April 2013 roadside buffel grass survey of north eastern South Australia

Report to NRM Biosecurity Unit, Biosecurity SA
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1 BACKGROUND

Background adapted from 2010 roadside survey

Buffel grass is a potential threat to the environmental and cultural values of arid and semi-arid South Australia (Greenfield 2007). Buffel grass ranked highly on a Weed Risk Assessment process carried for each of the seven bioregions in the South Australian Arid Lands (SAAL) region (Greenfield 2007).

Buffel grass is a favoured feed species of many pastoralists who have cultivated it in several parts of central Australia, including, but to a much lesser extent, in northern South Australia. It is recognised as the most valuable introduced grass in arid and semi-arid tropical areas (Mclvor 2003). In a phone survey conducted in 2007, forty one percent of pastoralists in SAAL region perceive buffel grass as a resource and forty two percent are not prepared to participate in a coordinated regional control program (Greenfield 2007).

Environmentally buffel grass is considered as one of Australia’s worst weeds (Humphries et al. 1991). Buffel grass is an aggressive invader of arid riparian areas due to its ease of establishment, rapid growth rate, fast maturation, prolonged flowering/fruiting periods, prolific seed production, high seed dispersal ability, relatively long seed dormancy and tolerant to drought, fire and grazing (Franks 2002; Franks et al. 2000). It forms dense monocultures, changes fire regimes, threatens refugia and displaces native and endemic plants (Greenfield 2007).

The distribution of buffel grass in South Australia has been recorded in part by government agencies and NRM Boards; however this data set is incomplete for most areas and generally lacks detail regarding impacts. There are also significant gaps in knowledge regarding the distribution and spread of this species in South Australia, making strategic management decisions difficult.

The predominant pathway for spread of buffel grass in South Australia is along roadsides, where road works and vehicles carry seeds and deposit them in disturbed roadside environments. Human activities including stock movement have also spread buffel grass into areas where there are no roads. Buffel grass is also naturally dispersed by wind and water and has successfully spread and established along a limited number of arid drainage lines in the region.

Opportunities may exist to minimise further spread to reduce the potential impacts of buffel grass in South Australia.

In recognition of this opportunity, the NRM Biosecurity Unit of Biosecurity SA developed a project to improve the understanding of the State-wide distribution of buffel grass, and to identify a strategic approach to its management. This project was supported with State NRM Program investment funding.

In order to address some gaps in the current knowledge of buffel grass distribution in South Australia, Rural Solutions SA (RSSA) conducted drive-by roadside surveys in areas of central and far northern SA in May 2010, March 2012 and in April 2013 as reported below.
2 METHODS

2.1 SURVEY ROUTE & TIMING

The route for this survey was designed to fill the knowledge gaps regarding buffel grass distribution in the north east of South Australia and contribute to the known distribution resulting from roadside surveys conducted in 2006, 2010 and 2012.

Roadsides and access tracks scheduled for the April 2013 survey were:
- Strzelecki Track - Lyndhurst to where it is intersected by the dog fence,
- Dog fence from Marree to Frome Downs Station,
- Gas pipeline track,
- Hawker to Yunta via Holowilena, Baratta, Koonamore stations,
- Tracks north of Barrier Highway through Florina, Oultonpa, Bimbowie, Boolcoomatta and Bindarrah stations.

Map 5.1.1 shows a captured track log of the 2013 roadside survey.

Buffel grass is a summer active perennial tussock, thus the ideal survey period would be after a rainfall event during the summer period. However due to OHS&W conditions associated with arid region surveys, it is preferable to conduct field work on the shoulder of the summer season i.e. October – early December and mid-March to April.

Weather was monitored in the north eastern region through accessing online resources e.g. Bureau of Meteorology, Weatherzone, and via discussions with field operators of the Dog Fence Board.

During late February and mid-March significant rainfall events had occurred in the north eastern region which had improved the condition of buffel grass. Confirmation was received from Bill Sandow and Michael Balharry from the Dog Fence Board that buffel was actively growing and displaying the flower/seed heads which are essential for accurate identification.

2.2 DATA COLLECTION

The survey methodology and data capture attributes utilised for the 2013 roadside survey were developed from similar surveys conducted in 2006 and refined in 2010 by Tim Reynolds (PIRSA), Victoria Marshall (University of Adelaide) and Ben Shepherd (RSSA).

Rural Solutions SA consultant, Adrian Harvey and Chris Brodie, Weeds Botanist, State Herbarium of SA, undertook the 9 day survey (7.5 days data collection 1.5 days travel) from the 15th April to the 23rd April 2013.

The survey route was driven at an average speed of 40-50km/hour with a primary observer mapping the presence of buffel grass from the front passenger seat. Where safe and practical to do so, the driver was also observing.

Presence, absence (via continuous track log recording) and density of buffel grass infestations were mapped in the disturbance zone of the roadside and beyond the disturbance zone in the natural zone.
The roadside disturbance zone was defined as:

- The area between the road pavement and the property fence (if present), in particular that portion affected by the road and any road maintenance activity disturbances, e.g. grader windrows and turn outs, stacking sites, borrow pits, tyre marks, culverts, gravel, paths, burrow, pull out and parking bays etc.
- In the absence of all other indicators the disturbance zone was considered as 0 - 5 metres from the roadside.

The natural zone was defined as any area beyond the disturbance zone that is not affected by the soil disturbance, increased run off and other anthropogenic factors associated with the road and other man-made structures (mine sites, rail roads, buildings, car parks etc.).

The attributes description for the disturbance and natural zones can be seen in Table 1.

Full description of the attributes for the disturbance and natural zones including photos of the density ratings can be seen in Shepherd, B. & Marshall, V., 2010 "May 2010 roadside buffel grass survey – a report to NRM Biosecurity Unit, PIRSA"

Where buffel grass was observed either poly line or point features were used to map infestations. Point features where used where isolated occurrences of buffel grass. Point and poly line data was captured using a Trimble Yuma rugged tablet running Arcpad 10 software.

Plant specimens were collected for lodgement in the SA Herbarium.

### 2.3 SURVEY LIMITATIONS

While the primary observer (passenger) attempted to survey both sides of the road and the driver surveyed the right hand side of the road where safe and practical, the left hand side of the road was surveyed more thoroughly than the right, simply because the primary observer was on the left hand side of the vehicle.

At times the natural zone was unable to be thoroughly viewed due to obstacles such as thick and tall vegetation and low observation points. Where the road formation was lower than natural ground level, clear vision was also restricted.

Livestock grazing may mask the true extent of buffel grass infestations in both the disturbance and natural zones.

Small portions of the survey route were unable to be surveyed due to locked access gates, or non-existent/ blocked tracks.
Table 1: Infestation Attributes

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Density of buffel grass in the disturbance zone</strong></td>
<td>Absent</td>
<td>Buffel grass is not being observed WITHIN the disturbance zone.</td>
</tr>
<tr>
<td></td>
<td>Sparse</td>
<td>Buffel grass is always in sight, or becomes insight within a few seconds, WITHIN the disturbance zone at very low density where the distance between single or small clumps of plants is 11 - 100 metres.</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>Buffel grass is being observed WITHIN the disturbance zone at low density where the average distance between plants is 3-10 metres.</td>
</tr>
<tr>
<td></td>
<td>Medium</td>
<td>Buffel grass being observed WITHIN the disturbance zone at medium density, where the average distance between plants is 0.5 to 2 metres.</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>Buffel grass is being observed WITHIN the disturbance zone at high density where the majority of the buffel grass canopies are touching each other or will be when they are fully grown.</td>
</tr>
<tr>
<td><strong>Disturbance zone information</strong></td>
<td>Culvert only</td>
<td>Buffel grass is being observed in a culvert only and the nominated disturbance zone density refers to the density within the culvert only.</td>
</tr>
<tr>
<td></td>
<td>Car park only</td>
<td>Buffel grass is being observed in a car park only and the nominated disturbance zone density refers to the density within the car park only.</td>
</tr>
<tr>
<td></td>
<td>Borrow Pit only</td>
<td>Buffel grass is being observed in a borrow pit only and the nominated disturbance zone density refers to the density within the burrow pit only.</td>
</tr>
<tr>
<td></td>
<td>Other observations</td>
<td>Buffel grass is being observed in a nominated disturbance zone unit and the nominated disturbance zone density refers to the density within the nominated disturbance zone unit only.</td>
</tr>
<tr>
<td><strong>Comments</strong></td>
<td>Single Occurrence</td>
<td>A small line segment with “scattered’ density recorded and then ‘single occurrence’ selected in this field indicated the small line segment is a single record. Single or small populations that are observed in isolation represent a strategic control opportunity, for which, separate point features where also taken.</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>Any other observations were typed in if needed.</td>
</tr>
<tr>
<td>Density of buffel grass in the natural zone</td>
<td>Sparse</td>
<td>Buffel grass is always in sight, or becomes in sight within a few seconds BEYOND the disturbance zone at very low density where the distance between single or small clumps of plants is 11 - 100 metres.</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>-------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Low</td>
<td>Buffel grass is being observed BEYOND the disturbance zone at low density where the average distance between plants is 3-10 metres.</td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>Buffel grass is being observed BEYOND the disturbance zone at medium density where the average distance between plants is 0.5 to 2 metres.</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>Buffel grass is being observed BEYOND the disturbance zone at medium density where the majority of the buffel grass canopies are touching each other or will be when they are fully grown.</td>
<td></td>
</tr>
<tr>
<td>Extent of buffel grass in the natural zone (if present)</td>
<td>0- 10 m</td>
<td>Buffel grass is being observed in the natural zone from 0-10 meters out from the disturbance zone.</td>
</tr>
<tr>
<td></td>
<td>10- 50 m</td>
<td>Buffel grass is being observed in the natural zone from 10-50 metres out from the disturbance zone.</td>
</tr>
<tr>
<td></td>
<td>Patchy</td>
<td>Buffel grass is being observed in the natural zone out to greater than 50m from the disturbance zone.</td>
</tr>
<tr>
<td></td>
<td>Widespread</td>
<td>Buffel grass is being observed in the natural zone widespread but patchy away from the disturbance zone.</td>
</tr>
<tr>
<td>Natural zone information</td>
<td>Drainage line</td>
<td>Buffel grass is being observed in the drainage line only and the nominated natural zone density and extent refers to the drainage line only.</td>
</tr>
<tr>
<td></td>
<td>Gilgai</td>
<td>Buffel grass is being observed in gilgais (natural depressions) and the nominated natural zone density and extent refers to the gilgai only.</td>
</tr>
<tr>
<td></td>
<td>Other observations (if necessary)</td>
<td>Buffel grass is being observed in a definable land unit. No values inputted into natural zone information (as with most line features) indicates the buffel grass is present in a less definable land unit (not in a drainage line, gilgai, sand dune etc.).</td>
</tr>
</tbody>
</table>
### 3 SURVEY SUMMARY

#### 3.1 WEATHER CONDITIONS

During late February and early March, significant rainfall events occurred across the north east of the South Australia, resulting in Feb/March totals of; Leigh Creek 55.6mm, Arkaroola 82mm, and Hawker 43mm. These conditions proved ideal conditions for the vigorous growth of buffel grass. In the southern survey area around Yunta where only 25.8 mm was recorded this was reflected in the lack of vigorous growth and absence of inflorescences observed in the southern portion of the survey area.

![Monthly Rainfall Total (mm)](image)

*Figure 1 Monthly rainfall (mm) received across the survey area*

#### 3.2 SURVEY AREA

Surveys undertaken in 2006, 2010, 2012 and April 2013 have surveyed the majority of public roadways and public access tracks (including the Gas Pipeline and Dog Fence) in eastern SA north of the Barrier Highway, i.e. east of Stuart Highway (Port Augusta to NT border) to SA/Qld/NSW border. See Appendix 5.1.4 for combined survey results.

The roadside survey, undertaken in April 2013 of the North Flinders and North East NRM Districts, was bounded by and followed the Strzelecki Track and the wild dog fence to the north and east, to the west by the Barndioota Rd (Hawker to Leigh Creek)/B83 and south by the Barrier Hwy/A32. Appendix 5.1.1 depicts the track log and buffel grass occurrences mapped during the April 2013 survey.

The survey also followed the gas and oil pipeline road where it is intersected by the Dog Fence in the north and to the Koonamore - Yunta Road in the south.

In April 2013 approximately 2800km of roadsides were surveyed (4300km for entire trip) during the 7.5 survey days and 66 occurrences (points (46) and polylines (20)) of buffel grass were recorded. Principal areas where buffel grass was recorded include:

- Baratta Station – Ootna Creek and Siccus River,
o Creek lines which flowed from the eastern side of the Vulkathuna Gammon Ranges NP into Lake Frome i.e. Balcanoona, Big John, Paralana, and Mulliyana creeks.

3.3 SPECIMEN COLLECTION

22 specimens of buffel grass were taken from different localities. Table 2 and Figure 2 summarise the locations and details of specimens submitted to the State Herbarium of SA.

Table 2: Specimens collected during April 2013 survey

<table>
<thead>
<tr>
<th>Collection no.</th>
<th>Ids</th>
<th>Location</th>
<th>GPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CJB 4875</td>
<td>Cenchrus ciliaris</td>
<td>Strzelecki Track,</td>
<td>54/ 276996 E</td>
</tr>
<tr>
<td>CJB 4877</td>
<td>Cenchrus ciliaris</td>
<td>Strzelecki Track,</td>
<td>54/ 279966 E</td>
</tr>
<tr>
<td>CJB 4880</td>
<td>Cenchrus ciliaris</td>
<td>Moolawatana Creek bed</td>
<td>54/ 378670 E</td>
</tr>
<tr>
<td>CJB 4889</td>
<td>Cenchrus pennisetiformis</td>
<td>Dog Fence western edge Lake Frome</td>
<td>54/ 378086 E</td>
</tr>
<tr>
<td>CJB 4893</td>
<td>Cenchrus pennisetiformis</td>
<td>Dog Fence western edge Lake Frome</td>
<td>54/ 370122 E</td>
</tr>
<tr>
<td>CJB 4895</td>
<td>Cenchrus ciliaris</td>
<td>C. 20km south Arkaroola</td>
<td>54/ 338918 E</td>
</tr>
<tr>
<td>CJB 4896</td>
<td>Cenchrus pennisetiformis</td>
<td>Dog Fence Balcanoona Creek</td>
<td>54/ 366656 E</td>
</tr>
<tr>
<td>CJB 4897</td>
<td>Cenchrus pennisetiformis</td>
<td>Wertaloona - Dog Fence</td>
<td>54/ 362899 E</td>
</tr>
<tr>
<td>CJB 4902</td>
<td>Cenchrus pennisetiformis</td>
<td>Pipeline road</td>
<td>54/ 358450 E</td>
</tr>
<tr>
<td>CJB 4903</td>
<td>Cenchrus pennisetiformis</td>
<td>Pipeline Road, Wooltana Creek south bore 4</td>
<td>54/ 362825 E</td>
</tr>
<tr>
<td>CJB 4904</td>
<td>Cenchrus pennisetiformis</td>
<td>Pipeline Road, Wooltana Station Caldina Creek</td>
<td>54/ 368293 E</td>
</tr>
<tr>
<td>CJB 4905</td>
<td>Cenchrus pennisetiformis</td>
<td>Pipeline Road, Paralana Creek</td>
<td>54/ 375884 E</td>
</tr>
<tr>
<td>CJB 4908</td>
<td>Cenchrus pennisetiformis</td>
<td>Pipeline Road, 4-Mile Creek</td>
<td>54/ 380623 E</td>
</tr>
<tr>
<td>CJB 4910</td>
<td>Cenchrus pennisetiformis</td>
<td>Strzelecki Track, c. 60km Nth Lyndhurst</td>
<td>54/ 286190 E</td>
</tr>
<tr>
<td>CJB 4911</td>
<td>Cenchrus ciliaris</td>
<td>Parachilna turn-off to Blinman</td>
<td>54/ 251844 E</td>
</tr>
<tr>
<td>CJB 4918</td>
<td>Cenchrus setiger</td>
<td>Arkaroola Road, Big John Creek</td>
<td>54/ 339398 E</td>
</tr>
<tr>
<td>CJB 4919</td>
<td>Cenchrus ciliaris</td>
<td>Arkaroola Road, 1km north of Big John Creek</td>
<td>54/ 338250 E</td>
</tr>
<tr>
<td>CJB 4921</td>
<td>Cenchrus ciliaris</td>
<td>Arkaroola Township</td>
<td>54/ 339949 E</td>
</tr>
<tr>
<td>CJB 4929</td>
<td>Cenchrus ciliaris</td>
<td>On Pipeline Road in Baratta Station Near Siccus River</td>
<td>54/ 332262 E</td>
</tr>
<tr>
<td>CJB 4931</td>
<td>Cenchrus ciliaris</td>
<td>On Pipeline Road in Baratta Station Just south of mining facility</td>
<td>54/ 330666 E</td>
</tr>
<tr>
<td>CJB 4938</td>
<td>Cenchrus ciliaris</td>
<td>Barrier Hwy 10km east of Yunta on Winnininnie Creek</td>
<td>54/ 374490 E</td>
</tr>
<tr>
<td>CJB 4940</td>
<td>Cenchrus ciliaris</td>
<td>Barrier Hwy 80km east of Yunta on McDonald Hill</td>
<td>54/ 449168 E</td>
</tr>
</tbody>
</table>
3.4 SUMMARY OF BUFFEL GRASS OCCURRENCES

Very few single plant occurrences were found, most infestations were typically sparse to high density level infestations in both the disturbed and natural zones.

Buffel grass was generally associated with open, loose sandy creeks, drainage lines and sandy rises. It was notably absent from areas that were associated with saline, silty and heavy clay areas, which exist along the western edge of Lake Frome.

3.4.1 Locations of buffel grass where widespread within the disturbance zone.

All infestations which were within close proximity of a creek line had widespread distribution in the disturbance zone. Areas associated with infrastructure i.e. compressor stations along the gas pipeline had dense infestations in their immediate vicinity.

Maintenance activities, e.g. grading and grazing along the gas pipeline road, are dispersing buffel away from the creek lines, and should be managed to prevent any further spread into adjacent vegetation. Similarly track and fence maintenance along the Dog Fence is resulting in the dispersal of buffel grass; however soil type and salinity appear to be limiting the spread away from the fence/track.
3.4.2 Locations of buffel grass where present within the natural zone.

Many of the creek lines in Vulkathunha-Gammon Ranges NP are infested with buffel grass. It was often observed that when travelling along the gas pipeline track, creeks infested were also infested where the Dog Fence bisected the same creek, approximately 10-15km to the east. It is reasonable to assume where this occurred, the infestation extended the 10-15km length. In these situations containment is the only reasonable option to prevent spread into surrounding grasslands/shrub lands.
Figure 6 Buffel grass in drainage line along Dog Fence on Wooltana Station, SA.
Herbarium Collection #CJB4889
The Siccus River and Ootna creek on Baratta Station had high density and widespread infestations in both the disturbance and natural zones.

![Dense buffel grass infestation along Ootna Creek, Baratta Pastoral Lease, SA.](image)

**Figure 7** Dense buffel grass infestation along Ootna Creek, Baratta Pastoral Lease, SA.

![Buffel grass along banks of Siccus River, Baratta Pastoral Lease, SA. Herbarium collection # CJB4931](image)

**Figure 8** Buffel grass along banks of Siccus River, Baratta Pastoral Lease, SA. Herbarium collection # CJB4931

3.4.3 Locations where isolated or limited distribution occurrences of buffel grass may present a strategic control opportunity.

Several of the occurrences of buffel grass could be classed as strategic control opportunities however; several locations stand out and should be pursued to prevent further expansion into the natural zones:

- Arkaroola Wilderness Sanctuary – surrounding visitor centre, accommodation, camp grounds and public private access routes. Arkaroola Wilderness Sanctuary has been highlighted in previous reports as a strategic control opportunity.
- Barrier Highway, all infestations within the disturbance zone
- Strzelecki Track, all infestations within the disturbance zone
o Gas pipeline; all infestations not in close association with a creek line could be classified as strategic control opportunities. Control of these infestations would prevent further expansion into the surrounding grasslands.

o Dog Fence: all infestations not closely associated with a creek line, these infestations are extending along the fence as a result of track and fence maintenance.

o Control of isolated infestations along Hawker to Marree Rd, control will limit further expansion.

Figure 9 Buffel grass on the Arkaroola Village Rd. Herbarium collection # CJB4895
3.4.4 Locations of buffel grass which warrant further investigation to establish a defined extent.

- Infested creek lines along the Strzelecki Track, refer to Herbarium collection# CJB4875, 4877and 4910 for grid references
- Big John Creek, establish the full extent of *Cenchrus setiger* along creek line, refer Herbarium collection #CJB 4918.
- Hamilton Creek on Moolawatana Station, isolated mature plants found extent along creek is unknown, Herbarium collection# CJB4880.

![Figure 10 Buffel grass along creek bank, Strzelecki Track. Herbarium collection # CJB4875](image1)

![Figure 11 Buffel grass in creek bed, Strzelecki Track. Herbarium collection # CJB4875](image2)
Figure 12 Collecting Cenchrus setiger at Big John Creek. Herbarium collection #CJB4918

Figure 13 Buffel grass on Copley Rd, Moolawatana Station. Herbarium collection # CJB4880
4 REFERENCES


5 APPENDICES

5.1.1 Map of survey results for 2013 roadside buffel survey

2013 survey results are shown in figure 5.1.1. Solid points indicate the density of the buffel occurrences, whereas the hollow/inner circles show the density of buffel grass infestation within the Disturbed Zone, while the shaded/outer circles indicate the extent of the invasion of buffel grass into the Natural Zone. The symbols (i.e. solid points, hollow and shaded circles) used in Figure 5.1.1 are survey points that represent the centre of each infestation but not the linear extent (i.e. along a road) at this map scale.

Where buffel grass was observed, either polygon line or point features indicate infestations. Point features indicate isolated occurrences. The absence of a mapped feature along the survey route indicates the absence of buffel grass.
5.1.2 Zoom A Buffel grass occurrences in the Wooltana / Vulkathuna-Gammon Ranges NP region.
5.1.3 Zoom B Buffel grass occurrences on Baratta Station.
5.1.4 Map of combined survey results from 2006, 2010, 2012 & 2013 surveys

The combined results from 2006, 2010, 2012 and 2013 surveys are shown in figure 5.1.4. Solid points indicate the density of the buffel occurrences, whereas the hollow/inner circles show the density of buffel grass infestation within the Disturbed Zone, while the shaded/outer circles indicate the extent of the invasion of buffel grass into the Natural Zone. The symbols (i.e. solid points, hollow and shaded circles) used in Figure 5.1.1 are survey points that represent the centre of each infestation but not the linear extent (i.e. along a road) at this map scale.

Where buffel grass was observed, either polygon line or point features indicate infestations. Point features indicate isolated occurrences. The absence of a mapped feature along the survey route indicates the absence of buffel grass.

Figure 5.1.4 Survey results from 2006, 2010, 2012 & 2013 roadside surveys
5.1.5 Comparison of the 3 species of *Cenchrus* collected during the April 2013 survey.

The following description has been prepared by Chris Brodie, Weeds Botanist, State Herbarium of SA.

Three different species of *Cenchrus* were collected on the survey. These were:

- *Cenchrus ciliaris* - ‘black buffel grass’ also known as ‘buffel grass’,
- *Cenchrus pennisetiformis* - ‘white buffel grass’ or ‘buffel grass’,
- *Cenchrus setiger* – ‘birdwood grass’ or ‘buffel grass’.

*Cenchrus ciliaris* and *C. pennisetiformis* are very similar in appearance, habit and flowering structure. The flowering burrs that surround the spikelets in these two taxa are soft and obviously ciliate but not spiny. Clayton & Renvoize (1982) note that in its native Africa, *C. pennisetiformis* is an annual or a short lived ascending perennial, 10-40cm tall, whereas *Cenchrus ciliaris* is a perennial, often forming matts or tussocks, 10-150 cm tall, ascending, wiry and almost woody.

Wipff (2001) even considered *Cenchrus ciliaris* and *C. pennisetiformis* in the closely related genus *Pennisetum* Rich. Recent work by Chemisquy et al. (2010) proposes the unification of *Cenchrus & Pennisetum with Pennisetum* transferred to *Cenchrus* as this name has priority. This is supported by Simon (2010) and has been adopted by Australian Plant Census ([http://www.chah.gov.au/chah/apc/index.html](http://www.chah.gov.au/chah/apc/index.html)). This decision is supported by the State Herbarium of South Australia.

The character used to separate the taxa by Jessop et al. (2006) in the ‘Grasses of South Australia’ is flower structure. In particular, the burrs surrounding the flowering spikelets are fused to different lengths in the two species. It is the amount of length-wise fusion of the inner burrs that separate the taxa. This fusion is either minimal or absent in *Cenchrus ciliaris* (black buffel grass), while the fusion occurs to a greater degree, to 1-3mm in length in *Cenchrus pennisetiformis* (white buffel grass).

Jessop *et al.* (2006) description agrees with Clayton & Renvoize (1982). They explain in detail that *C. ciliaris* has bristles that are fused at the base forming a disc 0.5 – 1.5 mm in diameter and is only fused for 0.5 mm vertically above the rim. In SA, Jessop *et al.* (2006) state that *Cenchrus ciliaris* are apparently not fused or more or less free from one another. A typical spikelet surrounded by the burrs can be seen in figures 1 & 2 (CJB4880, collected as part of the buffel survey).
Figure 1. *Cenchrus ciliaris* burr with minimal fusion above the disc in length (Collection number CJB4880).
Clayton & Renvoize (1982) state that *Cenchrus pennisetiformis* also forms a fused disc, but this is fused for 1-2.5 mm vertically above the rim. In SA, Jessop *et al.* (2006) state that *C. pennisetiformis* has fusion along the length of the burr up to 3 mm. A typical spikelet surround by the burrs and can be seen in figures 3 & 4 (CJB4896, collected as part of the buffel survey).
Figure 3. *Cenchrus pennisetiformis* with just over 1mm of fusion of burrs in length (Collection number CJB4896)

Figure 4. *Cenchrus pennisetiformis* with just over 1mm of fusion of burrs in length. (Collection number CJB4896)
However, Clayton and Renvoize (1982) also state that *C. ciliaris* intergrades with *Cenchrus pennisetiformis* in its native Africa. It is also suggested here that the separation of the two taxa could be further complicated by the many strains that have been introduced into Australia for cattle feed or soil stabilisation with the taxonomy still unclear. Further taxonomic work needs to be carried out looking at both morphological characters in conjunction with molecular tools.

*Cenchris setiger* is distinct from both *C. ciliaris* and *C. pennisetiformis*. *C. stiger* burrs are firm, usually spiny and not conspicuously ciliate as seen in figures 5 & 6 collected as part of this survey (CJB 4918 collected as part of the buffel survey).

![Figure 5. Cenchrus setiger with hard spiny burrs fused over 1mm (Collection number CJB4918)](image)
Figure 6. *Cenchrus setiger* with hard spiny burrs fused over 1mm (Collection number CJB4918)

Bibliography


