

A review of the proposed approach for biodiversity conservation (including threatened species) in NSW state forests through an IFOA

Preliminary Report

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A review of the proposed approach for biodiversity conservation in NSW State Forests through an IFOA - Preliminary Report

Summary

- This report has been prepared by the Tasmanian Forest Practices Authority for the NSW Environment Protection Authority. It provides preliminary comment and recommendations on the proposed conditions in the TSL draft agreement paper (EPA et al. 2013)(Milestone 1 of the contract brief, Appendix A).
- General comments are provided on the proposed approach. While the shift from complex, prescriptive, site-specific licence conditions to more outcome-based, landscape-scale provisions is considered positive, the need for systems to facilitate implementation, monitoring and adaptive management is raised.
- The importance of providing clear, outcomes-based objectives that can be flexible in their application is discussed. It is recommended that the objectives (outcomes) provided in the draft TSL are reviewed.
- The licence conditions of the TSL are commented on individually. The value of the proposed licence conditions, and the intent and wording of the proposed outcomes and licence conditions are discussed. Recommendations are made in relation to each of the proposed licence conditions. These recommendations aim to simplifying and clarify the approach, to ensure the desired outcomes are achieved. Several management issues not addressed in the current TSL are raised for consideration.
- **Summary of recommendations**

Topic	Recommended actions
General comments on the proposed TSL	<ol style="list-style-type: none"> 1. Consider changing the title of the licence conditions from ‘threatened species licence’ to ‘biodiversity licence’. 2. Re-structure the licence, with conditions that relate to the broad landscape-scale first and conditions for impacts at the local scale second. Consider adding a separate outcome/licence condition for impacts on freshwater systems. See suggested re-structure in Table 2. 3. Consider amalgamating some licence conditions where the desired outcome is similar (eg., the outcome for the ‘landscape connectivity conditions’ and the ‘conditions for the protection of threatened species habitat at the broad landscape scale’). The outcomes could be reworded as ‘Goals’, followed by a series of management targets to meet the goal and then recommended actions delivered through planning tools, see (FPA 2013a). 4. The EPA should consider taking an active role in promoting best practice through the development of ‘user-friendly’ planning tools/guidelines and an EPA co-ordinated training program and advisory service for forest managers and foresters.

Topic	Recommended actions
	<ol style="list-style-type: none"> 5. Planning tools and guidelines should be referred to in the TSL. Management actions likely to change may be delivered through planning tools that hang off the licence. Have a two-tier approach with some tools that are just informative, and some that are mandatory. Develop a clear process for the updating of such planning tools to promote adaptive management. 6. An advisory process should be developed to facilitate advice on ‘alternative approaches’ when the prescribed management targets/actions cannot be met. This will enable a clear and transparent decision-making process if management approaches are challenged by the broader community. 7. Develop an MOU with DPI Fisheries to cover an agreed management approach or procedures relating to the regulation of fisheries and threatened species licence conditions via the EPA. This will further streamline the bureaucratic process so that one agency is primarily responsible with referrals to the DPI Fisheries when required. 8. A monitoring program should be designed and the key elements included as part of the licence conditions. It should include ‘desired outcomes’ for implementation and effectiveness monitoring and should include a funding commitment and a commitment to adaptive management (the potential for changing ‘goal posts’). 9. A commitment from industry and government to support monitoring and adaptive management should be sought. Funding previously used for pre-harvest surveys could be redirected into monitoring.
<p>General comments on Outcomes</p>	<ol style="list-style-type: none"> 1. Review outcomes (objectives) in the IFOA and TSL and ensure they are clear, quantitative, outcomes based, appropriate for forestry planning, and flexible in how they might be applied. 2. Avoid conflicting outcomes and consider amalgamating where overlap (eg., outcome for single tree retention and habitat clumps) 3. Definitions of terms used in the outcomes should be provided in the TSL document. 4. Since the appropriate type of monitoring depends on the clarity and scale of the objectives this should be taken into account when reviewing the outcomes.
<p>Conditions for impacts at the local landscape scale</p>	<ol style="list-style-type: none"> 1. Review wording of the outcome. 2. Clarify the intent of the licence conditions. 3. For licence condition 1 clarify how areas are to be selected for retention, and how management might differ depending on the values that are or are not retained. 4. Clarify how the minimum habitat retention guidelines fit in with threatened species management. 5. Review definition for local landscape. 6. Consider catchment management when establishing maximum harvesting thresholds. 7. Consider managing for stand age structure more explicitly.

Topic	Recommended actions
	<ol style="list-style-type: none"> 8. Establish record-keeping procedure for the selection and location of retained areas. 9. The requirement to regenerate the forest following harvest does not appear to be emphasised in this licence concept? This is surprising as successful regeneration of a harvested area back to its pre-harvest state is a fundamental to the principle of ecologically sustainable forest management. A statement about use of appropriate silvicultural methods, ensuring adequate regeneration, should be included as part of this licence condition.
Threatened ecological communities	<ol style="list-style-type: none"> 1. Reword the outcome to clarify the intent of the TEC licence. 2. Consider rewording the outcome to allow for recognition that some forms of forestry may be compatible with maintaining the specific values of a TEC. 3. Consider indirect impacts (e.g. burning adjacent to a TEC) 4. Develop an on-ground assessment process (as part of harvest planning) for identifying TECs in the absence of fine-scale accurate habitat mapping. 5. Develop a process for updating TEC maps from survey data. 6. Develop a transparent process for determining when or under what conditions TECs may be impacted through an ecological harvest plan. 7. Define the vegetation communities, and provide the forest industry with a key to identifying each TEC and supporting training courses.
Tree retention	<ol style="list-style-type: none"> 1. Review wording of the outcome. 2. Consider taking an area-based landscape approach to management of mature trees. 3. If taking a single-tree retention approach, review the literature on fauna requirements in different forest types and be transparent in how a decision on what, and how much is retained, is reached. 4. Review wording of licence conditions to emphasise the desired outcome and be less prescriptive. 5. Develop definitions and identification tools. 6. Ensure the approach taken will help provide habitat over the long term, and is compatible with the different types of silviculture used.
Giant trees	<ol style="list-style-type: none"> 1. Clarify why giant trees are to be retained (eg., cultural/social value?) 2. Review definition of giant trees
Habitat clumps	<ol style="list-style-type: none"> 1. Clarify the wording/intent of the stated outcome. 2. Alter the licence prescriptions to be less prescriptive and more flexible to cater for local conditions. 3. Consider amalgamating the habitat clump requirements with the retained tree requirements, or taking a more landscape approach to habitat retention.

Topic	Recommended actions
Landscape connectivity	<ol style="list-style-type: none"> 1. Consider simplifying the wording of the outcome. 2. Develop a process for identifying the different topographies within the existing network of retained corridors to determine if a range of habitat types and topographies are being captured for landscape connectivity. 3. Consider the practicality of a catchment based stream classification system. 4. Consider providing more guidance around the desired width and spatial distribution of corridors.
Burning	<ol style="list-style-type: none"> 1. Consider the intent of the burning licence and the practicality of meeting the burning licence conditions in terms of achieving regeneration and managing the biodiversity values. 2. Consider the need for prescribed buffers between the burning boundary and a sensitive TEC.
Conditions for the protection of threatened species at a broad landscape scale	<ol style="list-style-type: none"> 1. Amalgamate with the ‘landscape’ connectivity section and move to earlier in the document (see Table 2Table 2) 2. Reference relevant planning guidelines
Key threatening processes	<ol style="list-style-type: none"> 1. Review wording of the outcome taking into account the above comments. 2. Consider including this section earlier in the licence structure (see Table 2).
Species not adequately protected by the general licence conditions	<ol style="list-style-type: none"> 1. Remove the term ‘harm’ from the outcome. It is too ambiguous. Suggest the wording ‘maintain viable populations’ to replace ‘mitigate harm’. 2. Define what ‘mitigate negative impacts’ is being applied to. For example ‘mitigate negative impacts to species populations within areas subject to forestry operations.’ 3. Develop a clear and transparent process to determine which (and to what extent) species are adequately managed through general licence conditions, which species require additional management conditions and a process for adaptive management (based on results of monitoring and/or research). 4. Develop a process to deliver information to practitioners in a clear and user-friendly way. 5. If this threatened species licence is required to manage potential habitat (as well as known locations/populations) for threatened species, additional information will be required such as range maps and habitat descriptions (for an example see http://www.fpa.tas.gov.au/fpa_services/planning_assistance/advisory_planning_tools/Biodiversity_values_database)

Topic	Recommended actions
Monitoring and process to adapt licence conditions/management	<ol style="list-style-type: none"> 1. Clarify wording of the outcome. 2. Undertake a prioritisation process to identify monitoring projects to be undertaken (for an example see (FPA 2012a)). 3. Develop an agreed monitoring program and refer to in the licence conditions 4. Clarify the parties responsible for funding and implementing the monitoring program. 5. Clarify the adaptive management process and mention in the licence conditions.

1. Introduction

While formal reservation has been the primary approach to conserve natural and cultural values in Australia, it is widely accepted that reserves alone are insufficient to conserve such values, including biodiversity, across the landscape (Lindenmayer & Franklin 2002). Consequently emphasis is also placed on management actions outside of formal reserves in areas commonly used for production activities. The goal for conservation as set out in the National Forest Policy Statement is as follows:

‘To maintain an extensive and permanent native forest estate in Australia and to manage that estate in an ecologically sustainable manner so as to conserve the full suite of values that forests can provide for current and future generations. These values include biological diversity, heritage, Indigenous and other cultural values’(Commonwealth of Australia 1995).

Most forest management agencies in Australia have focused on a coupe-by-coupe strategy to achieve this goal, taking into account the impact of forestry practices on biodiversity at the local or forest stand scale and developing management actions to ameliorate impacts appropriate for this spatial scale. There is increasing awareness, however, that this piecemeal, and often very prescriptive, approach is inadequate for the effective conservation of biodiversity, and that a more strategic landscape-scale approach is required with conservation measures applied at multiple spatial scales. Consideration of the landscape context when making decisions on appropriate management actions has become increasingly feasible with improvements in spatial information over the past two decades. If the goals/objectives or desired outcomes of a landscape-scale approach are clear, the best available information is used in the development and implementation of actions, and the approach includes a commitment to monitoring and adapting management actions if required, it should lead to a more efficient and effective way of conserving biodiversity in areas utilised for wood production (Koch et al. 2011a).

The NSW government developed Integrated Forestry Operations Approvals (IFOAs) for coastal areas utilised for wood production in the late 1990s with the aim of integrating, and hence streamlining, planning and approval processes for forestry operations. The IFOAs set out the terms and conditions under which all forestry operations on State forests and other Crown-timber lands may occur. The *Forestry Act 2012* provides for integrated forestry operations approvals (IFOAs), which integrate the regulatory regimes for environmental planning and assessment, for the protection of the environment and for threatened species conservation. The approvals contain the terms of a licence under the *Protection of the Environment Operations Act 1997*, the *Threatened Species Conservation Act 1995* and the *Fisheries Management Act 1994*.

A review of the four coastal IFOAs in 2010 identified major difficulties with the implementation and enforcement of the IFOA conditions (NSW Government 2010). Some

changes have been made but it has been noted that issues remain that make the IFOAs difficult to understand, implement and monitor (NSWEPA 2013).

A process to develop a single Integrated Forest Operations Approval (IFOA) for the coastal forest estate of NSW (Eden, Southern (including Tumut subregion) Lower North East and Upper North East) has commenced (NSWEPA 2013) (Figure 1). As part of this process a first stage agreement for to streamline the conditions for the management of threatened species and biodiversity values has been prepared jointly by the NSW Environment Protection Authority, DPI Fisheries and Forestry Corporation. The objective of the revised approach is to deliver both environmental protection targets and wood supply targets in a more efficient and effective manner (NSWEPA 2013). A broad framework for the management of habitat for a broad suite of species, including threatened species has been agreed with stakeholders and a paper has been prepared for public consultation (EPA et al. 2013). The proposed conditions in the draft paper (EPA et al. 2013) have been developed within the bounds of the scope of the broader IFOA remake process (NSWEPA 2013) which has agreed that there will be no net loss of the current level of biodiversity and threatened species protection, and likewise no net loss of timber supply.

The NSW project team has approached the Research and Advisory Section of the Tasmanian Forest Practices Authority (FPA) for an independent review of the proposed approach. In particular feedback and advice on the draft Threatened Species Licence (TSL) conditions, still under development (EPA et al. 2013; NSWEPA 2013). The Tasmanian FPA has considerable expertise in the issues involved in the design and implementation of strategic landscape approaches to the management of biodiversity (including threatened species and their habitats) in Tasmania, gained through a recent Commonwealth and State funded project (DPIPWE 2013; FPA 2013a, 2013b) and involvement in the implementation and monitoring of the Tasmanian Forest Practices System (FPA 2013c) over the past two decades.

This preliminary report provides initial comment on the overall approach proposed by the NSW project team and identifies areas that require further attention. Specific issues identified by the NSW team in the ‘remake’ discussion paper (NSWEPA 2013) (Table 1) will be addressed in more detail in the final report due in March 2014.

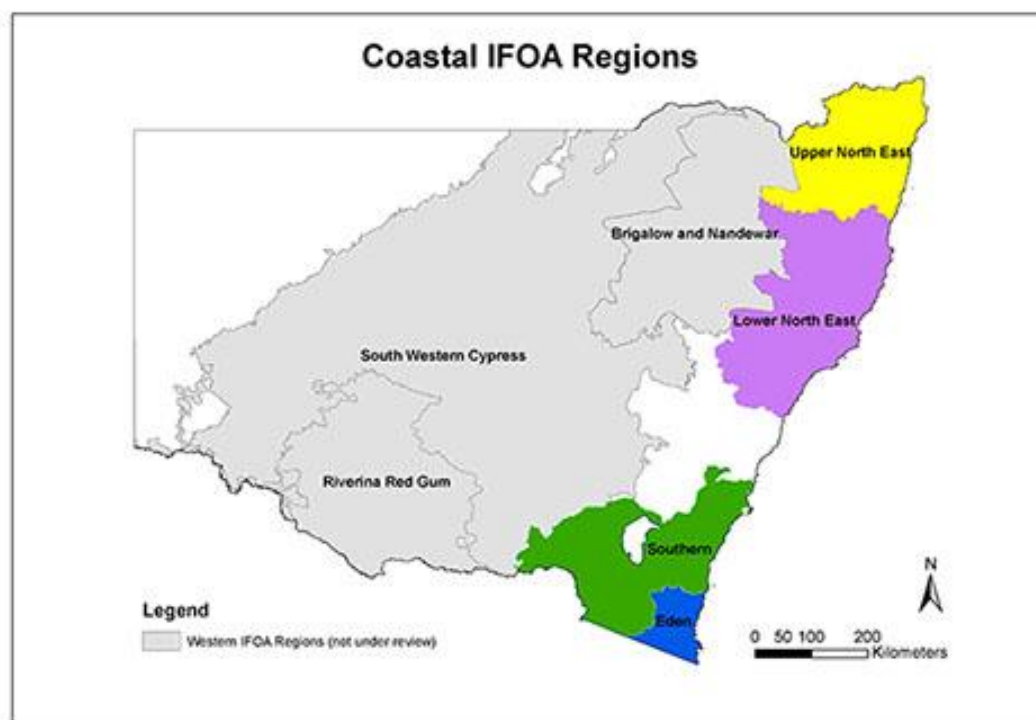


Figure 1 Coastal IFOA regions

1.1.Aim and scope of this report

The main aim of this preliminary report is to undertake an initial review and identify any outstanding gaps and issues relating to the proposed conditions in the TSL draft agreement paper (EPA et al. 2013)(Milestone 1 of the contract brief, Appendix A). This draft agreement covers the licences for the Eden, Southern (including Tumut subregion) Lower North East and Upper North East regions of the State (Figure 1).

The final report for this review, due in March 2013 (Milestone 2, Appendix A), will provide more commentary on the recommendations for specific licence conditions (whether or not the ‘no net loss’ objective has been achieved), management objectives and targets relating to threatened species and biodiversity conservation in production forest areas. The specific queries raised by the NSW project team relating to the conditions of the Threatened Species Licence (Table 1) will also be considered in more detail.

Table 1 Specific queries relating to the TSL conditions, raised by the NSW project team (NSWEPA 2013).

Topic	Query
General approach – The overall licence concept	What are the gaps?
	What aspects of the approach may be hard/ problematic?
	In what way could the approach be improved / adapted to meet the overall goal?
Local landscape conditions	Is 1500 ha an appropriate scale for considering local landscape

	scale objectives?
	Habitat clumps - Are the proposed clump sizes and spatial configurations appropriate? Should aggregating clumps be avoided?
	Minimum threshold for habitat protection in a local landscape – Is this a good idea? Is 20% protected from logging disturbance an appropriate number? If not, what is the appropriate threshold?
	Would it be best to have fixed local landscapes or could they move around (i.e a roving window)?
	Maximum disturbance threshold within a local landscape – Is this a good idea? Are the amounts appropriate? Is the variation with intensity suitable? Is a 5yr period a good idea or would linking to regeneration state be better? If so, how would this be done?
Monitoring and enforcement	Is the approach appropriate for outcome monitoring – implementation and effectiveness? Can the conditions be enforced?

2. Methods

The NSW project team provided the FPA with documents that covered a draft (proposed) approach for the conservation of forest dependent threatened species in State Forests in NSW through an Integrated Forestry Operations Approval process (EPA et al. 2013; NSW EPA 2013).

The comments made by the FPA review team (see Appendix A) in this preliminary report are based on the information provided and a follow-up telephone meeting with M. Pennay, NSW EPA. The technical comment is based on knowledge gained through review work conducted by the FPA as part of a recent Commonwealth funded project (DPIPWE 2013; FPA 2013b) and experience gained through the implementation and monitoring of provisions for biodiversity through the Tasmanian Forest Practices System (FPA 2013c) over the past two decades.

3. General comments on the proposed Threatened Species

Licence

In general, integrating the requirements of four separate licences and shifting from complex, prescriptive, site-specific licence conditions to more outcome-based, landscape-scale provisions (NSW EPA 2013) is considered positive. It appears that despite the best intentions the regulatory framework for threatened species in the forestry context in NSW has become unduly rigid, procedurally focussed and adversarial, which has not necessarily lead to favourable environmental outcomes. There are risks, however, associated with an outcome-based approach if the intended ‘outcome’ or objective is not clear to those tasked with the job of implementing and monitoring the actions taken to meet the ‘desired outcome’. For

example, in British Columbia the previous overly prescriptive Code was replaced in 2000 by ‘desired outcomes’ in the regulations of the *Forest and Range Practices Act 2000*. Forest managers and foresters found themselves relied upon to develop ways to meet the legislated outcomes and this led to considerable confusion and lack of consistency in approaches resulting in some perverse outcomes (Munks et al. 2010). Although best practice guidance material is mentioned in the discussion paper on the proposed structure of the new IFOA licence (NSWEPA 2013) it is not mentioned in the Threatened Species Licence. The effectiveness of the outcome-based approach would be enhanced by referring to agreed guidelines/planning tools in the licence conditions. An EPA co-ordinated training program and advisory service for forest managers would also help to ensure the desired outcome is achieved.

An outcomes focused approach can also result in perverse outcomes if there isn’t a clear monitoring (implementation and effectiveness) program and a process to ensure management actions are adapted when required. While a strategic monitoring program is proposed as part of the new IFOA process (NSWEPA 2013) the design of this monitoring program and the adaptive management process is not made clear in the information provided. A move to a outcome or results-based system with reliance on the forest manager to make the decision on actions to meet objectives (desired outcomes) in regulations, generally results in more flexibility than more prescriptive approaches (Munks et al. 2010; Munks & Koch 2011). Although it may be argued that the outcomes for biodiversity will be similar, or even improved, this is often largely unknown. Some in the broader community will always be concerned that the result will be a poor outcome for biodiversity with overall lower standards and the potential for variable standards in forestry practices across the landscape. Monitoring to evaluate both the implementation and effectiveness of the revised approach and a commitment by all stakeholders to adaptive management (the potential for changing ‘goal posts’) is essential if such an outcome-based system is to work and remain acceptable to the broader community. A requirement for monitoring in legislation and security in funding is essential to demonstrate commitment to the continual improvement component of an outcome-based system by government.

Planning of forestry activities commonly involves initial strategic planning followed by more local operational planning. This order of planning stages could be reflected in the ordering of the licence conditions with conditions that relate to the broad landscape-scale first and conditions for impacts at the local scale second. Since there is a high degree of overlap between the outcome for the ‘landscape connectivity conditions’ and the ‘conditions for the protection of threatened species habitat at the broad landscape scale’ these could be amalgamated.

The impact of forestry activities on freshwater systems does not seem to be covered by the TSL apart from the licence condition for riparian protection in the landscape connectivity section. A separate ‘outcome’ for the management of freshwater systems would probably be more appropriate with the specific licence conditions relating to freshwater systems moved to this section. Roading impacts need to be addressed.

3.1. Recommended actions

1. Consider changing the title of the licence conditions from ‘threatened species licence’ to ‘biodiversity licence’.
2. Re-structure the licence, with conditions that relate to the broad landscape-scale first and conditions for impacts at the local scale second. Consider adding a separate outcome/licence condition for impacts on freshwater systems. See suggested re-structure in Table 2.
3. Consider amalgamating some licence conditions where the desired outcome is similar (eg., the outcome for the ‘landscape connectivity conditions’ and the ‘conditions for the protection of threatened species habitat at the broad landscape scale’). The outcomes could be reworded as ‘Goals’, followed by a series of management targets to meet the goal and then recommended actions delivered through planning tools, see (FPA 2013a).
4. The EPA should consider taking an active role in promoting best practice through the development of ‘user-friendly’ planning tools/guidelines and an EPA co-ordinated training program and advisory service for forest managers and foresters.
5. Planning tools and guidelines should be referred to in the TSL. Management actions likely to change may be delivered through planning tools that hang off the licence. Have a two-tier approach with some tools that are just informative, and some that are mandatory. Develop a clear process for the updating of such planning tools to promote adaptive management.
6. An advisory process should be developed to facilitate advice on ‘alternative approaches’ when the prescribed management targets/actions cannot be met. This will enable a clear and transparent decision-making process if management approaches are challenged by the broader community.
7. Develop an MOU with DPI Fisheries to cover an agreed management approach or procedures relating to the regulation of fisheries and threatened species licence conditions via the EPA. This will further streamline the bureaucratic process so that one agency is primarily responsible with referrals to the DPI Fisheries when required.
8. A monitoring program should be designed and the key elements included as part of the licence conditions. It should include ‘desired outcomes’ for implementation and effectiveness monitoring and should include a funding commitment and a commitment to adaptive management (the potential for changing ‘goal posts’).
9. A commitment from industry and government to support monitoring and adaptive management should be sought. Funding previously used for pre-harvest surveys could be redirected into monitoring.

Table 2 Suggested re-structure of licence

General licence conditions		
	Conditions for impacts at the landscape scale	
		Habitat network (include threatened species protection areas and

		conditions for connectivity)
		Threatened Ecological Communities
		Freshwater systems
		Key threatening processes
	Conditions for impacts at the local scale	
		Thresholds for habitat protection (spatial and temporal)
		Refuge and food tree retention (clumps and single trees)
		Significant tree retention (Giant trees)
		Burning
Specific licence conditions for threatened species		
		Species management plans
		Species site-specific conditions
Licence conditions for monitoring		

4. General comments on the Outcomes (Objectives)

Having clear and measurable objectives is an essential part of biodiversity management planning. Clear objectives will facilitate understanding between stakeholders and provide guidance for the development of management strategies which link the intent of the objective to on-ground actions (Koch et al. 2011b). An objective with a clear intent allows flexibility in how the management guidelines are applied.

Many authorities responsible for biodiversity conservation in Australia have broad high-level objectives which offer little practical guidance for management. For example, a key objective in the Victorian Sustainability Charter 2006 that applies to State forest is ‘to maintain and conserve biodiversity in State forests’ (Victorian Government 2006). Similarly, the objective of the Tasmanian forest practices system in relation to the management of biodiversity is ‘to achieve sustainable management of the forests for the long term maintenance of natural and cultural values’ (Forest Practices Board 2000).

These broad high-level objectives need to be further refined by sub-objectives which are targeted and have a clear intent. Knowing the intent of an objective is necessary to implement the correct actions and to ensure that the objective is not misinterpreted.

For example, the FPA Biodiversity Landscape Planning Guideline (BLPG) (FPA 2013a) provides a series of high-level objectives (termed Goals) which are each broken down into a

number of management targets. Each management target has a clear intent for biodiversity management, which can be achieved by a number of actions. The actions suggest a way of achieving the management target on the ground, thereby providing a clear pathway from the broad high-level goal down to the on-ground action (see box 1 for example). Each action has a guideline (or recognised need for a guideline to be developed) to assist with on-ground implementation.

Table 3 An example of the how objectives are delivered in the FPA Biodiversity landscape planning guideline (FPA 2013a).

Goal	Management Target	Action
Maintain connectivity for flora and fauna	Maintain and/or enhance linkages along water courses and between water courses, capturing a range of habitat types and topographies.	Maintain streamside reserves on class 1-4 streams in native forest operations; progressively re-establish streamside reserves in plantations on previously cleared sites.

Outcomes (objectives) are provided for each licence condition in the draft NSW Threatened Species Licence (EPA et al. 2013). For some outcomes the intent is clear. For example, the outcome for landscape connectivity is - ‘*A network of forest areas that are excluded from logging operations will extend across the State Forest Estate at a local and landscape scale to allow the movement, dispersal of threatened species and facilitate access to areas of refuge and allow for recolonisation of areas after harvesting*’. This outcome is similar to the Goal and Management Target for maintenance of connectivity within the BLPG (Table 3). The licence concepts for landscape connectivity include riparian, ridge and headwater protection. Discussion may occur around the width of buffers etc., but the pathway from outcome to licence concept for landscape connectivity is clear.

Outcomes that do not provide the user with a clear intent can be open to misinterpretation and poor on ground outcomes. An example of an unclear outcome in the draft NSW Threatened Species Licence (EPA et al. 2013) is that proposed for threatened ecological communities (TECs), which states - ‘*Threatened Ecological Communities will be protected from harm caused by forestry operations.*’ The term ‘*protected from harm*’ is ambiguous. It is unclear if the intent of this outcome is to exclude all forestry operations from TECs or only allow forestry operations which do not harm TECs. No definition is provided for the term ‘*harm*’ and it is uncertain who determines if a TEC has been ‘*harmed*’. The ambiguity around this term means the user is not provided with a clear understanding of the intended on-ground outcomes.

A recent review of biodiversity monitoring programs in the forestry context in the Pacific North West (Munks et al. 2010) found that the clarity and scale of the objectives influences the type of monitoring undertaken. Broad-scale trend monitoring is the most appropriate response to broad-scale or fuzzy objectives such as those that are typically set in high-level policy statements. This may be the most cost-effective approach where objectives/targets are

unclear at the finer spatial scale and variable in application across landscape, and where there is a need to take into account cumulative effects. This type of monitoring has been implemented successfully in parts of Europe (e.g.(Kavanagh 2007)) and more recently in New Zealand, but it remains a notable gap in many jurisdictions including Australia. Where objectives or desired outcomes are clear, the question-oriented approach seems to improve forest management most rapidly. The cost of this approach is that it may be difficult to maintain continuity of institutional support and funding for such ‘operational-scale research’ after the first-order questions have been answered. Another cost, if such a program is run instead of a long-term trend monitoring program, is that new sites will need to be established to address each subsequent round of management questions, thus losing the capacity to examine trends and cumulative effects across the landscape. Ideally, both approaches to biodiversity monitoring should be employed.

4.1.Recommended actions

1. Review outcomes (objectives) in the IFOA and TSL and ensure they are clear, quantitative, outcomes based, appropriate for forestry planning, and flexible in how they might be applied.
2. Avoid conflicting outcomes and consider amalgamating where overlap (eg., outcome for single tree retention and habitat clumps)
3. Definitions of terms used in the outcomes should be provided in the TSL document.
4. Since the appropriate type of monitoring depends on the clarity and scale of the objectives this should be taken into account when reviewing the outcomes.

5. Conditions for impacts at the local landscape scale

The ‘conditions for impacts at the local landscape scale’ specifies minimum levels of forest retention and maximum levels of forest harvesting, in order to maintain species habitat. Both licence concepts have value for managing biodiversity in forestry areas, but further detail is required to ensure they help achieve the stated outcome.

5.1.Comments on the outcome

- The order of the current wording places greater focus on meeting the thresholds rather than maintaining habitat for fauna. A change in wording could emphasise that the reason for retaining stands is to ensure habitat is available for biodiversity.
- The current wording specifically mentions enhancing opportunities for recolonisation. This is one possible desired outcome, but can be difficult to achieve for some species. An alternative objective is to take a bigger picture view and aim to provide sufficient habitat at multiple spatial scales to maintain viable populations for all species. This alternative objective can be achieved by retaining habitat within or outside the harvest area, and so provides greater flexibility in how the outcome is delivered.
- Different seral stages provide habitat for different species, so maintaining habitat for all species requires maintenance of stand age structure. If maintenance of habitat for all species is mentioned in the objective then stand age structure does not need to be mentioned specifically, although it is important to raise the issue of stand age

structure somewhere. However this could potentially be done in the licence concepts rather than the outcome (e.g. licence concept 2).

- The current wording focuses on threatened species. This document is the threatened species licence, but it is important to manage all biodiversity regardless of whether it is threatened or not. Consider removing the explicit reference to threatened species.
- This approach will only be implemented on public land, which should be made clear here or elsewhere.
- Revised wording to consider is: “The licence will ensure that sufficient habitat is maintained in the local landscape to maintain species across their range on public land.”

5.2. Comments on the licence concepts

5.2.1 Minimum threshold for habitat protection

- Retaining intact forest in the local landscape will help provide habitat for many species, but the value of this retention depends on which areas are retained. The current wording provides little guidance on how to select areas for retention, or how to assess the value of the existing retained areas.
- It needs to be made clear how these thresholds for habitat retention fit in with threatened species management. Areas selected for retention could focus on suitable habitat for threatened species, and/or maintenance of stand age structure (mature forest in particular). However, the suggested threshold or the areas currently retained may not always be adequate to cater for the requirements of threatened species. It needs to be made clear how decisions are made in terms of managing threatened species habitat within this licence concept, or whether habitat management for some threatened species can be in addition to this requirement.
- Ecological thresholds are very hard to establish, particularly for multiple taxa. The ecological literature shows a range of habitat retention thresholds exist for different species (<5% to >80%, Fahrig 2002). The most commonly cited threshold is 30% (Andren 1994; Flather & Bevers 2002; Monkkonen & Reunanen 1999; Rompre et al. 2010), but there is considerable uncertainty around this value. It is therefore clear that any threshold used will be a management threshold not an ecological threshold, and this should be made clear in any relevant documentation.
- Re-zoning of the areas of habitat retained will help ensure protection of these areas over the long-term. However a process for reviewing the zoning will need to be established if the values of the retained areas change (e.g. due to wildfire).
- If this licence concept is applied, it is critical that records are kept of why areas were retained. A spatial layer with this information will help with long-term planning and monitoring over successive harvest rotations.

5.2.2 Maximum threshold for the amount of area recently disturbed

- It is not clear from the current wording what the actual intent of this licence concept is. Presumably the intent is to disperse harvesting in space and time to ameliorate the localised impacts of harvesting, and to maintain seral stage patterns in order to

provide habitat for the full range of species. An additional objective for this criterion may be to maintain stream flow.

- Providing a threshold limiting the amount of harvesting in an area is one way to ameliorate the localised impact of harvesting. Using a threshold has the benefit of being clear, easy to understand and easy to audit. The challenges with using a threshold include establishing a meaningful threshold that will not lead to perverse outcomes. For example a simple threshold for harvesting does not ensure that the full range of seral stages will be maintained. This could potentially be resolved by including an alternative or additional criterion that focuses on managing seral stages.
- Managing for seral stages could help maintain stream flow as well as maintaining habitat for a range of species. However, establishing a practical and meaningful seral stage management strategy would be challenging. The scale at which a seral stage management strategy would need to be applied may differ to other management strategies (e.g. the catchment scale).
- If using a threshold for harvesting, the different types of silviculture would need to be weighted differently. Potentially a formula would need to be developed to help establish if the threshold had been exceeded, with different weightings for the different types of silviculture. When developing this approach careful consideration would need to be given to the spatial information available and the record keeping processes.
- The proposed approach defines ‘recently disturbed’ as being harvested within the last five years. Presumably this five years is related to the age at which regeneration has fully established (or not). Ecologically it would be more meaningful to relate management to regeneration success directly, but this is more difficult to assess and monitor. The validity of using a time period (five years) as a surrogate for regeneration success would need to be demonstrated (e.g. through regeneration audits).
- The licence concept currently states that the ‘amount of area’ recently disturbed will be regulated. Presumably this is a proportion of the local landscape rather than an actual area, in case the size of the local landscape changes or is different between areas. If this is correct, it needs to be clear if this percentage is of the total area, or only the forested area.
- Applying this approach at the local landscape scale rather than the harvestable area is justified, as the harvestable area is an arbitrary boundary that should have little meaning ecologically or hydrologically. However, it should be considered whether any perverse outcomes could occur. For example, if all the retained areas are lower quality or lower density forest, would this impact the value of the approach?

5.2.3 Definition of local landscape

- The suggested definition of the local landscape is that it be made up of State Forest Compartments and that a maximum size is specified. The average compartment is about 250-300 ha (M. Pennay pers. comm.), but the suggested maximum size for the local landscape is 1500 ha.
- When defining the local landscape it is important to consider what is both ecologically meaningful and practical. Differentiating by land tenure is not

ecologically meaningful, but presumably it is not possible or practical to consider all land tenures in the local landscape. Presumably there is more flexibility in the size of the area that is defined as the local landscape, and so this can be given greater ecological consideration.

- In order to achieve the outcome of this licence condition, it is important to consider species ecology when defining the size of the local landscape. Species vary dramatically in their dispersal capabilities and home range sizes, and the definition of the local landscape should try and cater for species with more limited dispersal capabilities. The 1500 ha area suggested is much greater than the dispersal abilities of many species. We suggest that a smaller area be used to define the local landscape. The FPA are considering a two-scale approach to habitat management. To ensure *distribution* of habitat the local landscape applies at a 1km radius around the operation (~314 ha) and to ensure adequate *amount* of habitat the greater landscape is applied at a 5km radius (~8000 ha). These areas were loosely based around operation sizes and the ecological requirements of a high priority threatened species, and different management thresholds apply at the different spatial scales (FPA 2012b).
- There are two alternatives for applying management at a local landscape, having pre-defined local landscapes or having roving local landscapes that are applied over and around harvesting operations. There are advantages and disadvantages to both approaches, and the best approach is likely to depend on how forest planning occurs. Fixed boundaries can be easier for auditing and potentially long-term planning. Roving boundaries can help prevent perverse outcomes (e.g. if harvested areas are on the same boundary in adjacent local landscapes then the area of impact could be much larger than intended or expected). If a roving landscape is applied it is critical that there is a clear process for identifying the areas that are retained, so that these areas are flagged as not available for harvest in the near future.

5.2.4 Classifying silviculture intensity

- It is currently proposed that the intensity of operations is classified and different harvest threshold limits are applied for the different intensities of operations. This approach is reasonable as different types of silviculture have different ecological and hydrological impacts.
- The proposed method for classifying silviculture intensity is by retained basal area. Different forest types naturally have different basal areas, so classifying by a percentage of the basal area may be more appropriate.
- It will be difficult to define meaningful thresholds for classifying silviculture intensity into simple discrete categories (e.g. high, medium, low). To do so requires a clear understanding of the impact this licence condition is trying to mitigate. For example, different scales may be appropriate to mitigate impacts on hydrology than would be used if mitigating impacts on hollow-using fauna.
- If a weighted formula is used for establishing harvesting thresholds, as suggested above, the potential for using a sliding scale should be explored (i.e. the % basal area removed is considered in the formula).

5.2.5 Other comments

- The heading for this licence condition is not in keeping with the other headings in this document. Suggested alternative wording to make the focus clearer is ‘maintenance of stand structure’ or ‘forest/habitat retention at the local landscape scale’.
- The two licence concepts, a threshold for habitat retention and a threshold for amount of harvesting, could be independent or could be considered together depending on their intent. Potentially, the two could be combined into management of stand age structure which would help ensure some areas are managed for long term retention and there is a limit to the amount of harvesting. However, to develop a flexible and appropriate stand age structure management matrix would be challenging. If applied as percentages of the local landscape and the thresholds used are based on species ecological requirements or hydrology, the two licence conditions could complement each other but be applied independently.

5.3. Recommended actions

1. Review wording of the outcome.
2. Clarify the intent of the licence conditions.
3. For licence condition 1 clarify how areas are to be selected for retention, and how management might differ depending on the values that are or are not retained.
4. Clarify how the minimum habitat retention guidelines fit in with threatened species management.
5. Review definition for local landscape.
6. Consider catchment management when establishing maximum harvesting thresholds.
7. Consider managing for stand age structure more explicitly.
8. Establish record-keeping procedure for the selection and location of retained areas.
9. The requirement to regenerate the forest following harvest does not appear to be emphasised in this licence concept? This is surprising as successful regeneration of a harvested area back to its pre-harvest state is a fundamental to the principle of ecologically sustainable forest management. A statement about use of appropriate silvicultural methods, ensuring adequate regeneration, should be included as part of this licence condition.

6. Threatened ecological communities

A Threatened Ecological Community licence condition is important for maintaining the extent, condition and distribution of ‘at risk’ vegetation communities. It also contributes to the maintenance of native vegetation across the landscape thereby assisting with management of flora and fauna habitat.

6.1. Comments on the outcome

- The outcome for threatened ecological communities (TECs) is broad. The outcome states ‘Threatened Ecological Communities will be protected from harm caused by forestry operations’. It is unclear if the intent is to exclude all forestry operations from

TECs or to allow forestry activities which do not cause harm. The wording requires clarification.

- The term ‘protect from harm’ is problematic as not all forestry activities will harm all TECs. Depending on the type of operation and ecological values of the TEC, forestry has the potential to improve the condition of degraded TECs, or not affect the values of a TEC over the long term. For example, low intensity selective harvesting in dry eucalypt forests may be compatible with the maintenance of ecological values or may enhance the condition of the TEC through weed control and/or promoting regeneration. However, if the intent of the outcome for TECs is to exclude all forestry operations regardless of the effect on the ecological values then the current wording may be misinterpreted.
- Suggested wording to clarify the intent is: ‘Threatened Ecological Communities will be protected (intact) from forestry operation, unless the forestry operation is unlikely to substantially detract from the ecological values of the TEC’. This wording indicates that the intent is to protect the TECs from forestry operations in the first instance. The change from ‘harm’ to ‘unlikely to substantially detract’ allows for recognition that some forms of forestry may be compatible with maintaining the specific values of the TEC. The meaning of ‘substantially detract’ is also open to interpretation. Within the Tasmanian forest practices system the assessment of ‘substantially detract’ is made by the Forest Practices Authority in consultation with specialists as required. This provides an assessment which is more independent than if the decision was made by the timber harvesting applicant. If the decision making process was placed with the forest company it is recommended that a set of guidelines is developed by specialists to standardise the situations when forestry operations are compatible with the values of a TEC.

6.2. Comments on the licence concept

- A process for updating/validating the TEC map is needed. Producing these maps is a time consuming process and they can still be inaccurate. If decisions are made solely based on the maps, areas may be retained for values they do not have, or areas with these values may be available for harvest. It is important that there is a process for doing on-ground assessments and validating the map and that not all decisions are based on these maps (at least in the short term until the maps are validated).
- A buffer around fire sensitive TECs would reduce edge effects and improve the long term survival of retained areas.

6.3. Recommended actions

1. Reword the outcome to clarify the intent of the TEC licence.
2. Consider rewording the outcome to allow for recognition that some forms of forestry may be compatible with maintaining the specific values of a TEC.
3. Consider indirect impacts (e.g. burning adjacent to a TEC)
4. Develop an on-ground assessment process (as part of harvest planning) for identifying TECs in the absence of fine-scale accurate habitat mapping.

5. Develop a process for updating TEC maps from survey data.
6. Develop a transparent process for determining when or under what conditions TECs may be impacted through an ecological harvest plan.
7. Define the vegetation communities, and provide the forest industry with a key to identifying each TEC and supporting training courses.

7. Tree retention

The tree retention licence condition is a measure for maintaining hollow-bearing and feed trees. These are important fauna habitat features that take long periods of time to develop, and therefore require special management.

7.1. Comments on the outcome

- Consider changing the wording to focus more strongly on the ecological outcome (maintaining habitat for fauna) rather than the management target (meeting thresholds).
- Consider including the words ‘over time’ to make it clear that a continual supply should be provided over the long term.
- The current wording focuses on threatened species. This document is entitled the ‘Threatened Species Licence’, but it is important to manage all biodiversity regardless of whether it is threatened or not. Consider removing the explicit reference to threatened species.

7.2. Comments on the licence concept

- The benefits of using a single tree retention prescription are as follows -
 - It can help species which rely on these features to use the harvested area;
 - It can help retain higher levels of suitable trees if they are at low densities;
 - It is easy to audit.
- There are also limitations with using a single tree retention prescription -
 - In most areas the rate of retention within harvested areas is unlikely to alone meet the requirements for hollow-using fauna (Koch et al. 2008; Lamb et al. 1998);
 - Retained isolated trees can be subject to high rates of collapse due to windthrow or other factors (Duhig et al. 2000; Gibbons et al. 2008);
 - Not all species will utilise retained isolated trees, at least in the short term (Cawthen & Munks 2011);
 - Not all areas will have the prescribed rate of suitable trees (Munks et al. 2004);
 - It is very difficult to identify suitable hollow-bearing trees (Koch 2008; Koch et al. 2008; Stojanovic et al. 2012);
 - Single tree retention is not practical for some types of more intensive silviculture (e.g. clearfell-burn and sow).
- A potential alternative approach that addresses the limitations of single tree retention is patch retention. Retention of patches of suitable habitat throughout the landscape

mean areas with the highest quality and density of habitat can be maintained. Patch retention does not necessarily promote recolonisation of harvested areas by fauna, but can help maintain populations of species in areas utilised for wood production. Therefore, whether patch or single-tree retention (or a combination of both) is more appropriate depends on the management objective for a particular area of forest. See the Tasmanian mature habitat management approach for further ideas on multi-scale management of mature habitat (FPA 2012b). Relevant spatial information is required to apply patch retention at a landscape-scale.

- Having a single rate of tree retention does not account for the variability in tree density or fauna requirements between forest types.
- The draft licence suggests that 5 hollow-bearing trees and 5 recruitment trees should be retained. For some discussion on the number of hollow-bearing trees that may be required in NSW see Gibbons and Lindenmayer (1997) and Smith (1993). In Queensland the level of tree retention was not set at the level estimated to be used by fauna to strive for a compromise between fauna conservation and wood production (Lamb et al. 1998).
- The current wording is very prescriptive when it states the number of trees that ‘will be undamaged after two years. This two year time frame is not ecologically meaningful, and many issues can arise which affect the number of retained trees (e.g. wildfire, illegal firewood harvesting etc). The wording of this licence concept could be revised to be more outcomes based, by using words like ‘providing adequate habitat over time’ or ‘protect the trees from fire and woodcutting’.
- If the tree retention approach is adopted, clear definitions of feed, hollow-bearing and recruitment trees are required, and identification tools are needed to ensure the best trees are selected during planning.
- If suitable mature habitat or hollow-bearing trees are not available, it is important to retain recruitment habitat for the future. Modelling suggests that at least two recruitment trees are required for each hollow-bearing tree (Gibbons et al. 2010). The rate of retention of recruitment trees should be reviewed.

7.3. Other comments

- Consider rewording the title of this licence condition so it is clear the focus is on these special trees and not tree retention that may occur as part of the silviculture used.

7.4. Recommended actions

1. Review wording of the outcome.
2. Consider taking an area-based landscape approach to management of mature trees.
3. If taking a single-tree retention approach, review the literature on fauna requirements in different forest types and be transparent in how a decision on what, and how much is retained, is reached.
4. Review wording of licence conditions to emphasise the desired outcome and be less prescriptive.
5. Develop definitions and identification tools.

6. Ensure the approach taken will help provide habitat over the long term, and is compatible with the different types of silviculture used.

8. Giant trees

The giant tree licence condition aims to protect all giant trees not retained in other areas. It is unclear whether they are to be retained for ecological or social values, or a combination of the two.

8.1. Comments on the outcome

- The current wording of the outcome is unclear and a number of terms require definition (e.g. ‘isolated’, ‘very large/old trees’, ‘harm’). Some of these terms are clarified in the licence concept, but further clarification is required (see below).

8.2. Comments on the licence concept

- What is a large or old tree will vary between tree species and vegetation communities. A suitable definition for a giant tree will therefore depend on why these trees are being retained – whether for ecological or social values. If they are to be retained primarily for their ecological value, a range of diameters may be required for different ecological communities. If giant trees are to be retained for their social value, potentially a single diameter limit is sufficient, but a tree height threshold may also be required.
- Trees with a diameter over 1.8 m will almost certainly have high ecological value. However, trees of this size are relatively common in older wet forest areas (in Tasmania) and retention of all these trees may have considerable impacts on silvicultural practices. The prevalence of this diameter tree in NSW should be assessed so the impact of this provision is understood.
- It should be clarified if giant trees can be dead or if they must be live.
- There is a small potential that the stated threshold could lead to some perverse outcomes, in that retained trees may not be allowed to grow very large in case they exceed this threshold.
- Retained trees would probably need to be protected by a clump of vegetation to protect them from windthrow/burning etc. This does not necessarily need to be prescribed in the licence concept, but it could be suggested as an approach to ensuring the trees are protected.

8.3. Recommended actions

1. Clarify why giant trees are to be retained (eg., cultural/social value?)
2. Review definition of giant trees

9. Habitat clumps

Habitat clumps are small patches of intact vegetation that should be retained within the harvested area. It does not appear that habitat clumps need to have any particular values, but

they can be combined with the tree retention requirements. There is also potentially overlap between the habitat clump and local landscape licence conditions.

9.1. Comments on the outcome

- There is overlap between the outcomes for the tree retention and the habitat clump licence conditions, although the retained trees prescriptions are directed more towards achieving outcomes for fauna dependent on hollow-bearing and feed trees while the habitat clumps are more general. These licence conditions could potentially be combined.
- The habitat clump outcome is quite general and does not appear to be targeting any particular features, other than representative localities of the harvested area. Little guidance is therefore provided on how to select these retained areas (e.g. whether to focus on older habitat, or areas with a denser understorey etc).
- Consider using the term ‘intact’ rather than undisturbed/undamaged as retained areas can be damaged or affected by burning or edge effects etc.

9.2. Comment on the licence concept

- It is proposed in the draft licence that specified basal areas are used to define when to retain habitat clumps or not. This is difficult to achieve as basal areas vary between forest types, and so basal area is not necessarily an indication of the intensity of harvest (see discussion above). The alternatives are to use a percentage of basal area, or to always require clumps if harvesting occurs. In the notes it states that patches of undisturbed forest are retained in standard operations, meaning habitat clumps are effectively retained in these areas and so the need for defining when clumps are not required seems unnecessary.
- Consider including threatened flora as a value around which habitat clumps may be based.
- The current guidelines are quite prescriptive in how clumps are to be retained. Ensuring dispersal of clumps may help provide ‘stepping stones’ that animals can use to move through the landscape. However, if the guidelines are too prescriptive there will not be enough flexibility to modify them to best suit the local conditions. It therefore needs to be clearer what these habitat clumps are being provided for. Some suggestions can be made on how this could be achieved, but they should be worded so allow flexibility in how they are applied.
- Depending on the ultimate objective of the habitat clump provisions, it may be appropriate to allow aggregation of the clumps. Retained trees are more likely to persist if they are protected from fire and windthrow by patches of intact forest. If the best hollow-bearing and feed trees are naturally aggregated, good long-term ecological outcomes may be achieved by aggregating the habitat clumps around these retained trees. Larger patches can be less edge-affected, and can be preferentially used by some species (Cawthen & Munks 2011).
- How are habitat clumps to be managed in clearfall operations?

- There is no right answer for the best patch size or the number of patches to retain. However the importance of these retained areas is likely to depend on the condition and availability of habitat in the surrounding landscape.
- If habitat clumps are retained it is important that they are mapped and records are kept to facilitate management of these areas during successive harvests.
- The potential exists to take a more landscape-scale approach to habitat management than is suggested here.

9.3. Recommended actions

1. Clarify the wording/intent of the stated outcome.
2. Alter the licence prescriptions to be less prescriptive and more flexible to cater for local conditions.
3. Consider amalgamating the habitat clump requirements with the retained tree requirements, or taking a more landscape approach to habitat retention.

10. Landscape connectivity

Isolation of native forest patches can occur in space (e.g. a native forest patch within a plantation or agricultural landscape), and time (e.g. a mature patch of forest within a regenerating forest landscape). Maintaining connectivity at multiple spatial scales across the landscape is recognised as an important principle of biodiversity conservation (Lindenmayer & Franklin 2002). Connectivity of habitat across the landscape can assist movement of biota which promotes gene transfer, recolonisation of species into disturbed areas and reduces the risk of population fragmentation. Wildlife corridors, streamside reserves and stepping stones (habitat patches) can be valuable methods for maintaining habitat connectivity (see references in Lindenmayer & Franklin 2002) for biodiversity conservation in the broader sense. In order to meet the habitat connectivity requirements of specific species, particularly threatened species, connectivity needs to be considered at multiple spatial scales and for multiple values.

10.1. Comment on the outcome

- Consider a simplified outcome that stills captures the intent, such as ‘maintain connectivity to allow movement and dispersal of threatened species’.
- Consider replacing ‘threatened species’ with ‘flora and fauna’ to allow increased flexibility in connectivity design (not dependent on the specific requirements of threatened species).
- Recolonisation as an outcome may be difficult to achieve if threatened species have habitat requirements which are not found in young regenerating forest.

10.2. Comment on the licence concept

- Connectivity of habitat across the landscape can be achieved through habitat corridors, riparian habitat protection buffers and stepping stones (habitat patches). Modify wording to make it clear that a range of retained areas can help connect the landscape.

- To maintain connectivity for threatened species it is important to capture a range of habitat types (e.g. topographies) at multiple spatial scales as not all species use riparian areas.

10.2.1 Riparian habitat protection

- Narrow strips of retained riparian vegetation may be subject to edge effects (drying, weed invasion, windfall).
- Riparian habitat protection buffers will not provide suitable habitat for all species.
- Buffers on headwater streams will help protect the morphology of many streams and minimise changes in temperature that result from logging, which helps maintain habitat quality for some fauna. In Tasmania, streamside reserves that are 30 m wide appear to protect habitat for most aquatic and terrestrial fauna studied, but even these reserves are entirely edge-effected for some terrestrial fauna like ground-dwelling beetles when the adjacent area is harvested (i.e. for at least five years after harvest). Streamside reserves that are 40 m wide can be edge effective by seem to provide habitat for most riparian species examined (Koch et al 2013).
- It needs to be clear to users how to determine what the riparian buffers are.
- Some threatened species with limited distributions may need wider riparian buffers than most other species. Consider deleting licence concept three which may result in areas being retained unnecessarily. The requirements of the species that need wider buffers could be captured by the licence condition for other threatened species not captured by general licence conditions.

10.2.2 Stream classification

- Under the Strahler classification system higher order streams (1 and 2) could have large catchments (e.g. long narrow valleys) within minimal buffers. This has the potential to result in large-scale downstream effects on water quality and flow.
- Stream classification using a catchment area threshold may be more practical for management than the system proposed, because catchment areas can be easily assessed using GIS while a more careful examination of the stream network is required to use the proposed approach.
- The classification system chosen should reflect the purpose. If the purpose is management of water quality and flow by establishing buffers, then the classification should reflect the possible hydrological changes and the catchment area classification system may be more practical.
- Neither classification system adequately accounts for the complexities of the local environment. For example, steep slopes with erodible soils will require much less water for a flood event than a shallow gradient catchment with stable soils.

10.2.3 Ridge and headwater protection

- Provide more guidance on the spacing of corridors and the width of connections/corridors across ridges and/or between headwater streams. The width of corridors required for connectivity will vary depending on the landuse within the immediate landscape. An appropriate width and frequency of corridors has been

detailed in Tasmania (100 m wide every 3-5 km across the landscape, capturing a range of habitat types and topographies) which has been useful for monitoring.

10.3. Recommended actions

1. Consider simplifying the wording of the outcome.
2. Develop a process for identifying the different topographies within the existing network of retained corridors to determine if a range of habitat types and topographies are being captured for landscape connectivity.
3. Consider the practicality of a catchment based stream classification system.
4. Consider providing more guidance around the desired width and spatial distribution of corridors.

11. Burning

Prescribed burning is often used to achieve regeneration following logging. Burning is also increasingly being used as a tool to achieve a variety of stand management objectives, such as spatial heterogeneity, weed reduction and to stimulate reproduction in some plants (Lindenmayer & Franklin 2002). A burning licence should take into consideration and balance the positive and negative outcomes from burning.

11.1. Comments on outcome

- Retention of all trees including single scattered trees may be an impractical outcome if burning is required for regeneration and scattered trees retained under the ‘tree retention’ licence cannot be protected. The practicality of this outcome should be discussed with NSW Forestry Corporation.
- Native forest silviculture should not be applied to an area unless regeneration can be achieved and forest maintained in the long term. If the burning licence outcomes and concepts prevent regeneration due to other licence outcomes and concepts (e.g. single tree retention) then the licences must be reviewed to ensure they do not have conflicting conditions.
- Consider deleting the second sentence of the outcome and moving the intent of this sentence to the licence concepts under the tree retention licence condition.

11.2. Comments on licence concepts

- The first licence concept states ‘The licence will allow post-harvest burning within the harvested area for a period of 2 years following the completion of harvest.’ There may be circumstances when the post-harvest burn cannot be achieved within 2 years. It is recommended that the intent of this licence concept is reviewed to ensure that regeneration can be achieved.
- The long term survival of fire sensitive areas (such as rainforest or wetlands) can be improved if buffers are used to reduce edge effects. For example the long term survival prospects of relict rainforest patches is enhanced by the provision of an undisturbed buffer of at least 40 metres around the entire perimeter of a patch

(University of Tasmania 1990). Consider including a licence concept which specifies a buffer distance between the regeneration burning boundary and fire sensitive TECs.

- The tree protection provisions are very prescriptive and may be hard to achieve. Consider rewording this licence concept, and moving to the tree retention licence condition.

11.3. Recommended actions

1. Consider the intent of the burning licence and the practicality of meeting the burning licence conditions in terms of achieving regeneration and managing the biodiversity values.
2. Consider the need for prescribed buffers between the burning boundary and a sensitive TEC.

12. Conditions for the protection of threatened species at a broad landscape scale

12.1. Comments on outcomes

- The desired outcome for this condition is similar to the one for ‘landscape connectivity’. It would make sense to amalgamate these two sections and to have one combined ‘outcome’ for retention of a network of habitat across the forest estate to meet multiple goals.
- To be consistent with planning procedures this section should be moved to the front of the licence (see licence structure comments in 3.).

12.2. Comments on licence concepts

- Reference to the relevant planning guidelines, maps, tools would assist with implementation of these conditions.

12.3. Recommended actions

1. Amalgamate with the ‘landscape’ connectivity section and move to earlier in the document (see Table 2Table 2)
2. Reference relevant planning guidelines.

13. Key threatening processes

Many species can be impacted by the same or similar threatening processes. Therefore, having management targeted at these processes rather than a species-by-species approach may streamline management for threatened species.

13.1. Comments on the outcome

- It is unclear what is meant by ‘the activity’. Presumably this is the harvesting operation, but it is unclear if this licence applies to other forestry-related activities (roading, quarrying etc).
- It may not be necessary to state the organisation in the outcome.
- It should be made clear in the wording that not all key threatening processes (KTPs) are relevant to forestry activities.
- Suggested wording is: “Forestry-related activities will be conducted in a way that reduces or minimises the impact of key threatening processes”.

13.2. Comments on the licence concepts

- Have the option for external/independent feedback on how the impact on KTPs is assessed and mitigated.
- Some threats may be increased by forestry activities (e.g. bell bird dieback?). A process is needed to determine if the operations can still proceed if the threat cannot be mitigated.
- Who defines KTPs? Is this the list of KTPs published by the NSW Department of Environment and Heritage? If so, state that this is the agreed list of KTPs or provide a cut down list which applies to FCNSW activities.

13.3. Recommended actions

1. Review wording of the outcome taking into account the above comments.
2. Consider including this section earlier in the licence structure (see Table 2).

14. Species not adequately protected by the general licence conditions

The general licence conditions will contribute to the maintenance of habitat for threatened species but will not always completely capture a species’ management requirements. It is therefore important to have a licence condition that allows for targeted management of species with specialised management requirements. A process for developing the species-specific management conditions needs to be developed. It needs to be transparent when the general licence conditions have contributed to part or all of the management conditions required for a threatened species, and how this decision was reached.

14.1. Comments on outcome

- It is unclear what is meant by the term ‘mitigate any harm’. This may refer to individual animals, populations, the conservation status of the species, or to their required habitat. A similar lack of clarity over this type of wording led to legal proceedings in Tasmania, and it is recommended that it be clear that it does not apply to individuals.
- The term ‘harm’ is open to interpretation and would need to be defined for each species/group of species. For example, some threatened flora species require a certain

level of disturbance for regeneration and long-term population viability. The disturbance created by a forestry operation may initially ‘harm’ a species through local loss of mature plants, but be compatible with the species regeneration ecology and therefore the disturbance will assist with maintaining the species population in the long term and therefore not ‘harm’ the conservation status of the species.

14.2. Comments on licence concepts

- Clarification is required of the process for determining which species and to what extent they are managed through general licence conditions and which species require additional management conditions.
- Consider whether proposed site-specific conditions will take into consideration landuse practices on other tenures which impact the species.
- Consider whether the threatening process or the physical area where the species is most at risk are outside the areas managed for forestry and to what extent management conditions applied through forestry regulations can contribute to the conservation management of the species.
- Develop range maps/habitat maps for threatened species with targeted areas of concern.
- Develop definitions of habitat for each species.
- Consider short-term versus long-term habitat degradation and loss. Some forestry operations present a short-term loss. For example, light selective harvesting initially reduces numbers of mature threatened plant species, but over the longer term will increase the population by stimulating a regeneration event. Alternatively, loss of hollow-bearing trees from a landscape comprised mainly of young regrowth forest would be considered a long-term loss as it can take more than 100 years for hollows to develop (Gibbons & Lindenmayer 2002).
- Consider degradation of forest health (e.g. impacts from weeds and disease) which can cause major impacts on threatened species habitat. Forest health may need to be considered as a general licence.
- The habitat requirements of different threatened species within the same area may not be compatible; if no net loss for forest products is a desired outcome then there will need to be a transparent decision making process for determining where management is focused.
- Consider proximity and composition and contribution of reserves within the landscape. Site specific conditions may need to vary depending on the composition of the surrounding landscape.
- Monitoring the implementation and effectiveness of site-specific management actions is required to assist with adaptive management.
- Expert panels for evaluating and suggesting site specific management actions need to include a representative from the forestry industry who can provide feedback on the practicality of management actions.

14.3. Recommended actions

1. Remove the term ‘harm’ from the outcome. It is too ambiguous. Suggest the wording ‘maintain viable populations’ to replace ‘mitigate harm’.
2. Define what ‘mitigate negative impacts’ is being applied to. For example ‘mitigate negative impacts to species populations within areas subject to forestry operations.’
3. Develop a clear and transparent process to determine which (and to what extent) species are adequately managed through general licence conditions, which species require additional management conditions and a process for adaptive management (based on results of monitoring and/or research).
4. Develop a process to deliver information to practitioners in a clear and user-friendly way.
5. If this threatened species licence is required to manage potential habitat (as well as known locations/populations) for threatened species, additional information will be required such as range maps and habitat descriptions (for an example see http://www.fpa.tas.gov.au/fpa_services/planning_assistance/advisory_planning_tools/Biodiversity_values_database)

15. Monitoring and process to adapt licence conditions / management

Monitoring is an essential aspect of adaptive management. In order to be effective it is important that monitoring programs are targeted to ensure they will efficiently answer important questions, and that there is a process for updating management prescriptions (see also comments and recommendations in section 3. above).

15.1. Comments on outcomes

- It needs to be made clear that this outcome is referring to the threatened species licence conditions.
- Implementation monitoring is also very important to ascertain if the licence conditions are understood, can be, and are being, implemented.

15.2. Comments on licence concepts and other issues

- One of the justifications for the revised approach is to reduce the need for expensive and ineffective pre-harvest surveys and to conduct more monitoring and adapt management as required. Successful monitoring requires a financial commitment by all stakeholders and organisational commitment to adaptive management (see also comments and recommendations in section 3. above).
- It needs to be made clear who will be responsible for the monitoring program.
- There are numerous questions and projects that need to be done to assess the effectiveness of the biodiversity management process. It is not possible to do all of these projects, especially in the short-term and given financial constraints. It is therefore important that projects are prioritised to identify the most important and

cost-effective projects that will provide information that can be used to modify management (see (FPA 2012a)).

- The adaptive management process needs to be clearly identified to ensure that the results of monitoring are used to update management in a timely manner. This may mean that some of the details of the licence concepts should be delivered in planning tools rather than in the threatened species licence.

15.3. Recommended actions

- 1 Clarify wording of the outcome.
- 2 Undertake a prioritisation process to identify monitoring projects to be undertaken (for an example see (FPA 2012a)).
- 3 Develop an agreed monitoring program and refer to in the licence conditions
- 4 Clarify the parties responsible for funding and implementing the monitoring program.
- 5 Clarify the adaptive management process and mention in the licence conditions.

16. Additional comments

- The TSL does not include specific conditions for management of stream flow, forest health, weeds and diseases.
- The overall aim needs to be clear - protecting every individual or maintaining viable populations?
- The development of a decision support system to deliver species-specific management actions (either landscape-scale or local-scale actions) should be considered, to ensure actions recommended to meet outcomes individual are clear. This would help with species-specific monitoring and communication with the general public.
- Some of the wording in the TSL is still very prescriptive. Suggest having difference types of statements – those that are mandatory and those that may be negotiable? Avoid wording things so that it is an offence if something happens accidentally (eg., if a tree is accidentally burnt etc.)
- A delivery/implementation/training plan needs to be developed.
- Include measures to ensure forest (habitat) regeneration after harvest is adequate.
- Currently only talking single scale management approach but claiming want multi scaled approach. Can have different thresholds at different spatial scales.
- The current wording focuses on threatened species. This document is the threatened species licence, but it is important to manage all biodiversity regardless of whether it is threatened or not. Consider removing the explicit reference to threatened species.

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18. Appendix A. Contract Brief

Review of proposed approach for biodiversity conservation in NSW State Forests through an IFOA.

18.1. Background

The NSW project team has prepared a first stage agreement for the management of threatened species and biodiversity values in NSW State forests as part of an Integrated Forest Operations Approval. A broad framework for the management of habitat for a broad suite of species, including threatened species has been agreed with stakeholders and a paper is being prepared for public consultation. The NSW project team has approached the FPA for a review of the proposed approach and advice on the details. In particular on the management

actions and monitoring program (effectiveness, implementation or enforceability perspective) still under development.

18.2. Project Scope

1. The NSW project team will provide the FPA with a draft (proposed) approach for the conservation of a broad suite of forest dependent threatened species, in State Forests in NSW through an Integrated Forestry Operations Approval. This will include a NSW based meeting between the NSW project team and the FPA. This meeting will include a field visit to give the FPA an idea of the types of operations conducted and operational issues.
2. The FPA will undertake an initial review of the proposed approach and provide advice and recommendations on some specific areas relating to threatened species and biodiversity conservation in production forest areas identified by the project team.
3. The FPA will provide more detailed advice on specific management actions and prescriptions proposed to meet threatened species and biodiversity management objectives. The FPA will also provide information on any alternative actions/prescriptions that could be adapted for NSW to effectively manage logging impacts at both landscape (regional) and local scales. These advice and recommendations are to be made with;
 - a. Consideration of the key general/ broader* impacts to threatened species from forestry operations associated with
 - i. loss of hollow bearing trees, feed trees, and coarse woody debris,
 - ii. habitat fragmentation and disturbance, and
 - iii. direct and indirect impacts on aquatic ecosystems (eg wetlands, waterways).

*(acknowledging that some impacts are species or site specific and these will be dealt with individually where appropriate through a separate consideration)

and

- b. Consideration of the operational and environmental effectiveness of approaches taken in Tasmania (and other Australian Native forests where appropriate) to conserve threatened species and biodiversity under codes of practice.
4. Provide informal advice to the project team on questions to clarify any issues and considerations raised above.
5. Provide a draft report by 13th December 2013 and following consultation with the project team provide a Final report by 3rd March 2014.

Note: The NSW project team will provide FPA with background information on the current NSW licence conditions, threatened species and approaches used in the current framework, and clarification or supporting information as needed.

18.3. Project outputs and milestones

- The FPA will provide the NSW project team with a report covering a review of the proposed approach (1) and recommendations on specific areas identified by the NSW team (2 and 3).
- Milestone 1 - A short draft report covering the first preliminary stage of the review (1 and 2) will be provided to the review team by the 13th Dec 2013.
- Milestone 2 - Final report with a more in-depth review and advice on specific management actions and prescriptions will be provided by the 3rd March 2014.