

Enhanced Vegetation Survey Techniques for Riparian Management

Glenn Christie¹ & Steve Clarke²

SUMMARY: As part of a National Heritage Trust funded process, a vegetation survey was conducted by a local community group on 20km of the North and South Para and Gawler rivers within the Gawler Council boundary. Gawler is located 40 km north of Adelaide, South Australia.

The survey concentrated on documenting native and exotic vegetation species; both their presence and percentage coverage. This survey differs from many other surveys concentrating on vegetation in that 213 contiguous sites (each 100m in length) comprised the survey as opposed to sites randomly selected. It also differs in that native and exotic species were mapped according to their distance from the rivers edge.

Erosion and rubbish sites, their location, severity and possible causes were also mapped. Fauna presence, both native and exotic (and any attendant impacts) were noted.

This information was placed into a Geographic Information System, (GIS), using Arcview, to make and present maps of the river corridor's "state of health" to the public and land holders along the river.

THE MAIN POINTS OF THIS PAPER

- riparian vegetation in the Gawler Council native area is heavily fragmented and the range of the native species is not easily recorded in a random sample survey
- the contiguous nature of the survey leaves the surveyors confident that most of the native species were recorded
- a new methodology of identifying where both native and exotic vegetation occurs in the riparian zone was trialed
- the results from this survey were used to develop revegetation strategies based on these riparian zones
- Council, community groups and landowners have access to survey information to develop management strategies for rehabilitation of the river system

1. INTRODUCTION

The main aim of the survey was to document the species of native and exotic vegetation along the Gawler River. This information will be used for the progressive rehabilitation of the river.

The survey was conducted between June and September 1998 and documented native and exotic vegetation species and their densities. Also recorded were sites of river bank erosion, rubbish dumping and fauna observations. This information was placed in a Geographic Information System (GIS) which allowed the construction of maps such as Map 1. From these maps relatively 'healthy' sites or those subject to weed infestation, rubbish dumping and erosion can be easily identified.

Within the Gawler Council boundaries are three rivers. They are the North and South Para rivers which at their confluence (in Gawler itself) become the Gawler river. Most of the North and South Para rivers are owned by the Council and flow through primarily urban and parkland areas. In contrast the Gawler river is largely

privately owned and flows through agricultural and horticultural areas.

It was hoped that this survey would confirm observations made locally by the team members over the past couple of years. These observations are that exotic and native vegetation often occupied 'exchangeable niches'. That is, both exotic and native plants are adapted to occupy the same zone on the river bank. If this could be confirmed, then a simple strategy for river revegetation could be developed.

2. METHODOLOGY

The methodology is divided into two parts. The first deals with the definition of river vegetation zones and the second part is an overview of the GIS methods used to develop the map shown in Figure 3. Further detail of methods is available in the final report, "Assessment of Rivers in Gawler Council Area" which is hereafter referred to as 'the final report'.

¹Glenn Christie 49 Cowan St, Gawler SA 5118

²Steve Clarke, Email: s-clarke@roseworthy.adelaide.edu.au

2.1 Zone Theory

The river corridor was divided into 100 metre sections. Each section was then sub-divided into six zones (see Figure 1), three zones on either side of the middle of the river. The reasoning for dividing the river corridor into zones was based on previous observations made by the surveyors. These observations were that the river vegetation changed distinctly across the cross-section of the river corridor. There was some overlapping of species in zones but to the experienced eye, these zones were distinct. These vegetation changes seemed to be dependent on the availability of moisture whereby each species would find its niche at the area of moisture availability that suited it best.

The zones were designated **A, B** and **C**. The use of zones also allowed increased accuracy when describing the position of erosion or rubbish sites. The zone widths are arbitrary and depend upon the width of the river, the steepness of the river banks and the depth of the river cutting.

Zone A - This zone covered from the middle of the river to the rivers edge, and was the area covered by water at times of normal flow.

Zone B - This zone covered from the rivers edge to part of the way up the bank. This area was not frequently inundated.

Zone C - This zone covered part way up the bank to incorporate the top of the bank. Where the river banks were low with a flood plain stretching out from one or both banks, zone C may have stretched up to 50 metres from the centre of the river, (Figure 2).

Within these zones each identified species of plant was recorded, along with the percentage cover that each species occupied a particular site.

2.2 Overview of GIS Methodology

There were five procedures that were used to transform the data from the survey sheets into the map that was developed.

1. cadastral data for region of survey purchased from relevant authorities
2. survey data entry
3. ranking of survey data
4. calculation within Arcview based on ratings
5. map production

3. RESULTS

The following results document how many species of native and exotic plants were found along the river corridor. Where exotic species were seen, it was noted whether they were annual or perennial and which of these species rated highly on an 'invasiveness' scale. This implies that the species can invade undisturbed areas of river vegetation.

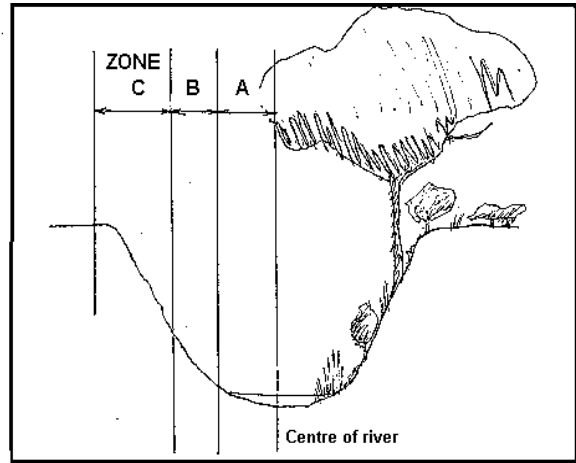


Figure 1: Zones of the river corridor

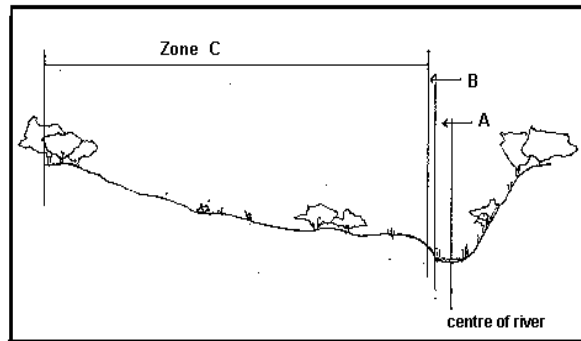


Figure 2: Variation in zone C width

3.1 Native Plants

There were a total of 44 native species recorded during the survey. Table 1 shows the breakdown between trees, shrubs, groundcovers and specialised wetland species.

Of these 44, all but three species have been identified. These unidentified species are each suspected to be native grasses. As the survey occurred in winter, there were no seed heads present to help identify them, (seeding for native grasses occurs in early summer).

	Number of species
Tree Species	4
Shrub Species	11
Groundcover Species	19
Wetland Species	7
Not yet identified	3
Species	
Total Species	44

Table 1: Native Species and Their Classification

The final report provides the botanical and common names of each of the 44 native species with extra columns indicating their mature form (whether they are a tree, shrub or groundcover) and which zone of the river (A,B or C) they commonly occur.

3.2 Exotic Plants

There were 57 species of exotic plants recorded. Twenty three of these species were perennial and 34 were annual species. Table 2 shows the breakup between trees, shrubs, groundcovers and specialised wetland species.

	Number of species
Tree Species	7
Shrub Species	11
Groundcover Species	36
Wetland Species	3
Total Species	57

Table 2: Exotic Species and Their Classification

The final report provides the botanical and common names of each of the exotic species. Extra columns provide information on whether the species is an annual or perennial plant, their mature form; whether tree, shrub or groundcover; which zone they occur in, (A,B or C) and a rating of the ability of the species to invade river corridors. This extra information was not provided for the native species as it is included to allow control strategies to be discussed.

3.3 River Status Ratings

Table 3 shows the GIS 'condition' ratings for the 213 sites surveyed.

Condition	Number of sites
Very good	3
Good	27
Fair	118
Poor	41
Very poor	24
Total Sites	213

Table 3: GIS Condition ratings for the River Corridor in the Gawler Council area

There are further results included in the final report that are outside the boundaries of this paper. They include:

- general erosion
- stormdrain erosion
- rubbish
- fauna
- locally rare native plants
- locally rare wetland native plants

4. DISCUSSION

The overall aim of this survey was to give the 20km of river corridor within the Gawler Council boundaries, a rating for the river vegetation's 'state of health'. The discussion takes in the implications of the survey results and GIS ratings for native and exotic vegetation.

This information is then applied to a management strategy developed by the team members. This strategy concentrates on replacing exotic species with relevant native species. It is felt that this strategy can dramatically shape the options available to Council, landholders and community groups and increase the chances of successful revegetation.

4.1 Native Species

A major outcome of the survey is that there is now a list of 44 native river plants which are adapted to the river corridors of the Adelaide Plains. Importantly, this list differs substantially from other lists of native plants previously documented for the Adelaide Plains. Most vegetation surveys in the Adelaide Plains region have been documenting comparatively flat surfaces. In river corridors, the species are selected by, amongst other factors, their adaptability to moisture. This adaptability is highly condensed into the height of the river bank. Therefore, plants from the Adelaide Plains will not necessarily prosper along river corridors and vice-versa.

There are thirteen native species that have been selected by the authors as being species to concentrate on for riverbank stabilisation. The species chosen are based on long term observations and it has been noted that these species meet the following observation based criteria:

- ability to compete with exotic plants
- quick to grow to maturity and seed set

These species are highlighted in Table 4.

Of these thirteen species, *Phragmites australis* (Common Reed) is perhaps the key native river species identified for rehabilitation as it occurs in zones A, B and C.

From the vegetation listing people interested in regenerating river systems in the Gawler region can put together an order for trees, shrubs and groundcovers and know where to place them on the river bank to maximise their likely success. The result is these plants will have the very best chance of survival and importantly, maturing and setting seed for new individuals to further revegetate the river bank.

Botanical Names	Common Names	Form	Zone
<i>Acacia salicina</i>	port Broughton will.	T	B,C
<i>Atriplex semibaccata</i>	berry saltbush	G	B,C
<i>Atriplex suberecta</i>	lagoon saltbush	G	A,B,C,
<i>Chloris truncata</i>	windmill grass	G	C
<i>Cyperus gymnocualos</i>	spiney flat-sedge	W	B,C,
<i>Danthonia sp</i>	danthonia	G	C
<i>Enchylaena tomentosa</i>	ruby saltbush	G	C
<i>Enneopogon nigricans</i>	blackheads	G	C
<i>Enteropogon acicularis</i>	windmill grass	G	C
<i>Maireana brevifolia</i>	bluebush	G	C
<i>Phragmites australis</i>	common reed	G	A,B,C,
<i>Rhagodia parabolica</i>	mealy saltbush	S	B,C,
<i>Stipa sp</i>	spear grass	G	C

Table 4: Table of Key Native Species

The 'form' column refers to the species size as a mature plant; GC refers to groundcover, S to shrub, T to tree and W to specialised wetland species.

This native plant listing is also relevant outside the Gawler Council area. The species lists will have applications to other rivers on the Adelaide Plains. Areas with higher or lower rainfalls can use the same zone principles that underpin this survey, though the actual species will differ.

4.2 Exotic Species

The GIS rated 65 sections of the river corridor as being poor to very poor, resulting from the site coverage by annual and perennial exotic species.

The control of exotic plant species forms a large amount of the effort involved in the regenerating and revegetating of river corridor. The authors of this report believe that this daunting task can be broken down into much easier 'chunks'.

The breakdown of the 57 exotic species into which are annual or perennial is quite important in shaping control strategies. Only seven of the 57 have the ability of be highly invasive. This means that they can colonise undisturbed vegetation. These seven species (which are shown below in Table 5) are marked out as key species and they are deemed the most important in terms of effort.

The 34 annual species can be controlled through covering bare ground. Based on the surveyors observations, *without direct sunlight and/or disturbance of the soil, the seed of annual exotic species will not germinate*. Whether the covering is achieved by the spreading of mulch or using native groundcover species; it insures that the germination of annual exotic species is sharply reduced.

Botanical Names	Common Names	Form	Zone
<i>Cynodon sp.</i>	couch	G	A,B
<i>Lycium ferocissimum</i>	boxthorn	S	B,C
<i>Myrsiphyllum asparagoides</i>	bridal creeper	G	C
<i>Olea europaea</i>	olive	T	B,C
<i>Oryzopsis miliacea</i>	rice millet	G	B,C
<i>Pennisetum clandestinum</i>	kikuyu grass	G	A,B
<i>Ricinus communis</i>	castor oil plant	S	B,C

Table 5: Key Exotic Species for Control

The 'form' column refers to the species size as a mature plant; GC refers to groundcover, S to shrub, T to tree and W to specialised wetland species.

Control methods for perennial exotics are well known; they usually involve chemical application or the use of chainsaws followed by the removal of root systems to stop regrowth.

It is emphasised though, that the bulk of the exotic species are annual and are comparatively easily controlled.

5. CONCLUSION

In terms of documenting the great bulk of the native and exotic species, the survey was considered highly successful. All the perennial shrubs and trees were identified and the authors are confident that the great bulk of the groundcovers were documented.

Even though the native vegetation along the river is highly fragmented, the authors feel that the contiguous nature of the survey succeeded in piecing together a representative picture of the original river system vegetation. The zone approach to mapping both native and exotic species has allowed the development of a more appropriate revegetation strategy for the Gawler river corridors.

This information can be used by Councils and community groups along the Adelaide Plains to rehabilitate river corridors. The broad principles in this paper can be used in areas outside the Adelaide region by groups seeking to rehabilitate vegetation along their own river corridors.

6. ACKNOWLEDGEMENTS:

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