an 84 percent reduction in the original extent of mapped old growth forest (hatched).

- 253 hectares of old growth was found to be incorrectly mapped.

- 47 hectares of old growth identified (blue).
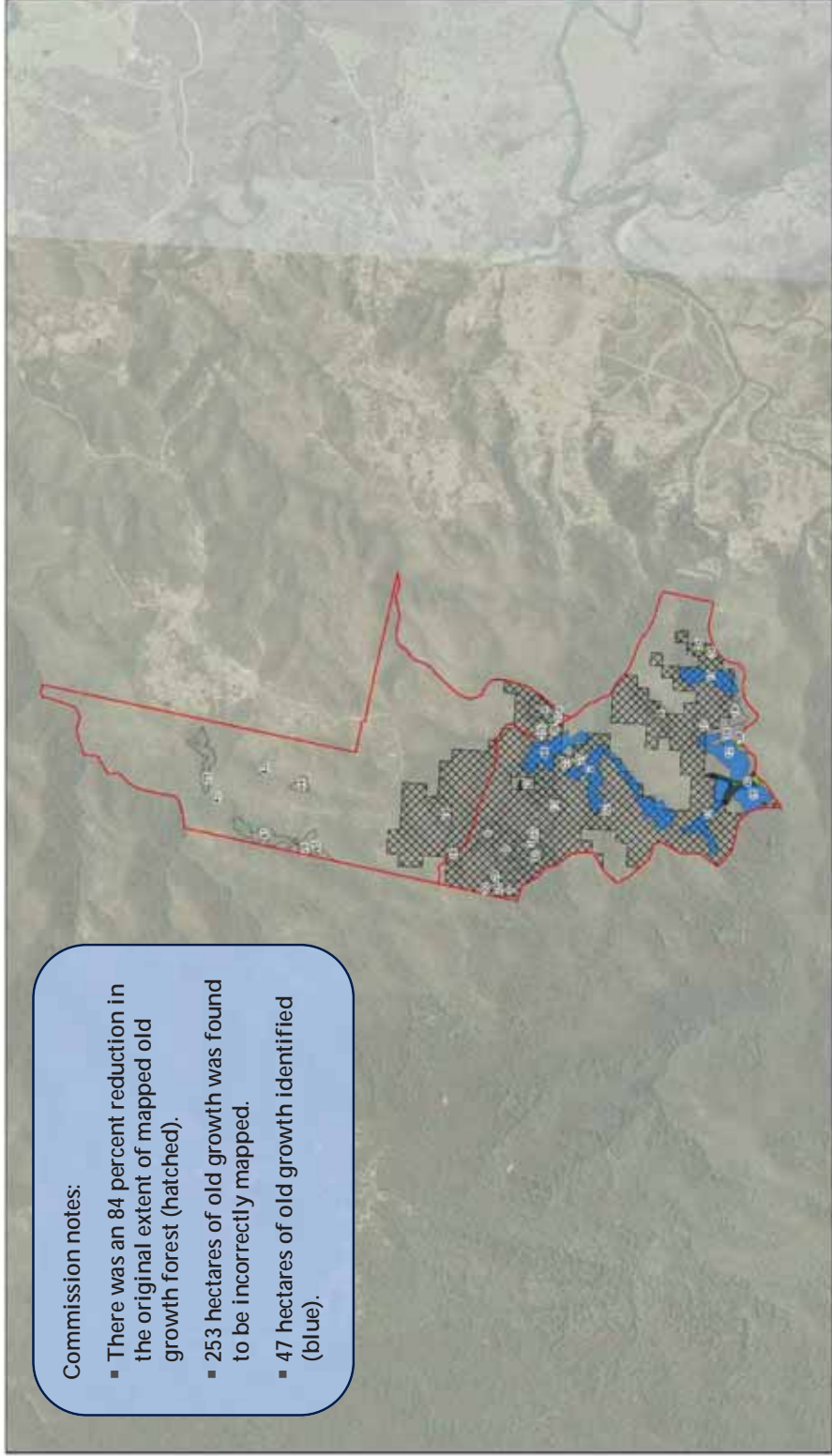
Old Growth & Rainforest Remapping
Ewingar State Forest Cpts 635 & 637

1:30,000 on A3

Office of Environment & Heritage

Legend

- Old Growth
- Rainforest
- NioOGRF
- Rainforest CRAFTi and RN17
- HCVOG

Girard Compartment 52 (Desktop assessment only; no site visit conducted. The area was difficult to access and/or involved work health and safety issues. No field data sheets are available.)
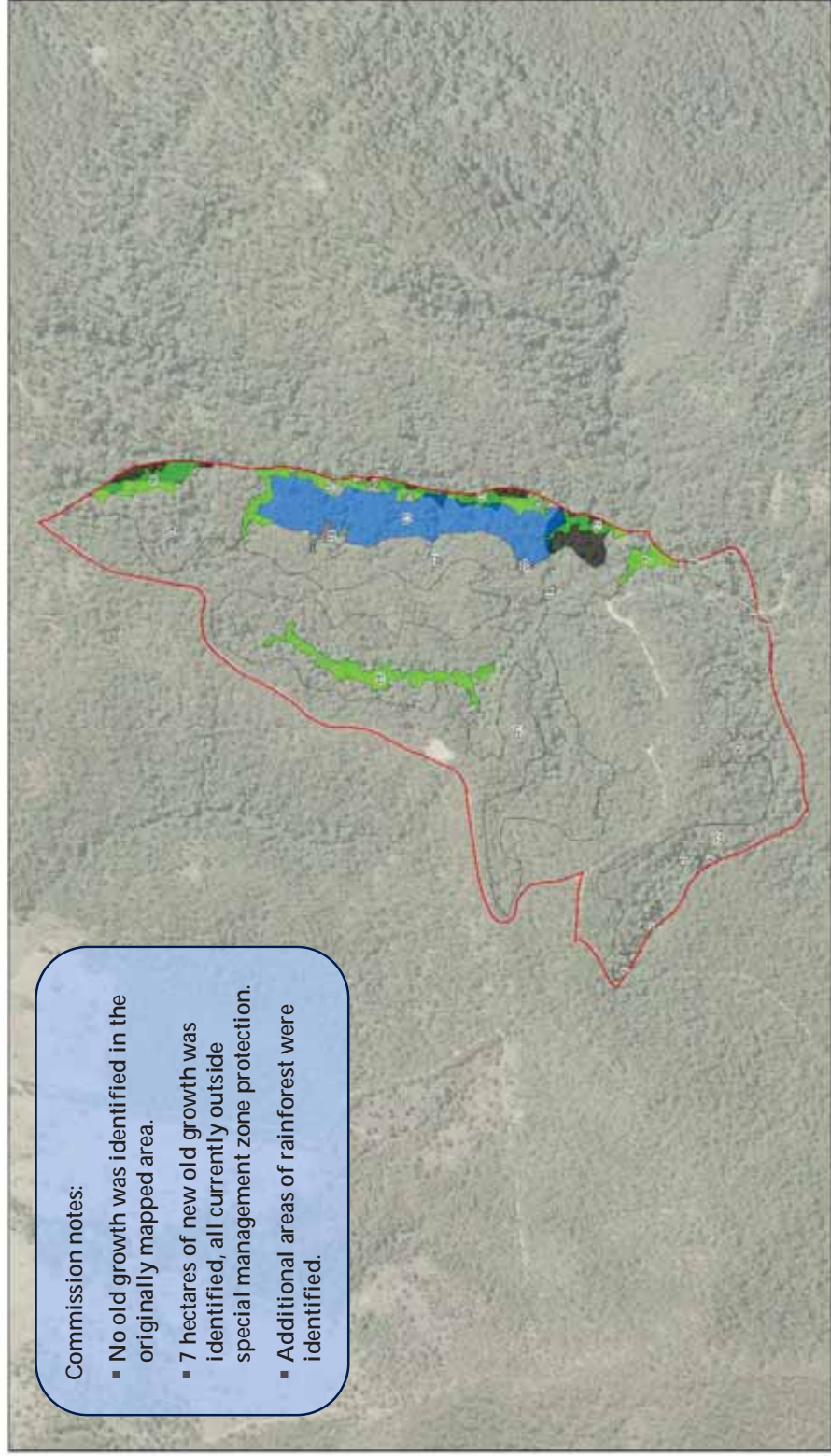
Commission notes:

- No old growth was identified in the originally mapped area.

- 7 hectares of new old growth was identified, all currently outside special management zone protection.

- Additional areas of rainforest were identified.

Old Growth & Rainforest Remapping
Girard State Forest Cpt 52

Legend

- Old Growth
- Rainforest
- NoOGRF
- Rainforest CRAFt) and RN17
- HCVOG

1:8,500 on A3

Office of
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& Heritage

Irishman Compartment 205 (Desktop assessment only; no field data sheets available.)
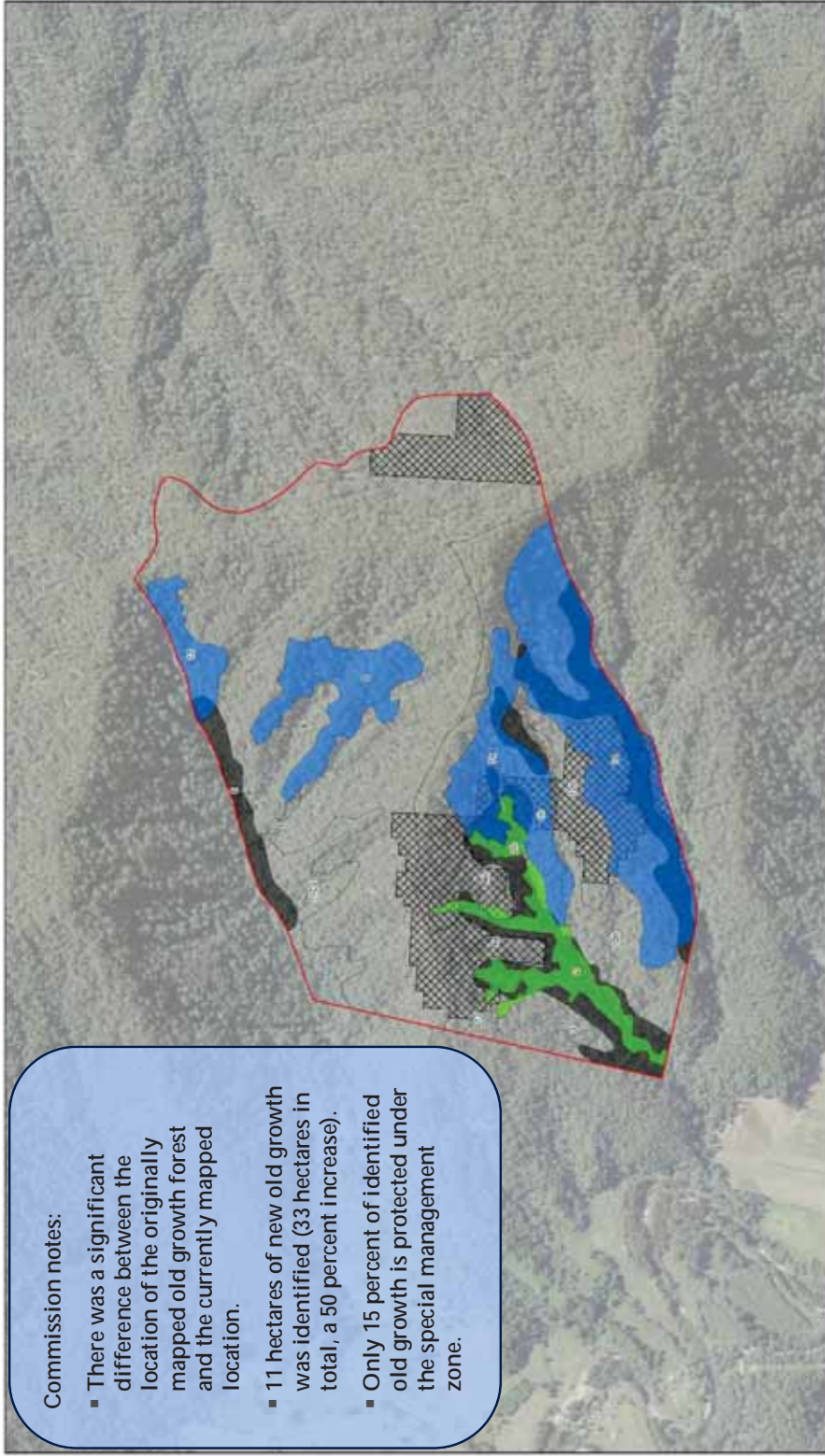
Commission notes:

- There was a significant difference between the location of the originally mapped old growth forest and the currently mapped location.

- 11 hectares of new old growth was identified (33 hectares in total, a 50 percent increase).

- Only 15 percent of identified old growth is protected under the special management zone.

Old Growth & Rainforest Remapping
Irishman State Forest Cpt 205

1:8,500 on A3

Office of Environment & Heritage

Legend

- Old Growth
- Rainforest
- NoOGRF
- Rainforest CRAFTI and RN17
- HCVOG

Kangaroo River Compartment 234

Data recorder: OEH Science

PNF Old Growth Field Transect Data Sheet (Revised 17 April 2012 with expanded instructions in header row)
Enter data in grey shaded cells. Enter distance (D) to nearest tree and average radius of crown (r) in metres. For null records (tree not present within 30m) enter lower case 'n' in D column. Record presence of disturbance with upper case 'Y'

Point	Regrowth D (n for null)	r	Area	Mature D (n for null)	r	Area	Senescent D (n for null)	r	Area	1. Recent or Older Logging or Constructed Tracks	2. Exotic woody weeds	3. Stags or dieback	4. Grazing infra.
TRANSECT: 1				REQUEST: Kangaroo River Cpt 234			DATE: 31/01/2018			Disturbance Indicators (Y/N)			
10	20	3	28.27	2.5	3	28.27	12	6	113.10				
11	14.5	2.5	19.63	8	3.5	38.48	24	10	314.16				
12	n		0.00	6	4.5	63.62	n		0.00				
			0.00			0.00			0.00				
			0.00			0.00			0.00				
			0.00			0.00			0.00				
			0.00			0.00			0.00				
			0.00			0.00			0.00				
			0.00			0.00			0.00				
			0.00			0.00			0.00				
			0.00			0.00			0.00				
			0.00			0.00			0.00				
			0.00			0.00			0.00				
			0.00			0.00			0.00				
			0.00			0.00			0.00				
Sample Size	3			3			3			Total	Total	Total	Total
Average	17.3		24.0	5.5		43.5	18.0		213.6	0	0	0	0
Null Scores	1			0			1			%Disturb	%Disturb	%Disturb	%Disturb
Non Null Scores	2			3			2			0	0	0	0
Null Score ratio	0.33			0			0.33			Not Sign't	Not Sign't	Not Sign't	Not Sign't
Conv Factor	0.5			#N/A			0.5						

RESULTS
Old Growth at Transect:	Yes
Regrowth %:	2.2
Senescence %:	18.2
Disturbance >50%:	No

CALCULATIONS

Step2ab				
Reg.	2D	34.50 N	8.40	
Step2ab_Mat.	2D	11.00 N	82.64	
Step2ab_Sen.	2D	36.00 N	7.72	

	Re-growth	Mature	Sen-escing	Total
Step2c	4	83	4	91
Step 3a	23.95	43.46	213.63	
Step 3b	101	3592	824	4517
Step 3c	2.2	79.5	18.2	100.0

Commission notes:

- There was a significant difference between the originally mapped location of old growth forest and the newly mapped location.

- 13 hectares of new old growth forest was identified (blue) (20 hectares in total, a 186 percent increase).

- No newly identified old growth forest is protected under the special management zone.

- Rainforest located in different areas than originally mapped.

Old Growth & Rainforest Remapping
Kangaroo River State Forest Cpt 234

1:17,500 on A3

Office of
Environment
& Heritage

Legend

- ▲ KangarooR_Wpts_31-Jan-18
- Old Growth
- Rainforest
- NoOGRF
- Rainforest CRAFTi and RN17
- HCVOG

Kippara Compartment 18

Data recorder: OEH Science

PNF Old Growth Field Transect Data Sheet (Revised 17 April 2012 with expanded instructions in header row)
Enter data in grey shaded cells. Enter distance (D) to nearest tree and average radius of crown (r) in metres. For null records (tree not present within 30m) enter lower case 'n' in D column. Record presence of disturbance with upper case 'Y'

	TRANSECT: T1			REQUEST: Kippara SF CPT18			DATE: 30/01/2018			s(OEH), N. Piercy(EPA), J. Bell(NRC), J. Williams			
Point	**Regrowth**			**Mature**			**Senescent**			**Disturbance Indicators (Y/N)**			
										1. Recent or Older Logging or Constructed Tracks	2. Exotic woody weeds	3. Stags or dieback	4. Grazing infra.
	D (n for null)	r	Area	D (n for null)	r	Area	D (n for null)	r	Area				
1	2.5	1	3.14	7	7	153.94	n		0.00	y		y	
2	18	0.5	0.79	4	4.5	63.62	n		0.00	y			
3	30	1	3.14	0.5	5	78.54	25	5.5	95.03	y			
4	0.5	3.5	38.48	4	4.5	63.62	n		0.00	y		y	
5	19	1	3.14	0.5	3	28.27	n		0.00	y			
6	8	0.5	0.79	5	4	50.27	8	6.5	132.73				
7	8	2.5	19.63	4	7	153.94	n		0.00				
8	16	2	12.57	1	5	78.54	n		0.00				
9	8	2	12.57	3	6	113.10	n		0.00				
10			0.00			0.00			0.00				
11			0.00			0.00			0.00				
12			0.00			0.00			0.00				
13			0.00			0.00			0.00				
14			0.00			0.00			0.00				
15			0.00			0.00			0.00				
Sample Size	9			9			9			Total	Total	Total	Total
Average	12.2		10.5	3.2		87.1	16.5		113.9	5	0	2	0
Null Scores	0			0			7			%Disturb	%Disturb	%Disturb	%Disturb
Non Null Scores	9			9			2			55.5555556	0	22.222	0
Null Score ratio	0			0			0.78			Sign't	Not Sign't	Not Sign't	Not Sign't
Conv Factor	#N/A			#N/A			0.13						

RESULTS

Old Growth at Transect:	No
Regrowth %:	0.8
Senescence %:	0.6
Disturbance >50%:	Yes

CALCULATIONS

Step2ab Reg.	2D	24.44 N		16.74	
Step2ab_Mat.	2D	6.44 N		240.78	
Step2ab_Sen.	2D	33.00 N		9.18	

	Re-growth	Mature	Sen-escing	Total
Step2c	17	241	1	259
Step 3a	10.47	87.09	113.88	
Step 3b	175	20970	136	21281
Step 3c	0.8	98.5	0.6	100.0

PNF Old Growth Field Transect Data Sheet (Revised 17 April 2012 with expanded instructions in header row)

Enter data in grey shaded cells. Enter distance (D) to nearest tree and average radius of crown (r) in metres. For null records (tree not present within 30m) enter lower case 'n' in D column. Record presence of disturbance with upper case 'Y'

TRANSECT: T2			REQUEST: Kippara SF CPT18			DATE: 30/01/2018			s(OEH), N. Piercy(EPA), J. Bell(NRC), J. Williams			
Point	**Regrowth**			**Mature**			**Senescent**			**Disturbance Indicators (Y/N)**			
										1. Recent or Older Logging or Constructed Tracks	2. Exotic woody weeds	3. Stags or dieback	4. Grazing infra.
	D (n for null)	r	Area	D (n for null)	r	Area	D (n for null)	r	Area				
1	0.5	1	3.14	13	7	153.94	n		0.00	y			
2	9	1.5	7.07	4	2.5	19.63	7	5	78.54	y			
3	5	0.5	0.79	1	7	153.94	7	3	28.27	n			
4	12	1	3.14	2	8	201.06	13	8	201.06	y			
5	15	1	3.14	7	7	153.94	4	6	113.10	y			
6	16	0.5	0.79	3	5	78.54	12	3.5	38.48	y			
7	6	0.5	0.79	2	5	78.54	n		0.00	y			
8			0.00			0.00			0.00				
9			0.00			0.00			0.00				
10			0.00			0.00			0.00				
11			0.00			0.00			0.00				
12			0.00			0.00			0.00				
13			0.00			0.00			0.00				
14			0.00			0.00			0.00				
15			0.00			0.00			0.00				
Sample Size	7			7			7			Total	Total	Total	Total
Average	9.1		2.7	4.6		119.9	8.6		91.9	6	0	0	0
Null Scores	0			0			2			%Disturb	%Disturb	%Disturb	%Disturb
Non Null Scores	7			7			5			85.7142857	0	0	0
Null Score ratio	0			0			0.29			Sign't	Not Sign't	Not Sign't	Not Sign't
Conv Factor	#N/A			#N/A			0.54						

RESULTS

Old Growth at Transect:	No
Regrowth %:	0.5
Senescence %:	10.4
Disturbance >50%:	Yes

CALCULATIONS

Step2ab				
Reg.	2D	18.14 N	30.38	
Step2ab_Mat.	2D	9.14 N	119.63	
Step2ab_Sen.	2D	17.20 N	33.80	

	Re-growth	Mature	Sen-escing	Total
Step2c	30	120	18	168
Step 3a	2.69	119.94	91.89	
Step 3b	82	14348	1677	16107
Step 3c	0.5	89.1	10.4	100.0

Old Growth & Rainforest Remapping
Kippara State Forest Cpt 18

Commission notes:

- The was a significant difference between the location of originally mapped old growth forest and the currently mapped location.

- 6 hectares of new old growth forest was identified (44 hectares in total).

- Only 14 percent of identified old growth is protected by the special management zone.

Lower Bucca Compartment 600

Data recorder: OEH Science

PNF Old Growth Field Transect Data Sheet (Revised 17 April 2012 with expanded instructions in header row)

Enter data in grey shaded cells. Enter distance (D) to nearest tree and average radius of crown (r) in metres. For null records (tree not present within 30m) enter lower case 'n' in D column. Record presence of disturbance with upper case 'Y'

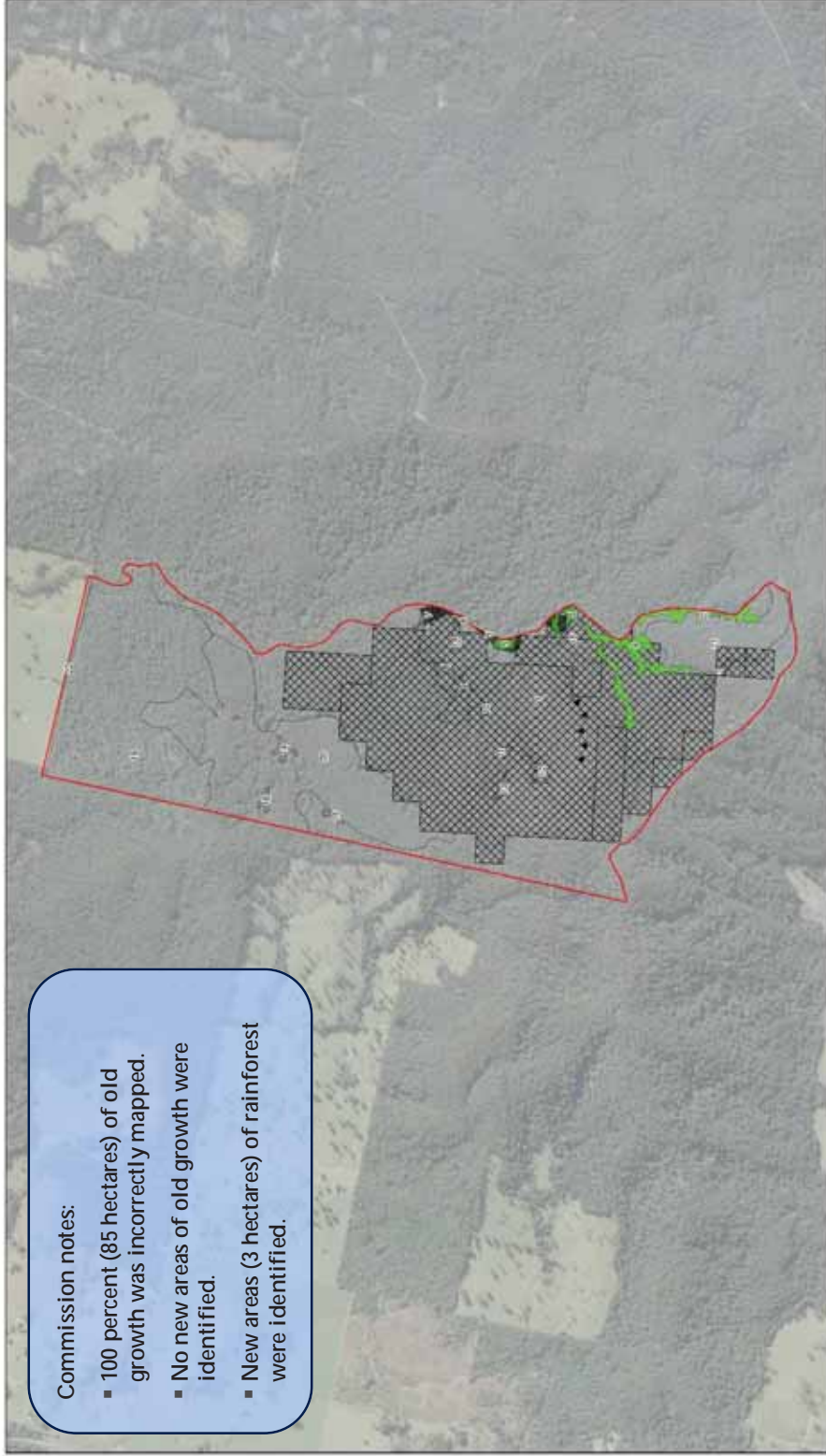| Point	Regrowth			Mature			Senescent			Disturbance Indicators (Y/N)			
	D (n for null)	r	Area	D (n for null)	r	Area	D (n for null)	r	Area	1. Recent or Older Logging or Constructed Tracks	2. Exotic woody weeds	3. Stags or dieback	4. Grazing infra.
1	9.5	2.5	19.63	0.5	4.5	63.62	n		0.00	y	y		
2	4	1	3.14	1.5	3	28.27	16	4.5	63.62		y		y
3	2.5	1	3.14	1	5	78.54	n		0.00	y	y		
4	3.5	1	3.14	4	1	3.14	11	5	78.54	y			
5	13	1.5	7.07	2	4	50.27	23	6	113.10		y		
6			0.00			0.00			0.00				
7			0.00			0.00			0.00				
8			0.00			0.00			0.00				
9			0.00			0.00			0.00				
10			0.00			0.00			0.00				
11			0.00			0.00			0.00				
12			0.00			0.00			0.00				
13			0.00			0.00			0.00				
14			0.00			0.00			0.00				
15			0.00			0.00			0.00				
Sample Size	5			5			5			Total	Total	Total	Total
Average	6.5		7.2	1.8		44.8	16.7		85.1	3	4	0	1
Null Scores	0			0			2			%Disturb	%Disturb	%Disturb	%Disturb
Non Null Scores	5			5			3			60	80	0	20
Null Score ratio	0			0			0.4			Sign't	Sign't	Not Sign't	Not Sign't
Conv Factor	#N/A			#N/A			0.43						

TRANSECT: 2 REQUEST: Lower Bucca SF DATE: 22/11/2017 N.Westman, G.Hodgins

RESULTS

Old Growth at Transect:	No
Regrowth %:	1.2
Senescence %:	0.9
Disturbance >50%:	Yes

CALCULATIONS

Step2ab				
Reg.	2D	13.00 N	59.17	
Step2ab_Mat.	2D	3.60 N	771.60	
Step2ab_Sen.	2D	33.33 N	9.00	

	Re-growth	Mature	Sen-escing	Total
Step2c	59	772	4	835
Step 3a	7.23	44.77	85.08	
Step 3b	428	34545	329	35302
Step 3c	1.2	97.9	0.9	100.0

Old Growth & Rainforest Remapping
Lower Bucca State Forest Cpt 600

Commission notes:

- 100 percent (85 hectares) of old growth was incorrectly mapped.

- No new areas of old growth were identified.

- New areas (3 hectares) of rainforest were identified.

Legend

▲ Wpts_LowerBucca_22Nov17
  Old Growth
  Rainforest
  NoOGRF
  Rainforest CRAFTi and RN17
  HCVOG

Office of
Environment
& Heritage

1:12,500 on A3

Mistake Compartment 341

Data recorder: OEH Science

PNF Old Growth Field Transect Data Sheet (Revised 17 April 2012 with expanded instructions in header row)
Enter data in grey shaded cells. Enter distance (D) to nearest tree and average radius of crown (r) in metres. For null records (tree not present within 50m) enter lower case 'n' in D column. Record presence of disturbance with upper case 'Y'

	TRANSECT: T1			REQUEST: Mistake SF CPT34			DATE: 31/01/2018			N(OEH), N. Piercy(EPA), J. Bell(NRC), M. Dobson			
Point	Regrowth			Mature			Senescent			Disturbance Indicators (Y/N)			
	D (n for null)	r	Area	D (n for null)	r	Area	D (n for null)	r	Area	1. Recent or Older Logging or Constructed Tracks	2. Exotic woody weeds	3. Stags or dieback	4. Grazing infra.
1	3	1	3.14	13	5	78.54	n		0.00	n	y		
2	3	1	3.14	8	3	28.27	21	7	153.94	n	y		
3	5	3	28.27	3	4.5	63.62	n		0.00	y	y		
4	15	1	3.14	4	5	78.54	n		0.00	y	n		
5	2	3	28.27	9	5.5	95.03	n		0.00	y	y		
6	4	1.5	7.07	5	3.5	38.48	n		0.00	y	y		
7			0.00			0.00			0.00				
8			0.00			0.00			0.00				
9			0.00			0.00			0.00				
10			0.00			0.00			0.00				
11			0.00			0.00			0.00				
12			0.00			0.00			0.00				
13			0.00			0.00			0.00				
14			0.00			0.00			0.00				
15			0.00			0.00			0.00				
Sample Size	6			6			6			Total	Total	Total	Total
Average	5.3		12.2	7.0		63.8	21.0		153.9	4	5	0	0
Null Scores	0			0			5			%Disturb	%Disturb	%Disturb	%Disturb
Non Null Scores	6			6			1			66.6666667	83.3333	0	0
Null Score ratio	0			0			0.83			Sign't	Sign't	Not Sign't	Not Sign't
Conv Factor	#N/A			#N/A			0.1						

RESULTS
Old Growth at Transect:	No
Regrowth %:	24.3
Senescence %:	2.0
Disturbance >50%:	Yes

CALCULATIONS

Step2ab Reg.	2D	10.67 N	87.89	
Step2ab_Mat.	2D	14.00 N	51.02	
Step2ab_Sen.	2D	42.00 N	5.67	

	Re-growth	Mature	Sen-escing	Total
Step2c	88	51	1	139
Step 3a	12.17	63.75	153.94	
Step 3b	1070	3253	87	4409
Step 3c	24.3	73.8	2.0	100.0

Old Growth & Rainforest Remapping
Mistake State Forest Cpt 341
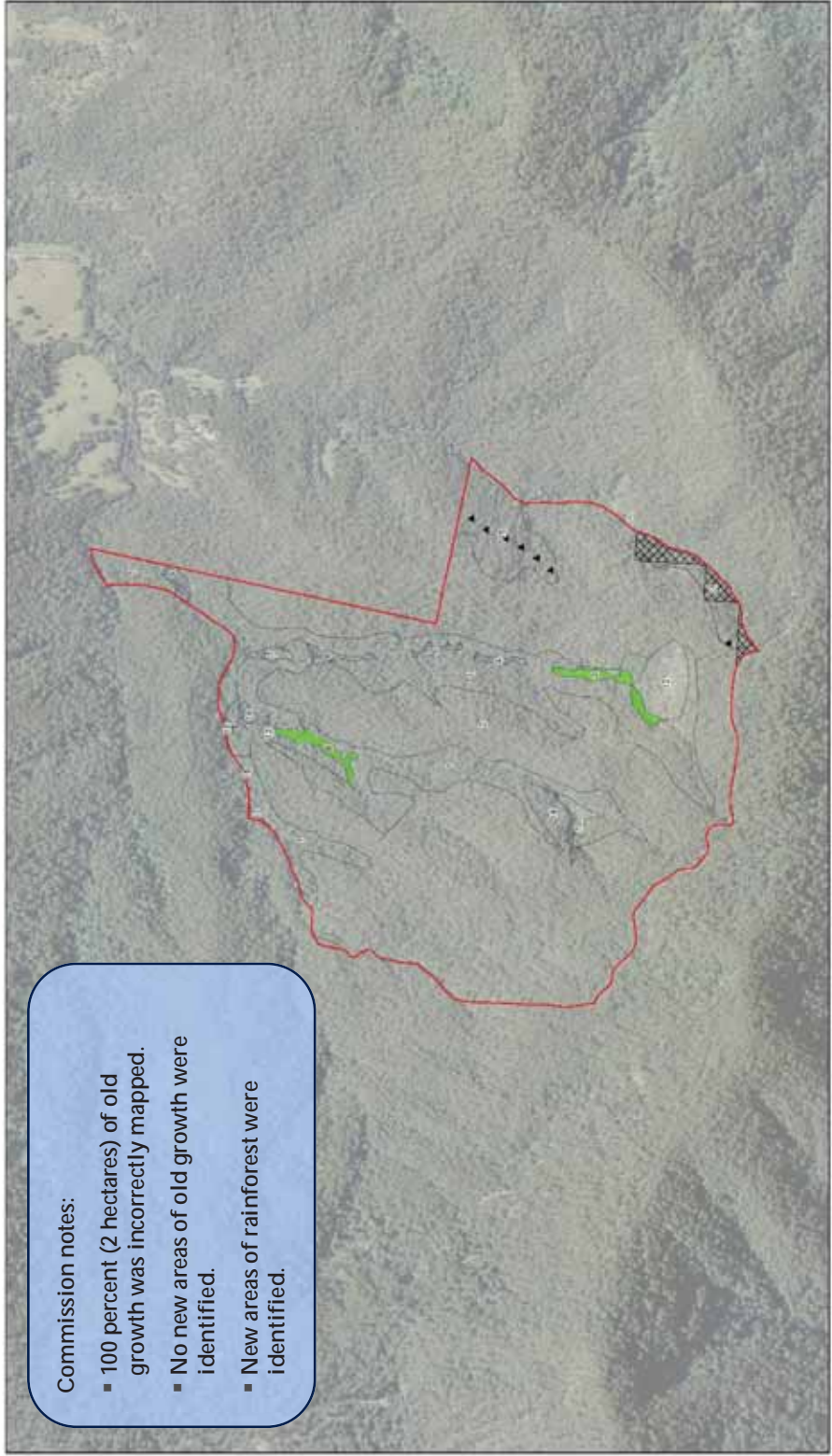
Commission notes:

- 100 percent (2 hectares) of old growth was incorrectly mapped.
- No new areas of old growth were identified.
- New areas of rainforest were identified.

Legend

MistakeCpt341_wrt_20180131

Old Growth
Rainforest
NoOGRF
Rainforest CRAFTi and RN17
HCVOG

1:10,000 on A3

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& Heritage

Nambucca Compartment 320

Data recorder: OEH Science

PNF Old Growth Field Transect Data Sheet (Revised 17 April 2012 with expanded instructions in header row)

Enter data in grey shaded cells. Enter distance (D) to nearest tree and average radius of crown (r) in metres. For null records (tree not present within 50m) enter lower case 'n' in D column. Record presence of disturbance with upper case 'Y'
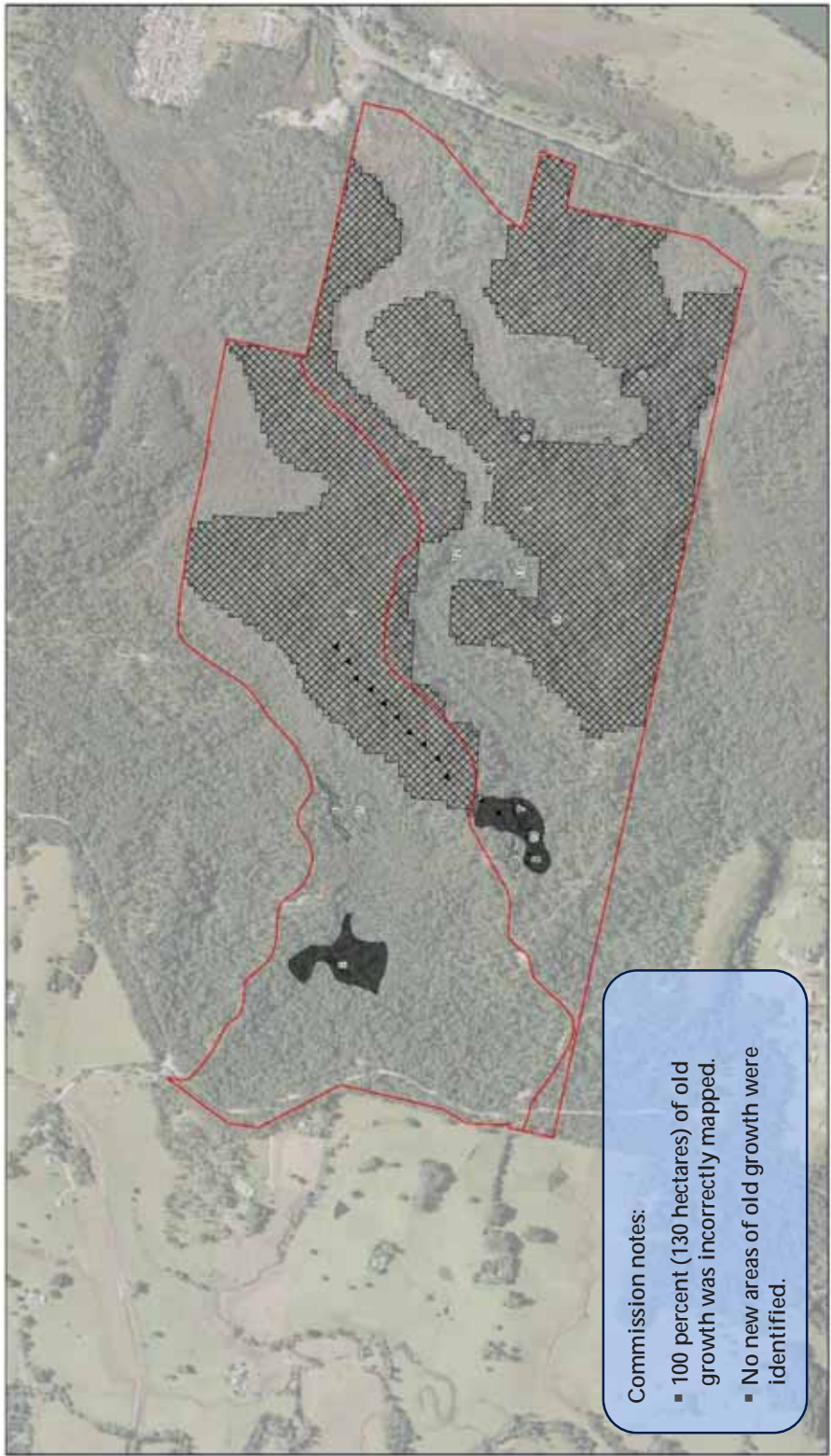
Point	TRANSECT: 1 Regrowth D (n for null)	r	Area	REQUEST: Nambucca SF Mature D (n for null)	r	Area	DATE: 22/11/2017 Senescent D (n for null)	r	Area	N.Westman, G.Hodgins Disturbance Indicators (Y/N) 1. Recent or Older Logging or Constructed Tracks	2. Exotic woody weeds	3. Stags or dieback	4. Grazing infra.
1	3	1	3.14	3	1.5	7.07	n		0.00	y			
2	1.5	4	50.27	3	4	50.27	n		0.00	y			y
3	2.5	1	3.14	5	3	28.27	8.5	6	113.10	y			
4	3.5	2	12.57	3	3.5	38.48	n		0.00	y			
5	5.5	1.5	7.07	11	6.5	132.73	n		0.00	y			
6	9	1	3.14	1	7	153.94	n		0.00	y			
7	7	1	3.14	4	3.5	38.48	n		0.00	y			
8	5	2	12.57	2.5	5.5	95.03	n		0.00	y			
9	8.5	2.5	19.63	0.5	3	28.27	n		0.00	y			
10	8	3	28.27	8	6.5	132.73	n		0.00	y			y
11			0.00			0.00			0.00				
12			0.00			0.00			0.00				
13			0.00			0.00			0.00				
14			0.00			0.00			0.00				
15			0.00			0.00			0.00				
Sample Size	10			10			10			Total	Total	Total	Total
Average	5.4		14.3	4.1		70.5	8.5		113.1	10	0	0	2
Null Scores	0			0			9			%Disturb	%Disturb	%Disturb	%Disturb
Non Null Scores	10			10			1			100	0	0	20
Null Score ratio	0			0			0.9			Sign't	Not Sign't	Not Sign't	Not Sign't
Conv Factor	#N/A			#N/A			0.06						

RESULTS

Old Growth at Transect:	No
Regrowth %:	10.4
Senescence %:	2.0
Disturbance >50%:	Yes

CALCULATIONS

Step2ab
Reg.	2D	10.70 N	87.34
Step2ab_Mat.	2D	8.20 N	148.72
Step2ab_Sen.	2D	17.00 N	34.60

	Re-growth	Mature	Sen-escing	Total	
Step2c	87	149	2		238
Step 3a	14.29	70.53	113.10		
Step 3b	1248	10489	235		11972
Step 3c	10.4	87.6	2.0		100.0

Old Growth & Rainforest Remapping
Nambucca State Forest Cpts 320 & 321

Commission notes:

- 100 percent (130 hectares) of old growth was incorrectly mapped.

- No new areas of old growth were identified.

Legend
- Wpts_Nambucca_22Nov17
- Old Growth
- Rainforest
- NoOGRF
- Rainforest CRAFTi and RN17
- HCVOG

Office of
Environment
& Heritage

1:10,000 on A3

Wild Cattle Creek Compartment 515

Data recorder: OEH Science

PNF Old Growth Field Transect Data Sheet (Revised 17 April 2012 with expanded instructions in header row)

Enter data in grey shaded cells. Enter distance (D) to nearest tree and average radius of crown (r) in metres. For null records (tree not present within 30m) enter lower case 'n' in D column. Record presence of disturbance with upper case 'Y'

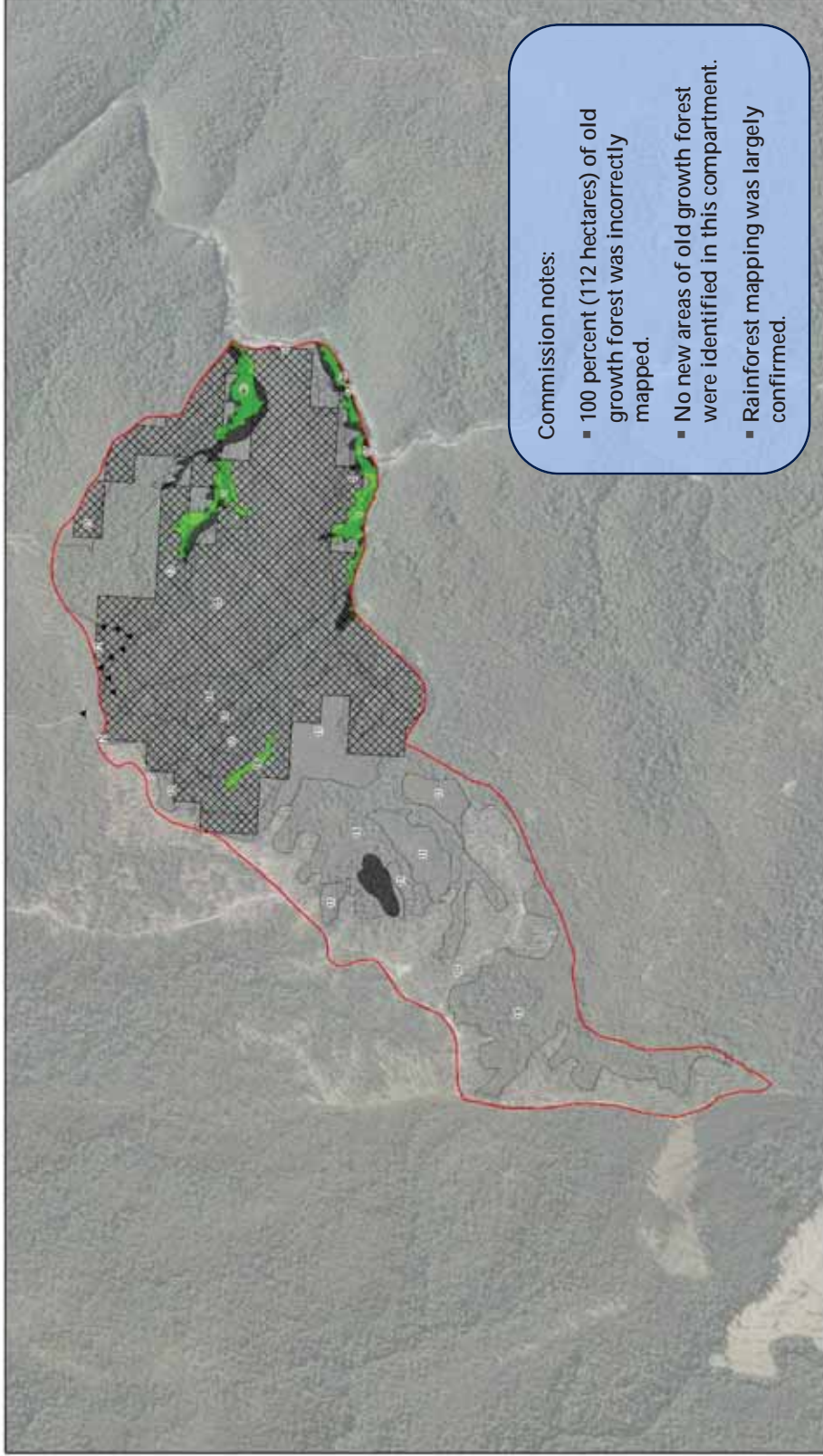| Point	TRANSECT: 1 Regrowth			Mature			Senescent			Disturbance Indicators (Y/N)			
				REQUEST: 515 Wild Cattle Ck Cpt			DATE: 31/01/2018			1. Recent or Older Logging or Constructed Tracks	2. Exotic woody weeds	3. Stags or dieback	4. Grazing infra.
	D (n for null)	r	Area	D (n for null)	r	Area	D (n for null)	r	Area				
2	3.5	2.25	15.90	2	3	28.27	n		0.00	y			
3	5.5	1.5	7.07	1	3	28.27	25	10	314.16	y			
4	3.5	2	12.57	3	4.25	56.75	25	6	113.10	y			
5	9	2.5	19.63	4.5	7	153.94	n		0.00				
6	10.5	2	12.57	3.5	5	78.54	7	4	50.27	y			
7	3.5	2	12.57	5	4.5	63.62	18.5	4.5	63.62	y			
8	4	1.5	7.07	2.5	2.5	19.63	1	2.5	19.63				
9	1	3	28.27	6	4	50.27	29	9	254.47				
			0.00			0.00			0.00				
			0.00			0.00			0.00				
			0.00			0.00			0.00				
			0.00			0.00			0.00				
			0.00			0.00			0.00				
			0.00			0.00			0.00				
			0.00			0.00			0.00				
Sample Size	8			8			8			Total	Total	Total	Total
Average	5.1		14.5	3.4		59.9	17.6		135.9	6	0	0	0
Null Scores	0			0			2			%Disturb	%Disturb	%Disturb	%Disturb
Non Null Scores	8			8			6			75	0	0	0
Null Score ratio	0			0			0.25			Sign't	Not Sign't	Not Sign't	Not Sign't
Conv Factor	#N/A			#N/A			0.58						

RESULTS

Old Growth at Transect:	No
Regrowth %:	9.6
Senescence %:	4.3
Disturbance >50%:	Yes

CALCULATIONS

Step2ab Reg.	2D	10.13 N	97.55	
Step2ab_Mat.	2D	6.88 N	211.57	
Step2ab_Sen.	2D	35.17 N	8.09	

	Re-growth	Mature	Sen-escing	Total
Step2c	98	212	5	314
Step 3a	14.46	59.91	135.87	
Step 3b	1411	12675	637	14723
Step 3c	9.6	86.1	4.3	100.0

Old Growth & Rainforest Remapping
Wild Cattle Creek State Forest Cpt 515

Commission notes:

- 100 percent (112 hectares) of old growth forest was incorrectly mapped.

- No new areas of old growth forest were identified in this compartment.

- Rainforest mapping was largely confirmed.

1:12,500 on A3

Office of Environment & Heritage

Legend

- WildCattleCk_Wpts_31Jan18
- Old Growth
- Rainforest
- NoOGRF
- Rainforest CRAFTi and RN17
- HCVOG

Appendix 8 – Additional forest ecosystem mapping data

Table A8.1: Old growth forest ecosystem types found at each sample site

State forest (compartment)	Assessed old growth forest ecosystem type (and number)	Commercial interest?	Over-target old growth forest ecosystem?	Area (ha)
1. Bellangry (11)	67. High-Elevation Ferny Blackbutt	Yes	Yes	15.7
	155. Wet Foothills Blackbutt-Turpentine	Yes	Yes	15.2
	32. Dry Foothills Blackbutt-Turpentine	Yes	No	3.2
	106. Open Coastal Brushbox	No	No	0.6
2. Clouds Creek (124)	67. High-Elevation Ferny Blackbutt	Yes	Yes	19.8
	84. Mid North Coast Wet Brushbox-Tallowwood-Blue Gum	Yes	Yes	59.8
	157. Wet Shrubby Brushbox-Tallowwood	Yes	Yes	4.9
	35. Dry Grassy Stringybark	No	Yes	0.6
	60. Grassy New England Blackbutt - Tallowwood	No	Yes	0.5
	69. High-Elevation Moist Open Tallowwood – Blue Gum	No	Yes	0.3
	88. Moist Escarpment New England Blackbutt	No	Yes	0.7
	91. Moist Open Escarpment White Mahogany	No	Yes	0.4
3. Clouds Creek (167)	19. Central Mid-Elevation Sydney Blue Gum	Yes	Yes	3.9
	33. Dry Foothills Spotted Gum	Yes	Yes	17.2
	59. Gorge Ironbark-Grey Gum	Yes	Yes	14.8
	84. Mid North Coast Wet Brushbox-Tallowwood-Blue Gum	Yes	Yes	6.6
	89. Moist Foothills Spotted Gum	Yes	Yes	20.2
	100. Northern Grassy Sydney Blue Gum	Yes	Yes	9.3
	135. South Coast Tallowwood-Blue Gum	Yes	Yes	0.4
	48. Escarpment Scribbly Gum-Apple	No	Yes	24.6
	69. High-Elevation Moist Open Tallowwood–Blue Gum	No	Yes	0.6
4. Dalmorton (406)	33. Dry Foothills Spotted Gum	Yes	Yes	67.3
	89. Moist Foothills Spotted Gum	Yes	Yes	1.3
	103. Northern Wet Brushbox	No	Yes	3.1
	157. Wet Shrubby Brushbox-Tallowwood	Yes	Yes	1.4
5. Ewingar (635, 637)	33. Dry Foothills Spotted Gum	Yes	Yes	189.0
	59. Gorge Ironbark-Grey Gum	Yes	Yes	1.6
	70. High-Elevation Open Spotted Gum	Yes	Yes	1.1
	89. Moist Foothills Spotted Gum	Yes	Yes	34.4
	109. Open Shrubby Brushbox-Tallowwood	Yes	Yes	49.3
	158. Wet Spotted Gum-Tallowwood	Yes	Yes	1.9
	24. Clarence Lowlands Spotted Gum	Yes	No	2.7
	52. Foothill Grey Gum–Ironbark–Spotted Gum	Yes	No	2.1
6. Girard (52)	No old growth forest ecosystems mapped in this compartment			
7. Irishman (205)	67. High-Elevation Ferny Blackbutt	Yes	Yes	2.0
	83. Mid-Elevation Wet Blackbutt	Yes	Yes	2.5
	155. Wet Foothills Blackbutt-Turpentine	Yes	Yes	10.3
	49. Escarpment Tallowwood-Bloodwood	No	Yes	0.1

State forest (compartment)	Assessed old growth forest ecosystem type (and number)	Commercial interest?	Over-target old growth forest ecosystem?	Area (ha)
	36. Dry Grassy Tallowwood–Grey Gum	Yes	No	0.1
	106. Open Coastal Brushbox	No	No	4.8
8. Kangaroo River (234)	33. Dry Foothills Spotted Gum	Yes	Yes	0.1
	89. Moist Foothills Spotted Gum	Yes	Yes	3.8
	106. Open Coastal Brushbox	No	Yes	2.0
9. Kippara (18)	67. High-Elevation Ferny Blackbutt	Yes	Yes	24.3
	155. Wet Foothills Blackbutt–Turpentine	Yes	Yes	5.2
	49. Escarpment Tallowwood–Bloodwood	No	Yes	0.1
	32. Dry Foothills Blackbutt–Turpentine	Yes	No	1.9
	50. Wet Bangalow-Brushbox	No	No	0.1
10. Lower Bucca (600)	89. Moist Foothills Spotted Gum	Yes	Yes	2.7
	135. South Coast Tallowwood-Blue Gum	Yes	Yes	24.8
	153. Wet Coastal Tallowwood-Brushbox	Yes	Yes	2.0
	106. Open Coastal Brushbox	No	Yes	1.5
	55. Foothills Grey Gum-Spotted Gum	Yes	No	33.8
11. Mistake (341)	155. Wet Foothills Blackbutt-Turpentine	Yes	Yes	0.1
	49. Escarpment Tallowwood-Bloodwood	No	Yes	0.3
	36. Dry Grassy Tallowwood–Grey Gum	Yes	No	1.5
12. Nambucca (320,321)	65. Heathy Scribbly Gum	No	Yes	23.3
	74. Lowland Scribbly Gum	No	Yes	3.0
	34. Dry Grassy Blackbutt-Tallowwood	Yes	No	87.4
13. Wild Cattle Creek (341)	33. Dry Foothills Spotted Gum	Yes	Yes	0.5
	34. Dry Grassy Blackbutt-Tallowwood	Yes	Yes	0.6
	36. Dry Grassy Tallowwood–Grey Gum	Yes	Yes	1.8
	67. High-Elevation Ferny Blackbutt	Yes	Yes	22.4
	84. Mid North Coast Wet Brushbox-Tallowwood-Blue Gum	Yes	Yes	31.3
	135. South Coast Tallowwood-Blue Gum	Yes	Yes	12.7
	157. Wet Shrubby Brushbox-Tallowwood	Yes	Yes	19.5
	105. Nymboida Tallowwood-Turpentine	No	Yes	18.0

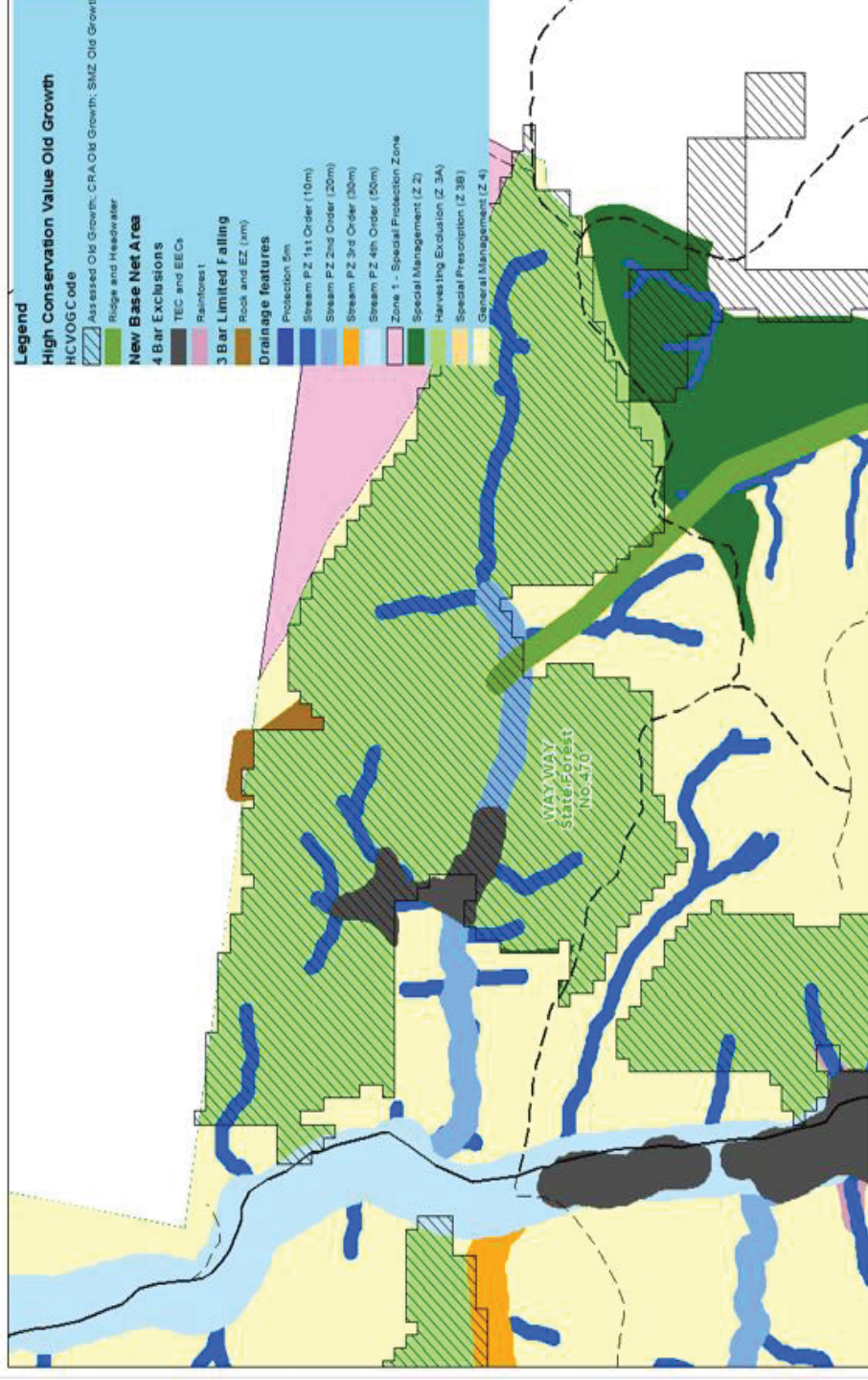# Appendix 9 – FCNSW's method of calculating wood supply

- The Commission requested that FCNSW estimate wood supply volumes.

- FCNSW provided the information in good faith on the basis of information believed to be reliable at the time of preparation.

- Volume estimates and forecasts are inherently uncertain and actual results are likely to differ from that forecast. As such, FCNSW makes no representations (express or implied) as to the accuracy, reliability or completeness of the information provided to the Commission.

Note: Text, figures and tables in this section have been provided by FCNSW.

1   Assess gross area to base net area.

2   Identify base net area of HCVOG ecosystems that are over target.

3   Consider maximum area of ecosystems that can be included due to JANIS targets.

4   Factor in an adjustment for small areas, areas that remain old growth forest through remapping, and areas otherwise not considered worthwhile for review (approximately 70 percent).

5   Review at IFOA region and commercial forest ecosystems to undertake timber assessment.

Step 1: Key results

- Identify the potential base net area of HCVOG polygons.
- Intersect old growth polygons and base net area exclusions.
- Gross area to base net area assessment result: 110,888 hectares of mapped HCVOG reduced to 57,836 hectares.

Legend

High Conservation Value Old Growth

HCVOG Code
- Assessed Old Growth; CRA Old Growth; SMZ Old Growth
- Ridge and Headwater

New Base Net Area

4 Bar Exclusions
- TEC and EECs
- Rainforest

3 Bar Limited Falling
- Rock and EZ (xm)

Drainage features
- Protection 5m
- Stream PZ 1st Order (10m)
- Stream PZ 2nd Order (20m)
- Stream PZ 3rd Order (30m)
- Stream PZ 4th Order (50m)
- Zone 1 - Special Protection Zone
- Special Management (Z 2)
- Harvesting Exclusion (Z 3A)
- Special Prescription (Z 3B)
- General Management (Z 4)

WAYWAY STATE Forest No.470

Legend

High Conservation Value Old Growth

HCVOG Code

Assessed Old Growth; CRA Old Growth; SMZ Old Growth

HCVOG - BNA and SLope Overlay

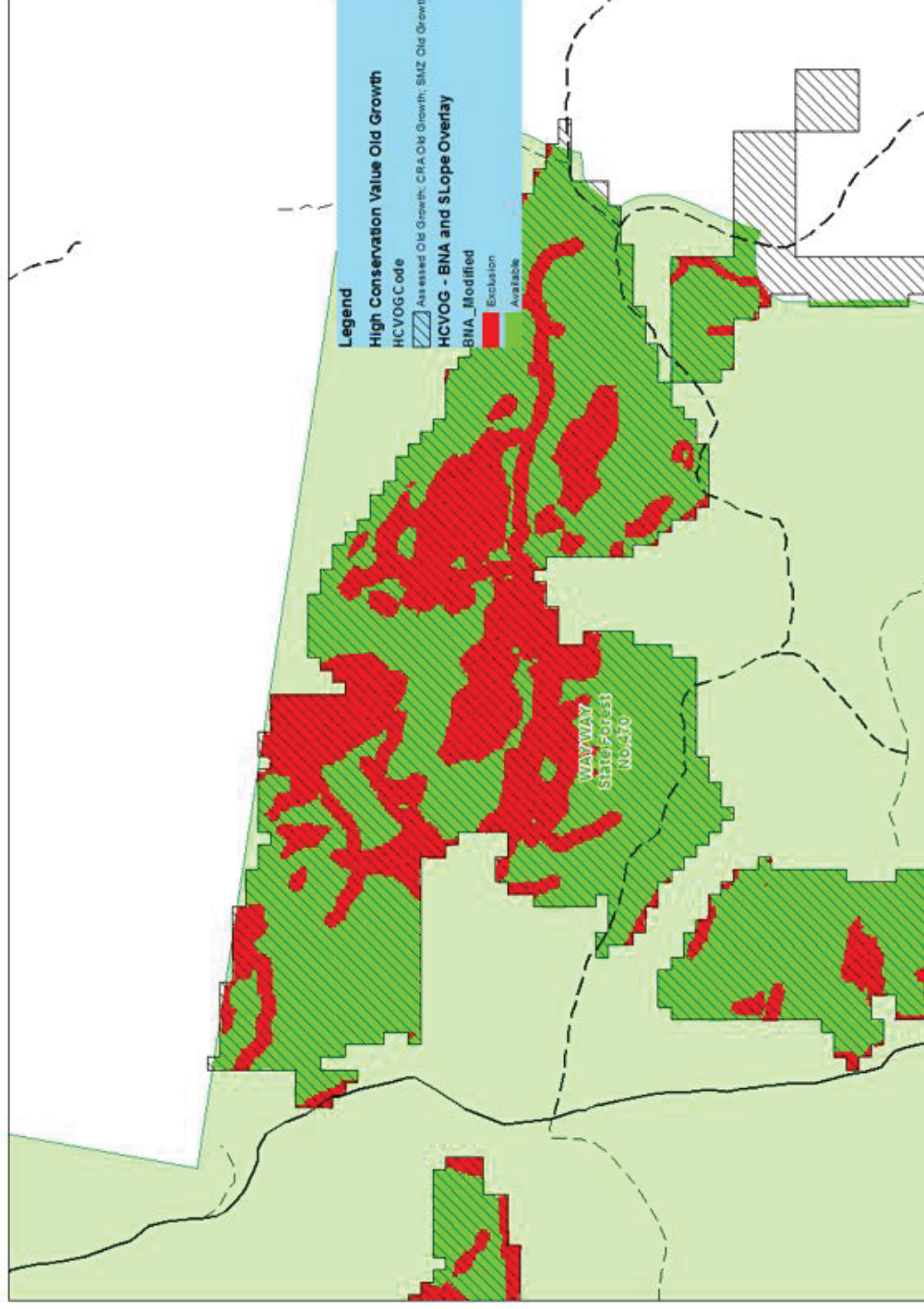BNA_Modified

Exclusion

Available

WAYWAY
State Forest
No.110

Green = HCVOG areas not excluded due to other factors
Red = base net area exclusions and steeper slopes

Step 2: Key results

- Adjust for ecosystem representation.
- Only include forest ecosystems that meet the JANIS targets and that are part of the potential net harvest area.
- Result: 57,836 hectares reduced to 29,710 hectares.

Legend

High Conservation Value Old Growth

HCVOGCode

▨ Assessed Old Growth; CRA Old Growth; SMZ Old Growth

HCVOG - BNA and SLope Overlay

BNA_Modified

■ Exclusion

Available

Steps 1 and 2: Key results

- Areas in green (hectares) are the over-target ecosystems that are on slopes of less than 25 degrees and that would be part of the net harvest area, other than current HCVOG mapping.

- The 25-degree slope limit was used as a simple alternative to the current net harvest area modifier and resulted in an approximately 10 percent reduction in available area.

IFOA Region	Part of Potential Net Harvest Area?	Area of Key commercial over target ecosystems	Area of other (less commercial) over target ecosystems	Area of Under target forest ecosystem	Area of Potentially available ecosystems
LNE	Yes	1,873	5,796	7,061	7,669
	Exclusion areas	5,257	10,607	13,862	
LNE Total		7,148	16,403	20,923	
UNE	Yes	13,670	8,371	21,065	22,041
	Exclusion areas	9,803	3,961	9,542	
UNE Total		23,472	12,333	30,608	
Grand Total		30,621	28,736	51,531	29,710

Step 3: Key results

- Account for maximum area available based on continuing to meet JANIS targets.
- This leads to approximately 30 percent reduction in potential area.
- 15,500 hectares reduced to 11,700 hectares for key commercial ecosystems:
  - 7,700 hectares to 7,450 hectares in the LNE region
  - 22,040 hectares to 13,720 hectares in the UNE region
  - 29,710 hectares to 21,170 hectares overall.

Step 4: Key results

- Most compartments are likely unviable for assessment (1,263 of 1,971 compartments have less than 10 hectares available for remapping). However, most areas (more than 80 percent) are in compartments with less than 10 hectares of re-mappable ecosystems.

Remappable Net Area in Comaprtment	Number of compartments	Area potentially available	Proportion of area
0-10 ha	1263	3,258	11%
10-25 ha	337	5,385	18%
25-50 ha	203	7,221	24%
50-100 ha	134	9,055	31%
100ha+	34	4,638	16%
Grand Total	1971	29,556	100%

Step 5: Key results

Price Zone	Key Commercial Types	Other Commercial Types	Total	Price Zone	Key Commercial Types	Other Commercial Types	Total
Supply Zone 1				**Supply Zone 3**			
Casino	1,363	1,240	2,604	Carrai	-	-	-
Ewingar Working Circle	9,740	235	9,975	Coopernook	0	-	0
Murwillumbah	-	-	-	Doyles - Bulga	74	3,182	3,256
Richmond Range Working Circle	7,067	218	7,285	Kempsey - Coastal	119	589	708
Tenterfield Slopes	11,452	2,802	14,253	Kendall	599	270	869
Tenterfield Tablelands	855	5,133	5,988	Lower Creek	-	-	-
Urbenville	2,044	604	2,647	Urunga Coastal	1,902	19	1,920
Supply Zone 1 Total	**32,522**	**10,231**	**42,753**	Urunga Upriver	6,164	242	6,406
Supply Zone 2				Wauchope Coastal	165	0	
Bom Bom	-	268	268	Wauchope Foothills	3,099	117	3,216
Coffs Harbour	20,974	6,284	27,258	Wauchope Upriver	1,789	1,577	3,366
Dorrigo Central	36,826	10,106	46,933	**Supply Zone 3 Total**	**13,910**	**5,996**	**19,906**
Dorrigo West	3,895	2,352	6,247	**Supply Zone 4**			
Glen Innes	106	2,545	2,651	Boonabilla	-	1,293	1,293
Grafton Coastal	13,021	2,504	15,525	Bulahdelah	123	312	435
Grafton Inland	34,338	116	34,454	Gloucester East	1,360	3,192	4,552
Supply Zone 2 Total	**109,160**	**24,175**	**133,335**	Taree	482	0	483
				Wingham	6,884	2,719	9,603
				4 Total	8,849	7,517	**16,366**
				Supply Zone 5 and 6	-	-	-
				Grand Total	164,440	47,919	212,360