Baroota Creek

Tree condition surveys

December 2022 - October 2025

FINAL REPORT

Produced by Todd Wallace

Riverwater Life Pty Ltd

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Disclaimer:

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Cover photo: Baroota Creek looking north-east from BarTCI_8 towards Port Germein Gorge and the Baroota Reservoir, December 2022. Photograph by Todd Wallace.

Executive summary

Scope of this report

This report presents the data set for eight (8) standardised tree condition transects in the mid-reach of Baroota Creek (South Australia), downstream of the Baroota Reservoir. Transects were established in December 2022 and resurveyed in November 2023, November 2024 and October 2025. The transects were established to enable the ongoing monitoring of river red gum (*Eucalyptus camaldulensis*) condition. Field surveys were undertaken using the standardised *The Living Murray* tree condition method, with data analysed and reported utilising The Tree Condition Index (TCI) in which trees with TCI scores ≥10 are considered to be in good condition.

The data is evaluated in the context of the Baroota Prescribed Water Resources Area draft Water Allocation Plan (WAP), which specifies an Ecological Objective of:

> ***the maintenance of existing river red gum trees along the watercourse, such that they provide the habitat structure, cultural outcomes and amenity to the watercourse corridor suitable for fauna and the community***

an Environmental Target of:

> ***90% of the river red gum trees need to maintain a TCI of ten or greater***

and an Asset condition limit of:

> ***at least 80% of the trees to have a TCI of greater than eight***

TCI scores of ≤8 indicate a high degree of water stress and indicate that trees may be at the edge of the resilience period, i.e. continuation of dry conditions is likely to lead to a marked loss of condition or defoliation, and multiple, back-to-back watering is likely to be required to achieve "good" condition. Because the strength of the response to environmental watering decreases as the TCI score decrease, avoiding the need for repeat watering by delivering water when trees are still in good condition should be a management priority. Therefore, we recommend that a Management Threshold i.e. ***More than 10% of established viable trees with DBH > 10 cm receive TCI scores ≤8*** is also incorporated into the planning and delivery of environmental water in Baroota Creek.

Results

Environmental Target: The data shows that all sites are in poor condition relative to the reference condition. However, condition has improved substantially at some sites between the baseline survey (2022) and the most recent surveys. In both December 2022 and November 2023, only one transect (BarTCI_7) met (passed) the Environmental Target of 90% of viable trees with TCI ≥10. In November 2024, four transects met (passed) the Environmental Target. In October 2025, only three transects met the Ecological Target. It is of note that for the transect that met the Ecological Target in 2024 but not 2025, there was a marked decline in condition.

Asset Condition Limit: The Asset Condition Limit was met (passed) at all transects in all survey periods.

Management Threshold: A high prevalence of trees with TCI scores ≤8 is evident. In December 2022 and November 2023, four out of the eight transects exceeded (triggered) the management threshold. In November 2024, three transects exceeded the management threshold. In October 2025, only two transects exceeded the management threshold. Transect 4 has shown a year-on-year decrease in the percentage of trees exceeding the threshold. Only one transect (BarTCI_7) consistently recorded no trees with TCI scores ≤8.

Watering priority: In December 2022 and November 2023, four transects were rated as "very high priority" and three transects were rated as "high priority" for environmental water delivery. In November 2024, three transects were rated as "very high priority" and one transect was rated as "high priority" for environmental water delivery. In October 2025, two transects (BarTCI_5 and BarTCI_8) were rated "very high priority". Only one transect (BarTCI_7) is consistently rated as "very low" priority.

Tree loss: In transect 4 (BarTCI_4), one tree became defoliated between the December 2022 and November 2023 surveys. In transect 3, (BarTCI_3), one tree became defoliated between the November 2023 and November 2024 surveys. In both cases, the trees were rated as 'very poor" condition in the preceding survey. In October 2025, one tree that had been in poor condition in all preceding surveys became defoliated.

Recruitment: The data from December 2022 indicates a distinct lack of recruitment in recent decades. For all transects pooled, only 13 trees (5%) were recorded with DBH less than 20 cm. Four out of the eight transects had no trees in this size class.

Summary

A high percentage (i.e. 53%) of viable trees throughout the assessment locations are characterised by the presence of epicormic growth. This is an indicator of partial recovery from preceding water stress. Marked improvement in both condition and watering priority was observed at transects 1-3 between the 2023 and 2024 surveys. However, multiple transects continue to receive ratings of "very high" priority for delivery of environmental water. Tree loss was observed in one transect between the 2022-2023 (transect BarTCI_4), 2023-2024 surveys (transect BarTCI_3) and 2024-25 surveys (transect BarTCI_4). In all cases, the trees were rated as poor or very poor condition in the preceding survey.

In November 2023, condition at transect 4 (BarTCI_4) had been approaching a critical tipping point. Between November 2023 and November 2024, condition improved substantially with some improvement continuing through to October 2025. However, the crown of these trees is dominated by recent epicormic growth and their habitat value is compromised as a result. It also of note that despite the general trend of improvement, one tree was lost (became completely defoliated) between November 2024 and October 2025, and one tree is in extremely poor condition, receiving the lowest possible field score. It is anticipated that in the absence of a substantial flow event, this tree will be recorded as defoliated in the 2026 surveys.

Recommendations

Based on the partial recovery observed at transect 4, combined with the gradual improvement in condition at transects 1-3, the recent loss of trees, and the ongoing presence of trees with TCI scores ≤8, it is recommended that planning for delivery of additional environmental water releases commence as soon as practicable. This will support the ongoing recovery of trees that have previously responded to improved soil water potential (as indicated by the high prevalence of epicormic growth), and (iii) increase the likelihood of recovery and achieving the Environmental Target.

Whilst size is a poor indicator of age, the December 2022 survey data indicates a distinct lack of recruitment in recent decades. For all transects pooled, out of 240 trees, only 13 trees (5%) were recorded with DBH less than 20 cm. Recruitment of river red gums was not considered an objective of the draft WAP, as it was considered that recruitment flows are only likely to be provided by unregulated spills from the reservoir or runoff from large rainfall events (NYLB 2022). Whilst frequent (sub-decadal scale) recruitment is not required to maintain the existing ecological character of the creek, existing recruitment processes (seedling establishment and survival through to mature tree) are inadequate. Consequently, it is recommended that environmental water provisions be used to support the key recruitment processes of seedling survival and sapling growth when germination is detected following unregulated spills and/or managed releases.

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1. Introduction

Scope of this report

This report presents the data set for eight (8) standardised tree condition transects in the mid-reach of Baroota Creek (South Australia), downstream of the Baroota Reservoir. Transects were established in December 2022 and resurveyed in November 2023, November 2024 and October 2025. The transects were established to enable the ongoing monitoring of river red gum (*Eucalyptus camaldulensis*) condition. Field surveys were undertaken using the standardised *The Living Murray* tree condition method, with data analysed and reported utilising The Tree Condition Index (TCI) in which trees with TCI scores ≥10 are considered to be in good condition. The data is evaluated in the context of the Baroota Prescribed Water Resources Area draft Water Allocation Plan (WAP) (NYLB 2022).

2. Methods

Site selection

It is preferable that monitoring for multiple attributes (e.g. tree condition, groundwater, soil condition, understory vegetation) are co-located so as to maximise the interpretation of data and trajectory of condition. For this project, assessment sites that are being used for geophysics (soil condition) and tree physiology monitoring currently being undertaken by the Flinders University (Banks and Shanafield 2022) were retained to maximise the management utility of collected data. Site locations are presented in Table 1 and Figure 1. The eight assessment areas (Table 1) were established as transects (not spatially constrained).

Table 1: Site locations (co-ordinates are for position of ground-based photo-points).

Transect	Date	Latitude	Longitude	MGA Zone	Easting	Northing
BarTCI_1	13/12/2022	-32.982208	138.015060	54H	221052	6346728
BarTCI_2	13/12/2022	-32.973676	138.017721	54H	221274	6347681
BarTCI_3	13/12/2022	-32.966025	138.021240	54H	221579	6348539
BarTCI_4	13/12/2022	-32.959130	138.027763	54H	222167	6349321
BarTCI_5	14/12/2022	-32.956357	138.033257	54H	222672	6349643
BarTCI_6	14/12/2022	-32.944887	138.042955	54H	223543	6350941
BarTCI_7	14/12/2022	-32.941628	138.044500	54H	223677	6351307
BarTCI_8	15/12/2022	-32.933038	138.048363	54H	224012	6352270

Figure 1: Locations of tree condition transects along Baroota Creek downstream of Baroota Reservoir

Tree crown condition - assessment method The visual condition of trees was determined using the standardised *The Living Murray* tree condition method (Souter *et al.* 2010a). In brief, at each transect the condition of 30 trees was visually assessed for crown extent (CE) and crown density (CD) with field data on CE and CD recorded to the nearest 5%. Trees with diameter at breast height (DBH, measured at 1.3 m above ground level) ≥ 10 cm were selected. The tree selection process aimed to (i) provide a representation of the population demographic within the assessment location, (ii) utilise trees which are the "next nearest neighbour" from the starting point of each transect, (iii) remain within a similar elevation gradient within the meso habitat, and (iv) include live and dead trees if both are present. Trees that have died are included within the transect as this provides data on relative proportion of live/dead trees and facilitates an assessment of rate of loss (die off) when surveys are repeated over time.

For each tree, a semi-permanent tag (plastic, yellow ca. 70 x 70 mm) labelled with a unique identifier was affixed to the tree at approximately 1.3-1.8 m above ground level. The location (easting and northing) of each tree was recorded with a handheld GPS (nominal position accuracy of ±4 m). The unique identifier, species location, CE and CD data are recorded in the electronic data file that accompanies this report. Although not included in the TCI score system (Wallace *et al.* 2020), in the baseline survey period, the presence of epicormic growth (new shoots from the main trunk or major support branches) was noted if it substantially characterised (dominated) the appearance of the tree, and was recorded as being either (i) early-stage epicormic growth; base of shoot < 1 cm diameter, (ii) mid-stage epicormic growth; base of shoot is 1-5 cm diameter, or (iii) late-stage epicormic growth; base of shoot is 5-10 cm diameter.

The field data was processed according to the method described in Wallace *et al.* (2020) in which field data is binned (a data management approach where continuous data values are placed into a pre-defined intervals) into one of seven categories (Table 2). The Tree Condition Index (TCI) for each tree is then calculated by summing the scores for crown extent and crown density generating a score between 0 and 14 (Table 3).

Interpretation of Tree Condition Index scores

The TCI data is interpreted within a conceptual model of tree response to wetting and drying cycles (see Table 3 and Figure 2 in section 3). A TCI score of 10 or above represents a tree in "good" condition. TCI scores between 8 and 9 are "moderate" condition, between 5 and 7 are "poor condition", and ≤4 is "very poor" condition. Trees with a TCI score of 0 are either (i) dead or unlikely to respond to watering, or (ii) be very near to the critical point of 'loss'. The strength of the response to environmental watering decreases as the TCI score decrease.

Population demographics

The age-class distribution of trees is an indicator for recruitment and survival, and the growth of young trees must at least match the mortality of old trees if a stand is to remain viable (George *et al.* 2005). Whilst size is a poor indicator of age, it does provide insight into the demographic of the transect, and the relative frequency of recruitment events within a meso-habitat. In the baseline survey (December 2022) data on size was collected following the principles detailed in the Joint Ventures Monitoring and Evaluation report (VTAG 2019). In brief, DBH for each tree in the transect (alive and dead) was measured and recorded to the nearest 0.1 cm according to the following rules:

- Measurement was made at 1.3 m above ground measured along the stem, where the tree is on a slope, 1.3 m was measured on the uphill side of the tree. Where the tree is on a lean, 1.3 m was measured on the underside of the lean.
- The measuring tape was located at 90° to the axis of the stem at 1.3 m.
- Where a tree has multiple stems at 1.3 m, the DBH of each stem was recorded. The DBH data were converted to area, summed to produce a "total area" and then converted to a proxy DBH (equivalent to DBH if the tree only had one primary stem).

Photo-points

To facilitate provision of a long-term visual record of change(s) in condition, a single ground-based photo-point was established for each transect. Each photo-point is orientated facing downstream to provide a representation of the transect location including (i) key geomorphological features where practicable, and (ii) maximising the number of transect trees captured in the image. In each case pink markers (ca 70 mm x 70 mm) were installed, one at the location at which the photograph is taken from (the primary marker) and one on another tree (downstream) as a sight marker in the centre of the image. The location of the primary marker was recorded with a handheld GPS, and the direction (in degrees) from the primary marker to the sighter marker was recorded. The photographer was positioned at the primary marker, and where possible (due to elevation and aspect), the viewfinder was centred on the sighter marker. Ground based photo-points are intended to be taken during each survey period.

In addition to the ground-based photo-points, aerial images were also collected during the baseline survey period (December 2022) using a remotely piloted aircraft (drone). At each location, two images were collected (1) facing downstream with the camera at a ca. 25^{o} angle, and (2) an overhead view with the camera pointing directly downwards.

Table 2: Tree crown cover and crown density categories and scores (Souter *et al.* 2010a).

Score	Description	Percentage of assessable crown
0	None	0 %
1	Minimal	1-10 %
2	Sparse	11-20 %
3	Sparse – Medium	21-40 %
4	Medium	41-60 %
5	Medium – Major	61-80 %
6	Major	81-90 %
7	Maximum	91-100 %

Table 3: Score system for TCI and corresponding condition description. Adapted from Wallace et al., (2020).

TCI score	Condition Description	
0	Non-viable	Tree may be dead or very near to the critical point of loss. A small proportion of trees may respond to delivery of water but are likely to be in a precarious position i.e. response may not be sustained, and tree may not recover.
2-4	Very poor	Tree viable but in very poor condition and in a precarious position i.e. continuation of dry conditions is likely to lead to death. Trees with low TCI scores have a slow response. A single watering may stabilise condition. Multiple, back-to-back watering will be required to achieve "good" condition.
5-7	Poor	Most trees would be expected to respond positively to watering. Inundation may stabilise condition or result in an improvement. Trees may be at the edge of the resilience period, i.e. continuation of dry conditions is likely to lead to a marked loss of condition or defoliation. Multiple, back-to-back watering is likely to be required to achieve "good" condition.
8-9	Moderate	Most trees with TCI scores ≥ 8 would be expected to respond positively to watering and increase to the next condition class. However, these trees may become defoliated under ongoing dry conditions.
10-12	Good	Trees are expected to have a moderate degree of resilience and should be able to withstand a short dry period with minimal loss of condition.
13-14	Excellent	Trees are expected to have a high degree of resilience and should be able to withstand a short period with minimal loss of condition.

3. Reporting Framework

Water Allocation Plan objective and targets

The draft Water Allocation Plan (WAP) for the Baroota Prescribed Water Resources Area (NYLB 2022) specifies an Ecological Objective of:

> ***the maintenance of existing river red gum trees along the watercourse, such that they provide the habitat structure, cultural outcomes and amenity to the watercourse corridor suitable for fauna and the community***

an Environmental Target of

90% of the river red gum trees need to maintain a TCI of ten or greater

and an Asset condition limit of

at least 80% of the trees to have a TCI of greater than eight

The draft WAP specifies that in order to achieve the ecological target, the Environmental Water Provision (EWP) for river red gums is receiving a flow event (or equivalent watering event) at least two in five years. If the trees are failing the target, then additional watering should be considered, however, **an asset condition trigger requiring at least 80% of the trees to have a TCI of greater than eight** will provide additional protections to ensure there is minimal loss of mature trees. Should this trigger be reached, the time since previous inundation or watering event is irrelevant and an EWP should occur by the end of the following winter (NYLB 2022).

Conceptual model of stress and recovery

A conceptual model outlining the stress-recovery model for floodplain eucalypts is presented in Figure 2 (from Wallace *et al.* 2020). That model highlights that delivery of environmental water would ideally be triggered before tree TCI scores fall below 8 to preclude the long recovery times and intensive management regimes required to restore severely stressed woodlands. As per the conceptual model (Figure 2 and Table 3), TCI scores of ≤8 indicate a high degree of water stress, and TCI scores below 8 indicate that trees may be at the edge of the resilience period, i.e. continuation of dry conditions is likely to lead to a marked loss of condition or defoliation, and multiple, back to back watering is likely to be required for trees to improve sufficiently to achieve "good" condition. Because the strength of the response to environmental watering decreases as the TCI score decrease, avoiding the need for repeat (high frequency) watering by delivering water when trees are still in good condition should be a management priority.

Therefore, it is recommended that the Asset condition limit be supplemented with a management threshold that triggers earlier action, in order to limit the potential for long-term or potentially irreversible damage, and improve the potential to improve condition sufficiently to achieve, and subsequently maintain the Ecological Objective (Wallace *et al.* 2021). It is recommended that the Management Threshold utilised throughout the lower River Murray (e.g. Wallace and Whittle 2014; Wallace 2022c, 2022b) i.e. ***more than 10% of established viable trees with DBH > 10 cm receive TCI scores ≤8*** is adopted.

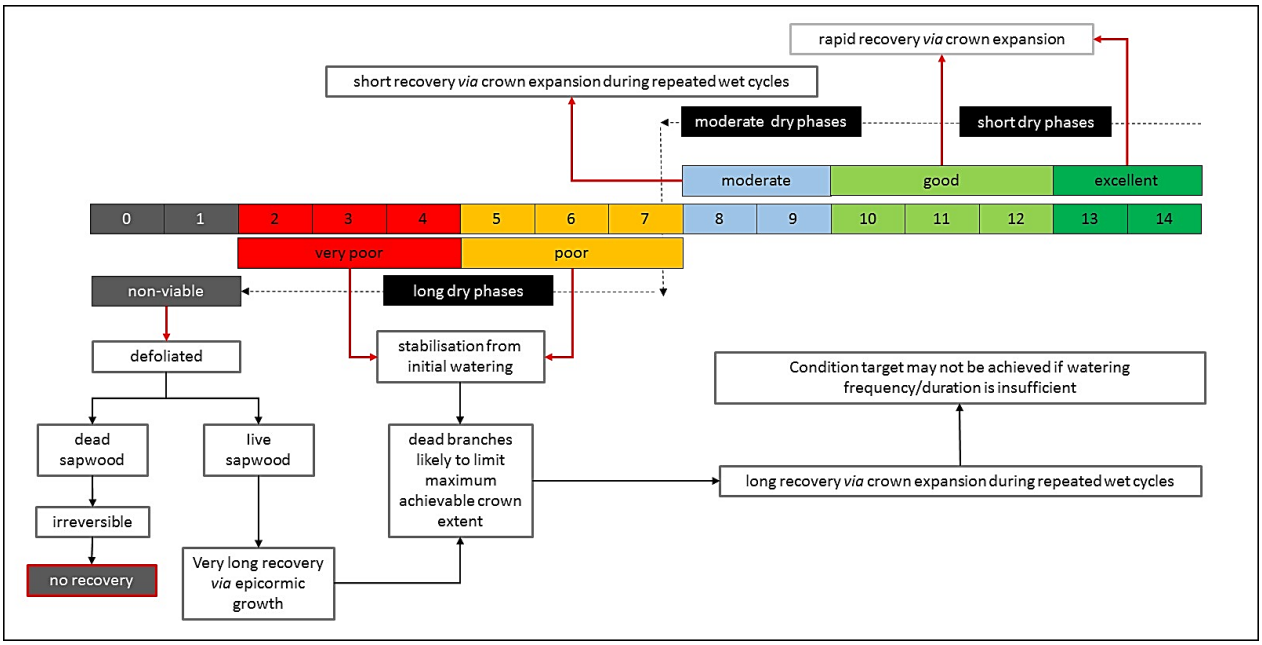


Figure 2: From Wallace *et al.* (2020); Conceptual model of stress-recovery (state transition model) for floodplain eucalypts that builds on Wallace (2015b), Souter et al. (2010b) and Bond et al. (2018) and recognises that (i) trajectories for crown decline and recovery occur via different pathways rather than a simple linear reversal, and (ii) recovery and decline do not proceed at the same rates. TCI values range from 0 (non-viable) to 14 (excellent). Short-interval dry periods facilitate maintaining condition within the good-excellent range (trees with TCI ≥10). Moderate-interval dry periods degrade crown condition to moderate condition (i.e. TCI 8 and 9) but a return to near natural inundation return intervals will restore trees to "good" condition within less than 3 years. Long-interval dry periods result in a major decline from poor to very poor condition (TCI 4 to 6), and a much longer period is required to recover trees. Very poor condition trees (TCI ≤4) undergo a much slower recovery rate and may become non-viable and fail to recover because of a lack of live sapwood to support transpiration. Delivery of environmental water would ideally be triggered before tree TCI scores fall below 8 to preclude the long recovery times and intensive management regimes required to restore severely stressed woodlands.

Reference conditions

Reporting of the percent of trees above/below a desired target or above a management threshold is useful for summary reporting but provides limited context for supporting decisions on the priority of delivery of environmental water. Presenting TCI data against a hypothetical data set that could be considered representative of good stand condition increases the utility of the condition data. To facilitate this, data for a hypothetical transect in which 90% of trees have TCI scores ≥10 is presented. A spline curve was fitted to this hypothetical data set to generate a reference condition (Figure 3) against which observational data from the established transects can be considered. The histogram shows the recorded percentage of trees that fall within each TCI score, relative to (i) the reference condition described above, (ii) the metric for the Ecological Target and (iii) the threshold for management action of "*more than 10% of established viable trees with DBH > 10 cm receive TCI scores ≤8*". It is evident from this reference frame, that if the Ecological Target is met, there should be no viable trees with TCI scores ≤8. With this guiding context, the position of the tree condition data relative to the Ecological Target, the management threshold and the hypothetical reference condition (the spline curve), provides insight into the trajectory of trees within any given transect over time, and hence the priority for watering areas that can be actively managed.

Figure 3. Hypothetical transect in which 90% of trees have TCI scores ≥10. The vertical reference line at TCI = 10 represents the Environmental Target, the spline curve (red line) fitted to this hypothetical data set generates a reference condition against which observational data from existing transects can be considered. It is evident that within this reference frame, that if the Ecological Target is met, there should be no viable trees with TCI scores ≤8.

Priority for environmental water delivery

An assessment of the priority for e-water delivery was undertaken based on the combination of position relative to the ecological target and management threshold, utilising the framework presented by Wallace (2018) (see table 4 for assessment matrix). A secondary assessment was undertaken by considering the percentage of viable trees with TCI scores ≥10 minus the percentage of viable trees with TCI scores between 2 and 8 (per Wallace 2022c).

Table 4. Matrix for assessment of priority for e-water delivery based on the combination of position relative to the ecological target and management threshold (from Wallace (2018)).

TCI Priority ranking	
very low	target met and no trees with TCI scores ≤8
low	target met and <10% of trees with TCI scores ≤8
moderate	target met but >10% of trees with TCI scores ≤8
high	target not met and <10% of trees with TCI scores ≤8
very high	target not met and >10% of trees with TCI scores ≤8

4. Results

Tree crown condition

Environmental Target: The data shows that all sites are in poor condition (left skewed) relative to the reference condition. However, condition has improved substantially at some sites between the baseline survey (2022) and the most recent surveys. In both December 2022 and November 2023, only one transect (BarTCI_7) met (passed) the Environmental Target of 90% of viable trees with TCI ≥10. In November 2024, four transects met (passed) the Environmental Target. In October 2025, only three transects met the Ecological Target. It is of note that for the transect (BarTCI_6) that met the Ecological Target in 2024 but not 2025, there was a marked decline in condition (Table 6A).

Asset Condition Limit: The Asset Condition Limit was met (passed) at all transects in all survey periods.

Management Threshold: A high prevalence of trees with TCI scores ≤8 is evident. Only one transect (BarTCI_7) consistently recorded no trees with TCI scores ≤8. In December 2022 and November 2023, four out of the eight transects exceeded (triggered) the management threshold. In November 2024, three transects exceeded the management threshold. In October 2025, only two transects exceeded the management threshold. Transect 4 has shown a year-on-year decrease in the percentage of trees exceeding the threshold.

In addition to the routine assessment of condition using the TCI system which adds categorical scores for Crown Extent (CE) and Crown Density (CD), an assessment using change in mTCI score (calculated as the field score for Crown Extent multiplied by the field score for Crown Density) is presented. The mTCI approach is more sensitive to small changes in condition than the standardised TCI system. The results show a modest decline in condition between 2024 and 2025 for most trees in all transects (Figure 4). This suggests that in the absence of an effective environmental or unregulated flow, condition is likely to decline.

Tree loss

In transect 4 (BarTCI_4), one tree became defoliated between the December 2022 and November 2023 surveys. In transect 3, (BarTCI_3), one tree became defoliated between the November 2023 and November 2024 surveys. In both cases, the trees were rated as ‘very poor” condition in the preceding survey. In October 2025, one tree that had been in poor condition in all preceding surveys became defoliated.

Epicormic Growth

Of the 240 trees comprising the 8 transects, 116 (53% of) viable trees were characterised by the presence of epicormic growth. This is considered an indicator of partial recovery from preceding water stress and reflects the progressive improvements in condition scores observed at most transects. The high prevalence of epicormic growth is considered a strong indicator that either high seasonal rainfall, an unregulated release (spill), or delivery of an environmental water release from Baroota Reservoir will be required to support a continuation of condition recovery and subsequent achievement of the Ecological Objective.

Priority for environmental water delivery

In December 2022 and November 2023, four transects were rated as “very high priority” and three transects were rated as “high priority” for environmental water delivery. In November 2024, three transects were rated as “very high priority” and one transect was rated as “high priority” for environmental water delivery. In October 2025, two transects (BarTCI_5 and BarTCI_8) were rated “very high priority”. Only one transect (BarTCI_7) is consistently rated as “very low” priority.

Using the alternative priority ranking (priority ranking B, Table 6E), which is calculated as *the % of viable trees with TCI scores ≥10 minus % of viable trees with TCI scores from 2-8* (values close to 100 indicate very low priority, values less than 50 indicate very high priority), only transect 6 and 7 were rated low priority (≥90) in November 2024. In October 2025, only one transect (BarTCI_7) was rated as low priority. One transect (BarTCI_5) has been rated as very high priority in all survey periods. Between the 2022 and 2023 surveys, watering priority was stable at BarTCI_3 and 7, and improved (was lower) at BarTCI_1 and 2, but worsened (was higher) at BarTCI_4, 5, 6 and 8. Between the 2024 and 2025 surveys, priority remained stable or improved at all sites except BarTCI_6, where the priority rating declined markedly (Table 6E).

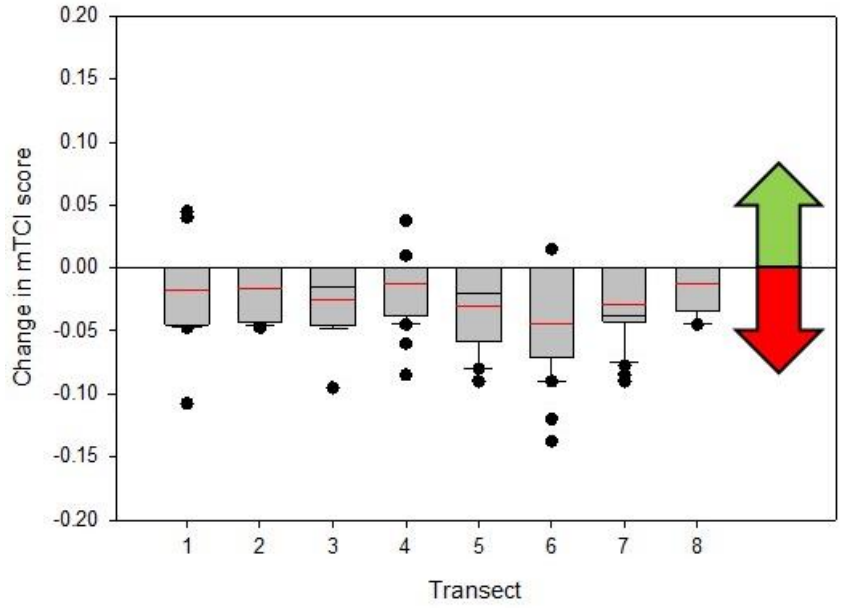


Figure 4. Change in mTCI score between the 2024 and 2025 surveys. The horizontal reference line at 0.00 indicates no change. Data points above the line indicate improvement, data points below the line represent decline in condition. Boxes contain 75th percentile, whiskers enclose 90th percentiles. Solid and red lines within box represent median and mean respectively. Circles denote outliers.

Table 5. Results for position relative to the Ecological Target, Asset Condition Limit and Management Threshold for river red gum in the mid-reach of Baroota Creek downstream of the Baroota Reservoir based on October 2025 survey data (values are percentage of viable trees meeting the condition metric). Priority ranking A is based on the matrix presented in Table 4.

Transect	Tree type	Ecological Target (TCI ≥10)	Asset Condition Limit (TCI ≥8)	Management Threshold (TCI = 2-8)	priority ranking A	priority ranking B
BarTCI_1	RRG	93	96	4	low	89
BarTCI_2	RRG	88	100	4	high	84
BarTCI_3	RRG	93	93	4	low	89
BarTCI_4	RRG	77	92	8	high	69
BarTCI_5	RRG	54	85	27	very high	27
BarTCI_6	RRG	79	96	4	high	75
BarTCI_7	RRG	90	100	0	very low	90
BarTCI_8	RRG	66	93	14	very high	52

Table 6A. Percent (%) of trees meeting Ecological Target in 2022, 2023, 2024 and 2025. Red text indicates that the management threshold was exceeded for that transect.

Transect	Dec-22	Nov-23	Nov-24	Oct-25
BarTCI_1	81	85	**93**	**93**
BarTCI_2	81	85	88	88
BarTCI_3	89	89	**93**	**93**
BarTCI_4	64	56	78	77
BarTCI_5	62	65	69	54
BarTCI_6	89	82	**96**	79
BarTCI_7	**90**	**90**	**90**	**90**
BarTCI_8	66	62	66	66

Table 6B. Percent (%) of trees meeting the Asset Condition Limit in 2022, 2023, 2024 and 2025. Red text indicates that the management threshold was exceeded for that transect.

Transect	Dec-22	Nov-23	Nov-24	Oct-25
BarTCI_1	96	96	96	96
BarTCI_2	100	100	100	100
BarTCI_3	93	93	93	96
BarTCI_4	86	81	89	92
BarTCI_5	92	92	92	85
BarTCI_6	96	96	96	96
BarTCI_7	100	100	100	100
BarTCI_8	93	93	93	93

Table 6C. Percent (%) of trees exceeding the Management Threshold in 2022, 2023, 2024 and 2025.

Transect	Dec-22	Nov-23	Nov-24	Oct-25
BarTCI_1	11	11	4	4
BarTCI_2	4	4	4	4
BarTCI_3	7	7	4	4
BarTCI_4	25	22	11	8
BarTCI_5	27	31	27	27
BarTCI_6	7	7	4	4
BarTCI_7	0	0	0	0
BarTCI_8	17	17	14	14

Table 6D Results for environmental watering priority in 2022, 2023, 2024 and 2025. Priority ranking A is based on the criteria outlined in Table 4.

Transect	Dec-22	Nov-23	Nov-24	Oct-25
BarTCI_1	very high	very high	low	low
BarTCI_2	high	high	high	high
BarTCI_3	high	high	low	low
BarTCI_4	very high	very high	very high	high
BarTCI_5	very high	very high	very high	very high
BarTCI_6	high	high	low	high
BarTCI_7	very low	very low	very low	very low
BarTCI_8	very high	very high	very high	very high

Table 6E. Results for environmental watering priority in 2022, 2023, 2024 and 2025. Priority ranking B is based on the % of viable trees with TCI scores ≥10 minus % of viable trees with TCI scores from 2-8 (values close to 100 indicate very low priority, values less than 50 indicate very high priority).

Transect	Dec-22	Nov-23	Nov-24	Oct-25
BarTCI_1	70	74	89	89
BarTCI_2	77	81	84	84
BarTCI_3	82	82	89	89
BarTCI_4	39	34	67	69
BarTCI_5	35	34	42	27
BarTCI_6	82	75	92	75
BarTCI_7	90	90	90	90
BarTCI_8	49	45	52	52

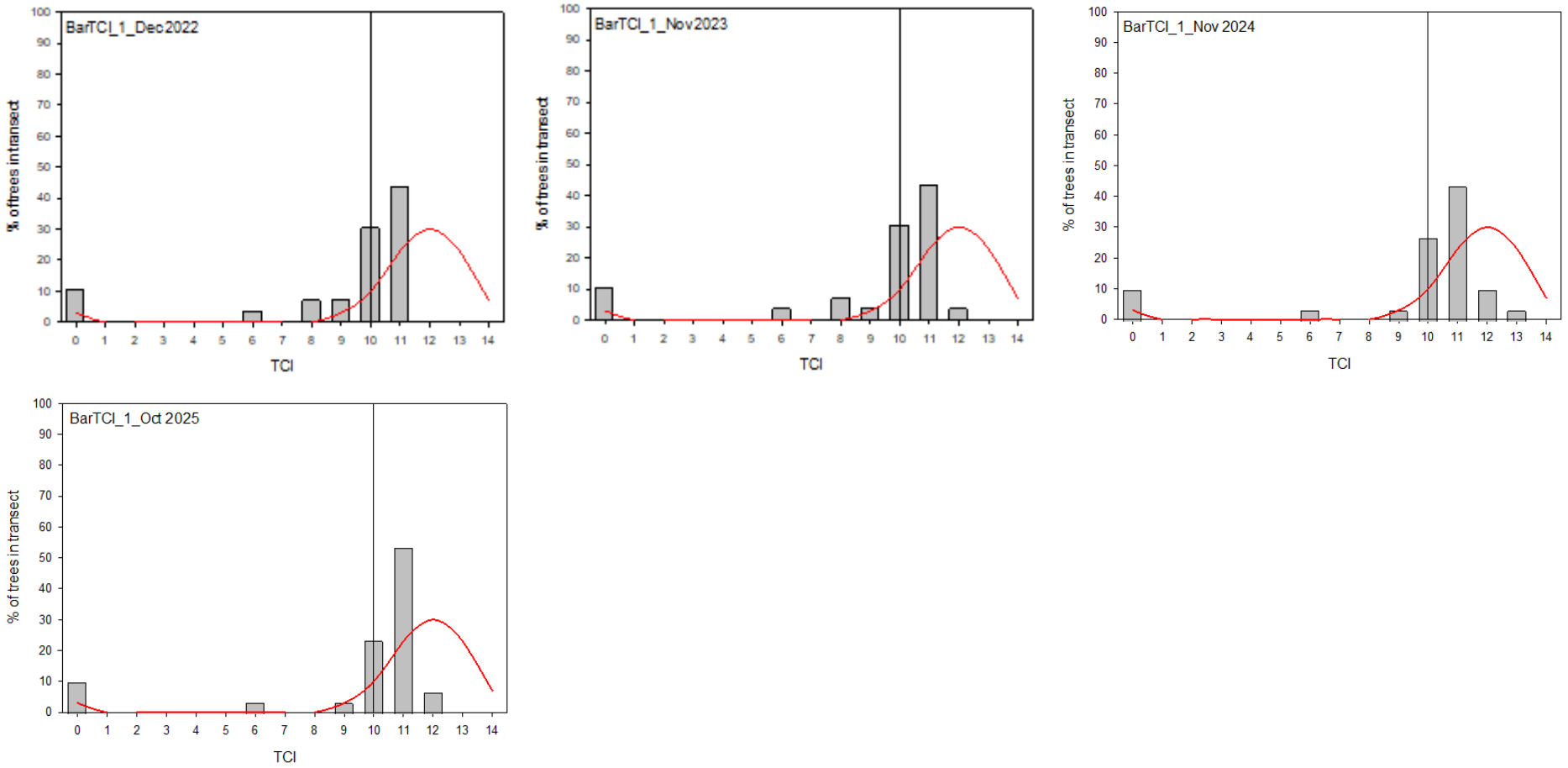


Figure 5 Proportion of river red gum in each TCI score group at Baroota Creek in each survey period. The vertical reference line at TCI = 10 represents the Environmental Target, the spline curve (red line) is the reference condition against which observational data from monitored transects can be considered.

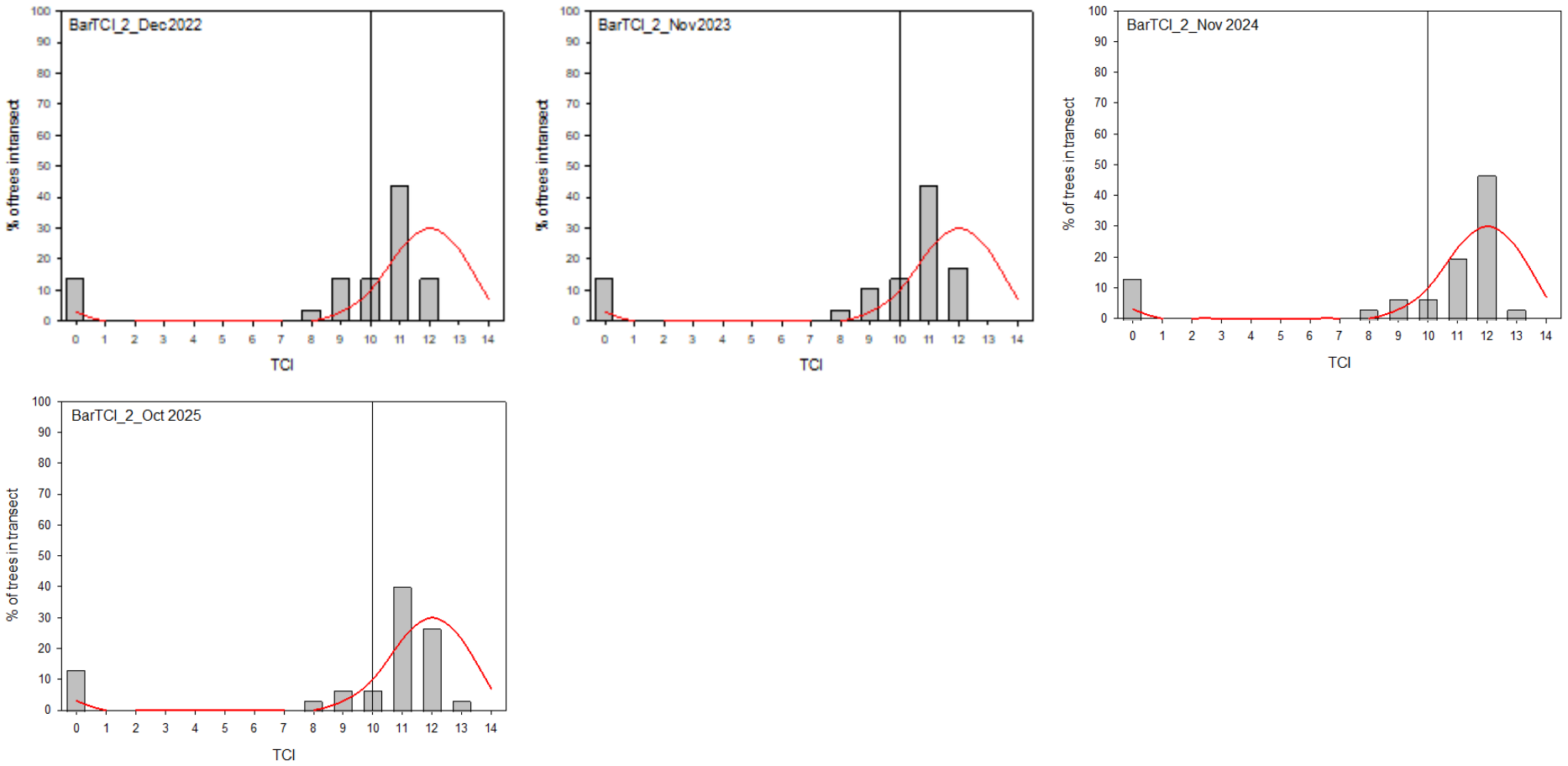


Figure 5 continued. Proportion of river red gum in each TCI score group at Baroota Creek in each survey period. The vertical reference line at TCI = 10 represents the Environmental Target, the spline curve (red line) is the reference condition against which observational data from monitored transects can be considered.

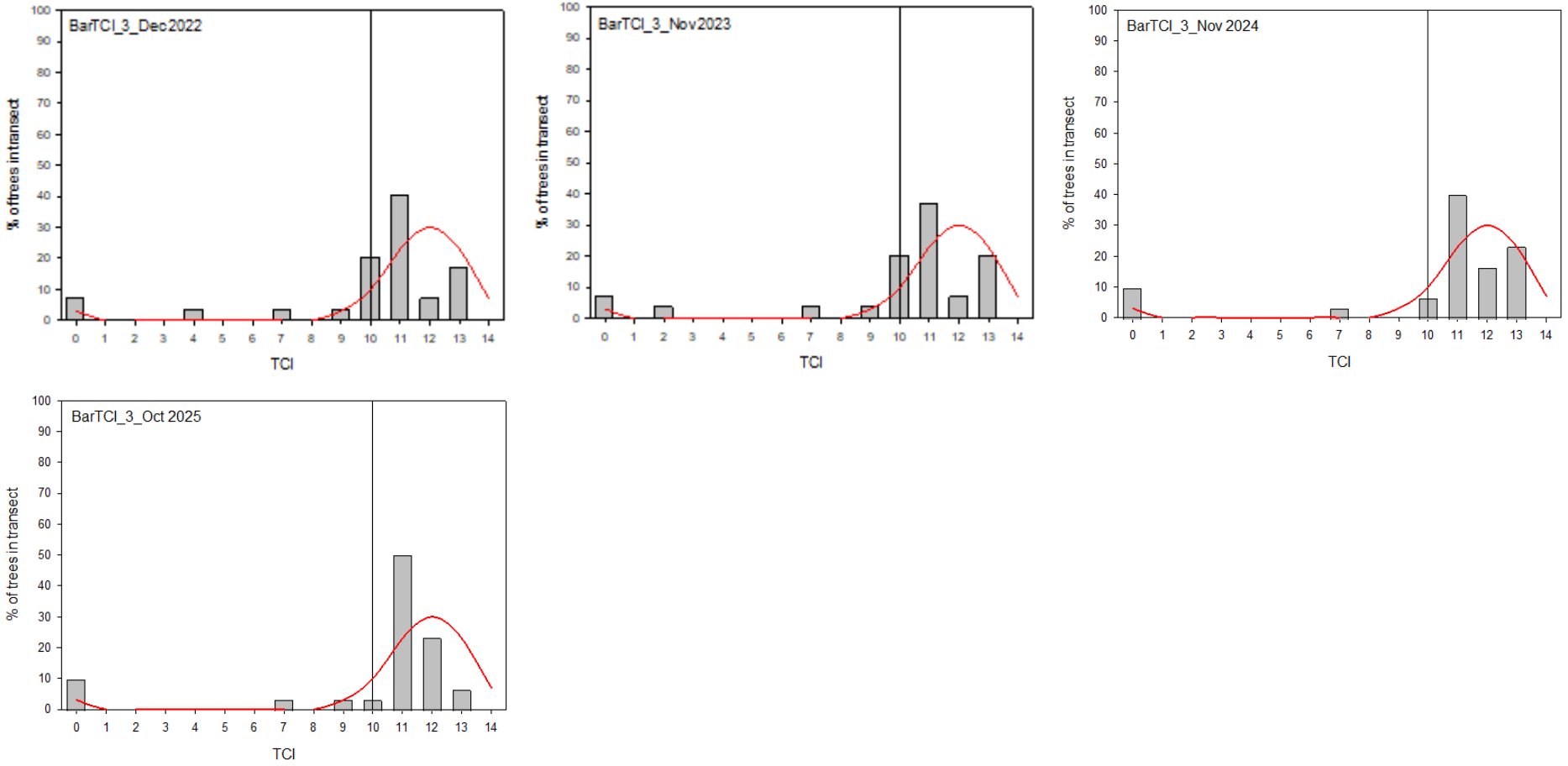


Figure 5 continued. Proportion of river red gum in each TCI score group at Baroota Creek in each survey period. The vertical reference line at TCI = 10 represents the Environmental Target, the spline curve (red line) is the reference condition against which observational data from monitored transects can be considered.

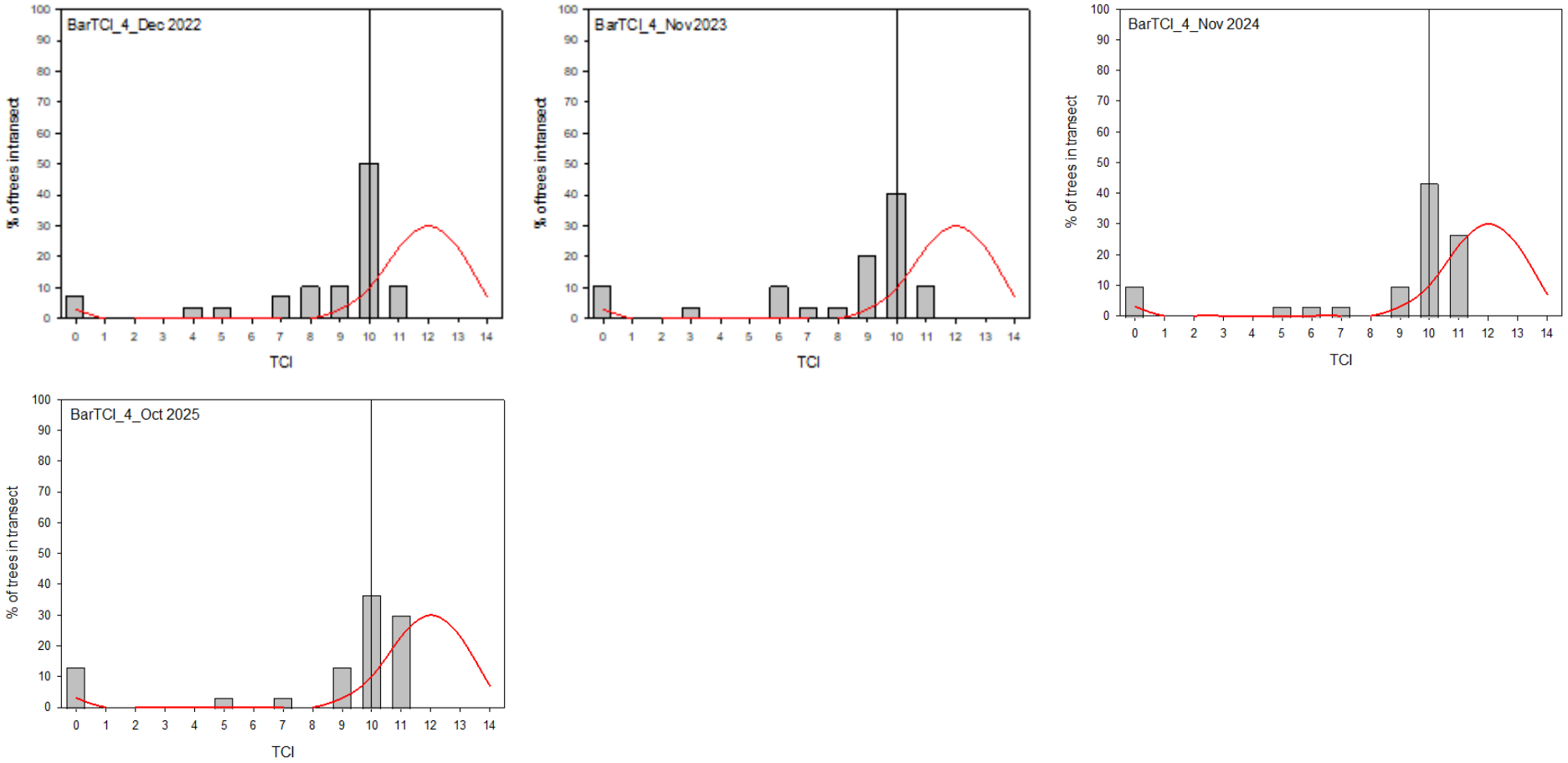


Figure 5 continued. Proportion of river red gum in each TCI score group at Baroota Creek in each survey period The vertical reference line at TCI = 10 represents the Environmental Target, the spline curve (red line) is the reference condition against which observational data from monitored transects can be considered.

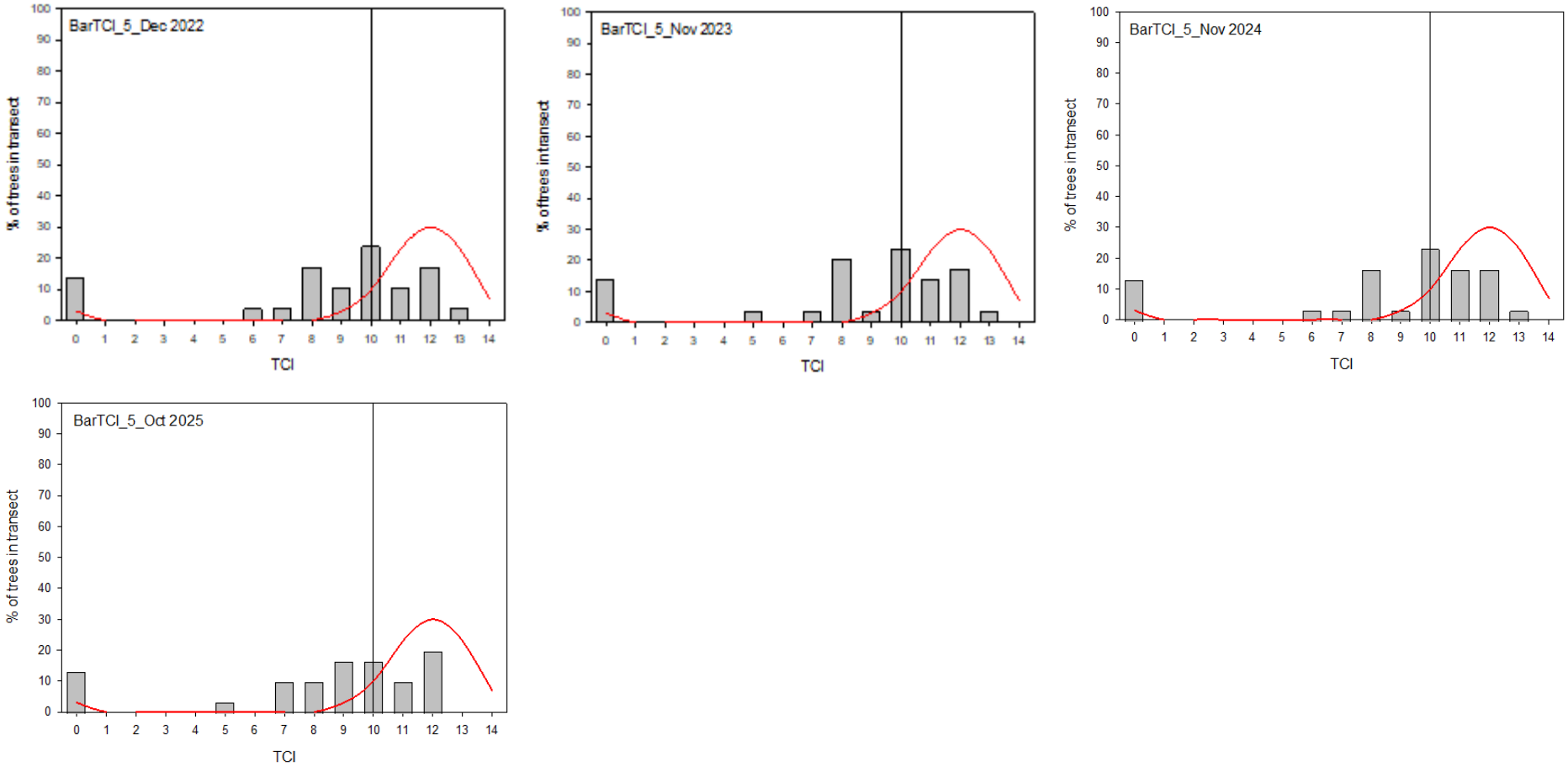


Figure 5 continued. Proportion of river red gum in each TCI score group at Baroota Creek in each survey period. The vertical reference line at TCI = 10 represents the Environmental Target, the spline curve (red line) is the reference condition against which observational data from monitored transects can be considered.

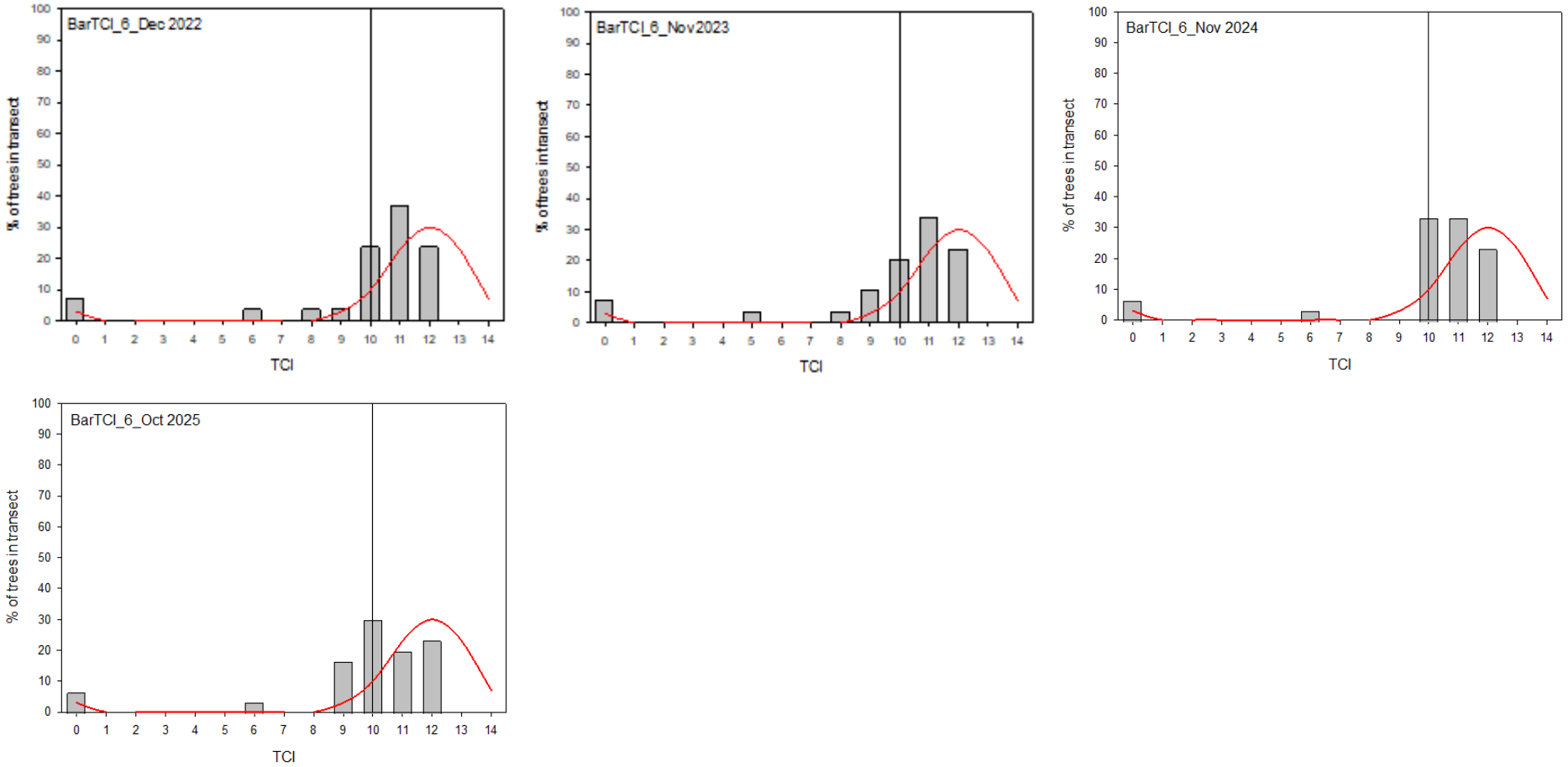
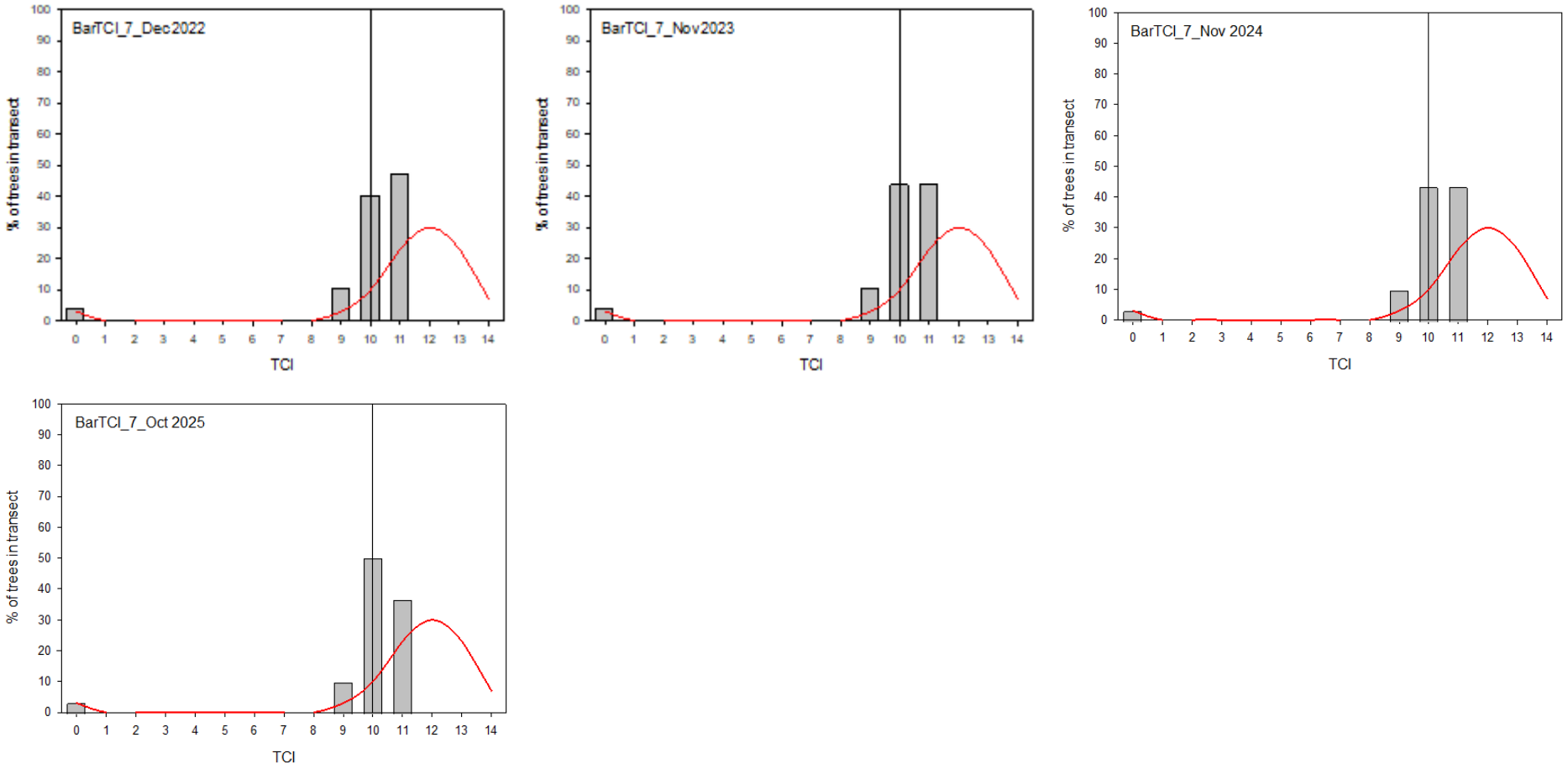


Figure 5 continued. Proportion of river red gum in each TCI score group at Baroota Creek in each survey period. The vertical reference line at TCI = 10 represents the Environmental Target, the spline curve (red line) is the reference condition against which observational data from monitored transects can be considered.



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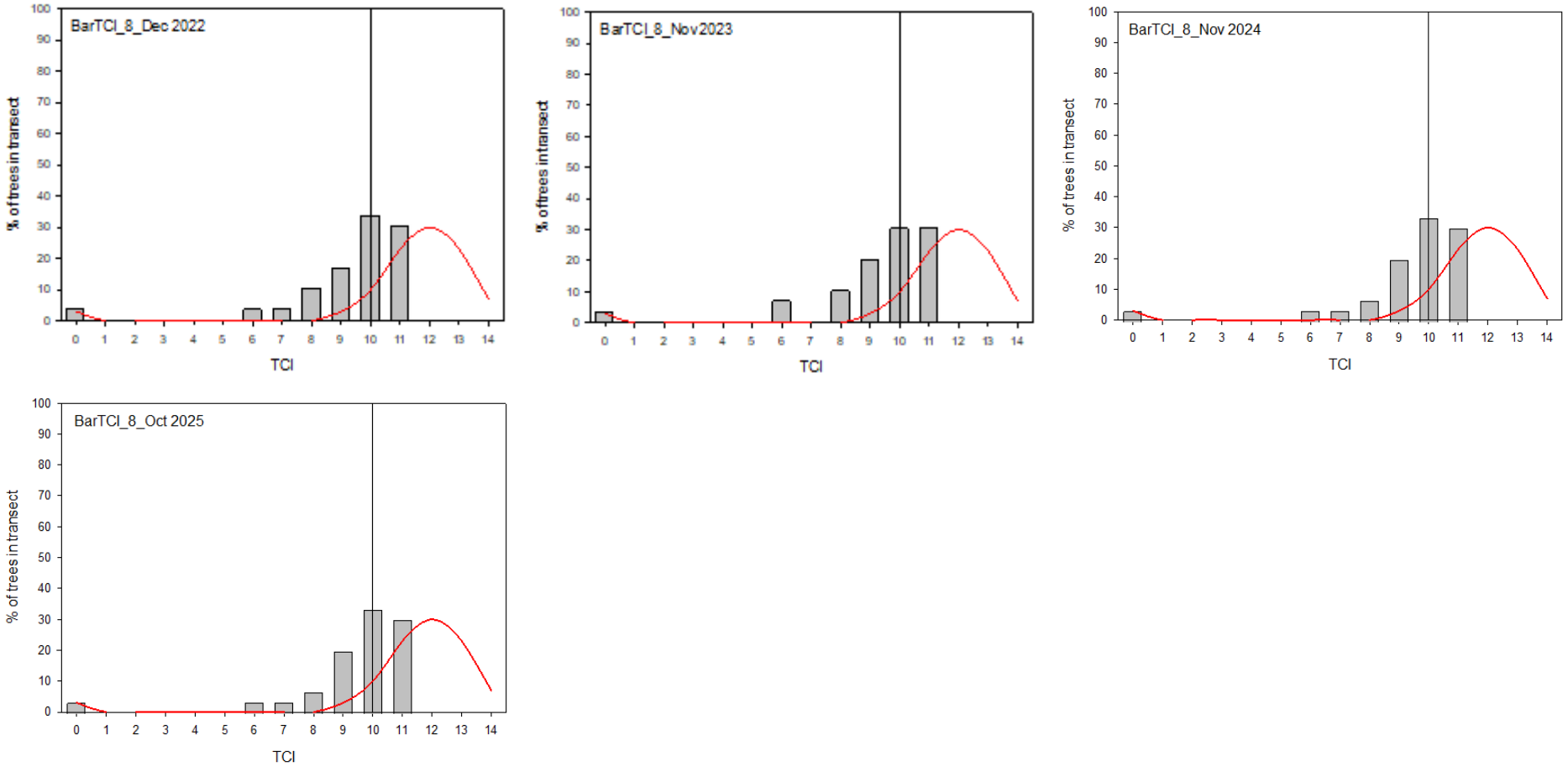

Figure 5 continued. Proportion of river red gum in each TCI score group at Baroota Creek in each survey period. The vertical reference line at TCI = 10 represents the Environmental Target, the spline curve (red line) is the reference condition against which observational data from monitored transects can be considered.

Figure 6: Ground based photo-point of BarTCI_1. Top left panel December 2022, Top right panel November 2023, Bottom left panel November 2024, Bottom right panel October 2025.

Figure 7: Ground based photo-point of BarTCI_2. Top left panel December 2022, Top right panel November 2023, Bottom left panel November 2024, Bottom right panel October 2025.

Figure 8: Ground based photo-point of BarTCI_3. Top left panel December 2022, Top right panel November 2023, Bottom left panel November 2024, Bottom right panel October 2025.

Figure 9: Ground based photo-point of BarTCI_4. Top left panel December 2022, Top right panel November 2023, Bottom left panel November 2024, Bottom right panel October 2025.

Figure 10: Ground based photo-point of BarTCI_5. Top left panel December 2022, Top right panel November 2023, Bottom left panel November 2024, Bottom right panel October 2025.

Figure 11: Ground based photo-point of BarTCI_6. Top left panel December 2022, Top right panel November 2023, Bottom left panel November 2024, Bottom right panel October 2025.

Figure 12: Ground based photo-point of BarTCI_7. Top left panel December 2022, Top right panel November 2023, Bottom left panel November 2024, Bottom right panel October 2025.

Figure 13: Ground based photo-point of BarTCI_8. Top left panel December 2022, Top right panel November 2023, Bottom left panel November 2024, Bottom right panel October 2025.

5. Summary and recommendations

Summary

A high percentage (53%) of viable trees throughout the assessment locations are characterised by the presence of epicormic growth. This is an indicator of partial recovery from preceding water stress. However, multiple transects continue to receive ratings of "very high" priority for delivery of environmental water. Tree loss was observed in one transect between the 2022-2023 (transect BarTCI_4), 2023-2024 surveys (transect BarTCI_3) and 2024-25 surveys (transect BarTCI_4). In all cases, the trees were rated as poor or very poor condition in the preceding survey.

In November 2023, condition at transect 4 (BarTCI_4) had been approaching a critical tipping point. An environmental flow was delivered at the start of September 2024 which reached this location. Between the November 2023 and November 2024 surveys, condition improved substantially with some improvement continuing through to October 2025. However, the crown of these trees is dominated by recent epicormic growth (Figure 14), and their habitat value is compromised as a result. One tree was lost (became completely defoliated) between November 2024 and October 2025. In the October 2025 survey, one tree received the lowest possible field score. It is anticipated that in the absence of a substantial flow event, this tree will be recorded as defoliated in the 2026 survey.

Recommendations

Based on the partial recovery observed at transect 4, combined with the gradual improvement in condition at transects 1-3, the recent loss of trees, and the ongoing presence of trees with TCI scores ≤8, it is recommended that pending water availability, planning for delivery of additional environmental water releases commence as soon as practicable. This will support the ongoing recovery of trees that have previously responded to improved soil water potential (as indicated by the high prevalence of epicormic growth), and (iii) increase the likelihood of recovery and achieving the Environmental Target.

Flows to support recruitment processes

Whilst size is a poor indicator of age, the data indicates a distinct lack of recruitment in recent decades. For all transects pooled, only 13 trees (5%) were recorded with DBH less than 20 cm. No trees in this size class were recorded at transects BarTCI_2, 4, 6 and 7. Recruitment of river red gums was not considered an objective of the draft WAP (NYLB 2022), as it was considered that recruitment flows are only likely to be provided by unregulated spills from the reservoir or runoff from large rainfall events.

River red gum in the south-western most section of the Murray-Darling Basin generally produce buds in January-February (summer), typically flowering between September-December (spring–early summer) every two years, with mature fruit retained in the crown for up to two years (George 2004; Jensen *et al.* 2007). Consequently, the likelihood of a successful germination event is dependent on antecedent conditions, and the likelihood of germinant survival through sapling stage is dependent on conditions following germination; either a follow-up flow or high rainfall, and low grazing pressure from domestic stock and native herbivores. It is of note that a relatively high percentage of trees were flowering at the time of the November 2023 surveys, indicating that an environmental flow could have potential to support a germination event.

Whilst frequent (sub-decadal scale) recruitment is not required to maintain the existing ecological character of the creek, existing recruitment processes (seedling establishment and survival through to mature tree) are inadequate. Consequently, it is recommended that environmental water releases be used to support the key recruitment processes of seedling survival and sapling growth when germination is recorded following unregulated spills and/or managed releases. To achieve this, it is recommended that population demographics are monitored through establishment of spatially standardised quadrats

that specifically target the detection and tracking the abundance of early life stages (seedlings and saplings) post flows.

Figure 14. Tree crown at transect 4 (BarTCI_4) dominated by epicormic growth in November 2024.

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