Koala Habitat Health Checks

Alistair Melzer, Rhonda Melzer, Michael Hewson

March 2019

Koala Research – CQ

Queensland Government

CQUniversity AUSTRALIA

Queensland
Government

Version 3 March 2019

Contributors

Dr Alistair Melzer, Dr Rhonda Melzer, Dr Michael Hewson

Acknowledgements

Recommended citation

Contents

1.0 Guide to undertaking Koala Habitat Health Checks

The Koala Habitat Health Check is a tool for efficiently, and routinely assessing the condition of koala habitat. The check uses simple visual 'cues' and require no specialist skills or equipment and has been designed to work state-wide.

This document provides: a) guidelines for undertaking the Health Check for natural values (appropriate koala habitat) – **Section 1**; b) descriptions of the Health Check Indicators – **Section 2**; and c) a record sheet – **Section 3**.

Ideally, a Monitoring and Research Strategy would be prepared prior to undertaking Health Checks. This would enable:

- questions about timing and site selection to be considered, and

- appropriate guidance or specifications to be documented.

1.1 *Qualitative* assessment; not *quantitative* analysis

This is a tool for undertaking **a qualitative assessment** of the state of koala habitat.

This tool **does not** provide quantitative data for statistical analysis.

The intent is for an observer to:

(1) develop **a considered opinion** of the state of the habitat; and

(2) **recommend** whether a more quantitative investigation is warranted, or whether management intervention is required.

1.2 How to do a Health Check and complete the record sheets

Health checks are undertaken within koala habitats. Typical koala habitat types are listed in **Table 1.1**. The current condition and desired condition for each habitat type are determined, through professional judgement, in conjunction with any management direction, required actions and the priority for those actions. The overall condition classes are defined in **Table 1.3**. Over time, the information from repeated health checks will provide a trend in condition of the habitat, and help determine whether current management is appropriate.

The completed Habitat Health Check should be reviewed by the relevant authority or land manager (in the case of rural or freehold lands) to determine whether, for example, current management actions are appropriate or need adjusting, urgent intervention is required, and/or additional investment is needed.

There are six key steps in undertaking a koala habitat health check.

Step 1: Identify the koala habitat types within the property being assessed.

Step 2: Within each habitat type, walk around, select at least three representative sites per habitat type.

Step 3: Undertake a site-based qualitative classification of *site-scale indicator* condition within each habitat type.

Step 4: Walk around each habitat type, assess and record condition using the *habitat-scale indicators*, and note your general impression of the overall condition, including the site assessments.

Step 5: Develop a considered opinion of the overall condition class within each selected habitat type, based on the walk-around, and the general impression of each indicator.

Step 6: Determine a recommended management response.

It may be useful for an assessment to be undertaken by two observers, and for them to have copies of previous assessments or reference photos.

Identifying the assessable habitat

Large properties will most likely encompass more than one koala habitat type. This will reflect the different land-form patterns and associated elements encompassed by the property as well as the associated differences in vegetation each support. In such cases, the property should be divided into the major classes of overstorey vegetation and each classified according to its suitability as koala habitat. Typical koala habitat types are listed in **Table 1.1**.Note that a koala habitat is a place where koalas live. This does not include lands across which koalas disperse and generally do not live. This *dispersal environment* is critical for a population's long-term survival, but is not assessed as part of this habitat health check.

In most cases, the area of assessable habitat would not exceed 1,000 ha. It is within this area that three to five sites would be located. Where the habitat type is more extensive, it may be necessary to undertake a number of replicate assessments – especially if there is *broad-scale variation* in the state of the habitat type. *Local variation* should be accounted for within the selected assessable habitat and associated sites. In landscapes that encompass multiple small holdings, the assessment may need to cross property boundaries, and require a neighbourhood approach.

Selecting sites

The assessment should be stratified where a property incorporates multiple habitat types. At least three, but up to five sites should be selected within the assessable area of each selected habitat type. If the habitat type is so small as to not accommodate three sites it is probably best to incorporate that into an adjacent type (in the same land form element or pattern if available). Choose sites that are most likely to be useful in informing on-ground management. Also consider accessibility – if a site is too difficult to get to then a health check is unlikely to get done. It may be valuable to use sites for which historical data are available.

Where the habitat type is extensive, and accessible by vehicle, drive through as much of it as possible to get an 'overview' of the condition. Ensure that you look beyond the road edge! It is also necessary to get out of the vehicle and walk into the habitat in a range of 'representative sites' to get as true perspective of its condition as possible and to do a health check. A site should be relatively 'uniform' (*e.g.* within the same ecosystem, but **don't** include a south and north facing slope or a ridgeline and a valley in one site).

The size of each 'representative site' (i.e. the area you include in your inspection) must be recorded on the record sheet and will depend on factors such as the area the habitat type covers and its uniformity. It is likely that site areas of at least 1 ha will be required in eastern, moister parts of Queensland, with larger site areas required in drier, western parts. The most important matter to consider is whether the three or more sites encompass a good representation of the variability across the selected habitat type. This should be gauged during the walk around.

It is not mandatory to go back to exactly the same site/s each year unless of course your options are limited. However, it will usually be highly beneficial to have some permanent sites that are revisited each year and to incorporate standard photo-monitoring points into your health check.

In many cases it will not be necessary to precisely define the boundary of your site in order to ensure that the next time you (or a colleague) do the health check you use exactly the same area, a few metres either side will not be a problem. However, in some circumstances the definition of your site will be important. For example, where the assessment relates to a particular aspect, or to a narrow or linear habitat type. Is it likely that someone else coming to do the health check in future could be confused about what might or might not be included in the site you are establishing? If the answer to that question is yes, then the assessor should provide clear details about the site and its boundaries on the first page of the record sheet (**Section 3**).

A record sheet (**Section 3**) has to be completed for each habitat type. The standard record sheet allows up to five sites per habitat type (**Table 3.1**). If more than five sites are required to get an adequate representation of condition (only likely for extensive habitat types with complex management issues) add extra columns.

Health check indicators (**Section 2**) are used to assess the condition of the selected habitat. Every health check indicator that applies to your habitat type **MUST** be used in your site assessment.

Use the tables in **Section 2** to determine the condition class, from *Good* to *Critical,* for each health check indicator. ***Ensure that you read the information and instructions provided for each health check indicator every time!*** **Do not assume you've remembered them correctly from last time!**

For each health check indicator, the condition class that you determine for each site must be recorded on the record sheet.

Your **general impression** of the condition of the selected habitat type across the property for each health check indicator is also recorded (unless the value occurs at only one site). Note that this general impression **IS NOT** an 'average' of the condition classes you recorded at each site. It is **your considered opinion** about the state of the habitat type across the property based on the site results **AND** your observations as you drive or walk between sites!

Where it is relevant, provide information in **Table 3.3** of the record sheet about factors contributing to the condition class assigned to the habitat at an inspection site, and in **Table 3.4** for your general impression for a health check indicator.

When you have completed your inspection of a habitat (*i.e.* assessments at all health check sites and your general

impression across the property), record the overall condition class based on all of the health check indicators.

Ideally, make sure that you make this decision on the day of the inspection, or at least within a few days of it. It is intended to be a 'considered opinion' guided by the site results and your other observations.

Common sense must also prevail. For example, if the habitat had a condition class of *Good* for ground cover but the ground cover consisted almost entirely of a pest plant (*i.e.* habitat type's condition class is *Significant Concern* or *Critical* with respect to pest plant density) – the latter condition class over-rides the former.

Make notes, in the space provided below **Table 3.4** on the record sheet, about your decision especially if you assign an overall condition class of *Significant Concern* or *Critical.*

Table 1.1 Typical koala habitat types

Climatic/land use zones	Habitat type/structure
Arid/semi-arid	Stream-fringing woodland
	Eucalypt woodland/open woodland
Sub-humid (tropical)	Stream-fringing open forest/woodland
	Eucalypt open forest/woodland/open woodland
	Acacia open forest/woodland with eucalypt
	Ecosystems (various) with emergent eucalypt
Sub-humid (subtropical)	Stream-fringing open forest/woodland
	Eucalypt open forest/woodland/open woodland
	Acacia open forest/woodland with eucalypt
	Ecosystems (various) with emergent eucalypt
Humid (tropical)	Stream-fringing forest/open forest
	Eucalypt open forest/woodland
	Ecosystems (various) with emergent eucalypt
Humid (subtropical)	Stream-fringing forest/open forest
	Eucalypt forest/open forest
	Ecosystems (various) with emergent eucalypt
Urban/peri-urban	Stream-fringing forest/open forest/woodland/open woodland
	Street scapes/road sides/gardens with eucalypts
	Eucalypt woodland/open woodland
	Parkland/minor reserves (including remnant) with eucalypts
Rural (rangeland grazing, pastures, horticulture, plantation)	Stream-fringing forest/ open forest/woodland/open woodland with emergent eucalypts
	Eucalypt forest/open forest
	Eucalypt woodland/open woodland
	Open lands (e.g. grasslands or crops) with emergent eucalypts
Rural (post-industrial)	Rehabilitated eucalypt open forest/woodland/tall shrubland
	Grasslands with emergent eucalypt

Table 1.2 Common Queensland koala food tree species.

(**Note: This list is not comprehensive. Check local knowledge. However, it is important that the selected species are confirmed as being eaten by direct observation, or by diet analysis. Do not include species that koalas have been seen using but not eating**).

Common name	Species	Note
river red gum	*Eucalyptus camaldulensis*	Important food source
Dawson river gum	*Eucalyptus cambageana*	Eaten in small amounts
coolabah	*Eucalyptus coolabah*	Important food source
narrow leafed ironbark	*Eucalyptus crebra*	Important food source
broad leafed ironbark	*Eucalyptus drepanophylla*	Important food source
flooded gum	*Eucalyptus grandis*	Eaten
silver leafed ironbark	*Eucalyptus melanophloia*	Eaten, but subject to droughting on "hard" landscapes
tallowwood	*Eucalyptus microcorys*	Important food source
mountain coolibah	*Eucalyptus orgadophylla*	Important food source when adjacent to other koala habitat. Little used when distant from other koala habitat.
blackbutt	*Eucalyptus pilularis*	Important food source
Planchon's stringybark	*Eucalyptus planchoniana*	Eaten in small amounts
poplar gum	*Eucalyptus platyphylla*	Eaten seasonally when associated with other food species. Little used in extensive, pure stands. Dry season deciduous, so not available during the dry season.
poplar box	*Eucalyptus populnea*	Eaten, but use varies regionally.
scribbly gum	*Eucalyptus racemosa*	Eaten, but varies seasonally
red mahogany	*Eucalyptus resinifera*	Eaten in small amounts
swamp mahogany	*Eucalyptus robusta*	Important food source
forest red gum/Queensland blue gum	*Eucalyptus tereticornis*	Important food source
white stringybark	*Eucalyptus tindaliae*	Eaten
brush box	*Lophostemon confertus*	Eaten, but use varies regionally and seasonally
broad-leafed paperbark	*Melaleuca quinquenervia*	Eaten, but use varies regionally and seasonally
paperbark tea tree	*Melaleuca* species	Eaten seasonally, and usually in small amounts

Table 1.3 Overall condition class – what the categories mean (IUCN 2012)

Good	The habitat is in good condition, and is likely to be maintained in the future provided current conservation measures are maintained.
Good with some concern	The habitat condition is likely to be maintained in the long-term with minor additional conservation measures to address existing concerns.
Significant concern	The habitat is at risk from current and/or potential threats. Significant conservation measures are required to preserve the habitat in the future.
Critical	The habitat is severely threatened. Urgent conservation is required or the habitat may be lost.

1.3 New/emerging issues noticed (anywhere on the property) while undertaking an inspection

When you are undertaking an inspection, you may notice localised disturbances, biosecurity breaches, or issues that require preventative management intervention. These should be noted in **Table 3.5**.

Relevant managers should be alerted to an emerging issue as soon as possible after the inspection and a decision made about the management response to be undertaken.

Table 3.5 should be taken on future inspections so that the effectiveness of the management response can be evaluated.

2.0 Health Check Indicators

2.1 About the indicators

Seventeen indicators address:

- habitat structure and function;
- habitat environmental factors;
- anthropogenic pressures acting on, or potentially acting on habitat; and
- the landscape context.

Within these 17, there is a group that is applied at the scale of the selected habitat type, and a group that is applied at a site scale.

The habitat-scale indicators are:

- Koala habitat size;
- Koala habitat integrity;
- Connectivity;
- Potential threats to koala habitat;
- Threats to koala survival or behaviour;
- Proximity to development.

The site-scale indicators are:

- Presence of koala food trees;
- Number of evergreen koala staple food tree types;
- Recruitment of koala staple food trees;
- Recruitment of non-koala food eucalypts;
- Tree health and dieback;
- Fire;
- Severe storm, cyclone or tornado;
- Pest plants that alter koala habitat or influence koala survival/behaviour;
- Rainforest invasion;
- Physical/mechanical damage by animal or human activity;
- Active soil erosion.

2.2 Habitat-scale indicators

Koala habitat size

Size	Description	Condition
Very large	>1000 hectares	Good
Large	100-1000 hectares	Good with Some Concern
small	10-100 hectares	Significant Concern
Very small	<10 hectares	Critical

Koala habitat integrity

Do not assess for urban habitat. Assess relative to regional and land use context. Record relevant details (Table 2.3 on your record sheet).

Fragmentation	Description	Condition
None	No fragmentation	Good
Minor	<5% is fragmented	Good with Some Concern
Moderate	5-15% is fragmented	Significant Concern
Major	>15% is fragmented	Critical

Koala habitat connectivity

Assess the connectivity of the selected habitat type to any other type of koala habitat.

Connectivity	Description	Condition
High	Abutting major koala habitat No gaps	Good
Moderate	Some direct links to adjacent koala habitat of size, or < 500m gap to nearby koala habitat of size	Good with Some Concern
Poor	Gap of > 500 to adjacent koala habitat, or minor wooded linkages [1]	Significant Concern
None	No adjacent koala habitat[2] or no wooded linkages [1]	Critical

[1] May be a natural or constructed vegetation corridor, but may also be an area of scattered trees that provide refuge to a dispersing koala (dispersal environment). [2] Judgement is required as to the distance here. If there are no elevated refuges (ideally a tree) within 1 km, or there is no available canopy to provide shade, then there is a high risk of a koala population not being able to connect to distant koala habitat.

Potential threats to koala habitat

Includes the risk of invasion and proliferation of destructive pest plants, altered hydrology, salting, waterlogging and contamination. Record relevant details in **Table 3.3** on record sheet.

Risk	Description	Condition
Very low	• No sources of propagules[1] close enough for invasion to be likely &/or no vectors[1]. • No management practices on or adjacent to the selected habitat likely to result in altered hydrology, salting or waterlogging. • No management practices on or adjacent to the selected habitat threatening contamination of, or adverse chemistry in the root zone or to the foliage.	Good
Low	• Sources of propagules[1] are close enough for invasion to be possible but there are few or no vectors[1] &/or the sources are being eradicated, contained or controlled &/or the risk of establishment is low. • Management practices on or adjacent to the selected habitat may result in altered hydrology, salting or waterlogging but risks are being contained or controlled. • Management practices on or adjacent to the selected habitat may lead to contamination of, or adverse chemistry in the root zone or to the foliage, but the risks are being contained or controlled.	Good with Some Concern
Moderate	• Sources of propagules[1] are close enough for invasion & suitable vectors[1] are present & conditions are suitable for establishment. • Management practices on or adjacent to the selected habitat have the potential to result in altered hydrology, salting or waterlogging & containment/ controls may be inadequate. • Management practices adjacent to the selected habitat have resulted in altered hydrology, salting or waterlogging but, as yet, there are no signs of impact on the selected habitat. • Management practices on or adjacent to the selected habitat may lead to contamination of, or adverse chemistry in, the root zone & containment/controls may be inadequate. • Adjacent land management practices have resulted in contamination or adverse chemistry in the root zone or in the foliage but, as yet, there are no signs of impact on the selected habitat.	Significant Concern
High	• Pest plants are common to abundant immediately adjacent to the selected habitat. • Management practices on or adjacent to the selected habitat may result in altered hydrology, salting or waterlogging & the risks are not being contained or controlled. • Adjacent land management practices have resulted in altered hydrology, salting or waterlogging & there are signs of on-site impacts. • Management practices on or adjacent to the selected habitat may result in contamination of, or adverse chemistry in, the root zone & the risks are not being contained or controlled. • Adjacent land management practices have resulted in contamination of, or adverse chemistry in, the root zone & there are signs of on-site impact.	Critical

1. Propagules include seeds, spores & other plant parts that can grow into a new plant. Vectors include wind, vehicles, water, animals including humans, birds & bats.

Threats to koala survival or behaviour

Record relevant details in **Table 3.3** on record sheet.

Risk	Description	Condition
Very low (All must be met)	• No predator[1] signs[2] or no more than would be expected in natural systems. • No vehicle access or minor tracks with infrequent traffic (within or nearby). • No rail corridor (within or nearby). • No adverse infrastructure[3] (within or nearby). • No tree loss[4].	Good
Low (Worst case determines risk)	• Predator[1] signs[2] somewhat above what is expected in natural systems. • Minor rural road/s with irregular traffic (within or nearby) • Occasional high speed or industrial rail (within or nearby) • Adverse infrastructure[3] present but limited in extent and/or uncommon. • <5% tree loss[4].	Good with Some Concern
Moderate (Worst case determines risk)	• Predator[1] signs[2] common. • Network of minor roads with regular traffic (within or nearby). • Frequent high speed or industrial rail (within or nearby) • Adverse infrastructure[3] is extensive and/or common (within or nearby) • 5-25% tree loss[4].	Significant Concern
High (Worst case determines risk)	• Predator[1] signs[2] abundant. • Dense network of roads with regular and frequent traffic and/or highway (within or nearby) • Very frequent high speed or industrial rail (within or nearby) • Adverse infrastructure[3] is widespread (forms a mosaic or network) and/or abundant (within or nearby) • >25% tree loss[4].	Critical

1. Predators include dingoes, stray dogs, domestic dogs, farm dogs.
2. Signs include animal sightings, tracks and scats.
3. Adverse infrastructure includes pools, dams, fences, rail/road barriers, pipelines.
4. Tree loss may be from legal or illegal harvesting, tree felling, ringbarking, poisoning, dozing.

Proximity to urban development

Record relevant details in **Table 3.3** on record sheet.

Risk	Description	Condition
Very low	• >10km to urban settlement.	Good
Low	• 5-10km to urban settlement.	Good with Some Concern
Moderate	• Less than 5km to urban settlement.	Significant Concern
High	• Within or adjacent to urban settlement.	Critical

2.3 Site-scale indicators

Presence of koala staple food trees

A staple food tree is a food tree that provides the bulk of the koala food resources in the locality being assessed. The predominant koala staple food tree types in Queensland are listed in **Table 1.3**.

Description	Condition
Abundant	Good
Common	Good with Some Concern
Rare	Significant Concern
Very rare or none	Critical

Number of evergreen koala staple food tree types

Do not include poplar gum (*Eucalyptus platyphylla*) as it loses its leaved in the dry season. If there are koala food trees nearby, but outside the sites, and elsewhere in the assessable habitat, make notes and include this in your overall assessment.

Description	Condition
3 or more	Good
2	Good with Some Concern
1	Significant Concern*
None	Critical

*Reliance on a single food tree species is a matter of concern as the koala population is at risk if a defoliation event occurs, or the environmental conditions induce a decline in the water content or the palatability of the foliage from that species.

Recruitment of koala staple food tree types

Some land management practices (e.g. burning, lack of burning, grazing) & natural processes (e.g. drought) can affect the processes required for natural regeneration. Some species may be impacted more than others (e.g. *E. tereticornis* - Qld blue gum seedlings are highly palatable compared to many other eucalypt species). To assess recruitment scan your site to see whether the koala food species have juveniles. Juveniles are defined here as individuals with a dbh (diameter at breast height) of < / = 10cm (measure the largest stem if individuals are multi-stemmed). <u>Do</u> <u>not</u> <u>including</u> <u>seedlings</u> because of the potential problems with identification & survivorship.

Recruitment	Description	Condition
Sustainable	• Juveniles of all koala food tree types are present (frequently/ commonly encountered).	Good
Probably sustainable	• Juveniles of all koala food tree types are present • (occasionally/infrequently encountered) or; • Juveniles of only some of the koala food tree types are present &/or; • Juveniles of the koala food trees are absent from the site but occur nearby • (near enough for future recolonisation).	Good with Some Concern
May not be sustainable	• Juveniles of koala food trees are absent or very rare on-site; or nearby, but there is little or no sign of the mature koala food trees dying.	Significant Concern
Probably unsustainable	• Juveniles of the koala food trees are absent or very rare on-site or nearby & the mature koala food species are dying.	Critical

Recruitment of non-koala food eucalypts

Non-koala food trees are tree species that koalas do not eat, or are eaten in very small amounts. Typically, this would be the Genus Corymbia, including Moreton Bay ash and bloodwoods. To assess recruitment scan your site to see whether the non-koala food species have juveniles. Juveniles are defined here as individuals with a dbh (diameter at breast height) of < or = 10cm (measure the largest stem if individuals are multi-stemmed); <u>not including</u> <u>seedlings</u> because of the potential problems with identification & survivorship.

| Recruitment	Description	Condition
Sustainable	• Juveniles of the non-koala food eucalypts are absent or occur as isolated plants or small isolated stands.	Good
Probably sustainable	• Juveniles of non-koala eucalypts are sparse/scattered.	Good with Some Concern
May not be sustainable	• Juveniles of non-koala eucalypts are conspicuous/ common.	Significant Concern
Probably unsustainable	• Juveniles of non-koala eucalypts are dense/abundant	Critical

Tree health & dieback

Dieback is the premature & relatively rapid decline in vigour that may end in the death of trees. It can be caused by a wide range of factors that are often interacting. Examples of causes include insect attack, pathogens, salting, nutrient enrichment, soil acidification, over-browsing by arboreal mammals, changes in the water table (water logging or water deficit), drought, herbicide overspray & soil-borne pathogens (e.g. phytophthora) (Stol 2006). Bell miner associated dieback occurs in southern Qld (& NSW & Vic) – it is associated with a combination of factors including disturbance that opens up the canopy, dense shrubby understorey (often invaded by lantana), moist soils, reduced fire frequency & the presence of bell miners & psyllids. Myrtle rust may cause substantial dieback, and possibly extinction, in the case of some myrtaceous species. Death, or epicormic regrowth occurring in response to the loss of branches/crowns, caused by storm, cyclone or intense fire **IS NOT** dieback and is covered elsewhere. When assessing your ecosystem, be aware of deciduous (winter or dry season) tree species such as poplar gum (*E. platyphylla*). **Note:** the term 'canopy' in the table is referring to the canopy of all the koala food trees collectively NOT the canopy of an individual koala food tree. Record relevant details in **Table 3.3** sheet including the symptoms (e.g. sooty mould/rust) and/or suspected cause/s of the dieback. Use the description to get a 'best fit' – not all parameters may be relevant or exactly 'fit' your site especially as the ecosystem recovers. Refer to the diagrams (next page) to determine the extent of branch death & epicormic growth throughout the canopy. (Ratings informed by Grimes 1978 & Stone 2006)

| Tree health	Description	Condition
Very healthy	• No or very few dead trees (no more than you'd expect in a healthy ecosystem). • No or very few dead small or large branches or branchlets in the canopy. • No to slight epicormic growth in the canopy. • No obvious insect or pathogen damage to foliage (i.e. you have to 'look' to notice it); few dead or discoloured leaves; little or no honeydew, sooty mould or rust. • No obvious defoliation; the canopy looks 'leafy.' • Mistletoe absent to rare	Good
Healthy	• Very few dead trees (no to slightly more than you'd expect in a healthy ecosystem). • No or very few dead large branches. Some dead branchlets & small branches present here & there throughout the canopy; they may be obvious but don't give the impression that there is any significant effect on the canopy. • Slight epicormic growth in the canopy. • Some obvious insect or pathogen damage; honeydew, sooty mould or rust, may be present but overall impression is of a healthy canopy; few dead/ discoloured leaves. • No obvious defoliation; the canopy looks 'leafy.' • Mistletoe occurs occasionally.	Good with Some Concern
Unhealthy	• Dead trees present (slightly to many more than you'd expect in a healthy ecosystem). • Dead large branches as well as small branches & branchlets are common. • For eucalypt communities – moderate epicormic growth in the canopy; some may be present on stems. • Insect or pathogen damage; honeydew, sooty mould or rust, widespread & conspicuous; foliage may appear 'tatty'; leaf death &/or discolouration may be common. • Some to considerable defoliation; the canopy looks sparse to very sparse. • Mistletoe is common.	Significant Concern
Very unhealthy	• Dead trees are common to abundant. • Many large branches are dead. • Severe epicormic growth in canopy &/or stems. • Insect or pathogen damage is widespread & severe; may be heavy honeydew 'rain' &/or abundant sooty mould or rust; leaf death widespread & very common to complete. • Canopy severely to completely defoliated. • Mistletoe is abundant (some trees with have multiple plants)	Critical

Crown diagrams (from Grimes 1978)

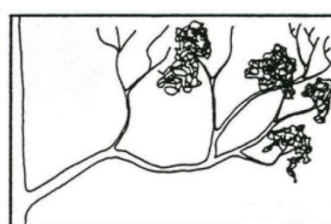### 1a-d Extent of dead branches; 2a-d Extent of epicormic regrowth
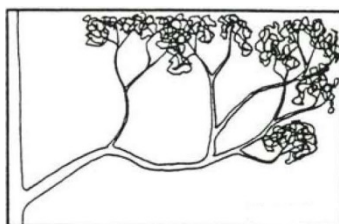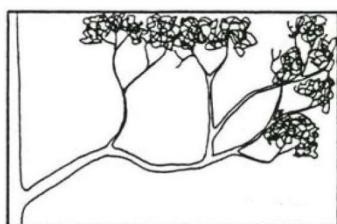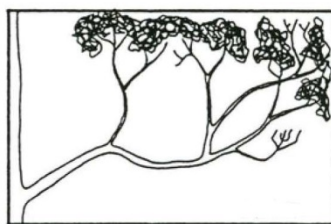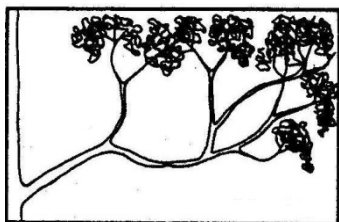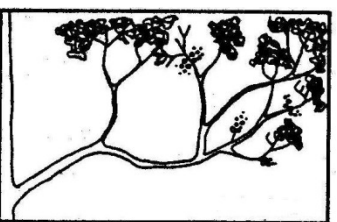

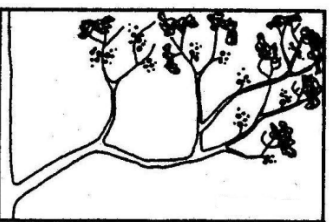1a. No dead branches   1b. Branchlets dead   1c. Small branches dead   1d. Main branches dead
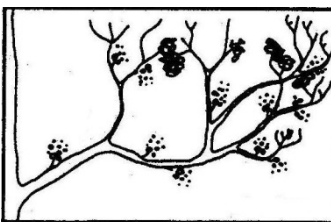

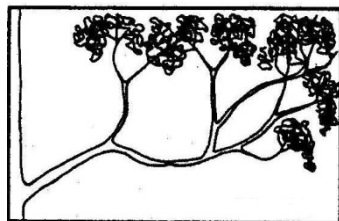2a. None   2b. Slight   2c. Moderate   2d. Severe

Fire

The condition of habitat will obviously change with time since a severe fire. Your first assessment may occur in the immediate aftermath or several years after it occurred. The descriptions below attempt to cover those circumstances. Fire here includes a fire that started as a planned burn but resulted in unplanned, major impacts typical of a severe wildfire. Refer to the diagrams (next page) to determine the extent of epicormic growth throughout the canopy (ratings informed by Grimes 1978). Record relevant details in Table 3.3 on your record sheet including when the fire occurred. Unless otherwise stated, use the description to get a 'best fit' – not all parameters may be relevant or exactly 'fit' your habitat especially as it recovers. Exclude impacts from other disturbances (e.g. standing dead trees from thinning/logging practices, non-fire related dieback) from your determination of the condition class.

Impact	Description	Condition
None *(All criteria must be met)*	No obvious signs of impact from fire: • No signs of crown[1] fire (e.g. canopy[1] structure appears 'normal'). • No to slight epicormic growth in the canopy[1]. • No or few signs of recent/young growth from lignotubers. • Very few dead trees (no more than you would expect in a natural healthy example of the ecosystem. • Ecosystem has reached pre-disturbance state (regardless of the initial level of impact) in terms of structure & dominant woody species – latter being typical of the ecosystem.	Good
Minor	Minor signs of damage due to fire: • Some signs of crown[1] fire damage • Slight epicormic growth in the canopy[1]. • A few dead stems with lignotuber resprouts. • Very few dead trees (no to slightly more than you would expect in a natural healthy example of the ecosystem). • Ecosystem nearing pre-fire state (regardless of the initial level of impact) in terms of structure & dominant woody species – latter being typical of the ecosystem.	Good with Some Concern
Moderate	Significant signs of damage due to fire: • Commonly signs of crown[1] fire damage. • Moderate epicormic growth in the canopy[1]; some may be present on stems. • Dead stems with lignotubers resprouting occasional to common • Dead trees are present (slightly, to many more than you would expect in a natural healthy example of the ecosystem). • Recovery underway but the ecosystem is well off its pre-fire state at least in terms of structure.	Significant Concern
Major	Severe signs of damage due to fire: • Widespread & severe crown[1] fire damage. • Severe epicormic growth in the canopy[1] &/or stems. • Dead stems with lignotubers resprouting common to abundant. • Dead trees are common to abundant. • No recovery evident &/or expected to require many years.	Critical

[1]Crown and canopy here refer to the upper layer of the tallest, dominant woody stratum.
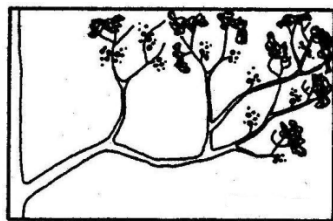
Crown diagrams (from Grimes 1978) – extent of epicormic regrowth
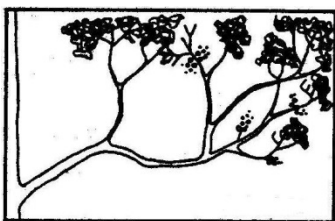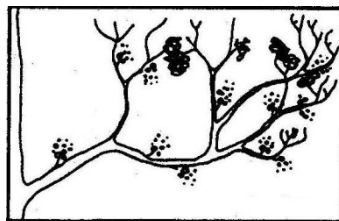

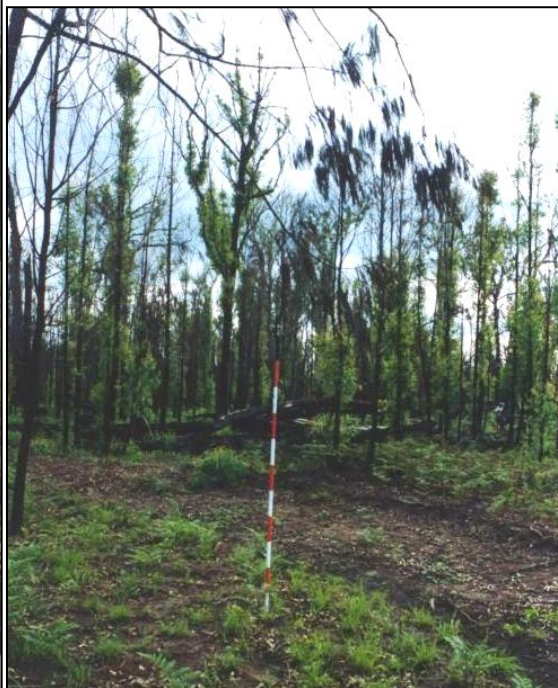a. None   b. Slight   c. Moderate   d. Severe

Examples of epicormic shoots. The shoots grow from buds that are protected deep within the bark of trunks, stems and branches. They usually remain dormant unless the actively growing shoots at the top of the plant are damaged or lost.

Severe storm, cyclone or tornado.

Severe weather events have the potential to alter the structure of koala habitat. This can range from total defoliation, removal of all lateral branches, or extensive tree fall, to the loss of occasional branches. After the event, the condition of habitat will obviously change with time since disturbance. Your first assessment may occur in the immediate aftermath of an event or several years after it occurred. The descriptions below attempt to cover those circumstances. Refer to the diagrams to determine the extent of epicormic growth throughout the canopy (Ratings informed by Grimes 1978 & Turton 2008). Record relevant details in Table 3.3 on your record sheet including whether the impact was due to storm, cyclone or tornado, and when the event occurred. Unless otherwise stated, use the description to get a 'best fit' – not all parameters may be relevant or exactly 'fit' your site especially as the ecosystem recovers. Exclude impacts from other disturbances (e.g. crown fire damage, standing dead trees from thinning/logging practices, non-fire related dieback) from your determination of the condition class.

Impact	Description	Condition
None *(All criteria must be met)*	No obvious signs of impact: • No obvious defoliation; the canopy[1] looks 'leafy'. • Very few dead trees (no more than you would expect in a natural healthy example of the ecosystem). • No or very few broken branches or stems. • No to slight epicormic growth in the canopy[1]. • No storm, cyclone or tornado debris[2].	Good
Minor	• For recent disturbance: partial defoliation of the canopy[1]. • Very few dead trees (no to slightly more than you would expect in a natural healthy example of the ecosystem). • Occasional broken branches &/or stems but rarely tree falls. • Slight epicormic growth in the canopy[1]. • Ecosystem nearing pre-disturbance state (regardless of the initial level of impact) in terms of structure & dominant woody species – latter being typical of the ecosystem. • Minor debris[2]	Good with Some Concern
Moderate	• For recent disturbance: substantial & widespread defoliation; the canopy[1] looks sparse to very sparse. • Dead trees present (slightly to many more than you would expect in a natural healthy example of the ecosystem). • Broken branches common. • Broken stems may be common; occasional tree falls. • Moderate epicormic growth in the canopy[1]; some may be present on stems. • Moderate debris. • Recovery underway but the ecosystem is well off its pre-disturbance state at least in terms of structure.	Significant Concern
Major	• For recent disturbance: canopy[1] severely to completely defoliated. • Dead &/or fallen trees are common. • Stems or crowns of many trees are broken, smashed or wind-thrown. • Severe epicormic growth in the canopy[1] &/or stems. • Substantial debris. • No recovery evident &/or expected to require many years.	Critical

[1]Canopy refers to the upper layer of the tallest, dominant woody stratum. [2]Debris poses an increased fire risk and can impede koala movement.
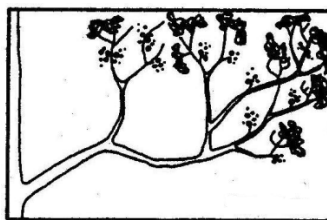
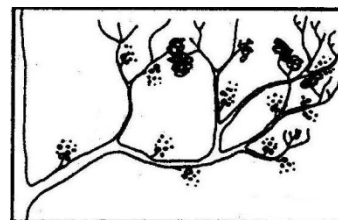## Crown diagrams (from Grimes 1978) – extent of epicormic regrowth
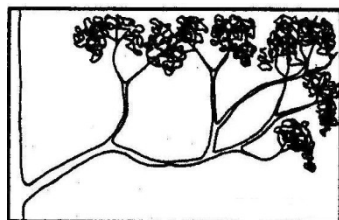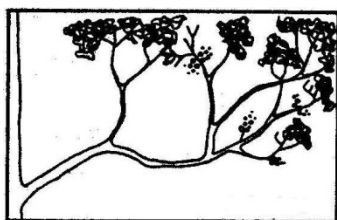
a. None   b. Slight   c. Moderate   d. Severe

Pest plants that alter koala habitat or influence koala survival/behaviour

A habitat changing pest plant is a non-native species, or a native species outside its natural range, that has the potential to substantially & permanently alter the structure &/or composition of the habitat by direct (e.g. competition) &/or indirect (e.g. changed fire regimes) means. A pest plant that influences koala survival/behaviour is a non-native species that: impedes overground movement by koalas or free movement up trees; reduces the food resource and/or; increases fire intensity and flame height. *Species that can change habitat* include buffel grass, Guinea grass, cat's claw, rubbervine, Madeira vine. *Species that can affect koalas directly* include lantana, rubbervine, morning glory, cat's claw, buffel grass and Guinea grass. Separate parameters are provided for three 'groups' of weeds: those in the ground stratum; shrubs/trees; climbing vines. Record the pest plants that are at your inspection site/s (**Table 3.3** on your record sheet).

Invasion	Description	Condition
None	Pest species are absent including on the margins.	Good
Inconspicuous	Native species dominate; pest species inconspicuous/mainly on margins: • Pest spp. in ground stratum – comprise up to 5% of cover &/or • Pest shrubs/trees – comprise up to 5% of stems or cover &/or • Pest climbers – cover up to 5% of canopy	Good with Some Concern
Conspicuous	Pest species are a conspicuous component of the vegetation: • Pest spp. in ground stratum – comprise 5-25% of cover &/or • Pest shrubs/trees – comprise 5-25% of stems or cover &/or • Pest climbers – cover 5-25% of canopy	Significant Concern
Dominant	Pest species dominate: • Pest spp. in ground stratum – comprise >25% of the cover &/or • Shrubs/trees – comprise >25% of stems or cover &/or • Pest climbers – cover >25% of canopy	Critical

The impact of burning Guinea/Hammel grass (darker green grass in the centre) on relic roadside koala habitat. Increased flame heights and fire intensity have killed the majority of the poplar box (*E. populnea*) in this roadside corridor.

Rainforest invasion

Use the descriptions in the table to get a 'best fit' – not all parameters may be relevant or exactly 'fit' your site. For example, some ecosystems may have a ground stratum dominated by herbaceous species other than grasses but remain readily 'burnable' – their condition would be Good or Good with Some Concern depending on other parameters.

Invasion	Description	Condition
None to rare	• Grasses & functionally equivalent herbaceous species (e.g. *Gahnia aspera*) are more abundant than other species (e.g. shade-loving sedges & ferns) & leaf litter combined. • Rainforest saplings & lianas are absent or occur as rare or isolated plants. • Field of view at eye level is open (e.g. can see through the forest for about 200m). • Ecosystem will readily carry fire, or is not susceptible to fire (e.g. gibber plain, mangroves).	Good
Light or scattered	• Grasses & functionally equivalent herbaceous species (e.g. *Gahnia aspera*) occur in similar proportion or abundance as other species (e.g. sedges & ferns) & leaf litter combined. • Rainforest seedlings/suckers are sparse in the ground stratum (<15% cover). • Rainforest saplings & lianas are sparse; can readily walk through the community without dodging many rainforest saplings. • Sapling crowns are well separated, providing very sparse cover • Field of view at eye level is fairly open (e.g. can see through the forest for about 50-100m). • Ecosystem will readily carry fire.	Good with Some Concern
Moderate	• Grasses & functionally equivalent herbaceous species (e.g. *Gahnia aspera*) account for ca. 25% of the ground layer; other species (e.g. sedges & ferns) & leaf litter combined account for the remainder. • Rainforest seedlings/suckers are encountered every few steps. • Rainforest saplings moderately dense & lianas may be conspicuous in the canopy; a walk through the community involves dodging rainforest saplings every few metres. • Sapling crowns are clearly separated to slightly separated providing sparse to mid-dense cover • Field of view at eye level is interrupted (*e.g.*, it is difficult to see beyond ca. 25m). • The ecosystem will soon be, or already is, difficult to burn.	Significant Concern
Dense	• Grasses & functionally equivalent herbaceous species (e.g. *Gahnia aspera*) account for < 25% of the ground layer. • Rainforest saplings are dense/abundant & lianas may be conspicuous to abundant in the canopy; a walk through the community involves encountering rainforest saplings every few steps; sapling crowns are slightly separated to touching or overlapping providing mid-dense to dense cover; OR • Rainforest seedlings/suckers are so abundant in the ground stratum that they are encountered nearly every step. • Field of view at eye level is limited (e.g. can see no further than ca. 20m). • The ecosystem is very difficult, if not impossible, to burn; will probably require a series of burns to progressively 'open it up' or burning after a wildfire creates the opportunity to reinstate planned burns.	Critical

## Physical/mechanical damage by animal or human activity

This includes over grazing and over browsing. Record (**Table 3.3 Your record sheet**) the pest/problem species or other agent impacting your inspection site/s. If there is more than one causal agent indicate, if possible, the primary agent. Use the description to get a 'best fit' – not all parameters are relevant to all grazers/browsers and ecosystems. (Refer to the diagrams to determine the extent of branch death)

Impact	Description	Condition
None	• No signs of disturbance or no more than expected from native fauna in 'normal' densities (e.g. rare wallaby pads & droppings). • No or very few dead small or large branches or branchlets.	Good
Minor	Ecosystem intact; amenity little impaired: • some signs of grazing (*e.g.* tops of grass tussocks eaten) &/or occasional pruning of shrubs/trees but no obvious browse line or canopy damage • weeds &/native species typical of over-grazed lands present but not common • dung occasional • 1-10% of soil surface has been visibly disturbed[1] &/or • 1-10% of area subject to slashing &/or • Little or no damage to, or loss of, koala food species canopy or stems	Good with Some Concern
Moderate	Impacts obvious to substantial; amenity impaired: • ground stratum lawn-like or nearly so, at least in places • pads &/or other bare patches are common • browse line or canopy damage obvious • ring-barking &/or excavation of rhizomes becoming obvious • weeds &/native species typical of over-grazed landscapes are common • dung occasional to common • 10-25% of soil surface has been disturbed[1] &/or • 10-25% of area subject to slashing &/or • Damage to, or loss of, koala food species is obvious	Significant Concern
Major	Extensive disturbance; amenity significantly impaired: • ground stratum heavily grazed (may be little left to see) • pads &/or other bare patches are abundant & extensive • browse line marked or canopy damage substantial • many large branches are dead • ring-barking &/or excavation of rhizomes common • weeds &/native species typical of over-grazed landscapes form a substantial proportion of the ground stratum • dung common to abundant • >25% of soil surface has been disturbed &/or • >25% of area subject to slashing &/or • Damage to, or loss of, koala food species is extensive	Critical

[1]Eroded/bare from, for example, trampling, slashing.

Crown diagrams (from Grimes 1978)

1a-d Extent of dead branches
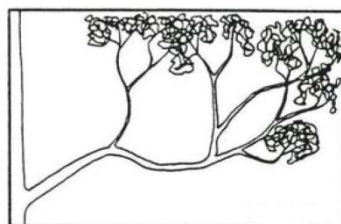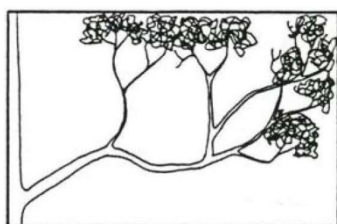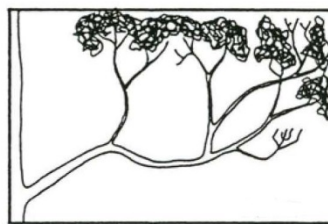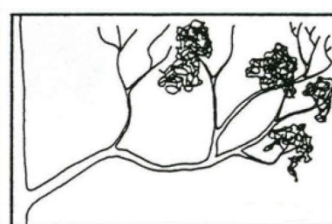
1a. No dead branches   1b. Branchlets dead   1c. Small branches dead 1d. Main branches dead

Active soil erosion

Includes all forms of active (current, recent and/or not stabilised) soil erosion (e.g. sheet, tunnel, gulley, landslip and coastal recession).Use the description to get a 'best fit' – not all parameters are relevant to every ecosystem, situation or stage of recovery.

Impact	Description	Condition
None	• No roots and tubers appear recently exposed on woody species. • No other signs of active erosion.	Good
Minor	• Minor active erosion; few, if any, roots and tubers exposed on woody species. • Fallen trees rare.	Good with Some Concern
Moderate	• Substantial active erosion; widespread exposure of roots and tubers on woody species. • Fallen trees occasional to common. • Little or no organic matter remains.	Significant Concern
Major	• Severe active erosion exposing or removing root systems &/or exposing rock across most/all of area. • Fallen trees common to abundant. • Most/all vegetation and organic matter stripped away; extensive bare ground.	Critical

3.0 Record sheets Health Check Indicators

3.1 Property and site details

Property name (or Lot/Plan): _____

Recorder/s: _____

Habitat type: _____
Koala notes
(sightings, tracks, traces, history): _____

_____

_____

_____

Site Details (for permanent and non-permanent sites):

	Site Id.	GPS Location (Datum:)	Permanent site & photo point established (Y/N)	Approx. site area	Date assessed (d/m/y)
1					
2					
3					
4					
5					

Site & photo point definition

In many cases it <u>will not</u> be necessary to precisely define the boundary of your sites in order to ensure that the next time you (or a colleague) do the health check you use <u>exactly</u> the same areas. A few metres either side will not be a problem. However, in some circumstances the definition of your sites will be important. Is it likely that someone else coming to do the health check in future could be confused about what might or might not be included in the site you are establishing? If the answer to the last question is yes, then provide clear details about your site and its boundary below. Details about why you chose the site may also be useful.

For permanent sites, describe how the photos were/are to be taken. Record photo numbers here also.

Site 1

_____

_____

Site 2

_____

_____

Site 3

_____

_____

Site 4

_____

_____

Site 5

_____

_____

3.2 Condition class summary

For each selected habitat type record in Table 3.1:

- the condition class of each indicator at each site;
- your general impression of the condition of the selected habitat type across the property for each indicator (based on site results, and a general walk around of the habitat type. Note that the condition class you record as your general impression *is not an 'average'* of the condition classes at each site. It *is a considered opinion* of the state of the habitat type on the property based on both the site results and the assessment of the habitat type more broadly;
- the overall condition of the selected habitat type on the property (based on the IUCN definitions **Table 1.3**).

Where it is relevant, provide information on factors contributing to the condition class assigned to an inspection site, in **Table 3.3**. Details relevant to your determination of the General Impression and Overall Condition Class can be recorded in **Table 3.4** and in the notes field below.

Table 3.1 Record of the Condition Class for the habitat-scale and site-scale indicators for each selected habitat.

Key: **G = good**; **GC = good with some concerns**; **SC = significant concern**; **C = critical**; **NA =** not applicable.

Koala Habitat Health Indicators	Condition						General impression
Habitat-scale							
Koala habitat size							
Koala habitat integrity							
Connectivity							
Potential threats to koala habitat							
Threats to koala survival/behaviour							
Proximity to development							
Site-scale	Site 1	Site 2	Site 3	Site 4	Site 5		Not an 'average'!
Presence of koala staple food trees							
Number of evergreen koala staple food tree types							
Recruitment of koala staple food trees							
Recruitment of non-koala food eucalypts							
Tree health and dieback							
Fire							
Severe storm, cyclone or tornado							
Pest plants that alter koala habitat or influence koala survival/behaviour							
Rainforest invasion							
Physical/mechanical damage by animal or human activity							
Active soil erosion							
Overall Condition Class (refer Table 2.2)							

Table 3.2 Overall condition class

Classification	Definition	Management response
Good	Habitat in good condition & likely to be maintained if current conservation measures are maintained.	Maintain effort
Good with some concern	Habitat probably maintained with minor additional conservation measures to address concerns.	Minor attention required – 'a stitch in time'
Significant concern	Habitat at risk from current and/or potential threats. Significant conservation measures required to preserve the habitat in the future.	Requires prompt decision &/action planning
Critical	Habitat is severely threatened. Urgent conservation measures required or the habitat may be lost.	Requires urgent decision on action.

Table 3.3 Information, including key issues/threats, relevant to determining the condition of the selected habitat

Health Check Indicator	Notes *If you don't use a separate notes page for each site then record the relevant site number below against each set of notes*
Habitat-scale	
Koala habitat size	
Koala habitat integrity	
Connectivity	
Potential threats to koala habitat	
Threats to koala survival/behaviour	
Proximity to development	
Site-scale	
Presence of koala staple food trees	
Number of evergreen koala staple food tree types	
Recruitment of koala staple food trees	
Recruitment of non-koala food eucalypts	
Tree health and dieback	
Fire	
Severe storm, cyclone or tornado	
Pest plants that alter koala habitat or influence koala survival/behaviour	
Rainforest invasion	
Physical/mechanical damage by animal or human activity	
Active soil erosion	

Table 3.4 Information relevant to the determination of the *General Impression* for a Health Check Indicator.

Health Check Indicator	Notes
Habitat-scale	
Koala habitat size	23
Koala habitat integrity	
Connectivity	
Potential threats to koala habitat	
Threats to koala survival/behaviour	
Proximity to development	
Site-scale	
Presence of koala staple food trees	
Number of evergreen koala staple food tree types	
Recruitment of koala staple food trees	
Recruitment of non-koala food eucalypts	
Tree health and dieback	
Fire	
Severe storm, cyclone or tornado	
Pest plants that alter koala habitat or influence koala survival/behaviour	
Rainforest invasion	
Physical/mechanical damage by animal or human activity	
Active soil erosion	

Notes relevant to the determination of the Overall Condition Class:

3.3 New or emerging issues noticed (anywhere on the property) while undertaking an inspection

Make a note in **Table 3.5** of localised disturbances, biosecurity issues, or matters that require attention to prevent degradation and significant resource input in the future or pose risk to habitat or koalas.

During future inspections, evaluate the effectiveness of any management response that has occurred since last assessment using the ratings.

Effectiveness of management response	Rating
Desired outcome achieved	1
Heading towards desired outcome	2
Situation static	3
Heading away from desired outcome	4

Table 3.5 Details of matters requiring attention and effectiveness of earlier management response.

Y = yes; N = no; P = partially

ISSUE 1								
Date of initial record (d/m/yr):			GPS location (including datum):					
Issue & current condition:								
Agreed management response (AMR):								
Desired outcome:								
		Follow-up inspections						
Date (d/m/yr)								
AMR implemented (Y/N/P)								
Rating:								
ISSUE 2								
Date of initial record (d/m/yr):			GPS location (including datum):					
Issue & current condition:								
Agreed management response (AMR):								
Desired outcome:								
		Follow-up inspections						
Date (d/m/yr)								
AMR implemented (Y/N/P)								
Rating:								
ISSUE 3								
Date of initial record (d/m/yr):			GPS location (including datum):					
Issue & current condition:								
Agreed management response (AMR):								
Desired outcome:								
		Follow-up inspections						
Date (d/m/yr)								
AMR implemented (Y/N/P)								
Rating:								

4.0 References

IUCN (2012) *Conservation Outlook Assessment-guidelines for their application to natural World Heritage Sites*. Version 1.3
(https://cmsdata.iucn.org/downloads/guidelines___iucn_conservation_outlook_assessments_08_12.pdf)

Melzer R. (2018) *QPWS Monitoring Framework: Guide to undertaking Health Checks for key natural values*. Version 1.5, July 2018. Ecological Assessment Unit, Technical Support, Queensland Parks and Wildlife Service, Department of Environment and Science

Grimes R.F. (1978) *Crown assessment of natural spotted gum, ironbark forest.* Qld Department of Forestry Technical Paper No. 7.

Osipova E., Shi Y., Kormos C., Shadie P., Zwahlen C., Badman T. (2014*) IUCN World Heritage Outlook 2014: A conservation assessment of all natural World Heritage sites.* Gland, Switzerland: IUCN. 64pp.

Stol J. (2006) *Assessment system for measuring state of tree health & level of dieback* (BioAssess Project, Holbrook). CSIRO Sustainable Ecosystems.

Turton S.M. (2008) Landscape-scale impacts of Cyclone Larry on the forests of northeast Australia, including comparisons with previous cyclones impacting the region between 1858 & 2006. *Austral Ecology* **33**: 409-416.