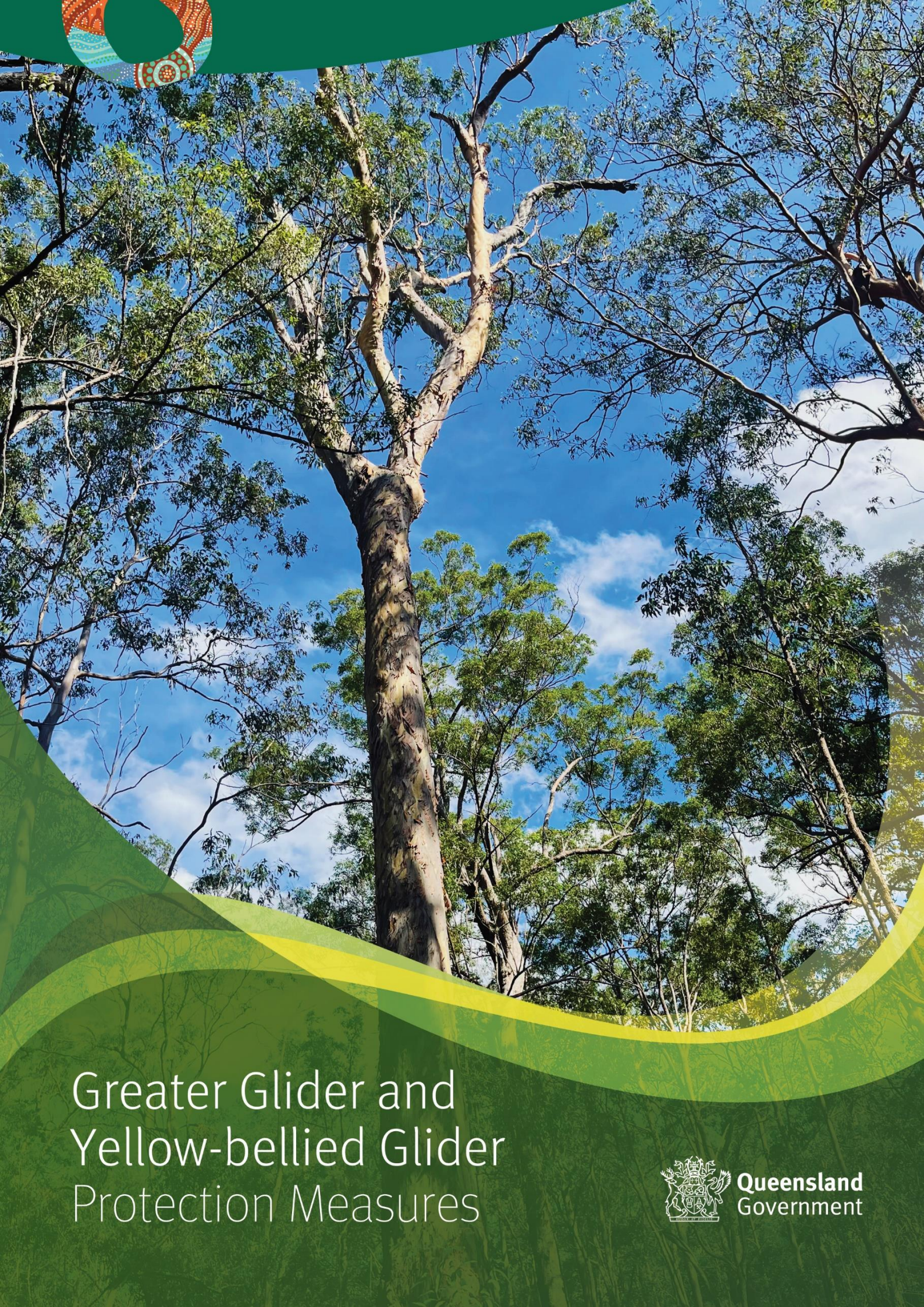

Greater Glider and Yellow-bellied Glider Protection Measures

Queensland Government

This publication has been compiled by Forestry, Department of Primary Industries.

The Department of Primary Industries proudly acknowledges all First Nations peoples (Aboriginal peoples and Torres Strait Islanders) and the Traditional Owners and Custodians of the country on which we live and work. We acknowledge their continuing connection to land, waters and culture and commit to ongoing reconciliation. We pay our respect to their Elders past, present and emerging.

Background

Australia's largest gliding marsupials, the greater glider (*Petauroides volans*) and yellow-bellied glider (*Petaurus australis australis*), are two highly specialised species that are entirely dependent on intact eucalypt forest and woodland habitat. Both species have similar geographic distributions and occupy similar habitat types throughout eastern Australia. In Queensland, the gliders are restricted to the mainland and are largely patchy in their distribution.

Conservation advice under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) for the greater glider lists key threats as frequent and intense bushfires, inappropriate prescribed burning, climate change, land clearing and timber harvesting. Similarly, conservation advice for the yellow-bellied glider lists its key threats as climate change, altered fire regimes, clearing, fragmentation and timber harvesting[1].

In 2022, following evidence of a sudden population decline and the catastrophic wildfires of 2019-20 which destroyed more than 30% of their habitat throughout eastern Australia, the greater glider (southern and central) was uplisted from vulnerable to endangered on the threated species list under the EPBC Act. In the same year, for similar reasons, the yellow-bellied glider (south-eastern subspecies) was listed for the first time as vulnerable under the EPBC Act. Both species were listed to the same status under the Queensland *Nature Conservation Act 1992* in 2021.

In response, the Department of Primary Industries (DPI) engaged Eco Logical Australia (ELA) to assess the potential risks arising from the interaction between glider habitat and DPI-authorised selective native timber harvesting activities in state-owned forests, and to identify possible opportunities for mitigating them. This work was based on contemporary scientific information and focussed specifically on the Queensland context. The findings of the project are outlined in the *Greater Glider and Yellow-bellied Glider Risk Assessment* report.

Scope of work

Eco Logical Australia conducted a comprehensive scope of work which involved:

Literature review and data analysis

ELA undertook a review of published scientific literature and available data to identify the habitat requirements of greater gliders and yellow-bellied gliders in Queensland related to nesting, foraging and dispersal. Potential threats to gliders were also identified.

Modelled habitat mapping for the yellow-bellied glider

Following the method used to model greater glider habitat in the *Guide to greater glider habitat in Queensland* report[2], ELA developed new mapping of modelled yellow-bellied glider habitat. The availability of modelled habitat mapping identified in the literature reviews for both species of glider allowed for an assessment of potential impacts of the threats to each species to be undertaken spatially.

Likelihood of interaction between gliders and historical selective native timber harvesting

ELA developed a classification for rating the likelihood (high, medium, low) of an interaction between gliders and historical selective native timber harvesting events in state-owned forests. The classification was based on modelled glider habitat, forestry planning management units, slope and commercial forest types. This mapping is a key input to the habitat disturbance index.

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[1] Department of Climate Change, Energy, the Environment and Water (2022). Conservation Advice for *Petaurus australis australis* (yellow-bellied glider (south-eastern)). Canberra: Department of Climate Change, Energy, the Environment and Water.

[2] Eyre T.J., Smith G.C., Venz M.F., Mathieson M.T., Hogan L.D., Starr, C., Winter, J. and McDonald, K. (2022). *Guide to greater glider habitat in Queensland*. Report prepared for the Department of Agriculture, Water and the Environment, Canberra. Department of Environment, Science and Innovation, Queensland Government, Brisbane.

Habitat disturbance index

A spatial habitat disturbance index was developed using modelled glider habitat, fire history mapping (wildfires and prescribed burns), timber harvest history mapping, steep slopes and a novel habitat fragmentation analysis. An assessment to rank the threats identified in the literature reviews was undertaken to inform the development of the model. The habitat disturbance mapping was designed to inform management decisions regarding selective native timber harvesting. However, the mapping requires ground verification to determine its potential for direct application to field operations and therefore may require further adjustments.

Mitigation options

ELA developed a range of options for mitigating potential risks and enhancing the protection of nesting and foraging resources and habitats for both species of glider. These include possible adjustments to current forest management practices to support the protection of glider populations.

Key findings

Habitat requirements for gliders in Queensland

Key habitat requirements identified by ELA for both species of glider are outlined below.

Foraging habitat

The greater glider is highly selective in its foraging requirements, feeding almost exclusively on eucalypt foliage. In contrast, the yellow-bellied glider has a highly varied diet consisting of a range of food types but is reliant on seasonal availability of these resources. Plant and insect exudates (nectar, sap, manna and honeydew) generally form major components of its diet.

Foraging resources for greater gliders and yellow-bellied gliders include preferred species of eucalypt trees that provide leaves for greater gliders and eucalypt nectar and sap resources for yellow-bellied gliders.

Density and characteristic requirements for foraging resources are not well understood, particularly for the greater glider. However, it is expected that the protection of hollow-bearing trees, and healthy, mature preferred species of trees greater than 40 cm diameter at breast height (DBH) is likely to be important to meet the foraging requirements of both glider species. The implementation of any harvesting regime that decreases the selection of trees of this size will therefore be beneficial for both glider species.

Nesting habitat

Greater gliders are highly reliant on the availability of hollow-bearing trees as shelter and nesting habitat. In southern and central Queensland, it is likely that greater gliders persist in suitable habitat where there are more than three live hollow-bearing trees per hectare. They will also use dead hollow-bearing trees when there are limited live ones available.

The yellow-bellied glider's habitat selection is less driven by the availability of hollow-bearing trees. They have been shown to be selective in the type of trees they use for nesting, preferring live, smooth-barked species, and dead hollow-bearing trees only when live hollow-bearing trees are limited. The size of the tree is also important for both species of glider, with trees greater than 50 cm DBH the preferred size for nesting in southern and central Queensland.

Dispersal

Glider movement and dispersal is limited by habitat patch size and connectivity. Greater gliders are particularly sensitive to dispersal limitations because they have small home ranges, are less social and tend not to traverse at ground level. Cleared habitat greater than 50 metres act as barriers to glider movement and although this is unlikely to be a key factor in state forests, maintaining habitat connectivity remains an important consideration for optimum habitat quality.

State forests contribute significantly to the protection of gliders

ELA found that Queensland's state forests make an important contribution to the conservation of greater gliders and yellow-bellied gliders because there is no broadscale vegetation clearing undertaken on this tenure. Their long-term management, including for selective native timber harvesting, has resulted in

extensive areas of glider habitat being preserved and protected from land conversion, resulting in a significant contribution to the ongoing survival and protection of both glider species across a substantial portion of their range.

Native forestry on freehold land in Queensland is regulated under the *Managing a native forest practice* accepted development vegetation clearing code. The code is currently under review, and it was not included within the scope of the risk assessment.

Impacts of selective native timber harvesting on gliders in Queensland

ELA's review of published literature identified that historical selective native timber harvesting events along with silvicultural practices have contributed to a decline in hollow-bearing trees (nesting resources) in some state-owned forests and that the protections for hollow-bearing trees introduced in 1999 specifically address this issue. However, the review found that the impacts of fire and the naturally slow process of development of hollows means that more attention to protecting this resource for both glider species may be necessary.

ELA also found that current selective native timber harvesting practices are likely to impact on foraging resources for both glider species. However, the retention of additional recruitment habitat trees as prescribed in the *Code of practice for native forest timber production on Queensland's state forest estate 2020*[3] (code of practice) could potentially function to secure suitable foraging trees if the appropriate species are selected.

Importance of other threats to gliders in Queensland

In addition to selective native timber harvesting, ELA's literature review identified the following threats to greater gliders and yellow-bellied gliders in Queensland.

- Historical and ongoing land clearing for purposes such as urban development and agriculture resulting in the loss of foraging and nesting habitat and fragmentation.
- Increased wildfire threat due to climate change.
- Increased temperatures and aridity due to climate change.
- Prescribed burns for wildfire management and on areas also used for livestock grazing.
- Barbed wire fencing of areas also used for livestock grazing resulting in entanglement.
- Linear clearing for forest management requirements (e.g. timber haul roads and landings) and coal seam gas activities.
- Myrtle rust infections (known threat for yellow-bellied gliders and potential threat for greater gliders).

For both species of gliders, ELA's threat assessment found that habitat loss and fragmentation from ongoing land clearing was ranked as a very high risk in Queensland. Historical selective native timber harvesting was ranked high for both species, with current selective native timber harvesting practices ranked as medium for both species.

Likelihood of interaction between gliders and harvesting

More than half of all modelled greater glider habitat and just over 40% of modelled yellow-bellied glider habitat was rated as having a medium or high likelihood of interaction with a historical selective native timber harvesting event. Note that these values also include the distribution of the northern greater glider (*P. minor*) within the North Queensland timber supply zone.

Habitat disturbance index

More than 60% of modelled greater glider habitat and almost 50% of yellow-bellied glider habitat within state-owned native forests was mapped as having a high or very high habitat disturbance index.

[3] The code is administered and overseen by the Department of Environment, Science and Innovation.

Glider habitat protections in the code of practice

ELA found that the prescriptions for glider habitat protection in the code of practice, which have been in place for more than 20 years, are likely to have resulted in the protection of sufficient nesting resources in places where historical fire frequency and selective harvesting frequency are low.

However, in forests that have been affected by multiple fires or harvests, there may be a shortage of nesting resources. In these circumstances, protection and recruitment of habitat trees will be important to maintain glider populations.

ELA also found that requirements relating to watercourse set-backs, retention of at least 50% of the forest stand's basal area following a selective harvesting operation, and limitations on harvesting on steep slopes will contribute to the maintenance of the structure, function and preferred species mix of habitat for both glider species. The gliders' species management profiles, used by DPI in conjunction with the code of practice to provide species specific management advice, include measures to identify and protect sap feed trees.

Options for mitigating potential impacts

ELA identified a range of options to enhance greater glider and yellow-bellied glider protection in state-owned forests. The options are presented in five themes, offering a comprehensive range of potential approaches to strengthen current protection measures.

DPI's response

In response to the glider risk assessment, DPI undertook immediate action to develop a work program that will be implemented in 2 phases. Phase one will focus on priority actions that can be implemented immediately in response to the options identified by ELA. These include:

- **Protecting habitat trees** – All live habitat trees[4] will be protected within the footprint of hardwood operations. As a minimum, 11 habitat-specific trees will be retained per hectare in hardwood operations, including all available habitat trees and additional recruitment habitat trees.
- **Selecting habitat trees** – The selection of recruitment habitat trees in hardwood operations will be enhanced to better target those trees more likely to form hollows quickly, to support the restoration and persistence of depleted nesting resources in the landscape.
- **Protecting large trees** – All large trees will be protected within the footprint of selective native timber harvesting operations, with a focus on trees that are used by gliders. Initially, large trees will be those with a DBH greater than 80 cm in dry forests and greater than 100 cm in wet forests. Further work will be undertaken to refine this definition to ensure it appropriately supports enhanced future habitat and foraging resources.
- **Protecting sap feed trees** – Previously, all trees with 5 or more fresh sap feed marks were protected. Now all sap feed trees used by yellow-bellied gliders with five or more feed marks will be retained, irrespective of whether the feed marks are active or calloused over.
- **Delivering training** – Workshops and online training are being developed and delivered by DPI for field staff and forestry industry representatives. This training will provide information about greater glider and yellow-bellied glider ecology and new protection measures to ensure there is on-ground understanding about the obligations and why they are being implemented.
- **Collaboration** – ELA identified a range of threats to gliders in addition selective native timber harvesting, including fires, fencing and other forest management activities. DPI has shared ELA's report with the Department of Environment, Science and Innovation (DESI) to inform their land management practices and is collaborating with DESI on glider protection measures, monitoring and research.

Phase 2 will focus on long-term actions that require more detailed analysis and stakeholder engagement prior to implementation, including identifying potential future changes to selective harvesting practices. All Phase 1 and Phase 2 actions are detailed in the table below.

[4] A habitat tree must have at least one 'hollow' 10cm or greater in diameter

Theme	Actions
Landscape scale habitat protection to maintain the ongoing viability of the state forest estate to play a critical role in glider conservation.	• **Corridors** – Low disturbance corridor linkages within glider habitat will be identified, maintained, and protected through pre-harvest planning, informed by available research. • **Forest condition thresholds** – Spatial BioCondition[5] scores, ecological condition classes[6] and other metrics will be assessed for their functionality as potential forest condition thresholds for state-owned forests to measure changes over time.
Enhance nesting and foraging resources within the footprint of timber harvesting operations to meet the key habitat needs of gliders.	• **Protection of habitat trees** – All live habitat trees will be protected within the footprint of hardwood operations. As a minimum, 11 habitat-specific trees will be retained per hectare in hardwood operations, including all available habitat trees and additional recruitment habitat trees. • **Selection of habitat trees** – The selection of recruitment habitat trees for retention in hardwood operations will be enhanced to better target trees likely to form hollows quickly and support the restoration and persistence of depleted nesting resources in the landscape. • **Protection of large trees** – Large trees will be protected within the footprint of selective native timber harvesting operations to enhance future habitat and foraging resources, with a focus on trees that are used by gliders. • **Protection of sap feed trees –** All sap feed trees used by yellow-bellied gliders with five or more feed marks will be retained, irrespective of whether the feed marks are active or calloused over. • **Code of practice –** The code and associated species management profiles (which provide species specific management advice) will continue to be implemented and refined to underpin the protection of gliders.
Harvest assessments to define footprints to allow better management of timber harvests	• **Due diligence** – Ecological due diligence processes for proposed selective native timber harvesting operations will continue to include assessments of glider habitat based on wildlife

[5] The Department of Environment's Spatial BioCondition framework is used to assess the condition of vegetation in most of Queensland's regional ecosystems.

[6] Ecological condition profiles for Queensland's regional ecosystems have been developed by the Queensland Herbarium to provide a visual guide for the rapid appraisal of broad ecological condition states typical or expected of the regional ecosystem.

Theme	Actions
and glider habitat protection in state-owned forest.	records, regional ecosystem mapping, aerial imagery, and field assessments to inform pre-harvest planning. • **Improved harvest data** – Historic selective native timber harvesting data will be analysed to better understand the level of harvest activity across the landscape and to inform pre-harvest planning, including identifying low disturbance areas for corridors. • **Habitat disturbance index** – A selection of sites will be identified to undertake ground verification and analysis for using ELA's habitat disturbance index modelling for application to field operations.
Share knowledge with other parties involved in timber harvesting activities and forest management to optimise the protection of glider habitat and meet legal obligations.	• **Training** – Workshops and online training will be developed and delivered by DPI for staff and forestry industry representatives about greater glider and yellow-bellied glider ecology and new protection measures. • **Collaboration** – DPI will continue to work collaboratively with DESI about ELA's findings, recognising the broader risks that were identified to gliders in Queensland.
Acquire further knowledge to improve management decisions for glider protection (research and monitoring).	• **Research on hollows** – DPI will pursue further research to better understand natural hollow development processes and practical methods for enhancing hollow formation. • **Research on glider foraging and habitat** – DPI will pursue further research to better understand glider foraging and habitat needs to support continued improvement of selective native timber harvesting practices. • **Adaptive monitoring** – DPI will design and implement an adaptive monitoring program in collaboration with DESI and relevant research institutions to measure performance outcomes and inform future management actions.