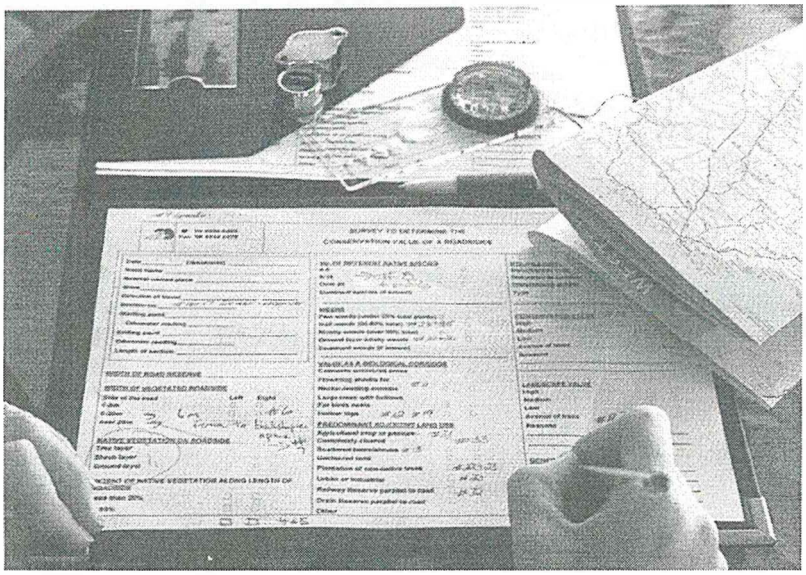
Roadside Conservation Committee

RCC MANUAL FOR PROCESSING ROADSIDE SURVEYS, DATA ENTRY AND MAPPING.



Assessing Roadside Conservation Value

GILLIAN STACK, MARCH 2002
KATE JACKSON, DECEMBER 2004

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**Important Note: Keep a record of the hours spent on scoring survey sheets, data entry, mapping, the correction cycle and report writing. This will be used to provide an invoice to the relevant Shire which they will not be required to pay, but which indicates the monetary value of the product given to them by the Roadside Conservation Committee.

1. WHAT THE MAPS ARE FOR:

The Roadside Conservation Value (RCV) maps and weed overlays are given to the Shire, community groups and Land Conservation District Committees (LCDC) that have organised the collection of data for their Shire's roads, along with a summary Report that interprets the data. See the RCC publication *Assessing Roadsides: A Guide to Rating Conservation Value* (Jackson, 2002) for further details. Note that town roads are not included in these surveys.

2. WHAT YOU WILL NEED:

- One set of 1:100 000 scale State of Construction maps and a digital copy of the road lengths data for the relevant shire, sourced from the Main Roads Department. These are requested from Main Roads (Danny Grillo, 9323 4410) by the RCC Technical Officer (Mapping) and is usually quickest when done by email (danny.grillo@mainroads.wa.gov.au). Request both the State of Construction (S of C) maps and the digital road lengths data for that shire. The S of C maps will be posted as hard copies, and the road lengths data will come as an attachment via email.
- Note: The road lengths data will be a *.txt* file (text document), which opens with notepad, see section 4.2 for further instructions.
- Main Roads' Straight Length Kilometre (SLK) books (Red cover) for Highways and Main Roads.
- Data sheets - 'Roadside Survey to Determine the Conservation Value of Roadsides in the Shire of...'
- Computer with Excel, Access, RCC survey program files (see Appendix 5).
- 4 x different coloured highlighters representing the 4 categories of conservation value - High, Medium-high, Medium-low and Low.
- Ruler for checking road lengths on map.
- Pencil and eraser.
- Coloured 'flags' to highlight certain sheets for the data correction cycle. (Eg, to indicate which roads have data reversed, which should not be scaled, etc.)

3. SYNOPSIS OF THE PROCESS:

The surveyors undertake a ½-1 day training session with RCC Technical Officer (Mapping).
Survey is carried out, and survey forms sent to RCC Technical Officer (Mapping).
The survey sheets are scored.
The data is entered and hand-mapped onto S of C maps.
The data is adjusted for GIS.
GIS Applications Section plots the data.
Data compiler and GIS representative go through the correction cycle in collaboration, making changes as necessary to both the Excel dataset and the ArcInfo tables until the finished map accurately reflects the data from the survey sheets received;
GIS representative produces the products specified in Section 9 and Appendix 4 and sends to RCC.
RCC's Technical Officer (Mapping) and the Executive Officer prepare a report to accompany the map and distributes.

4. SCORING THE SURVEY SHEETS:

4.1 Allocating scores

Allocate scores to every sheet as per Master Sheet (see Appendix 1). Add together the scores for those marked with a star (i.e., Native Vegetation on Roadside, Extent of Native Vegetation on Roadside, No. of Different Native Species, Weeds, Value as a Biological Corridor and Predominant Adjoining Land use) to provide the Conservation Value Score (0-12). Survey sheets from shires that have nominated weed species that they are particularly interested in will have these listed on the reverse or the right hand side as per Master Weed Sheet in Appendix 1. These are scored as 0 if absent and as 1, 2 or 3 if present, as per 4.3.

4.2 Obtaining the road lengths data

Copy the .txt file data and paste into a blank Word document.

- ☞ Highlight all the data (Edit, Select all).
- ☞ Now go to the Table menu, and select 'Convert text to table'. Select 'Number of columns' = 1, and 'Separate text at' = comma's.
- ☞ The data in the table is a numerical list of roads format. To get an alphabetic list of the Shire's roads, select the whole table and go to 'Table', select 'Sort'. Sort by 'road name' (may be titled NE_DESCR). You now have an alphabetic list also.

5. ENTERING THE DATA INTO EXCEL:

5.1. Map the data onto the State of Construction map as you enter the data into Excel. This will help to check road names, start and endpoints, direction of travel (see 5.2), road lengths (see 5.3) and build a picture of roadside conservation status. This will also provide an original map to compare the first draft plot to, once GIS produce a draft through ArcInfo, and will help identify errors in the data.

5.2. Check the data is 'pointing' the right way - the data will be plotted through ArcInfo with 'Left' and 'Right' determined by the road direction given on the State of Construction maps. Sometimes the survey is done from the opposite direction to that given on the map, and in those cases, the data needs to be reversed - start and endpoints, section odometer readings if road done in segments, direction of travel and all the data regarding left and right road verges.

5.3. Road lengths have to be checked from different sources. Enter the original odometer reading in the FROM and TO columns, as they provide a record of what was reported without going back to the hard copy survey sheets. It sometimes becomes clear that surveyors have misnumbered or misnamed roads, or that they have kept going once the on-ground road has changed number according to the map. It may be that they have stopped surveying before the GIS-decreed end of the road (eg, a farmer has put a gate across an access road to their property). In this case, stick with what the survey sheet says is the endpoint, or if it is less than 0.2km, extend the length of the road to the GIS-decreed endpoint.

5.4 When the data is oriented in the right direction, mark the sections on the road ensuring that any Starting Points/Ending Points given on the survey sheets that appear

on the map (eg, road intersections etc.) match up. Colour each side of the road with the appropriate highlighter.

5.5 Enter data:

A list of the Excel spreadsheet column headings and their translations is included here:

ROAD_# Road number - the identifying number ascribed by Main Roads WA (MRWA) to avoid confusion, eg through local name changes, ambiguous start and endpoints indicated by names, etc. Shire roads are entered as (Shire number)(4 digit Road number) - eg, 3030001, 3030084. Main roads are entered as (M)(3-digit Road number) - eg, M005, M031. MRWA is also responsible for Highways, entered as (H)(3-digit Road number) - eg, H001, H010.
SEC_# Section number - the number ascribed by surveyor to the length of road the data describes. May be changed by data compiler if road data needs to be reversed (see 4.2).
SHIRE_# Shire number - identifying number ascribed by WA Local Government Association (WALGA).
FROM Starting odometer reading. May be changed by data compiler if road data needs to be reversed (see 5.2).
SECTIONLEN Length of section - ie, the difference between the start and finish odometer readings for a section. ⊗
TO Finishing odometer reading. May be changed by data compiler if road data needs to be reversed (see 5.2).
ROADLEN Road length according to the last odometer reading for that road. ⊗
GIS_KM Road length according to MRWA data. (As provided by MRWA). ⊗
ROADNAME Road name - used by road users, should match MRWA road name ⊗
STARTPOINT Landmark or feature that identifies the start of a section (eg, creek line, intersection). ⊗
ENDPOINT Landmark or feature that identifies the end of a section (eg, creek line, intersection). ⊗
NEARPL Nearest named place. ⊗
DIR Direction ascribed by MRWA to determine which way the database plots data; ie, which end is start point and which is endpoint. This will not necessarily match direction of travel given on survey sheets. ⊗
DATE Date survey undertaken. Format must be day/month/year, using the forward slash as separator. In the present spreadsheet, the cell is set to default to this format; if '16oct01' is entered it will appear as '16/10/2001'.
OBSERVER Volunteer who undertook survey.
RES_WIDTH Road reserve width - needs to be entered as a multiple of 20m (see Appendix 3,p3). Where the data is not a multiple of 20, round to closest or if midway, round up.
WIDVEG_L Width of vegetation on left side of road - value (0, 1 or 2).
WIDVEG_R Width of vegetation on right side of road - value (0, 1 or 2).
VEG_TREE_L Native vegetation on roadside - Tree layer on left side - present (1) or absent (blank).
VEG_TREE_R Native veg'n on roadside - Tree layer on right side - present (1) or absent (blank).
VEG_SHRUB_L Native veg'n on roadside - Shrub layer on left side - present (1) or absent (blank).
VEG_SHRUB_R Native veg'n on roadside - Shrub layer on right side - present (1) or absent (blank).
VEG_GRND_L Native veg'n on roadside - Ground layer on left side - present (1) or absent (blank).
VEG_GRND_R Native veg'n on roadside - Ground layer on right side - present (1) or absent (blank).
NAT_VEG_L Native vegetation on left side of road - value score (0, 1 or 2).
NAT_VEG_R Native vegetation on right side of road - value score (0, 1 or 2).
EXT_VEG_L Extent of native vegetation on left side of road - value score (0, 1 or 2).
EXT_VEG_R Extent of native vegetation on right side of road - value score (0, 1 or 2).
#_SPECIES_L Number of different native species on left side of road - value score (0, 1 or 2).
#_SPECIES_R Number of different native species on right side of road - value score (0, 1 or 2).
WEED_L Weeds on left side of road - value score (0, 1 or 2).
WEED_R Weeds on right side of road - value score (0, 1 or 2).
CONNECTSUN_L Value as a biological corridor - Connects uncleared areas on left side - present (1) or absent (blank).
CONNECTSUN_R Value as a biological corridor - Connects uncleared areas on right side - present (1) or absent
FLOWER_L Value as a biological corridor - Flowering shrubs on left side - present (1) or absent (blank).
FLOWER_R Value as a biological corridor - Flowering shrubs on right side - present (1) or absent (blank).
TREEHOL_L Value as a biological corridor - Large trees with hollows on left side - present (1) or absent (blank).
TREEHOL_R Value as a biological corridor - Large trees with hollows on right side - present (1) or absent (blank).
HOLOGS_L Value as a biological corridor - Hollow logs on left side - present (1) or absent (blank).
HOLOGS_R Value as a biological corridor - Hollow logs on right side - present (1) or absent (blank).
VAL_CORR_L Value as a biological corridor on left side of road - value score (0, 1 or 2).
VAL_CORR_R Value as a biological corridor on right side of road - value score (0, 1 or 2).
LANDUSE_L Predominant adjoining land use on left side of road - value score (0, 1 or 2).
LANDUSE_R Predominant adjoining land use on right side of road - value score (0, 1 or 2).
CCV_TOTAL_L Conservation value score for left side of road - value score (0 - 12).
CCV_TOTAL_R Conservation value score for left side of road - value score (0 - 12).
DOM_WEEDS Dominant weeds - up to six nominated in discussions between Shire and RCC can be mapped onto individual overlays. The names aren't entered in here, but there is a formula that is entered into this column. To prevent records not appearing on the map through typographical errors, the weed names are only written as a column heading and then recorded in those columns as present or absent (see further down this list; WATSONIA_L etc.). This DOM_WEEDS column is a formula cell that enters the names automatically based on entries in the other columns (see 5.8).

⊗

DIST_L Utilities / disturbances on left side - Extent - value score (0, 1 or 2).
DIST_R Utilities / disturbances on right side - Extent - value score (0, 1 or 2).
FAUNA Fauna observed. ⊗
DIST_TYPE_L Utilities / disturbances on left side - Type - a text entry (eg, wood collection, gravel extraction). ⊗
DIST_TYPE_R Utilities / disturbances on right side - Type - a text entry (eg, wood collection, gravel extraction). ⊗

ADJ_LANDUSE_L Predominant adjoining land use on left side (Agricultural crop or pasture completely cleared (C), or scattered (S), uncleared land (U), plantation of non-native trees (P), urban or industrial (I), railway reserve parallel (R), or drain reserve parallel (D)).
ADJ_LANDUSE_R Predominant adjoining land use on right side (as above).
OTHERLNDUS Predominant adjoining land use - Other - a text entry for a land use not in the available list. ⊗
GENERALCOM General comments - a text entry for any comments given. ⊗
UPDATE Used by GIS for plotting purposes. Leave blank.
NOMINATED WEEDS:
(Eg) WATSONIA_L } Column headings are dependent on the weeds nominated by the Shire - up to six ⊗
(Eg) WATSONIA_R } may be nominated. The weeds are given a value score (0, 1, 2 or 3). ⊗
(Eg) BRIDAL_CREEPER_L } A formula cell then automatically records each of them in correct format ⊗
(Eg) BRIDAL_CREEPER_R } for GIS mapping purposes. (See 5.5 DOM_WEEDS). ⊗
OTHER_WEEDS Text entry, other (non-nominated or 'Dominant') weeds listed. ⊗
WEEDS_OTHER A formula cell that enters 'Y' or 'N' based on information in OTHER_WEEDS. (See 5.8).
TEMP Used by GIS for plotting purposes. Leave blank.

Also copy cross the ildcard-L' and ildcard-R' lumns across bel with the

Note: Columns that are marked with a '⊗' symbol are deleted from the GIS worksheet for mapping purposes (see 6.1).

5.6 Where data has not been recorded on the survey sheet, make a 'best guess' wherever possible rather than leaving it blank.

ecific attribute ame i-Salt affected_ adside_L , or shifter_tree_L

5.7 Roads will often need scaling to match up the usually small discrepancy between the odometer length of a road and its GIS length. Ensure that start and endpoints are the same. Care should be taken to determine the reason for large discrepancies, and judgement used to decide whether scaling is appropriate or not. If roads require large scale factors (i.e., they start within town boundaries which are not mapped, or end without intersecting another road) it is likely that the survey start and endpoints do not match the GIS-surveyed length of the road, and scaling is not appropriate.

5.8 Adjust the appropriate spreadsheet columns to the weeds nominated for this shire, up to 6 species can be put onto overlays, but Shire may choose to map more than 6 and pay for the extra overlays (see 5.5 eg WATSONIA_L, WATSONIA_R, BRIDAL_CREEPER_L and BRIDAL_CREEPER_R).

In the DOM_WEEDS column enter the following formula into line number 2:
[=CONCATENATE(IF(BN2+BO2>0,"PAMPAS_GRASS ",""), IF(BP2+BQ2>0,"WATSONIA ",""), IF(BR2+BS2>0,"BROOM_BUSH ",""), IF(BT2+BU2>0,"CAPE_TULIP ",""), IF(BV2+BW2>0,"VICTORIAN_TEA_TREE ",""), IF(BX2+BY2>0,"TAGASASTE ",""), IF(CR2>0,"OTHER",""))] where BN is PAMPAS_GRASS_L, BO is PAMPAS_GRASS_R, BP is WATSONIA_L, BQ is WATSONIA_R and so on; CR is OTHER_WEEDS, and 2 is the line number.
Change weed names as necessary, ensuring the column numbers match the column names. Be extremely careful to get the spaces right in this first instance or it will be self-defeating. There is a space after each weed name before the close-quote, and a space between the second pair of quotes. If these are not present the names will not be correctly recorded in the DOM_WEEDS column. Once correct, copy and paste to all other cells in the column. The line numbers in each formula will be corrected automatically.

In the WEEDS_OTHER column enter the formula [=IF(CR2>0,"Y","N")] (where CR is OTHER_WEEDS and 2 is the line number). Copy and paste it to all other cells in the column.

5.9 When data is entered, save file as [Shire Name] to:
C (computer's) drive (C:\My Documents\[your name]\Shires in Progress\[file (Shire) name]); and

T (shared) drive (T:\147-Wildlife Administration\Shared Data\Roadside\[your name]\[file (Shire) name]).
5.10 When all data is entered and saved, then copy and Paste Special-values to a new worksheet. The original worksheet (called (Shire name)) will act as Master data, used to write the accompanying report, and an accurate reflection of the data that appeared on the survey sheets. This second worksheet (called (Shire name)GIS) will be manipulated to make the map appear as it ought to appear.

6. ADJUSTING THE DATA FOR GIS:

6.1 Important Note: these operations apply only to the **copied** data ([Shire name]GIS)!
Arrange data so that the road numbers are consecutive and within that the Segment numbers are consecutive (Data,Sort,Sort by ROAD # ascending,Sort by SEC # ascending). Ensure road numbers are entered as stated in 5.5; i.e. Shire roads are entered as (Shire number)(4 digit Road number) - eg, 3030001, 3030084; and Main roads are entered as (M)(3-digit Road number) - eg, M005, M031.

6.2 If you followed the Paste Special-values procedure mentioned at 5.10, the data will be values, not formulae, so there won't be any reference cell problems (look like '#REF!').

6.3 Similarly, the formula cells in the DOM_WEEDS and WEEDS_OTHER columns should already be present as values if the data was Pasted Special-values instead of just Pasted. If not, copy the column and Paste Special-values back over itself.

6.4 Delete all other columns marked with an '⊗' in 5.5 so that the remaining columns match 1.2 in Appendix 3 (see p2). Note that all columns not marked '⊗' are required for GIS regardless of whether they contain data.

6.5 Delete any lines of data that can't be mapped - i.e., where surveys have followed a road further than the road appears on the map. In these cases there is no way for ArcInfo to know where to plot the data, and so it is either useless or worse, as it may then befuddle the accurate representation of the length of road that is shown on the map.

6.6 Ensure that there are no commas in any of the data sent to GIS. These are used as column delimiters to set up the ArcInfo tables, and any commas inside data cells will create bizarre and unusual columns in odd places. This should be no problem if the data has been entered earlier following those conventions mentioned at 5.5 DOM_WEEDS; i.e., where there is a list of items, individual items should be connected by underscores instead of spaces, and a space put between items instead of a comma (eg: BRIDAL_CREEPER WATSONIA PELARGONIUM VELDT_GRASS).

6.7 Resave the data to the same destinations as previously, and email the data to GIS.

7. GIS SECTION PLOTS THE DATA:

The data is imported from Excel into ArcInfo and an initial draft plot done. Ultimately the map will be produced at a scale of 1:100 000, but for large shires the scale may be

reduced at this stage to make the correction cycle more manageable - i.e., on one sheet of paper. For example, the Shire of Esperance is so large that the initial plot was done at 1:500 000.

It is important to make as many changes as possible on-screen rather than do repeated plots to check changes. This will keep the costs of consumables (paper, coloured ink) to a minimum. This must be balanced with the cost of labour - it is not efficient to have two people holding each other up at a relatively high cost per hour.

8. THE CORRECTION CYCLE:

The data compiler and the GIS representative go through the correction cycle in collaboration, making changes as necessary to either the Excel dataset or the ArcInfo tables until the finished map mimics exactly the S of C hand drawn map.

Once the map has been plotted, the data compiler goes over the map in detail, comparing the plotted map with the hand-coloured map. Each road must be checked to ensure that

- the colour is right,
- that the sections are the right length and order, and
- that the start and endpoints are correct.

Where there is a discrepancy, it is necessary to return to the source data sheets to confirm whether an error has been made in data entry or mapping. Many of these problems can be corrected in the Excel worksheet. As Main roads (Highways, Main Roads) are plotted a little differently to shire roads, problems may affect one set and not the other. The GIS representative will look at the SLK details of Main roads in the ArcInfo tables where necessary.

Sometimes a road is 'broken' when on the boundary between two shires - i.e., some sections are in the jurisdiction of each shire. This will affect the plotted start and endpoints of the road, and needs to be addressed by the GIS representative. The sections of road in the other shire's jurisdiction will not be plotted, and it is necessary to make sure that what is shown is correct to location on the ground, not to sequence of sections as surveyed.

The GIS representative also adds cadastral and hydrological information to this base map, and adds remnant vegetation information to the base map.

9. THE FINISHED MAP:

When this is all finished, GIS provide to RCC Technical Officer (Mapping) the following:

- 5 A0 paper copies of the RCV base map;
- 1 A3 paper copies of the RCV map (5 req'd but Wildlife to colour copy)
- 1 x 6 A0 film overlays of the nominated weed populations map;
- 1 copy of the map data as a .pdf file;
- 1 set of shape files for both the RCV data and the nominated weeds data.

(This is filed under T:\147-Wildlife Administration\Shared Data\Roadside\Completed Surveys\Shire).

The RCC Technical Officer (Mapping) and the Executive Officer then compile a report to accompany the map and distributes 5 copies to the appropriate groups, eg Landcare Conservation District Committees and/or Local Government Authorities (Shires).

10. Compiling the Results section of the Summary Report

Once the final map and weed overlays have been completed, the results can be inserted into the final report, as detailed below. There is a standard table, titled 'Summary of roadside conditions in the Shire of ...' which is inserted into the *results section* of the final report, see Figure 2.

10.1 Create a New Worksheet

Open the final Excel spreadsheet for that particular shire, and insert a new worksheet (Insert, Worksheet). Put the title 'Index' in column A, and number each row 1,2,3,4,5,etc, up to however many rows of data there may be (may be 300 or more). This will ensure that the data can be returned to its original layout.
Copy the following columns into the new worksheet (Use Copy, Paste special values):

- Column B: Road number
- Column C: Section number
- Column D: From
- Column E: To
- Column F: Section length

**Note- all figures for the final report comes from the section length (km).

10.2 Sort the Data

The quickest and easiest way to extract the various values (0,1,2), and calculate the number of kms of roadside each value occupies is to SORT the data by a particular column. This is done one attribute at a time (there's 8, see below) to avoid confusion and messy looking spreadsheets.

Start by copying and pasting the values for 'Width of Vegetated roadside' (left and right into separate columns), using the column next to the section Length column (should be columns G & H).

To extract the number of kms each value (i.e. 0,1,2) occupies, go to Data, Sort, Sort by 'Width Veg L', Ascending. The values (0,1,2) for that column are now ordered with all the 0's together, all the 1's together, etc.

Add together the number of kms (Column F, 'section length') for all the 'Width of vegetated roadside left', where the value = 0. To do this, write a sum formula, for example: =sum(F2:F30) into a blank cell, press enter. You now have the number of kms of roadside where the width of vegetated roadside = 0-5m on the left hand side. Now do the same sum formula for all the 1's and 2's.

Once the sums of the left hand side have been recorded, go back to the original layout by clicking on: Data, Sort, Sort by Index. Repeat for the Right hand side, making sure

you record the sums for all the 0's, 1's and 2's. You should have a small collection of figures similar to figure 1 below.

Value	Left (km)	Right (km)	Total (km)
1	94.31	96.88	191.19
2	38.36	33.93	72.29
3	151.2	142.6	293.8
TOTAL	283.87	273.41	557.28

Figure 1- Values for the Width of vegetated roadside.
The total number is simply the left and right column added together. Either 'Copy' and 'Paste special values' into a new worksheet, for insertion into a table later, or write down the various values onto hardcopy paper.

**Important - Go to Data, Sort, Sort by index to return to the original layout. Do this after completing analysis of each attribute, it ensures that the data remains in its correct order, and therefore, with the correct section length (km) values.

Repeat the process for the following attributes:

- Native Vegetation left and right;
- Extent of native vegetation left and right;
- Number of native species left and right;
- General weeds left and right;
- Value as a biological corridor, left and right;
- Adjoining land use left and right (use the alpha column [i.e. C, U, S, P, I, D, R,] not the numeric [0,1,2] adjoining land use column); and
- Conservation value score left and right.

10.3 Compile Summary Table

For all these 8 attributes, copy and paste the totals for left and right into a new worksheet called 'Summary Table'. This is the standard table showing the total kms and % of roadside for each attribute, see Figure 2. Once the total kms have been inserted into the table, you can work out the %. The table can be copied from previous shire summary reports to save time, just make sure you change the appropriate details, eg 'total length of road surveyed', 'period of survey' to the current Shire.

Summary Information: Shire of Bridgetown-Greenbushes 2003

Length of roadsides surveyed: 1051.8 km

Conservation Status

	Total (km)	%
High	354.8	33.7
Medium-high	170.0	16.2
Medium-low	136.7	13.0
Low	390.3	37.1
Total	1051.8	100.0

Native Vegetation on Roadsides

	Total (km)	%
2-3 vegetation layers	546.8	52.0
1 vegetation layer	250.7	23.8
0 vegetation layers	254.3	24.2
Total	1051.8	100.0

Width of Vegetated Roadside

	Total (km)	%
1 to 5 m	660.7	62.8
5 to 20 m	38.6	3.7
over 20 m	352.4	33.5
Total	1051.8	100.0

Extent of Native Vegetation

	Total (km)	%
Over 80%	329.6	31.3
20% to 80%	363.1	34.5
Less than 20%	359.2	34.1
Total	1051.8	100.0

Weed Infestation

	Total (km)	%
Light	322.59	30.7
Medium	375.68	35.7
Heavy	353.53	33.6
Total	1051.8	100.0

Number of Different Native Species

	Total (km)	%
Over 20	349.2	33.2
6 to 19	215.8	20.5
0 to 5	486.8	46.3
Total	1051.8	100.0

Adjoining Land use

	Total (km)	%
Completely Cleare	515.7	49.0
Scattered	50.6	4.8
Uncleared	335.7	31.9
Plantation	107.7	10.2
Urban/Industrial	33.2	3.2
Railway	8.8	0.8
Drain	0.0	0.0
Other	0.0	0.0
Total	1051.8	100.0

Value as a Biological Corridor

	Total (km)	%
High	515.37	49.0
Medium	26.93	2.6
Low	509.5	48.4
Total	1051.8	100.0

Data was collected in Bridgetown-Greenbushes Shire throughout 2002-2003

Figure 2 - Summary table showing roadside conditions in the Shire of Bridgetown-Greenbushes

From this table, create pie charts for all 8 attributes, it should have a title (eg, Native vegetation on roadsides), legend on the right, and show the % to one decimal place. Colour the segments accordingly, see Figure 3. The pie charts are inserted into the final report (word document).

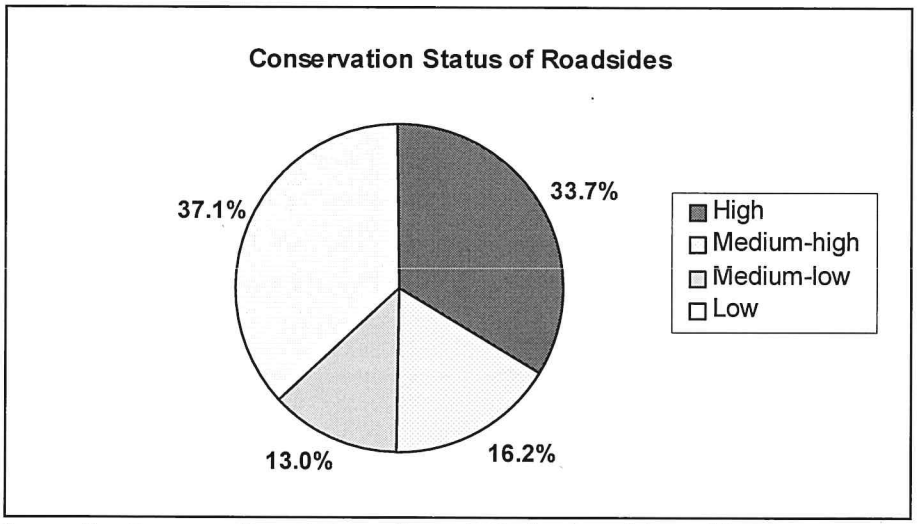


Figure 3 - Conservation status of roadside in the Shire of Bridgetown-Greenbushes.

10.3 Nominated Weeds Data

The nominated weeds data is slightly more complicated, so create a new worksheet, titled "Nominated Weeds'. Copy and paste the following columns from original data:

- Road number;
- Section number;
- Section length; and
- The columns for each nominated weed (left and right). There should be 13 of these columns, i.e. 6 weeds left and right =12, and the other_weeds (0 or 1) column=1.

Keep in mind that:
0=weed absent
1,2,3= different level of weed infestation.
We only map the total km of weeds, not the varying degrees of infestation, so total all the 1's, 2's and 3's together. This provides the number of kms of roadside that each weed was observed.

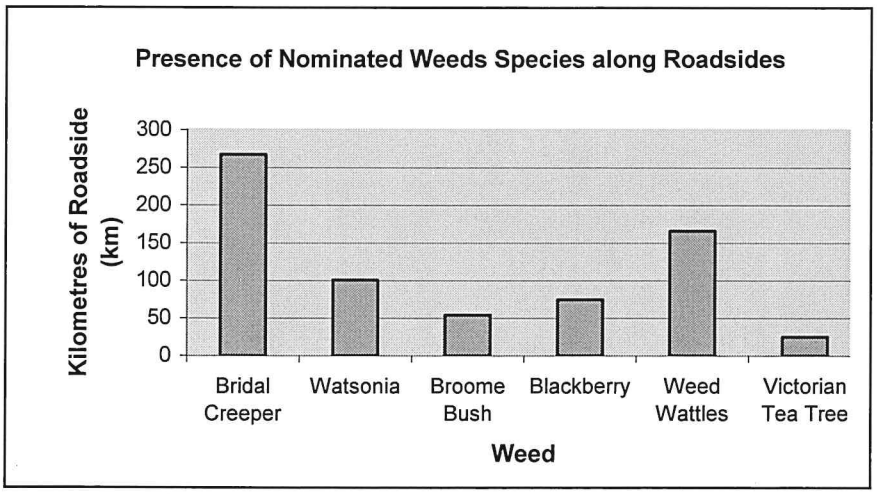
For each nominated weed column (eg, BRIDAL_CREEPER_L), add up each section length that has the weed recorded. At the base of each weed column, insert the 'Sum If' formula to get these values. For example, if BRIDAL_CREEPER_L is in column F, and section length is in column E, then the following formula would apply:
Value 1's- [=sumif(F2:F22,1,E2:E22)]
Value 2's- [=sumif(F2:F22,2,E2:E22)]
Value 3's- [sumif(F2:F22,3,E2:E22)]
Then add these together to get the total number of kms that Bridal Creeper was observed on the left hand side of the road throughout the Shire. Repeat for right hand side; add together to get a total for Bridal Creeper, and repeat for all other nominated weeds, and other weeds.

A	B	C	D	E	F	G	H	I
ROAD_#	SEG_#	FROM	TO	SECTION LEN	BRIDAL_CREEPER_L	BRIDAL_CREEPER_R	WATSONIA_L	WATSON
2030001	1	0.00	0.90	**0.90**	0	0	1	0
2030001	2	0.90	1.40	**0.50**	0	0	0	0
2030001	3	1.40	1.80	**0.40**	0	0	0	0
2030001	4	1.80	2.25	**0.45**	1	0	0	0
2030001	5	2.25	3.45	**1.20**	0	0	0	0
2030001	6	3.45	4.55	**1.10**	0	0	0	0
2030001	7	4.55	5.10	**0.55**	0	0	0	1
2030001	8	5.10	6.15	**1.05**	0	0	0	0
2030001	9	6.15	6.80	**0.65**	0	0	0	0
2030001	10	6.80	6.90	**0.10**	0	0	0	0
2030001	11	6.90	7.30	**0.40**	0	0	1	0
2030001	12	7.30	9.80	**2.50**	0	0	0	0
2030001	13	9.80	11.60	**2.20**	1	0	1	0
2030001	14	11.60	12.80	**0.60**	1	1	0	0
2030001	15	12.80	15.00	**2.20**	0	0	0	0
2030001	16	15.00	15.65	**0.65**	0	0	0	0
2030001	17	15.65	17.20	**1.55**	2	2	1	0
2030001	18	17.20	19.70	**2.50**	2	2	0	0
2030002	1	0.00	1.20	**1.20**	1	0	1	0
2030002	2	1.20	3.80	**2.60**	0	0	1	0
				VALUE	BRIDAL_CREEPER_L	BRIDAL_CREEPER_R	WATSONIA_L	
				1	94.31	96.88	39	
				2	38.36	33.93	1.1	
				3	2.1	1.9	0	
				TOTAL	134.77	132.71	40.1	

=sumif(F2:F22,1,E2:E22)

=sum(F25:F27)

Create a bar graph showing the number of kms that the various weed species occupied, see below. Insert into results section of final report.



APPENDIX 1

4.2 Master Sheet

Scoring in the Database. (Calculate Cons Value Score).

SURVEY TO DETERMINE THE CONSERVATION VALUE OF A ROAD

Roadside Conservation Committee
C/- P.O. Box 104 COMO W.A. 6152

Date _____ Observer(s) _____
Road Name _____
Nearest named place _____
Shire _____
Direction of travel _____
Section no. _____
starting point _____
odometer reading _____
ending point _____
odometer reading _____
length of section _____

WIDTH OF ROAD RESERVE _____

Side of the road	Left	Right
Width of Vegetated roadside		
1-5m	☐	0
5-20m	☐	1
over 20m	☐	2

NATIVE VEGETATION ON ROADSIDE

tree layer	☐	1	max 2 ✱
shrub layer	☐	1	
ground layer	☐	1	

RARE FLORA

Rare flora known to be present ☐ ✱
Name _____

EXTENT OF NATIVE VEGETATION ALONG LENGTH OF ROADSIDE

Less than 20%	☐	0
20-80%	☐	1
over 80%	☐	2 ✱

No. OF DIFFERENT NATIVE SPECIES

0-5	☐	0
6-19	☐	1
Over 20	☐	2 ✱

Dominant species (If Known) _____

WEEDS

Few weeds (under 20% total plants)	☐	2
Half weeds (20-80% total)	☐	1
Mostly weeds (over 80% total)	☐	0 ✱
Ground layer totally weeds	☐	0

Dominant weeds (If known) _____

VALUE AS A BIOLOGICAL CORRIDOR

Connects uncleared areas	☐	1	max 2 ✱
Flowering shrubs for nectar-feeding animals	☐	1	
Large trees with hollows for birds nests	☐	1	
Hollow logs	☐	1	

FAUNA OBSERVED

_____
_____

PREDOMINANT ADJOINING LAND USE

Agricultural crop or pasture:-

• completely cleared	☐	2	max 2 ✱
• scattered trees/shrubs	☐	1	
Uncleared land	☐	0	
Plantation of non-native trees	☐	1	
Urban or Industrial	☐	0	
Railway Reserve parallel to road	☐	1	
Drain Reserve parallel to road	☐	1	

Other _____

UTILITIES/DISTURBANCES

Disturbances continuous	☐	0
Disturbances Isolated	☐	1
Disturbances absent	☐	2

Type _____

CONSERVATION VALUE

High	☐	2
Medium	☐	1
Low	☐	0

Reasons _____

LANDSCAPE VALUE

High	☐	2
Medium	☐	1
Low	☐	0
Avenue of trees	☐	✱

Reasons _____

GENERAL COMMENTS

_____
_____
_____
_____

L R

Fig. 4. Example of the survey sheet developed to assess conservation value of roadsides in Western Australia. Scores given to each attribute are indicated.

When recording presence = 1 , absence = [blank]

4.3

Master Weed Sheet

TYPE OF WEEDS	Left	Right
Pampas grass (Cortaderis selloana)		
<20% total weeds	☐ 3	☐
20-80% total weeds	☐ 2	☐
>80% total weeds	☐ 1	☐
Watsonia (Watsonia spp.)		
<20% total weeds	☐ 3	☐
20-80% total weeds	☐ 2	☐
>80% total weeds	☐ 1	☐
BROOM BUSH		
<20% total weeds	☐ 3	☐
20-80% total weeds	☐ 2	☐
>80% total weeds	☐ 1	☐
CAPE TULIP		
<20% total weeds	☐ 3	☐
20-80% total weeds	☐ 2	☐
>80% total weeds	☐ 1	☐
Victorian tea-tree (Leptospermum laevigatum)		
<20% total weeds	☐ 3	☐
20-80% total weeds	☐ 2	☐
>80% total weeds	☐ 1	☐
TAGASASTE		
<20% total weeds	☐ 3	☐
20-80% total weeds	☐ 2	☐
>80% total weeds	☐ 1	☐
Blackberry, bramble (Rubus spp.)		
<20% total weeds	☐ 3	☐
20-80% total weeds	☐ 2	☐
>80% total weeds	☐ 1	☐
ACACIAS		
<20% total weeds	☐ 3	☐
20-80% total weeds	☐ 2	☐
>80% total weeds	☐ 1	☐

Bridal creeper (Myrsiphyllum asparagoides)		
<20% total weeds	☐	☐ 3
20-80% total weeds	☐	☐ 2
>80% total weeds	☐	☐ 1
WILD RADISH/TURNIP		
<20% total weeds	☐	☐ 3
20-80% total weeds	☐	☐ 2
>80% total weeds	☐	☐ 1
Arum lily (Zantedeschia aethiopica)		
<20% total weeds	☐	☐
20-80% total weeds	☐	☐ ≥ 50 cm.
>80% total weeds	☐	☐
DOLICHOS		
<20% total weeds	☐	☐
20-80% total weeds	☐	☐
>80% total weeds	☐	☐
PERIWINKLE		
<20% total weeds	☐	☐
20-80% total weeds	☐	☐
>80% total weeds	☐	☐
PATTERSONS CURSE		
<20% total weeds	☐	☐
20-80% total weeds	☐	☐
>80% total weeds	☐	☐
THISTLES		
<20% total weeds	☐	☐
20-80% total weeds	☐	☐
>80% total weeds	☐	☐

APPENDIX 2

CHAPTER 5

The flora roads survey — volunteer recording of roadside vegetation in Western Australia

B. M. J. Hussey[1]

The south-west agricultural region of Western Australia has 107 500 km of roads, many of which retain native vegetation on the roadside. Public concern for the preservation of wildflower drives led to the reservation of wide road reserves (up to 200 m) deliberately for flora conservation. Thus many roadsides retain a linear transect of the original vegetation and have important conservation value.

Degradation, however, is continually occurring, often due to lack of knowledge of the resource leading to inappropriate management. To obtain preliminary data, a survey was designed to use volunteers to assess the conservation value of road reserves.

This chapter outlines the techniques used and compares the results with other surveys — professional and amateur — in Australia, with regard to accuracy, quality of data, cost, value as a management tool and public involvement. It will be shown that the use of volunteers to survey roadsides is a cost-effective way of obtaining data while at the same time raising community consciousness.

INTRODUCTION

Roadsides as wildflower conservation areas

THE south-west agricultural region of Western Australia has some 107 500 km of public roads (see Figs 1 and 2), many of which retain native vegetation on the roadside.

Public concern for the preservation of wildflowers along road verges led to the adoption of a State Government policy in newly-released agricultural districts to increase the width of road reserves to create extra areas for wildflower conservation. By 1959 the Lands and Surveys Department had a policy of laying out road reserves to a minimum width of three chains (about 60 m), while some were five, or even ten chains (about 200 m). This policy served a dual purpose: "A strip of natural vegetation is preserved on each side of the road, and this in turn helps to prevent soil erosion." (Camm, unpublished report).

Personal interest by the then State Premier, David Brand, combined with continued public concern, led to a conference in 1961 which recommended that roads in agricultural land-release areas should be three to ten chains in width to "provide areas in which wildflowers could grow and flourish" (unpublished report). This was accepted by Cabinet and has remained government policy ever since.

During the years prior to this conference, there were a number of suggestions that existing roads should be examined to locate areas of good wildflower displays. The Surveyor-General, Harold Camm, took up the idea, and in 1960 despatched two surveyors on week-long patrols to note good wildflower country with a view to adding it to road reserves. W. G. Henderson travelled between Goomalling, Mullewa, Geraldton and Watheroo, while W. McFadden went to Kalgoorlie, Esperance, Ravensthorpe and Newdegate. Their reports resulted in a number of wide road reserves being created (notably on the Newdegate–Lake Grace road) and "protection of roadside flora" being endorsed alongside some roads on public plans (unpublished report).

The Tree Society, through its President, Peter Thorn, also advocated such surveys, listing suggested areas at the 1961 conference. Some, for example along the Ravensthorpe–Hopetoun road,

[1]Roadside Conservation Committee, P.O. Box 104 Como, Western Australia, Australia 6152.
Pages 41–48 *in* NATURE CONSERVATION 2: THE ROLE OF CORRIDORS ed by Denis A. Saunders and Richard J. Hobbs. Surrey Beatty & Sons, 1991.

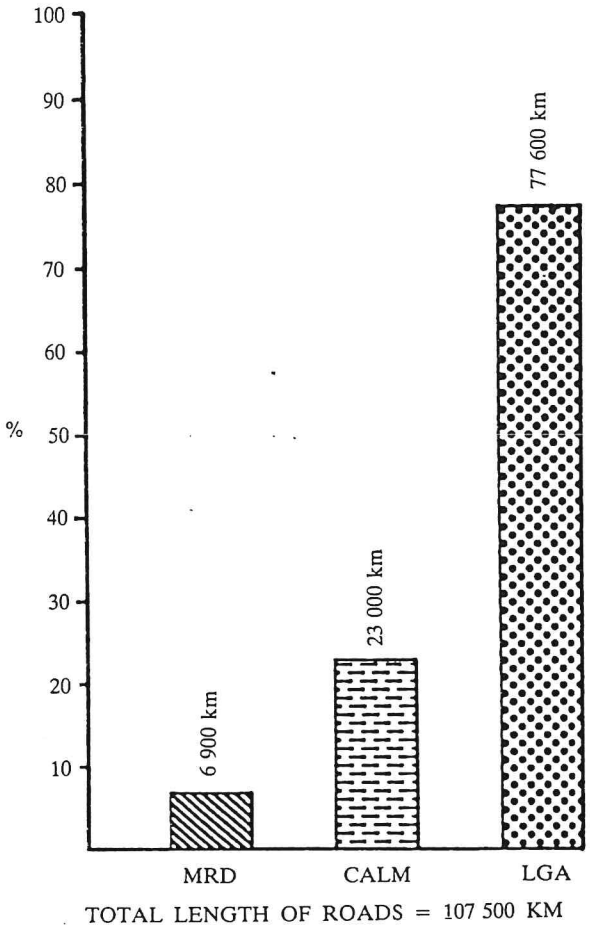


Fig. 1. Lengths of roads vested in different management authorities in the south-west agricultural region of Western Australia (excluding roads in the Perth metropolitan area) MRD = Main Roads Department; CALM = Department of Conservation and Land Management; LGA = Local Government Authorities. (From R. Shaw, unpublished report).

were subsequently followed up by a "protection of roadside flora" annotation on public plans (P. Thorn, pers. comm.). Over the years other suggestions concerning the need for a data base have been made.

The first serious attempt to develop a method for surveying roadside vegetation in Westerm Australia was undertaken in 1980. The then Road Verge Conservation Committee* employed John K. Scott as a temporary Research Officer in the Department of Fisheries and Wildlife for six months. His brief was to: "Develop a classification system of flora conservation values for roadside areas and demonstrate the use of the classification. This classification system should enable a person with minimal training to rapidly identify valuable roadside areas" (Scott 1981). He was also required to report on research needs. The method which Scott developed and field tested was published in 1981, but was not promoted or further used for reasons discussed later.

*In Western Australia, there have been three committees looking at the conservation of roadside vegetation.
1. Road Verge Conservation Committee 1969–1970
2. Road Verge Conservation Committee 1971-1983
3. Roadside Conservation Committee 1985-

The current Roadside Conservation Committee (RCC) listed its needs for research in 1986, placing "Inventory" third on the list. As the Committee's Executive Officer, I was instructed to pursue the matter.

Development of the survey method

Area to be surveyed: There are three principal vested authorities for public roads in Western Australia; Main Roads Department (MRD), Department of Conservation and Land Management (CALM) and Local Government Authorities (Shires). The percentage of roads under the control of these authorities in the south-west agricultural region of the State is shown in Figure 1.

CALM was presumed to have enough expertise to survey its own roads, should it wish to do so, and the MRD is able to employ consultants. Local Government Authorities, however, lack the resources of these State agencies, whilst at the same time controlling the largest percentage of roads, so it was decided to design a low-cost survey which would rapidly fulfil the requirements of this group.

The pastoral area was excluded as, although roads may have great influence on the ecosystems of the region, the influence is as a conduit for the introduction of weeds or as an engineering structure which changes the drainage rather than as areas for flora conservation. They may, however, develop a conservation value in the future, if the exclusion of grazing by the current Main Roads Department fencing programme leads to the expected increase in regeneration and floral diversity.

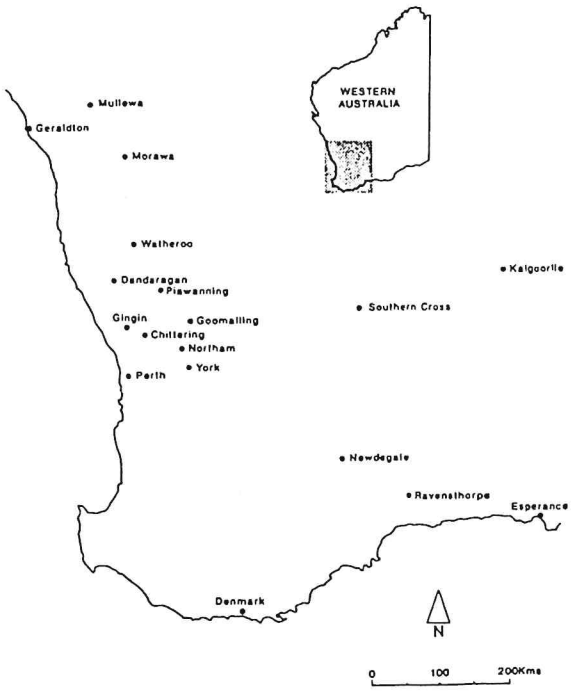


Fig. 2. Map of south-west agricultural region indicating localities discussed in the text.

The Perth Metropolitan area and outer Metropolitan Shires were excluded in an attempt to limit the administrative load.

What to record. It was clear from the instructions given by the RCC that the survey was to be an "inventory" of "flora conservation value". Thus the survey set out to compile a database on roadside ecosystems that will provide sufficient information to allow roadside managers and public utilities that locate their services on roadsides, to meaningfully incorporate the management of native vegetation into all decisions concerning roadworks.

In order to determine what sort of information would be useful to Local Government, extensive discussions were held with Shire staff and councillors at all levels from Ranger through Clerk to President. It was agreed by all that the project should provide: a clear and obvious map of vegetation condition ("where the good bits are"); a map to show both sides of the road (to allow consideration of carriageway off-setting or weaving and the location of public utilities on the poorer side); and a map to show exact location of rare or unusual species.

In addition, some Shires considered that a list of plants recommended for use in rehabilitation, for example of gravel pits, would be useful.

It is interesting to note that the following data were considered to be "not really useful": lists of plant species (especially Latin names); description of plant communities (especially if couched in scientific terms); and lists of fauna.

This undoubtedly reflects the fact that few Shire staff or councillors have any training in biology.

It is also interesting to note that as the survey entered its third year, in 1989, requests were being received to have incidence of "dieback" included in the survey. This is a very encouraging sign as it means that the role of roads in plant disease spread is now being appreciated by Local Authority roadmakers.

Discussions with the Main Roads Department, however, revealed that it wished to know much more detail about its roadsides. This is probably because it employs people who do understand biological data and the Department intends to rehabilitate disturbed areas in a thorough and scientific manner.

Who should undertake the survey? Enquiries indicate that a professional consultant would charge a minimum of $40 per kilometre for a full biological survey of a roadside, (D. Goble-Garrett, pers. comm.). Clearly this is well beyond the resources of most Local Government Authorities. In addition, much of the data would be superfluous to their requirements. Therefore, a survey by volunteers that would provide only information of direct relevance to road managers was decided upon.

The use of volunteers to collect distribution data is not new. The "Atlas of British Flora" (Perring and Walters 1962) was one of the first published, and other projects involving both plant and animal studies have subsequently been organized in various countries. In Australia, one of the most ambitious has been the "Atlas of Australian Birds" (Blakers *et al.* 1984) to which 2 969 observers contributed. More recently, some 500 people contributed to "The Banksia Atlas" (Taylor and Hopper 1988), 119 people contributed to the Wheatbelt Checklist Survey (Saunders 1989) and other surveys by volunteers are underway.

It was believed that the use of volunteers would have the following advantages: it involves the local community in roadside conservation; being done by locals, the data collected has greater local credibility; local expertise and detailed knowledge ensures good coverage; and it costs very little for a useable result.

Set against this, there is a concern that some professional people, notably engineers, might feel skeptical of the value of amateur work. Therefore the proposed survey needs to yield reliable and supportable results.

Design of the survey sheet. It was decided to go ahead with designing a volunteer survey method which would be: simple and readily understandable by all sections of the community; rapid to use; repeatable, i.e., multiple observers should obtain the same result; objective, avoids value judgements; and would provide field data that are easily converted into a measure of conservation value.

As a first stage, the three methods of roadside conservation assessment that had been published in Australia at that time were studied. They are: Scott (1981) in Western Australia, Mollenmans (1982) in South Australia and Grieves and Lloyd (1984) in Victoria. Field trials of each were done in 1986 in the Shire of York (wooded, hilly countryside, small properties, parkland clearing) and the Shire of Morawa [flat topography, broad-acre clearing of kwongan (heath) and open woodland]. Later a method developed by Palmer and Lewis (1987) in South Australia was also tested at the York sites (see Table 1). The trials indicated that none of these methods was entirely suitable for use by volunteers in Western Australia.

Mollenman's method was eliminated very quickly. The roadside has first to be divided into discrete vegetation units, each containing one particular vegetation community and an undisturbed reference area containing pristine vegetation of each type for comparison purposes needs to be located and assessed. In Western Australia, the subtle mosaic of community changes in the catenary sequence determined by soil, topographic position and geographic location, combined with the scarcity of pristine remnants, totally precludes this

Table 1. Comparison of different methods for assessing and scoring roadside conservation value (York Shire). Methods used were Grieves and Lloyd (1984); Mollenmans (1982); Palmer and Lewis (1987); Scott (1981) and Hussey (this study).

Author	Grieves and Lloyd		Mollenmans		Palmer and Lewis		Scott		Hussey	
Scoring Range	0–65		undefined		no numerical value		3–16		0–12	
Category	0–11 low	11–25 mod. 25+ high	individually determined for each community		low mod. high v. high		3–7 low	8–10 mod. 11–16 high	1–4 low	5–8 mod. 9–12 high
SITE Side of road	L	R	L	R	L	R	L	R	L	R
Site 1	21 high	23 high	85 ?	110 ?	mod.	high	10 mod.	12 high	9 high	10 high
Site 2	30 high	30 high	250 ?	351 ?	v. high	v. high	15 high	15 high	11 high	11 high
Site 3	6 low	6 low	2 ?	2 ?	low	low	5 low	5 low	3 low	3 low
Site 4	17 mod.	10 low	30 ?	22 ?	mod.	low	9 mod.	6 low	8 mod.	7 mod.

option. In addition, the method depends on a number of measurements to assess diversity which are unnecessarily onerous.

Scott's method also requires some preliminary study as the surveyor is expected not only to identify natural vegetation types, but to assess their relative rarity. In addition, a cadastral map of the road to be surveyed is required. The method does not provide a continuous assessment but rather relies upon the surveyor locating and scoring "special sites", which may be adjoining land rather than the road reserve itself. Thus the product is a disjointed list of individual areas separated by gaps of variable length for which no comment is made. This was not considered suitable for management.

Grieves and Lloyd's method has many good points. Its rationale is clearly explained and it is specifically designed for use by non-specialists. By providing clear alternative choices the scoring is made objective; however, the negative scores create confusion and some of the sections are not applicable to Western Australia. Because of its obvious merits, it was decided to use this method as a starting point to design a survey sheet for Western Australian conditions.

A prototype was further evaluated by members of the Western Australian National Parks and Reserves Association (Dandaragan Shire), second year Western Australian College of Advanced Education students (Gingin and Chittering Shire) and the Eastern Hills Branch of the Western Australian Wildflower Society (York and Northam Shires). Their comments and suggestions contributed substantially to the final design. During discussions with other bodies, notably the Main Roads Department, the sheet was further refined.

It was suggested that study of aerial photographs could provide a useful classification without costly field inspection. A week was spent studying photos at 1:40 000 scale for Victoria Plains Shire, and a map produced. It was clear that the technique had many disadvantages. While trees were easy to distinguish, the understorey was not. Native shrubs and ground flora were easily confused with weeds and this led to discrimination against heath vegetation types, which are very important in Western Australia. The date of the photography was not consistent over the Shire (1972, 1974 and 1979) and so it did not represent the 1986 ground situation.

Personal knowledge of the area made it obvious that anomalies of interpretation were occurring. Some six months later, after a viable survey sheet had been developed, some of the area was surveyed on the ground and the results compared (see Fig. 3). Ground work was far more detailed, and produced a result closer to that requested by Local Government Authorities. The aerial photographic method has not been tried again in Western Australia, although Palmer and Lewis (1989) have used the technique successfully in South Australia. However, they admit that the method discriminates against heath.

Contact with volunteers. Initial contact was made by letter to people who were on the Western Australian section of the Banksia Atlas contributor list. Anyone who responded positively was sent an information kit containing an instruction booklet and some 20 survey sheets.

At the end of the 1987 wildflower season, the results were evaluated and the survey sheet and instruction booklet revised in the light of comments received.

In 1988, all previous surveyors were contacted by letter and the Survey was publicized in the Newsletters of eight conservation-orientated organizations and in several local newspapers. In addition, the Executive Officer commenced a programme of talks to groups encouraging them to contribute. Particular attention was given to the possibility of setting up a group within a Shire with

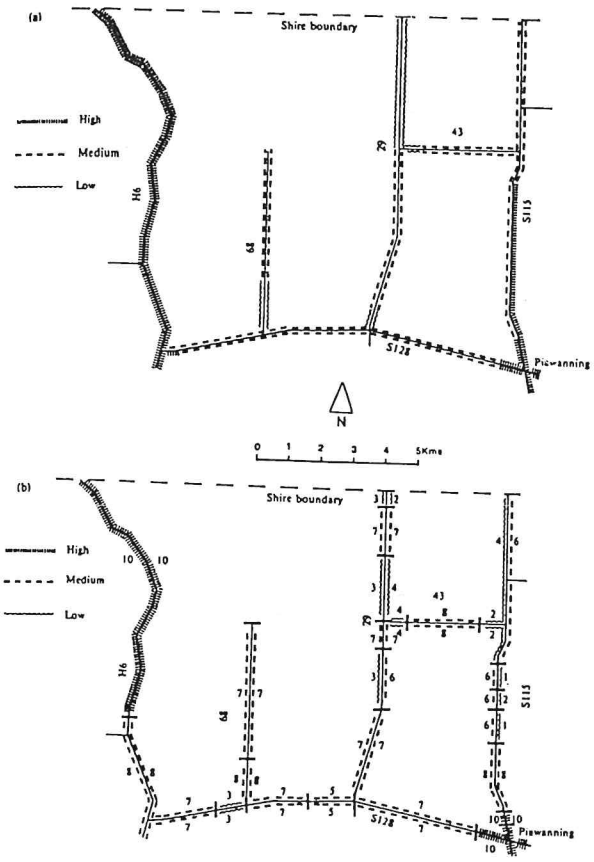


Fig. 3. Map showing part of Victoria Plains Shire indicating conservation value of roads as asessed from (a) aerial photographs, and (b) the survey of roadside conservation value.

the full knowledge and agreement of the Shire Council. Further contact with volunteers continued during 1989.

Input onto computerized database. With large amounts of information accumulating on the survey sheets, a method was sought whereby this could be made more readily accessible. A programme was developed to store the data on the mainframe computer at CALM.

Assessment and scoring. The final form of the field survey sheet is based on the same assumption as that of Grieves and Lloyd (1984): "the conservation value of roadside vegetation can be rapidly assessed using a qualitative approach concentrating on vegetation structure, to an acceptable level of accuracy, without recourse to detailed botanical survey and evaluation" (Fig. 4).

Throughout the development of the sheet, a number of assumptions have been made (again they are similar to those in Grieves and Lloyd): wider roadsides are easier to manage as they are more likely to be self-sustaining; local indigenous vegetation is more valuable for conservation than exotic plants; the more diverse the vegetation, generally the more valuable it will be for conservation; the location of rare or geographically restricted plants is important and should be noted for management purposes; weeds compete with native vegetation, hinder regeneration and decrease the conservation value; if the vegetation is conserved, animal habitat is automatically also conserved; corridors of native vegetation linking patches of uncleared land are important for the movement of biota; where the roadside vegetation is the sole example of native communities in an area, it has more value than when the road runs through uncleared land; and the presence of utilities or disturbances should be noted for management purposes.

The values used in scoring are shown on the form in Figure 4. Width of road reserve and presence of utilities or disturbances do not score, as they are management attributes and do not contribute to the actual conservation value as observed. Rare flora was not given a score as it could distort the value. Instead it is stated separately on the data sheet as a point reference for special management. The section "conservation value" is a subjective judgement which acts as a check for the assessor and the person who records the data that the scoring accurately reflects the visual condition of the road. Anomalies were discussed personally with the assessor.

"Landscape value" is also subjective. It was added to try to overcome a problem that became obvious very early in the development of the sheet. Many people have great difficulty in appreciating the sum of the variables which make up conservation value and take strong exception to some results. A magnificent avenue of salmon gums, *Eucalyptus salmonophloia,* e.g., would score only moderately if the understorey is totally weedy, as often happens. Yet to many people the preservation of these splendid stands of trees is of paramount importance. There is often a strong evaluative distinction that while trees may be beautiful and valuable, scrub is unsightly and worthless. This section allows the surveyor to express his/her "feel" for the scenic quality of the road in the total landscape, not just the roadside vegetation. Since it has no pretence of objectivity, it is not scored, but it could be mapped, at the request of the local Tourist Bureau, for example.

The total score is calculated to give the roadside a category of conservation value:

Score 0–4 low conservation value
5–8 moderate conservation value
9–12 high conservation value

These categories are mapped, and each section coloured for easy reference (see Fig. 3). Each map is thus hand-drawn, and slow to reproduce. As yet, little consideration has been given to the production of a printed map.

By the end of the 1987 wildflower season, 34 volunteers had surveyed 1 112.6 km of road, 1.4% of the roads to be covered. This was considered to

SURVEY TO DETERMINE THE CONSERVATION VALUE OF A ROAD

Roadside Conservation Committee
c/- P.O. Box 104 COMO W.A. 6152

Date _____ Observer(s) _____
Road Name _____
Nearest named place _____
Shire _____
Direction of travel _____
Section no. _____
starting point _____
odometer reading _____
ending point _____
odometer reading _____
length of section _____

WIDTH OF ROAD RESERVE

Side of the road	Left	Right
Width of Vegetated roadside		
1-5m	☐	☐
5-20m	☐	☐
over 20m	☐	☐

NATIVE VEGETATION ON ROADSIDE

tree layer	☐	[1]	max 2
shrub layer	☐	[1]	
ground layer	☐	[1]	

RARE FLORA

Rare flora known to be present ☐ [*]
Name _____

EXTENT OF NATIVE VEGETATION ALONG LENGTH OF ROADSIDE

Less than 20%	☐	[0]
20-80%	☐	[1]
over 80%	☐	[2]

No. OF DIFFERENT NATIVE SPECIES

0-5	☐	[0]
6-19	☐	[1]
Over 20	☐	[2]

Dominant species (If Known) _____

WEEDS

Few weeds (under 20% total plants)	☐	[2]
Half weeds (20-80% total)	☐	[1]
Mostly weeds (over 80% total)	☐	[0]
Ground layer totally weeds	☐	[0]

Dominant weeds (If known) _____

VALUE AS A BIOLOGICAL CORRIDOR

Connects uncleared areas	☐	[1]	max 2
Flowering shrubs for nectar-feeding animals	☐	[1]	
Large trees with hollows for birds nests	☐	[1]	
Hollow logs	☐	[1]	

FAUNA OBSERVED

_____
_____

PREDOMINANT ADJOINING LAND USE

Agricultural crop or pasture:-

• completely cleared	☐	[2]	max 2
• scattered trees/shrubs	☐	[1]	
Uncleared land	☐	[0]	
Plantation of non-native trees	☐	[1]	
Urban or Industrial	☐	[0]	
Railway Reserve parallel to road	☐	[1]	
Drain Reserve parallel to road	☐	[1]	

Other _____

UTILITIES/DISTURBANCES

Disturbances continuous	☐	☐
Disturbances isolated	☐	☐
Disturbances absent	☐	☐

Type _____

CONSERVATION VALUE

High	☐	☐
Medium	☐	☐
Low	☐	☐

Reasons _____

LANDSCAPE VALUE

High	☐	☐
Medium	☐	☐
Low	☐	☐
Avenue of trees	☐	[*]

Reasons _____

GENERAL COMMENTS

_____
_____
_____
_____

L R

Fig. 4. Example of the survey sheet developed to assess conservation value of roadsides in Western Australia. Scores given to each attribute are indicated.

be a good start considering the size of the agricultural region and the fact that the project commenced late in the wildflower season. The results were entered on maps for each Shire.

By December 1988, 7 186.4 km of roads had been surveyed representing 8.5% of the road system targeted. The coverage was very uneven. The work proceeded best where a group was directed by a strong central co-ordinator, such as happened in Denmark Shire, where the local Wildflower Group took on the task, dividing up the Shire between themselves.

Several things combined to make Denmark's a model contribution. It was undertaken by a cohesive group which met frequently and could spur each other on. Personal meetings with the Executive Officer on two occasions helped iron out problems. Members of the Group were genuinely concerned about roadside management and believed the survey would be useful, and Denmark is a small Shire, with only 600 km of road needing to be surveyed.

Work under way in 1989 should see the length of surveyed roads at least double.

DISCUSSION

Accuracy

As part of the initial evaluation, the method as developed was compared with the three previously published methods and later against the "ground truthing" proposed in Palmer and Lewis (1987) (see Table 1). It can be seen that they all produce similar results.

After the first year of volunteer work, the accuracy was checked by repeating sections done by volunteers. Eleven volunteers were selected, covering a range of different areas and 5–10 km of road surveyed by them chosen at random, assessed, and the results compared. In ten cases the results corresponded very closely, the scores either being the same or varying by only one. In the latter case, the score was always higher on the original, probably because the check was done in January, making floral diversity harder to assess. The variation of one was considered to be acceptable, although it could lead to the road being in a higher classification. Also pleasing was the fact that, in 92% of the cases, the assessors changed road sections at the same place as the checker. The 11th assessor had very variable results, and the few sheets completed by this person have not been included in the data list.

Where possible, the survey was also checked against professional work, though this is difficult as there are no clear points of correspondence. The briefs for the professional studies are detailed, and vary from one to another. It is really only where the consultant has mapped "disturbance" that they can be directly compared with the volunteers. When this has been done for a roadside (e.g., Goble-Garratt, unpublished report) it has been found to correspond to a change in sheet by the volunteer assessor. It must be emphasized, however, that the volunteer survey is producing only the information requested by road managers, a map of vegetation condition, and not the detail supplied by consultants.

Bias towards heath communities

It is possible that the survey may show a bias towards shrub communities as these are very diverse in species composition and so are likely to score highly in the "number of different native species" section. Jarrah *Eucalyptus marginata* forest, for example, when long unburnt, has only 24 understorey species visible (Christensen and Kimber 1975). Lamont (1976), however, found 34 species in 2 m^2 in kwongan (heath) at Eneabba. As a contrast, some saline soil communities may have a very low diversity. This shows on site 4 of Table 1 where the eastern roadside scores higher than would have been expected from the other methods. However, diversity is, in itself, considered important by most biologists. In addition shrub communities form an important component of the ecosystem in Western Australia. This bias is a result of the method which emphasizes diversity, and I consider it to be acceptable.

Variability between observers

If completed conscientiously, the scores should not vary between assessors. It has been noteworthy when on training trips with a number of potential assessors, that by the third sheet there is general agreement, with perhaps only one point difference. The point which leads to the most contention is the "extent of native flora along roadside", the ability to average out percentage cover being difficult for many people. To minimize this problem, the scores were made as extreme as possible, everything else being in the middle. To a lesser extent, this comment also applies to the weeds component.

Encouragement of volunteers

To obtain the greatest value from work undertaken by volunteers, the co-ordinator should budget a considerable amount of time for individual contacts. This shows that the work the volunteer is doing is really appreciated. This is a vital point when people are putting their own time and money into something and helps to iron out problems. Taylor and Hopper (1988) confirm that frequent personal contact is vital. Regrettably, due to the pressure of other duties, the contact was sporadic at best, and this was a major drawback upon the total surveying achieved.

Cost

Considering time and fuel only, the volunteer survey has been "costed" for use in discussion with Shires at a figure of $10.00/km. Using this figure, the work done by December 1988 would have "cost" $71 864.00.

Future directions

It was intended to continue the survey in 1989 and then take stock of the situation. It may be decided to hand over to Local Government Authorities, for them to undertake the survey themselves. In any event, as soon as a Shire is substantially completed, the data are handed over to the road manager, with the comment that the survey represents the situation on one stated date. To be kept current, it should be repeated after every roadwork or public utility operation, or perhaps biennially.

It is hoped to place the data onto a computer system compatible with that already in use by Shires, which will make the detail readily available to managers and other local interest groups. The results could also be digitized, and made available on a Geographic Information System. It will soon be possible to make predictive analyses from the data. Other maps available show soil, original vegetation community and date when the land was first released for agriculture. Together with information recorded by the volunteers, e.g., the width of the remaining native vegetation and the percentage cover of weeds, they could be analysed to look for correlations pointing to the rate of community decline.

The roadside conservation value maps form a basis for conservation planning by the Shire. Together with maps of remnants such as those produced by Coates (1987) they can be used to determine possible animal movement corridors and to decide on the priority for conservation effort by the local community. Maps could be produced showing a combination of high value conservation areas and high value scenic areas. This would assist in the planning of local tourist drives.

CONCLUSION

Consciousness of the importance of preserving roadside vegetation is increasing in the rural community, along with general concern over environmental change.

Most Local Government Authority road managers are aware of the need to conserve roadside vegetation, and they try to balance that with safe and economical road construction and maintenance.

The database that is being built up by the Survey of Roadside Conservation Value gives them a simple, straightforward tool which can be used to determine management priorities, all at no cost to the Shire. The process of undertaking the survey raises peoples' awareness of the value and extent of roadside bush and, especially where this is done in direct association with the Shire Council, it raises the profile of this vegetation in the eyes of the whole community. The survey provides a cheap effective and reliable method of assessing the conservation value of roadside vegetation, which can easily be undertaken by Local Government Authority road managers themselves. Anything which encourages the retention of existing bush corridors should be encouraged. This is emphasized in the Western Australian State Conservation Strategy (Anon. 1987).

ACKNOWLEDGEMENTS

This survey has been a true community effort, and far too many people have helped with it for me to list them by name. Three people, however, have actually been employed to help, Peter Hewett, Tom Hogarth and Kathy Meney. They all put in an enormous effort and their contribution has been immense. Many thanks also to members of the Western Australian National Parks and Reserves Association, the Western Australian Wildflower Society and students at the Western Australian College of Advanced Education who helped evaluate the survey sheet. Many valuable comments have also been received from John Blyth, Brett Loney, Joanna Seabrook and Graeme Rundle. A big debt is owed to Adrienne North, who undertook all the typing concerned with the project.

Lastly, very grateful thanks to the 55 people who have driven out to assess roadside conservation value. Their dedication and enthusiasm is leading to a new era in Local Authority roadside management.

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APPENDIX 3

Agreed format for Roadside Conservation (RCC) data between

Wildlife Conservation	**GIS Applications Section**
David Lamont	Robyn Wilson
Contractor FTE	Shane French
	Rick Tomlinson

(Version 1) May 14th, 2001
(Version 2) April 9th, 2002

Contents

1 What's new in Version 2 of this document

On April 9th, 2002 David Lamont, Shane French and Rick Tomlinson agreed to make some changes in the way the RCC maps are produced due to the following circumstances:–

1. **Workload**
   There are going to be heaps more shires needed to be done soon
2. **Remnant Vegetation**
   Rick has changed the code so that the remnant vegetation data is now displayed on the RCC maps themselves (previously done separately on clear film). See Section 3 on page 4 for details.

3. **Contractor**
   David Lamont has requested funding for a permanent employee to perform the conversion of raw data (hard copy collected from RCC volunteers in the field) to digital data for use in map creation. This will mean we don't have to retrain another person every 3 months to do this work (which takes time to learn)

4. **Plots**
   There have been changes to the number and type of plots need as *standard* for each shire. See Section 5.2 on page 4 for details.

2 RCC survey data

2.1 Road lengths

Shane will provide a list of all roads by both name and road number to Michael. This list will provide the total road length for each road. This will allow Michael to match — where possible — the volunteer's road lengths with Main Roads' digital road lengths. This should reduce the number of corrections where rcc data falls short or over shoots a road length.

This data has to be provided by Shane to Michael before work commences so that Michael doesn't have to perform this task more than once.

2.2 Required fields

The following table lists the field names and their data types. They must all be included. No extra fields can be included.

Type C = character
Type I = integer
Type N = numeric with some dec places (ie. floating pt numbers)
Type B = binary

COLUMN	ITEM NAME	WIDTH	OUTPUT	TYPE	N.DEC	ALTERNATE NAME
1	ROAD_#	7	8	C	-	
8	SEG_#	4	5	I	-	
12	SHIRE_#	4	5	I	-	
16	FROM	7	8	N	2	
23	TO	7	8	N	2	
30	DATE	8	10	D	-	
38	OBSERVER	30	31	C	-	
68	RES_WIDTH	3	4	I	-	
71	WIDVEG_L	2	3	I	-	
73	WIDVEG_R	2	3	I	-	
75	VEG_TREE_L	1	2	C	-	
76	VEG_TREE_R	1	2	C	-	
77	VEG_SHRUB_L	1	2	C	-	
78	VEG_SHRUB_R	1	2	C	-	
79	VEG_GRND_L	1	2	C	-	
80	VEG_GRND_R	1	2	C	-	
81	NAT_VEG_L	1	2	I	-	
82	NAT_VEG_R	1	2	I	-	
83	EXT_VEG_L	1	2	I	-	
84	EXT_VEG_R	1	2	I	-	
85	#_SPECIES_L	1	2	I	-	
86	#_SPECIES_R	1	2	I	-	

87	WEED_L	1	2	I	-
88	WEED_R	1	2	I	-
89	FLOWER_L	1	2	C	-
90	FLOWER_R	1	2	C	-
91	TREEHOL_L	1	2	C	-
92	TREEHOL_R	1	2	C	-
93	HOLOGS_L	1	2	C	-
94	HOLOGS_R	1	2	C	-
95	VAL_CORR_L	1	2	I	-
96	VAL_CORR_R	1	2	I	-
97	LANDUSE_L	1	2	I	-
98	LANDUSE_R	1	2	I	-
99	TREEROAD_L	1	2	C	-
100	TREEROAD_R	1	2	C	-
101	CCV_TOTAL_L	2	3	I	-
103	CCV_TOTAL_R	2	3	I	-
105	DOM_WEEDS	80	81	C	-
185	DIST_L	1	2	I	-
186	DIST_R	1	2	I	-
187	ADJ_LANDUSE_L	1	2	C	-
188	ADJ_LANDUSE_R	1	2	C	-
189	UPDATE	3	3	C	-
192	WEEDS_OTHER	2	3	C	-
194	TEMP	3	4	I	-

2.3 Quality Assurance RCC survey data

Some form of quality assurance should be performed where possible on the survey data as provided to *GIS Applications Section.*

For most of the data this is not practical — it's not worth getting a third person to go over all the work Michael does coordinating the road lengths. Maybe Michael could perform this himself after a short break from the work? ie. have another look at the survey after a few days break...

Suggested things to check : —

1. No **extra fields**
2. **All fields** listed above **included**
3. **Typo's**
   (a) Check occurrences of the letter "O" when the numeral "0" is required
   (b) Similarly, the letters "r" and "u' seem to creep in there for some reason

   Remember that any of these errors mean that that record will not be included on the map.
4. All **road widths** have to be 20m, 40m, 60m etc. or multiples of 20m.

   eg. 17m or 46m would both cause the drawing of the road width symbol to fail – ie. not appear on the map.
5. **Date Format** must be day/month/year, note the separation of each is the forward slash character "/".

   Remember that by default *EXCEL* will put date formats into month/day/year due to the US custom.

2.4 Correction cycle

There should, where possible, be only one (1) cycle of correction. We have to move away from plotting off 4 plots per shire to do corrections, errors should be found on screen as much as possible.

3 Remnant Vegetation

In the past — before April 9th, 2002 — remnant vegetation data was created on a clear film and was overlayed over the RCC maps. In April 2002 Rick Tomlinson changed the code in the program that creates the maps to include remnant vegetation in the RCC maps themselves.

This means that from April 9th 2002 onwards the remnant vegetation data will ALWAYS BE INCLUDED ON THE MAPS and no clear film of remnant vegetation data will be produced.

4 Weeds

Michael has created a macro in EXCEL that will greatly reduce the number of errors in the weeds data. It will ensure that all weeds are spelled the same way — get it right once and all the rest will be correct. THANKS Michael!!! This is a great improvement on the past, where any spelling deviation resulted in the non display of that weed for that road.

We still have to ensure some other things though.

1. David has decreed that there will be 6 (six) weeds per shire and no more. This means that there will a maximum of 6 weed overlays per shire but possibly less depending on the number of weeds selected and recorded for each shire.
2. The weeds entries in the DOM_WEEDS field have to be :–
   (a) Multiple words describing the same weed have to be joined by a "_" (underbar) character
      i. eg. "golden_wattle", not "golden wattle"
   (b) If there are more than one weed they have to be all included in the same cell value and be separated by a space character " ".
   eg. "golden_wattle big_black_bush cute_little_shrub" would be the entry for a single cell, don't enter them again for another cell like this:
   golden_wattle
   big_black_bush
   cute_little_shrub

5 Plots & files

5.1 Shires that fit on a 1:100,000 map

For each shire the GIS Applications Section need to provide to *Wildlife Conservation Section* **at least** the following:—

Plot size	#	*Media*	*Plot of...*	*When needed*
A0 (or smaller*)	5	Paper	**RCC map** *(Larger shires use smaller scale & rotate sheet)*	Always
A0 (or smaller*)	6	Clear Film	**Weeds** *(usually 6 types; maybe less, depends on shire)*	Only when weeds found in Shire
A0 (or smaller*)	1	PDF file *(mailed to David Lamont)*	**RCC map** *(pdf of plot file used to create the RCC map, user can print any size using free* ADOBE Acrobat Reader*)*	Always

*Most shires will fit onto an A0 sheet of paper when scaled at 1:100,000. Larger shires have to be handled case by case. (see Section 5.2)

When there is a need for more plots David Lamont will inform Rick Tomlinson or other member of GIS Applications Section.

5.2 Shires that won't fit on a 1:100,000 map

Some shires are very large and have to produced on the smallest scale possible (most zoomed in) that will allow the map to fit on a rotated sheet on the plotter. *This means that a few test plots might be required.*

The required number of plots remains the same as if the map would fit on a standard A0 (or smaller) at 1:100,000 scale.

Agreed format for Roadside Conservation data between

Wildlife Conservation
David Lamont
Michael Meffort

GIS App's
Robyn Wilson
Shane French

May 14th, 2001

Contents

1 RCC survey data

1.1 Road lengths

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23	TO	7	8	N	2	
30	DATE	8	10	D	-	
38	OBSERVER	30	31	C	-	
68	RES_WIDTH	3	4	I	-	
71	WIDVEG_L	2	3	I	-	
73	WIDVEG_R	2	3	I	-	
75	VEG_TREE_L	1	2	C	-	
76	VEG_TREE_R	1	2	C	-	
77	VEG_SHRUB_L	1	2	C	-	
78	VEG_SHRUB_R	1	2	C	-	
79	VEG_GRND_L	1	2	C	-	
80	VEG_GRND_R	1	2	C	-	
81	NAT_VEG_L	1	2	I	-	
82	NAT_VEG_R	1	2	I	-	
83	EXT_VEG_L	1	2	I	-	
84	EXT_VEG_R	1	2	I	-	
85	#_SPECIES_L	1	2	I	-	
86	#_SPECIES_R	1	2	I	-	
87	WEED_L	1	2	I	-	
88	WEED_R	1	2	I	-	
89	FLOWER_L	1	2	C	-	
90	FLOWER_R	1	2	C	-	
91	TREEHOL_L	1	2	C	-	
92	TREEHOL_R	1	2	C	-	
93	HOLOGS_L	1	2	C	-	
94	HOLOGS_R	1	2	C	-	
95	VAL_CORR_L	1	2	I	-	
96	VAL_CORR_R	1	2	I	-	
97	LANDUSE_L	1	2	I	-	
98	LANDUSE_R	1	2	I	-	
99	TREEROAD_L	1	2	C	-	
100	TREEROAD_R	1	2	C	-	
101	CCV_TOTAL_L	2	3	I	-	
103	CCV_TOTAL_R	2	3	I	-	
105	DOM_WEEDS	80	81	C	-	
185	DIST_L	1	2	I	-	
186	DIST_R	1	2	I	-	
187	ADJ_LANDUSE_L	1	2	C	-	
188	ADJ_LANDUSE_R	1	2	C	-	
189	UPDATE	3	3	C	-	
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   eg. "golden_wattle big_black_bush cute_little_shrub" would be the entry for a single cell, don't enter them again for another cell like this:

   golden_wattle
   big_black_bush
   cute_little_shrub

3 Plots

For each shire the GIS Applications Section need to provide to *Wildlife Conservation Section.*

Plot type	*Number*	*Media*	*Comments*
A0	5	paper	Larger shires = larger than A0 plots
A3	1	paper	3 req'd but Wildlife to photocopy balance
A0	1	film	Overlay of remnant vegetation map
A0	6	paper	Max. of 6, maybe less, depends on selection

Also :—

- All plots must be done at a scale of 1:100,000 no matter what size the shire.

  This means that some shires, due to their large area, will not fit on an A0 size paper plot while others will fit easily on A0 size.

APPENDIX 4

WORC

2003F000422 V01

Jackson, Kate

From: French, Shane
Sent: Wednesday, 4 June 2003 17:04
To: Atkins, Ken; Lamont, David; Jackson, Kate; Carr, Ben; Paczkowska, Grazyna; Wilson, Robyn; Eaton, Nathan
Subject: New RCC commitments as result of meeting on 16 May 2003

Roadside Conservation Mapping
extra work agreed to by
GIS Applications Section

Shane French

May 16, 2003

Previous agreed work per shire

Create maps for conservation information (remnant vegetation now included on maps, not mapped separately as before

Plots

For each shire the GIS Applications Section need to provide to Wildlife Conservation Section.

NB: All plots must be done at a scale of 1:100,000 unless otherwise specified by David Lamont or Kate Jackson (in the event of shires with large areas that won't fit onto A0 sheets @ 1:1,000,000)

Plot type	Number	Media	Comments
A0	5	paper	Larger shires = larger than A0 plots
A3	1	paper	3 req'd but Wildlife to photocopy balance
A0	6	paper	Max. of 6, maybe less, depends on selection

Additional work per shire

1. Create and supply to Wildlife Branch left and right shapefies for each shire. Each shapefile has it's own .avl legend file which defines offset, line width and colour, all of which match the RCC Arc/Info maps. This data also to be stored in our corporate data system for access by other DCLM staff members

2. Create and supply to Wildlife Branch left and right shapefies for all shires previously done. This to be done time permitting and supplied to both Wildlife Branch and stored corporately

Please contact me if changes need to be made. I am on leave from 5th til 11th of June.

regards Shane

Shane French
Acting Project Leader GIS Applications
Dept of Conservation & Land Management
Western Precinct, Technology Park
17 Dick Perry Drv
Kensington WA 6151

APPENDIX 5

630 Murray St. West Perth
Phone – 9226 3199
Fax – 9226 2599
ABN: 17 103 599 220
www.betterdigital.com.au
brad@betterdigital.com.au

Installation of RCC Survey

Firstly, make sure these files are present on your PC:

- Calm RCV.mdb file – this is the Access database;
- ~~CALM~~RCC setup.exe file – this is the Pocket PC application;
- ADOCE.exe file – this is required by the Pocket PC devices;
- ActiveSync – to install the program.

The 3 files outlined above can be located by going to: *T:147-Wildlife Admin\Shared Data\KateJ\RCV*. The Access database file (Calm RCV) may be found on the desktop as a shortcut. If it is not there, go to *T:147-Wildlife Admin\Shared Data\KateJ\RCV,* click on Calm RCV.mdb and then hold ALT and drag to the desktop (make sure you do not move the file to another folder or ActiveSync won't work properly).

ActiveSync can be found by going to the Start menu, Programs, and selecting Microsoft ActiveSync. If you don't have it go to http://www.microsoft.com/windowsmobile and the go to downloads.

To run the database make sure that Microsoft Access is installed and then double click on the Calm RCV.mdb file.

To install the RCC survey on the Pocket PC's you will need to follow these instructions:

1. Make sure ActiveSync is installed and connect the Pocket PC device, via the desktop cradle or extension lead.
2. Double click on the ~~CALM~~RCC setup.exe file and follow the prompts, you should see ActiveSync installing the program to the Pocket PC.
3. Do the same for the ADOCE.exe file.
4. The Pocket PC now has the program installed, however we need to copy the database over, so go to ActiveSync and the menu at the top called "Tools". Go to "Import Database Tables", and find the Calm RCV.mdb file and click ok.