Conservation Commission of Western Australia

Assessment criteria and process for the Conservation Commission review of old-growth amendments

Consultation Paper

Executive Summary

Through the Forest Management Plan 2004-13 (FMP) and the State Government's *Protecting our old-growth forests* policy, approximately 331,370 hectares of old-growth forest has been set aside from timber harvesting in formal and informal reserves.

The FMP also identifies an additional portion of forest for the Conservation Commission to assess. This portion of the FMP area consists of 9,387 hectares of State forest which was re-classified from old-growth to non old-growth by the Department of Conservation and Land Management (CALM) between 1997 and 2001.

The reclassifications undertaken by CALM from old-growth to non old-growth are categorised by CALM according to the main 'process of change' as follows:-

- Refinement of ecosystem records
- Areas harvested 1997 to 2001
- Updates of dieback mapping
- Refinement of harvesting records

The Conservation Commission is required under the FMP to examine these reclassifications and, based on the criteria supplied by CALM, develop an assessment process including detailed field criteria to determine whether to alter or confirm an area's reclassification. This process is to involve consultation with CALM and the public.

The Conservation Commission has undertaken a pilot study of old-growth forest areas and developed the field assessment criteria and field assessment process for public consultation.

The definitions of old-growth forest used to implement the *Protecting our old-growth forests* policy are as defined and mapped in the Regional Forest Agreement (RFA). These definitions provide the basis for the assessments to be undertaken by the Conservation Commission and are described as follows:-

- Karri and karri/tingle forest – uncut forest which is mature or senescent;
- Jarrah and jarrah/tingle forest – uncut forest or forest subject to minimal disturbance which is not known to be affected by Phytophthora cinnamomi;
- Jarrah woodland – all uncut woodland which is not known to be affected by Phytophthora cinnamomi; and
- Wandoo forest and woodland – uncut forest or woodland.

The Conservation Commission will assess each of the reclassified areas using a combination of remote and field analysis techniques. These are discussed in Section 2 with a detailed description of the field methodology given in Section 3. The process for analysing results is provided in Section 4.

The FMP also calls for a process for persons to request the Conservation Commission to assess whether areas on an indicative timber harvest plan should be classified as old-growth forest. A public nomination form has been developed and attached (Appendix III) for this purpose.

Table of Contents

1. Background & Context 4
1.1 Background 4
1.2 Objective 5
1.3 Legislative & planning context 5
1.4 Forest Management Plan 2004-13 6
1.5 Scope of CALM old-growth reclassifications 6
1.6 Old-Growth Criteria Used by CALM 10
2. Assessment by the Conservation Commission 10
2.1 Basis for Assessment Process and Field Criteria 10
2.2 Assessment process for reclassified old-growth areas 11
2.2.1 Ecosystem changes 12
2.2.2 Harvested 1997 – 2001 13
2.2.3 Harvesting records 13
2.2.4 Dieback records 14
2.3 Publication of Assessment Results 18
2.4 Nomination Process 18
3 Field Assessment Methodology 19
3.1 Disturbance assessment 19
3.2 Development stage assessment 20
3.3 Sampling 20
3.4 Data Capture 22
4 Analysis of Results 23
4.1 Decision-model for assessing the level of harvesting disturbance 23
4.2 Criteria 25
4.3 Transect design 26
4.4 Examples 26

Figure 1. CALM old-growth reclassifications – Area (hectares) by size class*. 8
Figure 2. Map showing an example of raster pixels (with area shown in hectares) of old-growth reclassification boundaries as depicted in the corporate database. 8
Figure 3. CALM old-growth reclassifications – Area (hectares) by category. 9
Figure 4. Review process – changes due to refinement of ecosystem data. 13
Figure 5. Review process – changes due to refinement of historical harvest records. 14
Figure 6. Review process – changes due to refinement of dieback mapping. 18
Figure 7. National classification of growth stage for native forest (Australia's State of the Forests Report 2003) 20
Figure 8. Variations in field sampling intensity. 21
Figure 9. Data capture of disturbance information for old-growth assessment. 23
Figure 10. Decision model for assessment of harvesting disturbance - jarrah forest. 24
Figure 11. The relationship between stump numbers - development stage and old-growth*. 25

Table 1. Old-growth forest reclassification categories with brief definition sets 12
Table 2. Library of old-growth descriptors for field assessment. 22

Attachments (3)

Appendix (I) & (I)a - Example of proposed report summary.
Appendix (II) & (II)a - Example maps with sample and recommendation detail.
Appendix (III) - Request form - Review of old-growth on Indicative Harvest Plan

1. Background & Context

1.1 Background

The Forest Management Plan 2004-13 (FMP) gives effect to the State Government's *Protecting our old-growth forests* policy. Implementation of this policy on CALM-managed land has effectively resulted in ending logging in Western Australia's old-growth forests. Approximately 331,370 hectares of old-growth forest has been set aside from timber harvesting in formal and informal reserves.

The FMP also identifies an additional portion of forest for the Conservation Commission to assess. The majority of this assessment area consists of 9,387 hectares of State forest which was reclassified from old-growth to non old-growth by CALM. Reclassification took place after old-growth areas were identified through the Regional Forest Agreement (RFA) process (1997), and before the commencement of the FMP in 2004. The 331,370 hectares of old-growth set aside in formal and informal reserves and listed in the FMP is not subject to this assessment.

One of the objectives of the RFA was the protection of old-growth forest through criteria which called for reservation of approximately 60% of the extant area of old-growth within each forest ecosystem, except where old-growth was rare or depleted in which case 100% reservation was required. Definitions of old-growth forest were derived from the National Forest Policy Statement (1992), with the criteria further refined and published in Chapter 13 of the Comprehensive Regional Assessment (CRA) Volume 1 report (Commonwealth and Western Australian RFA Steering Committee, 1998). The State Government's *Protecting our old-growth forests* policy effectively placed 100% of old-growth forest into categories unavailable for logging as opposed to approximately 60% under the RFA requirements.

In giving approval to the FMP, the Minister for the Environment required a review of old-growth forest areas reclassified by CALM in accord with the appeal decision in relation to the Environmental Protection Authority's (EPA) report on the FMP. Namely that:

> *The current definition of old-growth forest be retained, but based on the criteria applied by the Department, the independent assessor would write up the detailed field criteria and assessment process for review, in consultation with the Department and stakeholders, and publish the reasons for reversing or upholding an area's classification*

The assessment by the Conservation Commission, will apply to the portion of the area which was reclassified between 1997 and up to December 2001 which includes only the records which were formally reclassified in the CALM corporate database. Re-classifications to the old-growth layer made after December 2001 were not entered into the corporate database before the commencement of the FMP and will remain as informal reserve, unavailable for logging, and not subject to this assessment. Therefore, the reclassifications to be assessed by the Conservation Commission are only those which were entered into the corporate database between 1997 and December 2001, a total of 9387 hectares. This area is subject to a moratorium on logging pending the Conservation Commission re-assessment.

A pilot-study was undertaken by the Conservation Commission during 2004, to develop field assessment criteria and guidelines to be employed in the assessment of these areas of re-classified old-growth.

1.2 Objective

The objective of this document is to develop through public consultation the field assessment criteria and field assessment process to be used by the Conservation Commission in its review of old-growth areas that were classified as old-growth forest in 1997, but which were re-classified as non old-growth forest up to the date of the commencement of the FMP (as stated in the FMP, however, effectively 1997-2001 is the review period as outlined in the previous section). The review will determine whether areas should be returned to their previous classification of old-growth.

If a discrete reclassified area is recommended as old-growth following the Conservation Commission assessment, it will be returned in CALM's corporate database to old-growth forest. Where an assessed area is confirmed by the Conservation Commission as non old-growth, it will be confirmed in the corporate database as non old-growth forest, and will therefore become available for logging unless there is another reason for the area to remain unavailable (for example it within an informal reserve such as a diverse ecotype zone).

1.3 Legislative & planning context

It is a function of the Conservation Commission to prepare proposed management plans for land vested in it, and this process is prescribed in Part V of the Conservation and Land Management Act 1984 (CALM Act). The FMP gives effect to the Government's Protecting our old-growth forests policy and takes into account the principles of ecologically sustainable forest management in section 19(2) of the CALM Act. The Conservation Commission, CALM and the Forest Products Commission (FPC) seek to achieve the plan's objectives by undertaking specified actions (listed in FMP, Appendix 14). The Conservation Commission is also responsible for giving effect to the conditions imposed on the plan by the Minister under the Environmental Protection Act 1986 (EP Act).

The CALM Act and the Forest Products Act 2000 (FP Act) require CALM and FPC respectively to operate in accordance with an approved forest management plan.

The actions proposed in the plan are set out under the seven criteria for sustainability developed in the Montreal Process. During the period of the plan new information from monitoring, auditing and adaptive management and other sources will result in progressive refinement of the proposed actions. This refinement process will involve public consultation.

1.4 Forest Management Plan 2004-13

The majority of the management proposals in the FMP will be implemented in part by CALM, and in part by the FPC. Apart from Ministerial conditions under the EP Act, and a range of other consultative, monitoring and review responsibilities, within the FMP there are also some specific proposed actions to be addressed by the Conservation Commission relating to the management of old-growth forests. These are as follows:-

3.2 The Conservation Commission will:

3.2.1 assess whether any areas available for timber harvesting which were classified as old-growth forest in the Department's corporate database in 1997, but which are not classified as old-growth forest on the date of the commencement of this plan, should be reclassified as old-growth forest;

3.2.2 prepare with public consultation an assessment process and field assessment criteria, which will:

- be based on the Department's current approach to the application of the criteria for classification of land as old-growth forest in the Department's corporate database;
- include a process for persons to request the Conservation Commission to assess whether areas on an indicative timber harvest plan referred to in Action 11.5 should be classified as old-growth forest in the Department's corporate database, and for the Conservation Commission to determine whether such an assessment is warranted; and
- be made publicly available; and

3.2.3 publish the reasons for altering or confirming an area's classification in the Department's corporate database after it has been assessed by the Conservation Commission.

1.5 Scope of CALM old-growth reclassifications

There are three main categories of tenure upon which the old-growth reclassifications are located. These categories are formal reserves (e.g. national park, nature reserve), State forest and timber reserves and other public land. No assessment will be undertaken by the Conservation Commission on formal reserves, as these areas are unavailable for timber harvesting (see FMP extract in Section 1.4 above). The Conservation Commission will assess the following total areas of reclassified old-growth:-

- Reclassified areas from State forest 9390 hectares (rounded)
- Reclassified areas from other public land 2650 hectares (rounded)

In the period subject to this assessment there were also 4,500 hectares of reclassified old-growth additions to State forest and 30 hectares of old-growth additions to other public land. The reclassified additions are not subject to this assessment.

Assessment will be undertaken on State forest and timber reserves and other public land as these areas are available for timber harvesting.

Other public land

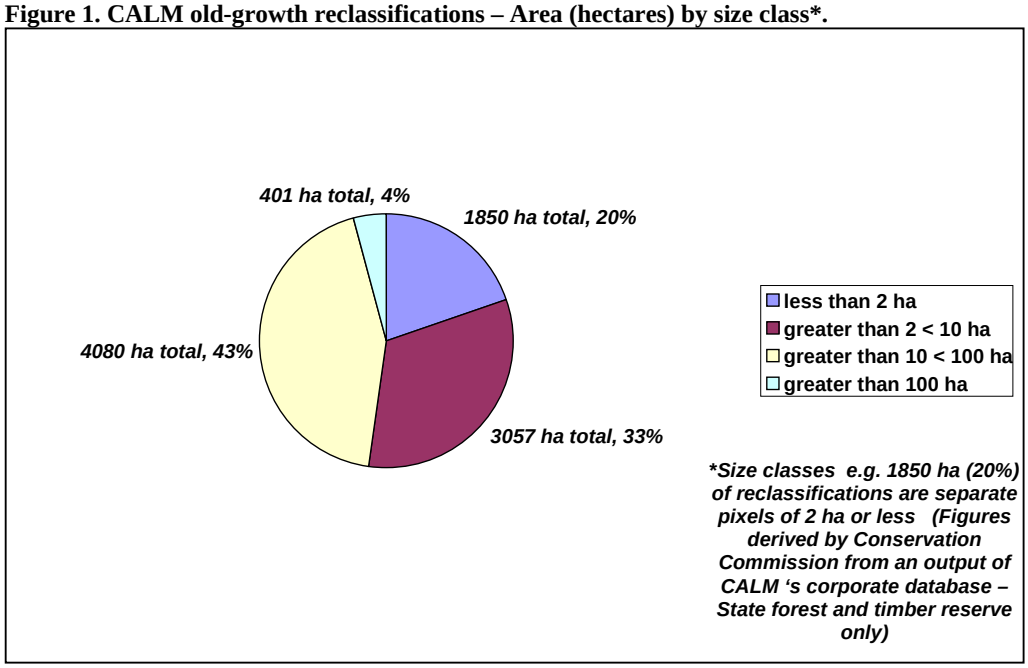
The graphs and figures below do not include old-growth reclassifications which are located on land tenures referred to as 'other public land' in the corporate database. The other public land category consists of a variety of tenures which are not vested in the Conservation Commission, such as reserves vested in the Water and Rivers Commission and local government. Timber from these lands generally only becomes available if there is a development proposal over these areas that requires vegetation clearing such as during road construction. These areas of other public land will be assessed separately to the reclassifications on State forest and timber reserve. The Comprehensive Regional Assessment process initially identified these parcels of old-growth on other public land during the assessment phase of the RFA (1997) when the accompanying data was entered into CALM's corporate database. The old-growth status of these areas (a total of 2650 hectares) was subsequently reclassified in the corporate database during the period up to December 2001. The co-operation of the relevant government authority will be sought where required to facilitate the assessment process. Assessment of these areas will follow the same criteria as outlined in this document for State forest and timber reserves however it will be afforded a lower priority than the assessment of the State forest and timber reserve old-growth reclassifications unless there is a development proposal over these lands that may threaten old growth status.

State forest and timber reserve

The most recent advice from CALM is that a total area of 9387 hectares of old-growth was reclassified by CALM on State forest and timber reserve in the period subject to this review. This total area figure and the figures used in the depictions below include approximately 2800 ha of informal reserve. Informal reserves include such areas as stream zones, travel route zones and diverse ecosystems, which are unavailable for timber harvesting. Old-growth reclassifications which occur on informal reserves will be assessed as a low priority because these areas are presently unavailable for timber harvesting, but could become available through the routine refinement of informal reserve boundaries. The majority of reclassified old-growth areas are located within the CALM Warren Region (71%) and the South-West Region (26%), with the remainder located in the Swan Region (3%).

A significant proportion of the total identified area on State forest and timber reserve occurs in relatively small, discrete parcel sizes (pixels as displayed in the corporate database) as indicated by Figure 1 below:-

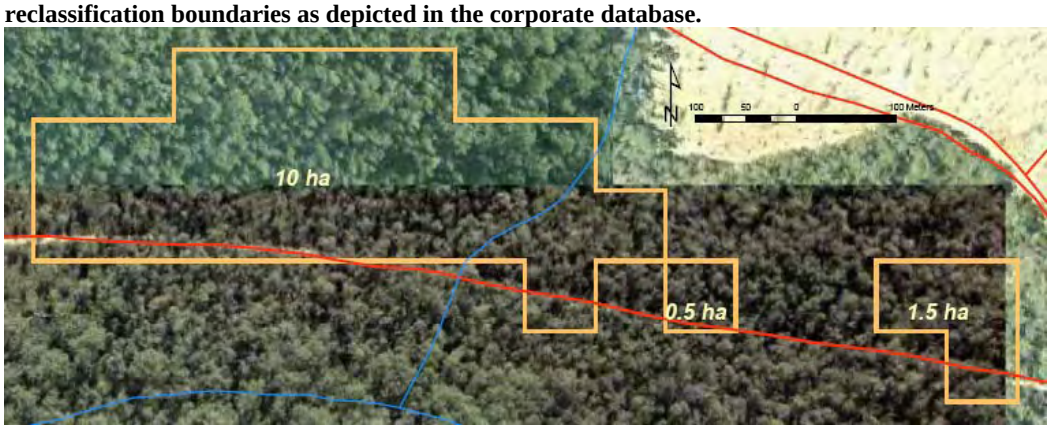
Figure 1. CALM old-growth reclassifications – Area (hectares) by size class*.



Minumum scale and 'pixel' size

The CALM approach to mapping old-growth is briefly detailed in Section 1.6 below. The minimum scale that has been adopted for mapping old-growth by CALM, and the minimum scale to be utilized in the Conservation Commission assessment is 2 hectares. A significant portion of the parcel size (20%) of the reclassified areas are map pixels less than 2 hectares in size as detailed in Figure 1 above and illustrated in Figure 2 below.

Figure 2. Map showing an example of raster pixels (with area shown in hectares) of old-growth reclassification boundaries as depicted in the corporate database.



CALM have suggested that these smaller areas are ususally a result of the data import process and a consequence of using a combination of raster and vector elements within the Geographic Information System (GIS). In other words a refinement of pixilated raster boundaries (jagged edges) with the smoothed boundary of a vector line, resulting in strings of pixels representing the overlap of boundaries. Such a situation might arise where a line depicting a road overlays the edge of old-growth pixels resulting in some isolated portions of pixels on the 'non old-growth' side of the road. Where the Conservation Commission is satisfied in its assessment that

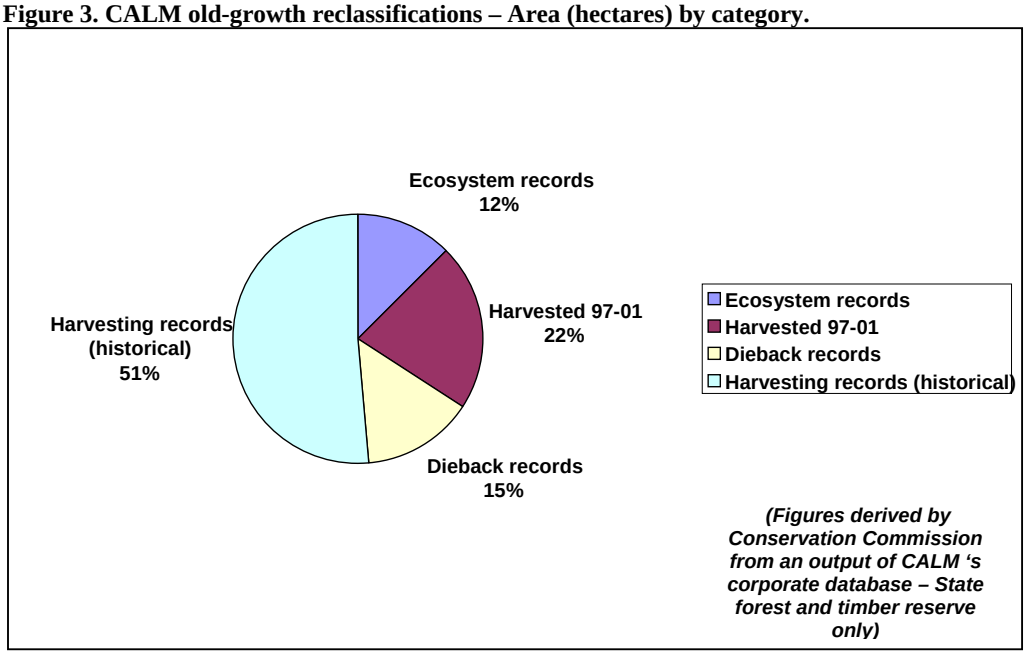
the actual and intended boundary of old-growth is the road, it will support the CALM old-growth reclassification, for these small (less then two hectare) patches. These small areas of less then two hectares will no longer be considered as old-growth in the database. All reclassifications will be examined through the Conservation Commission review process and areas of old-growth of two hectares or greater which are identified from the reclassifications will be returned to the corporate database as old-growth.

CALM have advised that the definitions applied by CALM for old-growth reclassification categories during the period 1997 to December 2001 are as follows:-

- Harvesting records - records of past harvesting were updated following field inspection and refined with improved resolution of the contributing datasets.
- Ecosystem records – changes made following the refinement of boundaries after field operations, and with the improved resolution of contributing datasets, particularly at the interface of forest and non-forest types, and at private property boundaries.
- Dieback records – the need to map the presence or absence of dieback prior to the operations in the forest resulted in an update of dieback records which contributed to the classification of jarrah old-growth.
- Harvested 1997-2001 – some of the areas classified as old-growth in 1997 were logged between 1997 and 2001.

The highest proportion of reclassification types as categorised by CALM, is reclassification of old-growth as a result of refinement utilising historical harvesting records. The relative proportions of the four different types of reclassification are summarised in Figure 3 below.

Figure 3. CALM old-growth reclassifications – Area (hectares) by category.



1.6 Old-Growth Criteria Used by CALM

The old-growth criteria developed by CALM are summarised in the Comprehensive Regional Assessment documents. The contributing datasets and process applied by CALM, is summarised in the following extract from CALM documentation:-

> "*The old-growth status for an area is derived from the intersection or overlay of the contributing records for forest extent, disease occurrence, disturbance history (including timber harvesting, agricultural clearing, roading and mining), and structural condition (for karri only). The corporate versions of these datasets were examined and accredited for use in the CRA process, with subsequent examination of various component datasets during the Ferguson processes. These contributing datasets were originally compiled from various historical and contemporary sources, including historical and recent aerial photography, archived maps, field inventory and specific mapping projects.*
>
> *The CRA documents also summarise the methodology used to derive or source these datasets.*
>
> *Changes in some of the contributing datasets, relative to the datasets used in 1997, have lead to the alterations in the extent of old-growth recorded since the Regional Forest Agreement. These have arisen from the routine cycle of updating the extent of disturbance activities each year, or intermittently as information is refined from field surveys and other sources. The Forest Management Plan (FMP) incorporates provisions to limit the extent of changes that could lead to a reclassification of old-growth status, check the veracity of areas reclassified since 1997, and to increase the transparency of future changes to records.*
>
> *Since the introduction of the Protecting our old growth-forests policy in 2001, planning for disturbance activities has incorporated a field reconnaissance, and where necessary, assessment to confirm the corporate record of old growth extent and assist demarcation."*
>
> Source:- *Old-growth Background Note 2004*, CALM Sustainable Forest Management Division

2. Assessment by the Conservation Commission

2.1 Basis for Assessment Process and Field Criteria

The Conservation Commission will use an assessment approach based on the current CALM departmental approach to the classification of old-growth as summarised in Section 1.6 above. The definition of old-growth is that used during the Comprehensive Regional Assessment, the Regional Forest Agreement and subsequent old-growth mapping as follows:

- Karri and karri/tingle forest – uncut forest[1] which is mature or senescent;

[1] The definitions for old-growth vary by species which has an impact upon the field assessment criteria and particularly the analysis of harvesting disturbance. See Section 3 Field Assessment Methodology.

- ~ Jarrah and jarrah/tingle forest – uncut forest or forest subject to minimal disturbance which is not known to be affected by *Phytophthora cinnamomi*;
- ~ Jarrah woodland – all uncut woodland which is not known to be affected by *Phytophthora cinnamomi*; and
- ~ Wandoo forest and woodland – uncut forest or woodland.

These definitions for karri, jarrah, and wandoo forests and woodland will provide the basis for the assessments to be undertaken by the Conservation Commission.

2.2 Assessment process for reclassified old-growth areas

This assessment process focuses on those areas of State forest available for timber production that had old-growth status in 1997 but were subsequently reclassified in CALM's corporate database as non old-growth. Areas within this category will be assessed to determine whether they should revert to their original old-growth classification. While some areas within this category have been harvested following reclassification from non old-growth in the period after 1997, there is now a moratorium on harvesting within the remaining reclassified areas until the Conservation Commission has re-assessed their status.

In reviewing these areas background information will be collated for each reclassified area. Depending upon content and extent of background detail available, an appropriate level of assessment will be assigned to individual areas for the review process. The CALM old-growth reclassification categories outlined in Section 1.5 (Harvest records, Ecosystem records, Dieback records, Harvested 1997-2001) will be utilised to systematically assess each discrete reclassified area. All the reclassified areas will be assessed to determine whether the old-growth definitions outlined in Section 2.1 above, have been applied correctly. While each examination will focus on CALM's reason or category of old-growth reclassification, the review will also take into account the other old-growth categories as shown in Table 1.

The detailed field assessment methodology is presented in Section 3 with the approach for analysing results provided in Section 4.

Table 1. Old-growth forest reclassification categories with brief definition sets

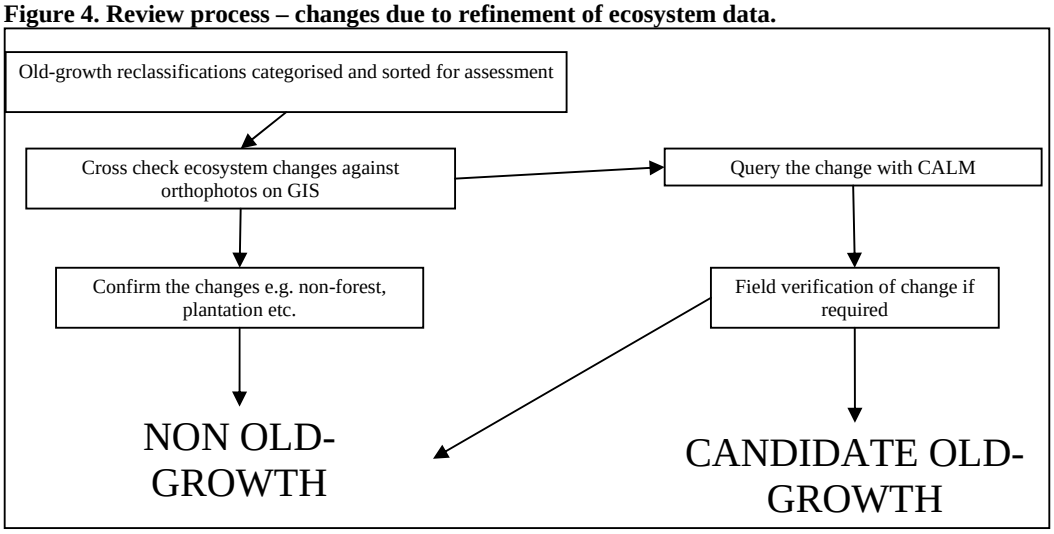
Category of Reclassification	**CANDIDATE OLD-GROWTH definition sets** (must meet all definitions below to be old-growth)	**NON OLD-GROWTH definition sets** (non old-growth if one or more definitions below are applicable)
Harvesting records	*Not logged historically - uncut mature or senescent (karri forest); or minimally disturbed (jarrah forest only)*	*More than minimal disturbance*
Ecosystem data	*Forest or woodland,*	*Non-forest (rocky outcrops, sedgelands etc.), plantation, cleared land*
Dieback occurrence	*Not affected by dieback*	*Dieback affected*
Harvested 1997-2001	*Not logged 1997-2001*	*Logged 1997-2001*
	OLD-GROWTH	**NON OLD-GROWTH**

The Conservation Commission will assess the reclassified areas using a combination of remote and field analysis techniques. The details for each of the categories of reclassification are outlined in the following sections.

2.2.1 Ecosystem changes

Ecosystem changes incorporate changes such as the delineation of forest and non-forest ecosystem boundaries, boundaries between private land and State forest, and boundaries between plantations and native forest. These changes will be verified remotely utilising aerial photographs in a systematic process. Where apparent discrepancies arise, the data will be reviewed by accessing background information and field verification as required. The type of field verification required will depend upon the nature of the reclassification. A foreseeable circumstance where remote assessment would not provide conclusive verification of ecosystem changes might be where an area of old-growth forest has been classified as non-forest but is in fact forest. Under these circumstances a field inspection to verify the imagery will be undertaken, utilising the sampling procedure as outlined in Section 3. The overall process is summarised in Figure 4.

Figure 4. Review process – changes due to refinement of ecosystem data.



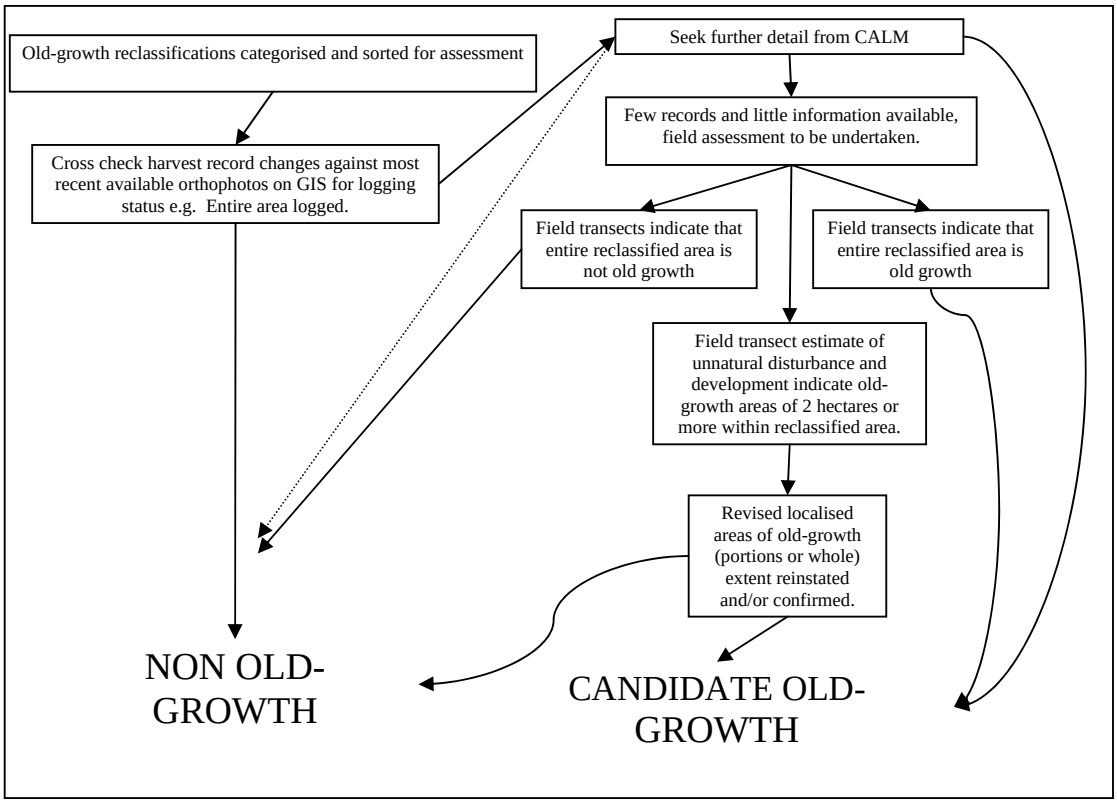
2.2.2 Harvested 1997 – 2001

Logged areas will be reviewed remotely utilizing aerial photographs to determine whether any areas of size greater than 2 hectares were not logged during operations. If such areas are located, these identified areas will be assessed for old-growth as per the unlogged-reclassified areas, using the available data, in combination with field assessment procedures as required (see 2.2.3).

2.2.3 Harvesting records

The historical records and other data used to refine these areas will be located and reviewed for reliability. Any field verification that may have been undertaken by CALM as part of its assessment process will also be reviewed. This process is summarised below in Figure 5 and discussed in detail under Section 3 Field Assessment Methodology.

Figure 5. Review process – changes due to refinement of historical harvest records.



2.2.4 Dieback records

Under the disturbance criteria for old-growth forest in the RFA, areas of jarrah forest known to be affected by *Phytophthora cinnamomi* were considered disturbed and excluded from old-growth. The source of this information was the existing map of known dieback infection. These criteria need to be followed by the Conservation Commission in its review of old-growth reclassifications. The assessment will verify that each identified old-growth reclassification is part of an area known to be affected by *Phytophthora cinnamomi*.

Detail from Interpreters Guidelines for detection, diagnosis and mapping

Mapping of disease presence in advance of soil disturbance operations is undertaken by trained and accredited interpreters according to guidelines specified in a manual titled *Phytophthora cinnamomi* and disease caused by it, Volume 2, Interpreters Guidelines for detection, diagnosis and mapping. These guidelines state that Interpreters are essentially looking for those areas that are:

- infested with *Phytophthora cinnamomi*;
- uninfested – free of plant disease caused by *Phytophthora cinnamomi*;
- uninterpretable – those areas where presence or absence of *Phytophthora cinnamomi* cannot be determined;

Within these categories, interpreters will also determine whether each area is:-

- unprotectable – infested areas and those areas where it is judged that autonomous spread of the pathogen will occur in the shorter term (within a few years and up to 50 years);
- protectable – free of plant disease caused by *Phytophthora cinnamomi* and likely to remain so (current determination based on 50 years spread up-slope)

Tools used by interpreters to map disease presence include remote interpretation using large-scale aerial photography and ground interpretation using a strip-line survey method. However, for this review, CALM have advised that ground surveys would have been undertaken for all the reclassified old-growth areas. Checking the type and detail of the CALM assessment report for individual reclassified areas will be part of the Conservation Commission re-assessment which is detailed in the following section. The Interpreters Guidelines indicate that strip-line surveys should consist of parallel lines at intervals not more than 50 metres. Interpreters then record sufficient field details of their observations onto a booking sheet to enable a map to be plotted at the completion of the survey area. Interpreters predominantly use indicator species deaths (ISDs) and any apparent geographic associations between the deaths, to group the following;

- Isolated ISDs - These are single dead plants (any indicator plant) that have no apparent association with any other death and may be within an area populated by many other healthy indicator plants (>50m between ISDs)
- Scattered ISDs - These can vary from a single dead plant (any indicator plant), to small groups of two or three dead plants. There may be many healthy indicator species between these scattered deaths which may occur over a wide area, and have no apparent association between deaths (20m – 50m between ISDs)
- Groups or clusters of ISDs - Two or more dead plants of the one species within close proximity of one another, with an apparent association between the deaths, but discrete from other potential infestations (ISDs in groups within close proximity to one another, cluster may be scattered)
- Multiple ISDs – Some or all of the indicator species are dead within the same area (some or most indicator plants, ISDs within close proximity to on another)

Interpreters will then attempt to gauge a chronology of deaths where there may be an age range from more recent deaths with yellowing or brown leaves through to older leafless stags to remnant stumps in the ground. In old infestations most indicator species may have been killed by the disease and old stags may have burnt or rotted away. Such areas are recognised as difficult to interpret however, the guidelines indicate that experienced interpreters should be able to recognise a change in vegetation type from what would be normally expected in the absence of disease and be able to identify correctly the area as an old infestation. Interpreters will walk towards where a disease boundary is expected (where old deaths are replaced by more recent deaths and then eventually by healthy indicators where the disease has not yet reached).

As detailed in the guidelines, other factors such as topography, soil type, vegetation type and the drainage characteristics of an area are likely to influence the shape or pattern of an infested area over time. Recent infestations may show a small cluster of dead indicator species which, over time, will spread to become a small circular shape ‘the ulcer effect’ and then begin lengthening towards natural drainage channels. In less susceptible communities (fewer susceptible species) observable pattern development may be vague.

In cases where two or more infestations occur close together the interpreter must decide whether they are close enough to be grouped. If the area between the infestations is less than 40 metres, the two areas are usually grouped (considered to be one infestation) and the whole area is considered to be infested.

Conservation Commission assessment

In its assessment, the Conservation Commission will review the assessment method and process which has been employed by CALM, for discrete reclassified old-growth areas. This will be achieved through accessing the original dieback interpreters report and recommendations which have resulted in changes to the corporate database. The recommendations and the map records of infection will be checked against the final mapped depiction of old-growth reclassification in the corporate database. The factors outlined in the previous section dealing with the interpreters guidelines will be utilised to check for an accurate depiction and interpretation of dieback free and dieback infected areas, as transferred onto the corporate database from interpreter's maps.

Based on an assessment of the quality of this mapping against the dieback interpretation criteria, a judgement will be made as to whether further analysis of likely dieback infection from other sources is warranted or if the dieback interpretation and hence old-growth reclassification is satisfactory.

If further analysis is required, the following information will be considered:-

A checklist of similar assessment factors to those utilised by the interpreters, will be compiled for each reclassified area. Reclassified areas will initially be crosschecked remotely utilising:- tissue sample records, elevation, slope and landform, the presence and location of possible vectors, soil type, and the depiction of the current dieback extent from historical aerial photographs and the autonomous rate of spread predictions. Soil type will be used broadly to assist with assessment at the remote level, taking account of its interaction with other environmental factors such as rainfall and landform. The remote information and the geographic representation of the reclassification in the old-growth database will be assessed against the archived, original records and recommendations from the dieback interpretation. The remote assessment will be complemented by field verification where necessary. For areas with high historical dieback incidence, a higher level of confidence for dieback occurrence and impact may result in a reduced level of field verification. For example, reclassification of old-growth in lowland areas where soil type, temperature, landform and rainfall all combine to provide ideal conditions for pathogen infection, and where dieback is historically prevalent in the area, may not be subject to field verification.

The tissue sample records are held in a database by the Vegetation Health Service, as detailed in the extract below from Section 6.4 of the *Dieback Interpreter Guidelines (July 2001):*

6.4 Vegetation Health Service

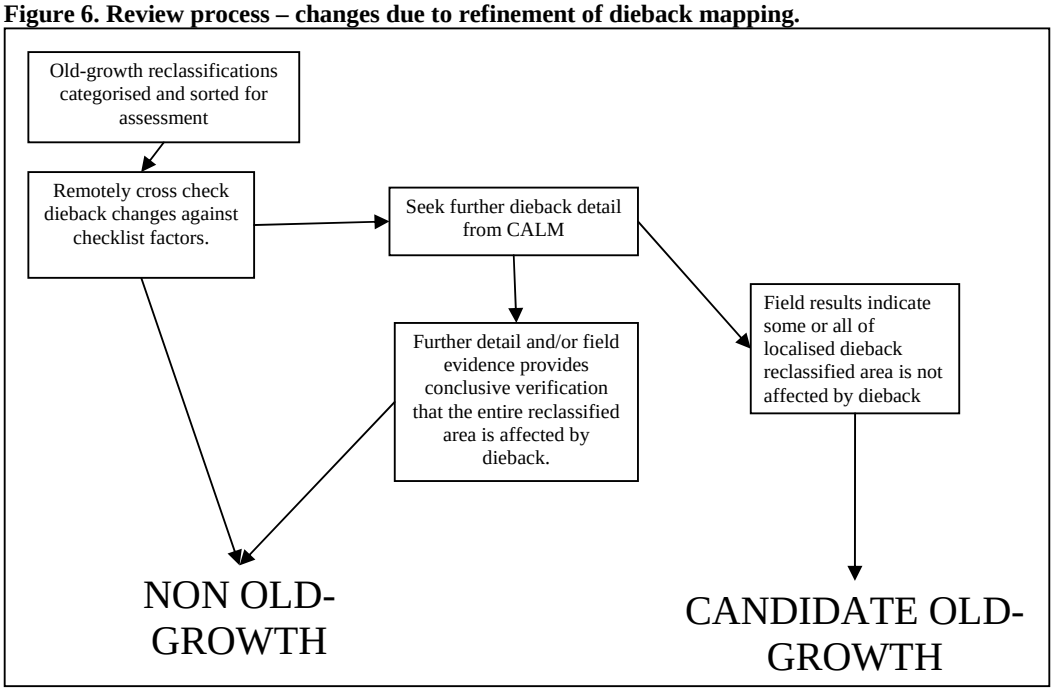
The Vegetation Health Service (VHS) carries out the *Phytophthora* detection process of samples sent to them at its laboratory in Kensington. The VHS returns detection results to Interpreters to verify decisions made in the field. The VHS keeps records in a database of all samples processed by them. The database keeps track of the distribution of *Phytophthora* species and their host plants throughout Western Australia. This database can be used for various interrogations and reports (Appendix 11).

Tissue sample records will provide physical verification of Phytophthora presence which can be traced to discrete areas, reclassified due to the change of dieback status. The Guidelines referred to above, indicate that the main function of the sampling component of dieback interpretation is to establish the reliability of diseased indicator plants used to predict the presence of *Phytopthora cinnamomi* over the area being interpreted. A positive sample will indicate the presence of *Phytopthora cinnamomi* , but will need to be assessed in the context of the size of the area being interpreted, and the location of the sample point in the landscape. A positive sample on a roadline hundreds of metres downslope from a reclassified area for instance, would not necessarily infer that the entire reclassified area is affected.

A negative result from a sample will not necessarily infer that *Phytophthora cinnamomi* is not present, as the tissue recovery process can be affected by sampling techniques and external factors. Issues such as the state of plant tissue, the species, seasonal differences and the time since a fire event can contribute to successful tissue recovery.

Where required, further detail on the decision to reclassify the section of old-growth will be sourced from CALM. The need for a further dieback assessment of the area reclassified from old-growth due to dieback interpretation, possibly including an independent interpretation, will be determined by the nature, extent and availability of all contributing data. This may include interpretation of the whole reclassified area or a sample of it to verify the overall reliability of the interpretation. This assessment procedure is summarised in Figure 6 below.

Figure 6. Review process – changes due to refinement of dieback mapping.



Some of these areas will have been logged following reclassification. Logged areas will be assessed under the methods described in 2.2.3.

2.3 Publication of Assessment Results

A report summarising the reasons for altering or confirming an area's status within CALM's corporate database will be published. The following detail will be included in the report; location details, categories of old-growth reclassification, Conservation Commission assessment procedures, results of the determination and reasons for altering status or otherwise. The summary report will be linked to a map which details site specific information as detailed in the example provided in Appendix II.

2.4 Nomination Process

The Conservation Commission has developed a systematic approach to assess requests from persons regarding old-growth status on indicative harvest plans. Requests for a review of old-growth status on indicative harvest plans, must be received by the Conservation Commission on the form attached (Appendix III). To allow the Conservation Commission to prioritise its assessments and provide a timely response, it is preferable that nominations are selected from the three year rolling plan (when it becomes available), and/or are provided well in advance of any scheduled harvesting activities. An initial assessment of the nomination will be undertaken by the Conservation Commission to determine the adequacy of the detail provided in the request, and to then decide whether further assessment is warranted. Where further assessment of the old-growth status of nominated areas is required, the Conservation Commission will undertake a review according to the procedures outlined previously in this document. This may include field assessments as described in Section 3 of this document. Until the review is undertaken by the

Conservation Commission there will be a moratorium on harvesting the area. Once the determination has been made, the details will be posted on the Conservation Commission website and provided directly to the nominee.

3 Field Assessment Methodology

As depicted in Figure 2, there are four categories of old-growth reclassification to be assessed; Harvesting records (historical), Ecosystem records, Dieback records and areas harvested from 1997-2001. For verification of harvesting disturbance, a field method has been developed for the identification of old-growth through on site inspection, which will be used in conjunction with the available records such as historical maps and photographs. The assessment will address verification of the reason for reclassification; however, if other issues are encountered during the assessment that may impact on the old-growth status of an area, these will be accounted for in any recommendations. For instance, if the goal of assessment is to verify reclassification due to historical harvest records, and there is suspected dieback present, the detail will be noted by the field assessor. Conversely during any field verification for old-growth reclassified due to dieback mapping updates, the assessor would note the presence of stumps within the area.

The assessment applies a systematic sampling process, divided into transects, which provides site data for analysis. Old-growth forest is determined by combining forest disturbance and development stage information. The parameters to be identified and measured by the field assessor have been selected to provide both quantitative and qualitative measures of localised old-growth extent.

3.1 Disturbance assessment

The field component of disturbance analysis is generally confined to the field evidence of previous harvesting events (as indicated the suspected presence of *Phytophthora cinnamomi* may also be noted for future dieback interpretation). The densitometer readings (see Section 3.2) are to be taken at sample points evenly spaced on the transect (every 10 metres). Disturbance information will also be recorded continuously along the transect line and recorded at these sample points. To derive area statistics, a width of 10 metres on either side of the transect line will be utilised to derive an estimate of stumps per hectare. If stumps are visible outside the sample transect range, they will be recorded in the comments field (see Table 2).

The types of field evidence of harvesting events to be noted in assessments include:-

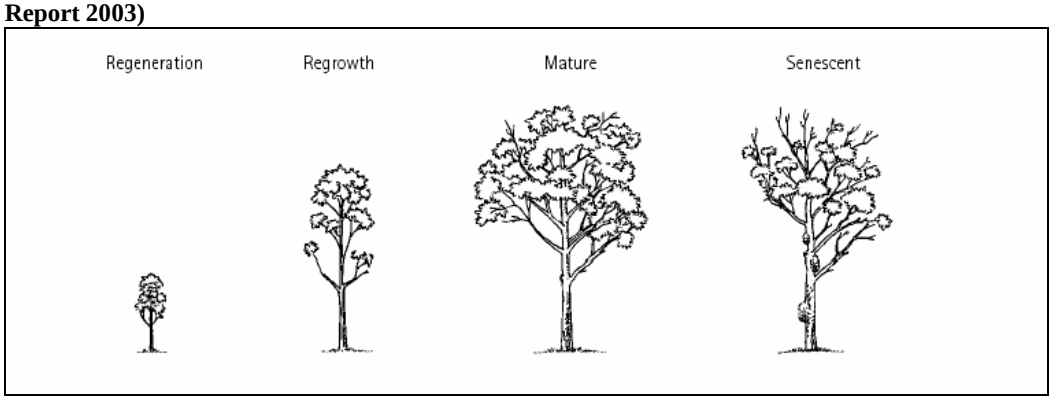
- snig tracks / roads / rail or tramway formations,
- landings / loading ramps,
- heads, cross-cut logs, treatment (e.g. ring-barking),
- presence of stumps,
- pattern of stumps (i.e. boundary and road-side effects, firewood and fire safety felling).

3.2 Development stage assessment

Assessment of development stage will estimate the presence of regrowth that may have persisted from past disturbance, as well as the mature/senescent component of the sample area. However, the primary field evidence of harvesting disturbance will be the number of stumps per hectare, as described in detail in Section 4.2 below.

Canopy estimates will be generated using a canopy-densitometer and are based on an evaluation of data collected at sample points evenly spaced on transects within the sample area. A canopy densitometer is used for estimating canopy cover. It enables collection of quantitative data by giving a view of the canopy vertically above the sample point, which is replicable at each sample point along the transect line. At each sample point the presence or absence of overhead canopy is recorded. If canopy is present, the species, the estimated diameter at breast height and a qualitative judgement of development stage is recorded for the tree in the highest part of the canopy. The sample records can then be used to estimate the relative crown cover of the regrowth component and the relative crown cover of the mature/senescent component. A broad general depiction of tree classifications is shown in Figure 7 below.

Figure 7. National classification of growth stage for native forest (Australia's State of the Forests Report 2003)



Regeneration: Includes juvenile and sapling stages where tree is very small and crown exhibits apical dominance.

Regrowth: Tree has well developed stem with crown of small branches, but below maximum height for stand, apical dominance apparent in vigorous trees.

Mature: Tree reached maximum height and crown reached full lateral development. Branch thickening can occur.

Senescent: Crown form contracting, decrease in crown diameter and crown leaf area.

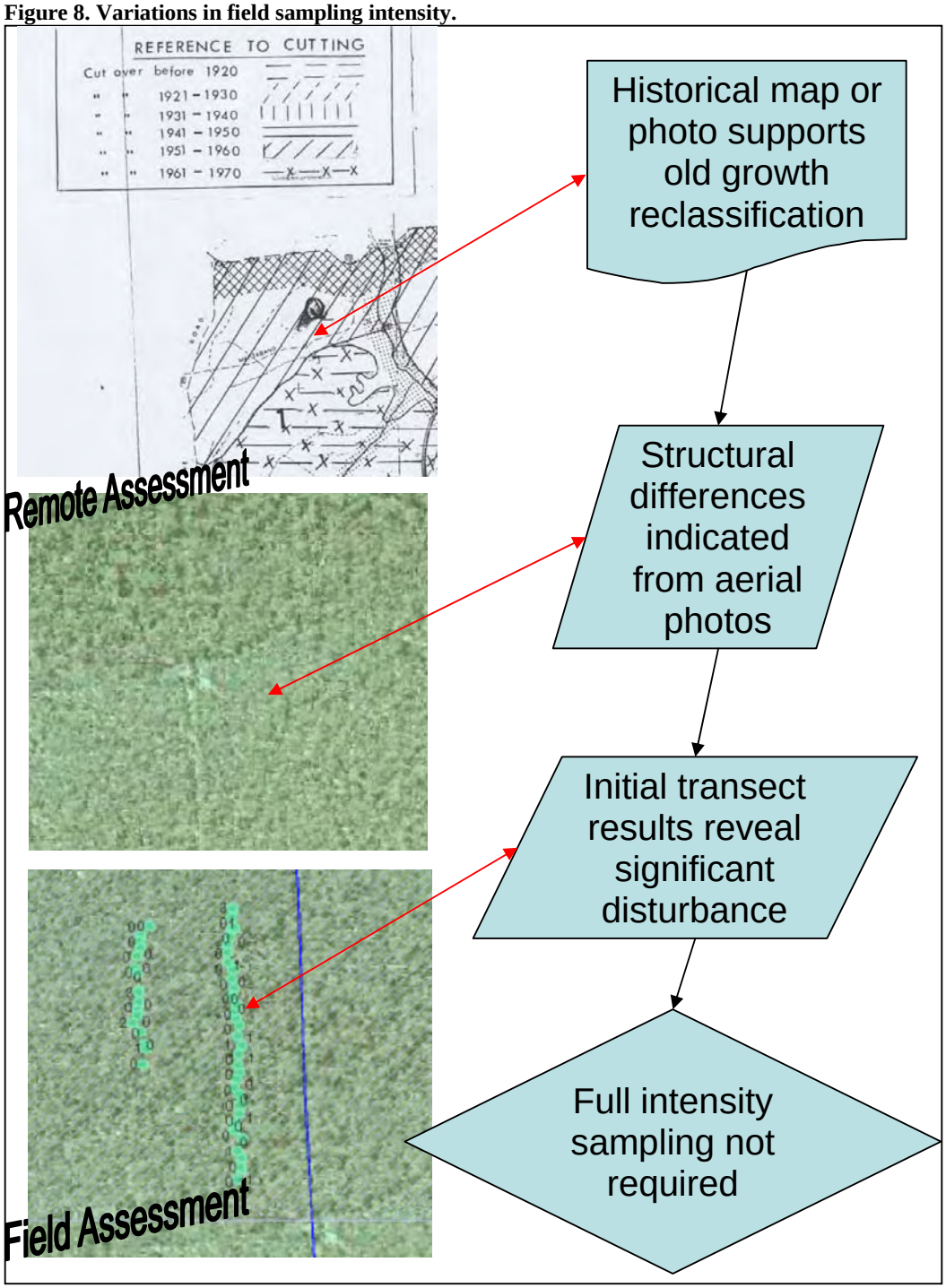
3.3 Sampling

Intensity

As described above, the field component of the assessment process will be used in conjunction with already available information such as historical records, maps and photos for remote sensing. Varying levels of sampling intensity will be undertaken for the assessment areas according to the detail and extent of available data. A

systematic grid survey method will be applied for transects, with a separation of approximately 100 metres. If required a finer scale of sampling distance between transects will be adopted. Where records of disturbance exist for a reclassified area, the level of field verification may be varied below full intensity, as depicted in Figure 8.

Figure 8. Variations in field sampling intensity.



Transect Location

Transects will be systematically located within reclassified blocks and will commence ten metres from main access roads to avoid the effect of felling for road clearance, safety and firewood collection. Summary statistics will be grouped by transects. A minimum transect length of 140 metres will be used to derive summary statistics for the decision-making process, however, smaller transects where they unavoidably occur will provide valuable qualitative reference material.

3.4 Data Capture

A basic library of the terms to be used in the description of development and disturbance criteria has been established for the sampling process, as shown in Table 2.

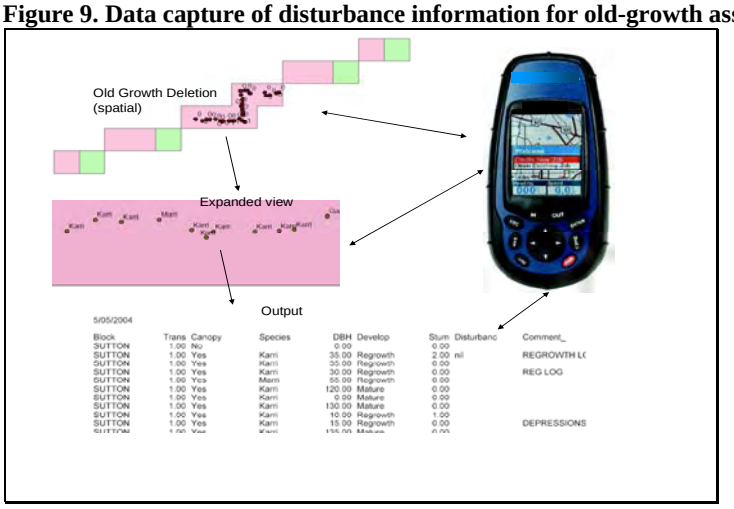
Table 2. Library of old-growth descriptors for field assessment.

Feature Name	Feature Type	Attribute Items
Primary	Number	Unique number allocated to deletion
Block	Text	CALM block name
Transect	Number	Sample transect line number
Canopy	Text	Yes or No (using Densitometer)
Species	Text	Jarrah, Marri, Karri, Wandoo, other, gap.
DBH	Number	Diameter@breast height of dominant canopy tree (cm)
Development	Text	Regrowth, Mature, Senescent, Gap.
Stumps	Number	Count of visible stumps.
Disturbance	Text	Snig Tracks, Heads, Cross-cut log, Treatment, nil.
Comment	Text	Other details to note in field,[2] e.g. suspected dieback.

Data will be recorded into these descriptive fields for each sample point along the transect. Details for this process are summarised in Figure 9.

[2] A software limited quantity of data features and attributes can be recorded at each sample point. To provide added flexibility outside the defined descriptors, any extra details will be entered in the comments field.

Figure 9. Data capture of disturbance information for old-growth assessment.



4 Analysis of Results

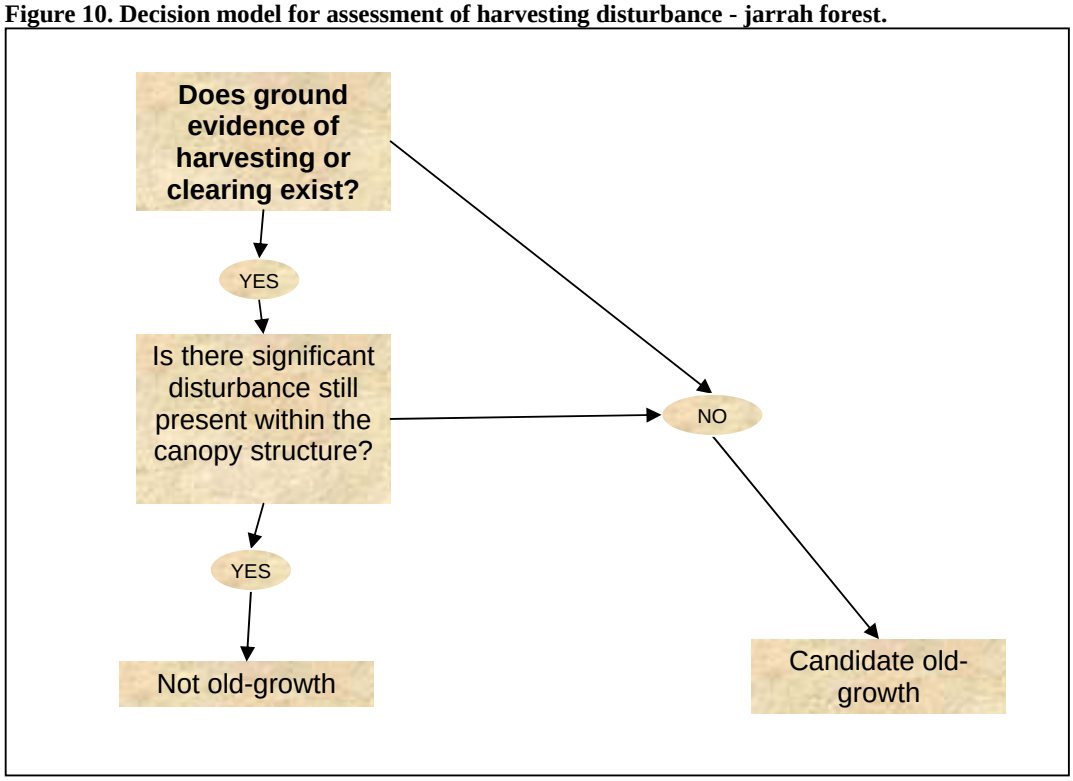
4.1 Decision-model for assessing the level of harvesting disturbance

This section provides further detail on the assessment of areas reclassified due to historical harvesting records. As described in Figure 2 (above), the majority of old-growth reclassifications can be attributed to changes derived from historical harvesting records (51%). Figures 4, 5 and 6 in Section 2.2 provide examples of the flow of information in the decision-making process for the different categories including harvest records (Figure 5).

Individual, reclassified old-growth blocks will be assessed progressively utilising data from aerial photos, file information and historical maps. As the definitions for old-growth vary by species (see Section 2.2), there will be some variation in the analysis of results. This difference is primarily the defined capacity for old-growth jarrah stands to have minimal disturbance and still be categorised as old-growth. The definition of karri and wandoo old-growth in Section 2.1 precludes the minimal disturbance component of the disturbance model. As defined, karri and wandoo stands must be uncut to qualify as old-growth. All uncut jarrah woodland has been included as old-growth in the corporate database (unless affected by *P. cinnamomi*).

Available data will be analysed in conjunction with field assessment information (as detailed above) where this has been collected. The decision model below outlines the framework for analysing field assessment information, for determining the status of the reclassified old-growth areas in jarrah forest. The depiction is to be applied for jarrah forest only due to the various definitions for old-growth. For forest-types other than jarrah, the decision-making process does not include the minimal disturbance component.

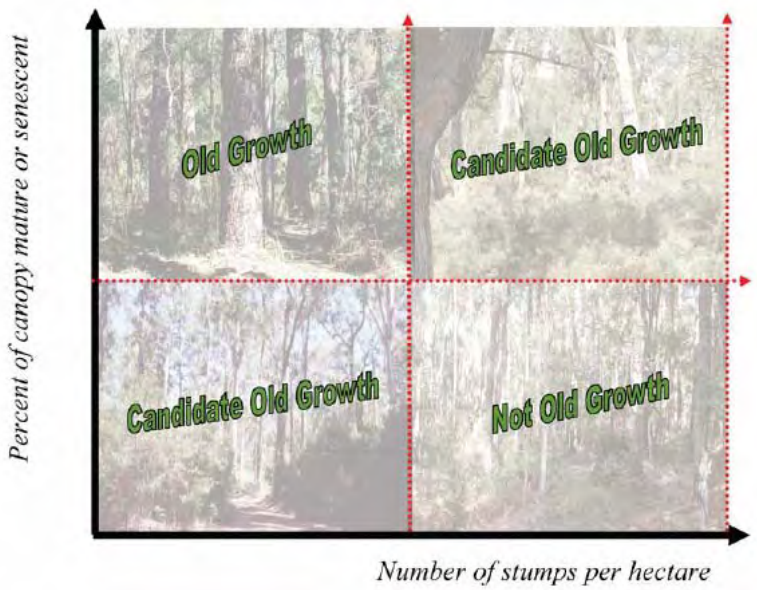
Figure 10. Decision model for assessment of harvesting disturbance - jarrah forest.



The most important information from field assessment will be that associated with evidence of disturbance, usually stumps and associated regrowth. Generating and analysing quantitative information to reflect field observations will initially involve combining field attributes from Table 2 above, with orthophotos on GIS. Appendix I illustrates a report grouped by Forest Block, and summarised by the key elements of disturbance (stumps per hectare) and development stage (of canopy trees in samples). The primary indicator to determine localised old-growth extent will be the disturbance (stumps per hectare) estimation. A combination of the other available information including development stage information and observations will be used in support of the recommendation.

For each transect, the development and stump parameters will be summarised and assessed as depicted on the following illustration, which will contribute to the decision-making process.

Figure 11. The relationship between stump numbers - development stage and old-growth*.



**Note that the old-growth and candidate old-growth depicted in Figure 11 would also need to be assessed for other old-growth factors such as dieback infection.*

4.2 Criteria

The primary field evidence of harvesting disturbance will be the number of stumps per hectare. In jarrah forest a guiding parameter for determining localised old-growth will be a level of the order of 5 stumps per hectare. Five stumps per hectare equates to one stump counted within the 20 metre width of a 100 metre transect length. It is intended to measure multiple transects for each sample area depending upon the size/geometry of the reclassified area. Canopy measurements (for development assessment), other field observations and background data can then be used to estimate whether this disturbance is still evident in the canopy. For jarrah forests structural development greater than 25% mature or senescent will be used as the guiding parameter in development stage estimates. During the WA Regional Forest Agreement, the oldest age class occupying at least 25% crown cover in karri forest was referred to as the dominant age class. This crown cover estimate will be used by the Conservation Commission in jarrah forest to assist in the assessment of minimal disturbance[3]. For karri forests, jarrah woodland and wandoo, the assessment area must be uncut to qualify as old growth. This effectively removes the capacity for negligible disturbance estimates in karri, jarrah woodland and wandoo forest. As

[3] The Conservation Commission has determined that a canopy measurement to support the ground disturbance measurement will benefit the determination of minimal disturbance in jarrah forest. Wording from the document *Old-growth mapping for the WA RFA* by Bradshaw states the following - "The effects of disturbance are considered more than negligible where changes to the structure of the overstorey caused by these disturbances are still evident or where changes to the overstorey or understorey are irreversible". This definition indicates that the overstorey or canopy condition is important evidence in the determination of minimal disturbance. As 25% has been used in karri forest to represent a dominant cohort, this percentage will be adopted as a guiding parameter for jarrah forest.

such there can be no logging stumps within karri, jarrah woodland and wandoo old-growth forest.

4.3 Transect design

Due to the variable nature of past logging events, it is common to find localised disturbance across forest blocks. Along a sample transect, this may result in obvious groupings of stumps, followed by no signs of unnatural disturbance. This situation can be accounted for by ensuring that the consideration of results along individual transects is divided into smaller lengths (for example 140 metres in length – a two hectare pixel being approximately 140 metres * 140 metres in dimension). Further measures will be undertaken to identify any old-growth 'patches' that are sampled in the field. This may incorporate assessment of disturbance within transects to derive disturbance estimates at the minimum mapping scale of two hectares. In practical application this may incorporate a GIS interpretation of patterns of stumps and field observations from samples, to locate isolated areas of old-growth of two hectares or more, within the area being assessed.

4.4 Examples

Appendices I and II show the outputs of some assessments undertaken during the pilot study. The two areas shown are Murtin Block (Appendix I and Appendix II) and Tone Block (Appendix Ia and Appendix IIa). In both examples, old-growth was reclassified by CALM to non old-growth due to refinement of harvesting records. The example areas were assessed remotely by GIS ortho-photograph and in the field. Field reconnaissance yielded estimates for disturbance parameters which are detailed in Appendix I (and Ia) and summarised in the comments field in Appendix II (and IIa).

The finding for Murtin Block is that the area is not old-growth due to the presence and extent of stumps in the area, which is supported by other field evidence of harvesting such as snig tracks and the low estimated proportion of mature trees. The recommendation for this example is that the non old-growth reclassification should stay in place.

The finding for Tone Block is that the area does contain old-growth. The two transects which were sampled in the field found no stumps, no visible evidence of past disturbance and 36% to 38% mature canopy cover. The recommendation for this example is that the entire polygon area should be re-instated in the corporate database as old-growth unless CALM undertake detailed mapping and assessment of the old-growth extent within the polygon. This information should be provided to the Conservation Commission within two months from the date of publishing the results for this polygon for further review by the Conservation Commission.

27/05/2005

Appendix I - Transect Summary

BLOCK	PRIMAR	TRANSECT_	CANOPY	SPECIES	DBH	DEVELOP	STUMPS	DISTURBANC	COMMENT_
					count of stumps		24		
	1				number of stumps		0		

0 *Stumps per hectare (this transect)*

2

No

Gap

					Gap			
TONE	3645	2	No	Gap	0		0	
TONE	3645	2	No	Gap	0		0	
TONE	3645	2	No	Gap	0		0	
TONE	3645	2	No	Gap	0		0	

Gap **100%** *% canopy development (this transect)*

No

Yes

Mature

					Mature			
TONE	3645	2	Yes	Jarrah	115		0	
TONE	3645	2	Yes	Marri	110		0	
TONE	3645	2	Yes	Marri	0		0	SAME CANOP
TONE	3645	2	Yes	Jarrah	90		0	
TONE	3645	2	Yes	Marri	100		0	

Mature **36%** *% canopy development (this transect)*

Regrowth

					Regrowth			
TONE	3645	2	Yes	Jarrah	40		0	
TONE	3645	2	Yes	Jarrah	50		0	
TONE	3645	2	Yes	Marri	45		0	
TONE	3645	2	Yes	Jarrah	45		0	
TONE	3645	2	Yes	Jarrah	25		0	
TONE	3645	2	Yes	Jarrah	5		0	
TONE	3645	2	Yes	Jarrah	10		0	
TONE	3645	2	Yes	Jarrah	30		0	
TONE	3645	2	Yes	Marri	55		0	

Regrowth **64%** *% canopy development (this transect)*

Yes

					count of stumps		18	
	2				number of stumps		0	

0 *Stumps per hectare (this transect)*

3645

TONE

31/03/2005

Appendix I - Transect Summary

BLOCK	PRIMAR	TRANSECT	CANOPY	SPECIES	DBH	DEVELOP	STUMPS	DISTURBANC	COMMENT_
			Yes						
						Mature			
						Mature			
MURTIN	4110	1	Yes	Marri	90		0	nil	
MURTIN	4110	1	Yes	Marri	80		2	nil	
MURTIN	4110	1	Yes	Marri	90		1	nil	
MURTIN	4110	1	Yes	Marri	95		1	nil	
MURTIN	4110	1	Yes	Marri	80		0	nil	
MURTIN	4110	1	Yes	Jarrah	95		0	nil	
				Mature		**17%**	*% canopy development (this transect)*		
						Regrowth			
						Regrowth			
MURTIN	4110	1	Yes	Jarrah	25		0	nil	
MURTIN	4110	1	Yes	Marri	25		0	nil	
MURTIN	4110	1	Yes	Jarrah	20		1		
MURTIN	4110	1	Yes	Marri	30		0	nil	
MURTIN	4110	1	Yes	Jarrah	40		0	nil	
MURTIN	4110	1	Yes	Jarrah	80		0	nil	
MURTIN	4110	1	Yes	Marri	65		1	nil	
MURTIN	4110	1	Yes	Jarrah	10		1	nil	
MURTIN	4110	1	Yes	Jarrah	25		0		
MURTIN	4110	1	Yes	Marri	20		1	Heads	
MURTIN	4110	1	Yes	Jarrah	20		0	Heads	
MURTIN	4110	1	Yes	Jarrah	45		0	Snig Tracks	
MURTIN	4110	1	Yes	Jarrah	45		0	nil	
MURTIN	4110	1	Yes	Jarrah	45		0	nil	
MURTIN	4110	1	Yes	Marri	5		0	nil	
MURTIN	4110	1	Yes	Marri	5		1	Heads	
MURTIN	4110	1	Yes	Marri	30		1	Heads	
MURTIN	4110	1	Yes	Marri	10		0	nil	
MURTIN	4110	1	Yes	Marri	45		0	nil	
MURTIN	4110	1	Yes	Jarrah	0		0	nil	SAME CANOP
MURTIN	4110	1	Yes	Jarrah	40		0	nil	
MURTIN	4110	1	Yes	Jarrah	20		1	nil	
MURTIN	4110	1	Yes	Marri	5		0	nil	
MURTIN	4110	1	Yes	Marri	10		1	nil	
MURTIN	4110	1	Yes	Marri	10		0	Heads	
MURTIN	4110	1	Yes	Marri	40		0	nil	
MURTIN	4110	1	Yes	Jarrah	40		1		
MURTIN	4110	1	Yes	Jarrah	45		1	nil	
MURTIN	4110	1	Yes	Marri	20		1	nil	
				Regrowth		**83%**	*% canopy development (this transect)*		

Yes

1

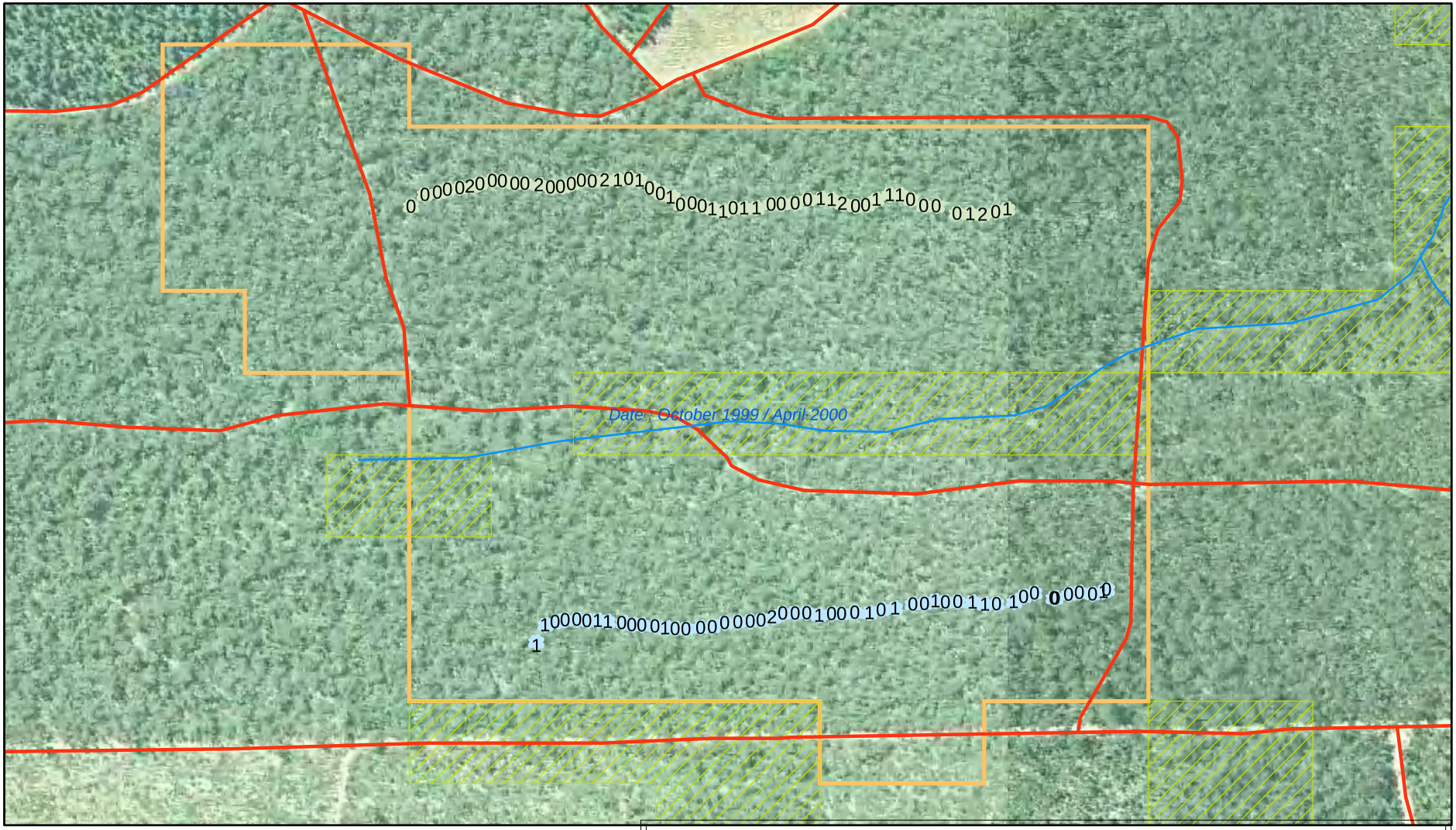
count of stumps 51
number of stumps 15

15 *Stumps per hectare (this transect)*

2

No

Appendix II - Murtin assessment- Polygon 4110



Report Detail

Comment

Jarrah forest-south.Two transects - Clear signs of logging (Transect 1estimated 15 stumps/hectare, T2 estimated 23 stumps/hectare). Snig-tracks, cross-cut logs, est. mature canopy 17-18%.

Recommendation

Evidence of past logging is present, the results of which are still visible. Recommendation non old-growth.

100 50 0 100 Meters

N

Legend

Samples (stumps labelled)

TRANSECT__

- 1
- 2
- 3
- 4

- hydro_minor
- roads_unsealed
- Reserves (formal/informal)

Old-growth declassifications

EXTCODE

- Dieback mapping
- Ecosystem mapping
- Harvest Records
- Harvested 97_01
- Orthophoto date

Sample points taken on straight line with hip-chain and compass. The changing sample point locations is due to variables GPS accuracy when logging data.

Appendix II(a) - Tone assessment- Polygon 3645

Report Detail

Comment	Recommendation
Jarrah forest-south. Two transects run outside the informal reserve, both estimated no stumps or visible evidence of logging. There is an estimated 36-38% mature canopy.	Re-instate all polygon as old-growth unless information is provided to the Conservation Commission by CALM detailing separation of old-growth and any disturbed areas.

100 50 0 100 Meters

N

Legend

Samples (stumps labelled)

TRANSECT__

- 1
- 2
- 3
- 4

- hydro_minor
- roads_unsealed
- Reserves (formal/informal)

Old-growth declassifications

EXTCODE

- Dieback mapping
- Ecosystem mapping
- Harvest Records
- Harvested 97_01
- Orthophoto date

Sample points taken on straight line with hip-chain and compass. The changing sample point locations is due to variables GPS accuracy when logging data.

Appendix III – Request for a review of potential old-growth on an indicative timber harvesting plan

Completed forms returned to: Conservation Commission of WA, Cnr Hackett & Australia II Drives, CRAWLEY, WA, 6009

Applicant contact details;

SURNAME:	**OTHER NAMES:**
ADDRESS (residential):	
ADDRESS (postal):	
PHONE: **FAX:**	**EMAIL:**
ASSOCIATED INSTITUTION OR BODY (if applicable)	

Land to which this request relates;

State Forest or Forest Block Name:
Coupe location detail from the indicative timber harvesting plan (attach map including identification of the specific areas within the coupe or block that you believe is old growth):

Please detail the research undertaken in lodging this request. Detail should incorporate inspection reports with recorded observations, photographs, maps and imagery (extra detail will need to be attached to this covering application);

Details:

Please indicate (tick) which of the following old-growth definitions applies to the request area – (the below definitions are as defined in the Regional Forest Agreement – for background information refer to Section 1.1 of *Assessment criteria and process for the Conservation Commission review of old-growth amendments*);

	Karri and karri/tingle forest – uncut forest which is mature or senescent
	Jarrah and jarrah/tingle forest – uncut forest or forest subject to minimal disturbance which is not known to be affected by *Phytophthora cinnamomi.*
	Jarrah woodland – uncut woodland which is not known to be affected by *Phytophthora cinnamomi*
	Wandoo forest and woodland – uncut forest or woodland

Continued (over)

Request processing information

Please ensure all the details specified above are included with this request as processing will not commence without adequate detail. If the detail provided is inadequate the request will be returned with guidance as to further information required and no further action will be taken until an adequate request is provided. Upon receipt of an adequately detailed request an initial review using remote data and CALM records will be undertaken. If this indicates that the area may be old-growth, there will be a moratorium on harvesting the area until the Conservation Commission of WA can undertake further assessment. Field assessment will be based upon the procedures detailed in Section 3 of *Assessment criteria and process for the Conservation Commission review of old-growth amendments*. For areas which are scheduled on the harvest plan in next 12 months, the assessment will be undertaken as a priority in order to avoid disruption to harvest planning activities. The results of assessment will be sent to the request applicant and will also be posted on the Conservation Commission's web site. If the nominated area is assessed by the Conservation Commission and found to be old-growth, the corporate database will be amended and the area will be recorded as old-growth.