Defining,
Identifying
and Protecting
Old-growth Forest in Victoria

Trevor Poulton

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Co-convenors: Nicky Moffat and Trevor Poulton

www.goolengook.green.net.au
info@goolengook.green.net.au

For further information contact
Trevor Poulton
5/12 Riversdale Road
Hawthorn, Victoria 3122
Mobile 0402 987 181
poulton@labyrinth.net.au

PREFACE

This report presents a literary review of the Victorian state government's old-growth forest studies which were conducted by the government to map old-growth forest. The report is intended to assist members of the community seeking a basic understanding of the term 'old-growth forest' and how it has been identified by the state government in the field. The report is also intended to encourage the state government to develop appropriate and transparent methodologies for identifying and monitoring old-growth forest.

Conflicting state government policies on protecting native forests and on logging native forests has led to a history of disastrous bureaucratic decision making. Examples include the adoption of narrow concepts for identifying old-growth forest, an ad-hoc and inadequate conservation reserve system, a tolerance of breaches of the *Code of Forest Practices for Timber Production*, illegal logging of rainforest, systemic failure to properly administer the *Flora and Fauna Guarantee Act* (1988) and continued logging of old-growth and high conservation value forests.

This report reveals that over 44,200 hectares of old-growth forest have been logged by the Victorian state government since signing the Regional Forest Agreements (RFAs) (1997-2000), representing 5.3% of the total old-growth mapped at the time of the RFAs. Further, 9.5% of timber scheduled to be logged by VicForests for the period 2004/2006 is old-growth forest. The Victorian state Labor government is logging old-growth forest at an alarming rate.

Old-growth forest studies were undertaken by the Victorian state government during the 1990s for the state's five regional forest management areas. The studies appear to have applied mercenary methodologies and naive operational rules for identifying old-growth forest to suit the state government's budget and political aims, thereby reducing the area of forest that could potentially be off-limits to industrial logging. Consequently, many ecologists and environment groups argue that the extent of old-growth forest is greater than that depicted in the state government's old-growth forest map.

Victoria's Comprehensive Adequate and Representative (CAR) Reserve System was established to conserve the full range of forests ecosystems and drew on the old-growth forest studies as well as a range of biodiversity studies. However, the reserve system fails to meet the government's stated conservation objectives. It is comprised of many fragments of old-growth and high conservation value forests standing in a sea of industrial logging zones, with limited vision for connectivity between the protected areas including effective wildlife corridors.

There is a need for the Victorian state government to refine the methodologies that were used to identify old-growth forest taking into account old-growth values specific to the different eucalypt forest ecosystems. There is a further need to review the mapping of Victoria's native forests using contemporary modelling techniques to reveal the true extent of old-growth forest. This would require the reconstruction of the Department's dataset on Negligibly Disturbed Forest which has been lost or destroyed by the Department. Full protection of old-growth forest is required to ensure adequate conservation of biodiversity and the long term viability of Victoria's Natural Forest Estate.

On 12 December 2005 VEAC was requested by the Minister for Environment to commence the current VEAC Goolengook Forest Investigation. VEAC has been required to make specific reference to the need to protect old-growth forest in determining Goolengook's potential to be added to Errinundra National Park in East Gippsland and is due to make recommendations to the Minister in July 2007.

The VEAC Goolengook Forest Investigation is represented as a formal scientific process inviting

public submissions, and as such offers an unique opportunity for environment groups and conservationists to demonstrate the need for an improved methodology for identifying and protecting old-growth forest, paving the way for the state government to redesign the CAR Reserve System such that it truly meets Victoria's forest and biodiversity conservation needs.

Recommendations for defining, identifying and protecting old-growth forest are contained in the final chapter of this report.

Trevor Poulton

August 2006

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1. INTRODUCTION

Forests that have a highly mature tree structure with a complex understorey and possess conservation values such as hollows and fallen logs for wildlife habitat are commonly characterised as old-growth forest. Such forests often possess aesthetic qualities that inspire public empathy.

While logging practices are marketed by the Victorian state government as ecologically sustainable, logging of natural forests continues and is resulting in unsustainable loss of animal habitat and plant diversity and is diminishing an extraordinary and uniquely Australian environmental heritage. During the 1970s and 80s political focus of environment groups was on saving 'wilderness' and 'natural forest' (eg Routley 1974). The Department and its underpinning science community soon responded to the volatile politics of forest land use, and the contemporary debate is now very much focused on implementation of ecologically sustainable forest management principles, with protection of old-growth forest, high conservation value forest and water catchments being rallying points for the environment movement. Whilst the state government maintains that its forest management practices are now scientifically based, the science in fact remains biased towards economic utilisation of forests and many of the assumptions built into the government's science are questionable. This particularly applies to identification and mapping of old-growth forest.

Features of old-growth forest include a predominance of mature and senescing trees, a multi-layered understorey, and habitat for many life forms. Many qualities which characterise old-growth forest are shared with younger forests so it is not possible to define exactly where the boundaries lie. However, for forest management purposes it is necessary to quantify and delineate old-growth forest. It is the narrow arbitrary criteria that was used by the Victorian state government's environment department ('the Department')[1] to meet this goal that is questioned in this report.

There are numerous generic definitions of old-growth forest which have emanated from governments, environment groups, institutions and ecologists. The author has devised his own definition, as follows:

> **Old-growth forest is a term that signifies the late successional growth stages of a forest ecosystem for which, notwithstanding disturbances, the natural ecological processes continue to occur. (Poulton 2006)**

Out of all the generic definitions, the JANIS Definition (Commonwealth of Australia 1997), which is now well entrenched in government agreements, policies and reports, is endorsed in this report as the most obvious and efficacious definition to work under for the purpose of dialogue with the Victorian state government and advancing the old-growth forest debate. The JANIS Definition states:

> **Old-growth forest is ecologically mature forest where the effects of disturbances are now negligible. (JANIS Definition 1997)**

The Department refers to the accumulative area containing old-growth forest in Victoria as the '**old-growth forest domain**'. Seeking the optimum protection of this domain requires consensus between the Victorian state government and stakeholders on more accurate and balanced

[1] 'The Department' refers to the Victorian state government department responsible for public forestry, currently the Department of Sustainability and Environment (DSE), and/or its predecessors and/or successors.

methodologies for identifying old-growth forest. Problems which need to be addressed include:

- What benchmarks ought be applied for identifying old-growth forest for specific forest ecosystems?
- How can old-growth forest best be identified in the field and mapped?
- What represents an adequate reserve system for conservation of old-growth forest?
- What monitoring procedures ought be put in place?

1.1 Old-growth forest and biodiversity

Forests evolve through various structural growth stages as a result of natural thinning of the younger dominant trees and maturing of others. This aging process is described as stand replacement disturbance. As a portion of the younger trees die off from competition others age and develop hollows that promote biodiversity. The greater the number and diversity of hollows present, the greater the diversity of faunal species that can occupy them. Biodiversity is increased in older forests which typically have a more heterogeneous structure than younger, more homogeneous-structured forests. If the ecological processes of the forest remain relatively intact and are not undermined by human disturbance or catastrophic natural events, such a forest may be described as ecologically maturing.

Spatial Aspects of Structural Complexity in Old-growth Forests points out the high levels of structural complexity of old-growth forests. The article states:

> This complexity includes a large variety of individual structures, such as a broad range of sizes and conditions of live trees, standing dead trees (snags), and boles on the forest floor. Such forests often include other structural features, such as well-developed and often diverse understories and thick forest floors (e.g., Spies et al 1988; Lindenmayer et al 2000).
>
> This structural complexity is the key to many distinctive functional and compositional roles played by old-growth forests, such as habitat for biodiversity and regulation of energy and material cycles (e.g. Franklin et al 1981). The diversity of structures and microclimates in an old-growth forest provides niches for a broad array of organisms. These structures constitute significant stores of energy, water, and nutrients and create protected environments that moderate responses to daily, seasonal, and annual fluctuations in environmental conditions.
>
> Franklin and Van Pelt 2004

Each growth stage of a forest ecosystem provides unique ecological niches. It is the assemblage of plants and animals occurring in an old-growth forest that is distinctive (Burgman and Lindenmayer 1998). A Wet Forest ecosystem in East Gippsland, for example, that has reached an old-growth stage comprises of highly mature eucalypts such as Errinundra Shining Gum, Messmate, Mountain Ash or Manna Gum. There is usually an understorey of small trees such as Elderberry Panax and Mountain Pepper with a tall shrublayer dominated by plants such as Musk Daisy-bush and Gippsland Waratah and beneath that a dense layer of Soft Tree-ferns and Rough Tree-ferns and a scattering of herbs such as Ivy-leaf Violet. (See DSE Ecological Vegetation Class Bioregion Benchmarks for current DSE descriptions of these vegetation communities).

Hollows develop in the more mature trees and, for example, in Wet Forest are used as nests for birds such as Sooty Owls, Yellow-tailed Black Cockatoos and forest bats. Nectar flows and Mistletoe densities increase in the older trees providing nectar and fruit for birds such as the Yellow-bellied Glider and Crescent Honeyeater. Stags are used as perching and feeding trees as well as providing basking sites for reptiles such as the Lace Monitor and Diamond Python. Fallen logs provide habitat for amphibians and travel routes for small mammals. The Long-footed Potoroo relies on the growth of fungi out of the decay of logs on the Wet Forest floor as a food

source. Spider webs, lichens and mosses are more abundant on mature or dead trees and are critical as nest building materials (habitat descriptions drawn from Woodgate et al 1994).

Old-growth forest is not necessarily composed of towering eucalypts with a moist understorey, as often depicted, but is shaped by the physical environment, vegetation and landscape and may, for example, comprise of low tree canopy cover and a dry scrubby understorey.

Depending on the forest type, older trees may have hundreds of years beyond their peak before they die, and even then they play an invaluable role as 'stags' or standing dead trees, and eventually as coarse woody debris on the forest floor.

Industrial disturbance processes such as logging, thinning and high-intensity fuel reduction burns often alter the structure of an older forest resulting in loss of hollows and other animal habitat and loss of biodiversity, impacting on species which rely on the mature ecosystems for feeding, shelter or reproduction.

Hollow bearing trees are a renowned feature of eucalypt forests in their older growth stages. Approximately 31% of all Australian terrestrial mammals, 79% of reptiles, 15% of land birds and 13% of frog species appear to use tree hollows (Lindenmayer & Gibbons 2002).

Many Victorian species listed as vulnerable under the *Flora and Fauna Guarantee Act (1988)* need hollows, for example the Leadbeater's Possum, Spotted-tail Quoll, Squirrel Glider, Red-tail Black Cockatoo, Powerful Owl and Littlejohn's Tree Frog. Appendix C of this report provides a list of threatened, hollow-dependent Victorian fauna.

Figure 1: Wet Schlerophyll Forest on Errinundra Plateau (Poulton)

'Loss of hollow-bearing trees from Victorian native forests' was listed as a threatening process in the *Flora and Fauna Guarantee Act (1988)*[2] in 1991[3]. A 'potentially threatening process' is defined as 'a process which may have the capability to threaten the survival, abundance or evolutionary development of any taxon or community of flora or fauna'[4] and is explained as having been made eligible for listing 'if, in the absence of appropriate management, it poses or has the potential to pose a significant threat to the survival or

[2] Schedule 3, *Flora and Fauna Guarantee Act* 1988
[3] Flora and Fauna Guarantee – Scientific Advisory Committee, (1991), *Final recommendation on a Nomination for listing; loss of hollow-bearing trees from Victorian native forests*
[4] Section 3, *Flora and Fauna Guarantee Act* 1988

evolutionary development of a range of flora or fauna.'[5]

Undiscovered, unrecorded and unnamed species are being lost due to disturbance (Hopper 1997), particularly fungi, algae, insects, even vascular flora and lower profile invertebrates (Burgman and Lindenmayer 1998). The issue of addressing threatening processes to conserve animal and plant habit is very much bound up with the need to protect old-growth forest from industrial logging and other human disturbances.

[5] Section 13 (3), *Flora and Fauna Guarantee Act* 1988

2. DEFINING OLD-GROWTH FOREST

2.1 Government definitions of old-growth forest

This report deals with eucalypt old-growth forest ecosystems. However, the term old-growth forest also pertains to intact rainforest communities. Rainforest is defined in the Department's Code of Forest Practices for Timber Production and is excluded from logging (See Appendix B).

In compliance with the *National Forest Policy Statement (Clth 1992)* the Victorian state government set about identifying old-growth. Studies of old-growth forest were initially pioneered in East Gippsland through *A Study of Old-growth Forests of East Gippsland* (Woodgate et al 1994) (referred to hereinafter as '*Woodgate et al*') which was overseen by Peter Woodgate, Bill Peel and others.

The study developed the methodology for identifying old-growth and was applied in the later regional old-growth studies. These studies were completed in readiness for signing the Regional Forest Agreements (RFAs) between 1997 and 2000, for the East Gippsland, Central Highlands, North-East, Central Gippsland and West Victoria regional forest management areas. The Department's oeuvre of old-growth studies comprises of the following:

1. *A Study of the Old-growth Forests of East Gippsland* (Woodgate et al 1994)
2. *Study of Old-growth Forests in Victoria's Central Highlands* (DNRE 1998a)
3. *Study of Old-growth Forests of Victoria's North East* (DNRE 1998b)
4. *A Study of Old-growth Forests of Gippsland* (DNRE 2000)
5. *Study of Old-growth Forests of West Victoria* (DNRE 2001a)[6]

The results of these studies were incorporated into Comprehensive Regional Assessment Reports (CRA) for designing the Comprehensive, Adequate and Representative (CAR) Reserve System and were then endorsed in each of the Regional Forest Agreements, countersigned by the Commonwealth and the Victorian state governments.

The old-growth studies drew on concepts such as successional growth stages, disturbance levels, forest canopy, Aerial Photograph Interpretation and Ecological Vegetation Class. The methodology involved identifying forest stands dominated by eucalypts in their oldest growth stages, using aerial photographs, and then eliminating those stands identified as being significantly disturbed as a result of natural and unnatural impacts. The primary method for the Department making decisions on levels of stand disturbance was by reference to historical government records on land uses and also by reference to aerial photographs evidencing either damage to tree crowns or large amounts of regrowth trees.

The state government, under the RFA process, officially adopted the following three generic definitions for old-growth forest in its pursuit of operational rules:

- 1992 National Forest Policy Statement Definition
- 1994 Woodgate Definition
- 1997 JANIS Definition

2.1.1 National Forest Policy Statement Definition (1992)

In 1992 the *National Forest Policy Statement* (Clth 1992) delivered an agreed approach by signatory governments, including Victoria, for conserving and managing native forests. The

[6] *Study of Old-growth Forests of West Victoria* was published after the signing of the West Victoria RFA.

National Forest Policy Statement provided the following definition of old-growth forest:

> **Old-growth forest is forest that is ecologically mature and has been subjected to negligible unnatural disturbance such as logging, roading and clearing. The definition focuses on forest in which the upper stratum or overstorey is in the late mature to overmature growth phases.**

2.1.2 Woodgate Definition (1994)

Woodgate et al, considered by the Department as the authoritative report for defining and identifying old-growth forest in Victoria, developed the following definition for the East Gippsland study:

> **Old-growth forest is forest which contains significant amounts of its oldest growth stage in the upper stratum - usually senescing trees - and has been subject to any disturbance, the effect of which is now negligible.**

This is referred to by the Department as the 'Woodgate Definition'.

The Woodgate Definition is complemented by an array of rules, collectively described by the author as *Old-growth Forest Technical Requirements and Disturbance Rules* ('the Rules'), for identifying old-growth forest. The Technical Requirements are reproduced in Appendix A. The Disturbance Rules have not been consolidated into one consistent, statewide document and are dispersed amongst the old-growth studies. The Rules are important to read in order to understand how the Department set about mapping old-growth forest. They provide standards for assessing and classifying forests of different growth stages and disturbance levels. The Rules tend to treat all forest ecosystems similarly. The Rules require:

- the proportion of senescing (late mature and overmature) trees to be >10% of crown cover;
- the proportion of regrowth trees to be <10% of crown cover; and
- the forest stand to be negligibly disturbed in accordance with sub-rules generated by the Department for determining the impact of various types of human and natural disturbances within each forest vegetation class.

The Rules are in fact the critical determinant of what is deemed by the Department to be old-growth forest. Once the Woodgate Definition is appraised in the context of the Rules, it may be rephrased (as it has been by the author herein) to read:

> **Old-growth Forest is forest which has more than 10% of the oldest (senescing) growth stage and less than 10% of the youngest (regrowth) growth stage in the upper stratum (identified by crown cover through Aerial Photograph Interpretation), and has been subject to human and/or natural disturbance, the effect of which (in accordance with disturbance rules generated by the Department for each Ecological Vegetation Class) is now negligible.**

In this light, the Woodgate Definition can be seen to be more so aligned with a forester's quantitative description of forest, rather than that of an ecologist's qualitative description.

2.1.3 JANIS Definition (1997)

The Joint ANZECC / MCFFA National Forest Policy Statement Implementation Sub-committee (JANIS) drafted the nationally-agreed criteria for a conservation reserve system for forests to address biodiversity, old-growth forest and wilderness. The criteria is outlined in the *Nationally Agreed Criteria for the Establishment of a CAR Reserve System for Forests in Australia Report*, (Clth 1997) (hereinafter referred to as the 'JANIS Report'). The principles contained in the JANIS

Report were incorporated into each of the Regional Forest Agreements (1997-2000) which established the contemporary legal framework committing Victoria and the Commonwealth to targets for conserving native forest and for guaranteeing timber resources for industry.

The 1997 JANIS Report provided a new definition for old-growth forest, as follows:

> **Old-growth forest is ecologically mature forest where the effects of disturbances are now negligible.**

The growth stage of old-growth forest is defined as 'ecologically mature'. Surprisingly, there appears to have been little effort made by governments, ecologists and environmental stakeholders, to provide an interpretation of 'ecological mature'; instead, the expression tends to be used interchangeably with 'old-growth'. However, the expression 'ecologically mature' clearly requires that there be an integrated understanding of old-growth forest ecosystems beyond what may lie in the upper stratum of the older trees or canopy which is the focus of the Woodgate Definition.

2.2 Definitional issues

Each of the five Regional Forest Agreements states:

> **Old-growth forest means old-growth forest as defined in the JANIS Report.**

The Regional Forest Agreements' endorsement of the JANIS Definition theoretically confers legal status on the definition. Despite this endorsement, the Department has maintained that the Woodgate Definition is not only compatible with the later JANIS Definition but that it has the advantage of being more technical.[7] The Woodgate Definition was therefore relied on by the Department for generating rules for identifying and mapping old-growth forest for each Regional Forest Management Area. Maintaining use of the Woodgate Definition meant that maps for the East Gippsland old-growth forest study, which pre-dated the formal RFA process, did not have to be updated or redrawn (being cost-effective for the Department), and ensured that the later old-growth studies for the other regions would be subject to similar definitional inferences and restrictions. However, the Woodgate Definition is **not consistent** with the JANIS Definition nor the NFPS Definition.

Commenting on the Woodgate Definition, the *Comprehensive Regional Assessment - East Gippsland Environment and Heritage Report* states:

> 'The suitability of the definition was referred to the Joint Scientific Advisory Group (JSAG) by Victoria and the Commonwealth in response to concerns raised by stakeholders during the Deferred Forest Assessments (DFA) process conducted in 1995. The JSAG accepted use of this definition, but recommended additional research to further evaluate its application to different forest types.'
>
> DNRE 1996b

There has not been any such evaluation by the state government to date apart from refining disturbance rules for the later old-growth studies. The focus on one structural key, being the upper stratum of the forest canopy, led to a speedy but problematical estimation of the extent of the old-growth forest domain. The timber industry was the chief beneficiary of this expeditiousness.

2.2.1 Defining growth stages

The JANIS Definition requires the growth stage of an old-growth forest to be 'ecologically mature'. The g*rowth stage* of a forest ecosystem refers to its ecological successional development

[7] *Study of Old-growth Forest in Victoria's Central Highlands* (1996) at p3-4

and takes into account factors such as age and spacing of trees, flora and fauna species and habitat, nutrient cycling and water flows. The use of the expression must not be confused with the *growth stage* of trees, as referred to in the Woodgate Definition, which relates to the maturity of an individual tree or group of trees within the ecosystem.

The Woodgate Definition assigns a surrogate measure for 'ecological maturity' by prescribing the relative proportions of tree growth stages as the measure of old-growthness. And in fact, the reference in the Woodgate Definition and the NFPS Definition to the 'upper stratum' specifically relates to the technique of identifying growth stages of eucalypts from aerial photographs.

The successional growth stages of eucalypts progresses from saplings, to pole shaped trees with a strongly developed main stem (regrowth stage), to mature trees with 'permanent' branches that form the framework of the crown (mature stage), through to senescing trees with dead branches, warts and burls (senescing stage). Apart from saplings, the crowns of these trees can generally be distinguished from the air, depending on forest types and site quality. The following table describes the critical growth stages of eucalypts.

Table 1: Growth stage definitions

Growth stages	Comment on growth stages of the dominant canopy tree (Eucalypt)
Regeneration (Sapling)	All leaves have a juvenile form and grow on the main stem.
Regrowth (Pole)	**Regrowth stage** is characterised by a strongly developed main stem. Semi-permanent branches growing on the main stem below the upper crown develop from some of the competing branches of the sapling stage, and the leaves are mostly mature. A young eucalypt enters this stage after it has gained a certain height, and the age at which it enters this stage is dependent on site quality.
Mature (includes Early Mature and Older Mature)	**Early mature stage (younger)** - large permanent 'shaping' branches which form the framework of the crown. **Mature stage (older)** - persists for a long time and although branches thicken, height and crown spread may change very little over this time in dense stands. As branches grow further from the main trunk and lose their apical dominance, epicormic shoots develop from dormant buds on the top and sides of the shaping branches closer to the main trunk.
Senescing (Late Mature & Overmature)	**Late mature stage** - the tree may develop large numbers of 'bayonets', dead branches from deceased leaf-bearing units, warts and burls, and some dead shaping branches. **Overmature stage** - characterised by declining crown leaf area. As major shaping branches are shed, epicormic growth develops from the trunk, to replace the lost leaf area, but which is never as persistent as the permanent shaping branches. The trunk and shaping branches are eventually weakened by fungal attack, causing shaping branches and often the top of the tree to fail and break. The trunk or tree bole is characteristically covered in burls and bumps.

Source: Adopted from Woodgate et al 1994, p18- 19

Identifying growth stages of trees is required for assessing and grading the sawlog and residual log components of stands for commercial forestry purposes. As stated in section 2.1.2, the Woodgate Definition looks at the proportion of tree growth stages in combination with the level of disturbance, with the focus being on delineating least disturbed older forests, and not simply on quantifying trees according to growth stages only as foresters do. The key growth stage is 'senescing' which includes both 'late mature' and the 'overmature' growth stages. '**Late mature**' is a growth stage which was identified by *Woodgate et al* as forming an early phase of the 'overmature' growth stage traditionally recognised by foresters. (Interestingly, the North East, Gippsland and West Victoria old-growth forest studies created a new rule to combine the late

mature growth stage with the mature growth stage, rather than senescent, thereby diminishing the area of identified and mapped old-growth forest.)

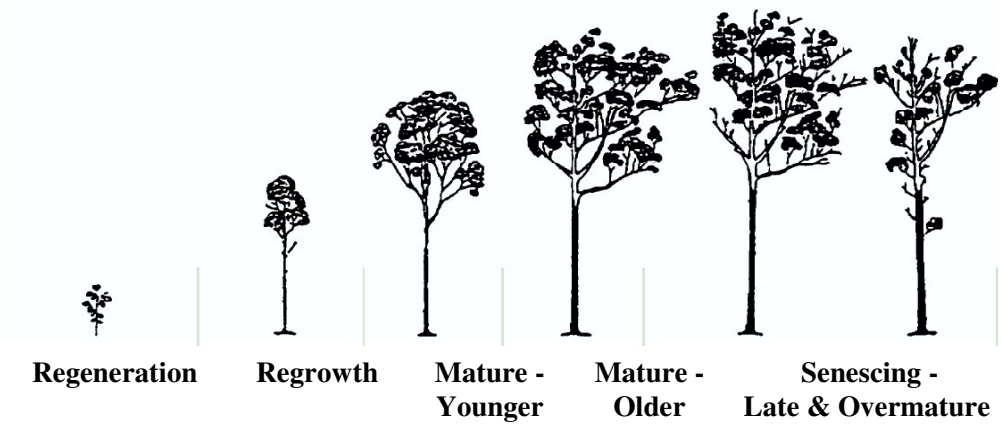


Figure 2: Tree growth stages for eucalypts
DNRE 1998a, from Jacobs 1955. Note: Senescing includes Late Mature and Over Mature

2.2.2 Ecological Maturity as an old-growth criterion

A 1991 Commonwealth report (ESDWG 1991) states that 'ecologically mature forest' refers to stands with a small net biomass increment, often high structural and compositional diversity and a richness of animal habitat such as hollows and dead stems.

Woodgate et al, on the other hand, suggests that an 'ecologically mature forest' refers to forests with a broad range of dominant tree growth stages:

> The term [ecologically mature] embraces a broad conceptual notion of forests that is hard to define and measure in practice although it appears to be aligned with Jacobs (1955) concept of mature, late mature and overmature growth stages. (p60)

In order to quantify old-growth forest it is essential to consider the age of the dominant tree species that represents the threshold for an ecologically mature forest ecosystem.

Woodgate et al provides the following diagram.

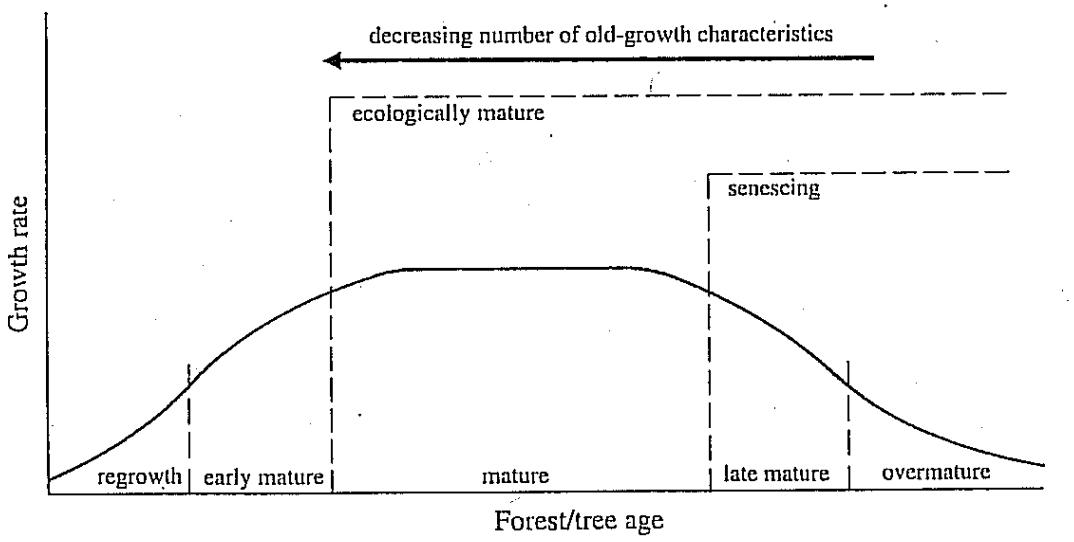


Figure 3: Successional growth stages and corresponding old-growth characteristics
Scanned from (Woodgate et al 1994, p61)

The diagram suggests that the concept 'ecologically mature forest' is not restricted to forests possessing a senescing tree component but encompasses forest stands in the mature growth stage without a senescing tree component albeit having 'lesser' old-growth characteristics.

However, the Woodgate Definition infers that forests must have a significant amount of canopy trees in their '**oldest'** growth stage for a stand to qualify as old-growth (perhaps better characterised as 'oldest growth forest' rather than old-growth forest). This view must be also distinguished from the principles in the JANIS Report cited below that refer to ecologically mature forest 'defined by the characteristics of the '**older** growth stages' (rather **oldest**). The expression 'oldest growth stage' in the Woodgate Definition unfortunately reinforces a misconception that old-growth forest must have reached an 'end-state' in its succession of growth stages signified by a predominance of senescing trees. It is a narrow vision of old-growth forest.

The *RAC Forest Inquiry Report* (1992) also tends to push the threshold for ecologically maturity towards the end of the life span of the dominant tree species. It states:

> 'Ecologically mature forests are stands of trees approaching the limit of their life spans. These stands are often either not or only slowly increasing in biomass and they usually support a high diversity of plant growth forms as well as a high diversity of plant and animal species.'

The *JANIS Report* applies the following principles to 'ecological mature' forest:

- Ecological maturity is defined by the characteristics of the **older growth stages**.
- If data are available on the structural, floristic, and functional qualities that would be expected to characterise an ecologically mature forest ecosystem, these data should be used in the assessment of the significance of disturbance effects.
- Negligible disturbance effects will be evident in most forests by a **significant proportion of trees with age-related features** and a species composition characteristic of the ecologically mature forest ecosystem.

In fact, it is argued in this report that the threshold for ecological maturity is forest that contains trees that have *started* to senesce, that is its upper stratum is characterised by the emergence of trees whose growth rate has past its peak and are beginning to suffer major branch failures. At this point the great majority of the trees in an old-growth forest stand may still however be in the mature growth stage. On this basis, the JANIS Definition and NFPS Definition requirement of 'ecologically mature forest' would appear to commence, depending on the vegetation community and forest type, somewhere between the mature and senescing tree growth stages of the dominant canopy trees.

2.2.3 Disturbance levels

Each of the three Definitions provides that old-growth forest must be 'negligibly disturbed.' A 'disturbance level' is an indication of the degree to which the ecological integrity of a forest has been altered through human impacts (for example, logging or grazing); it rates 'naturalness' or 'virginness' of a forest and therefore its eligibility to be classed as old-growth forest. It may also be a measure of a decline in old-growth characteristics resulting, for example, from natural disturbance such as wildfire causing loss of mature trees and a burst of regrowth temporarily altering the structure of the forest.

The NFPS Definition is distinguished from the other two definitions as by inference it permits forest to be considered as old-growth if it has been subjected to a natural disturbance such as wildfire, flood or cyclone. On the other hand, the Woodgate Definition and JANIS Definition provide that forest can only be recognised as part of the old-growth forest domain if it is currently

in a state of negligible disturbance. A forest with an overstorey severely damaged by wildfire would be classed as old-growth under the NFPS Definition but would not be considered as old-growth under a literal interpretation of the other two definitions.

The weakness of the NFPS Definition, however, is that it can be interpreted by implication to exclude forest that is now negligibly disturbed but has previously been significantly disturbed by human activity. According to the *CRA East Gippsland Environment and Heritage Report 1996*, Appendix 4:

> This [NFPS] definition can imply that once significantly disturbed by human generated disturbances, a forest can never again be considered to be old-growth forest.

Further, the NFPS Definition does not acknowledge claims that natural events such as wildfire may dramatically alter the structure and floristics of a forest ecosystem regardless of the survival of particular old-growth characteristics. This is a controversial issue which is becoming more potent given the potential shift in the frequency and severity of wildfires due to fire suppression affects and also global warming, which may impact on the future ecological development of native forests. The issue is dealt with in section 3.3.3.

2.3 Forest age

The perception of the older eucalypt forests as being 'ancient' is an attribute which does inspire popular public support for protection of old-growth forest values. However, age studies of trees, which involves techniques such as counting tree growth rings (dendrochronology), do not appear to have played any part in the Department's methodology for identifying old-growth forest. Actual growth stages of forest stands have not been measured at the species and forest type level; rather the Department appears to have assumed generic growth stages indicated by tree crowns to be a sufficient surrogate for measuring age in the various eucalypt forest ecosystems. In fact, research regarding the age of tree species in Victoria appears to be extraordinarily limited. Given that the *Woodgate et al* study remains the most in depth study of eucalypt growth stages in East Gippsland and is drawn upon heavily by the Department, it can be assumed tree age is a consideration that is absent from ongoing forest policy and management planning processes in Victoria.

One of the few studies that have been undertaken examined Errinundra Shining Gum and estimated ages of trees ranging from 225 years (55 m tall) to 252 years (53 m tall) (Chesterfield 1996). *Woodgate et al* did interpret age data to suggest that Mountain Ash have an immature growth stage lasting about 80 years, a mature phase for about 270 years, a senescing phase lasting for about 100 years, and finally a stag phase of about 50 years, making the potential life span of Mountain Ash around 500 years.

Woodgate et al stated at the time of the study:

> 'More detailed and statistically rigorous work needs to be done on the question of the absolute ages of different growth stages in order to develop a comprehensive picture of the age ranges of trees within the study area for all forested vegetation classes.'

Expanding knowledge of the age of tree species corresponding with growth stages of forests is important for projecting the timeframe for development of hollows and other habitat events. For example, it is estimated that hollows suitable for owls do not form, even in the fastest-growing eucalypts, until they are at least 150-200 years of age (Parnaby 1995). Of 21 nest trees observed by McNabb (McNabb 1996) in southern Victoria, about 50% were senescent and ranged between 350-500 years of age, based on data collected by Ambrose (1982).[8] Age knowledge is also important for forecasting the number of decades it could take for a particular forest type to reach a degree of senescence to qualify as old-growth forest under the Rules or under any other

[8] From Action Statement 92, Powerful Owl (Webster et al 1999)

methodology. It would also assist with planning recruitment of younger forests to the old-growth forest domain.

The USA Department of Environmental Management, in contrast with the Department's Rules, provides an age criterion for delineating old-growth forest. It stipulates in its definition of old-growth forest that 50% of the dominant canopy trees should be half the maximum longevity for the species. It is intended to be a simple objective indicator to address the question of where the old-growth forest threshold lies. Use of this formula has meant that there has been a greater impetus in the USA than in Australia for gathering age data.

The author recognises that determining age in the deciduous forests of the USA may be a simpler task than in Australian eucalypt forests. Deciduous forests, where trees lose their leaves and essentially hibernate through winter, produce growth rings that clearly correspond to annual climatic fluctuations. These forests have the advantage of much tree aging research, unlike Australia's eucalypt forests, which have dendrochronologists struggling to determine consistent age estimates. Experts have discovered that Australia's highly variable climate has produced a diversity of higher variable tree growth cycles, which are specific to the species. Eucalypts are opportunistic in their growth - they exploit favourable conditions (e.g. rainfall) with fast growth and in times of harsh conditions (e.g. drought) they will withdraw resources from growth and focus on surviving. Because they never 'shut down' and because Australia's climate is characterised by strong inter-annual fluctuations (ie severe drought occurs at least every ten years) growth rings are not always annually spaced which makes the process for determining eucalypt age more complicated.

3. IDENTIFYING AND MAPPING OLD-GROWTH FOREST

3.1 Aerial Photograph Interpretation (API)

A digital database was established by the Department for interpreting information on eucalypt forests collected through aerial photos and satellite imaging. This information was correlated with other data layers on the Department's Geographic Information System (GIS), including relevant Ecological Vegetation Classes and disturbance histories collected from government records, to produce a simplistic, broad scale portrait of Victoria's old-growth forest domain.

The Department's methodology for identifying the growth stage of a forest ecosystem is by interpreting the crown forms in stands primarily using Aerial Photograph Interpretation (API). The methodology used at the time of the old-growth studies was claimed by the Department to be efficient and cost effective, but to some extent the modelling involved could be compared with interpreting cultural and demographic differences between suburbs of a city based on interpreting photographs of its rooftops. In particular, as discussed further in this report, the scale of the modelling led to poor data quality used to map forests.

The growth stage characteristics of a canopy are identified by the shape and proportion of crown forms as illustrated in the table. A stand area for the purpose of API varies depending on scale of modelling, the terrain and other factors.

The system for aerial identification of growth stages of eucalypts by features of crown cover was developed by M R Jacobs in the 1950s. According to (National Parks and Wildlife Service; NPWS 1999) 'the reliability of aerial photographic interpretation of growth stage details varies according to species, site conditions, quality of photography and interpreter experience and skill.'

Table 2: Characteristics of tree growth stages used for Aerial Photograph Interpretation (API)

Growth stages	Morphological characteristics identifiable from aerial photographs (API)	Sample of aerial photographs
Senescing (Late Mature & Overmature)	some crown units dead and dying; crowns less rounded and lighter in colour than in younger mature trees of the same species	
mature (includes early Mature)	rounded crown view; well-foliated crown; may be taller than regrowth of the same species	
regrowth (Pole)	narrow, conical crown	
regeneration (Sapling)	small, flat appearance (individual crowns not discernable)	

Source: Adopted from Woodgate et al 1994, p18- 20. The sample pictures inserted into this table for the purpose of this report are of the Cobon area in East Gippsland, drawn from the Department's SFRI dataset.

Woodgate et al makes it clear that there are a number of forest types for which it is difficult to interpret through API the senescent growth stage of eucalypts due to poor site conditions impacting on the development of the crowns. In particular, senescent trees are not easily distinguishable from mature trees from the air in woodland and open forest types which tend to be dry and sparse or suffer poor drainage. These are described by *Woodgate et al* as Non-Jacobs Forests (as opposed to Jacobs Forests). Special rules were developed by *Woodgate et al* for forest vegetation classes where this applied. According to (National Parks and Wildlife Service; NPWS 1999) the methodology is most effective for high site qualities which include the tall moist forest communities.

The Department now makes available to the public on its website www.dse.vic.gov.au *Forest Explorer Online* Geographical Information System. The system allows access to interactive maps drawn from the Statewide Forest Resource Inventory (SFRI) including data collection on growth stages of forests derived from API. (To access the program directly click on: *Forest Explorer Online*.)

The SFRI itself was formally commenced in 1994 to provide a comprehensive assessment of timber resources within Victoria's 3.47 million hectares of State Forest and is intended to provide the most current data for predicting timber volumes and sawlog grades and to determine the 'sustainable yield' for timber production. The inventory identifies the dominant growth stages of eucalypt species within stands, the relative age of forest stands, and stand heights. The SFRI maps are critical for timber production planning. The SFRI data was also used for the old-growth studies that followed *Woodgate et al* as the primary source for identifying forest stands with the required proportion of tree growth stages under the Rules.

The Department's GIS programme is a practical computer tool which can be used by the community for forest investigations as is illustrated in the following case. Conservationist, Tony Hastings, undertook a field investigation of the forest stands labeled 'X' and 'Y' in the photographs below, at Upper Stagg Creek on the Errinundra Plateau in East Gippsland. He observed that, "Evidence of disturbance is negligible and the ecosystem is mature, the understorey well developed, there is high biodiversity and individual trees are centuries old." (Hastings 2006)

Figure 4: Stagg Creek (Hastings)

Hastings then overlaid the Department's SFRI03.shp file of the growth stages of the area onto the SFRI corresponding aerial photograph, below. According to Hastings, the forest stands 'X' and 'Y' were identified under SFRI from a forestry growth stage perspective as 'Mature' (dominated by trees in their mature growth stage), but could also possibly qualify, based on his raw field investigation, as old-growth forest under an ecological assessment of the stands. He noted that

stands mapped as 'Mature', such as the one to the left of the 'X', were co-dominated by Silver Wattle, *Acacia dealbata,* indicating significant disturbance by fire and these therefore might not be considered old-growth at this point in time.

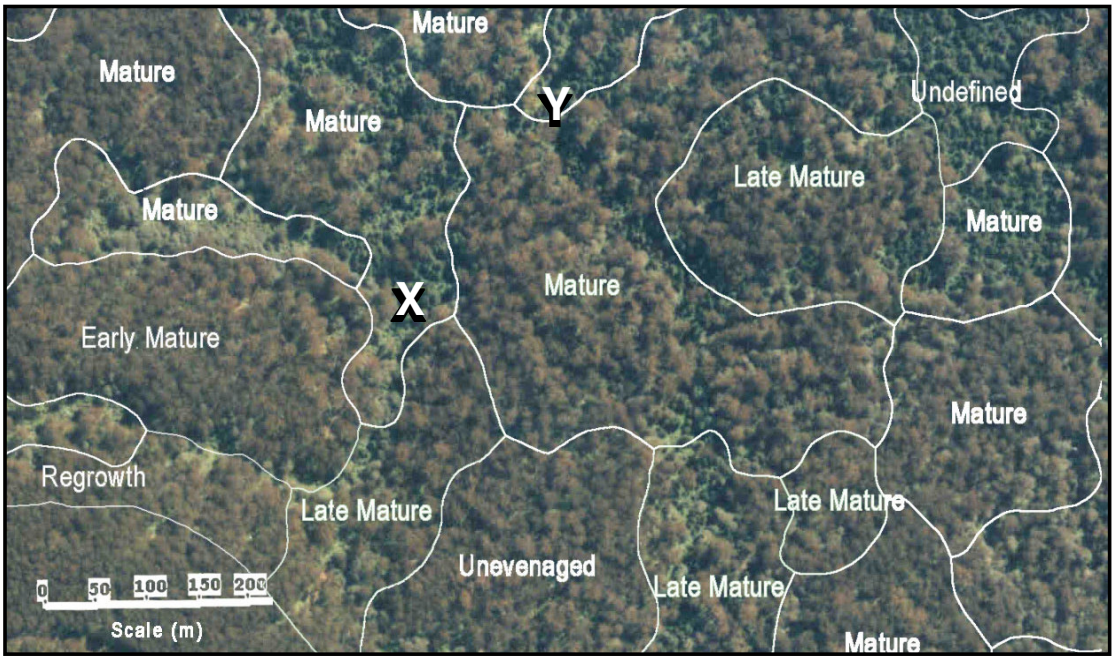


Figure 5: Aerial photograph interpretation of crown forms
The Department's SFRI03.shp file has been overlaid onto an aerial photograph from which the dominant growth stages were interpreted.

Identifying growth stages in the forest

Exercise: Enter a eucalypt forest and try and identify the growth stages of particular trees and forest stands by observing the tree characteristics including crowns, trunks, branches and hollows, and match your observations with a SFRI growth stages map of the forest block in the area being observed. The exercise helps to increase one's awareness of the aging characteristics of eucalypts and understanding of the Department's use of Aerial Photograph Interpretation for classifying forest ages based on the dominant growth stage of the canopy.

3.2 Review of the rules for identifying old-growth forest

The Rules used by the Department for identifying old-growth forest have implications for determining the extent of forest to be protected under the banner of old-growth and that which is available for logging.

The Rules, which were developed by *Woodgate et al*, comprise of twelve "Important Technical Requirements" for identifying old-growth forest in the field (see Appendix A) and an array of Disturbance Rules.

The Technical Requirements define forest and crown cover, outline the proportion of growth stages allowable for candidate old-growth forest, recognize the used mapping old-growth for each forest vegetation class, elaborate on disturbance impacts and acknowledge intangible qualities of old-growth forest such as spirituality and aesthetics. In addition to the Technical Requirements, the Department created specific Disturbance Rules for forest vegetation types known as

Ecological Vegetation Classes (EVCs). The Disturbance Rules were used to eliminate forest that contained the required proportion of growth stages but had been deemed to have lost ecological integrity as a result of natural/unnatural impacts causing excess regrowth, damage to the older trees or damage to the understorey.

Unlike the Woodgate Definition, the JANIS Definition does not provide a set of rules for identifying old-growth out in the field. The JANIS Subcommittee left it up to the states to determine their own rules specific to the native vegetation within each state. This has produced different 'objective' rules between the states.

Unlike the prescriptions for identifying rainforest (see Appendix B) which are legislated under the Code of Forest Practices for Timber Production, the rules for old-growth forest identification were resolved by the Department and were not settled through legislative processes or subject to parliamentary scrutiny.

3.2.1 Technical Requirements for growth stages

Forest is described under the Technical Requirements 'as woody vegetation with a potential height generally greater than 5 metre and with a crown cover projection generally greater than 10%.' *Woodgate et al* resolved to classify a forest stand as candidate old-growth forest if the canopy cover comprised of senescing trees greater than 10% (">10% senescing rule") and regrowth trees less than 10% ("<10% regrowth rule"). Requirements (5), (7) and (8) of the Technical Requirements provide:

> (5) More than one growth stage (senescing, mature or regrowth) may be present in the upper stratum. The oldest growth stage is the senescing growth stage and it must be present as a dominant, co-dominant or subdominant component of the stand. When present in these proportions the senescing growth stage is considered to significantly influence the ecological processes of the stand (eg growth of younger trees, development of hollows, and nutrient cycling).
>
> (7) 'Dominant', 'codominant' and 'subdominant' refer to the area occupied by the crowns of a given growth stage in the upper stratum of the stand. They do not refer to the vertical structure through the profile of the crown. They broadly occupy >50%, 30-50% and 11-50% respectively of the relative crown cover of the stand.
>
> (8) If regrowth growth stages are present they must be 'sparse' (generally less than 10% of the crown cover of the upper stratum) for the stand to qualify as old-growth. More regrowth than this probably indicates a greater than negligible (ie significant) disturbance.

The growth stage requirements (>10% senescing rule; <10% regrowth rule) were applied across most EVCs in Victoria through each of the Department's old-growth forest studies.

3.2.2 >10% Senescing Rule

The >10% senescing rule is arbitrary as different vegetation communities will be influenced in different ways by the number and type of older trees in a stand. For example, there are extreme differences in the ecology of a Snow Gum forest that endures severe frost on the tablelands in north east Victoria and a fire prone Stringybark forest on the lower elevations. There is little scientific explanation as to why the figure of 10% was nominated as the threshold for the senescing (late mature and overmature) growth stage and it no doubt represents some sort of political compromise, with the timber industry demanding a higher threshold (for example 50% senescence) and environmentalists demanding a lower threshold (such as a requirement that there merely be evidence of some senescence).

The *Old-growth forest assessment in South-east Queensland, Technical Paper 4* 1996 makes the following observations about the Woodgate Definition:

> '*Woodgate et al* (1994) suggested that "the senescing growth stage becomes a significant influence on the ecological process of the stand when present in at least subdominant proportions (ie greater than 10% of crown cover in the upper stratum)". However, the proportion of trees in any one growth stage that may (subjectively) be taken to characterise an ecologically mature forest will vary from one vegetation type to another, and from one site to another. And, in view of the subjective nature of the assessment process it may also vary from one observer to another. One of the objects of this study is to attempt to create a set of objective criteria for the definition of different degrees of ecological maturity.'
>
> DNR 1996, p2

The Queensland state government adopted a more environmentally precautionary approach to identifying old-growth forest than Victoria with regards the >10% senescing rule and has in fact identified various forest types as old-growth forest where the proportion of senescing trees was less than 10%. For 'moist forests' the Queensland old-growth rules provide that:

> 'Forest stands could tentatively be classed as old-growth if senescing stems were dominant, subdominant **or trace [<10%]**, regenerating stems were not dominant, and logging had been very light (ie basal area of cut stumps less than 10% of the standing basal area).'
>
> DNR 1996, (Qld)

The senescing rule provided a threshold for the Department to quantify old-growth forest in circumstances where little is known about the structure and function of old-growth systems. The requirement of a universal threshold ought only be viewed as an interim precautionary measure until more is known about the individual old-growth forest types and until customised rules are created specific to vegetation communities. The question remains as to whether >10% senescence represents a reasonable precautionary measure.

3.2.3 Negligibly Disturbed Forest (also known as Natural Mature Forest)

Under the Woodgate Definition negligibly disturbed forest that does not have more than 10% senescing crown cover does not qualify as old-growth and was mapped by the Department as **Negligibly Disturbed Forest**. It is forest dominated by canopy trees in their mature growth stage. The *East Gippsland Comprehensive Regional Assessment Environment and Heritage Report* defines Negligibly Disturbed Forest as follows:

> 'Forest which has less than 10% of the eldest (senescing) growth stage and less than 10% of the youngest (regrowth) growth stage in the upper stratum, and where the effects of any disturbance are negligible or non existent.'
>
> DNRE 1996b, p90

The name Negligibly Disturbed Forest is confusing as old-growth forest is itself negligibly disturbed forest under both the Woodgate and JANIS Definitions. A source within the Department has stated that at the time of the *Woodgate et al* study the delineation between old-growth forest and Negligibly Disturbed Forest was highly contested within the Department with some experts arguing that Negligibly Disturbed Forest ought to be called "Near Old-growth Forest". The name was rejected as it was considered by the Department from a timber resource perspective politically imprudent to connect negligibly disturbed mature forest with eminent old-growth. Interestingly, Negligibly Disturbed Forest is additionally categorised as 'Natural Mature Forest' in the *Study of Old-growth Forests in Victoria's North East* (DNRE 1998b); this name more clearly identifies both the naturalness (negligible disturbance) and dominant growth stage (mature) of the forest class.

It is often presumed that only trees in their oldest growth stage (senescing) provide high value habitat for fauna and hence industrial logging of forests predominantly in mature or younger growth stages can be more easily justified on economic grounds. However, *Tree Hollows and Wildlife Conservation* confirms that 85% of mature trees with distinct gaps in the crown contain hollows, and also 45% of mature tree with 'rounded' crowns contain hollows as illustrated in the following table. Different sized hollows provide niches for different sized fauna, with a uneven-age old-growth forest providing habitat value for a plethora of terrestrial mammals, birds, reptiles and amphibians.

Table 3: Percentage of tree hollows for growth stages

Growth Stage	Percentage of hollows
Dead tree	100%
Senescing live tree with gaps	94%
Mature tree with distinct gaps in crown	85%
Mature tree with 'rounded' crown	45%
Advanced regrowth stem	15%
Regrowth stem with apically dominant crown	8%
Sapling	3%

Source: Lindenmayer & Gibbons 2002, p63

The *National Forest Policy Statement* generally addresses only two growth stages, being old-growth and regrowth and makes minimal reference to mature forests. The statement provides the following under the heading, *Strategy to protect old-growth forests and wilderness*:

> 'In recent years the wood production industry has relied less on old-growth forests and drawn increasingly on regrowth native forests and plantations. The Governments' agreed approach to conserving and managing old-growth forest will facilitate continuation of this transition. Further, other strategies in this Statement - such as those relating to plantations and industry development and workforce education and training - will facilitate the industry's move from old-growth to regrowth and other managed native forests and plantations.'
>
> Commonwealth of Australia 1991

This appears to reflect a policy view in 1992 of including mature forest as part of the old-growth forest domain (ie a subset of ecologically mature forest). It has been well over a decade since the statement was endorsed yet the political will has not been discovered to introduce targets for protection of Negligibly Disturbed Forest from industrial logging operations.

The following is a summary of points that have been made linking Negligibly Disturbed Forest to the old-growth forest domain. Negligibly Disturbed Forest (Natural Mature Forest):

- is forest in its mature growth stage and may contain forest with up to 10% senescing trees (DNRE 2001a);
- is classed as old-growth forest under the Queensland old-growth rules, in the case of 'Moist Forests' where the senescing trees within a forest stand are trace [<10%];
- possesses a high level of ecological integrity (DNRE 1996b);
- is an important successional stage in the development of old-growth attributes (Jacobs 1955);
- possesses high habitat values including hollows (Lindenmayer & Gibbons 2002);
- may reasonably be considered ecologically mature forest consistent with the *JANIS Report* principles as it has many characteristics of the older growth stages and is negligibly disturbed;
- may possess intangible characteristics similar to senescing forest which include grandeur, antiquity, naturalness, spirituality and aesthetics (per common observations by the public).

The figures in the following table below represent the occurrence of the *two* forest classes, as mapped by the Department between 1994-2001 in the old-growth forest studies.

Table 4: Old-growth Forest and Negligibly Disturbed Forest in Victoria

Forest Management Areas (FMA)	Old-growth Forest (ha)	Negligibly Disturbed Forest (Natural Mature Forest) (ha)
North-East	261,210	261,960
East Gippsland	224,364	204,330
Gippsland	212,215	118,805
Central Highlands	24,252	141,900
Western Victoria	122,500	15,335
Total hectares	**844,541**	**742,330**

Source: 1994-2001 figures were drawn from each of the Department's old-growth forest studies. The old-growth figures were slightly modified under the RFAs as a result of modelling reviews.

It is not known how much of the above Negligibly Disturbed Forest was placed in reserves at the time of the RFAs, apart from East Gippsland for which the East Gippsland CRA cites the figure of 56%. The figures, otherwise, were never made public to the author's knowledge. It is also not known how much Negligibly Disturbed Forest has been logged since the RFAs nor the amount that is currently located in reserves. This information is not maintained by the Department.

There is a clear argument that Negligibly Disturbed Forest has an abundance of old-growth values where it contains at least some degree of senescence. It is recommended that until the Department develops comprehensive customised rules for identifying old-growth forest for particular vegetation communities, a similar threshold as applied in Queensland for various forest types ought be broadly applied in Victoria such that:

> Negligibly Disturbed Forest be classed as old-growth where there is at least a sparse [<10%] proportion of trees in the senescing growth stage.

The following table for East Gippsland region alone shows that at the time of the old-growth forest studies an additional 166,147 hectares of Negligibly Disturbed Forest (out of a total of 204,330 hectares of Negligibly Disturbed Forest in East Gippsland) would have been mapped as old-growth forest if the Rules had included Negligibly Disturbed Forest with a sparse (<10%) proportion of senescing trees.

Table 5: Areas of Negligibly Disturbed Forest in East Gippsland

East Gippsland Forest Management Area	Proportion of Growth Stages <10% senescing trees	Negligible Disturbance type & level (ha)		
		Undisturbed	Negligible Natural	Negligible Unnatural
Negligibly Disturbed Forest (Natural Mature Forest) containing at least a sparse proportion (<10%) of senescing trees	Sparse senescing, dominant mature & no regrowth	9,931	8,651	133,945
	Sparse senescing, dominant mature & sparse regrowth	753	981	11,886
	Total - **166,147** hectares	**10,684**	**9,632**	**145,831**

Source: Figures from Woodgate et al 1994, p74 - see Appendix F for complete table.
'dominant' broadly occupying >50%, and 'sparse' (also called 'trace') broadly occupying <10%

A breakdown of figures in relation to the above classifications for the other four Regional Forest Management Areas were respectively sought from the Department but appear to no longer exist, which is also discussed later in this report. If the proposed rule were to be applied statewide then the above example indicates that large areas of natural mature forest would be incorporated into

the old-growth forest domain.

There is much Negligibly Disturbed Forest that does not contain senescing trees and is dominated by mature trees with no or some degree of regrowth. Such forest contributes a significant area to Victoria's Natural Forest Estate and also warrants recognition and protection as pristine forest, although it would be *bending the bough too low* to assert that Negligibly Disturbed Forest that does not contain any element of senescence ought be classed as old-growth.

3.2.4 <10% Regrowth Rule

The Department's Technical Requirements for old-growth forest also provide that no more than 10% of the crown cover of the upper stratum can contain regrowth trees for a forest stand to be considered candidate old-growth forest. (See Requirement (8) of the Technical Requirements in Appendix A of this report).

As noted previously, the reference to the upper stratum relates to the fact that growth stages are identified from the crown forms through Aerial Photograph Interpretation of the canopy.

The scientific validity of this Technical Requirement was referred to a Joint Scientific Advisory Group (JSAG) during the East Gippsland Forest Agreement process. The JSAG was asked, in relation to East Gippsland, to:

> 'Advise on whether the *Woodgate et al* premise (that for an area of forest to be classed as old-growth there should be no more than 10% regrowth) is appropriate. If it is not, provide advice and reasons on the figure that should be adopted, bearing in mind the range of forest communities.'
>
> DNRE 1996b, p102

The JSAG recommended the <10% regrowth rule for crown cover was appropriate on the following grounds:

- 'The definition used by *Woodgate et al* was considered generous enough in that it permitted up to 90% mature trees, as distinct from senescing (late mature and over mature trees), to be included in the classification of old-growth forest;
- Field transects and inspections by *Woodgate et al* suggested that regrowth crown cover of more than 10% was almost always associated with significant unnatural disturbance; and
- Expanding the regrowth crown cover limit to the next identified level of 50% would be much more likely to include forest that has experienced significant disturbance than it would be to include additional old-growth forests.'

DNRE 1996b, p102

The findings of JSAG can be challenged on the following grounds:

(1) The first point suggests that forest stands with regrowth >10% ought not be included as candidate old-growth because the Technical Requirements under the *Woodgate Definition* require a minimum of 10% senescing thereby permitting up to 90% mature forest, and this, according to JSAG, is generous. It may also be conversely argued, for reasons previously stated, that the old-growth forest domain ought be expanded to include forest in its mature growth stage with less than 10% senescing trees currently included in the class of Negligibly Disturbed Forest.

(2) The second point, which asserts that 'regrowth crown cover of more than 10% is almost always associated with '**significant unnatural disturbance**', is untrue when applied to forest that has the required 10% senescent component. These forests are evidently older forests. The figures below which were extracted from *Woodgate et al* in relation to East

Gippsland in fact reveal that where the senescing component is above 10%, regrowth crown cover greater than 10% is more so associated with significant natural disturbance (wildfires) than significant unnatural disturbance (logging, grazing etc).

Table 6: Significant Disturbance type where regrowth is >10%

EAST GIPPSLAND FOREST MANAGEMENT AREA	**DISTURBANCE TYPE AND LEVEL (Hectares)**	
GROWTH STAGE where senescing is >10% and regrowth is >10%	Significant **natural** disturbance (wildfire)	Significant **unnatural** disturbance (human)
Senescing dominant, mature sparse, regrowth subdominant	971	1,386
Senescing dominant, no mature, regrowth subdominant	461	293
Senescing, mature, regrowth co-dominant	411	826
Senescing subdominant, mature dominant, regrowth subdominant	6,802	7,051
Senescing subdominant, mature and regrowth co-dominant	575	418
Senescing and regrowth co-dominant, no mature	2,207	537
Senescing and regrowth co-dominant, mature sparse	3,166	1,286
Senescing and mature subdominant, regrowth dominant	2,671	2,528
Senescing subdominant, mature sparse, regrowth dominant	1,163	1,678
Senescing subdominant, no mature, regrowth dominant	4,203	805
Total	**22,630**	**16,808**

Source: Adopted from Woodgate et al, p74 - see Appendix F for complete table.
'dominant ' - broadly occupy >50%, 'co-dominant' - broadly occupy 30-50%, 'subdominant' - broadly occupy 11-50%, and 'sparse' - broadly occupy <10%

(3) The third point refers to the next identified threshold for growth stages in Victoria as 50%. To suggest that the next threshold is fixed and therefore the Department would have to protect old-growth forest with up to 50% (co-dominant) regrowth if it accepted that a limit of 10% regrowth was too narrow is not logical. Threshold levels are operational constructions only and can be varied. For example, NSW provides for an intermediate threshold for identifying old-growth forest stands by permitting:

- up to 30% regrowth crown cover for candidate old-growth where the proportion of senescing trees is >30%; and
- up to 30% regrowth where the proportion of senescing trees is >10% in forest types where senescence is difficult to interpret from API.

Jenny Barnett of Victorian National Park Association Inc in her submission to JSAG at the time commented:

> 'The setting of a level of 10% or of any other percentage of regrowth for any forest type is obviously arbitrary to at least some extent and a degree of flexibility may be required, especially when older forest of the particular forest type is rare. When ideal representative examples of old-growth are not available, then sufficient areas of "next best" must be preserved. Time will then result in an improvement in the situation. It should be noted that the National Forests Inventory workshop in 1991 chose 50% regrowth as an initial cut off point noting that forests with more than 50% mature and senescing trees had at least some

> old-growth characteristics with capacity to generate enhanced characteristics with time.'
>
> DNRE 1996b, p118

Peter Attwill, School of Botany, University of Melbourne, in his submission to JSAG commented:

> 'Is the proportion of regrowth a good character to use in the classification of old-growth forest? It may well be if our classification is intended to indicate yields from water catchments, but it may not be if our classification is intended to indicate habitat for powerful owls and gliders. It may be a good character for species such as Mountain Ash, but it obviously is not a good character for species which regenerate in gaps (Borman and Likens shifting mosaic).
>
> One might set a limit of no more than 10% regrowth, but if this results in old-growth forest by all other standards then being classified as not old-growth, one would have to question its use. The system would have to be trialled over a range of forests. I do not know of any self-evident reasoning why one should choose 10% over 5% or 20%. And how is this 10% to be measured? On a catchment basis? Over landscape units?
>
> Perhaps one might classify old age forests to include processes which guarantee, as far as we can, that there are old age forests for the future. Thus an old age forest now that contains a proportion of regrowth as result of past disturbance would have great value. However, without knowing the purpose of the classification, I am not able to assess the relevance of 10% regrowth.'
>
> DNRE 1996b, p117

According to Dr Peter Kershaw of Department of Geography & Environmental Science, Monash University the weakness of the <10% regrowth rule is that it is used by the Department to definitively measure the ecologically integrity of forests. In his submission to JSAG he states:

> 'The danger then in targeting 'old-growth forests' with only a small amount of regrowth is that desired values are likely to be lost in the long term. Today's old-growth becomes either tomorrow's young growth after fire or senescing. Under these conditions, I should have thought that attention should be directed away from "old-growth" to identification and conservation of a whole range of successional states to ensure the maintenance of successional processes and have the long term survival of the range of communities represented. If the 'old-growth' concept is to be retained much more than 10% regrowth should be included.'
>
> DNRE 1996b, p126

In fact, Peter Woodgate, co-author of *A Study of the Old-growth Forests of East Gippsland* and one of the architects of the <10% regrowth rule, reported to JSAG that the rule was arbitrary. He pointed out that there ought be specific regrowth rules for each vegetation type, and that would also require the >10% senescing rule to be reviewed as well.

3.2.5 Comparison with other old-growth studies in other States

The following table notes examples of growth stage proportions that have been permitted in Queensland and NSW in addition to the *Woodgate et al* 10% rules which these states have also adopted for specific sites. In fact, NSW provides for a number of growth stage 'interpretabilities' (required proportions) in addition to those listed here. The author has not investigated the rules for Tasmania, Western Australia or South Australia.

Table 7: Required proportions of tree growth stages

OLD-GROWTH FOREST	REQUIRED TREE GROWTH STAGE PROPORTIONS		
Ecological Maturity Range (Interpretabilities)	**Senescing**	**Mature**	**Regrowth**
VIC, QLD, NSW - Senescing is >10% with regrowth <10% (Jacobs Forests) (*Woodgate et al* rule)	10 - 100%	0 - 90%	0 - 10%
VIC, QLD, NSW – Senescing is <10% with regrowth <10% (Non-Jacobs Forests) (*Woodgate et al* rule) for where it is difficult to interpret or identify senescing crown forms in these forest communities.	90 - 100%		0 - 10%
Examples of other ranges used by Qld and NSW in addition to the 2 *Woodgate et al* ranges			
QLD - Senescing is <10% and regrowth is <10%. (Queensland - Moist Forests)	1 - 10%	80 - 99%	0 - 10%
NSW - Up to 30% regrowth where senescence is difficult to interpret from API.	10 - 30%	40 - 80%	10 - 30%
NSW - Up to 30% regrowth where wildfire effects are considered to be negligible and senescing trees exert significant affect.	30 - 100%	0 - 60%	10 - 30%

3.3 Disturbance ratings

Every forest vegetation type has a natural disturbance regime that shapes its development and ecological continuation. The climate and resulting disturbance regime of a given area, including rainfall, temperature, relative humidity, wind direction and speed are arguably the most important factors in understanding how and why different forest ecosystems develop. Forests respond differently to natural disturbance depending on their species composition because different species have different strategies for surviving fire or regenerating after fire. Wildfire is an example of natural disturbance, the frequency and intensity of which is a key determinant in the spatial distribution of vegetation communities across a landscape. Natural disturbances are generally of low severity but may also be extreme and necessary for influencing forest structure and ecological functions. For this reason, definitions such as the JANIS Definition, the Woodgate Definition and the NFPS Definition that require disturbance impacts to be 'now negligible' are misleading.

Requirement (10) of the *Woodgate et al* Technical Requirements (see Appendix A) defines the scope of negligible disturbance as:

> (10) Forest for which disturbance is known to have occurred, but, the disturbance is unlikely to have altered the structure (growth stage combination or crown cover) or the usual floristic composition of species for that vegetation class; or, if the alteration did occur in the past it is no longer measurable. Disturbances may be natural (eg wildfire) or un-natural (eg anthropogenic or human-induced disturbances such as agricultural clearing, timber harvesting, grazing and mining).

'Disturbance' for the purpose of the JANIS Definition, the Woodgate Definition and the NFPS Definition that is not ‘negligible’, therefore, needs to be understood as an event or series of events that have caused long term damage to the ecosystem preventing it from recovering and/or progressing in the development of its structure and innate ecological functions. Such events are typically human initiated, such as logging, which have the capacity to destroy genetic and historic elements of the ecosystem.

On the issue of recovery, the National Forest Inventory workshop in 1991 recommended that:

‘Potential old-growth (modified or disturbed, but possessing some old-growth characteristics

> now with the capacity to generate enhanced or additional properties under prevailing management regimes) not be excluded as old-growth forest.'
>
> DNRE 1996b

The Department established the following disturbance level ratings:

- no record of disturbance;
- negligible natural disturbance (associated with mild or distant occurrence of wildfires);
- negligible unnatural disturbance (associated with human disturbance where the affect is thought to be negligible);
- significant natural disturbance (associated primarily with severe or recent wildfires); and
- significant unnatural disturbance (associated with human disturbance where the affect is thought to be significant).

In order for the Department to determine whether forest stands were in a state of negligible disturbance to qualify under the old-growth definitions as old-growth forest, it generated rules for implying disturbance levels from government records collected from various archival sources for all forest areas. The Department relied heavily on this methodology, which was developed by *Woodgate et al*, in order to limit time spent by teams out in the field directly assessing forest areas, which the Department considered impractical and extremely costly.

The assignment of disturbance level ratings for forest stands were in turn cross-referenced (overlaid) using the Department's Geographical Information System (GIS) with data on the growth stages of forest stands derived from API. Forest stands that met both the negligible disturbance threshold and the requisite proportion of >10% senescing trees and <10% regrowth trees were then deemed old-growth forest.

Forest maps were then produced delineating old-growth forest. These maps were then ultimately used to select old-growth forest stands for incorporation into the CAR Reserve System meeting the JANIS Criteria of 60% minimum protection of old-growth forest.

The definition of 'negligible disturbance' encompasses old-growth forest and Negligibly Disturbed Forest. Apart from fire disturbance (wildfire and fuel reduction burns), as noted later, the definition does not take into account recovery capacity of eucalypts or the understorey and therefore a rating only represents a snapshot of a forest at the time of the rating. (It ought also be noted that although a significantly disturbed forest stand may not fulfil the Department's conceptual requirements of old-growth forest, that does not necessarily mean that its ecological importance is any less. For example, significantly disturbed forest may contain many hollows and fallen logs that provide habitat for threatened species, and could also become the old-growth of tomorrow if left undisturbed.)

According to *Woodgate et al*:

> 'Much of the remaining older forest has been changed by a number of disturbances which vary greatly in their intensity, spatial extent, the time taken for their consequences to become apparent and the time needed to recover from the disturbance. The effects of different disturbance types upon physical and biological characteristics also vary according to forest type and are not well-understood, as most research on disturbances is both short-term and limited in its scope (*Resource Assessment Commission*, 1992).'

Disturbance rules have had a critical impact on determining the extent of the old-growth forest domain. The *Old-growth forest assessment in South-east Queensland* warned against being too prescriptive in relation to disturbance issues:

> 'In ecological discussion *disturbance* has often been used to refer to events that are

> massively destructive and rare. As Rykiel (1985) points out, "the difficulty of constructing a satisfactory definition of disturbance is related both to the generality and ambiguity of the term; generality because *disturbance* is applied to a wide range of phenomena and ambiguity because the specific circumstances surrounding the occurrence of a disturbance are often implicit, and therefore dependent on the subjective context in which the term is used.'
>
> DNR 1998, p27 (Qld)

The determining principle behind the concept of 'negligible disturbance' ought be whether the ecosystem has maintained or recovered or has the capacity to recover its ecological integrity after a disturbance. There is no such reality as a pure old-growth forest. 'Disturbance ratings' ought be used, therefore, to rank stands on the basis of 'least disturbed' through to 'most disturbed' without negating stands as being old-growth forest as has occurred under the Department's methodology, unless a stand has definitely lost its ecological integrity and old-growth value.

3.3.1 Disturbance impacts inferred from government records

Sources for disturbance records resorted to by the Department to infer the degree of disturbance for forest stands included the following:

Table 8: Examples of sources for disturbance records

Disturbance Type	Sources
Wildfire and fuel reduction burn	sourced from the Department of Conservation and Natural Resources (now DSE), historical records, regional records and growth stage mapping (through API).
Agricultural clearing	sourced from Crown Lands selection records, and growth stage mapping (through API).
Grazing	sourced from the former Department of Crown Lands and Survey, and the former Forests Commission.
Mining	sourced from the Geological Survey of Victoria, reports from the former Department of Minerals and Energy and other secondary sources.
Logging	sourced from the Department and further information was derived from aerial and satellite imagery and remote sensing techniques. In the case of selective logging (pre-1970s) records were sourced from historical log allocation licences and interpretation of 1940s and 1950s aerial photographs. Clearfell logging records (previous 25-30 years) were compiled from regional wood utilisation maps, aerial photos and satellite imagery.
Weeds	sourced from various literature and existing records.

Source: As cited in the Department's old-growth forest studies

It is reasonable to suggest that assumptions made by the Department regarding disturbance impacts from the records led to a risky methodology reliant on probabilities and resulted in unmerited omissions of stands from the old-growth forest domain.

In the case of the East Gippsland and Central Highland studies, a significant disturbance rating appears to have generally only applied if growth stage mapping indicated that regrowth was >10%. The three later studies however generated new disturbance rules to exclude forest as candidate old-growth where crown cover or growth stage mapping indicated no disturbance but for which it could be assumed that the understorey had been significantly altered due to a disturbance inferred from the paper records.

Refinement of the rules, in reliance on these records, led to higher thresholds for rating negligible disturbance and may have been driven in part by political considerations for limiting the size of the old-growth forest domain. Information on the application of disturbance rules to particular

forest stands are not provided in the old-growth forest studies and therefore, without accessing the Department's disturbance data layers (if they still exist) it is not possible to quantify the areas effected by particular rules nor test the rulings themselves.

A critical task for environment groups is to lobby the state government for the development and application of ongoing ground truthing requirements which would leave less room for error.

3.3.2 Significant Unnaturally Disturbed Forest (human)

The following are summaries of **examples** of disturbance rules generated by the Department's old-growth studies to rate levels of **Significant Unnatural Disturbance**.

Grazing – disturbance rules were developed for particular Ecological Vegetation Classes (EVC) in forested areas leased for grazing. The rules assumed that stock would graze in forests where the vegetation was palatable on slopes up to at least 20 degrees. Weed invasion and burning practices were associated with, and assumed to cause, a significant disturbance to the land.

Selective Logging and Thinning - For certain EVCs where selective logging and thinning was recorded as having taken place after 1940, it was assumed that weed invasion was highly likely on the flatter slopes, impacting on the understories, and such sites were given a disturbance level rating of 'significant unnatural disturbance' and were therefore excluded from consideration as potentially containing old-growth forest.

Despite this disturbance rule, according to (Franklin 2001) thinning of regrowth may in fact accelerate the development of many old-growth structural attributes such as encouraging the growth of mature trees and regeneration of the understorey. However the scale of thinning that would stimulate the development of large trees may be a different form of thinning to the thinning regime designed by the Department which is to accelerate the growth of saw-log valued trees.

Firewood harvesting - records were used to identify the areas over which firewood cutting and collection had been traditionally undertaken, and the areas where firewood collection were still permitted. According to the studies:

> 'The intensity of these activities and the resultant disturbance appeared to be associated with a slope threshold of 10 degrees due to practical limitation on collection activities. Areas within a designated firewood collection zone with a slope less than 10 degrees were generally assigned a significant unnatural level of disturbance in the old-growth forest context. Areas with a slope of greater than 10 degrees were considered to be negligibly disturbed. EVCs were assigned a firewood collection probability rating. EVCs within a firewood collection area that were assessed as being unsuitable for firewood collection were considered negligibly disturbed because they provide little or no suitable material.'
>
> DNRE 2000

Mining – old-growth forest was deemed not to be located within 200 or 500 metres of mining areas on the basis that it was inferred that mining operations are likely to cause severe localised impacts on native vegetation.

Fuel Reduction Burns - According to the studies, it was difficult to determine the ecological impact of fuel reduction burns on a forest stand from the Department's records as the records are not detailed. Hence, to avoid making sweeping assumptions, *Woodgate et al* rated the impact of fuel reduction burns as a negligible unnatural disturbance. This policy was also applied to the Central Highlands old-growth forest study (DNRE 1998a).

Woodgate et al (p185) makes the following comments on fuel reduction burn records:

> '… existing records only indicate the frequency and perimeter of the burn, not the actual

> intensity or total area burnt. Because the records do not indicate the area burnt within the fuel reduced area, frequency data is not accurate. As a result, generalized assumptions about the effect of fuel reduction burning have been made; although frequent fuel reduction burning can degrade old-growth forest values, inadequacies with the data mean that only a negligible unnatural disturbance level can be assigned at this stage of our understanding.'

Despite this, the three later old-growth studies (for the North-east, Gippsland and West Victoria regions) introduced rules for interpreting the likely effect of fuel reduction burning on the regeneration of understories for each EVC. Those EVCs that were considered to be less flammable (generally the wetter communities) were deemed by the Department as unaffected by burns and therefore given a disturbance level rating of 'negligible unnatural disturbance' or a rating of 'temporary natural disturbance'. For certain EVCs, the Rules provided that a forest stand would be awarded a disturbance level rating of 'significant unnatural disturbance' if there had been more than one fuel reduction burn recorded in the previous 'x' number of years, eliminating such sites from consideration as old-growth forest. For example, in the case of Sub-Alpine Woodland, if a fuel reduction burn occurred in the previous 10 years then it was eliminated as candidate old-growth forest.

The reliance by the Department in the later studies on fuel reduction burn records resulted in a further reduction of the area of identified old-growth forest. Doubt must arise as to the accuracy of the disturbance level ratings for those particular areas where this rule was applied.

Disturbance ratings that relied on paper records to eliminate candidate old-growth forest ought only to have been used as a first approximation and such ratings ought to have been conditional upon extensive field verification.

3.3.3 Significant Naturally Disturbed Forest (wildfire)

'Significant Naturally Disturbed Forest' is forest that has suffered a significant disturbance from a natural event. Assessments for this category in the old-growth forest studies were limited to wildfire disturbance. This category is the most contentious as wildfire is considered a natural event that controls patterns of vegetation for many eucalypt forest types and is not an occurrence that would detract from the ecological integrity of these forests.

In contrast to the Woodgate Definition, the NFPS Definition does not recognise an exclusionary principle for eliminating forest as candidate old-growth where forest has been impacted by wildfire. As previously noted, the NFPS Definition only recognises 'unnatural disturbance' as an exclusionary principle. From an environmental perspective, this represents a more precautionary test for rating disturbances than that provided in the Woodgate Definition and the JANIS Definition.

Woodgate et al states that increased fire frequency or intensity can significantly disturb forests causing loss of hollows and greater levels of tree death, resulting in increasing levels of regrowth, and therefore a decline in old growth characteristics. Other studies highlight the fact that fire may in fact be necessary for maintaining ecological development. For example, in the case of Shrubby Foothill Forest regular fire disturbance is required to regenerate the understorey shrubs otherwise herbs tend to proliferate transforming the forest into a form of a Herb-rich Foothill Forest. Wildfire may also enhance hollow development. The destructive impact of wildfire depends on frequency, temperature and the environmental context including the forest type and species habitat.

The *Old-growth forest assessment in South-east Queensland* states:

> 'The concept of ecological maturity presupposes an understanding of population dynamics

- an awareness of the whole process from the generation of a particular forest association or community, through to its maintenance or in some cases its replacement. This dynamic process is rarely a simple progression, and in many forest types is poorly understood.

In some moister types, mature eucalypts are killed by wildfire and the forest regenerates from a fire-created seedbed. In the absence of fire, eucalypt regeneration in the moist-forest understorey may gradually be out-competed by rainforest species, which, in terms of the conservation of wet schlerophyll eucalypt forest associations would be an undesirable occurrence.

The drier forests are less well understood. It does appear, however, that regeneration in such ecosystems does not necessarily require a fire - or disturbance - created seedbed, as many dry forest shrub and tree species can regenerate vegetatively from subterranean lignotubers. The lignotubers can persist for many years before shooting and recreating the forest stand. Except under extreme circumstances the original forest association is maintained rather than replaced by another forest type**.'**

DNR 1996 (Qld)

Woodgate et al created a general API rule for assessing the impact of wildfire disturbance in the East Gippsland study area. The rule provided that where government records indicated that a wildfire had occurred at some stage and API confirmed significant disturbance through measurable wildfire effect in the canopy, the stand was given a disturbance rating of 'significant natural disturbance' and was excluded as old-growth forest. If there was no evidence from the aerial photographs of significant damage to the canopy or excess regrowth, the stand was deemed to be only negligibly disturbed by fire and was not eliminated as candidate old-growth.

The *Central Highlands Old-growth Study* (DNRE 1998a) relied on the same general wildfire rule as *Woodgate et al* by merely drawing on the wildfire records to explain a disturbance detected from API rather than rate the disturbance.

The *Comprehensive Regional Assessment - East Gippsland Environment and Heritage Report,* states:

'Wildfire records were not considered to be always reliable, and hence the effects of wildfire were assumed to be significant only where they could be confirmed using growth stage mapping or crown damage evident through aerial photograph interpretation.'

DNRE 1996b, p109

The following abstract refers to the Department's dataset for Regional Wildfire Records for forests in the East Gippsland old-growth study area as cited in the *Comprehensive Regional Assessment - East Gippsland Environment and Heritage Report*.

TITLE:	**REGIONAL WILDFIRE RECORDS**
Short Title:	VIC:E_Gipp:Wildfire_Recs_100k
Abstract:	Polygons delineating major wildfire boundaries derived from records for the period 1953 to 1991 held in regional DNRE offices on 1:100,000 base maps. Historical records were used for wildfires from 1939 to 1952. Areas are indicative only and do not show precise distribution and intensity of fires.
Attribute Accuracy:	The external perimeter of fires is accurate however the severity of fire damage within boundaries is not known
Completeness:	Complete

Source: DNRE 1996b.

The 'Attribute Accuracy' indicates that the Department could not rely on wildfire records to rate the severity of damage to forest stands. Hence, the records were merely useful for pointing to a wildfire disturbance where API indicated damage to crown cover or extensive regrowth.

Woodgate et al suggested the need for more sophisticated wildfire rules that would apply to each EVC as follows:

> 'More detailed analyses of the effects of wildfire should be possible by developing rules which seek to explain the specific effect of wildfires on each EVC and forest type. In particular, the rate (or time) of recovery of structural and floristic attributes following a **wildfire of known intensity** for given vegetation classes could be used to more accurately assign a disturbance level.' (p185)

Woodgate et al refers to 'wildfire of known intensity'. The most effective way to determine the intensity of a wildfire is through ground truthing. The above recommendation did not encourage the Department to create new rules relying on wildfire records per se as occurred with the later North East, Gippsland and West Victoria old-growth studies for which the Department decided to draw on wildfire records to develop broad exclusionary rules for disturbance ratings. The three studies generated rules which eliminated fire disturbed areas for which the most recent recorded fire had occurred during a designated 'recovery period' of the understorey for each EVC.

These later rules could collectively be called 'Wildfire Understorey Exclusion Rules' (the author's name for these rules). The rules were generated to eliminate candidate old-growth forest based on the possibility that a wildfire disturbance had a significant impact on the understorey even though no disturbance could be detected from the air through API. The rules assigned a 'recovery period' for each EVC ie the time for a forest stand to recover from the structural and floristic impact of wildfire. The recovery periods ranged from 10, 20, 50, 100 or 200 years depending on the EVC, dating back from the time of the studies. A rating of 'significant natural disturbance' was applied to a stand where a wildfire was recorded within such a 'recovery period', on the basis that the understorey of the stand was still in a state of recovery.

A typical entry in the Disturbance Rules Tables of the later old-growth forest studies was worded as follows:

> Wildfire is recorded and pre-dates API (SFRI 1995-1997). Growth Stage Mapping indicates no canopy disruption, but the understories of these vegetation classes take up to 'x' years to recover from fire and a wildfire is recorded less that 'x' years previously. *['x' being 10, 20, 50, 100 or 200 depending on the EVC being referred to.]*

As a consequence of Wildfire Understorey Exclusion Rules, sites for particular EVCs where wildfire had been recorded within 10, 20, 50, 100 or 200 years prior to the relevant study were attributed a disturbance level rating of 'significant natural disturbance' on the assumption that the understorey of the vegetation class takes that length of time to recover from wildfire. Such sites were excluded as candidate old-growth forest.

The later studies therefore adopted two sets of wildfire rules that may be summarised as follows:

1. The effects of wildfire were assumed from wildfire records to be significant where the effects could be confirmed through occurrence of regrowth or crown damage evident from aerial photograph interpretation (being the same rule as for *Woodgate et al*).

2. Wildfire Records were used to eliminate stands as candidate old-growth forest if wildfire had occurred during the designated understorey recovery period for the relevant EVC regardless of whether there was no evidence of disturbance from API.

Contrary to *Woodgate et al*, these later rules did not take into account the intensity of wildfire in order to rate its impact. As intensity did not form part of the assessments under the Wildfire Understorey Exclusion Rules, it is argued the rules wrongly assumed that wildfire of whatever intensity is destructive or catastrophic in relation to the ecological integrity of a forest, and therefore the rules were open to much error.

State Forests and National Parks in Victoria's North East, Tambo and East Gippsland Forest Management Areas were affected by the January 2003 Alpine fires, which although huge in scale were not necessarily of high intensity. Rather than a massive fire front, such as the 1939 fires, the 2003 fires consisted of many 'fingers' and 'spot-fires' (Harry pers com 2003).

Every forest type has a disturbance regime that shapes its development. The extent and frequency of the disturbance regime for the old-growth forest type needs to be properly understood and investigated, and not simply guessed, before the Department dismisses areas from being considered old-growth forest. The fact that a wildfire may cause an increase in regrowth or oppression or encouragement in the growth of particular understorey plant communities does not necessarily mean that there has been a decline in old-growth values. The danger with the wildfire rules is that they may largely reflect a meaningless fidelity by the Department to the maintenance of vegetation typologies (such as the Ecological Vegetation Class) rather than actually identifying any decline in old-growth values.

Nearly ten years have passed since many forest stands were eliminated from being considered candidate old-growth forest under the recovery rules and some of these stands would now be eligible under a review for inclusion as old-growth forest. No work has been undertaken by the Department, nor is it seemingly intended so, to update old-growth forest maps to include forest for which the understorey has since recovered from wildfire. The following table indicates forest areas for which a 'significant natural disturbance' rating was applied.

Table 9: Significant Naturally Disturbed Forest

RFA Region	Significant Naturally Disturbed Forest rating (ha)
East Gippsland	82,353
Central Highlands	no figures provided; mapped as significant or severely disturbed without delineating natural and un-natural disturbances
North-East	131,610
Gippsland	152,885
Western Victoria	131,415
Total	**498,263 (not including Central Highlands)**

Source: Figures from the five old-growth forest studies Woodgate et al 1994, DNRE 1998b, DNRE 2000 and DNRE 2001a

The above table indicates a larger proportion of forest was designated as Significant Naturally Disturbed in the later three old-growth studies compared with the East Gippsland study which may well be attributed to the moot Wildfire Understorey Exclusion Rules.

The following questions arise:

(1) Were the Department's wildfire rules for eliminating areas as old-growth forest ecologically sound?
(2) Should have wildfire records been relied upon in the North East, Gippsland and West Victoria old-growth studies to rate disturbance levels without field verification?
(3) How much Significant Naturally Disturbed Forest has recovered since the assessments and what areas would now be considered old-growth forest?

(4) How much forest that has been identified as old-growth forest has been significantly disturbed (under the Rules) as a result of recent wildfires?

(5) Has the Department updated its datasets to provide current information on the impact of wildfires, inside and outside of the CAR Reserve System, and if so what decision rules have been invoked?

3.4 Ground truthing

The Department's old-growth forest studies noted that API struck interpretative problems in cases where senescing features apparent from the ground were not always fully apparent from an aerial perspective and that the actual proportion of senescing trees was sometimes underestimated. The studies also advised that field checking was generally restricted to areas accessible by road or track (DNRE 1996b, p107).

Further, the Department has recently advised the author that areas designated from API as old-growth forest erroneously included, for example, streams and roads that could not be detected in the broad scale modelling used at the time**.**

Many of the assumptions applied by the Department to the government records for developing disturbance rating rules were precarious, as is apparent from commentary in the various studies. Records relied on by the Department, for example grazing leases and logging records, would clearly have been limited or superficial for the purpose, probably open to inaccuracies due to human error and subjectivity, and were not adequately validated through ground-truthing. *Woodgate et al* states:

> 'It is possible that some areas of older forests that have been assigned a significant unnatural disturbance record may not be significantly disturbed. If this is so, such forest stands could qualify as old-growth.' (p78)

In the case of wildfire, as previously noted, the records did not include any useful fire intensity measure and were rejected by *Woodgate et al*. Despite this, the records were fully relied upon for the last three studies to rate disturbance.

The records are not available for public scrutiny nor has the Department detailed the stands and locations for which the records were applied. The actual records themselves and the Department's data layers for disturbances may no longer exist as has occurred with the data layer for Negligibly Disturbed Forest. The use of these government records makes it very difficult to have a relatively uniform product that can be shared by the Department with a large number of users including institutions, environmental consultants and environment groups for undertaking forest investigations or reviews. The methodology ensured that the Department has had a monopoly on settling what is now deemed to be old-growth forest.

Woodgate et al states:

> 'With over a million hectares of native vegetation [in East Gippsland], over one fifth of which is considered to be old-growth forest, it was not possible to field check all of this area and ongoing verification is required. While the growth stage, forest type and ecological vegetation class mapping were considered reliable, the existing records of disturbance were less accurate, particularly for selective logging, grazing and fuel reduction burning. Wildfire is also a disturbance that requires more research. It has a profound effect on the extent, growth stage distribution and floristics of most vegetation types in the study area and its influence on old-growth forest characteristics is particularly important.' (p62)

The following abstract, from the *Comprehensive Regional Assessment - East Gippsland Environment and Heritage Report* (DNRE 1996b), refers to the Department's digital dataset

summary for disturbance levels of forest areas in East Gippsland.

Title:	**Disturbance Levels For Old-Growth Forest Study**
Short Title:	VIC:E_Gipp:Old_Growth_Dist
Custodian:	DNRE
Description:	The dataset identifies disturbance levels derived from a number of disturbance datasets as part of the old-growth forest analysis process. Levels of disturbance were assigned on the basis of best available knowledge of disturbance effects. For areas with multiple disturbance records, the most significant disturbance level identified is assigned. Areas shown to be undisturbed indicate that no authentic disturbance records have been discovered and have not been field validated as undisturbed.
Attribute Accuracy:	Extensive field checking was carried out iteratively while assigning disturbance classes to given areas. Disturbance rules were generated during air photo interpretation and mapping of Ecological Vegetation Classes
Completeness:	Complete

Source: DNRE 1996b

The 'Attribute Accuracy' suggests that validation was carried out through extensive field checking. It is not known whether the Department's datasets provide any detailed information on the actual extent of field verification of the disturbance ratings. However, recommendations for the need for field validation of areas excluded as old-growth forest are echoed throughout the East Gippsland, Central Highlands, North East Victoria, Gippsland and West Victoria old-growth forest studies. The indications from the studies are that field validation was very limited and therefore the disturbance level ratings cannot be fully relied upon. Comments include:

- 'Sampling was generally carried out along short transects and restricted to areas accessible by road or track.' (DNRE 1996b, pB23) - East Gippsland old-growth forest study

- 'It was not possible to field check all of these areas on the ground and on-going verification of old-growth forest will be required. The area mapped as old-growth forest is only as accurate and reliable as the information used to define it. Assumptions regarding the impact of, and recovery times following, disturbance could also be refined though further research and application of improved remote-sensing techniques.' (DNRE 1998a) - Central Highlands old-growth forest study

- 'Some field checking was undertaken to verify the disturbance records but this was not comprehensive. However, it is not possible to validate the old-growth mapping without further extensive field work.' (DNRE 1996b) - *Comprehensive Regional Assessment - East Gippsland Environment and Heritage Report*

- There has been 'limited amount of objective field verification undertaken to support rules and assumptions used in the modelling process.' (DNRE 2001a, p36 and DNRE 2000, p32) - North East and Gippsland old-growth forest studies

- 'It must be kept in mind that the study produced an old-growth forest model and the results represent a snapshot in time. It was only possible to field check a limited proportion of this forest to confirm the findings. Consequently ongoing field verification of old-growth forest stands is required.' (DNRE 1998b and DNRE 2000) - North East and Gippsland old-growth forest studies

The effect of this is that much forest may have been erroneously omitted from the old-growth forest domain, which further indicates that the state government has failed to meet its commitment to protect a minimum of 60% of old-growth forest as well as all viable examples of rare or depleted old-growth forest types.

The potential for error demands ongoing verification of old-growth forest as is undertaken by the Department for rainforest. In New South Wales greater emphasis has been placed on the need for field validation, as opposed to iterative trials to test assumptions generated out of an 'ad hoc' collection of historical records. A Comprehensive Regional Assessment Report produced by the NSW National Parks and Wildlife Service states that it is important to apply -

> '… the JANIS guidelines for assessing the current effects of disturbance on stand structure and function, as distinct from excluding stands as being considered negligibly disturbed on the basis of the occurrence of a disturbance record per se. While this approach would seem a minimum to justify that a precautionary approach has been followed, it should be noted that the arising candidate old-growth forest map will require additional field evaluation if the intention is to minimise the likelihood that old-growth forests and, especially, old-growth forests of high conservation value are to be reliably identified and conserved regionally.'
>
> NPWS 1999, p7 (NSW)

Given that all old-growth forest planning processes and the development of the CAR Reserve System under the Regional Forest Agreements (1997-2000) relied largely on paper records with limited information, and aerial photography using now-outmoded and inaccurate modelling techniques, the lack of ongoing field validation represents a significant oversight by the Department. It is likely that since the RFA process has been signed-off and the CAR Reserve System consolidated, the state government would prefer to consider the book closed on the issue of identifying old-growth. This is despite the following advice of *Woodgate et al*:

> 'As a better understanding of the complex interactions between disturbance types and vegetation classes is gained it will be necessary to reanalyse the datasets in order to improve the mapping of old-growth forests.' (p83)

3.5 Ecological Vegetation Classes

The concept of old-growth forest has greater ecological meaning when it relates to a particular vegetation class. Different ecosystems express growth stages in different ways, and a given vegetation class will likely possess 'a set of characteristics that uniquely defines old-growth forest within it and that may serve to distinguish old-growth forest types and successional stages' (Lindenmayer 2004). Requirement (9) of the Technical Requirements (see Appendix A) points to the importance of vegetation classes for classifying old-growth forest ecosystems:

> (9) **Ecological vegetation classes and forest types**
> The morphological (physical) characteristics that identify each growth stage vary with the ecological vegetation class (floristic composition and environmental attributes) and forest type (dominant species and structure) both of which are influenced by environmental site quality. For this reason the old-growth condition manifests itself in different ways, so forest must be stratified by ecological vegetation class and forest type.

Ecological Vegetation Classes represent the highest level in the hierarchy of vegetation typology (Woodgate et al 1994). They were introduced in the early 1990s to provide a contemporary and standardised state-wide classification system for vegetation communities. Since then, land use planning and management processes in Victoria have used EVCs as the principle unit for vegetation circumscription and mapping (Parkes 2003). EVCs are continually being refined to suit

various management and mapping purposes.

The *East Gippsland Comprehensive Regional Assessment: Environment and Heritage Report* defines an EVC as follows:

> 'An Ecological Vegetation Class consists of one or a number of floristic communities that appear to be associated with a recognisable environmental niche, and which can be characterised by a number of their adaptive responses to ecological processes that operate at the landscape scale. Each ecological vegetation class is described through a combination of its floristic, life-form and reproductive strategy profiles, and through an inferred fidelity to particular environmental attributes.'
>
> DNRE 1996b

Forty-four forest EVCs were identified as occurring in East Gippsland at the time of the East Gippsland old-growth forest study and included nomenclatures such as Shrubby Dry Forest, Montane Grassy Woodland, Herb-rich Forest, Damp Forest and Wet Forest.

3.5.1 Delineation of Old-Growth by Forest Type required

Old-growth forest was stratified by EVCs identified within each of the five geographical Regional Forest Management Areas. Appendix G of this report is a collation of tables from each of the RFAs which quantifies the area of old-growth forest contained in each EVC.

One EVC may include a number of forest types. For example, the Wet Forest EVC pictured in the diptych below, may be characterized by eucalypts such as Errinundra Shining Gum (*Eucalyptus denticulata*) in areas in East Gippsland, and Mountain Ash (*E. Regnans*) in the Otway Ranges and the Central Highlands.

Figure 6: Wet Forest EVC (Hastings)
at Dingo Creek, East Gippsland (left) and Riley's Ridge in the Otway Ranges (right)

Given that morphological characteristics of the dominant overstorey species in Wet Forests vary

considerably, structure at the forest type or stand level is likely to differ significantly. For example, Mountain Ash is a 'resilient' eucalypt in its response to fire - it is fire sensitive and regenerates vigorously, often resulting in generally even-aged stands. On the other hand, Errinundra Shining Gum is a 'resistant' eucalypt – it relies less on vigorous growth after fire, with trees allocating resources to enable survival through fire. This often results in uneven-aged stands where pure stands of this species occur. These different growth responses result in quite different stand structure and species composition, and require different old-growth forest definitions. *Woodgate et al* did not map old-growth forest at this level and the Department has not reviewed the EVC-scale old-growth forest mapping taking forest type into account.

3.5.2 Discrepancies with EVC descriptions

The EVC descriptions used in the old-growth forest studies have since been superseded by EVC benchmarks for 28 ecologically defined Bioregions established by the Department under Victoria's *Biodiversity Strategy (1997)* and the national *Environment Protection and Biodiversity Conservation Act (1999)*. Bioregions are the broad scale mapping units for biodiversity planning in Victoria and capture the patterns and ecological characteristics in the landscape. Each Bioregion is characterised by its own set of EVCs for species typical of the Bioregion.

The EVCs used in the old-growth studies and referred to in the RFAs were in a brief descriptive form only, whilst the later Bioregional EVCs include sets of benchmarks in table form and are therefore more sophisticated. (See Appendix D for an example of the Department's list of EVCs for East Gippsland Uplands as at 2004. Also click on www.dse.vic.gov.au - bioregions to access DSE's website for Bioregion EVC Benchmarks.)

Comparing the Shrubby Dry Forest EVC for the East Gippsland Uplands Bioregion (see Appendix E) with the description of Shrubby Dry Forest EVC in the East Gippsland old-growth study one notes that differences in the plant communities are evident, including:

Table 10: Comparison of current description of Shrubby Dry Forest with *Woodgate et al*

SHRUBBY DRY FOREST EVC	East Gippsland Uplands Bioregion 2006	East Gippsland – *Woodgate et al* 1994
Height of overstorey	Up to 25 metres tall	Variation in height from 8 to 45 metres depending on rainfall. Most stands are less than 28 metres in height
Fire	Desirable period between disturbances is 20 years	Fire is a frequent and often intense plant selection factor
Most common overstorey tree species	Red Stringybark, Yertchuk, Silvertop Ash, White Stringybark	Red Stringybark, Yertchuk, Silvertop Ash, White Stringybark, Red Box and Brittle Gum
Understorey tree	Black Sheoak	Nil
Shrubs	Lance Beard-heath, Shrubby Platysace, Shiny Cassinia, Tangled Guinea-flower, Common Rice-flower, Common Heath	Shining Cassinia, Pale Hickory Wattle, Sunshine Wattle, Cluster-flow Geebung, Hop Bitter-pea, Gorse Bitter-pea, Common Heath
Herbs	Germander Raspwort, Ivy-leaf Violet, Small St John's Wort, Small Poranthera	Uncommon

The author has also compared the descriptions of Shrubby Dry Forest EVC for East Gippsland Lowland and East Gippsland Highland Bioregions with the same EVC used for the East

Gippsland old-growth study and notes similar differences. The variance in the descriptions between the current Bioregion EVCs for Shrubby Dry Forest in East Gippsland and *Woodgate et al* appear significant.

The discrepancies appear to also apply to many other EVC descriptions in the old-growth studies and the Regional Forest Agreements.

According to the *North East Victoria Comprehensive Regional Assessment*:

> 'Each EVC represents one or more plant communities that occur in similar types of environments. The communities in each EVC tend to show similar ecological responses to environmental factors such as disturbance (for example, wildfire).'
>
> DNRE 1998c

As discussed above, forest type within EVCs vary markedly in their ecological response to environmental factors. The discrepancies between the plant community descriptions raises questions about the reliability of the Disturbance Rules for rating ecological responses to disturbances based on the EVC descriptions used at the time. For example, the Wildfire Understorey Exclusion Rules eliminated much candidate old-growth forest on the basis of postulated significant impacts of wildfire on assumed types of understorey. The East Gippsland RFA table in Appendix G indicates that 213,883 hectares were identified in East Gippsland as Shrubby Dry Forest of which 88,012 hectares were assessed as old-growth forest. Much of this forest was eliminated as old-growth on the basis of possible disturbance to an assumed understorey ecology.

The stratification of old-growth forest by Ecological Vegetation Class descriptions in the Department's old-growth studies needs to be reviewed and cross-referenced with the new Bioregional benchmarks as well as forest types in order to accurately map vegetation, and in particular to revisit stands where disturbance rules for EVCs were applied to eliminate the stands as old-growth forest. Where there are major discrepancies in the EVC descriptions then it may well be that the previous stratification of old-growth forest has less ecological meaning or no real scientific usefulness. Any future stratification of old-growth forest must include a reappraisal of conjectured ecological responses to disturbances (wildfire and human), which in conjunction with improved modelling techniques, may present an entirely different picture of Victoria's old-growth forest domain.

3.6 Re-mapping old-growth forest

A special task of the National Forest Inventory in 1991 was to establish a workshop of forest experts from around Australia to identify attributes of old-growth needed to assemble meaningful information on these forests for the purpose of identifying the extent and location of old-growth forests in Australia. The report of the National Forest Inventory workshop indicated that API surveys should be used as a 'first approximation' followed by site-based methodology. The report states:

> 'The first approximation should have the effect of focusing resources and efforts towards more detailed (usually ground-based) surveys of selected areas of old-growth. These should comprise both reconnaissance sites (for characteristics such as floristics and structure) and detailed plots (for more detailed measurements e.g. basal area).'
>
> DNRE 1996b

The Department's methodology under the Rules ought to have represented the 'first approximation' rather than the final determination of the location of old-growth forest.

3.6.1 Secret government forest business

The Department's Forest Services is currently undertaking a discrete re-mapping of old-growth forest in East Gippsland using more up-to-date technologies than that which were available at the time of the old-growth studies. It is unfortunate that the re-mapping, which is reportedly due to be finalised towards the end of 2006, is being kept a secret from environmental stakeholders and the community at large as secret projects often lead to flawed methodologies and misleading results. The secrecy attached to the re-mapping presumably relates to the preparation by the state Labor government of a measured forest policy statement designed to attract the 'green vote' in the lead up to the November 2006 state election. Re-mapping old-growth forest is an urgent priority but it must be a transparent process inviting peer review and not tainted by political exigencies.

The re-mapping is reportedly taking into account areas affected by recent wildfire. But will it, for example, be revisiting areas previously excluded as old-growth forest? There has been no public input into the methodologies being used by the Department and, therefore, it seems highly likely that the current re-mapping will be another ‘first approximation’ perpetuating mistakes and misguided political compromises of the past.

The mapping of EVCs and old-growth forest carried out during Regional Forest Agreement process was modelled at a 1:100 000 scale. This scale is a very coarse scale to carry out this type of work and would not have represented smaller or lineal areas. It accounts for many of the excuses in the old-growth forest studies and the CRAs for possible inaccurate mapping. The advancements in remote sensing, API and spatial analysis, coupled with a decade more experience in interpretation such as the completion of the Statewide Forest Resource Analysis, means that the same work carried out today can be more detailed and accurate. Modelling ought now be carried out at a 1:25 000 scale, being a far more acceptable scale.

If the Department’s re-mapping of East Gippsland also includes forest protected within the CAR Reserve System results may show that the total reserved area of old-growth is proportionally less than the percentage previously claimed under the Regional Forest Agreements, and as such the Department may be compelled to transfer old-growth zoned in State Forest to the reserve system to meet the conservation targets under the East Gippsland RFA.

3.6.2 Victorian Government should fund an ‘Old-growth Forest Project’

Rather than simply 're-map' old-growth forest, the Victorian state government needs to launch an **Old-growth Forest Project** that tackles the flaws of past methodologies, utilises new information obtained through Departmental projects and studies, and applies latest remote sensing techniques and other technologies, to lead to a more complete contemporary understanding of Victoria’s old-growth forests.

In addition to coarse broad scale mapping, a modern field survey methodology would need to be developed to identify ecological maturity of forest stands on the ground, and in particular for assessing controversial sites in areas of reputed high conservation value currently located outside of the CAR Reserve System and available for logging or exposed to other kinds of deleterious disturbance. Importantly, the project would need to review all areas excluded as old-growth forest under the Disturbance Rules.

Determining ecological maturity of forest stands requires the development of refined definitions specific to each of the old-growth forest ecosystems. Peter Woodgate reported to the Joint Scientific Advisory Group (JSAG):

> ‘[The Department] needs to understand the full temporal cycle of forests as they move from youngest to older expression. This would lead to **custom-made definitions** for each Ecological Vegetation Class with thresholds based on strong correlations with biophysical parameters (a la Franklin) - functional composition eg nutrient cycling, biodiversity;

structural eg all wood material; contextual - neighbourhood; and cultural (possibility).'
JSAG 1996

Whilst the above advice was taken to the extent of the Department developing fire recovery and other questionable disturbance rules specific to EVCs, each of the Department's old-growth forest studies stated that it was beyond the scope of the studies to determine old-growth forest definitions for each EVC.

The National Forest Inventory workshop identified the following set of old-growth characteristics, acknowledged in each of the old-growth forest studies, which could be used as a beginning point for developing customised definitions and rules.

(a) **Characteristics which directly contribute to, or enhance, old-growth status**
Structural and compositional characteristics (these are either measurable or inferred and contribute directly to a description of the old-growth state)

- relatively large trees and other plants for the area
- relatively old trees and other plants in terms of development stage
- presence of large crown gaps (in some forest types)
- presence of tree hollows and/or fallen trees, characteristic biotic composition, presence of indicator species,
- presence of certain growth forms, such as epiphytes in some forest types

Functional characteristics (measurable or inferred but are less clearly associated with old-growth forests and may be seen as secondary characteristics)

- characteristic levels of gross and net productivity
- stable nutrient cycles, high litter levels (in some vegetation classes)
- low or negative biomass increment
- low rates of change in species, forest structure and ecosystem functioning

(b) **Disturbance characteristics which alter old-growth status**
(characteristics which diminish or detract from old-growth status)

- evidence of physical disturbance (like fire, logging, grazing, mining)
- evidence of biological disturbance (such as introduced weeds or pathogens)

(c) **Intangible characteristics**
(often subjective but relevant to policy and management considerations)

- aesthetic considerations (like antiquity and grandeur - in some vegetation classes)
- wilderness quality
- public perceptions and opinion
- ease of long-term management or maintenance

The optimum surrogate characteristics that correspond to 'old-growthness' need to be determined for each old-growth forest ecosystem. The Department's current blanket surrogates of growth stages are not an appropriate surrogates for all forest ecosystems. Surrogates are required for each of the successional growth stages of EVCs and forest types as opposed to the 10% rules.

The living tree component would need to include ranges for the required proportion of senescing trees and the allowable proportion of regrowth trees, understorey cover, crown gaps, tree hollows, growth forms such as epiphytes, and indicator animals. The dead tree component would need to include surrogates that correspond with the presence of standing snags, fallen trees, woody debris on the forest floor, and other indicators of 'old-growthness'.

The project brief for *Woodgate et al* proposed that a simple threshold approach for assigning a

level of significance within a criterion, could provide that the age of the forest overstorey of a stand must be greater than '100 years' for it to be considered old-growth forest. This proposal was ultimately disregarded by the project team in favour of the 10% growth stage thresholds which rely on measuring crown cover using API. It may be that an age based criterion would now be feasible given increased information on tree age and stand age of forest types. If a review of old-growth forest were to adopt an age criterion, which appears more in line with the USA experience, then detailed denchronologly studies would need to be drawn on.

Thomas Spies, Research Ecologist for Pacific North West Research Station, Oregon, USA has made the following comment in relation to classifying old-growth:

> 'There ought to be an indexing approach using a full suite of forest structure measures including canopy, live trees, dead trees, and spatial pattern etc. Such approach enables all forests to be evaluated and scored for their relative contribution to old-growth development and associated ecological functions. This would also provide flexibility to modify the definitions as more information becomes available.'
>
> Spies 2006

Site surveys for assessing vegetation quality on private and crown land which is to be cleared are required for conservation of native vegetation under *Victoria's Native Vegetation Management – A Framework for Action* (DNRE 2002) ('Native Vegetation Framework'). The *Native Vegetation Framework* applies a methodology known as 'Habitat Hectare' for measuring the quality and quantity of a vegetation relative to the EVC context on a site-basis.

Table 11: Components and weightings of the habitat score

	Component	Max Value %
Site Condition	Large Trees	10
	Tree Canopy Cover	5
	Understorey	25
	Lack of weeds	15
	Recruitment	10
	Organic Litter	5
	Logs	5
Landscape Context	Patch Size *	10
	Neighbourhood *	10
	Distance to Core Area *	5
Total		**100**

* these components can be derived on-site or with the assistance of maps and other information (e.g. GIS) (DSE 2004a, p16)

The Habitat Hectare, developed by the Department since *Woodgate et al*, is a relatively simple methodology for use by private land owners and government agencies. It provides a score system with a range of components of which tree canopy cover makes up only 5%. It allocates a score for habitat components and multiplies the score by the site area to provide a 'habitat hectare' score. The components assessed are listed in the table. While the Habitat Hectare method does not include reference to 'growth stages' or old-growth forest, it does specify a benchmark for 'large trees', describing the size and number per hectare required to maintain habitat values.

A methodology, perhaps analogous to the Habitat Hectare model, but possibly of a more comprehensive scientific standard, would need to be considered for any contemporary Old-growth Forest Project.

To deal with the issue of political impartiality the state government ought engage an independent institution such as Monash University's Environmental Science and GIS Departments to manage the project in conjunction with the Department. Such an independent body ought have the responsibility for devising acceptable customised definitions and rules for identifying old-growth forest as well as developing an impartial GIS-based identification and re-mapping process.

The project would be a need to revisit the Department's Technical Requirements and Disturbance Rules commencing with *Woodgate et al*, and in particular review the relationship between wildfire and ecological integrity. It may well be that wildfire ought not be considered a 'disturbance' trigger. This would also entail consultation with relevant stakeholders to incorporate different perspectives. There would also need to be a comparative study of work undertaken interstate and overseas such as the USA where old-growth mapping and monitoring techniques are continuing to be refined. Scientifically robust ground truthing would be required to calibrate the model to fit agreed definitions and identification procedures.

The project would entail the project team's GIS/ Remote Sensing section working with high resolution satellite or Aerial Photography Interpretation (API) to identify and map workable boundaries for the old-growth areas such as ridgelines and catchment units rather than polygons as currently used. Once this work is completed by the project team it would then need to carry out detailed analysis of images and data to produce draft maps. Further extensive on-ground checking would be required to validate the modelling and boundaries on maps.

A final report would need to include:

- Customised definitions for 'old-growth forest' for each EVC and Forest Type with technically and empirically supported evidence to justify the definitions;
- A final map of old-growth areas with workable boundaries such as ridgelines and catchment units (rather than polygons); and
- A detailed explanation of the processes applied, of desktop and field based work and of the methodology and final reasons for applying the boundaries.

It is important that a future process for delineating old-growth forest does not result in stands being dismissed as old-growth because they fail to match all surrogate measurements. Forests should be given a relative ranking based on the abundance of a number of attributes (T.F. Braumandl and R. F. Holt 2000). This would overcome the rigid disturbance rules whereby, for example, forests have been eliminated as old-growth forest due to a recent fire, and would produce a more valuable picture of the extent of the old-growth forest domain.

A further policy that recognises old-growth forest as a subset of a broader range of protected forest classes would better guarantee that its value and extent is not undermined by coarse definitions and inflexible or naive decision rules. Such a class might be the Negligibly Disturbed Forest Class.

3.6.3 Compendium of Technical Requirements for Old-growth Forest

The Department needs to create a *Compendium of Technical Requirements and Disturbance Rules for Identifying and Monitoring Old-growth Forest in Victoria,* including commentary, figures and maps. The compendium would address the current lack of transparency in relation to growth stage requirements, EVC descriptions and disturbance rules and figures which are dispersed across various Departmental datasets, the old-growth forest studies, the Comprehensive Regional Assessments reports and Regional Forest Agreements. A compendium would assist with future monitoring of Victoria's old-growth forest domain.

4. PROTECTING OLD-GROWTH FOREST

4.1 Cultural devaluing of old-growth forest

'Old-growth forest' appears to be viewed by the Victorian state government and various peak environment groups primarily as a political concept for arguing how much native forest ought potentially remain off-limit to industrial logging.

There has been no progress since the Regional Forest Agreements of the 1990s in refining rules and processes for identifying old-growth forest and for monitoring its protection and there appears to be a culture within the Department to resist any further focus on old-growth. Its devaluing possibly relates to the fact that the CAR Reserve System was perceived as representing the final statement on protection of old-growth forest and other conservation values under the Regional Forest Agreements. With the segregation of native forests into reserves and logging zones, the Department appears to have adopted the view that old-growth ought now be treated simply as a continuum of forest stands generally and ought not attract special attention or monitoring. However, the Regional Forest Agreements specifically provide for the capacity to change boundaries to reserve more forest areas based on 'new information'. Given the rapid advances in forest modelling in recent years, now is the appropriate time to reinvigorate scientific interest in this unique forest class and consider maximising its protection.

The environment movement appears to have also stalled, in any practical sense, on the issue of refining a working definition of ‘old-growth forest’ and revising mapping. The expression 'old-growth' is incorporated into political slogans to pressure the government into protecting more areas of native forest. An example includes The Wilderness Society's mantra, *Protect Victoria's Old-growth Forests: clean air, water & wildlife OR woodchips … You decide* (TWS 2006). However, little serious research has been undertaken by non-government organisations and institutions to further illuminate the intrinsic values of old-growth forest ecosystems. Its values and its extent are now suppose to be assumed by the public.

Does the *environment movement* (being both ‘peak’ city-based groups and regionally based groups and individuals) support the same model of old-growth forest as the Department, and if not, what scientifically based model(s) has it developed or adopted?

Without doubt, there is much confusion in the public arena as to what old-growth really means. However, there is a clear public will for the older native forests to be protected. The state government ought now be challenged to invest capital and resources into long-term scientific research for identifying old-growth attributes of specific forest ecosystems and for fully protecting and monitoring them.

4.2 Inadequate protection under the CAR Reserve System

The Regional Forest Agreement (RFA) process was commenced in 1995 by the state governments in agreement with the Commonwealth to fulfil the commitment to the 1992 National Forest Policy Statement (NFPS). The Department undertook Comprehensive Regional Assessments (CRA) of native forests on public land to meet targets for an envisaged Comprehensive, Adequate and Representative (CAR) Reserve System. The assessments applied the JANIS Criteria to the design, taking into account existing legislated reserves such as National Parks, State Parks and Flora and Fauna Reserves. As part of the process the Department completed the old-growth forest studies to identify and map old-growth forest, applying the Woodgate Definition (as a surrogate for the JANIS Definition) and the accompanying Rules.

The principles for establishing the CAR Reserve System were described as follows:

Comprehensive: must include the full range of forest communities across the landscape.
Adequate: must ensure the viability and integrity of populations, species and communities.
Representative: must reflect the diversity within each forest ecosystem.

The NFPS pointed to the need to conserve and manage areas of old-growth forest and wilderness as part of the CAR Reserve System to acknowledge 'the significance of these areas to the Australian community because of their very high aesthetic, cultural and nature conservation values and their freedom from disturbance.'

NFPS 1992, p11

In 1997 the Joint ANZECC / MCFFA National Forest Policy Statement Implementation Sub-committee (JANIS) determined criteria for assessing which areas should be included in the CAR Reserve System. The criteria are cited in the JANIS Report and include a commitment to protect at least 60% of old-growth forests.

The minimum 60% figure was applied by the Department, where practical, to old-growth forest defined by its Ecological Vegetation Class with full protection 'wherever possible' of rare or depleted forest EVCs.

The JANIS criterion of a minimum 60% protection was a political quota which has been strongly contested by conservationists as environmentally 'inadequate'.

The *JANIS Report* states:

> 'It is recognised that old-growth, as part of an ecological succession, is not static and cannot be maintained indefinitely merely through the reservation of existing examples of that age-class. The inclusion of old-growth in the reserve system should be seen in the context of the selection and reservation of an **appropriate mosaic of age-classes**, which, with ecological processes intact will have the potential to generate the old-growth of the future.
>
> Old-growth forest also has aesthetic and cultural values, and to meet these community expectations old-growth forest should be protected in areas which optimise those values. In some cases additional reservation may be required above that needed for biodiversity purposes and decisions on such additional reservation would vary from region to region.'

The *JANIS Report* provides criteria for protection of old-growth forest as follows:

> **'Criteria**
> It is necessary to approach old-growth criteria in a flexible manner according to regional circumstances, especially when forest ecosystems are still relatively widespread and retain large areas of old-growth. Wherever possible, areas of old-growth requiring protection should be included in the area identified to meet biodiversity criteria.
>
> (1) Where old-growth forest is rare or depleted (generally less than 10% of the extant distribution) within a forest ecosystem, all viable examples should be protected, wherever possible. In practice, this would mean that most of the rare or depleted old-growth forest would be protected. Protection should be afforded through the range of mechanisms described in section 4.
>
> (2) For other forest ecosystems, **60% of the old-growth forest** identified at the time of assessment would be protected, consistent with a flexible approach where

appropriate, **increasing** to the levels of protection necessary to achieve the following objectives:

- the representation of old-growth forest across the geographic range of the forest ecosystem;
- the protection of high quality habitat for species identified under the biodiversity criterion;
- appropriate reserve design;
- protection of the largest and least fragmented areas of old-growth;
- specific community needs for recreation and tourism.'

Public forests chiefly comprise of the following land tenures:

CAR RESERVE SYSTEM	
Dedicated Conservation Reserve (PRK)	Formal Reserves - legislated parks and reserves which are legally distinguished from State Forest under various statutes. Timber harvesting is excluded. Examples of land tenure include: Reference Area, National Park, State Park, Nature Conservation Reserve, Wilderness Park, Regional Park, Natural Features Reserve, Heritage River, Coastal Park, Flora and Fauna Reserve, Wildlife Reserve.
Special Protection Zone (SPZ)	Informal Reserves – located in State Forest and reserved under Forest Management Plans prepared by the Department. They are managed specifically for the protection of conservation values. Timber harvesting is excluded. SPZs generally comprise of the following categories: • Large and contiguous areas; • A network of connecting areas (200-400 wide) based around riparian zones (including Heritage River corridors) but also including wildlife corridors on ridges and crossings between catchments.
STATE FOREST LOGGING ZONES	
General Management Zone (GMZ)	Located in State Forest, GMZs are managed by the Department for a range of uses, but timber production generally has the highest priority.
Special Management Zone (SMZ)	Located in State Forest, SMZs are managed by the Department under Forest Management Plans. This zone is managed to conserve specific features (eg fauna species, historic sites and isolated populations of key threatened plant species) but caters for timber production.
Code of Forest Practices (CFP) Exclusion Area	Located in State Forest, CFP Exclusions prescribe areas with temporary exclusion from logging under the Code of Forest Practices for Timber Production, Management Plans etc.

The land tenure included in the CAR Reserve System is not well defined. Some sources in the Department say that it includes only Dedicated Conservation Reserves – PRK. Others suggest it includes Dedicated and Informal Reserves - PRK & SPZ. Others think it includes all reserves and areas protected by Code of Forest Practices prescriptions - PRK, SPZ & CFP Exclusion.

Determining which zones form part of the CAR Reserve System is important both in terms of meeting conservation targets under the JANIS Criteria and for conservation planning and monitoring. The question of what land tenure is *legally* included in the CAR Reserve System is best answered by examining the tables of reserved old-growth in the Regional Forest Agreements. The tables have been collated in Appendix G of this report and indicate contrary perspectives as follows: old-growth forest in CFP Exclusions is included as part of the CAR Reserve System under the East Gippsland RFA and the Central Highlands RFA (and appear to be equated with SPZs), while CFP Exclusions in the later North East RFA, Central Gippsland RFA and the West

Victoria RFA are classed as being outside of the CAR Reserve System.

The primary purpose of Dedicated Conservation Reserves (PRK) and Special Protection Zones (SPZ) is to preserve flora and fauna. Whereas forest stands, including old-growth forest, are zoned for exclusion from logging under the *Code of Forest Practices timber production* for safety and environmental reasons (e.g. to minimise erosion by restricting access to steep slopes and stream-side areas). The CFP Exclusions tend to be linear and hence do not protect values like old-growth particularly well. Although not harvested, the linear streamside reserves are threatened by regeneration burning, wind and sun exposure. They are also not permanent and may change with the Code or under revised local Forest Management Plan prescriptions. For these reasons it is unjustifiable to include CFP Exclusions as part of the CAR Reserve System as occurred with two of the RFAs.

The following figures, provided by the Department to Save Goolengook Inc in 2006, indicate total areas old-growth forest as at 2003 (being the last Department estimate) contained in reserves and CFP Exclusions.

Table 12: Summary of zonings old-growth forest by Regional Forest Management Areas as at June 2003

FIGURES AS AT 2003		Old-growth in Dedicated Conservation Reserves (PRKs)		Old-growth in SPZs		Old-growth in Code of Forest Practices (CFF) Exclusions	
RFA Area	**Total Old-growth as at 2003**	**Area**	**%**	**Area**	**%**	**Area**	**%**
East Gippsland	207,170	115,590	56%	26,910	13%	10,220	5%
Central Highlands	21,950	13,840	63%	5,270	24%	530	2%
North-east	257,160	96,640	38%	49,230	19%	28,100	11%
Gippsland	193,490	81,940	42%	49,230	25%	17,110	9%
Western Victoria (incl. areas outside of West Victoria RFA)*	130,690*	82,290	63%	34,880	27%	110	<1%
Total (2003)	**810,460***	390,300	48%	165,520	20%	56,070	7%
Total for RFA areas (2003)	**803,012**						

Source: Prepared by Projects Officer, VEAC from data supplied by DSE, on request of Save Goolengook Inc.

*The Western Victoria figures include 7,448 ha located outside of the RFA as discussed in the next table. The figure for the actual West Victoria RFA area was 123,242 ha. (See footnote to **Table 13**.)

The percentages are relative to the amount of old-growth as at 2003 and not at the time of the signing of the RFAs. As more old-growth forest is logged outside of the reserves and CFP Exclusions, naturally the proportion located inside these areas will further inflate.

It needs to be noted that the total of old-growth forest as at 2003 for the Regional Forest Agreement (RFA) areas was 803,012 ha, whereas at the time of signing the RFAs (1997-2000) it was 841,593 ha , indicating a decline of 38,581 ha up to 2003 (see **Table 14**).

The following figures, which were provided by VEAC in June 2006 on request of Save Goolengook Inc, detail the zoning of old-growth forest in each Regional Forest Management Area

as last reviewed in 2003 after the Alpine fires.

Table 13: Summary of old-growth forest by Zoning Category as at July 2003 (latest figures)

SUMMARY OF OLD-GROWTH BY ZONING CATEGORY (2003)						
Zoning	**North East**	**Central Highlands**	**Gippsland**	**East Gippsland**	**Western Victoria***	**Total**
FORMAL RESERVES						
PRK	96,640	13,840	81,940	115,590	82,290	390,300
Sub-total	**96,640**	**13,840**	**81,940**	**115,590**	**82,290**	**390,300**
INFORMAL RESERVES						
CFP	28,100	530	17,110	10,220	110	56,070
SPZ	49,230	5,270	49,230	26,910	34,880	165,520
Sub-total	**77,330**	**5,800**	**66,340**	**37,130**	**34,990**	**221,590**
PRODUCTION FOREST						
GMZ	76,050	1,780	42,360	50,320	9,830	180,340
SMZ	3,990	20	1,140	3,190	2,430	10,770
Sub-total	**80,040**	**1,800**	**43,500**	**53,510**	**12,260**	**191,110**
OTHER ZONES						
HRM	40	0	30	0		70
HRO	0	0	120	0		120
HRT	0	0	300	0		300
OPL	2,520	480	1,060	360	960	5,380
OPR	540	0	0	0		540
PLT	40	0	50	0		90
PRV	10	30	110	560		710
WAT	0	0	40	20		60
unknown					190	
Sub-total	**3,150**	**510**	**1,710**	**940**	**1,150**	**7,460**
Total	**257,160**	**21,950**	**193,490**	**207,170**	**130,690***	**810,460**

Zoning key	**Description**
CFP	Code of Forest Practice
COM	Commonwealth
GMZ	General Management Zone
HRB	OPR - Timber
HRM	OPR - Other
HRO	OPR - Other
HRP	OPR - Protect
HRT	OPR - Timber
INF	OPL – Informal Reserve
OPL	Other Public Land

Zoning key	**Description**
OPR	Other Parks and Reserves
OPT	OPR – Limited timber harvesting
PLT	Licenced/Leased Plantations
PPK	Proposed Parks
PRK	Conservation Parks and Reserves
PRV	Private Land
SMZ	Special Management Zone
SPF	Special Protection – River Frontage
SPZ	Special Protection Zone
WAT	Water Bodies

Based on DSE dataset *mog2003* (updated by *lastlog25* and *lastburnt100* from the DSE Library) & *fmz100*.

- Information for North East, Central Highlands, Gippsland & East Gippsland provided by DSE Parks & Forests Division
- Information for Western Victoria developed by VEAC from DSE GIS data layers.
- North East includes North-east & Benalla-Mansfield FMAs
- Central Highlands includes Central & Dandenong FMAs
- Gippsland includes Gippsland & Tambo FMAs
- Western Victoria includes all FMAs west of the Hume Highway, and includes the Box Iron-bark and River Red Gum Forests deserts (Little, Wyperfield, Murray-Sunset) in addition to the West Victoria RFA area

* The West Victoria Regional Forest Area was assessed under the RFA process in 2000 as containing **123,242 ha** of old-growth forest. The West Victoria RFA area extends up to the north of the Wombat State Forest but does not include the Box-Ironbark forests around Central Victoria or the River Red Gum Forests of the Murray or the deserts (Little, Wyperfield, Murray-Sunset). According to VEAC the above 130,690 ha figure for Western Victoria was constructed from DSE data layers which now includes all of the old-growth forest areas in western Victoria, not just the RFA area. These additional areas explains the extra 7,448 ha.

Source: Figures supplied by Projects Officer, VEAC, from data supplied by DSE in 2006, on request of Save Goolengook Inc

It is interesting to compare the proportion of old-growth forest that is protected in Dedicated Conservation Reserves with that which is protected in informal reserves. The above table indicates that 27.1% of old-growth forest that is protected is contained in SPZs and 9.2% is contained in CFP Exclusions. This means that 36.3% of the total of old-growth forest excluded from logging has been designated outside of Dedicated Conservation Reserves with 63.7% protected in PRKs.

SPZs are a source of controversy as they are not legislated reserves but were created as zones under the Department's Forest Management Plans. They can be logged by being swapped for other sites in GMZs and SMZs, provided that in doing so there is no perceived net loss of conservation values attributed to the SPZs. SPZs are fragmented across the landscape and often linear in shape, as illustrated by the orange code in the land use map for East Gippsland below. They have similar conservation limitations to the CFP Exclusions.

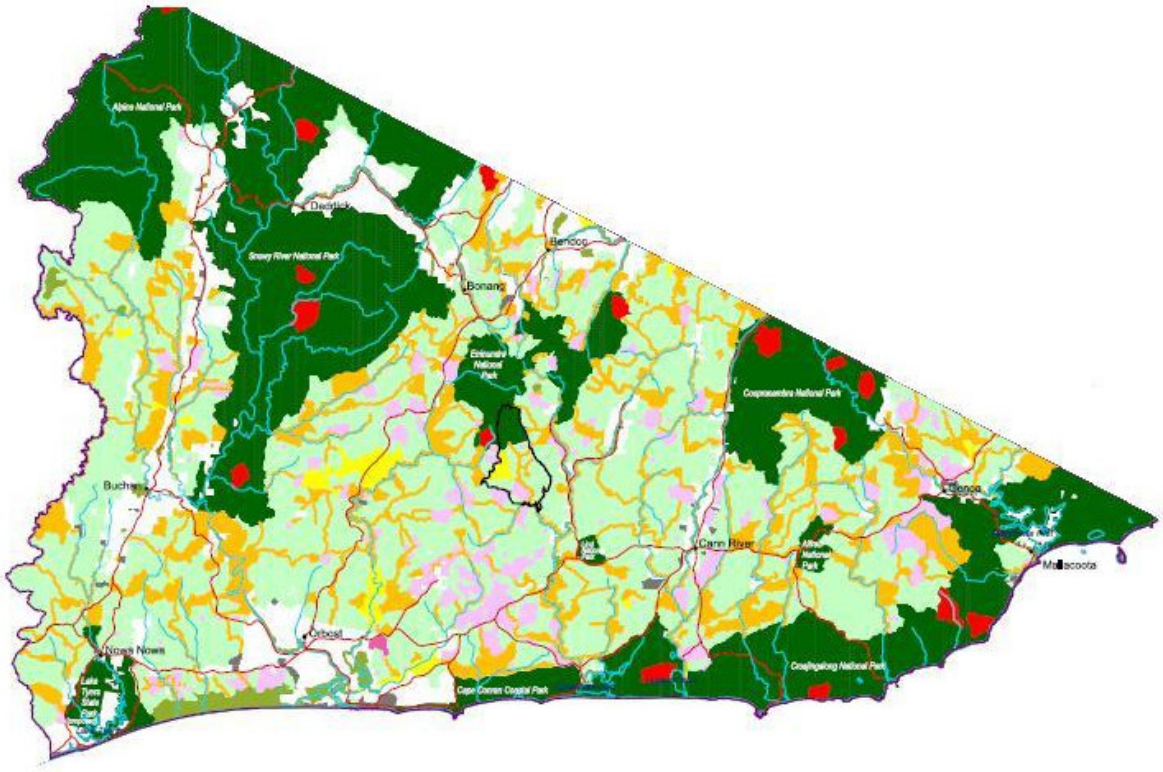
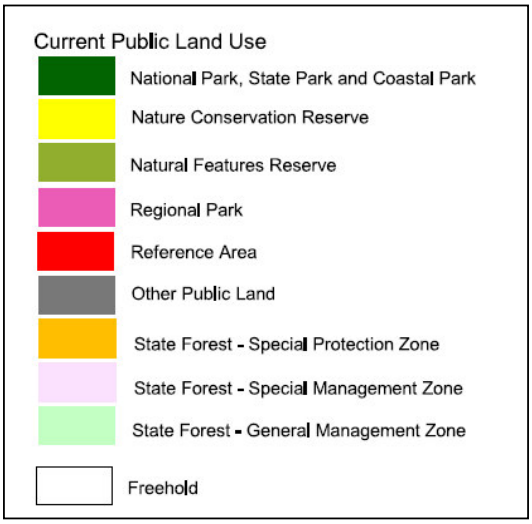


Figure 7: Map of East Gippsland Current Public Land Use
(Base Data from DSE GIS Corporate Library (c) DSE) extracted from VEAC Goolengook Forest Investigation Information Booklet, March 2006)



The design of these zones makes them vulnerable to edge disturbance including increased wind-throw, weed invasion, loss of connectivity and habitat value and vulnerable to increased risk of fire, as with CFP Exclusions. SPZs permit mining and grazing, which ironically are disturbance impacts used to exclude forest stands from being identified as old-growth forest under the Rules, and therefore they cannot seriously be deemed effective conservation reserves.

The inclusion of SPZs as part of the CAR Reserve System for meeting the criteria for minimum 60% old-growth protection (and full protection for rare and depleted old-growth) is frequently dismissed by conservationists as having been largely a ruse by the Department to minimise legislating new or expanded permanent Dedicated Conservation Reserves and to provide flexibility for access to conservation areas for timber production.

It is important for the Department to have the capacity to quarantine ecologically significant areas from industrial disturbances. For example, conservation of the Powerful Owl requires broad areas of forest containing old-growth attributes. These owls are non-migratory and show strong site fidelity. As such, management requires protecting and enhancing their individual territories (Newton *et al* 2002). Zoning forest as SPZs is certainly useful for conservation purposes, but it is clear that SPZs have been overused as a substitute for Dedicated Conservation Reserves.

The *Gippsland RFA Consultation Paper* confirms the bias of the Department against zoning smaller old-growth forest stands as formal reserves. It states:

> 'Reserving small isolates of old-growth presents operational and management problems particularly in relation to the identification of old-growth forest in the field and the delineation of identifiable boundaries. The old-growth Ash forest types are themselves of considerable commercial value and meeting JANIS targets in full would have an impact on the overall regional timber resource availability.'
>
> Clth 2000, p24

Woodgate et al raised the following issues relevant to forest connectivity, proximity and viability, and which are pertinent to the design and land use zoning of a reserve system that has protection of old-growth as one of its priorities:

- 'Do old-growth forest stands retain their complement of biota irrespective of the size of the stand, the shape of the stand or the severity of the edge effect?
- Do old-growth forest stands retain their complement of biota irrespective of the disturbance level of their neighbourhood? Is this dependent on the structure or floristics of the stand?
- Are the neighbourhoods of old-growth forest stands likely to isolate the populations of old-growth dependent species if these stands are separated through significant disturbance?
- What is the minimum distance between separate stands of old-growth forest which would facilitate gene flow for old-growth dependent biota?'

There is no evidence that the above factors referred to by *Woodgate et al* were researched and addressed by the Department at the time of designing the CAR Reserve System and given that large tracts of old-growth forest are either contained in precarious SPZs and CFP Exclusions or else available for logging in GMZs and SMZs, it remains a point of much controversy as to

whether the state government has applied the CAR principles to meet its commitment to 'adequately' protect old-growth forest for the full range of forest communities. The level of protection claimed by the Victorian state government to be afforded to old-growth forest under the CAR Reserve System design as it currently stands may well be illusory.

The Victorian Forest Alliance has recently produced a report titled *Choosing a Future for Victoria's Forests* (VFA 2006) for consideration by the political parties for the November 2006 state election. The report proposes a new protected area network that links and expands dedicated reserves 'to minimise disturbance of the natural landscape that will be critical to the conservation of forest biodiversity in the long term.' The report raises similar issues to *Woodgate et al* in relation to disturbance but proposes vastly expanding the reserve system based on 'twelve forest-dependent species whose protection requirements could be used as a surrogate'. The report also recognises the need to review conservation links between the different forest classes and the current vulnerability of isolated old-growth stands.

4.2.1 Destruction of Negligibly Disturbed Forest data layer

Environment groups have long called for the end to logging of Negligibly Disturbed Forest (Natural Mature Forest) as well as old-growth forest. Unfortunately, from the author's recent enquiries with the Department, it appears that the Department has not retained the statewide data layer on Negligibly Disturbed Forest constructed during the RFA process in the 1990s. Therefore, the Department cannot provide past or current information on this forest class, other than by reference to a few outdated tables and coloured maps contained in the Comprehensive Regional Assessment Reports. The Department has advised the author informally that the Negligibly Disturbed Forest data layer was developed purely as part of the old-growth forest modelling process and only the data layer determining the final old-growth status of stands has been maintained. Valuable information gathered by the Department on this significant forest class has been bureaucratically *clearfelled,* leaving an embarrassing gap in information required for future ecologically sustainable forest management planning.

Whilst the Victoria state government chose in practice to focus on protecting forest located at the far end of the successional growth stage spectrum ie old-growth forest, the USA Federal Government recognises the significant link of high levels of structural diversity found in both forest in its mature growth stage and forest in its old-growth stage. This has led to a management process of maintaining and protecting large, contiguous blocks of late-successional forest habitat described as Late-Successional and Old-Growth Forests (LSOG) (See Northwest Forest Plan USDA 1998). Late-Successional Forests are defined as mature stands (being, depending on the native species, generally older that 80 years), and Old-Growth Forests are defined as stands dominated by species which are older than around the middle period of the species' life span. Old-growth forest is considered to be a subset of Late-Successional Forest. Interestingly, Late-Successional Forest is similar to Negligibly Disturbed Forest as both comprise of stands that have reached maturity and are relatively undisturbed.

Although the CAR Reserve System unavoidably forms some kind of mosaic of age classes, forest types and Ecological Vegetation Classes it is doubtful that it was designed with any great thought on addressing issues of connectivity, proximity and viability of old-growth forest stands as raised by *Woodgate et al*. The octopus shape of Errinundra National Park in East Gippsland with its small core is the classic example of a reserve design being politically compromised to maintain access to timber. The multitude of SPZs is also a point in case.

Ongoing mapping and research is important for achieving viable connections between the different successional growth stages of forest ecosystems. It is clearly not realistic for the Department to even consider simply monitoring the old-growth end of the spectrum without monitoring changes to Negligibly Disturbed Forest that evolves into old-growth in time and has

an integral link to old-growth forest ecosystems. However, unless the Department reconstructs the data layer on Negligibly Disturbed Forest it will not be possible for the Department to embrace a more sophisticated reserve design as is applied in the USA and as envisaged under the JANIS Criteria.

4.3 Failure to implement Ecologically Sustainable Forest Management

As the following quote illustrates, Ecologically Sustainable Forest Management (ESFM) applies to both the CAR Reserve System and to State Forest. The National Forest Policy Statement states:

> 'To ensure that nature conservation objectives are met in forests, the management of public native forests outside the reserve system will complement the objectives of nature conservation reserve management.'
> and
> 'Ecologically Sustainable Forest Management will be given effect through the continued development of integrated planning processes, through codes of practice and environmental prescriptions, and through management plans that, among other things, incorporate sustainable-yield harvesting practices.'
>
> NFPS 1992

ESFM can be defined operationally as the management of forest on all land tenures to maintain the overall capacity of forests to provide goods, protect biodiversity, and protect the full suite of forest values at the regional level (Clth 2000).

A range of commitments to ESFM were made in the RFAs which include:

- monitoring, reporting and consultative mechanisms
- forest inventory and sustainable yield reviews
- establishing sustainability indicators consistent with the Montreal Process Criteria to monitor forest changes
- developing conservation strategies for priority flora and fauna species and vegetation communities
- managing cultural values

ESFM principles are supposedly reflected in the Code of Forest Practices for Timber Production which regulates timber production in GMZs and SMZs. However, controversy centres on the failure of the Department to fully apply these principles. Examples include:

- loss or destruction of forest datasets
- a fragmented reserve system
- impacts of clearfell logging on floristic diversity and structural complexity
- failure to develop customised old-growth forest definitions specific to forest ecosystems
- continued logging of old-growth forest that is invaluable for biodiversity conservation
- inadequate action for the protection of threatened species
- logging water catchments which impact on water yield and quality
- lack of long term planning for biodiversity conservation in State Forests
- lack of ongoing flora and fauna surveys
- use of discretionary definitions of rainforest and inadequate reserve design to protect rainforest from logging, roading and other disturbance (see Appendix B for current draft reform)

In February 2002 the state government released *Our Forests Our Future* policy statement (Victorian Government 2002) admitting that the Department had been drastically over-cutting

Victoria's State Forests and that the timber resource would be completely exhausted by as early as 2011 in some areas if the government did not act. The government deemed it necessary to reduce the overall rate of logging (annual sustainable yield rate) across the state by 31% as recommended in *Evaluation of Data and Methods for Estimating the Sustainable Yield of Sawlogs in Victoria* (Vanclay and Turner 2001). Consequently, it established a program to buy out sawlog licences, resulting in the closure of around 35 sawmills. It also incorporated VicForests to take over the Department's management of logging operations under the *Sustainable Forests (Timber) Act* (2004).

Commenting on the gross misjudgement of the Department in over-estimating the projected sustainable timber volumes, the Hon. Gavin Jennings MLC, current Minister for Aboriginal Affairs & Aged Care, stated to the Victorian Legislative Council in July 2002:

> 'We undertook a review of the long-term sustainable yield figures that underpin [the Regional Forest] agreements and we have come up with the assessment through an independent process that we were wrong ... We have not spent a lot of our time apportioning blame for the reasons why those figures were wrong but the cumulative effect of environmental management practices, standards of operation, the Code of Forest Practice, and of even the cost of timber extraction from the forests on the industry side meant that there was a huge overestimation of the availability of timber.'
>
> Hansard 12 July 2002, p18

Failure of the Victorian state government to implement its own forest policies has given rise to localised and statewide forest campaigns, street marches, blockades and court cases. Groups involved in recent campaigns have included Wombat Forest Society, ALP Otway Ranges Interest Group (ALP ORIG), Otway Ranges Environment Network (OREN), Upper Bunyip Action Group, Central Highlands Alliance, Goongerah Environment Centre (GECO), Friends of the Earth (FoE), Friends of the Gippsland Bush, The Wilderness Society (TWS), Lawyers For Forests (LFF), Doctors for Native Forests, Environment Victoria (EV), Australian Conservation Foundation (ACF), Environment East Gippsland (EEG), Geelong Community Forum, Western Victoria Forest Protection Network and Save Goolengook Inc (SG), supported by numerous conservation societies and individuals.

In March 2002 the long standing forest blockade at Goolengook in East Gippsland, which was resourced by community groups such as GECO and FoE, was demolished under the orders of the then Minister for Environment, Hon. Sherryl Garbutt. The *raid* included declaring the entire valley a public Exclusion Zone and cost more than $2.5 million to enforce, whilst the subsequent logging operation netted an estimated $250,000 to $350,000.[9] This operation was perceived within the environment movement as a political stunt by the state government to appease the timber industry and country MPs over the closure of sawmills and consequential job losses.[10] Save Goolengook Inc was established during the chaos that ensued, and coordinated the endorsement of a formal statement by around 40 environment groups calling on the state government to announce an independent investigation into adding the Goolengook Forest Block to Errinundra National Park (Poulton and Moffat 2002)[11]. During the November 2002 state election, after much lobbying of the government and the ALP by certain environment groups, Premier Bracks announced that there would be a VEAC Goolengook Forest Investigation into protecting Goolengook's old-growth.

The Victorian state government also announced during the 2002 state election, and has since

[9] Fyfe, M., (9/8/2002) *Logging protests cost state $2.5m,* The Age

[10] *The Last Valley,* a film documentary directed by Peter Vaughan, was premiered in 2006 and examines the fate of Victoria's old-growth forests including the Department's venture into the iconic Goolengook Valley.

[11] *Common Position Statement from Conservation and Community Groups and Political Parties concerning logging in Goolengook Forest Block* (2002), Save Goolengook Inc

implemented: policies to end all logging in the Otways[12] by 2008 and create the vastly extended Greater Otways National Park; end woodchipping in the Wombat State Forest; conduct a VEAC investigation into Riverine Red Gum Forests; and prohibit burning of native forest wood for power generation (ALP Melbourne 2002a). It has also implemented recommendations of the VEAC Box-Ironbark Forests & Woodlands Investigation and most recently has banned cattle grazing in the High Country.

Despite the state government's pro-activism in addressing various high profile forest conservation issues, there are numerous examples of the Department's failure to comply with the legislative and policy framework for the ESFM System. On 28 June 2005 Justice Harper of the Supreme Court overturned guilty verdicts against conservationists who were charged in 2001 with obstructing a lawful logging operation at Dingo Creek in East Gippsland. The obstruction took place after it was discovered that a Rainforest Site of National Significance and senescing eucalypts providing Powerful Owl habitat were being logged by the Department, allegedly in contravention of the Code of Forest Practices for Timber Production. Justice Harper made landmark rulings that a breach of the Code of Forest Practices for Timber Production is a breach of the law. The rulings were certified by the Supreme Court[13] and are precedents that now establish that the Code is not merely a guide, as was argued by the Office of Public Prosecutions on behalf of the Victorian state government during the hearing, but that it has legal status governing the conduct of forest operations in Victoria.

Published EPA audits of Code of Forest Practices for Timber Production compliance confirm that the illegal logging of Dingo Creek is not an isolated incident. Now that the Code of Practices for Timber Production is recognised as law, the EPA audits put the Department and VicForests on legal notice to improve their compliance.

The advanced hollow development in senescing trees means that there is a high ratio of low grade residual logs (used for wood chipping) to sawlogs in old-growth forests. Given the low prices of residual logs, the continuing clearfelling of old-growth forests demonstrates an imbalance in valuing timber commodities over habitat. Elaborating on the importance of hollows for ecological sustainability, the JANIS Report states:

> 'The biodiversity attributes attributed to old-growth forest are based on the fact that some plants and animals are restricted to the old-growth stages or are dependent on old-growth forest for some of their habitat requirements. For example, one of the most significant characteristics of the older stages of Australian eucalypts is the propensity for creating hollows and it is well established that the number of tree hollows can be a limiting factor in the abundance of some fauna.' (Mackowski 1984)

4.3.1 Old-growth forest logged since the RFAs

The following table is a comparison of figures of old-growth forest quantified under the RFAs (1997-2000) with figures as at 2003 provided by VEAC, from which the author has been able to calculate the decline of old-growth forest since the RFAs.

[12] *Voter Attitudes to clearfell logging in the Otways conducted for Trevor Poulton, Lindsay Hesketh and Nick Adams of ALP Otway Ranges Interest Group (a non-constituent unit of the ALP) et al* by Irving Saulwick & Associates, September 2001 www.alporig.green.net.au

[13] *Hastings v Brennan & Anor; Tantram v Courtney & Anor (Ruling no 1)* [2005] VSC 36 (18 February 2005); *Hastings v Brennan & Anor; Tantram v Courtney & Anor* (Ruling no 2) [2005] VSC 37 (21 February 2005); *Hastings v Brennan & Anor* [2005] VSC 269 (22 July 2005); *Hastings v Brennan & Anor; Tantram v Courtney & Anor* (No. 3) [2005] VSC 228 (28 June 2005) - http://www.austlii.edu.au/au/cases/vic/VSC/toc-H.html

Table 14: Comparison of area of old-growth reserved under the RFAs and 2003 figures

Regional Forest Areas (RFAs)*	Area of Old-Growth Forest mapped under RFAs 1997 - 2000	Old-growth in CAR Reserve System under RFAs 1997 - 2000	% Old-growth in CAR Reserve System 1997 - 2000	Area of Old-Growth Forest figures as at 2003	Loss of Old-growth Forest since RFAs
	ha	Total ha	Total %	ha	ha
East Gippsland	224,674	155,025	69.0%	207,170	- 17,504
Central Highlands	25,951	19,640	75.7%	21,950	- 4,001
North East	259,465	145,870	56.2%	257,160	- 2,305
Gippsland	208,261	139,013	66.74%	193,490	-14,771
West Vic	123,242	110,396	89.6%	123,242	0
VIC	**841,593**	**569,944**	**67.8%**	**803,012**	**- 38,581**

Source: RFA figures obtained from RFA Tables in Appendix G of this report, and the 2003 figures from VEAC.
*To be consistent with the figures contained in the RFAs, the figures in the 3rd and 5th columns include old-growth forest located in CFP Exclusions for East Gippsland and Central Highlands.

The above figures show that the total area of old-growth in East Gippsland has declined from 224,670 ha in 1997 to 207,170 ha being 17,500 ha. The total area of old-growth in Gippsland has declined from 208,261 ha in 1999 to 193,490 ha being 14,771 ha. The decline in Central Highlands is 2,305 ha, North East is 2,305 ha and West Victoria - no loss recorded by the Department. Some of the decline in old-growth forest is due to controversial 'salvage logging' from the reserve system which followed the 2003 Alpine fire. The figures disclose a total loss of 38,581 ha of old-growth since the signing of the RFAs up to 2003.

The following table compares areas of old-growth in various Forest Management Blocks (FMB) in East Gippsland that were scheduled for clearfell logging, with the total areas of remaining unprotected old-growth forest contained within those blocks, for the period 2002/2004.

Table 15: Area Statement of old-growth scheduled for logging in East Gippsland

Forest Management Blocks (FMB) in East Gippsland	Unprotected Old-growth as at 2002 (ha)	Old-growth scheduled for logging 2002 to 2004 (ha)
Brodribb	1,223	169.4
Goongerah	1,816	96.2
Queensborough	1,277	105.8
Coast Range	338	46.5
Snowy River	169	70.4
Cobon	2,216	532.6
Quadra	794	131.7
Murrungowar	428	60.9
Kuark	404	57.7
Martins Creek	1,480	191.5
Ada River	987	270
Goolengook	830	Moratorium * (194)
Ellery	2,752	523.4
East Errinundra	559	213.8
Yalmy	2,391	229
Other East Gippsland FMBs	45,030	3,200
Total hectares	**62,665**	**6,093**

Source: Obtained by Save Goolengook Inc from Forest Services, DSE in 2002

The figures reveal that 62,665 hectares of old-growth forest was available for logging in GMZs and SMZs in East Gippsland Forest Management Area in the year 2002, with 6,093 hectares having been scheduled for logging for the three year period 2002/2004. This represent an average of **2,031 ha** logged out of East Gippsland per annum over the period.

The following table outlines the amount of old-growth currently scheduled for logging for the seasons 2004/05, 2005/06, 2006/07. These figures were obtained recently from the Department by Save Goolengook Inc and are based on *MOG2003* which is the DSE Modelled Old-growth Layer.

Table 16: Scheduled old-growth harvest for period 2004/2006

SCHEDULED OLD-GROWTH LOGGING				
Regional Forest Areas	**Scheduled Harvest**	**Total Coupe areas (ha)**	**Old-growth forest area within Coupes (ha)**	**% old-growth to be logged out of total timber to be logged**
Central Highlands	2004/05	3,703	0	0.0%
	2005/06	5,395	0	0.0%
	2006/07	4,458	10	0.2%
Central Highlands Total		**13,556**	**10**	**0.1%**
East Gippsland	2004/05	5,413	884	16.3%
	2005/06	10,943	1,418	13.0%
	2006/07	11,341	1,808	15.9%
East Gippsland Total		**27,697**	**4,110**	**14.8%**
Gippsland	2004/05	928	113	12.2%
	2005/06	3,514	193	5.5%
	2006/07	3,031	245	8.1%
Gippsland Total		**7,473**	**551**	**7.4%**
North East	2004/05	1,816	92	5.1%
	2005/06	10,154	960	9.5%
	2006/07	3,076	317	10.3%
North East Total		**15,046**	**1,369**	**9.1%**
West Victoria	2004/07	**Nil**		
Grand Total		**63,772**	**6,039**	**9.5%**

Source: Coupe extents have been provided by VicForests from their Coupe Information System in June 2006

The figures indicate that 6,039 ha of old-growth forest are to be logged over the three year period July 2004 to June 2007 representing 9.5% of native timber to be logged by VicForests during the period. (The total figure up to June 2006 is 3,660 ha.)

The total loss of old-growth since the signing of the RFAs can therefore be estimated as follows:

Table 14: Total old-growth forest as at the the time of signing the RFAs (1997-2000)		**841,593 ha**
LESS		
Table 14: Decline of old-growth forest from the time of signing the RFAs (1997-2000) to 2003	38,581 ha	
Table 15: Old-growth scheduled for logging in East Gippsland 2003/04*	2,031 ha	
Table 16: Old-growth scheduled for logging		

statewide 2004/05, 2005/06	3,660 ha	
Decline of old-growth forest since RFAs (1997-2000)	**44,272 ha**	**44,272 ha**
Current estimate area of old-growth forest as at 2006		**797,321 ha**

*The figure for the year 2003 only includes East Gippsland, as figures for the other regions were not available to the author.

The Victorian old-growth forest domain has therefore declined by at least 44,282 ha since the signing of the RFAs (1997-2000) representing a loss of at least 5.3% of the old-growth forest domain. On the basis of these figures the Victorian state government is logging old-growth forest at an alarming rate.

A further 550 ha of old-growth forest contained in thinning coupes is to be thinned for the period 2004/06. However, the Department has advised the author that these thinning coupes tend to be larger than clear fell/seedtree/shelterwood coupes and rarely contain any old-growth and that these stands exist in the old-growth layer because of poor data quality at the time the model was constructed which was during the RFA process. This is presumably based on an argument that the areas identified as old-growth under the Rules in fact proved to contain an excess proportion of regrowth which was not picked up at the time of the modelling. This discrepancy in itself indicates serious inaccuracies in mapping old-growth forest.

4.3.2 The Geco Tree

The photograph below is of a senescing Errinundra Shinning Gum located in old-growth forest on the foothills of Errinundra Plateau, East Gippsland near Result Creek.

Figure 8: The Geco Tree, Errinundra Plateau (Cumming)

The Geco Tree was discovered by Dave, Rena Gabarov and Joe Henderson from Goongerah Environment Centre (GECO) around 2003. According to a source from the DSE Office at Orbost, the tree is referred to by the Department as the *Geco Tree*, as the Department was first alerted to its existence in 2003 by forest activists from GECO. The tree is also known parochially as *Darejo* (after its finders) and *Big Foot*. It is approximately 5 metres in diameter and 76 metres tall.

As a result of the discovery of the *Geco Tree*, a 5 hectare exclusion area radiating from the base of the tree has been prescribed to buffer the tree and its soak catchment from logging operations. A stand of Cut-tail located up-slope from the tree and adjacent to the buffer has been scheduled for logging on the Timber Release Plan for 2006/07. The *Geco Tree* is a giant senescing tree encircled by a dense jungle type understorey that had kept it a secret from the public for so long. It is tragic that forest in such close proximity to this tree will be clearfelled and the environmental context in which the *Geco Tree* is located largely destroyed. The fate of forest surrounding the *Geco Tree* is a case study in itself of blinkered state government forest management practices.

4.4 Corporatisation of public forestry

In 2004 the Victorian state government separated the Department's commercial timber harvesting functions from its policy, regulation and stewardship functions by corporatising the Department's timber harvesting agency Forestry Victoria and naming the new entity VicForests. The entity would perhaps be more aptly titled VicWood or VicTimber as it has no policy functions and limited management functions and is purely concerned with ensuring profitable native forest exploitation.

The departmental restructure was driven by National Competition Policy principles as articulated in state government's forest manifesto *Our Forests, Our Future: Balancing Communities, Jobs and the Environment* (Victorian Government 2002). The creation of a separate commercial entity was initiated under these principles to ensure government forest policy and regulations do not unfairly disadvantage the private plantation sector as occurred in the past with a longstanding policy of subsidising timber communities and local industry through under-pricing of timber sold from public forests.

National Competition Policy is a set of policies agreed upon between the Commonwealth, state and territory governments in the *Competition Policy Agreements (1995)*. It claims to promote higher economic and employment growth on a sustainable basis through micro-economic reforms that follow free market and competition principles. National Competition Policy seeks to establish a level playing field (described as 'competitive neutrality') between publicly and privately owned enterprises and has limited regard to progressive social and environmental reforms that might inhibit competition between the sectors.

VicForests was set up as a state owned business corporation under the *State Owned Enterprises Act 1992,* with corresponding amendments made to the *Conservation, Forests and Lands Act* (1987) by the *Forests and National Parks Act (Amendment) Bill* (2003). VicForests responsibilities under the *Sustainable Forests (Timber) Act* (2004) include:

- planning and scheduling of coupes for harvesting and determining sale lots;
- identifying and grading logs and overseeing harvesting operations;
- pre and post harvest activities, such as regeneration;
- the sale of timber, including implementing auctions or tender processes, setting reserve prices and managing existing sawlog and residual log licences and agreements; and
- monitoring compliance of timber contractors with the Code of Forest Practices for Timber Production.

4.4.1 Can VicForests deliver environmentally sustainable forestry?

In accordance with the principles of competitive neutrality, VicForests has developed a market based pricing and selling system, with the reserve price set so as to recover costs, including associated road construction, fire protection and forest management costs, as well as a return to the state government. The pricing system addresses environment groups' past complaints of Departmental fiscal mismanagement. However, the questions arises as to whether the restructure itself was necessary to achieve realistic timber pricing, and whether it has in fact degraded the Department's capacity to ensure better environmental management of forests.

In particular, what impact does the establishment of VicForests have for resolving the debate over continued logging of old-growth forest given that old-growth forest, which may contain up to 90% mature trees under the Rules, forms a significant proportion of VicForests primary resource as indicated in the above table?

This question needs to be understood within the context of political action of peak environment groups in promoting the corporatisation of public forestry. The Australian Conservation Foundation (ACF) ran a campaign since 2001, supported by The Wilderness Society (TWS), to encourage the state government to fully corporatise public forestry. This strategy gambled on the hope that corporatisation would lead to a dramatic increase in sawlog and residual log prices thereby fast tracking a shift by the timber industry out of public forestry into the arms of a supposedly cheaper and more competitive private plantation sector. The campaign has led to a peculiar 'alliance' between ACF and TWS and private plantation operators who remain far less constrained by environmental regulation than the Department and are far more resistant to environmental reform. Examples include the planting of monocultures, logging and degradation of water catchments and use of poisons.

ACF's campaign was underpinned by a report that it had commissioned, titled *Forestry and National Competition Policy* (Marsden Jacobs 2001) published prior to VicForests' incorporation in 2004. The adoption by ACF of a free market philosophy to achieve environmental reform is reflected in the foreword to *Marsden Jacobs 2001* written by ACF Executive Director, Don Henry. The foreword states:

> 'At a time when the rest of the Australian economy is coming to grips with expectations of a level playing field in a global market, Australia's state-owned forestry departments are living in a time warp. While water, telecommunications, electricity and gas must stand on their own two feet, forest departments remain insulated and protected from competition.'
>
> Marsden Jacobs 2001

In September 2003 select environment groups were invited to make submissions to DSE Public Land Policy Branch in response to the Directions Paper titled *Delivering Sustainable Forest Management* which outlined the state government's commercial vision for VicForests. ACF and TWS made a joint submission, contrary to the position of other environment groups, supporting the state government's proposed coporatisation of VicForests. Their submission included the following statements:

> 'The resolve to achieve better compliance for state forestry within the micro-economic reform principles of the National Competition Policy is highly applauded. It is a much needed and long overdue reform agenda with the outcomes giving greater transparency, stronger incentives and more opportunity for broader private sector investment in the Victorian timber industry.'
>
> 'The establishment of VicForests as a State Business Corporation under the *State Owned Enterprises Act* is a progressive reform for performance.'
>
> Australian Conservation Foundation & The Wilderness Society 2003

No longer is public forestry overseen by the Minister for Environment. The Department of Treasury and Finance is responsible for VicForests' commercial governance frameworks and capital structure, and for ensuring an appropriate rate of return to the state. The government has powers under the *State Owned Enterprises Act 1992* to exempt VicForests from the *Freedom of Information Act.* As a largely autonomous corporation there is potential for VicForests to be privatised, as were a number of corporatised bodies in Victoria under the Kennett government such as energy authorities, the public transport system and more pertinently state owned plantations (now owned by Hancock Timber).

The corporatisation of VicForests represented adoption of the most extreme economic model provided under National Competition Policy. More public friendly alternative models with a lesser degree of separation from the Department included a commercial agency operating under a different Minister, or a statutory authority along the lines of the Sustainable Energy Authority or the Environment Protection Agency, or simply retaining the agency within the Department under the control of the Minister for Environment but with stricter commercial guidelines.

Lawyers For Forests (LLF) in its *Review of the Flora and Fauna Guarantee Act 1988 (Vic)* had urged careful scrutiny of the state government's proposal to create greater separation through the establishment of VicForests:

> 'LFF considers that one advantage of having NRE [the Department] perform a licensing and monitoring role is that NRE does have access to data collected by the forest industry, and there is a cross fertilisation of information between what could be described as pro-conservation divisions of NRE and the pro-logging divisions of NRE. The exchange of information should not be compromised by any break-up of the Department.'
>
> LFF 2002

The Goongerah Environment Centre (GECO) has recently encountered a lack of transparency with VicForests and has made the following observation on its website http://www.geco.org.au/:

> 'With the corporatisation of our forests comes an even further breakdown of public access to input and knowledge of what is going on in our state forests. When forestry was under the Department of Sustainability and Environment there was a public consultation period each year where it was advertised that the public could view changes in the log harvest schedule and make submissions. This process was advertised in newspapers and on websites. It wasn't very useful for those who wished to conserve high conservation forests as comments on submissions were generally ignored but at least it was a transparent process. The information was more publicly accessible and anyone who was concerned could have their say. VicForests has dropped this process.'

Under the new regime, gazetted logging coupes are now strictly enforced public Exclusion Zones thereby reducing transparency of forest operations. VicForests has also been given additional enforcement powers such as a new offence of 'threatening or abusing an authorised officer'.

VicForests is required to ensure that adequate regeneration is achieved for forest ecosystems and that the harvesting site is stabilised before returning the land to the Department's management in between rotations. The fact that the Department was required by the state government to abrogate this major environmental responsibility to a logging business is a serious concern.

With an emphasis on consolidating VicForests, further concerns include the likelihood that taxpayer funded research and development is more likely to focus on short term economic goals such as efficient growing and harvesting techniques which may lead to an increase in conversion of native forests to plantations. This is already occurring systemically in Tasmania where public forestry operates under the most developed National Competition Policy framework in Australia.

ACF and TWS's support for corporatisation of public forestry has created an ideological division

within the environment movement whereby many conservationists and groups reject the proposition that the 'free market' will somehow redress the shortfalls in ecologically sustainable forest management practices. There is no doubt that VicForests has the potential to be competitive with the private plantation sector and profitable for the state government, and this will also be at the expense of logging high conservation value native forest. Negotiating environmental reforms will now be more formidable and exhausting for environment groups than any previous dealings with the embattled Department which has been relieved of its commercial forestry functions.

4.5 Pre-logging Flora and Fauna Surveys

In order for the Department to reliably comply with ESFM principles it must introduce a precautionary system that ensures coupes released to VicForests do not in fact include high conservation value forest. Pre-logging Flora and Fauna Surveys were introduced in 1982 under the Cain Labor Government, pioneering the use of field-validated expert forest surveys for management and planning purposes. Under this program, botanists and wildlife biologists conducted systematic and detailed pre-logging fauna and flora surveys across East Gippsland. The results are incorporated in the *Flora Information System* and *Wildlife Atlas* databases and published in a set of 'Block Reports' (for example, Lobert et al 1991). The surveys were brought to an end by the Kennett government and ought be reintroduced in a contemporary form.

The Minister for Environment's Office has indicated to the author that the Department does not have the budget to finance such surveys. It is possible that the current commercialisation of public forestry is leading to a more stringent control of public finances in relation to the implementation of environmentally sustainable management practices.

Typical of each of the studies, the *Study of Old-growth Forests of Victoria's North East* (DNRE 1998b) states:

> 'Three key elements: forest growth stage, Ecological Vegetation Class (EVC) and disturbance history were mapped for all forested public land. A limited number of old-growth forest stands identified in the analysis were field checked and ongoing field verification is recommended to be incorporated into routine forest management activities.'

The Department's current re-mapping of old-growth forest is an admission in itself that its data is not always reliable and that there does need to be credible checks and balances in the ESFM system, such as pre-logging flora and fauna surveys.

4.6 VEAC Goolengook Forest Investigation

This Victorian Environmental Assessment Council (VEAC) Goolengook Forest Investigation commenced in late 2005 to examine the potential to protect Goolengook Forest Management Block by adding it to the adjoining Errinundra National Park. Particular reference is to be made to protecting old-growth forest in the block. Logging of Goolengook was halted in 2002 as a result of the announcement of the VEAC investigation.

Goolengook is located in the Orbost region of East Gippsland. The community campaign for Goolengook's protection has spanned nearly a decade and has involved scores of organisations and thousands of individuals. Since 1996 volunteers have spent countless hours dedicated to ecological research, community awareness raising, protesting and forest blockades to save Goolengook. Direct action and strategies for persistent lobbying of the state government have been critical to the success of the campaign.

The history of the Goolengook Forest Block epitomizes the policy, planning and political failings that have plagued Regional Forest Management Areas to date. The Goolengook Forest Management Block is a microcosm of East Gippsland's most celebrated natural features: old-

growth forest, threatened species, rainforest and near pristine rivers and catchments (Picone 2004). The Slender Tree-fern, Forest Geebung, Long-footed Potoroo, Tree Goanna, Powerful Owl and Spot-tailed Quoll are just a few of the species that make Goolengook an invaluable environmental asset. There is currently no realistic management strategy to conserve the block's values. With documented values[14] which fulfilled the JANIS criteria of high conservation value forest, Goolengook has become the centre-piece of the environmental campaign objective of maximising protection of old-growth in Victoria.

The following terms of reference for the scientific investigation were announced on 12 December 2005 and VEAC is due to make recommendations to the Minister for Environment in July 2007.

VEAC Goolengook Forest Investigation

12 December 2005

Pursuant to Section 15 of the *Victorian Environmental Assessment Council Act 2001*, the Minister for Environment hereby requests the Victorian Environmental Assessment Council (VEAC) to carry out an investigation of public land within the Goolengook Forest Management Block in East Gippsland.

The purposes of the investigation are to:

1. Examine the Goolengook Forest Management Block for its potential for all or part to be added to the Errinundra National Park, with particular reference to the need to protect old-growth forest[1].
2. Provide advice on the costs, benefits and implications, in terms of biodiversity, timber resource and other values, of options under 1 above.
3. Ensure that there is no net deterioration in timber production capacity.
4. Recommend preferred options and advise on implementation requirements to achieve the preferred option.

Note: [1]Old-growth, for the purposes of this investigation, is forest that meets the definition specified in the Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia.

http://www.veac.vic.gov.au/goolengook/InformationBooklet.pdf

The VEAC investigation has the potential to undertake invaluable work by reappraising the Department's methodologies used for identifying and protecting old-growth and biodiversity values. Given the relatively small size of Goolengook and its complex range of ecological values and land use zonings, scientists associated with VEAC could use the investigation to produce significant recommendations for future statewide forest management planning and not just simply make land use recommendations for Goolengook's partial or complete inclusion into Errinundra National Park. This would possibly involve increasing the resources and extending the timeframe of the investigation.

[14] Goolengook's values are detailed in the Block Report (Lobert et al 1991) and further documented in (Picone 2004)

According to Nicky Moffat, Co-convenor of *Save Goolengook Inc*:

> 'The inquiry presents an opportunity on a micro scale to address the issues of logging old-growth and high conservation value forests that are shared with forest management across East Gippsland.'[15]

The terms of reference place emphasis on investigating old-growth forest in the block. VEAC cannot avoid the responsibility of addressing the scientific issues surrounding its identification. In fact, the state government has promoted the investigation in various media releases as an old-growth forest inquiry.

Unlike the prescriptions for identifying rainforest which are legislated under the Code of Forest Practices for Timber Production (see Appendix B which includes the state government's draft changes to the rules for identifying rainforest), the Rules for identifying old-growth forest are not legislated. The Rules were determined by managers, planners, foresters and scientists within the Department and may be amended through internal departmental decision-making processes. The VEAC investigation is required to apply the definition of old-growth specified in the JANIS Report being the JANIS Definition. However, there is nothing preventing VEAC from devising appropriate recommended rules for implementing the JANIS Definition by revisiting the Department's methodologies. The draft changes to the rules for identifying rainforest set a precedent for this.

It is a wasteful exercise for the state government to consider a review of the old-growth forest in the Goolengook Forest Block (and statewide) unless many of the issues raised in this report and voiced by environment organisations are intended to be tackled.

VEAC ought not primarily rely on a literature review and public submissions of the forest block but:

- undertake a serious scientific and ecological study of the old-growth attributes using methods that do not simply rely on the broad scale assessments of almost 20 years ago;
- provide a transparent account of its methodology for assessing and mapping the old-growth forest, EVCs, Sites of Biological Significance and rainforest for the block; and
- investigate improved methodologies involving detailed site based assessments for old-growth forest.

4.7 Conclusion

In 2001 the West Australian Labor government was re-elected on the promise to protect all remaining old-growth forest. In 2003 the New South Wales Labor government promised to protect all old-growth forest in North-East New South Wales. The public has reasonable expectation that the Victorian state government will take a national approach on this issue and follow the lead of the other progressive states.

The Victorian state government committed to a review during the last state election of silvicultural practices in all forest areas to ensure the practices are ecologically sustainable (ALP 2002 Election Platform). With over 44,200 hectares of old-growth forest logged since the RFAs representing 5.3% of the remaining old-growth forest, and 9.5% of all timber scheduled for logging for the period 2004/2006 being old-growth, and a recognition by the Department that its mapping relied on poor data, it would appear that the government has failed to meet its election commitment. It is now time that the Victorian state government reviewed its methodologies for identification, mapping and protection of the old-growth forest domain.

[15] *Snowy River Mail,* 12/4/2006

The following photograph is of Fort Goolengook, constructed on a logging road in the Goolengook Valley. The fort had stood for several years as part of a permanent forest blockade. Whilst it was demolished by the Department in 2002, the fort remains a metaphor for public opposition to the Victorian state government's native forest logging policies. The time has come for the state government to *close the road* on logging of high conservation value forest and old-growth forest.

Figure 9: Entrance to Fort Goolengook with 'Road Closed' sign in the background (Poulton)

5. RECOMMENDATIONS

5.1 Defining Old-growth Forest

(1) The JANIS Definition, as distinguished from the Woodgate Definition, be applied by the Victorian state government as the generic definition of old-growth forest. (Section 1)

(2) Customised definitions of old-growth forest be developed for each forest ecosystem for determining ecological maturity of the ecosystem. (Section 3.6.1)

(3) Old-growth forest be defined by both its Forest Type and Ecological Vegetation Class. (Section 3.5.1)

(4) Old-growth forest be classed as a subset of the Negligibly Disturbed Forest class. (Sections 3.2.3 and 4.2.1)

5.2 Identifying and Mapping Old-growth Forest

(5) The Victorian state government launch an Old-growth Forest Project, using latest modelling techniques, to revisit identification, mapping, protecting and monitoring of old-growth forest. (Section 3.6.2)

(6) The surrogate 10% rules be reassessed in line with customised definitions. (Sections 3.2.2 - 3.2.4)

(7) A site methodology be developed for identifying old-growth forest ecosystems, stratified by Forest Type and Ecological Vegetation Class, including developing a range of surrogates for the following:

Living component - age threshold, minimum proportion of mature trees and/or senescing (late mature and overmature) trees and maximum proportion of regrowth trees, crown gaps, tree sizes and heights, understorey species, tree hollows, indicator animals

Dead component **-** snags, fallen trees, woody debris

(Sections 3.6 - 3.6.2)

(8) The criteria for ecological integrity and Disturbance Rules be reviewed in relation to:

(a) significant unnaturally disturbed forest (human) (Section 3.3.2); and

(b) significant naturally disturbed forest (Wildfire Understorey Exclusion Rules) (Section 3.3.3);

and that areas previously mapped as significantly disturbed be reassessed for old-growth forest stands

(9) The Department clarify why it classified forest with >10% of trees in their 'late mature forest' stage (ie having equally regular and/or moderately regular crowns) as mature forest rather than old-growth forest in the North East, Gippsland and West Victoria old-growth forest studies, which is inconsistent with the *Woodgate et al* East Gippsland study and the Central Highlands study for which the late mature and overmature growth stages were combined to form the critical 'senescing' component. (Section 2.2.1)

(10) The Department maintains a *Compendium of Technical Requirements and Disturbance Rules for Identifying and Monitoring Old-growth Forest in Victoria*. (Section 3.6.2)

Interim rules until the Department develops customised definitions

(11) Negligibly Disturbed Forest be classed as candidate old-growth if there is at least a sparse [<10%] proportion of trees in the senescing growth stage. (Section 3.2.3)

(12) Forest stands where the proportion of trees in the senescing growth stage is >30% and the proportion of trees in the regrowth growth stage is <30% be deemed old-growth forest (as similarly allowed in NSW). (Section 3.2.4)

5.3 Protecting Old-growth Forest

(13) The Department ranks forest on the basis of abundance of old-growth attributes from 'least disturbed' to 'most disturbed', rather than negating stands as old-growth forest on the basis of disturbance impact ratings. (Section 3.6.2)

(14) The Department reconstructs the dataset for Negligibly Disturbed Forest and provides conservation targets for Negligibly Disturbed Forest. (Section 4.2.1)

(15) The Department updates old-growth forest maps to include forest for which the understorey has since recovered from fuel reduction burns and wildfire. (Section 3.3.3)

(16) The Department monitors changes to the old-growth forest domain and produces regular reports on the status of old-growth forest statewide. (Section 3.6.2)

(17) The Victorian state government immediately provides reserve protection for the remaining old-growth forests. Further, areas regarded as Negligibly Disturbed Forest be protected from future industrial disturbance.

Ecologically Sustainable Forest Management (ESFM)

(18) The Department conducts Flora and Flora Surveys of coupes prior to logging by VicForests. (Section 4.5)

(19) The Victorian state government reverts responsibility for regeneration of coupes back to the Department from VicForests. (Section 4.4.1)

(20) The Department implements Forest Stewardship Council certification of native forest timber. (Section 4.3)

(21) The Department reviews silvicultural practices in all forest areas to ensure they are ecologically sustainable. (Section 4.3)

(22) The Department establishes an ‘optimal yield’ (i.e. the rate of logging that delivers the greatest benefit to all stakeholders in forest management) as recommended by (Vanclay and Turner 2002). (Section 4.3)

(23) The Victorian state government initiates a review of the CAR Reserve System to take into account re-mapping of old-growth forest under customised definitions, and addresses issues of connectivity, proximity and viability of forest areas using old-growth forest stands, threatened species and water catchments as surrogates for determining the new boundaries.

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Click on links to the Department's Old-growth Forest Studies

www - Study of Old-growth Forest in Victoria's Central Highlands

www - Study of Old-growth Forest in Victoria's North East

www - A Study of the Old-growth Forests of Gippsland

Note:

A Study of the Old-growth Forests of East Gippsland and *Study of Old-growth Forests of West Victoria* are not published on the DSE website and are therefore not immediately accessible to the public.

APPENDIX A - Woodgate Definition & Technical Requirements

The Woodgate Definition and following accompanying Technical Requirements (and a variety of Disturbance Rules) were used by DSE to classify and identify old-growth forest.

Definition of Old-growth Forest

Old-growth forest is forest which contains significant amounts of its oldest growth state in the upper stratum, and has been subject to any disturbance, the effect of which is now negligible.

Important Technical Requirements

Primary characteristics

1) The definition is based on the two primary characteristics of old-growth forest; growth stage and disturbance level. It has been developed so that old-growth can be delineated and mapped in practice.

Forest

2) Forest, for the purpose of this study, is defined as woody vegetation with a potential height generally greater than 5m and with a crown cover projection generally greater than 10%

Crown Cover

3) Crown cover is the percentage of the site (or stand of forest) covered by the vertical projection of the periphery of the tree crowns in the upper stratum; crowns are considered to be opaque.

Growth Stages

4) It is assumed that old-growth forests have attained their oldest, naturally achievable growth stage(s) combination for a particular site under a contemporary regime of 'natural' disturbance which in East Gippsland is generally fire disclimax.
5) More than one growth stage (senescing, mature or regrowth) may be present in the upper stratum. The oldest growth stage is the senescing growth stage and it must be present as a dominant, codominant or subdominant component of the stand. When present in these proportions the senescing growth stage is considered to significantly influence the ecological processes of the stand (eg growth of younger trees, development of hollows, and nutrient cycling).
6) The morphology of the senescing growth stage in many eucalypts is characterized by declining crowns and dead or dying branches, although these and other characteristics may vary between species.
7) 'Dominant', 'codominant' and 'subdominant' refer to the area occupied by the crowns of a given growth stage in the upper stratum of the stand. They do not refer to the vertical structure through the profile of the crown. (They broadly occupy >50%, 30-50% and 11-50% respectively of the relative crown cover of the stand.)
8) If regrowth growth stages are present they must be 'sparse' (generally less than 10% of the crown cover of the upper stratum) for the stand to qualify as old-growth. More regrowth than this probably indicates a greater than negligibly (ie significant) disturbance.

Ecological vegetation classes and forest types

9) The morphological (physical) characteristics that identify each growth stage vary with the ecological vegetation class (floristic composition and environmental attributes) and forest type (dominant species and structure) both of which are influenced by environmental site quality. For this reason the old-growth condition manifests itself in different ways, so forest must be stratified by ecological vegetation class and forest type.

Disturbance

10) All forests are assumed to have had some form of disturbance. Undisturbed forest is forest for which there is no record of disturbance, although wildfires almost certainly occurred in the past. Negligibly disturbed forest is forest for which disturbance is known to have occurred, but, the disturbance is unlikely to have altered the structure (growth stage combination or crown cover density) or the usual floristic composition of species for that vegetation class; or, if the alteration did occur in the past it is no longer measurable. Disturbances may be natural (e.g. wildfire) or un-natural (e.g. anthropogenic or human-induced disturbances such as agricultural clearing, timber harvesting, grazing and mining). In the context of this study, and without records that enable a systematic search, disturbances induced by indigenous people before European settlement are also treated as being natural.

Intangibles

11) Old-growth forests have considerable intangible characteristics which are not directly addressed by this definition; they include grandeur, antiquity, naturalness, spirituality and aesthetics. The type of disturbance influences the intangible characteristics of forest and determines their values within the old-growth domain.

Old-growth dynamics

12) Significant anthropogenic disturbances may cause long-term changes to forest structure and floristics. Although such forests may not fulfil the old-growth definition after one cycle of regeneration and senescence, they may do so after several cycles provided they are not significantly disturbed in the meantime. The definition thus recognizes the dynamic nature of old-growth and allows for forests to be recruited into, or excluded from, the old-growth domain with time.

Source: Woodgate et al 1994, p64

APPENDIX B - Protection and Identification of Rainforest

CURRENT Code of Forest Practices for Timber Production Revision No. 2, 1996

Department of Natural Resources and Environment

2.3.7 Protection of Rainforest

Goal: Rainforest must be excluded from timber harvesting and, because rainforest communities may be particularly vulnerable to adjacent disturbance, they should be surrounded by an appropriate buffer.
Guidelines:

- areas of rainforest must be defined, and a strategy for their management must be included as part of planning for conservation of flora and fauna in Forest Management Plans and/or in the relevant prescriptions. The most important rainforest areas should be accorded highest protection;
- in the absence of detailed strategies within an approved Forest Management Plan, which address regional characteristics, the following prescriptions will apply:

(i) for stands of lesser significance - 40 m buffers, or 20 m exclusion plus a 40 m modified harvesting strip (> 40% of basal area retained, low machine disturbance, minimal burning);
(ii) for stands where *Nothofagus* makes up >20% of the canopy - buffers of 60 m, or 40 m buffer with 40 m modified harvesting zone (> 40% of basal area retained, low machine disturbance, minimal burning);
(iii) for stands containing nationally significant rainforest - the highest degree of protection, generally sub-catchment level, except where full protection can be provided by other measures, which are/will be outlined in approved plans.

- rainforest areas must be shown on the Forest Coupe Plan and buffers identified in the field;
- buffers must be protected from damage caused by trees felled in adjacent areas.

Note: These protection levels may be adjusted prior to the next Code review depending on the results of further research into rainforest protection.

Current Definition

Rainforest is defined ecologically as closed broadleaved forest vegetation with a more or less continuous rainforest tree canopy of variable height, and with a characteristic composition of species and life forms. **Rainforest canopy species** are defined as shade tolerant tree species which are able to regenerate below an undisturbed canopy, or in small canopy gaps resulting from locally recurring minor disturbances, such as isolated windthrow or lightning strike, which are part of the rainforest ecosystem. Such species are not dependent on fire for their regeneration.

DRAFT Code of Practice for Timber Production Revision No. 3, 2006

Department of Sustainability and Environment

Draft Definition

Rainforest community - closed (>70 per cent projected foliage cover) broadleaved forest vegetation with a more or less continuous rainforest tree canopy of variable height, and with a characteristic composition of species and life forms, of at least 100 square metres in area. Refer to the Rainforest and Cool Temperate Mixed Forests Action Statement for a full definition including field identification.

Rainforest tree canopy species - characteristic shade tolerant tree species that are able to regenerate below an undisturbed canopy, or in small canopy gaps resulting from locally recurring minor disturbances, such as isolated windthrow or lightning strike, which are part of the rainforest ecosystem. Such species are not dependent on fire for their regeneration.

APPENDIX C - Victorian Hollow-Dependent Species

Table 17: FFG Act listed Victorian hollow-dependant species

Species name	Common Name	Victorian Rating	National Rating
Litoria littlejohni	Littlejohn's Tree Frog	Vulnerable	Vulnerable
Anas rhynchotis	Shoveller	Vulnerable	
Geopelia cuneata	Diamond Dove	Vulnerable	
Calyptorynchus banksii	Red-tailed Black Cockatoo	Endangered	
Cacatua leadbeateri	Major Mitchell's Cockatoo	Vulnerable	
Polytelis swainsonii	Superb Parrot	Endangered	Vulnerable
Lathamus discolor	Swift Parrot	endangered	
Neophema chrystogaster	Orange-bellied Parrot	critically endangered	
Neophema pulchella	Turquoise Parrot	near threatened	
Ninox strenua	Powerful Owl	Endandered	
Ninox connivens	Barking Owl	Endangered	
Tyto tenebricosa	Sooty Owl	Vulnerable	
Tyto novaehollandiae	Masked Owl	Endangered	v (subsp)
Todiramphus pyrrhopygia	Red-backed Kingfisher	vulnerable	
Climacteris affinis	White-browed Treecreeper	vulnerable	
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	vulnerable	
Nyctophilus timoriensis	Greater Long-eared Bat	vulnerable	
Dasyurus maculatus	Spotted-tailed Quoll	endangered	vulnerable, endangered (subsp)
Phascogale tapoatafa	Brush-tailed Phascogale	vulnerable	
Petaurus norfolcensis	Squirrel Glider	endangered	
Gymnobelideus leadbeateri	Leadbeater's Possum	endangered	Endangered
Cercartetus lepidus	Little Pygmy Possum	near threatened	

Source: *Flora & Fauna Guarantee (1988) Act*. Adopted from (Lindenmayer and Gibbons 2002)

APPENDIX D - East Gippsland Uplands Bioregion EVCs

As an example, below is a copy of the list of Ecological Vegetation Classes for the East Gippsland Uplands Bioregion (DSE 2004a).

Table 18: EVCs in the East Gippsland Uplands Bioregion

EVC no.	BCS	EVC name
3	V	Damp Sands Herb-rich Woodland
6	R	Sand Heathland
7	V	Clay Heathland
8	LC	Wet Heathland
14	LC	Banksia Woodland
15	V	Limestone Box Forest
16	LC	Lowland Forest
17	LC	Riparian Scrub/Swampy Riparian Woodland Complex
18	LC	Riparian Forest
19	R	Riparian Shrubland
20	LC	Heathy Dry Forest
21	LC	Shrubby Dry Forest
22	LC	Grassy Dry Forest
23	LC	Herb-rich Foothill Forest
24	V	Foothill Box Ironbark Forest
27	R	Blackthorn Scrub
28	R	Rocky Outcrop Shrubland
29	LC	Damp Forest
30	LC	Wet Forest
31	R	Cool Temperate Rainforest
32	R	Warm Temperate Rainforest
33	R	Cool Temperate Rainforest/Warm Temperate Rainforest Overlap Complex
34	E	Dry Rainforest
35	LC	Tableland Damp Forest
36	LC	Montane Dry Woodland
37	V	Montane Grassy Woodland
38	LC	Montane Damp Forest
39	LC	Montane Wet Forest
40	E	Montane Riparian Woodland
41	LC	Montane Riparian Thicket
42	R	Sub-alpine Shrubland
43	LC	Sub-alpine Woodland
45	LC	Shrubby Foothill Forest
47	D	Valley Grassy Forest
73	R	Rocky Outcrop Shrubland/Rocky Outcrop Herbland Mosaic
82	R	Riverine Escarpment Scrub
83	E	Swampy Riparian Woodland
127	V	Valley Heathy Forest
133	E	Limestone Pomaderris Shrubland
135	E	Gallery Rainforest
169	V	Dry Valley Forest
175_61	D	Rainshadow Grassy Woodland
175_62	D	Limestone Grassy Woodland
177	R	Valley Slopes Dry Forest
201	LC	Shrubby Wet Forest
206	V	Sub-alpine Grassland
316	LC	Shrubby Damp Forest
318	E	Montane Swamp

319	LC	Montane Herb-rich Woodland
322	E	Dry Rainforest/Warm Temperate Rainforest/Gallery Rainforest/Riparian Shrubland/Riverine Escarpment Scrub/Blackthorn Scrub
342	R	Rocky Outcrop Shrubland/Rocky Outcrop Herbland/Shrubby Foothill Forest Complex
877	LC	Lowland Herb-rich Forest

EVC - Ecological Vegetation Class

BCS - Bioregional Conservation Status (see DNRE 2002, p51 for full description);

X	Presumed extinct	No longer present in the Bioregion
E	Endangered	Less than 10% left, or less than 30% left and degraded
V	Vulnerable	10-30% remains, or >50% and degraded
D	Depleted	30-50% remains, or depletion, degraded and threatened
R	Rare	rare geographic occurrence
LC	Least Concern	>50% remains without degradation

Click on - DSE EVC Bioregion Benchmarks

APPENDIX E - Shrubby Dry Forest (EVC) - East Gippsland Uplands Bioregion

Table 19: Summary of Shrubby Dry Forest (EVC) - East Gippsland Uplands Bioregion

SHRUBBY DRY FOREST (EVC) - EAST GIPPSLAND UPLANDS BIOREGION (2004)		
Description: Occurs on a range of geologies on exposed aspects such as ridge-lines and medium to steep upper slopes, often in high rainfall areas and on shallow infertile soils. Open forest to 25 m tall characterised by the diversity and variability of the eucalypts. The understorey often lacks a secondary tree layer but contains a well-developed medium to low shrub layer. The ground layer is often very sparse with tussock-forming graminoids being the dominant life form.		
Tree Canopy Cover - 30% cover **Common Names** – Red Stringybark, Yertchuk, Silvertop Ash, White Stringybark		
Understorery Life Form	**% Cover**	**Species typical of part of EVC range (common names)**
Immature Canopy Tree	5%	Nil
Understorey Tree or Large Shrub	10%	Black Sheoak
Medium Shrub	30%	Lance Beard-heath, Shrubby Platysace, Shiny Cassinia, Common Heath
Small Shrub	25%	Tangled Guinea-flower, Common Rice-flower
Medium Herb	5%	Germander Raspwort, Ivy-leaf Violet, Small St John's Wort, Small Poranthera
Large Tufted Graminoid	5%	Spiny-headed Mat-rush
Large Non-tufted Graminoid	1%	Thatch Saw-sedge, Forest Wire-grass
Medium to Small Tufted Graminoid	5%	Grey Tussock-grass Lily, Variable Sword-sedge, Wattle Mat-rush
Medium to Tiny Non-tufted Graminoid	10%	Weeping Grass
Ground Fern	1%	Austral Bracken
Scrambler or Climber	5%	Common Apple-berry, Twining Glycine, Bearded Tylophora, Mountain Clematis
Bryophytes/Lichens	5%	n/a
Soil Crust	10%	n/a
Total understorey projective foliage cover	80%	
Recruitment: Episodic/Fire. Desirable period between disturbances is 20 years. Organic Litter: 30 % cover; Logs: 20 m/0.1 ha; Weediness: There are no consistent weeds in this EVC.		

Source: Tabulated from DSE's website

APPENDIX F - Forest Growth Stages - East Gippsland Regional Forest Area (as at 1994)

FOREST GROWTH STAGES - CONCEPTS, CLASSIFICATION AND SURVEY

Table 4.6 Forest growth stage classes (ha) on public and freehold land within the study area as mapped through aerial photo interpretation.[1,2]

Growth Stages		Public Land	F'hold Land	Total
Senescing				
S_1	senescing only	6 946	273	7 219
S_2	senescing dominant, sparse mature, no regrowth	2 597	47	2 644
S_3	senescing dominant, mature subdominant, no regrowth	1 358	14	1 372
S_4	senescing dominant, sparse mature and regrowth	1 215	0	1 215
S_5	senescing and mature codominant, no regrowth	9 431	513	9 944
S_6	senescing and mature codominant, sparse regrowth	361	0	361
S_7	senescing dominant, sparse mature, regrowth subdominant	2 357	45	2 402
S_8	senescing dominant, no mature, regrowth subdominant	754	0	754
Mature				
M_1	senescing subdominant, mature dominant, no regrowth	156 721	4 651	161 372
M_2	senescing subdominant, mature dominant, sparse regrowth	23 402	1 104	24 506
M_3	sparse senescing, mature dominant, no regrowth	235 470	13 597	249 067
M_4	sparse senescing, mature dominant, sparse regrowth	20 322	816	21 138
M_5	senescing, mature and regrowth codominant	1 337	0	1 337
M_6	senescing subdominant, mature dominant, regrowth subdominant	14 532	733	15 265
M_7	senescing subdominant, mature and regrowth codominant	995	126	1 121
M_8	sparse senescing, mature dominant, regrowth subdominant	35 978	1 432	37 410
M_9	mature only	244 090	23 181	267 271
M_{10}	no senescing, mature dominant, sparse regrowth	19 292	1 287	20 579
M_{11}	no senescing, mature dominant, regrowth subdominant	39 320	3 471	42 791
Regrowth				
R_1	senescing and regrowth codominant, no mature	2 744	82	2 826
R_2	senescing and regrowth codominant, sparse mature	4 494	93	4 587
R_3	senescing and mature subdominant, regrowth dominant	5 381	124	5 505
R_4	senescing subdominant, sparse mature, regrowth dominant	2 841	32	2 873
R_5	senescing subdominant, no mature, regrowth dominant	5 009	342	5 351
R_6	sparse senescing, mature and regrowth codominant	7 003	723	7 726
R_7	sparse senescing, mature subdominant, regrowth dominant	16 652	1 065	17 717
R_8	sparse senescing, sparse mature, regrowth dominant	9 015	1 036	10 051
R_9	sparse senescing, no mature, regrowth dominant	4 736	112	4 848
R_{10}	no senescing, mature and regrowth codominant	12 359	702	13 061
R_{11}	no senescing, mature subdominant, regrowth dominant	17 602	1 414	19 016
R_{12}	no senescing, sparse mature, regrowth dominant	3 382	118	3 500
R_{13}	regrowth only	11 137	1 836	12 973
All Growth Stages	Total	918 833	58 969	977 802

1 Growth stage classes M_1 to M_4, M_9 and M_{10} contain some areas of non-Jacobs vegetation classes that were known to be of senescing dominated growth stages (see discussion Section 4.2). Only by examining the growth stages in combination with the vegetation mapping (Chapters 5 and 6) could these growth stages be revised for public land (Chapter 10). The procedure for this revision is detailed in the 'GIS Analysis Stages Table' in Appendix G. However, as no vegetation class mapping was undertaken on freehold land growth stage class revisions could not be undertaken for freehold land.

2 Areas (ha) shown are reliable to the nearest 5 ha (approx.).

- 'Dominant ' - broadly occupy >50%, 'co-dominant' - broadly occupy 30-50%, 'subdominant' - broadly occupy 11-50%, and 'sparse' - broadly occupy <10%

Scanned from Woodgate et al 1994, p31

APPENDIX G - Regional Forest Agreement Tables

Representative conservation of Old-Growth Forest in the CAR Reserve System

Table 1: *East Gippsland RFA (Clth 1997)*
(The table of old-growth was not included in the RFA but a table has been located in the June 1997 amendment to the East Gippsland Forest Management Area Plan)

Table 2: *Central Highlands RFA (Clth 1998)*

Table 3: *North East RFA (Clth 1998)*

Table 4: *Central Gippsland RFA (Clth 2000)*

Table 5: *West Victoria RFA (Clth 2000)*

TABLE 1: EAST GIPPSLAND REGION - REPRESENTATIVE CONSERVATION OF OLD-GROWTH IN THE CAR RESERVE SYSTEM

(Extracted from June 1997 amendment to the East Gippsland Forest Management Area Plan, as figures were not included in the actual RFA document). Columns 4, 5 and 6 respectively refer to (a), (a) and (c) which are the zonings identified in the CRA as forming the Car Reserve System for East Gippsland, as with the Central Highlands RFA.

Table 3. Representation of old growth forest in conservation reserves and forest management zones

Ecological Vegetation Classes	Old Growth Area (ha)	Representation %							
		Proportion of EVC as Old Growth	Conservation Reserves (a)	Forest Management Zones					Formal Protection (a+b+c)
				SPZ Broad (b)	SPZ Code (c)	SMZ	GMZ Timber	GMZ Other	
21 Shrubby Dry Forest	88013	42	56	8	1	1		34	66
29 Damp Forest	42748	18	46	14	3	3	25	9	63
30 Wet Forest	36585	41	47	13	3	3	30	4	63
14 Banksia Woodland	18337	50	60	15	3	2		20	78
16 Lowland Forest	16486	7	62	18	1	2	16	1	81
17 Riparian Scrub Complex	4393	25	42	20	38				100
39 Montane Wet Forest	3329	25	87	0.5	1	0.5	11		88.5
36 Montane Dry Woodland	2886	6	28	46	1		25		75
27 Rocky Outcrop Scrub	2639	52	40	40	1	1		18	81
26 Rainshadow Woodland	2392	11	100						100
35 Tableland Damp Forest	2180	31	45	21	1	3	30		67
2 Coast Banksia Woodland	1086	32	100						100
20 Heathy Dry Forest	767	26	50	29	1			20	80
28 Rocky Outcrop Shrubland	716	45	96	3					99
18 Riparian Forest	522	4	28	48	2	6	9	7	78
24 Box Ironbark Forest	377	63	84	1				15	85
15 Limestone Box Forest	323	7	23	53	1	4	19		77
1 Coastal Dune Scrub Complex	305	9	99		1				100
38 Montane Damp Forest	275	2	97	0.4	0.1		2.5		97.5
23 Herb-rich Forest	141	1	1	84	1	5	9		85
43 Sub-alpine Woodland	55	1	53	42				5	95
22 Grassy Dry Forest	55	<1	91	9					100
40 Montane Riparian Woodland	31	6	38	60	2				100
4 Coastal Vine-rich Forest	22	18	100						100
25 Limestone Grassy Woodland	7	2	100						100
41 Montane Riparian Thicket	3	9	100						100
Total Old Growth Forest	224672		54	12	3	2	12	17	69

TABLE 2: CENTRAL HIGHLANDS REGION - REPRESENTATIVE CONSERVATION OF OLD-GROWTH IN THE CAR RESERVE SYSTEM							
Ecological Vegetation Class	**Area EVC (ha)**	**Percent of EVC as Old-growth**	**Area Old-growth (ha)**	**Percent of Old-growth in the CAR Reserve System**			
				Dedicated Reserve	**Informal Reserve[b]**	**Prescription[c]**	**Total**
Lowland Heathy Foothill Forest	42,805	<1	22	61.5	38.5	0.0	100
Riparian Forest	31,801	<1	130	17.7	82.3	0.0	100
Heathy Dry Forest	14,435	64	9,210	32.8	47.4	0.7	80.2
Grassy Dry Forest	41,579	<1	7	0.0	99.9	0.0	99.9
Herb-rich Foothill Forest	123,049	<1	77	1.0	83.8	0.0	84.8
Damp Forest	162,307	<1	547	47.0	51.9	0.1	99
Wet Forest	120,068	4	5,048	95.7	4.0	0.0	99.7
Cool Temperate Rainforest	12,970	13	1,689	96.8	3.2	0.0	100
Montane Dry Woodland	7,050	57	4,040	1.7	59.2	1.7	60.9
Montane Damp Forest	20,150	<1	75	40.5	59.5	0.0	100
Montane Wet Forest	49,678	2	940	96.4	3.6	0.0	100
Montane Riparian Thicket	3,056	<1	10	82.3	11.9	0.0	94.2
Sub-alpine Woodland	7,259	<1	3	100.0	0.0	0.0	100
Shrubby Foothill Forest	35,482	<1	32	89.6	10.4	0.0	100
Valley Grassy Forest	7,201	10	695	70.9	0.0	0.0	70.9
Heathy Woodland	6,684	51	3,426	80.5	5.9	0.6	87
Total	685,574		25,951				

a. The figures shown in this table are based on modelled information mapped at a scale of 1:100,000 derived during the old-growth analysis of vegetation types in the Central Highlands, and are therefore only approximate.
b. Informal Reserve includes broad areas and linear elements of SPZ greater than 100 metres and other informal reserves.
c. This comprises those elements of SPZ protected by regional prescriptions, including stream buffers and rainforest with a surrounding buffer.

TABLE 3: NORTH EAST REGION - REPRESENTATIVE CONSERVATION OF OLD-GROWTH IN THE CAR RESERVE SYSTEM										
				Percent of Old-growth in each land tenure category						
				CAR reserve system		Special	General		Other	Other
Ecological Vegetation Classes	Area EVC (ha)	% EVC as Old-growth	Area of Old-growth (ha)	Dedicated Reserve	Informal Reserve	Management Zone	Management Zone	Code Prescription	Parks & Reserves	Public Land
Riparian Forest	11,270	4.6	520	29.9	64.2	0	0.3	0	0.1	5.4
Heathy Dry Forest	83,090	26.6	22,110	46.0	20.1	3.5	22.2	7.4	0	0.3
Shrubby Dry Forest	276,930	33.9	93,800	33.2	19.1	1.1	34.9	11.4	0.2	0.1
Grassy Dry Forest	146,500	11.4	16,750	26.3	36.2	0	29.2	6.5	0.1	1.6
Herb-rich Foothill Forest	402,600	15.0	60,250	27.9	22.2	1.6	34.4	13.6	0.0	0.3
Damp Forest	46,690	13.5	6,320	27.5	21.0	3.5	27.4	19.2	0.2	1.3
Wet Forest	6,250	23.3	1,460	48.6	18.4	1.5	13.5	15.6	0	2.3
Montane Dry Woodland	136,330	23.3	31,790	46.1	10.6	2.1	26.1	13.1	1.0	1.1
Montane Damp Forest	38,330	17.7	6,790	37.9	11.6	1.8	28.4	17.9	0.3	2.1
Montane Riparian Thicket	1,090	10.7	120	30.4	64.9	0	0	0	0	4.8
Sub-alpine Woodland	35,340	42.1	14,870	82.7	1.5	0.3	3.6	1.6	1.0	9.4
Valley Grassy Forest	18,810	0.1	15	63.6	23.9	0	10.8	0.1	0	1.6
Granitic Hills Woodland	21,150	20.1	4,260	99.1	0.8	0	0.1	0.1	0	0
Swampy Riparian Woodland	2,010	12.6	250	39.0	49.7	0	0	0	0	11.3
Riparian Mosaic - North East	2,600	6.1	160	34.5	65.5	0	0	0	0	0
Total	1,228,990		259,465							

The figures shown in this table are based on modelled information mapped at a scale of 1:100,000 derived during the pre-1750 analysis of vegetation types in the North East, and are therefore only approximate. For the old-growth analysis in the North East it was considered that old-growth only occurs on public land, due to the generally high levels of disturbances on private land. Areas rounded to near 10 ha if over 100 ha, or nearest 5 ha if under 100 ha. Only those EVCs that contain old-growth are shown in the table. The total area of each EVC is derived from the pre-1750 analysis and includes extant forest on both public and private land. The proportion of old-growth in each EVC has been derived using the total area of extant forest on both public and private land. Code Prescription refers to areas protected under the Code of Forest Practices for Timber Production prescriptions for exclusion of timber harvesting from streamside buffers and slopes of 30 degrees or more. Special Management Zone is abbreviated to SMZ and General Management Zone to GMZ.

TABLE 4: GIPPSLAND REGION - REPRESENTATIVE CONSERVATION OF OLD-GROWTH IN THE CAR RESERVE SYSTEM													
EVC No	Ecological Vegetation Class	Area of EVC (ha)	% EVC as Old-growth	Area of Old-growth (ha)	CAR Reserve System				Areas in ha				
					Total (ha	%	Formal Reserves (ha)	Informal Reserves (SPZ) (ha)	SMZ	GMZ	Code P'scriptn	Other Parks & Reserve	Other Public Land
*3	Damp Sands Herb-rich Woodland	14,306	0.1	16	11	63.9	9	1	-	-	-	-	6
*15	Limestone Box Forest	746	5.8	43	38	87.7	29	9	-	-	-	5	-
*16	Lowland Forest	116,680	2.1	2,397	1,943	81.1	1,410	533	3	386	45	15	5
*18	Riparian Forest	9,014	2.9	261	201	77.2	132	70	0	29	31	0	0
20	Heathy Dry Forest	85,017	23.6	20,092	12,969	64.5	8,443	4,525	161	5,211	1,655	66	31
21	Shrubby Dry Forest	263,826	28.0	73,938	46,025	62.2	28,357	17,669	458	20,138	7,197	88	32
22	Grassy Dry Forest	33,368	30.3	10,110	6,611	65.4	3,978	2,632	250	2,025	1,126	95	3
23	Herb-rich Foothill Forest	116,606	10.6	12,353	9,692	78.5	8,316	1,377	37	1,363	1,233	27	0
27	Blackthorn Scrub	7,378	37.1	2,737	2,381	87.0	739	1,642	3	284	68	-	2
28	Rocky Outcrop Shrubland	1,807	46.3	838	838	100.0	276	561	-	-	-	-	-
29	Damp Forest	106,062	14.2	15,030	8,118	54.0	3,146	4,972	44	4,510	2,298	58	3
*30	Wet Forest	68,453	6.9	4,697	2,637	56.1	1,491	1,146	4	1,424	628	4	-
*35	Tableland Damp Forest	11,031	9.2	1,020	457	44.8	129	328	6	471	86	-	-
36	Montane Dry Woodland	131,619	12.6	16,564	11,227	67.8	9,388	1,839	192	4,016	1,087	35	7
*37	Montane Grassy Woodland	29,952	9.0	2,689	2,260	84.0	448	1,812	9	243	25	48	104
*38	Montane Damp Forest	104,135	6.7	7,000	4,425	63.2	3,738	687	4	1,880	681	2	8
39	Montane Wet Forest	11,613	18.2	2,116	1,419	67.1	1,282	136	-	448	249	-	-
*40	Montane Riparian Woodland	2,759	1.1	29	29	100.0	22	7	-	-	-	-	-
41	Montane Riparian Thicket	2,654	12.7	336	326	96.9	50	275	-	0	-	10	-
43	Sub-alpine Woodland	38,388	17.0	6,509	5,400	83.0	5,317	84	16	628	39	-	426
*45	Shrubby Foothill Forest	36,887	7.5	2,774	1,288	46.4	522	766	25	1,228	220	13	-
*47	Valley Grassy Forest	3,118	1.8	57	55	96.1	44	11	0	1	1	-	-
48	Heathy Woodland	34,506	23.8	8,226	7,708	93.7	5,296	2,412	7	362	12	-	137

TABLE 4: GIPPSLAND REGION - REPRESENTATIVE CONSERVATION OF OLD-GROWTH IN THE CAR RESERVE SYSTEM														
EVC No	Ecological Vegetation Class	Area of EVC (ha)	% EVC as Old-growth	Area of Old-growth (ha)	CAR Reserve System				Areas in ha				
					Total (ha	%	Formal Reserves (ha)	Informal Reserves (SPZ) (ha)	SMZ	GMZ	Code P'scriptn	Other Parks & Reserve	Other Public Land
72	Granitic Hills Woodland	3,979	30.2	1,203	1,203	100.0	1,203	-	-	-	-	-	-
*73	Rocky Outcrop Shrubland/Herbland Mosaic	9,394	5.9	554	480	86.6	455	25	-	27	46	-	-
*82	Riverine Escarpment Scrub	8,637	3.1	266	197	74.0	80	118	3	41	25	-	0
127	Valley Heathy Forest	1,130	45.1	510	510	100.0	-	510	-	-	-	-	-
*151	Plains Grassy Forest	19,781	8.2	1,618	1,072	66.3	307	765	1	517	28	-	-
*169	Dry Valley Forest	18,851	4.0	746	426	57.1	151	276	1	205	115	-	-
*175	Grassy Woodland	13,981	1.7	243	242	99.7	160	83	-	-	0	1	0
177	Valley Slopes Dry Forest	1,840	44.3	816	815	99.9	257	558	-	-	-	-	1
*191	Riparian Scrub	3,903	5.0	195	173	88.8	95	78	-	15	4	-	2
*192	Montane Rocky Shrubland	3,259	5.3	172	172	100.0	166	5	-	-	-	-	-
201	Shrubby Wet Forest	2,250	11.0	248	152	61.3	3	149	-	79	17	0	-
*315	Shrubby Foothill Forest/Damp Forest Complex	7,707	2.6	204	114	56.1	31	84	0	55	34	-	-
316	Shrubby Damp Forest	68,161	13.5	9,211	5,689	61.8	2,118	3,571	83	2,230	1,188	21	-
*319	Montane Herb-rich Woodland	22,421	8.8	1,984	1,344	67.8	1,078	266	8	322	310	0	0
*320	Grassy Dry Forest/Heathy Dry Forest Complex	503	5.3	27	27	100.0	27	-	-	-	-	-	-
*877	Lowland Herb-rich Forest	20,444	2.1	431	339	78.7	74	265	4	68	15	5	0
Total		1,436,164		208,261	139,013		88,765	50,248	1,320	48,206	18,461	494	767

* denotes those Old-growth EVCs that are rare or depleted and which the nationally agreed JANIS Reserve Criteria specify all viable examples should be protected where ever possible.

The figures shown in this table are based on modelled information mapped at a scale of 1:100,000 derived during the pre-1750 analysis of vegetation types in the Gippsland region, and are therefore only approximate. For the Old-growth analysis in the Gippsland region it was considered that Old-growth only occurs on public land, due to the generally high levels of disturbances on private land. Only those EVCs that contain Old-growth are shown in the table. The total area of each EVC is derived from the pre-1750 analysis and includes extant forest on both public and private land. The proportion of Old-growth in each EVC has been derived using the total area of extant forest on both public and private land. Code Prescription refers to areas protected under the Code of Forest Practices for Timber Production prescriptions for exclusion of timber harvesting from streamside buffers and slopes of 30 degrees or more. Special Management Zone is abbreviated to SMZ and General Management Zone to GMZ.

TABLE 5: WEST VICTORIA REGION - REPRESENTATIVE CONSERVATION OF OLD-GROWTH IN THE CAR RESERVE SYSTEM												
EVC No	Ecological Vegetation Classes	Area of EVC (ha)	% EVC as Old-growth	Area of Old-growth (ha)	CAR Reserve System				SMZ (ha)	GMZ (ha)	Other Public Land (ha)	Private Land (ha)
					Total (ha)	%	Formal Reserves (ha)	Informal Reserves (SPZ) (ha)				
*3	Damp Sands Herb-rich Woodland	43 042	3	1 475	1 293	88	1 087	206	74	52	56	
*16	Lowland Forest	86 608	5	4 239	3 988	94	3 597	391	10	237	3	
*18	Riparian Forest	4 775	2	88	88	100	79	9				
20	Heathy Dry Forest	95 826	15	14 593	14 198	97	12 483	1 715	38	118	233	6
*21	Shrubby Dry Forest	8 738	6	520	510	98	510				9	1
*22	Grassy Dry Forest	46 744	5	2 107	2 015	96	1 515	500	6	18	68	
*23	Herb-rich Foothill Forest	65 008	0	127	126	99	118	8		1		
*29	Damp Forest	2 130	1	29	29	100	29					
*30	Wet Forest	40 653	6	2 631	2 494	95	1 843	651	9	128		
*45	Shrubby Foothill Forest	68 082	2	1 298	1 287	99	1 125	162	5	5		
*47	Valley Grassy Forest	15 638	9	1 406	1 396	99	1 387	10			9	
48	Heathy Woodland	179 030	39	70 294	60 117	86	37 447	22 669	2 034	7 738	309	98
*55	Plains Grassy Woodland	36 104	0	156	125	80	55	69		30	2	
*61	Box Ironbark Forest	8 427	1	101	96	95	42	54		5		
64	Rocky Chenopod Woodland	666	20	135	134	99	134					1
*67	Alluvial Terraces Herb-rich Woodland	3 804	3	108	108	100	103	5				
71	Hills Herb-rich Woodland	17 028	15	2 564	2 521	98	2 494	27		3	39	
*134	Sand Forest	374	4	13	13	100		13				
*164	Creekline Herb-rich Woodland	2 097	1	16	15	89	12	3			2	
174	Grassy Dry Forest/Rocky Outcrop Shrubland/Herbland	31	25	8	8	100	8					

TABLE 5: WEST VICTORIA REGION - REPRESENTATIVE CONSERVATION OF OLD-GROWTH IN THE CAR RESERVE SYSTEM												
EVC No	Ecological Vegetation Classes	Area of EVC (ha)	% EVC as Old-growth	Area of Old-growth (ha)	CAR Reserve System				SMZ (ha)	GMZ (ha)	Other Public Land (ha)	Private Land (ha)
					Total (ha)	%	Formal Reserves (ha)	Informal Reserves (SPZ) (ha)				
	Mosaic											
*175	Grassy Woodland	5 963	0	14	14	100	14	1				
*178	Herb-rich Foothill Forest/Shrubby Foothill Forest Complex	7 996	0	8	1	17		1		7		
179	Herb-rich Heathy Woodland	21 788	13	2 883	1 847	64	1 120	727	161	803	72	
*195	Seasonally Inundated Shrubby Woodland	4 424	5	206	202	98	173	29			3	
198	Sedgy Riparian Woodland	6 151	17	1 038	1 002	97	946	56			36	
*201	Shrubby Wet Forest	31 812	2	656	533	81	109	424	10	114		
278	Herb-rich Heathy Forest	430	94	403	402	100	402				1	
282	Shrubby Woodland	7 906	31	2 461	2 443	99	2 433	10		9	9	1
*283	Plains Sedgy Woodland	2 277	3	68	68	100	36	33				
285	Dry Creekline Woodland	352	23	83	65	79	26	39		17		
336	Grampian Ranges Mosaics (includes EVCs 336-350, 352-381, 384-400, 402-471, 475-480, 484-634)	8 336	24	1 976	1 925	97	1 876	49		2	49	
*351	Rocky Outcrop Shrubland/Herbland Mosaic/Grassy Dry Forest Complex	1 603	3	44	44	99	44				1	
382	Lowland Forest/Heathy Dry Forest Complex	743	41	306	306	100	306					

TABLE 5: WEST VICTORIA REGION - REPRESENTATIVE CONSERVATION OF OLD-GROWTH IN THE CAR RESERVE SYSTEM

EVC No	Ecological Vegetation Classes	Area of EVC (ha)	% EVC as Old-growth	Area of Old-growth (ha)	CAR Reserve System				SMZ (ha)	GMZ (ha)	Other Public Land (ha)	Private Land (ha)
					Total (ha)	%	Formal Reserves (ha)	Informal Reserves (SPZ) (ha)				
383	Lowland Forest/Valley Grassy Forest Complex	1 150	13	144	144	100	144					
*401	Hills Herb-rich Woodland/Heathy Woodland Complex	737	4	28	28	100	28					
481	Heathy Woodland/Heathy Dry Forest Complex	1 294	19	252	252	100	252					
645	Wet Heathland / Heathy Woodland Mosaic	4 486	21	945	945	100	934	12				
650	Heathy Woodland / Damp Heathy Woodland / Damp Heathland Mosaic	12 835	38	4 933	4 916	100	607	4 309			9	8
*704	Lateritic Woodland	1 422	4	56	56	100	47	10				
*711	Shallow Sands Woodland / Plains Sedgy Woodland Mosaic	1 878	2	46	46	100	46					
*713	Damp Sands Herb-rich Woodland / Damp Heathland / Damp Heathy Woodland Mosaic	2 929	0	15	15	100		15				
*725	Damp Sands Herb-rich Woodland / Riparian Woodland / Swamp Scrub Mosaic	195	5	11	11	100	11					
726	Rocky Outcrop Shrubland/Herbland Mosaic / Heathy Woodland Mosaic	401	32	130	130	100	130					

TABLE 5: WEST VICTORIA REGION - REPRESENTATIVE CONSERVATION OF OLD-GROWTH IN THE CAR RESERVE SYSTEM												
					CAR Reserve System							
EVC No	Ecological Vegetation Classes	Area of EVC (ha)	% EVC as Old-growth	Area of Old-growth (ha)	Total (ha)	%	Formal Reserves (ha)	Informal Reserves (SPZ) (ha)	SMZ (ha)	GMZ (ha)	Other Public Land (ha)	Private Land (ha)
*734	Damp Heathland / Damp Heathy Woodland / Wet Heathland Mosaic	634	4	25	25	100		25				
*737	Heathy Woodland / Limestone Woodland Mosaic	3 210	3	89	85	96	85			4		
740	Damp Sands Herb-rich Woodland / Heathy Woodland / Sand Heathland Mosaic	969	39	382	382	100	382					
*746	Damp Heathland / Damp Heathy Woodland Mosaic	4 008	9	349	340	97	105	235		9		
*748	Shallow Sands Woodland / Heathy Woodland Mosaic	788	2	15	15	100	13	2				
*749	Shallow Sands Woodland / Plains Sedgy Woodland / Seasonally Inundated Shrubby Woodland Mosaic	905	3	25	25	100	25					
*750	Shallow Sands Woodland / Plains Sedgy Woodland / Seasonally Inundated Shrubby Woodland Mosaic / Damp Sands Herb-rich Woodland Mosaic	5 692	2	98	76	78	8	68	13	9		
751	Seasonally Inundated Shrubby Woodland / Plains Sedgy Woodland Mosaic	1 251	25	308	194	63	80	115	14	100		
753	Rocky Outcrop Shrubland/Herbland /	168	31	52	52	100	52					

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EVC No	Ecological Vegetation Classes	Area of EVC (ha)	% EVC as Old-growth	Area of Old-growth (ha)	CAR Reserve System				SMZ (ha)	GMZ (ha)	Other Public Land (ha)	Private Land (ha)
					Total (ha)	%	Formal Reserves (ha)	Informal Reserves (SPZ) (ha)				
	Broombush Mallee Mosaic											
756	Heathy Woodland / Seasonally Inundated Shrubby Woodland Mosaic	178	27	48	47	98		47	1			
757	Damp Sands Herb-rich Woodland / Seasonally Inundated Shrubby Woodland Mosaic	340	21	73	73	100	73					
*780	Plains Sedgy Woodland / Shallow Sands Woodland / Heathy Woodland Mosaic	365	7	25	25	100		25				
783	Grassy Dry Forest / Heathy Woodland Complex	191	11	21	21	100	21					
*785	Heathy Herb-rich Woodland / Damp Sands Herb-rich Woodland Mosaic	716	9	68	68	100	68					
786	Heathy Woodland / Heathy Herb-rich Woodland / Damp Heathy Woodland Mosaic	2 622	10	266	266	100		266				
*793	Damp Heathy Woodland	833	8	67	65	98	2	63		2		
*803	Plains Woodland	4 349	0	13	12	90	7	5			1	
881	Damp Sands Herb-rich Woodland / Heathy Woodland Mosaic	4 816	21	1 034	1 031	100	1 031			3		
*882	Shallow Sands Woodland	8 569	2	155	125	81	79	46	21	9		

TABLE 5: WEST VICTORIA REGION - REPRESENTATIVE CONSERVATION OF OLD-GROWTH IN THE CAR RESERVE SYSTEM												
					CAR Reserve System							
EVC No	**Ecological Vegetation Classes**	**Area of EVC (ha)**	**% EVC as Old-growth**	**Area of Old-growth (ha)**	**Total (ha)**	**%**	**Formal Reserves (ha)**	**Informal Reserves (SPZ) (ha)**	**SMZ (ha)**	**GMZ (ha)**	**Other Public Land (ha)**	**Private Land (ha)**
892	Heathy Woodland/Sand Heath Mosaic	4 642	33	1 514	1 512	100	1 218	294				3
Total		897 159		123 242	110 396		76 998	33 398	2 396	9 423	911	116

* denotes those Old-growth EVCs that are rare or depleted and which the nationally agreed JANIS Reserve Criteria specify all viable examples should be protected where ever possible.

The figures shown in this table are based on modelled information mapped at a scale of 1:100,000 derived during the pre-1750 analysis of vegetation types in the West Victoria region, and are therefore only approximate. For the Old-growth analysis in the West Victoria region it was considered that Old-growth only occurs on public land, due to the generally high levels of disturbances on private land. . Only those EVCs that contain Old-growth are shown in the table. The total area of each EVC is derived from the pre-1750 analysis and includes extant forest on both public and private land. The proportion of Old-growth in each EVC has been derived using the total area of extant forest on both public and private land. Special Management Zone is abbreviated to SMZ and General Management Zone to GMZ.

GLOSSARY OF TERMS

Term	Definition	Source
Crown cover	Crown cover is the percentage of the sample site within the vertical projection of the periphery of tree crowns; crowns are treated as opaque	*Woodgate et al* (1994)
Ecological Vegetation Class (EVC)	An EVC is the name given to a level within a hierarchical vegetation classification system. It is the base mapping unit used for forest ecosystem assessments, biodiversity planning and conservation management at the regional scale in Victoria and may be composed of one or more Floristic Communities. Its composition is dependent upon a consistent set of ecological processes and habitat variables that may occur across a number of biogeographical zones. A particular EVC is identified on the basis of its floristic composition, vegetation structure, landform, environmental and ecological characteristics. Examples of EVCs include: Wet Forest, Damp Forest, Montane Dry Woodland, Riparian Thicket and Shrubby Foothill Forest.	DNRE: *A Study of the Old-growth Forests of Gippsland* (2000)
High Conservation Value Forests	High Conservation Value Forests are those that possess one or more of the following attributes: (a) forest areas containing globally, regionally or nationally significant: concentrations of biodiversity values (e.g. endemism, endangered species, refugia); and/or large landscape level forests, contained within, or containing the management unit, where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance. (b) forest areas that are in or contain rare, threatened or endangered ecosystems. (c) forest areas that provide basic services of nature in critical situations (e.g. watershed protection, erosion control). (d) forest areas fundamental to meeting basic needs of local communities (e.g. subsistence, health) and/or critical to local communities' traditional cultural identity (areas of cultural, ecological, economic or religious significance identified in cooperation with such local communities).	Forest Stewardship Council (2000)
Precautionary Principle	As defined in the inter governmental Agreement on the Environment:- Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.	*National Forest Policy Statement* (NFPS) 1992
Victoria's Natural Forest Estate	All native forests that have not been significantly disturbed or are ecologically recoverable, and includes both old-growth forest and natural mature forest (ie all Negligibly Disturbed Forest), Mixed Forest and rainforest, and high conservation value forest areas that contain rare, wilderness areas and threatened or endangered species and ecosystems.	Trevor Poulton (2006)

ACRONYMS

API	-	Aerial Photograph Interpretation
CAR	-	Comprehensive, Adequate and Representative Reserve System
CMA	-	Catchment Management Authority
CRA	-	Comprehensive Regional Assessment report
DCE	-	Department of Conservation and Environment
DCNR	-	Department of Conservation and Natural Resources
DNRE	-	Department of Natural Resources and Environment
DSE	-	Department of Sustainability and Environment
ESD	-	Ecologically Sustainable Development
ESFM	-	Ecologically Sustainable Forest Management
EVC	-	Ecological Vegetation Class
FMA	-	Forest Management Area
FMB	-	Forest Management Block
GIS	-	Geographic Information System
JANIS	-	Joint ANZECC / MCFFA National Forest Policy Statement Implementation Sub-committee
JSAG	-	Joint Scientific Advisory Group
LCC	-	Land Conservation Council
NCP	-	National Competition Policy
NFPS	-	National Forest Policy Statement
NRE	-	Department of Natural Resources and Environment
RFA	-	Regional Forest Agreement
SFRI	-	State Forest Resource Inventory
VEAC	-	Victorian Environment Assessment Council
WUP	-	Wood Utilization Plan

DEFINITION

The Department' refers to the Victorian state government department responsible for public forestry, currently the Department of Sustainability and Environment (DSE), and/or its predecessors and/or successors.

VICTORIA

Time timbers down on
these philosophers of ranges.
Trunks lie stacked in sawmill yards
bark sheared from their backs.

Leaves download light in coupes
where money grows on trees.
In the canopy country
crowns turn grey and forlorn.

These are no longer kingdoms
that renovate and furnish gullies
or reshape horizons.
This is the fallen country.

Trevor Poulton (2006)