Fauna Technical Note No. 2:

Explanatory notes on the mapping of areas that potentially contain mature forest characteristics (the 'mature habitat availability map')

FPA
FOREST PRACTICES AUTHORITY

The Fauna Technical Note Series provides information for Forest Practices Officers on fauna management in production forests. These technical notes are advisory guidelines and should be read in conjunction with the requirements of the Forest Practices Code. *The current technical note provides background information for practitioners using the mature habitat availability map.*

The technical notes can be accessed on the Forest Practices Authority's website: www.fpa.tas.gov.au

1. Introduction

Forests are classified as mature when they are about 100 years old and begin to develop structural features typically found in older forests. These structural features can provide important habitat for a range of species, and thus mature forests need to be managed in the landscape in order to maintain biodiversity. Features important for biodiversity that are found in mature forest include large spreading crowns, tree hollows and coarse woody debris.

Strategic management of the mature forest habitat is required, particularly in production forest areas, but effective management is hampered by a lack of information on current distribution (Lindenmayer and Franklin 2002, Munks *et al.* 2009). Information on forest structure, as obtained from aerial photographs (Appendix 1), can be used to explain a significant proportion of the variability in hollow-bearing tree density (Koch and Baker 2011). Photo-interpreted data (PI-data) of mature eucalypt tree density explained half of the variability in hollow-bearing tree availability in wet forest (when two outlying sites were removed due to unusual crown structure). A similar amount of variability in hollow availability was explained in dry forest, except that approximately 8.5% was explained by stand senescence (Koch and Baker 2011). Mature hollow-bearing trees are expected to have larger crowns and contribute to the availability of coarse woody debris (rotting logs), so information on mature tree density and senescence can be used to produce a mapping layer to assist conservation planning across all land tenures.

2. Development of the mature habitat availability map

In the swift parrot interim habitat planning guideline (Fauna Strategic Planning Group 2009), the mature eucalypt crown density component of PI-type data (Stone 1998), senescence codes (CoASoT 1996) and TASVEG 2.0 data were used to differentiate potential hollow availability classes. The allocation of different mature eucalypt crown density categories to the different potential hollow availability classes was decided by hollow experts after informal field assessments and a round-table discussion with members of the Fauna Strategic Planning Group. These classes are used as the basis of the mature habitat availability map, which shows the distribution of mature habitat availability classes (as defined in Table 1).

On both public and private land, crude attempts were made to update the mature habitat availability map for harvest operations that had been approved or completed but not yet translated into other mapping layers. For all forest practices plans (FPPs) approved from 2000 onwards, the central coordinates of the planned operation were located on the mature habitat availability map. If these units were located in an area of low or negligible mature habitat availability on public land, or negligible mature habitat availability on private land, it was assumed that details of the harvested area have been incorporated into the mapping layers. (Note: a different approach is taken between public and private land due to the regularity with which mapping layers are updated). FPP coordinates located in

other areas (areas of medium or high mature habitat availability, or low mature habitat availability on private land) were assumed to not have been incorporated into recent mapping layers. For these unmapped harvesting operations, a circular buffer was digitally created around each central coordinate, equal in area to the specified harvesting area as stated on the FPP. Circular areas were used as an approximation of coupe location because the Forest Practices Authority does not have access to spatial data on the boundaries of harvested areas. These circular areas were changed to have 'low' mature habitat availability. It was assumed that harvesting resulted in low mature habitat availability because many FPPs include a range of harvesting techniques which vary in the amount of mature habitat that is retained.

Table 1. Definition of mature habitat availability categories using PI-type, SenCode and TASVEG data.

Mature habitat availability class	PI-type categories included
High	Mature native forest with PI-type density class 'a' or 'b' (≥40 % crown cover is mature eucalypts), where no information was available for senescence or where SenCode information was not equal to 'nil'.
Medium	Mature native forest with PI-type density class 'c' (20-40% crown cover is mature eucalypts) where no information was available for senescence or where SenCode information was not equal to 'nil'.
Low	Mature native forest with PI-type density class 'd' or 'f' (<20% crown cover is mature eucalypts), areas of higher PI-type density where SenCode information was equal to 'nil', and areas with a certified Forest Practices Plan for which the PI-type information has not been updated (see 'Updates').
Negligible	Areas mapped as plantation and areas PI-typed as regrowth forest with no or patchy (class 'P') mature eucalypt cover.
Not Applicable	Areas mapped as a non-eucalypt dominated vegetation type (all vegetation categories in Box 1 except for cleared land vegetation types). [a]

[a] Note: areas classified as not having a eucalypt component in the TASVEG mapping layer but that were indicated in the PI-type layer as having at least 20% cover of mature eucalypts were assumed to be incorrectly mapped in TASVEG.

3. Updates

A different procedure for updating the map will be used on private and public land, due to differences in information availability.

On public land, the mature habitat availability map will be updated annually using updated information on the location and extent of mature forest, and the location of certified FPPs. FPPs need to be taken into account because there can be a time lag between FPP certification and completion of the operation and updating of mapping layers. The process used on public land (outlined in detail above) involves applying a circular buffer around certified FPPs located in high or medium mature habitat availability. The process of updating the map using FPP data will be repeated annually for all FPPs from 2000 onwards. The reason for repeating the process for all FPPs (and not just the most recent ones) is that updates in the mapping layers may provide more accurate information on coupe boundaries than the crude estimations made using the process outlined above.

Areas of private land will be updated when information is available, which is expected to primarily be from the forest groups layer on an annual basis. However, native forest harvesting is rarely used to update mapping layers on private land. Therefore around the central coordinates of all certified FPPs located in areas of high, medium or low mature habitat availability, a circular buffer (equal in area to the specified harvesting area stated on the FPP) will be converted to low mature habitat availability. The reason that certified FPPs located in areas of low mature habitat availability are used in private land but not public land is because of the general lack of updating mapping layers for private land.

In addition to the annual updates outlined above, the mature habitat availability map will have further monthly updates on both public and private land. This will involve applying the circular buffer method, as outlined above, to all FPPs certified in that month.

The FPA can also be notified if people using the map identify areas that are incorrectly mapped. If documentation demonstrating why the area is not mapped correctly and a shapefile of the area is provided, then the FPA can update the map accordingly.

4. Limitations and areas of concern

There are a number of limitations and inaccuracies associated with this map that need to be taken into account when using this map for decision-making. Some of the main limitations are listed below.

- Using remotely-sensed data to predict features at the tree-level will obviously provide a result with varying levels of accuracy. However, research on this method has shown that areas predicted to have high mature habitat availability are more likely to contain hollow-bearing trees than areas predicted to have low mature habitat availability (Koch and Baker, 2011). This does not mean that these area classified as high mature habitat availability will always contain quality hollows useful for fauna, or that areas with low mature habitat availability are always hollow-poor.
- When aerial photographs are PI-typed, assessments are generally done for areas of forest at least 3ha in size (and often substantially larger), so the map is not designed to be accurate at small spatial scales.
- The data for private land has not been systematically updated since its creation in the 1980s and is out of date. This means that some areas on private land that were harvested after the creation of the layer, either by clearfall or partial harvest methods, may still be classified as either medium or high mature habitat availability. We have used available information to minimise areas where this occurred. Inaccuracies associated with these corrections are that the area harvested is often less than the area planned for harvest, that variability in the amount of maturity retained will not be captured, and the exact location of the harvested area is unknown. Some of the areas harvested between the time when the photos were taken and 2000 could not be taken into account due to limitations in data availability, so substantial errors in mapping accuracy may occur.
- FPPs used for updating the mature habitat availability map that were entered into the database prior to the coverpage system (mid 2008) do not have the coordinates validated at all and those in the coverpage system are only validated to the map sheet selected. A significant number of older FPPs have centre coordinates which have been taken off physical map sheets and have only been estimated to the nearest 100m or 1km in some cases. A number of FPPs are likely to have incorrect coordinates entered into the database through human error. Furthermore some FPPs that were certified prior to 2008 may have been in AGD 66 coordinates rather than GDA 94, but information on mapping units is unavailable so we assume GDA 94 was used for all FPPs. Consequently, the circular buffer applied to certified FPPs may not always be located in the exact area where harvesting occurred.
- Some areas will have aged and developed mature features such as hollows since the PI-type information was gathered and so the map may under-predict mature habitat availability in some areas.
- Some areas classified as negligible mature habitat availability will actually contain trees with mature features such as hollows (e.g. paddock trees).

5. Using the mature habitat availability map

The mature habitat availability map may be useful for planning mature habitat management at both the landscape-scale and the coupe-scale. At the landscape-scale it may be useful in estimating the extent and spatial arrangement of mature habitat in a forest block. At the coupe-scale it may be useful to estimate how much of the area around the coupe and within the coupe is expected to contain suitable mature habitat. The mature habitat context of an area can be calculated using the habitat context assessment tool, available on the FPA website (www.fpa.tas.gov.au → FPA Services → Planning Assistance). To use the tool forest planners simply enter the central coordinates of the planned

forestry operation (in GDA 94), and the radius around this point that they are interested in (in kilometres). The tool then calculates how much of the specified area potentially supports mature habitat (high or medium mature habitat availability on the mature habitat availability map). The tool also calculates the proportion of the corrected area that is comprised of high or medium mature habitat availability. This corrected area excludes areas classified as 'not applicable' (non-forest and forest without a major eucalypt component, see Appendix 2), and a proportion of land that has been cleared since European settlement that may have previously contained non-eucalypt dominated vegetation communities. The area of cleared land that is removed from the calculation is estimated by taking the proportion of the non-cleared area that is comprised of non-eucalypt dominated vegetation types, as outlined below.

$$\text{Mature habitat availability} = \frac{\text{Habitat}}{(\text{Area} - \text{Non-Eucalypt area} - (\frac{\text{Non-Eucalypt area}}{(\text{Area} - \text{Cleared})}) * \text{Cleared})} \times 100$$

Where:

Mature habitat availability: percentage of the corrected area (excluding non-Eucalypt dominated vegetation areas) within the specified radius that is classified as high or medium mature habitat availability.

Habitat: Area of high and medium mature habitat availability in a set radius (ha)

Area: Land area within a set radius (ha)

Non-Eucalypt area: Area, within the specified radius, of native vegetation without a dominant eucalypt component (ha). (i.e. TASVEG classes 'rainforest and related scrub', 'non-eucalypt forest and woodland', 'scrub, heathland and coastal complexes', 'highland treeless vegetation', 'saltmarsh and wetland', 'moorland sedgeland, rushland and peatland', 'native grassland', 'other environments' (Box 1)).

Cleared: Area of cleared land within a set radius (ha)

The mature habitat availability map has been designed to help forest planners plan for the management of mature habitat and fauna dependent on mature habitat features (e.g. hollows) taking landscape-scale availability of mature habitat into account. The output from the on-line habitat context tool will be:

- the version of the mature habitat availability map that was used,
- the central co-ordinates used (in GDA 94),
- the radius around the central co-ordinates that was assessed (km),
- the area estimated to contain high or medium mature habitat availability (ha),
- the percentage of the corrected area estimated to contain high or medium mature habitat.

As the mature habitat availability map is subject to a number of limitations and inaccuracies, ground-truthing is recommended wherever possible. This is particularly important in areas PI-typed as d density mature eucalypt crown cover.

References

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Appendix 1. Summary of relevant PI-data derivation

Below is some information on PI-type mapping techniques and classifications used in Tasmania. PI-typing is primarily conducted by Forestry Tasmania, and the information provided here is only intended to provide readers with sufficient understanding to allow interpretation of the limitations of the potential hollow availability map. For more detailed information refer to Stone (1998).

Photo-interpretation mapping (PI-type mapping) is when high resolution aerial photographs are examined stereoscopically, providing a three-dimensional view of the forest canopy. Areas of forest are divided into polygons, primarily based on natural features or obvious changes in forest structure. Polygons are generally at least three hectares in size. Each polygon is assessed for a number of attributes, including the presence and density of mature crowns.

Maturity

Trees with discrete, circular, slightly conical crowns are defined as regrowth crowns. The rest are considered mature and are generally larger, more irregular in shape and lacking a conical form. The density of mature eucalypt crown cover is classified into one of six categories.

Process and availability

PI-type mapping in Tasmania is done by experienced photo-interpreters, primarily at Forestry Tasmania. The process is extremely costly and time consuming, so areas are re-examined only infrequently. However, PI-type layers can be updated as other information becomes available, for example if harvesting or clearing is known to have occurred. Forestry Tasmania have continued to update their aerial photograph interpretation over the years, so aerial photographs used in current mapping range from the mid 1980s until the present. The majority of State forest land is mapped from photographs taken in the last two decades. Areas of private land were photo-interpreted when

managed by Forestry Tasmania, and so are primarily derived from photographs taken in the late seventies and early eighties.

Senescence mapping

Senescence mapping in Tasmania was undertaken as part of the 1996 Regional Forest Agreement process, for the purpose of mapping RFA defined old-growth (CoASoT 1996). Senescent trees were defined as eucalypts with shrinking crowns, bayonet branches (branches sticking out of the canopy), dead branches and missing branches. Using the 1996 PI-type base layer, areas that potentially contained oldgrowth forest (JANIS 1997) were assessed for the proportion of the mature crowns that were senescent, categorised into four classes. It should therefore be noted that senescence mapping is not an indication of the *abundance* of senescent trees, but rather the *proportion* of mature trees that are senescent. Senescence mapping has not been repeated since the 1996 RFA process.

Appendix 2. Areas classified in the mature habitat availability map as 'negligible' or 'not applicable'

TASVEG and PI-type data were used to determine whether an area was classified as having negligible mature habitat availability, or was of a vegetation type that was not dominated by eucalypts prior to European colonisation (i.e. areas classified as 'not applicable'). TASVEG categories assumed to have negligible mature habitat availability are outlined in Box 1. Some of these areas can contain mature forest features (e.g. rainforest), but eucalypts are more prone to forming features such as hollows and so mapping of mature habitat focuses on eucalypt forests. In some cases TASVEG data can be inaccurate, so areas PI-typed as having >20% mature crown cover (i.e. a, b and c density) were included in the mature habitat mapping regardless of the TASVEG category.

Areas PI-typed as non-forest, unstocked forest and plantation were assumed to have negligible mature habitat availability.

Box 1: TASVEG categories classified as 'negligible' or 'not applicable' mature habitat availability

NEGLIGIBLE	NOT APPLICABLE
Cleared land*	**Moorland, sedgeland, rushland and peatland**
Agricultural land (FAG)	*Alkaline pans (MAP)*
Permanent easements (PDE)	*Buttongrass moorland (undifferentiated) (MBU)*
Pteridium esculentum *fernland (FPF)*	*Buttongrass moorland with emergent shrubs (MBS)*
Extra-urban miscellaneous (FUM)	*Eastern buttongrass moorland (MBE)*
Regenerating cleared land (FRG)	*Highland grassy sedgeland (MGH)*
Urban areas (FUR)	*Pure buttongrass moorland (MBP)*
Weed infestation (FWU)	*Restionaceae rushland (MRR)*
Non-eucalypt forest and woodland**	*Sparse buttongrass moorland on slopes (MBR)*
Acacia dealbata *forest*	*Sphagnum peatland (MSP)*
	Subalpine Diplarrena latifolia *rushland (MDS)*
	Western buttongrass moorland (MBW)
NOT APPLICABLE	*Western lowland sedgeland (MSW)*
Highland treeless vegetation	
Alpine coniferous heathland (HCH)	**Rainforest and related scrub**
Cushion moorland (HCM)	Athrotaxis selaginoides *subalpine scrub (RKS)*
Eastern alpine heathland (HHE)	*Rainforest fernland (RFE)*
Eastern alpine sedgeland (HSE)	*Highland low rainforest and scrub (RSH)*
Eastern alpine vegetation (undifferentiated) (HUE)	*Coastal rainforest (RCO)*
Western alpine heathland (HHW)	Nothofagus gunnii *rainforest and scrub (RFS)*
Western alpine sedgeland/herbland (HSW)	Nothofagus *rainforest undifferentiated (RMU)*
	Lagarostrobos franklinii *rainforest and scrub (RHP)*
Saltmarsh and wetland	Athrotaxis selaginoides - Nothofagus gunnii *short rainforest (RKF)*
Freshwater aquatic herbland (AHF)	Athrotaxis selaginoides *rainforest (RKP)*
Freshwater aquatic sedgeland and rushland (ASF)	*Highland rainforest scrub with dead* Athrotaxis selaginoides *(RKX)*
Lacustrine *herbland (AHL)*	Nothofagus - Leptospermum *short rainforest (RML)*
Saline aquatic herbland (AHS)	Athrotaxis cupressoides - Nothofagus gunnii *short rainforest (RPF)*
Saline sedgeland/rushland (ARS)	Athrotaxis cupressoides *rainforest (RPP)*
Saltmarsh (undifferentiated) (AUS)	Athrotaxis cupressoides *open woodland (RPW)*
Succulent saline herbland (ASS)	Leptospermum *with rainforest scrub (RLS)*
Wetland (undifferentiated) (AWU)	
Scrub, heathland and coastal complexes	**Non-eucalypt forest and woodland****
Subalpine heathland (SHS)	Allocasuarina littoralis *forest (NAL)*
Banksia marginata *wet scrub (SBM)*	Allocasuarina verticillata *forest (NAV)*
Melaleuca squamea *heathland (SMM)*	Acacia melanoxylon *swamp forest (NAF)*
Broad-leaf scrub (SBR)	Acacia melanoxylon *forest on rises (NAR)*
Coastal heathland (SCH)	Banksia serrata *woodland (NBS)*

Coastal scrub on alkaline sands (SCA) *Coastal scrub (SSC)* Acacia longifolia *coastal scrub (SAC)* *Heathland on granite (SHG)* *Heathland on calcarenite (SHC)* *Inland heathland (undifferentiated) (SHU)* *Coastal complex on King Island (SCK)* *Scrub complex on King Island (SSK)* *Dry scrub (SDU)* Leptospermum *scrub (SLW)* *Western wet scrub (SWW)* *Queenstown regrowth mosaic (SQR)* *Western subalpine scrub (SSW)* *Wet heathland (SHW)* Melaleuca squarrosa *scrub (SMR)* Melaleuca pustulata *scrub (SMP)* *Riparian scrub (SRI)* *Seabird rookery complex (SRC)* *Heathland scrub mosaic on Flinders Island (SHF)* *Heathland scrub complex at Wingaroo (SCW)* *Lowland sedgy heathland (SHL)*	Callitris rhomboidea *forest (NCR)* Leptospermum scoparium - Acacia mucronata *forest (NLA)* Leptospermum *forest (NLE)* Melaleuca ericifolia *swamp forest (NME)* Leptospermum lanigerum - Melaleuca squarrosa *swamp forest (NLM)* Notelaea - Pomaderris - Beyeria *forest (NNP)* *Subalpine* Leptospermum nitidum *woodland (NLN)* Bursaria - Acacia *woodland and scrub (NBA)* **Native grassland** *Lowland grassland complex (GCL)* *Coastal grass and herbfield (GHC)* *Highland* Poa *grassland (GPH)* *Lowland* Poa labillardierei *grassland (GPL)* *Rockplate grassland (GRP)* *Lowland grassy sedgeland (GSL)* *Lowland* Themeda triandra *grassland (GTL)* *Lowland grassland complex (GCL)* *Coastal grass and herbfield (GHC)* **Other environments** *Lichen lithosere (ORO) (includes rocky areas)* *Sand, mud (OSM)* *Water, sea (OAQ)* *Marram grassland (FMG)* *Spartina marshland (FSM)*

* All vegetation categories in Box 1 are classified as 'non-eucalypt area for the mature habitat availability calculation (Section 5), with the exception of the 'cleared land' vegetation types which are considered separately.

**Note: *Acacia dealbata* forest is classified as 'negligible' mature habitat rather than 'not applicable' because this forest type can develop after disturbance to an area of eucalypt forest

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Version Control

Version	Date	Author(s)	Summary of changes
1	September 2011	Amy Koch	
1.1	January 2012	Amy Koch	Greater detail is provided on how PI-type and TASVEG vegetation categories are classified on the Mature Habitat Availability Map, and rainforest is now included as non-eucalypt forest. The name of the document has been adjusted.
1.2	March 2012	Amy Koch	Remove most references to PI-type information being used to identify areas classified as not suitable, as this information was almost entirely derived from TasVeg data.