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Development and application of a method for the rapid appraisal of riparian condition

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Summary

- Riparian habitats are where terrestrial and aquatic ecosystems meet. They are vital sites in a catchment supporting high levels of biodiversity.
- Given the extensive degradation of riparian zones in Australia, there is a need for a rapid method of measuring riparian condition to underpin strategies for improved management.
- Riparian *condition* refers to the degree to which human-altered ecosystems diverge from local semi-natural ecosystems in their ability to support a community of organisms and perform ecological functions.
- This Technical Guideline outlines a method for undertaking a Rapid Appraisal of Riparian Condition. It assesses the ecological condition of riparian habitats using indicators that reflect functional aspects of the physical, community and landscape features of the riparian zone.
- The Rapid Appraisal of Riparian Condition index is made up of five sub-indices, each with a number of indicator variables: Habitat continuity and extent (HABITAT), Vegetation cover and structural complexity (COVER), Standing dead trees and fallen logs and leaf litter (DEBRIS), Dominance of natives *vs* exotics (NATIVES), and Indicative features (FEATURES).
- The Rapid Appraisal of Riparian Condition has been tested in three areas in south-eastern Australia: the floodplain reaches of the Murrumbidgee River, west and south Gippsland, and the upper and mid-Goulburn-Broken catchment. In all three areas, there was a strong negative relationship between grazing intensity and riparian condition.
- Testing of the Rapid Appraisal of Riparian Condition index confirms that it is a good indicator of the biodiversity and functioning of riparian zones.

Background

Riparian habitats are where terrestrial and aquatic ecosystems meet. They are vital sites in a catchment, supporting high levels of biodiversity and being critical in controlling flows of energy and nutrients between terrestrial and aquatic ecosystems (Naiman & Decamps, 1997). Being at the boundary of terrestrial and aquatic ecosystems, riparian areas are powerful indicators of catchment quality (e.g. Rapport et al., 1998). Human settlement has always been focused on rivers, and is often a major determinant of riparian structure and function (e.g. Dynesius & Nilsson, 1994). One of the biggest impacts on riparian areas has been the introduction of domestic stock, with grazing being the major land use over 60% of Australia's land surface (Wilson, 1990). Stock concentrate around water sources, which means riparian and wetland habitats, as well as those around artificial watering points in pastoral regions, suffer greater impacts from domestic and feral grazing herds than dryland areas (Robertson, 1997; James et al., 1999). These impacts have led to extensive loss of ecological condition in riparian areas across Australia.

Given the critical role of riparian areas within catchments and their extensive degradation in Australia, there is a need for improved management of these areas. A baseline for improved management must be an understanding of current condition and the factors which determine this. Thus, there is a need for a rapid method of measuring riparian condition to enable assessment of a large number of sites in a catchment. There is an expanding field of research focused on rapid appraisal techniques to measure ecosystem condition or integrity (Fairweather, 1999; Boulton, 1999). This Guideline reports on a project that has developed a rapid appraisal method for use at a large number of sites and is responsive to changes in grazing management.

Throughout this Guideline, *condition* refers to the degree to which human-altered ecosystems diverge from local semi-natural ecosystems in their ability to support a community of organisms and perform ecological functions (c.f. Karr, 1999).

Rapid Appraisal of Riparian Condition (RARC)

Assessment methods incorporating indicators of geophysical and biological properties and processes are likely to provide reliable estimates of ecological condition in riverine ecosystems (Fairweather, 1999; Boulton, 1999). Ladson et al. (1999) described an index of stream condition based on 18 indicators that measure alterations to the hydrology, physical form, streamside vegetation, water quality and biota of streams. This project used a similar approach, and chose indicators to reflect functional aspects of the physical, community and landscape features of the riparian zone, as defined by Naiman & Decamps (1997) (see Table 1). Some of the indicators chosen reflect a variety of functions, for example, different aspects of vegetation cover can play a role in reducing bank erosion, providing organic matter and habitat for fauna, and providing connections in the landscape. The Rapid Appraisal of Riparian Condition (RARC) index is made up of five sub-indices, each with a number of indicator variables (see Table 2). In summary they cover:

1. Habitat continuity and extent (HABITAT).
2. Vegetation cover and structural complexity (COVER).
3. Standing dead trees, fallen logs and leaf litter (DEBRIS).
4. Dominance of natives *vs* exotics (NATIVES).
5. Indicative features (FEATURES).

Table 1. Summary table of functions, components and indicators assessed in the Rapid Appraisal of Riparian Condition index.

Functions of the riparian zone at different levels of organisation	**Components of the riparian ecosystem that perform those functions**	**Indicators of the functions used in the RARC**
Physical:		
Reduction of erosion of banks	Roots, ground cover	Vegetation cover *
Sediment trapping	Roots, fallen logs, ground cover	Canopy cover, fallen logs, ground cover vegetation, leaf litter cover
Controlling stream microclimate/ discharge/water temperatures	Riparian forest	Canopy cover
Filtering of nutrients from upslope	Vegetation, leaf litter	Ground cover vegetation, leaf litter cover
Community:		
Provision of organic matter to aquatic food chains	Vegetation	Vegetation cover, leaf litter cover
Retention of plant propagules	Fallen logs, leaf litter	Fallen logs, leaf litter cover
Maintenance of plant diversity	Regeneration of dominant species, presence of important species, dominance of natives *vs* exotics	Native canopy and shrub regeneration, grazing damage to regeneration, reeds, native vegetation cover
Provision of habitat for aquatic and terrestrial fauna	Fallen logs, leaf litter, standing dead trees/hollows, riparian forest, habitat complexity	Fallen logs, leaf litter cover, standing dead trees, vegetation cover, number of vegetation layers
Landscape:		
Provision of biological connections in the landscape	Riparian forest (cover, width, connectedness)	Vegetation cover, width of riparian vegetation, longitudinal continuity of riparian vegetation
Provision of refuge in droughts	Riparian forest	Vegetation cover

* Vegetation cover = canopy, understorey and ground cover

Table 2. Sub-indices (and their weighting in the final score) and indicators of the Rapid Appraisal of Riparian Condition, the range within which each is scored, the method of scoring for each indicator, and the maximum possible total for each sub-index. (Note that in Table 2 the indicators are not grouped by function as in Table 1.)

Sub-index	Indicator	Range	Method of scoring	Total
HABITAT				8
(10/50)	Width of riparian vegetation (scored differently for channels < or ≥ 10 m wide)	0–4	*Channel < 10 m wide*: 0 = < 5 m vegetated, 1 = 5–9 m vegetated, 2 = 10–29 m vegetated, 3 = 30–39 m vegetated, 4 = ≥ 40 m vegetated	
			Channel ≥ 10 m wide: 0 = < 0.5 CW, 1 = 0.5–0.9 CW, 2 = 1–2.9 CW, 3 = 3–3.9 CW, 4 = ≥ 4 CW where CW = channel width	
	Longitudinal continuity of riparian vegetation (≥ 5 m wide)	0–4	0 = < 50% vegetated bank, 1 = 50–64% vegetated bank, 2 = 65–79% vegetated bank, 3 = 80–94% vegetated bank, 4 = ≥ 95% vegetated bank; with 1/2 point taken off for each significant discontinuity (≥ 50 m long)	
COVER				12(13)
(10/50)	Canopy (> 5 m tall)	0–3	0 = absent, 1 = 1–30%, 2 = 31–60%, 3 = > 60% cover	
	Understorey (1–5 m tall)	0–3	0 = absent, 1 = 1–30%, 2 = 31–60%, 3 = > 60% cover	
	Ground (< 1 m tall)	0–3	0 = absent, 1 = 1–30%, 2 = 31–60%, 3 = > 60% cover	
	Number of layers	0–3(4)	0 = no vegetation layers to 3 = ground cover, understorey and canopy layers (4 if sub-canopy present)	
DEBRIS				7
(10/50)	Leaf litter	0–3	0 = none, 1 = 1–30%, 2 = 31–60%, 3 = > 60% ground cover	
	Standing dead trees (> 20 cm dbh)	0–1	0 = absent, 1 = present	
	Fallen logs (> 10 cm diameter)	0–3	0 = none, 1 = small quantities, 2 = abundant but some removed, 3 = abundant with no signs of removal	
NATIVES				12
(10/50)	Canopy (> 5 m tall)	0–3	0 = none, 1 = 1–30%, 2 = 31–60%, 3 = > 60% cover of natives	
	Understorey (1–5 m tall)	0–3	0 = none, 1 = 1–30%, 2 = 31–60%, 3 = > 60% cover of natives	
	Ground (<1 m tall)	0–3	0 = none, 1 = 1–30%, 2 = 31–60%, 3 = > 60% cover of natives	
	Leaf litter	0–3	0 = none, 1 = 1–30%, 2 = 31–60%, 3 = > 60% cover of natives	

dbh = diameter at breast height < = less than > = greater than ≥ = greater or equal

Table 2. continued

Sub-index	Indicator	Range	Method of scoring	Total
FEATURES				7
(10/50)	Native canopy species regeneration	0–2	0 = none, 1 = scattered, and 2 = abundant seedlings	
	Damage to regeneration	0–2	0 = all damaged, 1 = some damaged, 2 = no damage	
	Native shrub/sub-canopy regeneration	0–2	0 = none, 1 = scattered, and 2 = abundant seedlings	
	Reeds	0–1	0 = absent, 1 = present	

Photo 1. A site in excellent condition on the Edward River (RARC Score = 50; note continuous canopy of native trees, standing dead trees and fallen logs, native shrub understorey, reeds and regeneration of canopy trees).

Photo 2. A site in very poor condition on the Murrumbidgee River (RARC Score = 13.2; note discontinuous canopy, lack of shrubs, small amounts of leaf litter, lack of native ground cover and reeds, little regeneration of canopy trees).

Photos 1 and 2 show contrasting sites in excellent and very poor condition. Details of the scoring for these sites can be found in the box below.

Example of scoring indicators for the sites shown in Photos 1 and 2 (see Table 2 for indicators and details)

	Excellent condition site (Photo 1)		Very poor condition site (Photo 2)	
Sub-index	Raw score / max. total	Weighted score*	Raw score / max. total	Weighted score*
Habitat	4 + 4 = 8 / 8	10	0 + 0 = 0 / 8	0
Cover	3 + 3 + 3 + 3 = 12 / 12	10	1 + 0 + 3 + 2 = 6 / 12	5
Debris	3 + 1 + 3 = 7 / 7	10	1 + 1 + 1 = 3 / 7	4.3
Natives	3 + 3 + 3 + 3 = 12 / 12	10	1 + 0 + 1 + 1 = 3 / 12	2.5
Features	2 + 2 + 2 + 1 = 7 / 7	10	1 + 0 + 0 + 0 = 1 / 7	1.4
Total		50		13.2

* Raw score divided by maximum possible total and multiplied by 10

Applications of the Rapid Appraisal of Riparian Condition index

The RARC was initially developed as a tool to determine the impacts of grazing management practices on riparian condition, and to identify those practices which resulted in minimal impacts. We have now tested this approach in three areas of south-eastern Australia (see Figure 1); some results are presented below.

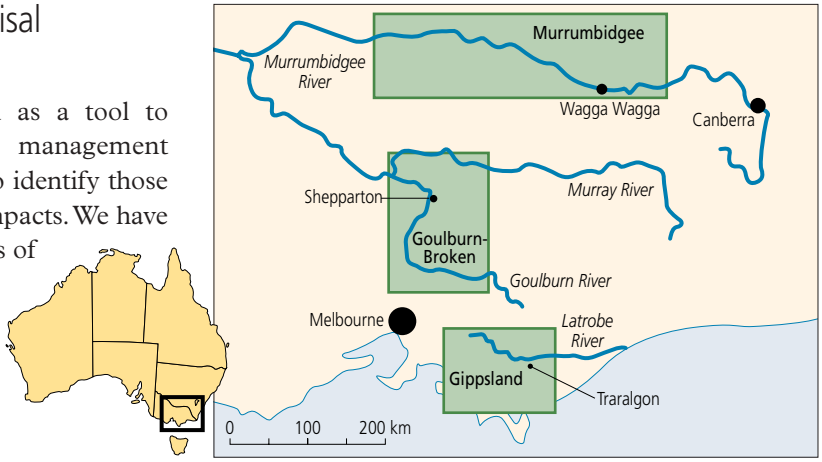


Figure 1. Location of sites where the rapid appraisal of riparian condition has been applied.

Murrumbidgee River

A total of 138 sites (each 1 kilometre in length) were surveyed between Gundagai and Hay, on private properties, crown land and State Forests (Jansen & Robertson, 2001a). The majority of sites on private property were in very poor condition, while sites on Crown Land (mainly Travelling Stock Reserves) were very variable. Most State Forest sites were in good to excellent condition (Figure 2a).

Gippsland

A total of 108 sites (each 150 metres in length) were surveyed in West and South Gippsland, at three types of sites — grazed paddocks on private properties, planted and fenced riparian areas on private properties, and remnant patches of uncleared native vegetation both on private properties and in reserves (Thompson et al., 2003). All private property sites were on dairy farms. The majority of sites were in very poor condition, with only remnant sites scoring above average (Figure 2b). It should be noted that most planted sites were relatively recently fenced, and their condition can be expected to improve as the plantings mature.

Goulburn-Broken

A total of 46 sites (each 200 metres in length) were surveyed in the upper and mid-Goulburn-Broken catchment, at grazed and ungrazed sites on private properties, and at ungrazed sites in reserves (Wilson et al., 2003). Again, the majority of sites were in very poor condition (Figure 2c). Like the Gippsland planted sites, many of the Goulburn-Broken ungrazed sites on private properties were relatively recently fenced, and their condition can be expected to improve as plantings mature.

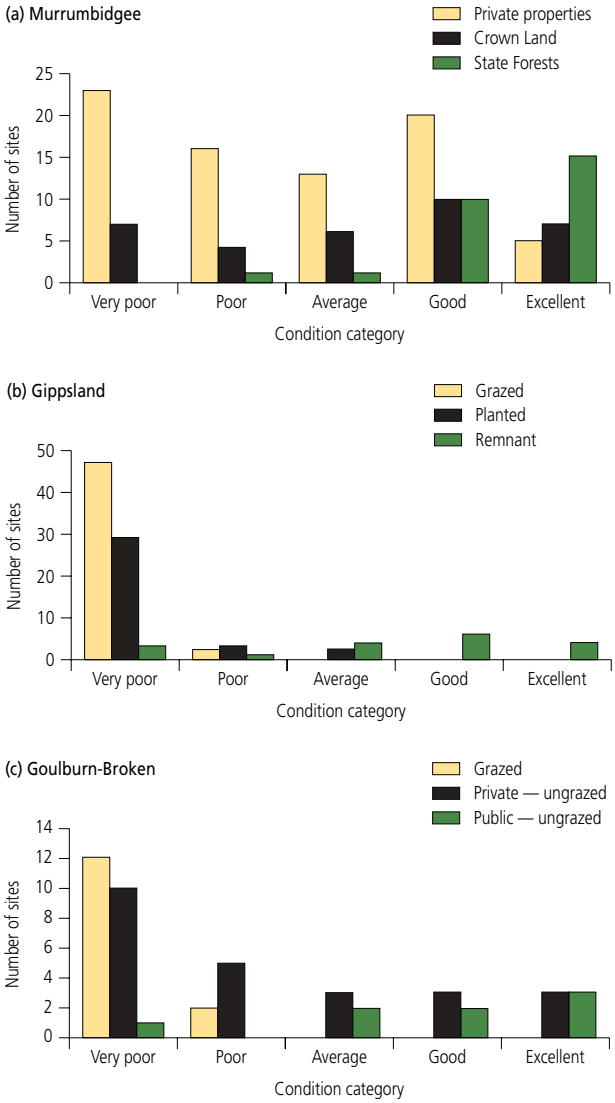


Figure 2. The number of sites scoring in each category (< 25 Very poor, 25–30 Poor, 30–35 Average, 35–40 Good and > 40 Excellent) of the riparian condition index for three regions: (a) Murrumbidgee River, (b) West and South Gippsland, and (c) upper and mid-Goulburn-Broken catchment.

Riparian condition in relation to stocking rates

In all three regions, the relationship between stocking rates and riparian condition was examined, with Figure 3 below summarising results. Clearly, riparian condition declined with increased stocking rates, across all regions and a large range of stocking rates. Given the large number of sites in poor condition in all catchments, this suggests that stocking rates commonly used on private properties are too high to maintain riparian zones in good condition.

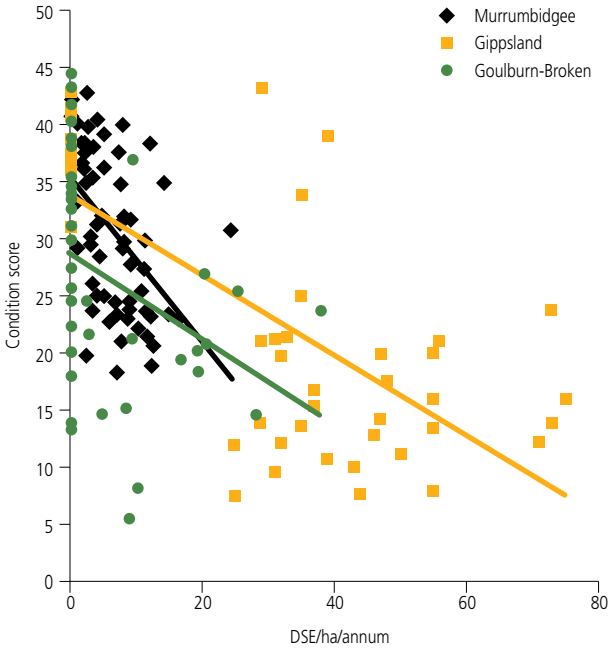


Figure 3. Condition scores in relation to stocking rates (DSE/ha/annum) for three regions: Murrumbidgee River, West and South Gippsland, and upper and mid-Goulburn-Broken catchment.

Sub-indices of the riparian condition index

There was variation across regions in relation to which sub-indices accounted for most of the variation in the total riparian condition score (Table 3). In the Murrumbidgee region, 85% of the variance in the total condition score was explained by the DEBRIS sub-index (scoring for leaf litter, fallen logs and standing dead trees). In Gippsland, 90% of the variance in the total condition score was explained by the NATIVES sub-index (scoring for native species in the vegetation cover and debris). In the Goulburn-Broken, 79% of the variance in the total condition score was explained by the COVER sub-index (scoring for % cover in each vegetation layer, and the number of vegetation layers).

Sub-index	Murrum-bidgee	Gippsland	Goulburn-Broken
COVER	0.42	0.83	0.79
DEBRIS	0.85	0.75	0.70
HABITAT	0.81	0.80	0.62
NATIVES	0.23	0.90	0.77
FEATURES	0.60	0.32	0.56

Table 3. Proportion of variance in the total riparian condition index score explained (R^2 value) by each sub-index for three regions: Murrumbidgee River, West and South Gippsland, and upper and mid-Goulburn-Broken catchment. The R^2 value was obtained by regressing the values for each sub-index against the total index scores for each site.

Dairy cows grazing in the riparian zone, Gippsland, Victoria. Photo Sharon Aarons.

The DEBRIS sub-index consistently explained at least 70% of the variance in the total condition score, suggesting that management practices aimed at retaining standing dead trees and fallen logs would improve riparian condition scores in all regions. The HABITAT sub-index was also relatively consistent across regions, explaining at least 62% of the variance in total condition scores. This suggests that maintaining or restoring a continuous canopy in the riparian zone is also important in all regions. In contrast, the NATIVES sub-index explained little of the variance in the Murrumbidgee but most of it in Gippsland. This sub-index indicates that in the Murrumbidgee, the canopy trees are predominantly native, there is little shrub cover, and the ground cover is predominantly exotic. In this region, there is little chance of altering this on a large scale. In Gippsland, however, the index indicates a lot of variability in the dominance of natives over exotics in all vegetation layers, and that management aimed at maintaining or restoring native species could significantly improve riparian condition.

Why is the RARC a useful tool?
What does riparian condition tell us about the biodiversity and functioning of riparian zones?

The RARC has been tested against more detailed measures of the biodiversity and functioning of riparian zones in the Murrumbidgee and Gippsland regions. There was a significant positive relationship between litter decomposition rates in the soil and the COVER sub-index of the RARC score in both Summer ($r = 0.50$, $p < 0.05$) and Autumn ($r = 0.78$, $p < 0.01$), indicating that decomposition rates were higher where there was more vegetation cover in the riparian zone of the Murrumbidgee River. There were highly significant relationships between bird communities and all sub-indices, as well as the total RARC score ($r = 0.68$, $p < 0.0001$), indicating that riparian bird communities varied according to the condition of the riparian zone of the Murrumbidgee River (Jansen & Robertson, 2001b). Of particular significance ($r = 0.74$, $p < 0.0001$) was the DEBRIS sub-index (scoring for leaf litter, fallen logs and standing dead trees), indicating that retention of leaf litter and woody debris in riparian habitats is crucial to the survival of riparian bird communities. Many of the species most dependent on these features (e.g. Treecreepers) are threatened or declining throughout the agricultural regions of southern Australia (Ford et al., 2001).

In Gippsland, there was also a significant relationship ($r = 0.59$, $p < 0.0001$) between bird communities and the total RARC score, indicating again that riparian bird communities varied according to the condition of riparian zones in Gippsland (Thompson et al., 2003).

Given the importance of riparian zones in supporting high levels of regional biodiversity (Naiman & Decamps, 1997), and the links between riparian condition and biodiversity demonstrated here, the RARC is a useful tool for assessing riparian condition and hence biodiversity and functioning of riparian zones.

r = correlation coefficient (indicates the strength of a relationship

p = significance (where $p < 0.05$ indicates a significant relationship)

Right: A white-throated treecreeper. These birds live in riparian areas and their presence can be used as an indicator of riparian health. Photo Andrew Tatnell.

Relatively intact riparian area with wood providing in-stream habitat and hydraulic complexity. Photo Guy Roth.

Applying the RARC: Steps in assessing riparian condition

The Rapid Appraisal of Riparian Condition index can be used for a variety of applications. Examples include determining relationships between riparian condition and management practices, as in the studies mentioned earlier, or surveying overall condition within a catchment to determine priorities for future rehabilitation works in the catchment. Whatever the application, care should be taken to clearly define the question to be answered, determine the sampling design and select sites appropriately to answer the question. This may require help from a consultant with experience in experimental design and data analysis.

The steps outlined below assume that sampling sites have been chosen appropriately to answer the question of interest. Relatively pristine sites, undisturbed by grazing and clearing, should also be sampled and used as benchmarks for the index. This enables scoring of each indicator to be checked against what may be expected for the catchment.

Tips:

- In general, sampling of sites should be *random**, rather than only sampling sites which are easily accessible by road.
- A single observer should conduct all assessments, and they should undertake some training beforehand, to ensure consistency of data collection.
- The observer will need to have some experience in discriminating native and exotic plant species, and may benefit from previous experience in habitat surveys.
- Survey all sites at a similar time of year.
- Use a separate scoring sheet for each site.
- Allow 20–60 minutes per site, depending on size and accessibility.

* If you were interested in surveying overall catchment condition, you could choose sites randomly by laying a grid over a map of the catchment, locating and numbering all squares which contain a riparian zone, then putting these numbers in a hat and pulling out as many sites as you wish to sample. For more specific advice on sampling, help should be sought from a consultant.

1 Determine site size

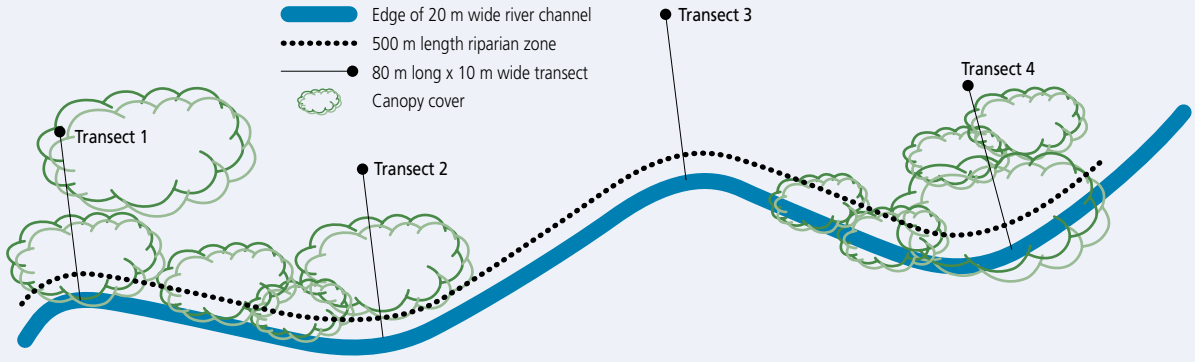
Site size must be determined according to the size of the management unit of interest. For example, our studies have examined impacts of grazing management on riparian condition, so management units have been individual paddocks. On the Murrumbidgee River where paddocks are relatively large, a one kilometre length of the riparian zone was defined as a 'site', while in Gippsland, where paddocks are much smaller, a 150 metre length was used. Ideally, sites should be at least 200 metres long, with 500 metres being the preferred length where practicable. On larger rivers, only one side of the river is surveyed, while at smaller sites where it is practicable to do so, both sides may be surveyed (provided they are subject to the same management regime).

The length of transects (see below) at each site is determined by the width of the river channel — 40 metres long for channels < 10 metres wide, and four times the channel width for larger rivers. Figure 4 illustrates a hypothetical river with the layout of the survey area and the transects indicated.

2 Score indicators

A sample scoring sheet can be found on page 13 of this Guideline. At each site, canopy vegetation along the bank is mapped to show the length and number of any discontinuities (gaps of at least 50 metres) in canopy cover (the bank is considered to be vegetated if the riparian canopy vegetation is at least 5 metres wide). Four transects (10 metres wide; perpendicular to the direction of river flow) are evenly spaced along the bank. The following parameters are scored according to Table 2 within each of these transects:

- Channel width and width of the riparian canopy vegetation (on the side of the river being assessed — this can be determined from aerial photographs for large rivers).
- Percentage vegetation cover within each layer (ground cover — lichens, mosses, grasses, herbs, reeds and sedges to 1 metre tall; understorey — herbs, reeds, shrubs and saplings 1–5 metres tall; canopy — trees > 5 metres tall).
- Percentage cover of native species in each vegetation layer.



Condition scores for this hypothetical riparian sample site

Longitudinal continuity of riparian vegetation (> 5 m wide)

Map			Score
200 m vegetated	150 m bare	150 m vegetated	1.5 (70% vegetated with 1 discontinuity)

Width of riparian vegetation

Transect	Channel Width (CW)	Vegetation Width	Score
1	20	> 80	4
2	20	60	3
3	20	0	0
4	20	70	3

Vegetation cover

Transect	Canopy
1	3
2	2
3	0
4	3

Figure 4. Hypothetical river with length and transects marked. The box gives the scoring for the indicators shown in this diagram (see page 13 for full score sheet).

- The number of vegetation layers.
- Percentage leaf litter cover on the ground and the percentage cover which is of native species.
- Presence of standing dead trees (> 20 centimetres dbh).
- Abundance of fallen logs (> 10 centimetres in diameter).
- Abundance of native canopy species seedlings (< 1 metre tall).
- Grazing damage to canopy species seedlings.
- Abundance of native shrub regeneration.
- Presence of reeds.

All measures are recorded as rank scores in the field, except channel width and width of the riparian vegetation, which are estimated to the nearest 5 metres in the field and then converted to scores. Photos 3–5 illustrate scoring of some of these features.

- The channel width is defined by the area normally lacking any terrestrial or bankside vegetation.
- The width of the riparian canopy vegetation is the distance from the bank to the first gap of > 50 metres in the canopy vegetation.
- To estimate percentage cover of native species, imagine removing all exotic species and re-estimating percentage vegetation cover with only the native species.
- Tussocky perennial (long-lived) grasses tend to be native species while annual (short-lived) grasses tend to be exotic species (with a few obvious exceptions such as *Phalaris* which is a perennial exotic species).
- Reeds include species such as *Phragmites*, *Typha* (Cumbungi) and *Carex* which are normally only found on riverbanks or in swampy areas.

Photo 3 (above): Leaf litter cover increasing from 1 to 3 (left to right).

Photo 4 (left): Exotic annual understorey (left) *vs* Native perennial tussock understorey (right).

Photo 5 (below): Canopy cover increasing from 1–3 (left to right).

3 Analyse data

Using Table 2, the indicators are averaged across transects, then summed into sub-indices. The final index score is then a weighted sum (each sub-index is divided by its maximum possible total and multiplied by 10) of the sub-indices, with a possible maximum of 50 indicating best condition. To examine the results, it is helpful to categorise the index scores, e.g. less than 25 very poor, 25–30 poor, 30–35 average, 35–40 good and more than 40 excellent. It is also helpful to examine sub-index scores, and to determine which sub-indices contribute most to the final condition score. This can be done by regression of sub-index scores on the total index score.

- If there is no regeneration, you cannot score for grazing damage. This means that when you average across transects, you should only include those where there is regeneration when calculating the average grazing damage score.
- If there is no regeneration in any transect, you will have to adjust the weighting for the FEATURES sub-index to reflect this (divide by 5 instead of 7).
- Other weightings may have to be adjusted depending on the results of the benchmarking process. For example, in the Murrumbidgee region, historical data suggested that native understorey cover was probably naturally low, so we only scored this indicator as 0 or 1. Thus, the COVER and NATIVES sub-indices both had maximum possible totals of 10, and were weighted accordingly.

Limitations of the RARC

While the condition index outlined in this Guideline has been tested in a number of catchments and situations, it has some potential limitations. With further work in the future, we expect to overcome some of the limitations listed below:

- The RARC has been designed and tested on creeks and rivers in south-eastern Australia. Its usefulness in other regions is yet to be explored.
- The RARC is designed for riparian zones that are naturally dominated by trees, with at least 60% canopy cover.
- The RARC is intended as an indicator of *current* condition. Thus for restored areas, it will not indicate the potential for recovery of ecosystem function.
- Benchmarking against relatively pristine sites is not always possible in highly modified catchments. In these situations, we can only make a 'best guess', based on local knowledge and historical information, about the appropriate scoring for each indicator in these catchments.

Concluding comment

The RARC is a general tool for assessing riparian zone function and biodiversity. For specific projects, users may wish to record additional features of the riparian zone or adjust scorings and weightings to suit specific circumstances.

Further information

We will be continuing to refine and update the RARC so to get the most recent version check the website www.rivers.gov.au. The scoring sheet is also on the website and can be easily downloaded. The original scientific paper describing the method and its application on the Murrumbidgee River is Jansen & Robertson (2001a). Copies of this paper are available on request from Amy Jansen. The reports on the work in Gippsland and the Goulburn-Broken are available from the Johnstone Centre website: www.csu.edu.au/research/jcentre/

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Sample scoring sheet for the Rapid Appraisal of Riparian Condition

Site: _____ GPS beginning: _____

Date: _____ Observer: _____ GPS end: _____

Longitudinal continuity of riparian canopy vegetation (> 5 m wide)

Map	Score

0 = < 50% vegetated bank, 1 = 50–64% vegetated bank, 2 = 65–79% vegetated bank, 3 = 80–94% vegetated bank, 4 = ≥ 95% vegetated bank, with 1/2 point taken off for each significant discontinuity (≥ 50 m long)

Width of riparian vegetation

Transect	Channel Width (CW)	Vegetation Width	Score
1			
2			
3			
4			

Channel < 10 m wide: 0 = < 5 m vegetated, 1 = 5–9 m vegetated, 2 = 10–29 m vegetated, 3 = 30–39 m vegetated, 4 = ≥ 40 m vegetated
Channel ≥ 10 m wide: 0 = < 0.5 CW, 1 = 0.5–0.9 CW, 2 = 0.9–2.9 CW, 3 = 2.9–3.9 CW, 4 = ≥ 4 CW

Vegetation cover: Canopy > 5 m, Understorey 1–5 m, Ground cover < 1 m

Transect	Canopy	Native canopy	Understorey	Native understorey	Ground cover	Native ground cover	# layers
1							
2							
3							
4							

Cover and native cover: 0 = none, 1 = 1–30%, 2 = 31–60% , 3 = > 60%

Debris

Transect	Leaf litter	Native leaf litter	Standing dead trees	Fallen logs
1				
2				
3				
4				

Leaf litter cover and native leaf litter cover: 0 = none, 1 = 1–30%, 2 = 31–60%, 3 = > 60%
Standing dead trees (> 20 cm dbh): 0 = absent, 1 = present
Fallen logs (> 10 cm diameter): 0 = none, 1 = small quantities, 2 = abundant but some removed, 3 = abundant with no signs of removal

Indicative features

Transect	Canopy species regeneration	Grazing damage to regeneration	Shrub/sub-canopy regeneration	Reeds
1				
2				
3				
4				

Regeneration < 1 m tall: 0 = none, 1 = scattered, and 2 = abundant Damage: 0 = all damaged, 1 = some damaged, 2 = no damage
Reeds: 0 = absent, 1 = present

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