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The historic flowering behaviour of River Red-gum and Black Box in a flooding forest

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Abstract

River Red-gum (Eucalyptus camaldulensis) and Black Box (E. largiflorens) are the dominant tree species of Barmah forest, Victoria; part of a floodplain ecosystem which has been identified as being under threat due to the reduced frequency and duration and altered timing of flooding associated with river regulation, water extraction and drought.

The flooding regime plays a significant role in the phenology in both these species. Hence establishing past flowering behaviour using long-term records (1934 to 1973) provides a historical baseline against which current and future flowering behaviour can be judged.

Black Box was more consistent in its flowering, with an annual failure recurrence interval of 1 in 36 years less compared to 1 in 9.25 years for River Red-gum. Black Box was also the more intense flowering species and flowered for longer (4.0 ± 1.9 months compared to 2.1 ± 1.4 months), with its flowering period encompassing River Red-gum’s. The flowering of the two species was therefore synchronous. River Red-gum displayed evidence of flowering more intensely every second year and therefore some dependence on the previous year’s flowering; this was absent in Black Box.

The influence of flooding on flowering intensity over this 40 year interval indicated that flooding 10 years out of 13 years with an inundation period greater than 6 months has a
depressive effect on flowering intensity while flooding in 7 out of 13 years with an
inundation period of no greater than 5 months enhances flowering intensity. This is more so
for Black Box than River Red-gum. However, flooding is a recurring event in this study, and
therefore it is difficult to isolate the effect of a single flood on flowering.

Keywords
Barmah, *Eucalyptus camaldulensis*, *E. largiflorens*, flowering, flooding

INTRODUCTION
River Red-gum (*Eucalyptus camaldulensis*) is the most widespread eucalypt across mainland
Australia (Boland *et al.* 2006; Smith and Smith 2014). Historically it was of major
importance commercially (Colloff 2014). Consequently, facets of its biology have been well-
studied including its silviculture and regeneration (Dexter 1967; 1978). River Red-gum along
with Black Box (*Eucalyptus largiflorens*) are also important components of a suite of
eucalypts which sustain the bee-keeping industry (Paton *et al.* 2004; Somerville and

The largest River Red-gum forest is the Barmah-Millewa Forest, located on the floodplain of
the River Murray approximately 200 km north of Melbourne (Bren 2005). Black Box is
mostly associated with watercourses in the Murray-Darling system where it usually occurs
just above River Red-gum in areas subjected to flooding (Boland *et al.* 2006; Smith and
Smith 2014); in Barmah it is associated with areas of low flooding frequency (5 to 40% of
years flooded) and duration (Bren 1988b; Bren and Gibbs 1986).

The flooding regime plays a significant role in the distribution, health, recovery and
phenology in both these species (Bren 1988b; Bren and Gibbs 1986; Catelottia *et al.* 2015;
Moxham *et al.* 2018; Newell *et al.* 2009; Roberts 2004; Roberts and Marston 2011).

The floodplain ecosystem of which these two species are the dominant tree species has been
identified at being vulnerable to ecological collapse (Keith *et al.* 2013) due to the reduced
frequency and duration and altered timing of flooding associated with river regulation, water
extraction, drought and increases in salinity levels (CSIRO 2008; Mac Nally *et al.* 2011).
River Red-gum has been identified as being particularly impacted (Catelottia *et al.* 2015; Mac
Nally *et al.* 2011).
This study examines the flowering of River Red-gum and Black Box within Barmah Forest. The data source is a 40-year record of monthly observations in “budding and flowering” reports for the former forest management agency. As far as the authors are aware, this is the longest record of flowering available for these species. The data were used to investigate the following questions:

1. What are the flowering patterns of River Red-gum and Black Box along parts of the River Murray?
2. Is the flowering of these two species synchronous?
3. How strong is the annual cyclicity of these species, and are there other underlying cycles in the flowering records?
4. Is flowering in each year independent of flowering in the previous year?
5. Is there any relationship between the flooding status of the forest and flowering either in the year of flooding or in the subsequent year after flooding?

METHODS

Budding and Flowering Returns

The original function of the early budding and flowering reports was to provide information on the reproductive cycle of commercial eucalypts (Fig. S1). By 1935, however, there was a focus on honey production. Observers – typically experienced overseers or young foresters – made monthly observations on whether the trees were budding and/or flowering (Keatley et al. 1999). These observers categorised their observations of flowering according to the quantity and distribution of flowering across the population. Flowering quantity was ranked from ‘No flowering’ to ‘Heavy flowering’, whilst distribution ranged from ‘Isolated’ to ‘General’. These observations were then scored using the method of Keatley and Hudson (2007) (Table 1). The result was a monthly discrete-valued time-series for each species with a minimum score of 0 (no flowering) to a maximum score of 5 (which equates to heavy (scored as 3) generally distributed flowering (scored as 2)).

In general, at Barmah, attempts were made to summarise budding and flowering over the administrative region (Fig. S2) and forms filled out were a general summary rather than observations on particular trees (B.D. Dexter, pers. comm. who was a young forester who filled in some of these records in the mid-1950s). Observers’ marginal notes refer to issues
such as the difficulty of accessing stands due to flooding, so it is reasonable to assume that
the records covered areas subject to inundation.

The dataset covers the period December 1934 to December 1973 for River Red-gum and
January 1933 to December 1973 for Black Box. However, data were missing from both
series. In the River Red-gum data, a total of 36 months was missing: April to June 1934, July
to September 1936, 1947, 1952, 1959 and 1973, January to June 1948, October to December
1956 and 1965, January to March 1957, July to December 1958 and 1972. In the Black Box
data there was a total of 34 missing months. January to March 1948, 1956 and 1958,
September to December 1948, 1958 and 1972, October to December 1956, 1963 and 1965
and September in 1952 and 1959.

Flowering behaviour and synchrony
Flowering behaviour in these species was characterised using the method in Keatley and
Hudson (2007):
- Annual Flowering Success: the probability of flowering in each year and the flowering
  failure recurrence,
- Mean Flowering Duration: the average period over which flowering occurred each
  flowering year,
- Peak Flowering: the month in which highest flowering intensity occurred,
- The most probable month of commencement and finishing of flowering and the range
  of months these phases occurred in.

Synchrony or the degree of overlap between River Red-gum and Black Box for individual
years and overall was calculated using the method described in Keatley et al. (2004).

Flowering cycles and independence
“Caterpillar” Singular Spectrum Analysis (SSA) (Golyandina and Zhigljavsky 2020) was
used to determine the trend and cycles within the flowering and the flooding time series. As
SSA requires a complete data set, missing values as detailed above were assigned the average
value for a particular month. Kendall’s rank correlation coefficient (τ) (Hollander et al. 2013)
was also used to examine the concordance between the annual maxima value of flowering of
the two species.
The flowering time series were also examined using cross-correlation for lags of up to 36 months to determine whether flowering in each year was independent of flowering in the previous year(s).

**Flooding and flowering**

The percentage of the forest flooded was determined using the relationship between flooding and peak flows based on a study of past flooding records as described in Bren (2005). The flowering time series were used to provide the monthly distribution of flowering scores for River Red-gum and Black Box. Examination of the relationship between flooding and flowering used the “classical” hydrologic technique of “double mass plots” in which the cumulative score of one sequence is plotted as a function of the cumulative score of a second sequence (Searcy and Hardison 1960). In this instance the River Red-gum and Black Box scores were divided by the maximum Black Box score to facilitate comparison. Similarly, cumulative flooding was scaled (0,1) to facilitate direct comparison. Because the technique uses integrated data, it is particularly good at depicting long-term trends that are hard to show by more statistically-based techniques (Searcy and Hardison 1960). Additionally, Kendall’s rank correlation coefficient (Hollander et al. 2013) was used to examine the concordance between the percentage of the forest flooded and maximum value of flowering for either species.

**RESULTS**

**Flowering behaviour and synchrony**

Both species, on average, reach peak flowering in December (Fig. 1 and Table 2) and to that extent show synchronous behaviour. River Red-gum was also most likely to commence flowering (0.69) in December. Black Box, however, was equally likely to commence flowering in three months: September, October and December (0.26). River Red-gum was equally as likely to stop flowering in both December and January (0.34) whereas February (0.34) is the most probable month in which flowering ceases in Black Box. Black Box has a longer mean flowering period and range of flowering: 4.0 and 9.0 months, respectively compared to the 2.1 and 7.0 months, respectively of River Red-gum (Table 2). Not surprisingly, a longer flowering period is associated with a greater flowering score.
The mean flowering of River Red-gum is significantly positively skewed (and for the individual years it was positively skewed for 21 of the 24 years). In Black Box the mean flowering pattern is not significantly skewed, and this was the case in 15 of the 29 individual years. Comparing skewness between the species in the individual years; on 14 of the 22 occasions they were same; 12 of these 14 years were positively skewed; in the eight years where they were differed River Red-gum was positively skewed and Black Box normally distributed.

Flowering in Black Box was more consistent than River Red-gum over the observation period: Black Box missed flowering once compared to the four years that River Red-gum missed (Table 2). This equates to Black Box not flowering approximately once in 36 years compared to about once in 9.25 years for River Red-gum. There is the possibility that neither species flowered in 1957/1958 but both species have missing data for January to March 1958. If this was the case the flowering failure recurrence rate would be once in 18 years for Black Box and once in 7.4 years for River Red-gum.

Based on the most probable months of commencement and cessation of flowering (Table 2); River Red-gum is totally synchronous with that of Black Box. However, when examined on a yearly basis (for the years when there are no missing data), the flowering period of River Red-gum is only totally synchronous with Black Box in 19 out of 25 years (mean = 0.93; range 0.50 to 1.00). Consequently, the overlap of Black Box is less (mean = 0.56; range 0.17 to 1.00). In the remaining six years, flowering of Black Box finished earlier than River Red-gum by two months in 1934 and one month in 1935, 1961 and 1969 and later in 1945 and 1949 (one and two months, respectively) one month later. The synchrony of individual years ranges from 0.50 to 1.00 (mean = 0.74) between the two species.

Synchronicity was also shown by a cross-correlation plot of the River Red-gum and Black Box scores as a function of monthly lag (Fig. 2). The peak in cross-correlation at 12, 24 and 36 months reflects the high synchronicity of December flowering. The smoothly curved behaviour of the plot at 6, 18 and 24 months reflects that there is a longer period in which River Red-gum does not flower and Black Box may or may not flower. Therefore, the species are highly synchronous in peak flowering but not synchronous in their non-flowering.

Flowering cycles and independence

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There was a weak, positive correlation ($\tau = 0.249$, $p = 0.039$) between the annual maxima value of River Red-gum flowering and Black Box flowering. Therefore, it is likely that a good flowering year for River Red-gum is a good flowering year for Black Box as well. There was a weakly negative correlation between percentage of the forest flooded and maximum value of flowering for both species, but this was not statistically significant (River Red-gum $\tau = -0.149$, $p = 0.21$; Black Box $\tau = -0.198$, $p = 0.099$).

The autocorrelation between maximum annual flowering score for River Red-gum and Black Box, respectively is shown in Figure 3. There is some indication of anti-cyclicity in River Red-gum, as shown by a positive score for the two-year lags and a negative autocorrelation for the one and three-year lags. Examination of the data showed that good flowering years of River Red-gum tend to be followed by weaker years, although the species still flowers. SSA also detected a very weak two-year flowering intensity signal (reconstructed series 8 and 9) accounting for 2.9% of the variation in the data. There was no evidence of this, however, in Black Box (by either autocorrelation or SSA), the score achieved in a given year appears to be independent of that achieved in the previous year. SSA clearly identifies an annual cycle (reconstructed series 2 and 3, Fig. 4.) within both species and in the flooding, accounting for 30.6% of the variation in Black Box, 23.7% in River Red-gum and just 8.2% in the flooding series. The change in amplitude also indicates variation in the intensity flowering and flooding within these cycles.

The autocorrelation functions for River Red-gum and Black Box flowering scores, as a function of the monthly lag show a very strong annual cyclicity with maximum autocorrelation being achieved at 12, 24, and 36 months. This is indicated by the peaks of the autoregression coefficients at these time periods (Fig. 5). The autocorrelation values for both species show similar behaviour, reflecting their synchrony in flowering. A consistent difference is also apparent in the behaviour of the negative autocorrelation evident at 6, 18, and 30 months. This reflects the longer period for which River Red-gum is not flowering compared to Black Box (i.e., there is a much more sharply defined period for which Black Box is not flowering than River Red-gum). An inference from this, for Black Box at least, is that investigation of the periods when it is not flowering and the associated causal factors may be equally illuminating as studying the period of flowering.

**Flooding and flowering**

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The data sequences of flowering for the two species, the monthly flow in the River Murray at Tocumwal, New South Wales, and the estimate of the percentage of forest flooded at that time are illustrated in Figure 6. The cyclic nature of each of these variables is evident.

There was a weakly negative correlation between the percentage of the forest flooded and maximum value of flowering for both species, but this was not statistically significant (River Red-gum $\tau = -0.149, p = 0.21$; Black Box $\tau = -0.198, p = 0.099$).

The cumulative plots (Fig. 7) reveal that Black Box consistently achieves a higher cumulative flowering score than River Red-gum (which reflects its long flowering period). Flowering of both species, however, is aligned in that a good flowering period for River Red-gum tends to also be a good flowering period for Black Box and vice versa. In addition, the cumulative plots indicate that flowering behaviour is not homogeneous over longer time periods, with differing behaviour evident over about thirteen-year blocks. Thus, for the period from 1934 to about 1946 the flowering of both species was the most intense. From 1947 to about 1959 the flowering was, on average, least intense for both species. The remaining period can be viewed as intermediate. The accumulated plot of flooding percentage shows that the period of least intense flowering corresponded to a period of substantial flooding, but this agreement is not perfect. Analyses using the other flow variables give similar results. Therefore, heavy flooding appears to be associated with relatively low flowering in both Black box and River Red-gum, but the agreement is not close enough to infer “cause and effect.”

The reduction in flowering intensity during flooding, however, is supported by the results of the cross correlation of the trends delineated by SSA (Fig. 8: in Black Box the three periods of flowering intensity are clearly seen, less so in River Red-gum). At zero lag, Black Box is more strongly negatively influenced ($\rho = -0.72; P = 0.05$) than River Red-gum ($\rho = -0.44; P < 0.05$) by flooding. The trend accounts for a large amount of the variance in flooding (52.2%) but less so in flowering of Black Box (31.7%) and River Red-gum (14.9%). It should also be noted that SSA indicates that there is an overall reduction in flowering intensity in both the species examined over the observation period.

DISCUSSION

Flowering periods

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The results present an interesting historical picture of two species more or less working in synchrony but also functioning with rather different modalities. River Red-gum has a closely defined flowering period and evidence of flowering more intensely every second year. Black Box has a much longer duration of flowering, is more uniform in its behaviour, and its flowering behaviour appears not to be influenced by its behaviour in a previous year.

The flowering period within River Red-gum is location dependent (Paton et al. 2004; Wykes 1947). In general, this is attributable to variation in climate and geographical influences at sites (Ashton 1975; Griffin 1980; Rawal et al. 2015) and specifically to genetic variation between subspecies (McDonald et al. 2009). Along the Murray River and therefore within Barmah only the subspecies *camaldulensis* occurs (McDonald et al. 2009). This subspecies has been recorded as being in flower in each month of the year (Dexter 1967; George 2004). Over the 40-year observation period of this study, River Red-gum was recorded flowering between September and March. However, flowering in March and September occurred only once in 1935 and 1939, respectively. The early flowering in September was attributed to the “… excellent bud development early in the year it was expected that flowering would have commenced much earlier” by the Forest Officer. The most probable flowering period delineated in this study is December and January (≥ 50% chance of flowering (Keatley et al. 1999)), this agrees with that reported by others (Beuhne 1922; George 2004; Somerville and Nicholson 2005) as well as being in agreement with Colloff (2014) who undertook observations in Barmah. Dexter (1967) also studied flowering in Barmah and found the major flowering period to be between November and January.

The agreement with other studies on the flowering range of Black Box is less-evident. As with River Red-gum, Black Box has also been recorded flowering in each month of the year (Boland et al. 2006; George 2004; Jensen et al. 2007; Somerville and Nicholson 2005). In Black Box some of this variation is likewise attributable to different locations (Roberts and Marston 2011) where flowering might occur opportunistically in relation to rainfall and flood (Parsons and Zubrinich 2010).

In this study Black Box has a nine month range from August to April. Flowering in August was only recorded twice over the observation period in 1939 and 1966 and in April just once in 1966. The most probable months of flowering are October to January: hence a spring and summer main flowering season. An eight-month range of June to January was recorded by...
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Flowering cycles and intensity

Only an annual flowering cycle was detected for Black Box in this study. In general at the population level, this seems to be the case: Boomsma (1972) using a 10 year observation period identified a two year cycle in flowering within both species. SSAs and autocorrelation clearly identify the annual cycle of flowering within both species. Cycles in flowering intensity are known in eucalypts (Ashon 1975; Hudson and Kealley 2010; Hudson et al. 2007; Raon et al. 2004; Raymond 1916; Somerville and Nicholson 2005). However, this current study examines flowering intensity at the population level. Therefore, it is not surprising that the contribution to the variation indicated by either method is quite small but significant.

Flowering synchrony

Black Box flowering was either normally distributed or positively skewed. The normal distribution implies that early or late flowers should have access to fewer pollinators but with less competition for them (Elzinga et al. 2007; Wyatt 1982).

Flowering within River Red-gum is usually within the flowering period of Black Box with both species peak flowering occurring in the same month indicating facilitation in relation to attracting pollinators, rather than competition - particularly given that the flowering pattern is positively skewed. A positively skewed pattern indicates the majority of flowers being opened rapidly at the beginning of a flowering period to enable potential pollinators to quickly adjust to an uncustomed food source (Makino and Sakai 2007; Thomson 1980) and pollinators then remaining faithful to the plant even as the number of flowers decline. This pattern may also ensure that the majority of seeds are available as soon as possible (Forrest and Thomson 2009; Keatley and Hudson 1988).

Environmental watering in the Lower Murray Valley (Jensen and Walker 2017) has received intense spot-flowering recorded in the months of June, September and December in Black Box which has received environmental watering in the Lower Murray Valley (Jensen and Walker 2017).
period for Black Box only found evidence of an annual cycle. At the individual level biennial flowering has been noted (Beuhne 1922; Jensen et al. 2007).

Additionally, flowering in both species became less intense over the observation period; whether this has remained the case is not known and could only be determined if phenological monitoring was again undertaken. Methods could follow those are previously undertaken or those detailed in Bassett (2014) or possibly a combination of both. It is tempting to suggest that the reduction is related, at least in part, to the shift in flooding regime post-construction of the Hume Reservoir (Dexter et al. 1986). Various analyses (e.g., Bren 1988a; Colloff 2014) have quantified changes in the flooding regime of the River Murray since the advent of river regulation began with the first filling of Hume Weir in 1934. In general, these have shown a decrease in the number of larger winter-spring floods, an increase in the variability of these floods compared to the natural river, and a substantial increase in summer flooding in near-river environments associated with “rejections” of irrigation flows in summer.

Flooding and flowering

Although flooding is a requirement to maintain the health of both tree species and their flowering, extended flooding can cause stress (Kozlowski 1997; Roberts and Marston 2011) which can result in less buds, flowers and fruits (Kozlowski 1997). Drought-stressed Black Box and River Red-gum trees are also known to flower less and produce smaller buds (Blackwood et al. 2010; George 2004; Somerville and Nicholson 2005).

In this study, the period which coincides with the least intense flowering (approximately 1947 to about 1959) occurred when the forest was effectively flooded (effective flooding only considers months May to December (Dexter et al. 1986)) in 10 out of the 13 years (Dexter et al. 1986) (see Fig. 6). On three occasions, 1952, 1955 and 1956, the effective flooding duration was greater than 6 months with the period 1955 to 1956 being when the forest was flooded continuously (Bren 1987). For the two more intense flowering periods (1934 to 1946 and 1960 to 1973) the forest was effectively flooded 7 times with a median of three months in both periods (Dexter et al. 1986) (Fig. 6). In these two periods the maximum effective flooding was five months in 1935, 1939, 1964 and 1973. They also include two extended dry periods of approximately 18 months for much of the forest in 1944 and 1967 (Bren 1987; Dexter et al. 1986).

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As the condition of forests and woodlands have been deteriorating within the Murray Darling Basin (Chesterfield 1986; Cunningham et al. 2007; Dexter 1967; Mac Nally et al. 2014; Wen et al. 2009) much work has been undertaken to determine the water regime to optimally maintain and improve their condition (e.g. Catelottia et al. 2015; Doody et al. 2015; George 2004; Roberts and Marston 2011; Wen et al. 2009). The flooding frequency and flooding durations during the more intense flowering periods broadly align with these. To maintain their condition River Red-gum forests require a range of three to seven months duration with a flooding frequency ranging from four to seven years out of ten (Catelottia et al. 2015; Doody et al. 2015; Murray–Darling Basin Authority 2012; DSE 2008 in Roberts and Marston 2011; Ward and Colloff 2010). However, an upper flooding frequency threshold of 9 years out of ten has been nominated by the Murray-Darling Basin Authority (2012). Not surprisingly, the requirements for woodlands is less: a duration of one to four months with a flooding frequency ranging from three to five years out of ten (with a preference for flooding to occur over winter and spring (Murray–Darling Basin Authority 2012; DSE 2008 in Roberts and Marston 2011; Ward and Colloff 2010). Each of the flood frequency values with the exception of the Murray-Darling Basin Authority’s is less frequent than the least intense flowering period.

The flooding frequency suggested for Black Box ranges from 1 in 10 to 10 in 22 years (Bren 2005; Murray–Darling Basin Authority 2012; Roberts and Marston 2011). For Black Box a range of two to six months of flooding is nominated as a requirement for maintaining moderate to vigorous flowering (Roberts and Marston 2011; Rogers 2011) whereas the Murray-Darling Basin Authority advises one to three months specifically for Barmah (Murray–Darling Basin Authority 2012). Rogers (2011) suggests two to four months for inundation with a cut point of 4 months of inundation as it results in reduced reproductive success attributed to a flood adaption response of stomatal closure and increased transpiration. A contributing factor could be soil type as stress was observed after 2.5 months on sodic clays (Akeroyd et al. 1998). The flooding frequency and inundation during the least intense flowering period exceeded these values.

**CONCLUSIONS**

The 40-year data sequence examined has enabled the flowering patterns of both these species over that interval to be established and indicates that they flower more or less in synchrony. It
also showed that flowering in both species has become less intense over the observation period. Determining whether this reduction is related to the change in flooding regime is worthy of future research. There is an indication, more so for Black Box than River Red-gum, that flooding in 10 out of the 13 years with inundation greater than 6 months has a depressive effect on its flowering intensity while flooding in 7 out of 13 years with inundation of no greater than 5 months enhances flowering intensity. However, as flooding is a recurrent event (in this data set) it is difficult to isolate the effect of a single flood.

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REFERENCES


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Figures

Fig. 1. Monthly distribution of flowering scores (July to June) for River Red-gum and Black Box.
Fig. 2. Cross-correlation as a function of months lag between the River Red-gum and the Black Box flooding score.

Fig. 3. Autocorrelation of maximum flowering score achieved as a function of annual lag.

Fig. 4. Annual cycle as determined by SSA. Reconstructed series 2 and 3: (A) Black Box, (B) River Red-gum and (C) flooding. Note the different starting points on the x axes.

Fig. 5. Autocorrelation coefficient of monthly flowering score as a function of monthly lag for River Red-gum and Black Box.

Fig. 6. River Red-gum and Black Box scores, flow in the River Murray at Tocumwal, and estimated percentage of the Barmah forest flooded for the period of the flowering sequence.

Fig. 7. Accumulated flowering score for Black Box and River Red-gum, and accumulated monthly percentage of the forest flooded. The values for Black Box and flooding have been scaled by the maximum value achieved. The value for River Red-gum has been scaled by the maximum value achieved by Black Box to show the parity of flowering.

Fig. 8. SSA trend results for River Red-gum, Black Box and monthly flooding (note the different scales on both vertical axes). The trends highlight the decline in flowering intensity, more evident in River Red-gum, over the observation period.

Tables

Table 1. Terms used to describe flowering intensity and their assigned value (after Keatley and Hudson 2007).

Table 2. Flowering behaviour of River Red-gum and Black Box.
<table>
<thead>
<tr>
<th>Observation parameter</th>
<th>Description</th>
<th>Assigned Value</th>
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<tbody>
<tr>
<td>Quantity</td>
<td>No flowering</td>
<td>0</td>
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<tr>
<td></td>
<td>Very scattered or isolated</td>
<td>0.5</td>
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<tr>
<td></td>
<td>Light Flowering</td>
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<tr>
<td></td>
<td>Medium Flowering</td>
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<td></td>
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<td></td>
<td>Scattered</td>
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<tr>
<td></td>
<td>Fairly General</td>
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<tr>
<td>Missed years (July to June)</td>
<td>River Red-gum</td>
<td>Black Box</td>
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<tr>
<td>----------------------------</td>
<td>---------------</td>
<td>-----------</td>
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<td>Annual flowering success</td>
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<td>1 in 36 yrs</td>
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<tr>
<td>(intensity)</td>
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<td>Most probable month of</td>
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<td>Sept, Oct, Dec</td>
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<td>commencement (range)</td>
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<td>(Aug to Jan)</td>
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<td>Most probable month of</td>
<td>December, January</td>
<td>February</td>
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<tr>
<td>cessation (range)</td>
<td>(Dec to Mar)</td>
<td>(Dec to Apr)</td>
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<td>Mean flowering period (months)</td>
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<td>4.0 ± 1.9</td>
</tr>
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