Conservation Commission of Western Australia

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

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 reclassified from old-growth to non old-growth by the Department of Conservation and Land Management (CALM) between 1997 and 2001. A further 2650 hectares of other crown land which is not vested in the Conservation Commission was also reclassified in CALM's corporate database during the same period and is also subject to this assessment.

The reclassifications undertaken by CALM from old-growth to non old-growth were 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 applied by CALM, develop an assessment process including detailed field criteria to determine whether to alter or confirm an area's reclassification. As required in the FMP the development of this process and criteria has involved consultation with CALM and the public.

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 I) for this purpose.

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1. Background & Context

1.1 Background

Area subject to assessment

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 Department of Conservation and Land Management (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 for its old-growth status. 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. However, the assessment by the Conservation Commission, will only apply to 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. This area is subject to a moratorium on logging pending the Conservation Commission re-assessment. 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.

Also subject to this assessment will be 2650 hectares of other crown land which is not vested in the Conservation Commission but was reclassified in CALM's corporate database during the same period. 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.

Old-growth definition

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

Development of the assessment process

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 reclassified old-growth, and the proposed assessment criteria were published in the form of a public consultation paper. Comments received were considered and from this process a number of improvements and changes have been implemented which are detailed in the relevant sections of this document, and summarized below:-

- A benchmarking overstorey analysis of unlogged jarrah old-growth forest to assist in the assessment and demonstration of minimal disturbance.
- An alteration in the way in which canopy measurements are recorded as a result of the benchmarking analysis. The new benchmarking data will enable direct relative crown cover sampling of the overstorey for comparison.
- An independent analysis of the sampling technique and statistical technique which was implemented in the pilot-study field work.
- As a result of the recommendations from the independent analysis, a revision of the systematic sampling methodology which will no longer be based upon transects, but upon point sampling at alternate grid intersections.

1.2 Objective

The objective of this document is to present the field assessment criteria and 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 reclassified as non old-growth forest up to the date of the commencement of the FMP (as stated in the FMP and outlined in the previous section however, 1997-2001 is effectively the review period). The review will determine whether areas should be returned to their previous classification as 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 is 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, 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. The Conservation Commission will assess the following total areas of reclassified old-growth:-

- Reclassified areas from State forest 9387 hectares
- Reclassified areas from other public land 2650 hectares

In the period subject to this assessment there were also 4,500 hectares of old-growth additions to State forest and 30 hectares of old-growth additions to other public land. The 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.

State forest and timber reserve

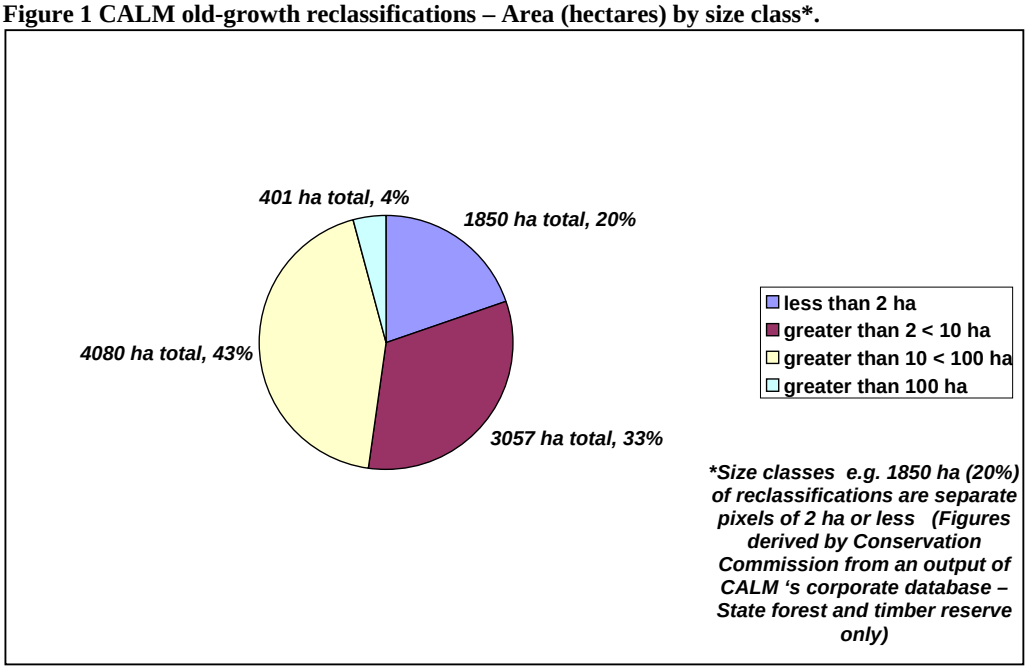
The most recent advice from CALM is that a total area of 9387 hectares of old-growth was reclassified by CALM on State forest and timber reserve in the period subject to this review. This total area figure and the figures used in the depictions below include approximately 2800 ha within existing informal reserves. 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, although they 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%).

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. These areas of other public land will be assessed by the Conservation Commission separately to the reclassifications on State forest and timber reserve. 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. 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 and process 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. In such cases the relevant assessment will be afforded a higher priority.

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%) within the reclassified area is composed of map pixels less than 2 hectares in size as detailed in Figure 1 above. Appendix 3 of the FMP describes the methodology to be employed for field confirmation and boundary demarcation of old-growth forest as follows:- "The areas adjacent to any old-growth forest patches identified in the corporate database will be inspected by applying, where practicable, a systematic grid survey spaced at approximately 100 metre intervals. If the boundaries of the old-growth patch are found to be more extensive than the database indicates, the survey is to be extended until the true boundaries of the area that meets the criteria for old-growth forest reserve are identified, and the Department's corporate database will be amended accordingly." Implementation of these field measures will ensure that old-growth patches which are smaller than the minimum two hectare patch size, but contiguous with old-growth forest will be accurately demarcated and protected in the field. In other words, boundaries will be demarcated at the actual old-growth boundary in the field.

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

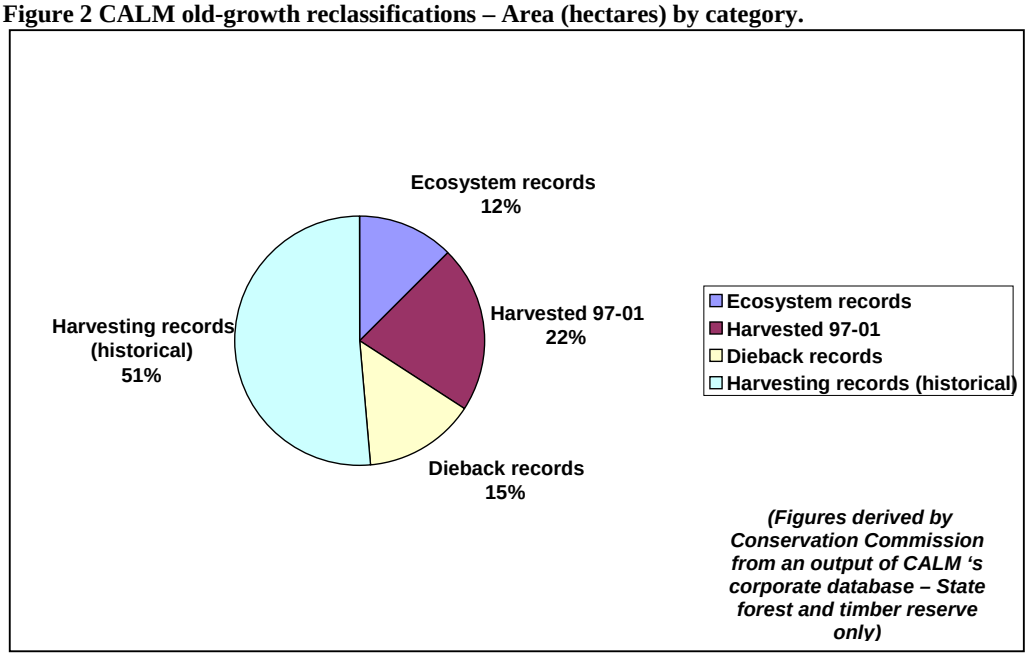
1.7 Old-growth reclassifications by CALM - categories

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 2 below.

Figure 2 CALM old-growth reclassifications – Area (hectares) by category.



2. Assessment by the Conservation Commission

2.1 Basis for Assessment Process and Field Criteria

As stated, the appeal decision by the Minister for the Environment in relation to the EPA's report on the FMP, detailed the following recommendation:-

> *The current definition of old-growth forest be retained, but based on the criteria applied by the Department* [CALM]*, 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*

CALM have advised that the current definition of old-growth forest is as follows:

- Karri and karri/tingle forest – uncut forest[1] 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.

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

During public consultation it was submitted to the Conservation Commission that the wording in the Comprehensive Regional Assessment (CRA) document in relation to

[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 woodland omitted the word “uncut”. CALM have advised the Conservation Commission that,- “The omission of the word ‘uncut’ from the definition of jarrah woodland cited on page 166 of the CRA document was presumably an editing error. The area of jarrah woodland old-growth reported in Table 13.2 on the same page was the area of uncut woodland. Note that irrespective of their previous cutting history, all areas mapped as jarrah woodland (including those that had been previously cut-over) have been set aside from timber production as informal reserves under the previous and current FMP.”

The Conservation Commission is required to develop its assessment criteria and process based on the current CALM departmental approach to the classification of old-growth as summarised above.

2.2 Conservation Commission assessment process

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 (up to December 2001) 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 reassessed 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)
Jarrah and jarrah-tingle		
Harvesting records	*Not logged historically (uncut) or minimally disturbed*	*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**
Karri and wandoo		
Harvesting records	*Not logged historically (uncut)*	*Unnatural disturbance (eg stumps)*
Ecosystem data	*Forest or woodland,*	*Non-forest (rocky outcrops, sedgelands etc.), plantation, cleared land*
Harvested 1997-2001	*Not logged 1997-2001*	*Logged 1997-2001*
	OLD-GROWTH	**NON OLD-GROWTH**

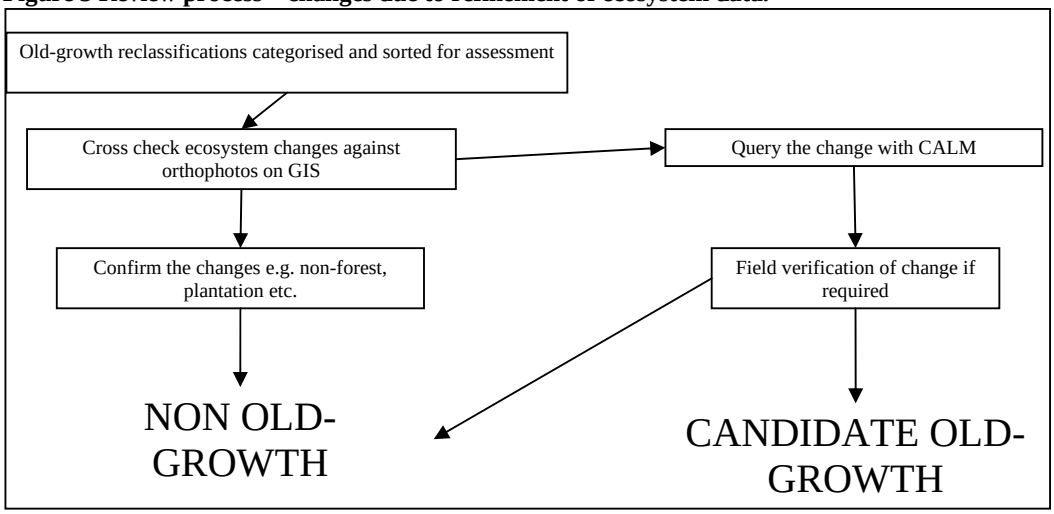
The Conservation Commission will assess the reclassified areas using a combination of remote and field analysis techniques. The details for each of the categories of reclassification are outlined in the following sections.

2.2.1 Ecosystem changes

CALM 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 3.

Figure 3 Review process – changes due to refinement of ecosystem data.



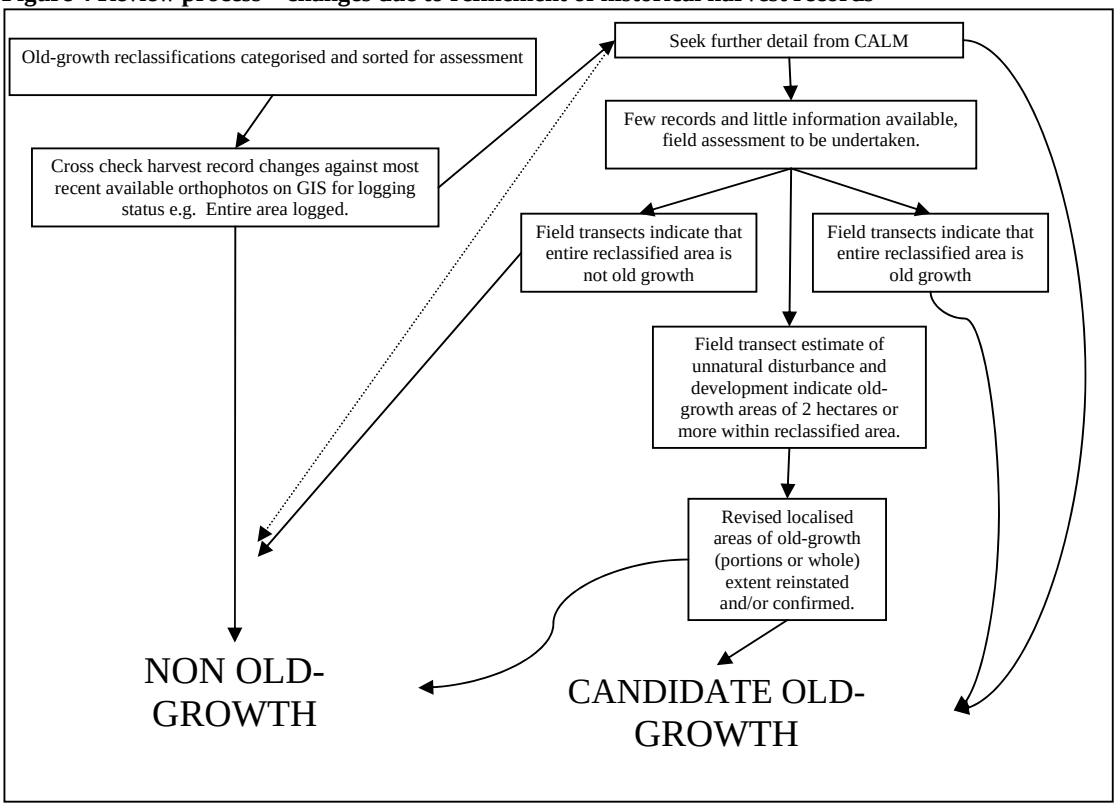
2.2.2 Harvested 1997 – 2001

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 4 and discussed in detail under Section 3 Field Assessment Methodology.

Figure 4 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*.

Details from CALM's 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 of 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 one 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

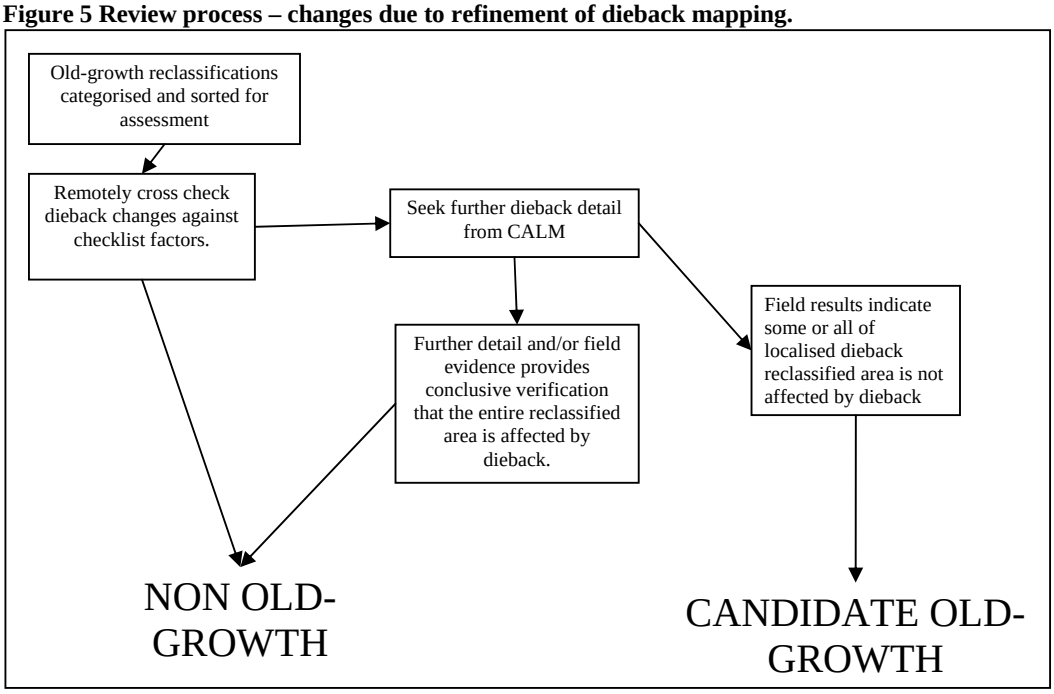
The Vegetation Health Service (VHS) carries out the *Phytophthora* detection process of samples sent to them at its laboratory in Kensington. The VHS returns detection results to Interpreters to verify decisions made in the field. The VHS keeps records in a database of all samples processed by them. 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. Conversely, 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 reinterpretation 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 5 below.

Figure 5 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 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 I). To allow the Conservation Commission to prioritise its assessments and provide a timely response, nominations must be received by the Conservation Commission within two months of the release of the rolling three year indicative harvest plan[2]. 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. This will be achieved through formal notification to both CALM and the FPC that harvesting will not proceed until an assessment and decision is made by the Conservation Commission on old-growth status. Accepted nominations will be listed on the Conservation Commission website, with the current status of the assessment. Once the determination has been made, the details will be

[2] For both 2005 and 2006 a single year harvest plan has been released, as the three year rolling plan is under development. For areas on the 2005 and 2006 indicative harvest plans, the period of nomination will commence two months after the finalisation of the document *Assessment criteria and process for the Conservation Commission review of old-growth amendments*. A rolling three year indicative harvest plan is a requirement under section 11 of the FMP. The rolling plan is developed by CALM in conjunction with the FPC; it is consistent with allowable timber yields and is publicly available.

posted on the Conservation Commission website and provided directly to the nominee.

Section 3.3 of the FMP also states the following in relation to forest areas which are not necessarily nominated by the public, but which are assessed to be old-growth forest by the Conservation Commission:-

> 3.3 Where the Conservation Commission advises the Department that it has assessed that land not currently classified as old-growth forest should be reclassified as old-growth forest, the Department will amend the Department's corporate database in accordance with the Conservation Commission's assessment.

Effectively this section of the FMP allows the Conservation Commission to identify, assess and amend the classification of areas of old-growth forest outside of both the public nomination and reclassification assessment processes.

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 level of disturbance if any.

The assessment applies a systematic sampling process, with sample locations determined by grid intersection, which provides site data for analysis. Old-growth forest is determined by combining forest disturbance and development stage information.

The old-growth field sampling approach which has been applied by CALM in the past, has been variable across the FMP area, without a systematic and transparent process but with reliance upon the judgement of the field assessor. For the Conservation Commission assessment, 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. The emphasis upon supplying a quantitative assessment is in response to a perceived need for a systematic and transparent process which provides detailed information for decision-making. As per the EPA recommendation detailed in the Background section of this document, the detailed field criteria for this assessment will be based upon the criteria applied by CALM. The Conservation Commission has determined that collecting data but not providing details on the application of any threshold analysis does not satisfy the requirement for 'detailed field criteria' as referred to in the EPA recommendation.

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 determined systematically by grid intersection. At these sample points disturbance information will also be measured and recorded. A stump count within a circular plot two hundred square metres in size will be measured at each sample point to derive an estimate of stumps per hectare. If stumps are visible outside the sample area, 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

Development stage assessments will estimate the mature/senescent component of the sample area.

For the consideration of minimally disturbed areas in jarrah forest during the RFA, wording from the document *Old-growth mapping for the WA RFA* by Bradshaw states the following:-

"*To address the question of whether the effects of logging disturbance are now negligible, the intensity of past harvesting, the time since harvest and the number of times harvested have been considered.- The jarrah forest has undergone a variety of harvesting intensities (Stoneman et al 1989). Intensive harvesting was characteristic of jarrah forest harvested up to about 1940 and the high component of regrowth which resulted from that logging and the subsequent silvicultural treatment remains an obvious structural change in these forests. Harvesting since 1970 was also relatively intense and the evidence of harvesting is both too recent and too intensive for the disturbance to qualify as negligible. Many of these areas have also been cut over more than once. Harvesting in the 1960's is considered too recent to have allowed any of these disturbances to become negligible. All of the above areas are excluded from consideration as old-growth.*

Harvesting of jarrah forest between 1940 and 1960 was more variable in intensity and there was a possibility that some would qualify as having negligible disturbance in the context of old-growth. The following criteria were used to select areas for possible field inspection: areas of forest which had been harvested only once between 1940 and 1960; that had not been previously mapped as pole or sapling stands (Bradshaw et al 1997); that had not been subject to intensive silvicultural treatment (Stoneman et al 1989); and that had not been mapped as having symptoms of infection with Phytophthora cinnamomi. These areas were identified and a sample of these areas (25,000 ha) was jointly inspected in the field by Commonwealth and State officers. Areas were excluded from old-growth (i.e.

disturbance still more than negligible) if they showed evidence of harvesting that was sufficiently intense to have resulted in persistent regrowth as a result of that harvesting. Areas that showed evidence of harvesting (stumps etc) but no evident structural change to the overstorey were described as 'minimally disturbed'. Areas containing patches of regrowth that were not a consequence of harvesting were included as old-growth. In most cases the decision to include or exclude was obvious. Areas found to be virgin or 'minimally disturbed' in this process were included as old-growth."

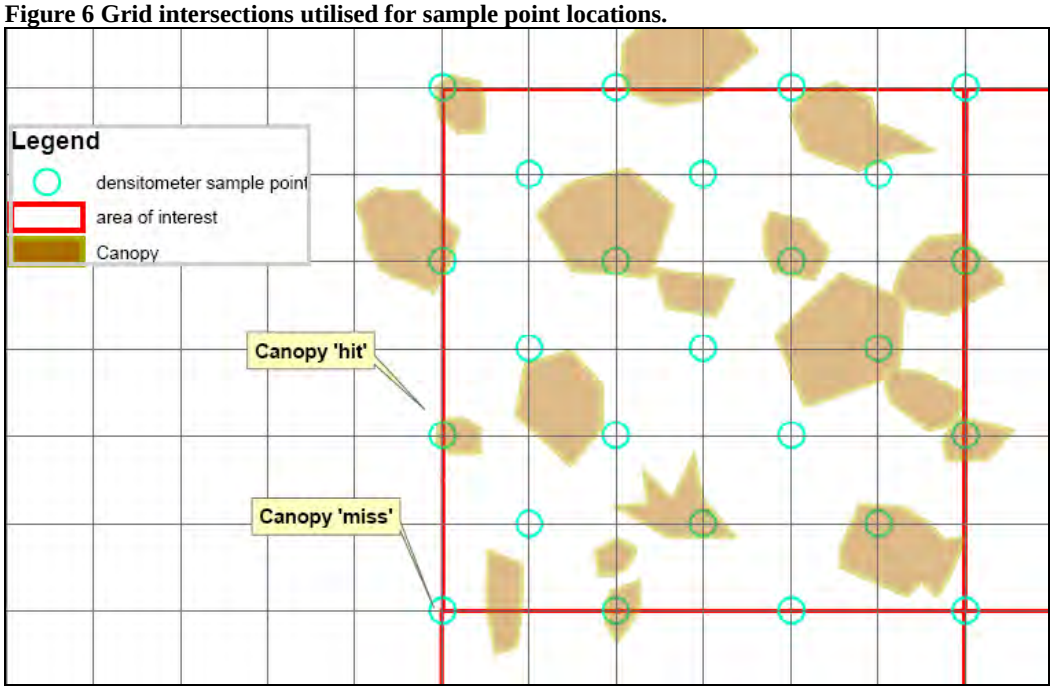
The pilot study criteria and benchmarking analysis have been developed primarily to assess for minimal disturbance as outlined in the extract above. The jarrah forest areas which were harvested between 1940 and 1960 are logically the most likely candidate areas for minimal disturbance. These areas, more than other forest sites, may have had a relatively small amount of disturbance, and/or the forest may have recovered to the point that the disturbance could now be considered as negligible.

In areas that have been more recently disturbed, for instance harvesting since 1970, the logging has generally been more intensive. Therefore for canopy estimates in these forests it may be more relevant to assess the total crown cover (and the relative proportions of the mature/senescent and regrowth components). This is because the regrowth cohorts will not have had sufficient time to grow into the overstorey, and the relative proportion of remnant mature/senescent trees in the overstorey may consequently be disproportionately high. The total overstorey cover can be derived from the benchmarking data and sampling data if required as per the need for a more intense sampling and benchmarking analysis (see Section 4.2). Areas harvested before 1940 were reportedly intensively harvested, but where these sites occur within the reclassified old-growth areas to be assessed under this procedure or as public old-growth nominations, they will be assessed for old-growth.

For the reasons outlined in the extract above however, the main candidate areas for minimal disturbance will logically be drawn from areas logged once relatively lightly from a period in the 1940s to 1960s. An example might include the following scenario:- Regrowth cohorts from light logging during the period between the 1940s to 1960s have grown into the overstorey, replacing the few removed stems and resulting in no visible or evident changes remaining in the overstorey.

Canopy estimates will be generated using a canopy-densitometer and are based on an evaluation of data collected at sample points located at grid intersections within the sample area (see Section 3.4 for further description of this sampling method). 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 in the grid. Canopy cover for the purposes of this assessment will be defined as the percent of a fixed area covered by the crown of the overstorey species, delimited by the vertical projection of its outermost perimeter. Small openings in the crown are included and crowns are treated as opaque. At each sample point the presence or absence of the overstorey is recorded as detailed in the following figure.

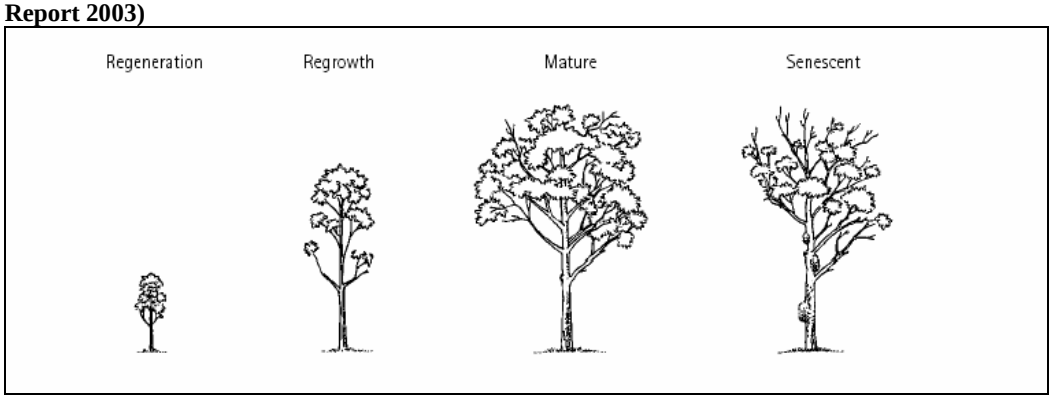
Figure 6 Grid intersections utilised for sample point locations.



Readings from the vertical densitometer can have three outcomes – (i) regrowth, (ii) mature or senescent, or (iii) canopy gap. For any patch for which (number of regrowth 'hits') observations are made for regrowth and (number of mature/senescent 'hits') observations are made for mature or senescent crowns, the relative crown cover of the mature or senescent component is (number of mature/senescent 'hits') / ((number of regrowth 'hits')+ (number of mature/senescent 'hits')). In other words the overstorey consists of proportions of tree canopies of different development stages. The relative proportion of the overstorey which is mature or senescent is estimated by the relative number of canopy 'hits' made with the densitometer that are estimated as mature or senescent trees.

A broad general depiction of tree development 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.

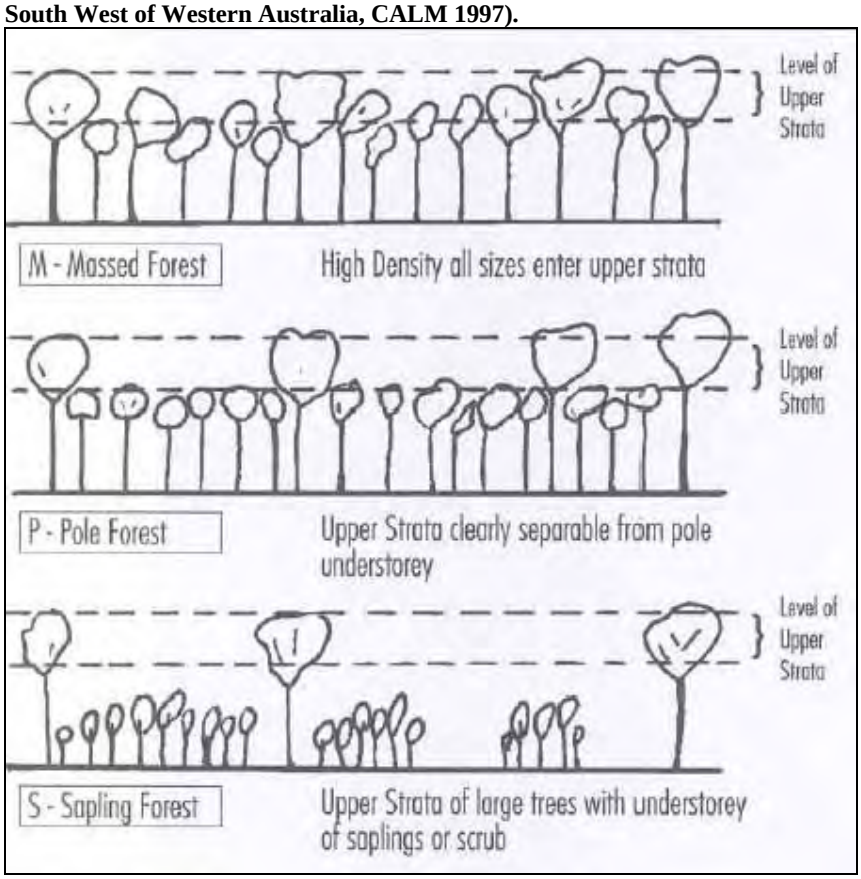
Senescent: Crown form contracting, decrease in crown diameter and crown leaf area.

3.3 Benchmarking

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. As outlined above, 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 upper canopy condition is important evidence in the determination of minimal disturbance.

A benchmarking assessment was undertaken following consultation with stakeholder groups and because a suitable threshold for relative crown cover of mature and senescent stems could not be reliably inferred from methodologies employed in jarrah forest in the past. For the benchmarking assessment, the ground determination of the overstorey utilizes the same structural definitions as that described for mapping during the RFA in Figure 8 below. This direct measure of the overstorey component will also be utilized for the assessment of reclassified areas and nominated areas.

Figure 8 Structural composition of massed, pole and sapling stands (from Forest Mapping in the South West of Western Australia, CALM 1997).



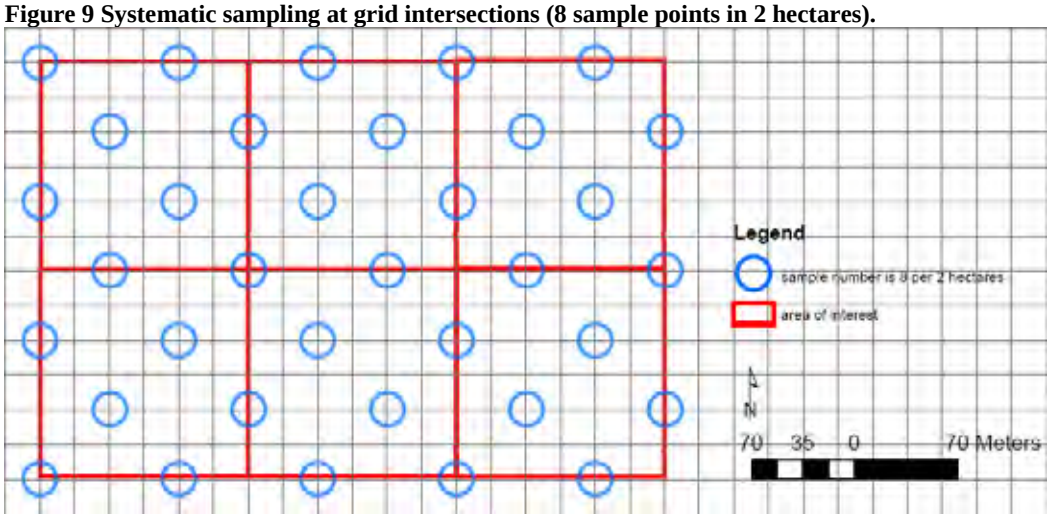
A series of benchmarking sites have been established in unlogged, old-growth jarrah forest by the Conservation Commission. These sites will be used to compare like sites both from the areas which were reclassified by CALM between 1997 and 2001 and for areas which may be nominated by the public. Further benchmarking of old-growth reference sites will be established. A canopy sampling estimate has been derived for those areas of jarrah old-growth already selected for the benchmarking process. Initial results from these sites indicate that the relative proportion of mature and senescent trees in the overstorey of unlogged, old-growth jarrah forest is greater than 50 per cent (see section 4.2 Criteria).

3.4 Sampling

Following the decision to undertake field inspection, the Conservation Commission will inspect and sample the target area. The field work will be undertaken by the Conservation Commission independently of all parties. For areas nominated by the public, if an inspection is undertaken, it will also be undertaken independently of all parties, however, specific details in relation to the sampling methodology, location and timing will be provided to the nominee. The possibility of random sampling was suggested by stakeholders during the consultation phase instead of systematic sampling as employed during the pilot study. An independent analysis by a consultant for the Conservation Commission has been undertaken in relation to the sampling methodology. The accompanying report to this sampling methodology analysis suggests that the efficiencies in precision gained through systematic grid sampling outweigh the potential costs of any bias and recommends that a systematic

sampling approach is suitable. However, to avoid sampling variability between the minimum mappable units of two hectares, the sampling analysis report suggests using alternate intersections on a systematic grid as previously detailed for canopy point sampling as follows:-

Figure 9 Systematic sampling at grid intersections (8 sample points in 2 hectares).



The process aims to collect two key types of quantitative information at the grid intersections, namely information about the presence or absence of stumps from previous logging and information relating to the canopy. A 200 m2 circular plot will be sampled at each point with a count of stump presence (this will be used to estimate the number of stumps per hectare). Also recorded at the grid intersection will be the point sample of the canopy using the canopy densitometer (as described in Section 3.2).

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. Where records of disturbance exist for a reclassified area, the level of field verification may be varied.

3.5 Data Capture

A basic library of the terms to be used in the description of development and disturbance criteria as well as other qualitative observations 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 reclassification.
Block	Text	CALM block name
Sample Point	Number	Sample point 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)

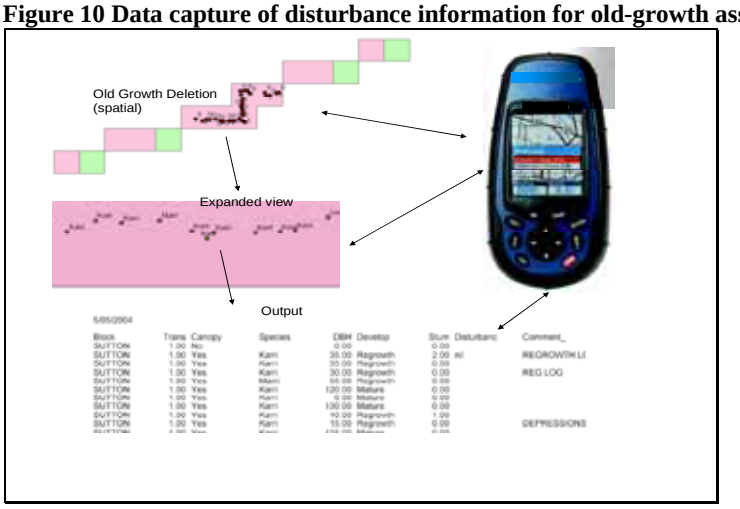
Development	Text	Regrowth, Mature, Senescent, Gap.
Stumps	Number	Count of visible stumps.
Disturbance	Text	Snig Tracks, Heads, Cross-cut log, Treatment, nil.
Comment	Text	Other details to note in field,[3] e.g. suspected dieback.
Qualitative	Text	Mostly upper canopy, mixed, mostly lower canopy

Data will be recorded into these descriptive fields for each sample point on the designated grid intersections. Feedback from stakeholder groups during the consultation phase of this review indicated a concern in relation to the level of information being recorded in relation to stand characteristics in the immediate vicinity of the sample points. To provide further information for analysis and reporting, another field has been added to the list of features to be described during field assessment. This will involve a qualitative assessment of the forest structure immediately around the sample point. Figure 8 from earlier in this document visually depicts the stand structure in terms of upper strata (the overstorey or upper canopy) and lower strata. The additional field will include the assessor's judgement in relation to the stand development characteristics in the immediate vicinity of the sample point (approximately within the 200 metre square circular plot), which will be described as:-

- mostly upper canopy
- mixed upper and lower canopy
- mostly lower canopy

Details for the data capture process are summarised in Figure 10.

Figure 10 Data capture of disturbance information for old-growth assessment.



Sampling location

The assessor will apply a systematic sample, with sampling to take place at grid intersections as depicted in Figure 9 above. The sampling grids are configured to fit CALM's corporate database map depiction which is represented as a series of two hectare squares orientated in a north-south direction. This configuration will allow an analysis to the minimum mappable scale of two hectares. The minimum width of old-growth forest patches will normally be 141.2 metres, which is the side dimension of a

[3] 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. Future improvements in technology and experience may help to develop the sampling process, resulting in slight variations to the data capture process as described in this section.

2 hectare square. The assessor will also need to make some field judgements in relation to roading and road maintenance activities. These judgements may be required where road maintenance has resulted in safety felling, road drainage maintenance or simply pushing debris into the roadside verge. This is only likely to be a factor on maintained roads which traverse through the target area. The sampling grid should avoid the collection of data from within maintained road alignments or immediately adjacent.

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 3, 4 and 5 in Section 2.2 provide examples of the flow of information in the decision-making process for the different categories including harvest records (Figure 4).

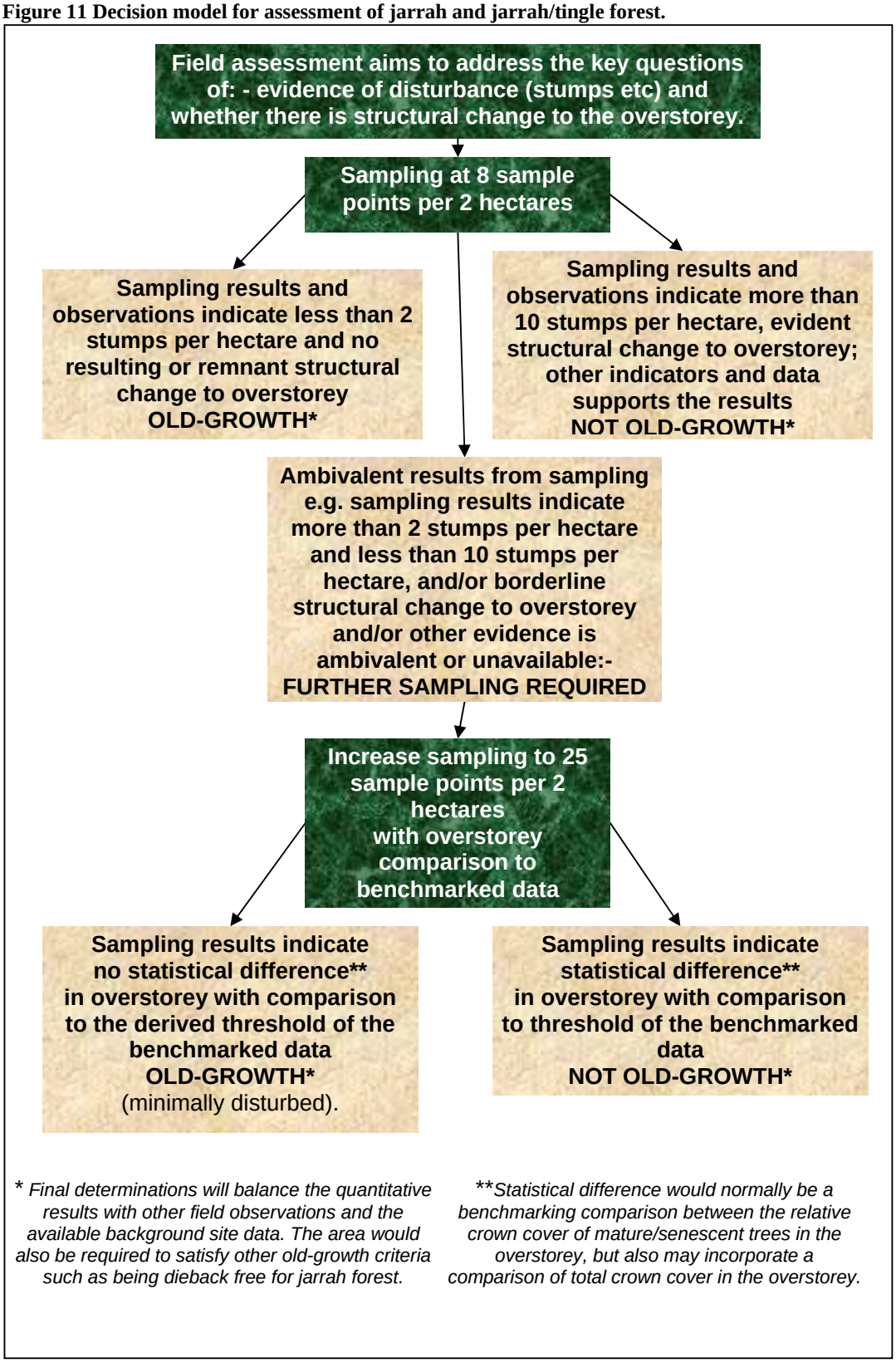
Individual, reclassified old-growth patches will be assessed progressively utilising data from aerial photos, file information and historical maps. As the definitions for old-growth vary by species (see Section 2.2), there will be some variation in the approach used to analyse results. This difference 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 jarrah woodland whether or not included as old-growth in the corporate database is unavailable for logging.

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 and nominated 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.

Generating and analysing quantitative information based upon field observations will initially involve combining field attributes from Table 2 above, with orthophotos on GIS. Data will be summarised with a recommendation detailing the key elements considered in the decision-making process such as disturbance (stumps per hectare) and development stage (relative crown cover).

Sampling of disturbance and development parameters will be summarised and assessed as depicted on the following illustration, which will form the framework for the decision-making process.

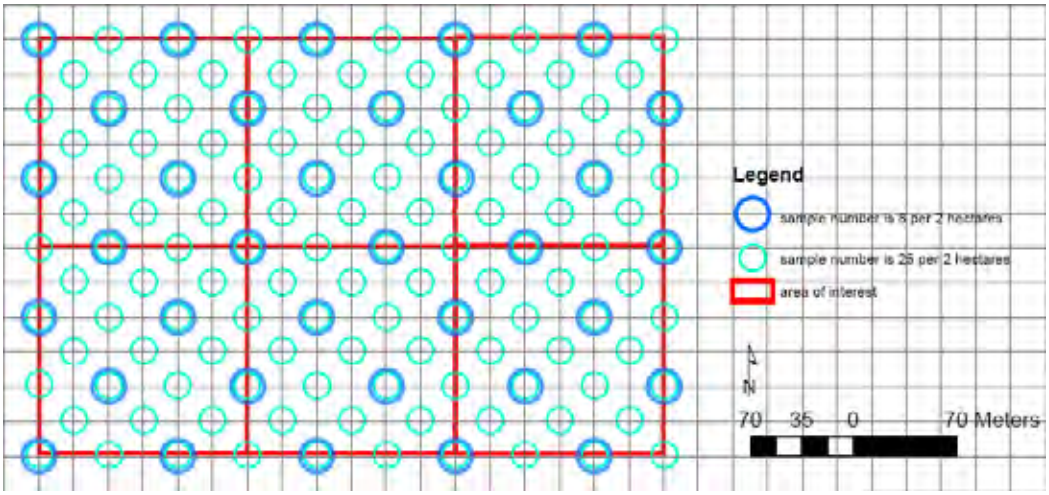
Figure 11 Decision model for assessment of jarrah and jarrah/tingle forest.



As indicated for sample areas which are ambiguous, extra measures such as increased sampling intensity (see Figure 12 below) and comparison with the

benchmarked areas (see Figure 13 below) will be employed to assist the decision-making process.

Figure 12 Increased sampling intensity from 8 points per two hectares to 25 points per two hectares



The depiction details two sampling intensities, eight sample points per two hectare pixel, and twenty-five sample points per two hectare pixel. When areas are field sampled, an initial sampling intensity of 8 sample points will be applied. If results indicate that the old-growth status of the block remains ambiguous, a higher sampling intensity can be applied (number of sample points equals 25). Gap or canopy "miss" observations effectively reduce the sample size when estimating the relative upper crown cover of mature or senescent trees. To overcome this limitation in low density or fire affected forest where large numbers of gap readings are encountered, the crown cover estimation methodology may be modified. This may incorporate an additional procedure where in the case of a gap densitometer reading, crown cover may be measured at the nearest point to where the sample point is located.

4.2 Criteria

Ground disturbance

As previously detailed, the document *Old-growth mapping for the RFA* by Bradshaw clearly indicates that "*Areas were excluded from old-growth (i.e. disturbance still more than negligible) if they showed evidence of harvesting that was sufficiently intense to have resulted in persistent regrowth as a result of that harvesting. Areas that showed evidence of harvesting (stumps etc) but no evident structural change to the overstorey were described as 'minimally disturbed'.*"

A threshold figure of the order of 5 stumps per hectare was developed from the pilot-study analysis, as a guide for minimally disturbed old-growth forest. However, the Conservation Commission does recognize the concerns raised in relation to the natural range in both forest density and spatial pattern across the geographic range of forest species, and the variability of the silvicultural practices which have been applied. For this reason, the Conservation Commission proposes to assess the criteria in conjunction with other information such as relative crown cover estimates

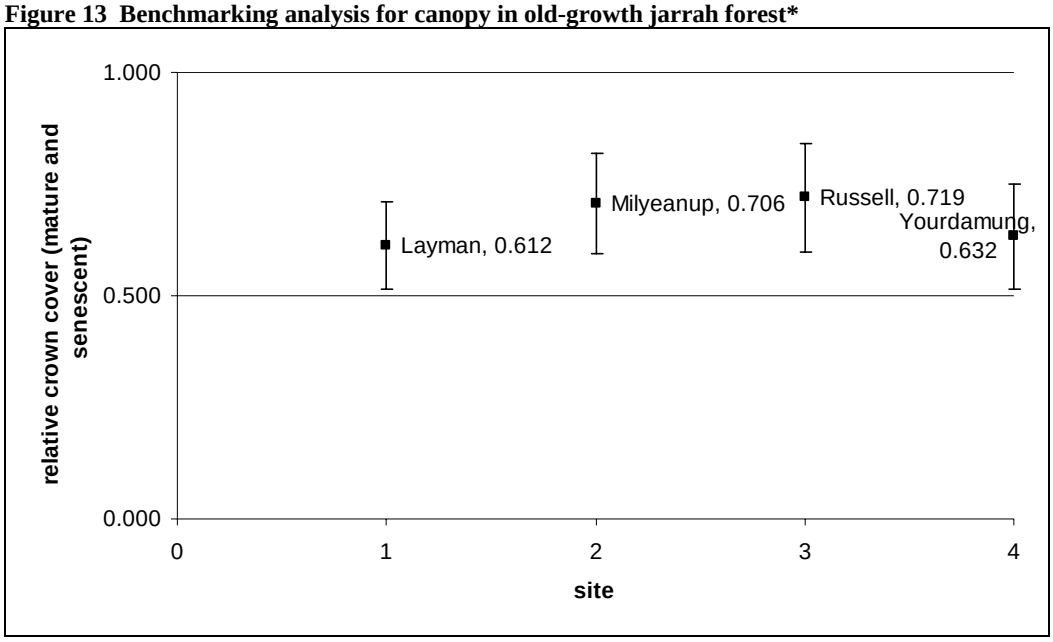
and the available records, to improve the assessment and to provide transparent information to stakeholders.

Further sampling trials in eastern jarrah forest have indicated that the variations in stand density across the jarrah forest within the FMP area, needs to be accounted for when mapping minimal disturbance in these forests. In lower density jarrah forest a lower stumps per hectare threshold can be justified by the slower growth rates of the eastern jarrah forests. A slower growth rate will have an effect on the forests ability to return to a minimal disturbance level. This variation associated with the geographic distribution of jarrah forests and the variability of the types of logging operations which have been employed, both indicate that the criteria to be applied when measuring minimal disturbance should be used as guiding parameters, to be utilized in context of the available information and observations, while triggering a more detailed analysis as described above in relation to sampling intensity. This may incorporate either an increased sample size and/or a canopy benchmarking analysis with actual mapped old-growth of a similar forest type as described in Section 3.3. As detailed in Figure 11, a range within the stump count estimates will be used to trigger the requirement for a more detailed field sample. This will be a stump count estimate of between 2 and 10 stumps per hectare. Where initial sampling results indicate less than or equal to 2 stumps per hectare, and the other data and observations support minimal disturbance, no further sampling will be undertaken and the area will be returned to old-growth (if unaffected by dieback etc). Conversely where initial sampling results indicate more than 10 stumps per hectare and the other data and observations indicate clear structural overstorey change, no further sampling will be undertaken and the area will be confirmed as non old-growth.

Canopy

As previously described in Section 3.3, to assist the Conservation Commission in its assessment of minimal disturbance in jarrah forest, additional benchmarking information in relation to canopy in old-growth jarrah forest has been collected and analysed. This was undertaken following consultation with stakeholder groups and because a suitable threshold for relative crown cover of mature and senescent stems could not be reliably inferred from methodologies employed in jarrah forest in the past. This assessment incorporated the selection and sampling of unlogged old-growth jarrah forest in a range of locations. Relative crown cover was derived for the mature/senescent component of the overstorey. This differed slightly from the pilot study which aimed to collect information on the overstorey and canopy from the lower strata. Only overstorey information was collected for the benchmarking study as it was designed to directly record the overstorey and compare any variations with nominated forest or reclassified old-growth forest. As expected, the relative crown cover for the overstorey is higher than the guiding threshold adopted for the pilot study of 25 per cent which estimated the relative crown cover of both the overstorey and the lower strata. This is because sampling both the lower and upper strata effectively dilutes the relative proportions of mature/senescent canopy as the lower strata recording will be predominantly regrowth. The result of the benchmarking study has been used as a basis for a guiding threshold for the sampled areas of 50 per cent relative crown cover of mature/senescent in the overstorey. A graphical depiction of this analysis is included below.

Figure 13 Benchmarking analysis for canopy in old-growth jarrah forest*



***** *Mean estimate and 95% confidence intervals for the relative crown cover of mature and senescent stems in four stands recognised as old-growth. Mean estimates ranged from 0.61 to 0.72 with the lowest bound on any confidence interval at 0.51 for the Layman site. The horizontal line represents a 0.50 (50%) guideline for sampling old-growth (see below).*

Part of the selection process for these sites incorporated selection of a range of unlogged jarrah forest sites in given geographical areas. Sampling from further reference sites to inform and refine the benchmarking system will also be undertaken. The intention for the benchmarking process is to sample enough sites to derive a number of graphical summaries similar to that depicted in Figure 13; however, these graphs will depict samples from old-growth sites within different ecological/geographical boundaries. These would include the broad categories of jarrah forest south, jarrah blackwood and north-eastern jarrah. An interim overall guideline of 50% mature and senescent relative upper crown cover will provide general guidance for relative crown cover estimates. When direct comparisons between samples and the benchmarked threshold (50%) are made, the decision will be based upon a perceived 'significant' difference between the two figures. No significant difference would incorporate a situation where the mean of the sample area falls above the interim benchmark threshold of 50% or where the mean falls below the benchmark threshold but there is an overlap of the upper bounded confidence interval for the sample area and the interim benchmark threshold. Therefore if evidence of disturbance exists (e.g stumps etc) but the sampling indicates no significant difference in the structure of the overstorey, the area will normally be considered as minimally disturbed old-growth and returned to the corporate database as old-growth. As with the other phases of the proposed analysis, the benchmarking comparison data will be utilized in conjunction with the other available information, including evidence of disturbance on the ground and historical records. Recommendations will draw on all sources of information including the qualitative field observations.

Field sampling procedure for karri and wandoo forest will be the same as detailed for jarrah forest above however the analysis will preclude the minimal disturbance component of the disturbance model. As defined, karri and wandoo stands must be

uncut to qualify as old-growth. During the RFA, the oldest age class occupying at least 25% crown cover in karri forest was referred to as the dominant age class. Karri forest which was uncut with greater than 25% mature and senescent in the overstorey was mapped as old-growth during the RFA.

For the purposes of the assessment of reclassified karri old-growth areas and for publicly nominated areas in karri forest, the Conservation Commission will apply the following criteria for decision-making;

Sampling results indicate areas of 2 hectares or more with the following attributes;

- uncut forest (undisturbed by logging or clearing)
  and
- 25% or more mature and senescent trees in the overstorey

OLD-GROWTH

A threshold for relative crown cover of mature and senescent stems in the overstorey for wandoo forest cannot be reliably inferred from methodologies employed in the past, and a benchmarking study for these forests is not envisaged. As stated previously, wandoo forest must be uncut to qualify as old-growth and the presence of stumps with overstorey sampling and observations within a sample area will be utilized primarily for determining old-growth status.

All jarrah woodland whether or not included as old-growth in the corporate database is unavailable for logging.

For sampled areas of all forest types, sampling will be assessed in conjunction with the other available information, records and observations. Final decisions upon old-growth status will draw upon and refer to all the available information and considerations.

4.3 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.

Appendix I – 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 at a scale which indicates the area or portion which best represents old-growth forest in the nominated area):

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.