

# **SOUTH AUSTRALIA NATIVE VEGETATION EXTENT BASELINE AND MONITORING**

**Final Report**

**DEH 02/2251**

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## EI REPORT

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## NATIVE VEGETATION EXTENT BASELINE AND MONITORING

DEPARTMENT FOR ENVIRONMENT AND HERITAGE SA  
FELICITY SMITH

### *Final report for NLWRA*

Project Duration: 10/9/06 - 01/03/2008

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## **1. SUMMARY**

This report documents the work undertaken to create a 2004 baseline for native vegetation mapping in SA. The work was undertaken with funding from National Land and Water Resources Audit (NLWRA). All state's and territories were undertaking equivalent projects to create a national baseline extent layer that will inform the status of native vegetation for Australia's Natural Resource Management. The work also undertook to identify the presence of native vegetation for 1990 and 1995 in conjunction with the 2004 assessment.

The project created a classification of land cover from 2004 Landsat imagery into seven classes which included one class to represent woody native vegetation. The project verified DEH's existing woody native vegetation mapping data in the agricultural regions for the years 1990, 1995 and 2004. Verification work identified where woody vegetation mapping was incorrect based on clearance. The data was not able to verify the non-woody component and this will remain unknown within South Australia's native vegetation cover for the specified years until better tools are available. It is acknowledged that the native vegetation cover is not complete with some regions requiring more work to include gaps in native vegetation but the existing woody data is correct for 2004.

## **2. INTRODUCTION**

The national framework for Natural Resource Management (NRM) Standards and Targets has been developed to define national outcomes for investment in natural resource management. Within the framework "Matters for Target" have been identified which includes recommended indicators. Under Native Vegetation Communities' Integrity Matter for Target, the Native Vegetation extent and distribution indicator has been proposed (<http://www.nrm.gov.au/publications/factsheets/me-indicators/native-veg/pubs/present-vegetation.pdf>). To achieve this indicator a paper prepared for advice on the indicator noted that there was a need for:

- baseline information on the extent of present native vegetation;
- change information on the extent of present native vegetation.

The baseline acts as a benchmark against which change can be compared. The baseline needs to be clearly identified against a year for which it was measured.

Currently the spatial mapping in SA that would inform this indicator is the native vegetation mapping data managed by the Department for Environment and Heritage (DEH). The data is based on a range of imagery sources from the 1960's to the present and does not include any comprehensive change information. To enable monitoring of this indicator the information needs to be spatially explicit and the existing data needs to be consistently captured for one identified year. For SA the identified year is 2004.

### **2.1 Activities and Milestones**

The project's objectives are to produce a baseline of native woody vegetation for the agricultural region of SA. This is to meet the objectives of developing The extent and distribution of native vegetation for Australia. The following work was undertaken for the project.

- Landsat imagery dated 2004 was classified into 7 land cover classes including woody native vegetation.
- Validation of the native woody vegetation mapping data using the woody vegetation component of the classification for 2004, and equivalent classifications for 1990 and 1995.
- Delivery of the product using web services for an agreed set of regions.

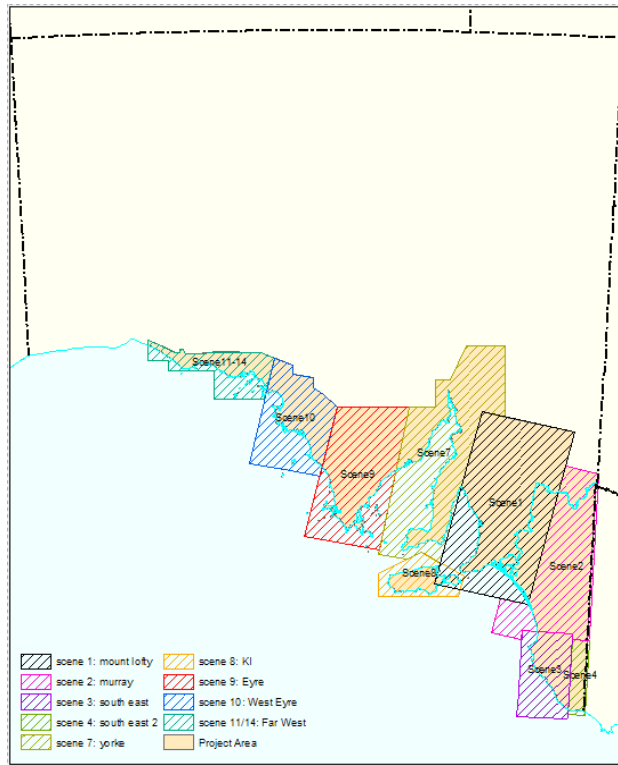
Table 1 presents the activities and milestones identified in the project that reflect the above, and deadlines as agreed in the contract between DEH and NLWRA.

**Table 1: Overview of project schedule and milestones.**

Tasks	Date
Contract signed	1 Sep 2006
<b>Milestone 1</b>	
Method developed and trialled for pilot region	1 Nov 2006
Mapping commenced	1 Dec 2006
Method report	1 Feb 2007
<b>Milestone 2</b>	
Delivery of interim extent mapping and summary statistic tables (if possible to specifications provided by NLWRA)	1 June 2007
Financial Statement 06/07	1 Sep 2007
<b>Milestone 3</b>	
Delivery of final extent mapping and summary statistic tables (if possible to specifications provided by NLWRA)	1 Dec 2007
Final Project report	1 Dec 2007
Financial Statement 07/08	1 Mar 2008

### 3. STUDY AREA

The project area was the agricultural region of SA (Figure 1). The scenes available for the region have been optimised for processing and to match the area within SA that has been subject to clearance of native vegetation. Each scene was processed separately. A pilot was undertaken in the mount lofty ranges (scene 1). This scene ranged from northern semi-arid areas across to the river murray. This attempted to pick up a range of native vegetation issues to develop the methods for the project.



**Figure 1: Location of SA Baseline Extent Project Region. Scenes represent classification work with scene 1 used as the pilot region to test method.**

## 4. METHODS

### 4.1 Imagery Classification

The method to provide classified and filtered imagery for use in a GIS is summarised in the flow diagram (Figure 2) and in detail in the following sections.

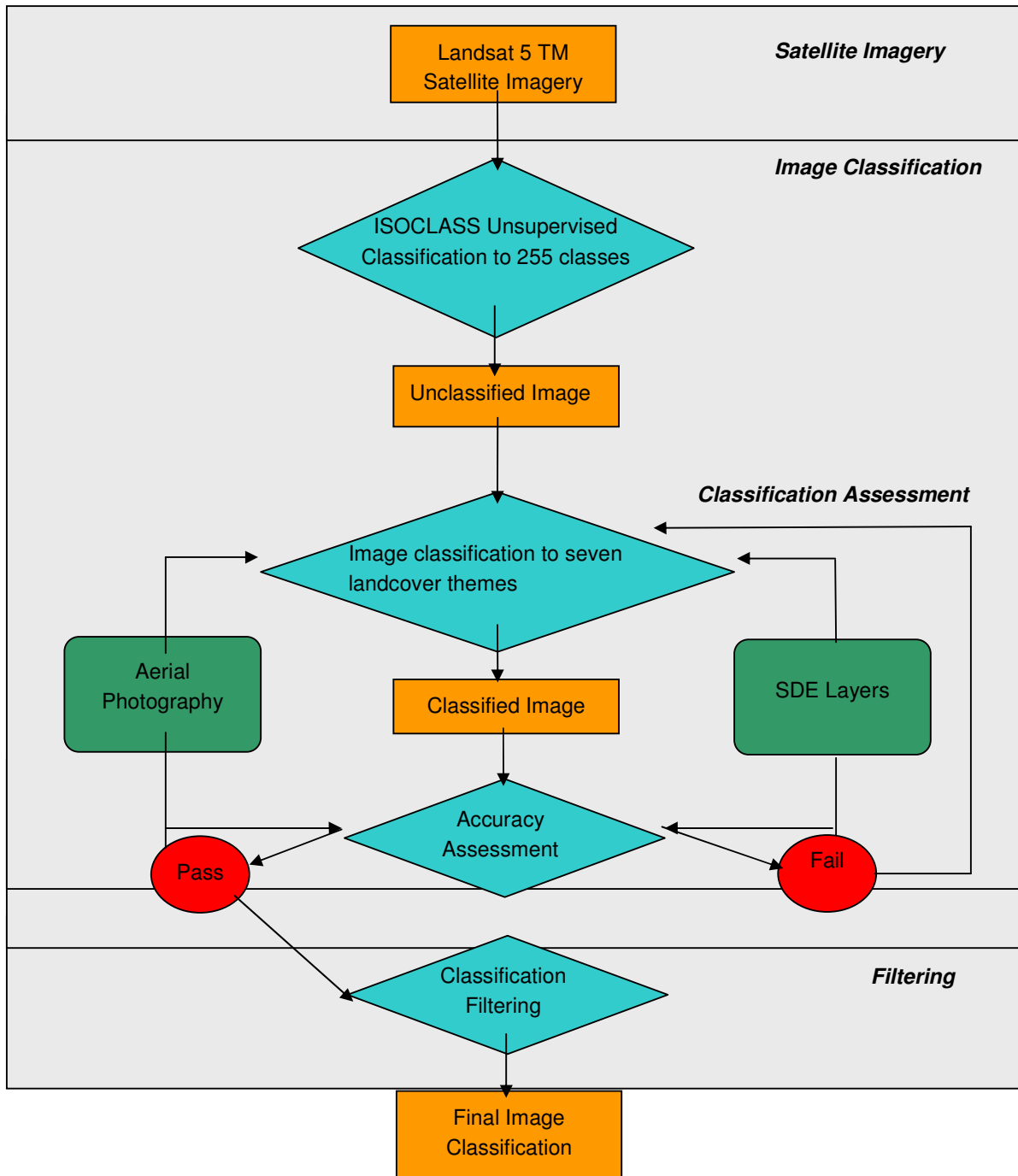


Figure 2: Overview of the steps involved in the imagery classification.

#### 4.1.1 Satellite Imagery

Landsat 5 TM (Thematic Mapper) was chosen to provide the satellite imagery for this project for the following reasons:

- large area coverage,
- spatial resolution suitable for mapping land systems,
- frequent revisit times,
- large archive of Landsat imagery, and
- allows for comparison with similar land cover studies that used Landsat imagery.

DEH had 2004 Landsat 5 TM imagery over southern South Australia. The requirements were for summer scenes in 2004 to maximise image contrast and to be cloud free so details were not masked by cloud and associated shadow.

The original Landsat imagery was acquired through the Australian Centre for Remote Sensing (ACRES). The imagery was georectified using a Landsat 7 ETM+ mosaic acquired in 2000 which had been georectified to 1:50000 mapping standards (+/-25m). The intended accuracy of the 2004 imagery was to be within a pixel (12.5m) of the 2000 mosaic. The actual mean error for the 2004 imagery generally varied between 5.8m to 14.6m. Images acquired over the far west coast were less accurate (~20m) due to the paucity of accurate ground control in these areas.

The spectral and spatial resolution of Landsat 5 is sufficient to map reliably at the 1ha level, and the seven spectral bands allow for better discrimination of different environments due to the presence of the mid-infra red bands (Barson and Kitchin 1996)

An important consideration for Landsat 5 was the ability to compare the results of the image classifications to previous land cover classifications from the Agricultural Land Cover Change (ALCC) project (Barson *et al.*, 2000). The ALCC project also used Landsat 5 TM imagery collected in 1990 and 1995 over a similar study area.

#### 4.1.2 Image Classification

The methodology used to derive land cover classes from the Landsat imagery was adapted from Cameron & Hart (1998) developed for the ALCC project. The benefit of adapting an existing methodology allowed for comparisons to previous classifications to get a better understanding of the temporal changes occurring.

In summary, each image is classified using an ISOCCLASS unsupervised classifier. The output is an unattributed classification containing 255 classes. The operator then attributes each class to one of seven pre-determined classes that were defined in the ALCC project (Table 2).

The resultant classification, known as the unfiltered dataset, is made up of seven digital numbers (DNs) that correspond to each of the classes in Table 2. This classification can be displayed within image processing software or a GIS.

**Table 2: Image classification pre-determined classes assigned to Landsat unsupervised classification.**

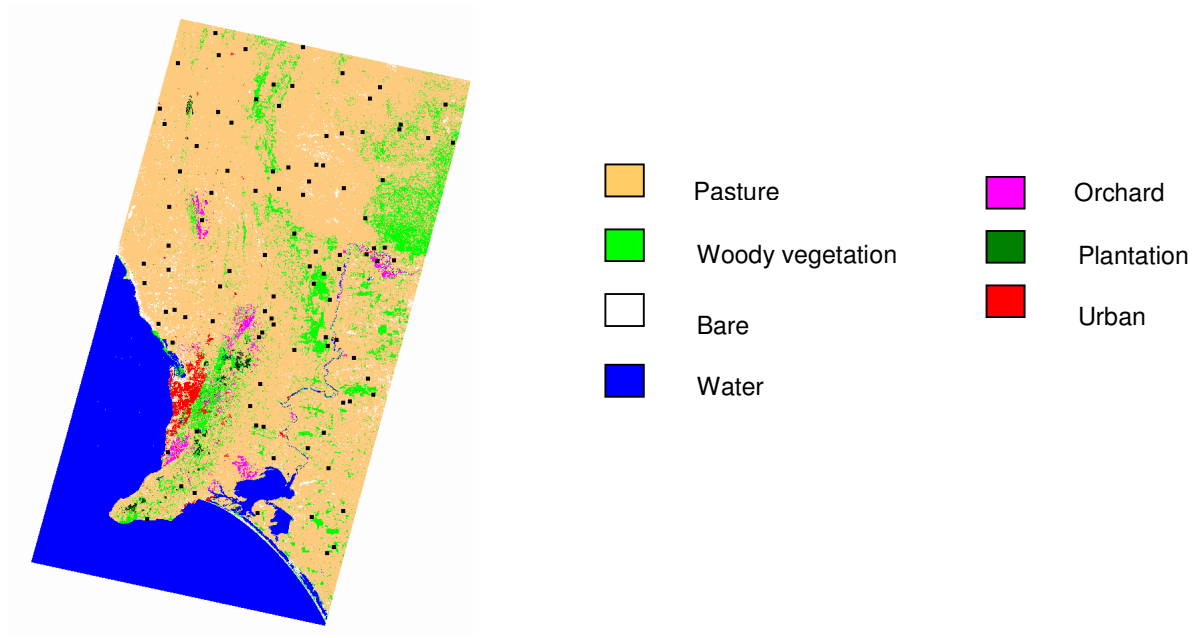
Class	Name	Examples
1	Pasture	Dryland pasture, Irrigated pasture, chenopods, samphire, herbfields
2	Urban	Towns, Cities
3	Bare	Roads, Exposed sand and rock, Quarries
4	Water	Fresh water, Saline Water, Seawater
5	Plantation	Native species woodlots, Other timber trees, Pine
6	Orchard	Citrus, Nut trees, Stonefruit, Vineyards
7	Woody vegetation	Native trees/mallee/tall shrubs, Non-native trees, >2m height, >20% canopy cover

During the classification process, a number of ground truthing aids were utilised. These include ortho-rectified aerial photography and layers contained within the Department’s GIS database (SDE). The classes of “Urban”, “Plantation” and “Orchard” were masked using a combination of image interpretation and SDE layers (specifically TOPO.BuiltupAreas and VEG.PlantedVegetationCover respectively). The other classes were classified using aerial photography as a reference. Actual site visitation was not undertaken but may have been of value in the murray mallee where blue gum plantations were suspected but not verified.

#### **4.1.3 Classification Assessment**

To determine the accuracy of the classification a program was developed that produces 100 random points across the classified image. The program was designed to restrict the 100 points to land based classes (therefore no ocean areas classified as “water” were included in the assessment). The unfiltered classified image was then checked using these point locations against the unclassified source image to check the veracity of class assignment. Ortho-rectified aerial photography was the primary means of assessment, followed by SDE information. If more than 90% of the points were validated the quality of the classification was deemed acceptable.

Figure 3 below shows the extent and placement of the random points across the scene 1 image. For the Mt Lofty region, 97% of the points were correct. If the accuracy assessment falls below 90%, the image has to be reclassified and re-assessed. The image does not proceed to the next stage until it passes the minimum 90% accuracy standard. In the development of this assessment the location of the random points was compared to the classes across the region. The focus of the project is to ensure accurate classification of class 7. Across the project region the degree of clearance means that class 7 would be a low component. It was observed that a representative number of all classes were being picked up in the assessment process.



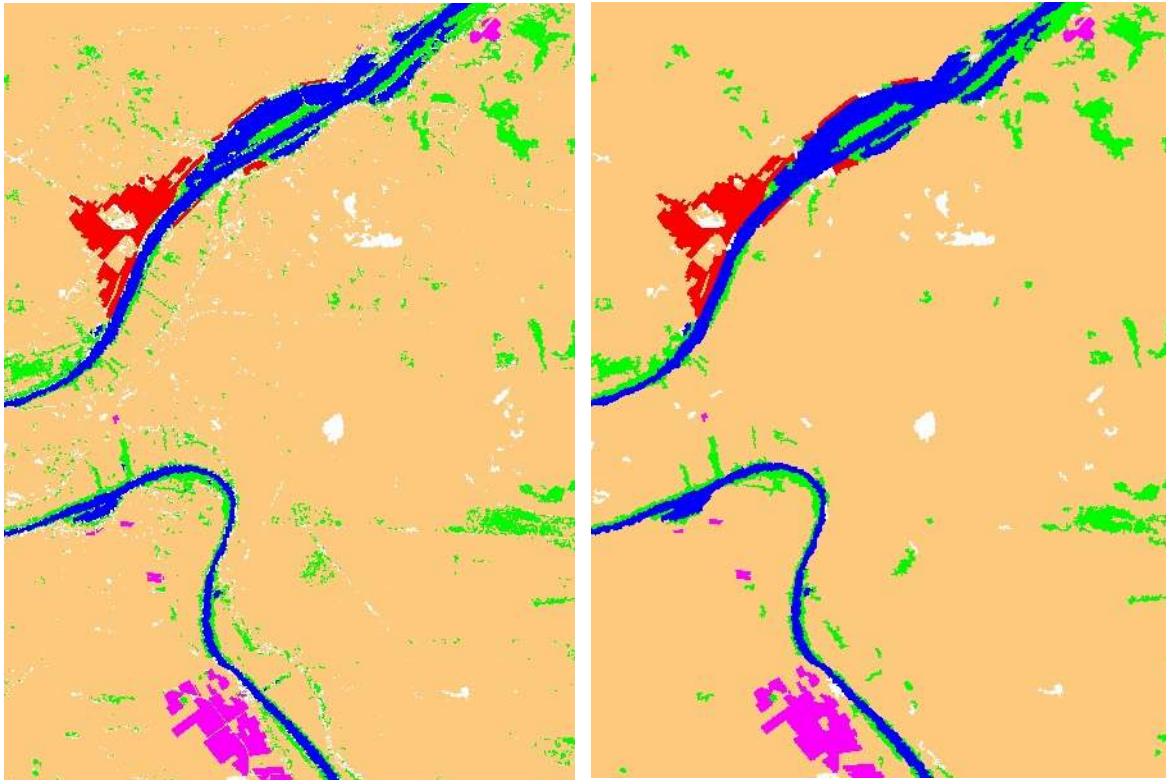
**Figure 3. Classified image over the Mt Lofty region showing 100 random points used for image assessment.**

#### **4.1.4 Filtering**

The image classifications from the ALCC project had a minimum mappable unit of 1ha (4x4 or 16 pixels). Groups of pixels smaller than this are generally attributable to errors caused by image mis-registration, and errors of commission and omission, however it is possible that smaller spectrally distinct objects were classified correctly. One hectare is also (generally) the minimum mapping unit for the native vegetation data.

A filtering routine was developed that removed extraneous noise from the classification image less than 1ha. This can include solitary trees, small tree clumps, narrow roadside verge strip vegetation and small patches of bare ground. Figure 2 shows the effect of the filter on a portion of the Mt Lofty classified image. The filtering process includes pixels that are contiguous edge to edge or side to side in linear or vertical arrangement, not just the standard 4 by 4 box.

The final classified, assessed and filtered image was then delivered for undertaking the vegetation mapping GIS work. The final image is a classified image in BIL format with associated image headers.



**Figure 4. Effect of filtering routine on the classified image, unfiltered on left and filtered to 1 hectare on right.**

#### **4.1.5 Imagery compilation**

For validation of the vegetation mapping data it was necessary to mosaic all classified scenes into one large contiguous dataset. The Landsat scenes were generally acquired in summer and early autumn, however these slight differences did cause some images to display classification differences in areas of image scene overlap. These errors tended to occur between paths rather than along paths. To reduce the effects of edge mismatching, Landsat imagery had originally been chosen during times where a single path of Landsat could be acquired on one date. However, adjacent paths are separated by approximately seven days and may be cloud covered necessitating the purchase of imagery during a different month or season.

In overlap areas where there was a difference in classification, the method of correction depended on the nature of the error. If gross systematic errors were observed where one or multiple classes had been wrongly attributed, the classification was re-done. Most errors were small and scattered and were related to one or two classes due to different time of acquisition and some small scene mis-registrations. Small areas of difference were corrected by manually editing the classification to reflect the correct thematic layer. In general the scenes matched well and were easily brought together.

## **4.2 GIS Extent Capture**

The woody component (class 7) of the classification was used to validate the existing native vegetation mapping data. To undertake the validation a method was developed using a pilot region

(scene 1, Figure 1). In addition to the 2004 classification, classifications from 1990 and 1995 were also used to verify the mapping for the respective years. This data was created from the Australian Land Cover Change Project (Barson and Kitchin 1996). In effect this will provide South Australia with a 1990 baseline which fits with the introduction of the *Native Vegetation Act 1991* in South Australia. The access to 1990 and 1995 data enabled the validation to be more robust through cross comparison of multiple datasets.

#### 4.2.1 Data model

DEH's vegetation mapping data is modelled in an ArcSDE editing environment. For this project, additional fields were added to map native vegetation extent and change. Table 3 lists only the fields that exist on the data that are relevant to this project.

The fields of interest are FEATURECODE, EXTENTYEAR and WOODYPCYEAR, where YEAR is 1990, 1995 and 2004 corresponding to the available classification layers. Prior to this project the mapping process identified change, such as clearance using the FEATURECODE field. During this project this change data was collected using the EXTENT1990, EXTENT1995 and EXTENT2004 fields. In summary:

- EXTENTYEAR identifies the presence of the native vegetation in the particular year.
- WOODYPCYEAR identifies for each native vegetation entity (as mapped) at time of project how much was classified as woody in the classification, based on zonal statistics. These fields will be a record of the information used in the project but may be archived at the projects end, due to differences that would come about with ongoing changes in spatial accuracy of a feature.

**Table 3: Subset of fields on GIS editing data, that relate to the extent capture validation process.**

Field	Description
FEATURECODE	6001 – all native vegetation 6020 – used to define those areas that were cleared. All should be reattributed to 6001 and given appropriate EXTENTYEAR code. 6021 – used to detect regrowth, areas not mapped in first capture process. All features re-attributed to 6001 and given appropriate EXTENTYEAR code.
SA_VEG_ID1	Code for vegetation group – first group in mosaic, if applicable
SA_VEG_ID2	Code for vegetation group – second group in mosaic, if applicable
SA_VEG_ID3	Code for vegetation group – third group in mosaic, if applicable
SA_VEG_ID1PERCENT	Percent of area covered by first group
SA_VEG_ID2PERCENT	Percent of area covered by second group
SA_VEG_ID3PERCENT	Percent of area covered by third group
FEATURERELDATE	Date for Imagery of photography used to capture features boundary
ATTRIBUTERELDATE	Date for native vegetation data used to identify group, based on field sites
EXTENT1990	Presence of mapped entity based on woody field and interpretation for 1990. Domain: YES, NO, NO NW, UNKNOWN or CHECK
WOODYPC1990	Percent of woody from classification within mapped entity (based on raster analysis of 1990 data)
EXTENT1995	Presence of mapped entity based on woody field and interpretation for 1995. Domain: YES, NO, NO NW, UNKNOWN or CHECK
WOODYPC1995	Percent of woody from classification within mapped entity (based on raster analysis of 1995 data)
EXTENT2004	Presence of mapped entity based on woody field and interpretation for 2004. Domain: YES, NO, NO NW, UNKNOWN or CHECK
WOODYPC2004	Percent of woody from classification within mapped entity (based on raster analysis of 2004 data)

The SA\_VEG\_ID fields provided information of whether the native vegetation is a woody or non-woody type. This enabled the validation to be divided into those areas that could be verified against

the woody classification. For the project region vegetation type data did not exist for the northern area of scene 10, scene 1 and scene 7. Within the EXTENT YEAR fields a list of codes (domain) have been set up to attribute the presence of native vegetation. Table 4 summarises the codes and how they have been used.

**Table 4: Domain for mapping native vegetation presence in EXTENT2004, EXTENT1995 and EXTENT1990 fields**

Code	Description	Usage
NO	Woody Not Present	Shows the woody vegetation types that have been cleared. For a feature if there was change this code is only used in conjunction with “Woody Present” in other EXTENT fields.
YES	Woody Present	Shows the woody vegetation types that are present For a feature if there was change this code is only used in conjunction with “Woody Not Present” in other EXTENT fields.
UNKNOWN	Unknown	Shows the non-woody vegetation types in agricultural region that could not be verified Paddock trees/scattered trees in paddocks or woody types that were not as dense to be easily verified. For a feature if there was change this code is only used in conjunction with “Non Woody Not Present” in other EXTENT fields.
NO NW	Non Woody Not Present	Non-woody vegetation types that through differences in imagery or tones and textures have been cleared For a feature if there was change this code is only used in conjunction with “Unknown” in other EXTENT fields.
CHECK	Unsure	Used to flag uncertainty in coding, not for delivery.
NULL		All vegetation types outside project region (arid region).

#### 4.2.2 Assessment of classification

The classification of woody vegetation from the Landcat imagery was checked over by an expert in mapping native vegetation, in addition to the process summarised in Section 4.1.3. This was undertaken to provide an initial feedback of the classification and highlight how the classification into class 7 (woody vegetation) can be used for the project. The following issues were observed.

- In urban areas roads were being defined in class 7. The urban mask reduced some of this through removing buildings but not wholesale. We still required the greater urban area to be included in the unsupervised classification due to presence of pockets of urban remnant native vegetation.
- Wet areas, such as along the River Murray, dams or ovals in urban regions were being defined in class 7.
- Orchards/planted vegetation were being defined in class 7.

The classification detected areas that are not just native woody vegetation. This highlights that the classification acts as a guide and cannot be used indiscriminately for updating the native woody vegetation. Within the agricultural region of SA the number of uniquely mapped native vegetation features is enormous so a streamlining process was investigated and is discussed below.

### 4.2.3 Data method investigation

The existing native vegetation mapping data includes vegetation types through the spectrum of non-woody to woody. The classification method indicates that woody vegetation types are detected based on a crown cover of > 20% and height parameters of >2m. This is not exact and through preliminary analysis some of non-woody vegetation types are picked up as “woody” due to certain signatures, such as wet areas. For consistency all non-woody types have been deemed not possible to validate in this project and will be coded as “UNKNOWN”. For the purposes of the final native vegetation baseline these areas will be included in the overall native vegetation cover data.

The native vegetation mapping is classified as woody by structure and floristic information. The vegetation types range from sedgeland, grasslands, shrublands (typically non-woody) to forest, woodlands and mallee (typically woody). Within any one vegetation type a structural class has been defined. In reality, the entities mapped as a vegetation type may vary across a range of cover and height with the structural class being the average/mid point. The percent woody data from the classification could be a guide to woodiness of a vegetation type, and therefore the structural class but from preliminary assessment may not be accurate because of the following reasons.

1. Mosaics of woody and non-woody types within one feature.
2. Size of areas mapped.
3. Signature of the type in imagery, such as presence of woody shrub in understorey.

A low classified woodiness does not exclude the vegetation from being present but rather represents the spread of the woody component. The comparison of the defined structure for a mapped entity and the percent woody from the classification is presented in Table 5 for scene 1. It was observed that the range of percent of classified woody in any one structural class was quite diverse and this could not be used to help guide how to treat the classified woodiness data. This is probably a fact of the generalisation of the vegetation types into structural classes and the contribution of the understorey to the woody signature.

**Table 5: Relationship of structural classes for native vegetation mapping against the percent woody of the classification using a zonal statistic analysis. Each structural class is defined into whether it is woody, part woody or not woody and the crown cover that the class represent.**

Vegetation Type Mapping Information		Woody Classification Data			
Structural Class	Crown Cover	Woody	% Woody Min	% Woody Mean	% Woody Max
low closed forbland	80-100	No	0.0	61.6	100.0
low closed forest	80-100	Yes	0.0	24.5	100.0
low fernland	50-80	No	0.0	42.4	99.0
low grassland	50-80	No	0.0	7.7	100.0
low hummock grassland	50-80	No	0.0	4.5	75.0
low open forest	50-80	Yes	0.0	53.8	100.0
low open grassland	20-50	No	0.0	0.3	3.0
low open sedgeland	20-50	No	0.0	25.7	96.0
low open shrubland	20-50	No	0.0	7.1	100.0
low open tussock grassland	20-50	No	0.0	2.9	74.0
low open woodland	<20	Part	0.0	20.9	100.0
low sedgeland	50-80	No	0.0	4.1	100.0
low shrubland	50-80	No	0.0	14.0	100.0
low sparse shrubland	<20	No	0.0	4.0	100.0

Vegetation Type Mapping Information		Woody Classification Data			
Structural Class	Crown Cover	Woody	% Woody Min	% Woody Mean	% Woody Max
low tussock grassland	50-80	No	0.0	3.2	83.0
low woodland	20-50	Yes	0.0	37.1	100.0
mid closed sedgeland	80-100	No	0.0	2.5	5.0
mid closed shrubland	80-100	No	94.0	97.3	100.0
mid closed tussock grassland	80-100	No	0.0	23.4	100.0
mid grassland	50-80	No	0.0	6.6	100.0
mid hummock grassland	50-80	No	0.0	3.6	84.0
mid mallee woodland	20-50	Yes	0.0	26.6	100.0
mid open forest	50-80	Yes	0.0	53.0	100.0
mid open hummock grassland	20-50	No	58.0	58.0	58.0
mid open mallee forest	50-80	Yes	0.0	43.0	100.0
mid open mallee woodland	<20	Part	0.0	38.1	100.0
mid open sedgeland	20-50	No	0.0	10.7	100.0
mid open shrubland	20-50	No	0.0	14.8	100.0
mid open woodland	<20	Part	0.0	23.4	100.0
mid sedgeland	50-80	No	0.0	19.7	100.0
mid shrubland	50-80	No	0.0	32.6	100.0
mid sparse shrubland	<20	No	0.0	3.8	49.0
mid tussock grassland	50-80	No	0.0	0.4	7.0
mid woodland	20-50	Yes	0.0	47.8	100.0
tall closed grassland	80-100	No	0.0	28.0	100.0
tall closed sedgeland	80-100	No	0.0	27.2	76.0
tall closed shrubland	80-100	Yes	0.0	46.2	100.0
tall grassland	50-80	No	0.0	13.8	100.0
tall open hummock grassland	20-50	No	0.0	14.9	76.0
tall open sedgeland	20-50	No	0.0	30.7	100.0
tall open shrubland	20-50	Yes	0.0	43.2	100.0
tall sedgeland	50-80	No	0.0	18.2	100.0
tall shrubland	50-80	Yes	0.0	30.7	100.0
tall sparse sedgeland	<20	No	0.0	34.0	100.0
tall sparse shrubland	<20	Part	0.0	17.2	100.0

A more detailed comparison of the native vegetation mapping with the degree of woodiness from the classification was undertaken. For each mapped entity the percent of the area covered by the woody classification was stratified into % woody and area size classes as summarised in Table 6. The size classes were arbitrary but were meant to reflect very small, to large features. The data showed that the woodiness of the mapped features ranges from zero to hundred percent with most of features in any one size category falling into the 0-20% class.

**Table 6: Analysis of woodiness of vegetation mapping within size classes**

Feature Area	0-20%	20-40%	40-60%	60-80%	80-100%	Total	Percent Total
<5 ha	10588	1539	1818	1741	1802	17488	55
5-20ha	3707	1205	1262	1370	1334	8878	28
20-100	1494	410	401	481	693	3479	11
>100ha	1098	159	105	134	234	1730	5
Total	16887	3313	3586	3726	4063		
Percent total	53	10	11	12	13		

Within each of these categories a visual assessment was undertaken of 126 features to determine if the feature would be attributed as “YES” or “NO” or “UNKNOWN” to find trends. In cases where the observer was unsure because the available data was not easily pointing to presence “CHECK” was used. The results of this analysis highlighted that features that had a high woody percent were slightly more likely to be “YES” than “CHECK” with significantly less to be “NO” (Table 7). However those that are “CHECK” indicate that the answer is not clear and some rules need to be defined as to how to deal with them to ensure consistency in data validation.

**Table 7: Results of visual comparison of woody data with native vegetation mapping data.**

Polygon Selection Method	Yes	No	Check	Unknown
0% to 20% Less than 5ha	3	2	2	4
0% to 20% 5ha to 20ha	1	2	4	4
0% to 20% 20ha to 100ha	0	1	3	4
0% to 20% Greater than 100ha	0	1	2	6
20% to 40% Less than 5ha	3	0	2	3
20% to 40% 5ha to 20ha	2	0	3	3
20% to 40% 20ha to 100ha	1	0	3	2
20% to 40% Greater than 100ha	0	0	4	0
40% to 60% Less 5ha	1	0	2	2
40% to 60% 5ha to 20ha	2	0	2	1
40% to 60% 20ha to 100ha	2	0	3	0
40% to 60% Greater than 100ha	0	0	3	1
60% to 80% Less than 5ha	4	0	1	3
60% to 80% 5ha to 20ha	4	0	2	2
60% to 80% 20ha to 100ha	3	0	0	1
60% to 80% Greater than 100ha	4	0	0	0
Greater than 80% Less than 5ha	3	1	0	1
Greater than 80% 5ha to 20ha	4	0	1	0
Greater than 80% 20ha to 100ha	3	0	1	1
Greater than 80% Greater than 100ha	3	0	0	0
<b>Total</b>	<b>43</b>	<b>7</b>	<b>38</b>	<b>38</b>

A comparison was also undertaken to assess how the vegetation defined into different structurally categories compared to the woody classification. There were three classes defined: woody, part woody and non-woody. Woody covered the mallee, trees and shrubs with height >2m and cover >20%; part woody covered mallee, trees and shrubs that were <2m and <20% while non-woody was everything else. 150 features were selected randomly from scene 1. The following observations were made during the examination (Table 8).

1. Woody features >80% were all considered present, with the visual comparison highlighting a high confidence that they would all be verified present if updated globally. This is similar to between 60-80%.
2. Non-woody features were being picked up in the woody classification and if one ignored that they are non-woody when the percent of woody was high they represented the features well. Generally however they are not well represented.

3. "CHECK" implied that through the validation some features are not well-represented by the imagery classification while others are partly incorrect and will need to be updated.
4. Not a lot of areas were picked up as "NO". For scene 1 the original data capture was using 2000 imagery.
5. The lower the percent representation, the greater the need to determine if the features are appropriately represented, or need to be re-mapped, or their presence in mapping is not justified. However, generally the woody classification is not good at mapping the scattered open features and that are not truly woody.

**Table 8: Results of visual comparison of woody data with native vegetation mapping data classed into woody types.**

Polygon Selection Method	Yes	No	Check	Unknown
0% to 20% Woody	0	1	10	1
0% to 20% Part Woody	0	0	0	0
0% to 20% Non Woody	0	1	8	1
20% to 40% Woody	3	0	8	1
20% to 40% Part Woody	3	0	5	3
20% to 40% Non Woody	1	0	0	9
40% to 60% Part Woody	7	1	3	0
40% to 60% Woody	7	0	3	1
40% to 60% Non Woody	0	0	0	10
60% to 80% Woody	10	0	1	0
60% to 80% Part Woody	9	1	0	1
60% to 80% Non Woody	3	2	1	4
80% to 100% Woody	10	0	0	0
80% to 100% Part Woody	9	0	0	2
80% to 100% Non Woody	5	0	1	4
<b>Total</b>	<b>66</b>	<b>7</b>	<b>40</b>	<b>37</b>

#### 4.2.4 Capture method

From the method investigation it was identified that all features need to be assessed. The non-woody ones can not be verified and will be "globally" updated to "UNKNOWN". Finally it was felt that the areas that are > 60% woody will be updated to "YES", but still checked.

Multiple officers undertook the data validation. To ensure that the initial analysis was consistent, an ArcGIS script was written. This was run to create the initial zonal statistics data to undertake capture work. Secondly a set of rules were developed for the capture.

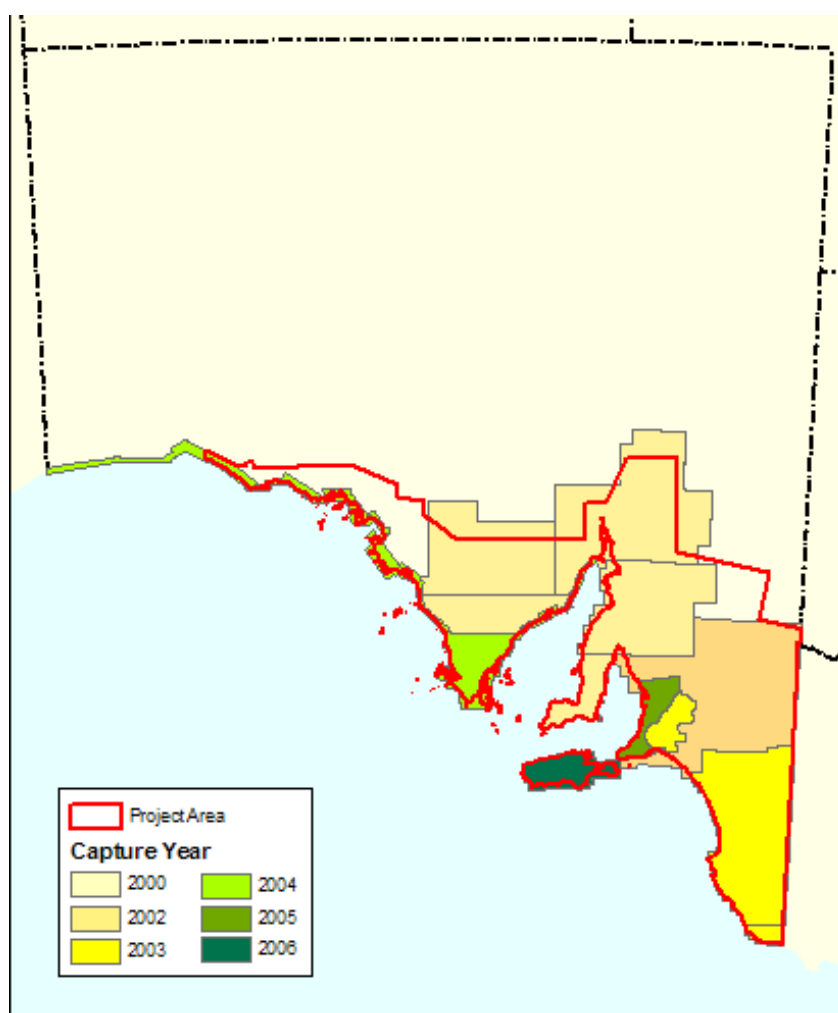
To attribute the classified woody data on the vector mapping the following process was developed using a script run before any editing/validation work was undertaken for a scene. The following steps are a summary of the script.

1. Extract the woody class (7) from the classified image (bil) and reclassify to 1 (all other data classes are classified as 0).
2. Treat each unique mapped entity in the native vegetation mapping data as a zone. Code the features with a unique number (zoneid).
3. Undertake zonal statistics of woody classification against the native vegetation mapping based on zoneid.
4. Determine the percent of each zone that is woody.
5. Transfer the percent woody on to the native vegetation mapping data (WOODYPCYEAR).
6. Use the native vegetation type as identified in the mapping to update some presence data (EXTENTYEAR).
  - a. Select all non-woody native vegetation types and update to "UNKNOWN"

- b. Select where vegetation types are woody and woody percent is greater than or equal to 60 and updated to “YES”.

Although some features are updated to “YES”, all features will be checked to ensure that the mapping is verified due to uncertainties about making any absolute conclusion between the woody classification and the native vegetation mapping data.

Existing imagery and dates are mapped in Figure 5. Aerial photography provided the officers with a reality as to what they were verifying. The only area that did not have good aerial photography was the far west coast. The classification data was used in association with the raw satellite imagery for each year to verify the mapping. The woody areas that were not being detected from the classification process were checked using the raw images. The tones and textures of the raw satellite images were compared to the aerial photography to check for differences. Similar patterns would reflect no change, while different patterns would reflect changes in landcover.



**Figure 5: Aerial photography imagery used in verification work, generally of 1:40,000 to 1:80,000 resolution.**

In summary, the steps to verify the mapping involved using the existing aerial photography, 1990, 1995 and 2004 imagery and the classification data to compare and ensure that all were correlating.

1. Is it classified as woody, is this similar pattern to aerial photography?

- a. Yes – Code as “YES”
  - b. No go to step 2
2. Is the raw imagery of 2004, 1990 or 1995 reflecting similar tone and textures as aerial photography?
  - a. Yes – code as suggested by aerial photography
  - b. No go to step 3
3. Is the 1990, 1995 and 2004 imagery reflecting different tone and textures to each other and aerial photography?
  - a. Yes – code appropriately.

In some cases a subset of a feature was cleared. The appropriate area was cut and identified as cleared. In the case of the non-woody vegetation, if the existing photography that was not always 2004 showed signs of cropping the feature was coded as “NO NW” (Non-woody not present) for 2004 but all other years were left as “UNKNOWN”

#### **4.2.5 Limitations**

The following limitations have been identified from the validation process.

- Data validation was only looking at the existing mapping and did not pick up additional areas not already captured in the mapping data.
- Generally the data was not spatially aligned to the aerial photography.
- Thin linear strips of treed vegetation were generally treated as non-woody and could not be accurately verified.
- Scattered trees and other woody treed areas that were open were classified as “UNKNOWN”. For example, *Allocasuarina verticillata* Low woodlands.
- Degraded or sandy mallee communities were not always easily detected in the imagery or classification and may be coded as “UNKNOWN”

## **5. RESULTS**

### **5.1 Classification**

The 2004 classification is presented in Figure 6. The amount that fell into each class for the project region is summarised in Table 9.

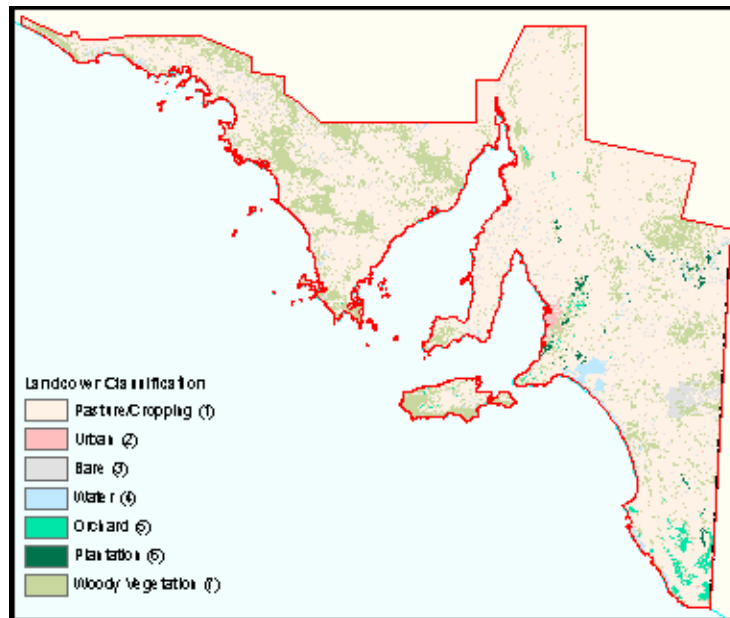


Figure 6. Classification for 2004 landsat imagery.

Table 9: Composition of classification classes for project area. Count represents each 25m by 25m pixel, which has been calculated to hectares (16 pixels to a hectare).

Class	Name	Count	Area hectares
1	Pasture	224,018,158	14,001,135
2	Urban	1,080,421	67,526
3	Bare	13,200,280	82,5018
4	Water	2,984,766	186,548
5	Plantation	2,635,186	164,699
6	Orchard	1,558,729	97,421
7	Woody vegetation	46,704,245	2,919,015
	<b>Total project area</b>		<b>18,261,362</b>

## 5.2 GIS Extent Data

The final mapping was coded into four types based on woody type and presence. Table 10 summarises the data for the State. The areas mapped as “UNKNOWN” were the non-woody component in the southern project region or those woody types that did not show a woody signature on the image and could not be verified. The area mapped as “NULL” is the native vegetation that was outside the project region. The mapping coded as “YES”, “UNKNOWN” and “NULL” is used to identify the native vegetation baseline extent for the specific year. The areas detected as “non woody not present” were based on existing imagery that identifies differences or visible signs of cropping in paddocks.

Table 10: Summary of the attribution for the native vegetation mapping data.

Type	1990		1995		2004	
	Number	Area	Number	Area	Number	Area
“YES”: woody present	99,719	5,243,538	99,805	5,241,196	99,725	5,238,887
“UNKNOWN”	37,154	22,820,621	37,156	22,820,725	37,047	22,816,986
NULL	27,814	56,480,228	27,814	56,480,228	27,814	56,480,228
<b>Total present</b>	<b>164,687</b>	<b>84,544,387</b>	<b>164,775</b>	<b>84,542,149</b>	<b>164,586</b>	<b>84,536,100</b>
“NO NW”: non woody not present	406	28,425	404	28,321	512	32,058
“NO”: woody not present	2,024	52,201	1,938	54,543	2,019	56,855
<b>Total cleared</b>	<b>2,430</b>	<b>80,626</b>	<b>2,342</b>	<b>82,865</b>	<b>2,531</b>	<b>88,913</b>

For 2004, 56,855 hectares of woody vegetation has been removed from the native vegetation cover in the agricultural region leaving 5,228,887 hectares of woody vegetation verified as present. However approximately 81% of the vegetation in the agricultural region is non-woody and can not be verified but is included as native vegetation cover. The mapping not included in the project is 67% of the native vegetation cover in South Australia. Similar results exist for 1990 and 1995. In comparison to the woody vegetation in Table 9, the area mapped as “YES”, woody present, is double the area classified from Landsat imagery; it does include some of the same areas as well as different areas on the ground.

### 5.2.1 Unknown data

A considerable area of vegetation that was mapped as woody by the vegetation mapping process has been classified as “UNKNOWN” (as mentioned above) due to open or low vegetation types or species with small canopy that are not detectable as “woody”. It was decided that they would remain part of the native vegetation but as they are hard to detect as woody they were treated and attributed like the non-woody component. Table 11 provides a list of the types mapped in this way. Not all the vegetation types listed are consistently mapped as “UNKNOWN” due a continuum in structure of the vegetation types mapped. There will be work in the future to determine whether these areas are appropriate for inclusion in a native vegetation dataset.

**Table 11: Summary of the woody vegetation types that have been coded as unknown.**

SA_VEG_ID1	Dominant stratum description	Area (Hectares)	Number of features
SE0007	<i>Eucalyptus fasciculosa</i> low woodland	2,962	335
EP0701	<i>Acacia papyrocarpa</i> low woodland	109,417	276
SE0018	<i>Eucalyptus camaldulensis</i> var. <i>camaldulensis</i> mid woodland	1,952	236
YP0805	<i>Melaleuca lanceolata</i> +/- <i>Allocasuarina verticillata</i> low woodland	1,364	232
EP0901	<i>Allocasuarina verticillata</i> low woodland	3,051	183
EP0501	<i>Casuarina pauper</i> low woodland	2,336	173
SE0012	<i>Eucalyptus arenacea/baxteri</i> mid woodland	1,840	169
RM1202	<i>Eucalyptus largiflorens</i> low woodland	581	129
EP0801	<i>Alectryon oleifolius</i> ssp. <i>canescens</i> low woodland	2,173	124
YP0801	<i>Melaleuca lanceolata</i> low woodland	644	119
SE0010	+/- <i>Eucalyptus obliqua</i> mid woodland	1,019	87
YP0802	<i>Melaleuca lanceolata</i> +/- <i>Allocasuarina verticillata</i> low woodland	589	82
RM0801	<i>Eucalyptus camaldulensis</i> var. <i>camaldulensis</i> mid woodland	461	81
RM0803	<i>Eucalyptus camaldulensis</i> var. <i>camaldulensis</i> mid woodland	180	73
WM8701	<i>Allocasuarina verticillata</i> low woodland	464	65
MN1503	<i>Allocasuarina verticillata</i> low woodland	337	62
SE0097	<i>Eucalyptus camaldulensis</i> var. <i>camaldulensis</i> , <i>Eucalyptus fasciculosa</i> , <i>Eucalyptus leucoxylon</i> ssp., <i>Eucalyptus arenacea/baxteri</i> mid woodland	383	58
RM0802	<i>Eucalyptus camaldulensis</i> var. <i>camaldulensis</i> low woodland	133	57
EP0502	<i>Acacia papyrocarpa</i> , <i>Casuarina pauper</i> low woodland	6,298	50
WM6601	<i>Allocasuarina verticillata</i> low woodland	304	43
MN2101	<i>Eucalyptus camaldulensis</i> var. +/- <i>Callitris glaucophylla</i> mid woodland	648	41
EP0401	<i>Callitris gracilis</i> low woodland	367	40
SE0086	<i>Melaleuca lanceolata</i> low woodland	281	39
WM6801	<i>Allocasuarina verticillata</i> +/- <i>Callitris gracilis</i> low woodland	314	37
MN0901	<i>Eucalyptus leucoxylon</i> ssp.+/- <i>Eucalyptus odorata</i> +/- <i>Amyema miquelii</i> mid woodland	102	33
EP0902	<i>Allocasuarina verticillata</i> low woodland	253	32
RM1002	<i>Eucalyptus camaldulensis</i> var. <i>camaldulensis</i> , <i>Eucalyptus largiflorens</i> mid woodland	177	29
YP0704	<i>Allocasuarina verticillata</i> +/- <i>Melaleuca lanceolata</i> +/- <i>Eucalyptus porosa</i> +/- <i>Santalum acuminatum</i> low woodland	143	27
MN0603	<i>Eucalyptus odorata</i> +/- <i>Eucalyptus leucoxylon</i> ssp.+/- <i>Callitris glaucophylla</i> low woodland	126	27

SA_VEG_ID1	Dominant stratum description	Area (Hectares)	Number of features
MM3801	Myoporum platycarpum ssp. low woodland	1,242	23
SM2403	Eucalyptus fasciculosa low woodland	181	20
MN2201	Acacia salicina+/-Eucalyptus camaldulensis var. low woodland	74	18
RM1101	Eucalyptus largiflorens+/-Eucalyptus camaldulensis var. camaldulensis mid woodland	116	18
MN0605	Eucalyptus odorata+/-Allocasuarina verticillata low woodland	30	18
SM1104	Eucalyptus camaldulensis var. camaldulensis, Eucalyptus leucoxyton ssp. mid woodland	529	17
FR0022	Callitris glaucophylla low woodland	2,516	16
EP1001	Callitris verrucosa+/-Eucalyptus incrassata+/-Eucalyptus leptophylla low woodland	164	16
MM0201	Casuarina pauper low woodland	292	16
RM0402	Eucalyptus largiflorens low woodland	97	16
RM1001	Eucalyptus camaldulensis var. camaldulensis, Eucalyptus largiflorens mid woodland	160	15
FR0003	Eucalyptus camaldulensis var.+/-Callitris glaucophylla mid woodland	798	13
SM2003	Eucalyptus fasciculosa, Eucalyptus leucoxyton ssp. mid woodland	108	13
SM1802	Eucalyptus odorata+/-Eucalyptus leucoxyton ssp. low woodland	224	13
SE0087	Allocasuarina luehmannii low woodland	49	12
YP0703	Allocasuarina verticillata low woodland	120	12
MN0306	Eucalyptus porosa+/-Eucalyptus odorata low woodland	27	12
MN1507	Allocasuarina verticillata+/-Eucalyptus odorata+/-Eucalyptus gracilis+/-Acacia pycnantha low woodland	48	11
WM1801	Eucalyptus baxteri+/-Eucalyptus leucoxyton ssp.+/-Allocasuarina verticillata low woodland	98	11
EP5201	Eucalyptus cladocalyx mid woodland	174	11
KI1902	Allocasuarina verticillata low woodland	43	10
SM1205	Eucalyptus camaldulensis var. camaldulensis low woodland	115	9
EP0301	Eucalyptus camaldulensis var. camaldulensis+/-Callitris gracilis mid woodland	59	9
RM0501	Eucalyptus largiflorens, Acacia stenophylla low woodland	92	9
RM0403	Eucalyptus largiflorens mid woodland	23	8
WM1401	Eucalyptus odorata low woodland	43	8
RM1301	Acacia stenophylla low woodland	76	7
RM1302	Acacia stenophylla low woodland	14	7
WM1501	Eucalyptus odorata+/-Eucalyptus porosa low woodland	33	7
RM1203	Eucalyptus largiflorens mid woodland	22	6
CT0046	Eucalyptus odorata low woodland	28	6
YP0701	Allocasuarina verticillata low woodland	27	5
KI0301	Eucalyptus arenacea/baxteri, Eucalyptus obliqua, Eucalyptus cosmophylla low woodland	428	5
SM2401	Eucalyptus fasciculosa low woodland	21	5
SE0088	Eucalyptus microcarpa mid woodland	33	5
SE0081	Eucalyptus ovata var., Eucalyptus viminalis ssp. mid woodland	38	5
MN1501	Allocasuarina verticillata low woodland	6	3
MM0101	Allocasuarina verticillata, Eucalyptus leucoxyton ssp.+/-Eucalyptus diversifolia ssp. diversifolia low woodland	7	3
MN1508	Allocasuarina verticillata+/-Melaleuca lanceolata low woodland	51	3
MN1801	Callitris glaucophylla low woodland	9	3
MN2706	Callitris gracilis low woodland	16	3
SP0007	Casuarina pauper+/-Alectryon oleifolius ssp. canescens+/-Myoporum platycarpum ssp. low woodland	809	3
SM1201	Eucalyptus camaldulensis var. camaldulensis mid woodland	38	3
SE0008	Eucalyptus leucoxyton ssp. low woodland	31	3
SM1001	Eucalyptus leucoxyton ssp. mid woodland	14	3
SM0802	Eucalyptus obliqua, Eucalyptus fasciculosa low woodland	6	3
SM2206	Acacia pycnantha+/-Allocasuarina verticillata+/-Banksia marginata low woodland	3	2
RM1303	Acacia stenophylla low woodland	15	2
SM2201	Allocasuarina verticillata low woodland	6	2
SM2207	Allocasuarina verticillata low woodland	5	2
OS0005	Avicennia marina ssp. marina low woodland	2	2

SA_VEG_ID1	Dominant stratum description	Area (Hectares)	Number of features
MN3303	Casuarina pauper, Myoporum platycarpum ssp. low woodland	8	2
MM0301	Eucalyptus arenacea low woodland	2	2
KI0302	Eucalyptus arenacea/baxteri+/-Eucalyptus obliqua+/-Eucalyptus cladocalyx+/-Eucalyptus cosmophylla low woodland	1	2
SM0203	Eucalyptus baxteri, Eucalyptus obliqua, Eucalyptus fasciculosa mid woodland	5	2
SM1206	Eucalyptus camaldulensis var. camaldulensis mid woodland	5	2
SP0014	Eucalyptus camaldulensis var.+/-Eucalyptus largiflorens low woodland	1,436	2
SM2601	Eucalyptus cosmophylla mid woodland	2	2
SM2303	Eucalyptus fasciculosa, Allocasuarina verticillata low woodland	8	2
SE0079	Eucalyptus largiflorens mid woodland	13	2
SM1301	Eucalyptus leucoxyton ssp., Eucalyptus viminalis ssp. cygnetensis mid woodland	6	2
MN0401	Eucalyptus microcarpa+/-Allocasuarina verticillata low woodland	9	2
MN0602	Eucalyptus odorata mid woodland	25	2
SM3601	Melaleuca lanceolata low woodland	7	2
SE0084	Allocasuarina verticillata low woodland	1	1
YP0201	Callitris gracilis mid woodland	13	1
SM0706	Callitris gracilis, Eucalyptus camaldulensis var. camaldulensis mid woodland	16	1
MN2702	Callitris gracilis, Eucalyptus odorata+/-Eucalyptus porosa low woodland	4	1
SM0404	Eucalyptus baxteri, Eucalyptus cosmophylla, Eucalyptus fasciculosa low woodland	5	1
RM0202	Eucalyptus camaldulensis var. camaldulensis, Eucalyptus largiflorens mid woodland	8	1
KI1702	Eucalyptus camaldulensis var. camaldulensis, Eucalyptus leucoxyton ssp. leucoxyton, Eucalyptus fasciculosa, Eucalyptus cladocalyx+/-Eucalyptus viminalis ssp. cygnetensis mid woodland	6	1
KI0504	Eucalyptus cladocalyx, Eucalyptus fasciculosa mid woodland	4	1
SM2402	Eucalyptus fasciculosa low woodland	11	1
SM2102	Eucalyptus goniocalyx ssp. goniocalyx, Eucalyptus fasciculosa low woodland	1	1
MN0905	Eucalyptus leucoxyton ssp.+/-Eucalyptus odorata low woodland	6	1
MN3901	Eucalyptus macrorhyncha ssp. macrorhyncha low woodland	1	1
SM2702	Eucalyptus obliqua, Eucalyptus cosmophylla low woodland	3	1
SM0902	Eucalyptus obliqua, Eucalyptus goniocalyx ssp. goniocalyx low woodland	1	1
MN0606	Eucalyptus odorata, Allocasuarina verticillata+/-Eucalyptus leucoxyton ssp.+/-Eucalyptus camaldulensis var. low woodland	7	1
SM1601	Eucalyptus viminalis ssp. cygnetensis+/-Eucalyptus obliqua mid woodland	6	1
SM1701	Eucalyptus viminalis ssp. viminalis+/-Eucalyptus viminalis ssp. cygnetensis+/-Eucalyptus dalrympleana ssp. dalrympleana mid woodland	1	1
KI2303	Melaleuca halmaturorum low woodland	3	1

### 5.2.2 Percent woody

The percent woody data in WOODYPC YEAR fields that have been attributed across the project region is currently incomplete. This data will provide future awareness of the amount of each feature that was classified as woody classified and used to inform the validation process. Only the later scenes had the data updated with percent. Due to spatial re-alignment and cutting of features the data will be updated again for the entire project region.

### 5.3 Dataset comparison

The woody vegetation in the raster analysis was compared to the woody component of the native vegetation mapping data to determine if gaps existed in the vector mapping. The analysis was

undertaken to highlight significant areas that might have been missed from the mapping. Significant was defined as continuous areas greater than 10 hectares and used to filter out noise in the classification that would not be considered mappable.

Table 16 is a preliminary comparison of the data by NRM region for woody classified from Landsat imagery but not mapped in the native vegetation mapping data. The classification detected approximately 22,890 hectares of woody vegetation that was greater than 10 hectares and not included in the mapping. This is where more work could be undertaken to re-assess the SA baseline. This does not indicate that there is 22,890 hectares of native vegetation currently unmapped in the data. The table highlights the composition of the differences based on a preliminary comparison using aerial photography. Verification work would still need to be undertaken to evaluate the appropriateness of these areas before they would be included. For example, wet paddocks and planted vegetation are included as they have a similar signature in the landsat imagery as woody native vegetation.

**Table 16: Summary of the area differences between the classification and the native vegetation mapping data.**

<b>NRM Region</b>	<b>Area native (HA)</b>	<b>Comments on common composition</b>
Adelaide and Mount Lofty Ranges	7070	Includes planted vegetation, vegetation in urban areas and in paddocks
Alinytjara Wilurara	NA	
Eyre Peninsula	4410	Includes wet paddocks
Kangaroo Island	2360	Linear roadside vegetation, regrowth and planted vegetation
Northern and Yorke	1010	Includes wet non-woody vegetation or paddocks
SA Arid Lands	NA	
SA Murray Darling Basin	4910	Area of native vegetation, regrowth
South East (SA)	3120	Includes wet non woody vegetation, planted vegetation
<b>Total</b>	<b>22890</b>	

## 5.4 Extent Statistics

For the national collation of a 2004 baseline, area statistics have been created for:

- IBRA regions (version 6.1)
- IBRA subregions (version 6.1)
- NRM regions
- State boundary

Statistics for all regions are shown in Table 12, 13, 14 and 15, respectively. Delivery of the data as web feature services is through ESRI's ArcIMS using the data specifications supplied by the NLWRA.

**Table 12: Summary Statistics for Interim Vegetation Extent in IBRA regions for SA.**

<b>Region</b>	<b>Region Code</b>	<b>Vegetation Area (Hectares)</b>
Broken Hill Complex	BHC	1,874,408
Channel Country	CHC	5,314,072
Central Ranges	CR	2,846,681
Eyre Yorke Block	EYB	1,939,472
Finke	FIN	1,961,832
Flinders Lofty Block	FLB	5,610,729
Gawler	GAW	10,950,543
Great Victoria Desert	GVD	19,961,802
Hampton	HAM	44,530
Kanmantoo	KAN	254,427

Murray Darling Depression	MDD	2,842,966
Naracoorte Coastal Plain	NCP	314,207
Nullarbor	NUL	5,942,062
Riverina	RIV	100,720
Simpson Strzelecki Dunefields	SSD	11,398,213
Stony Plains	STP	13,155,132
Victorian Volcanic Plain	VVP	3,819

**Table 13: Summary Statistics for Interim Vegetation Extent in IBRA subregions for SA.**

<b>Subregion</b>	<b>Subregion Code</b>	<b>Vegetation Area (Hectares)</b>
Barrier Range	BHC1	1087,688
Barrier Range Outwash	BHC4	786,721
Sturt Stony Desert	CHC2	2318,206
Diamantina-Eyre	CHC4	850,841
Coongie	CHC6	2,074,382
Lake Pure	CHC7	70,642
Mann-Musgrave Block	CR1	1,902,760
Wataru	CR2	424,118
Everard Block	CR3	519,803
Southern Yorke	EYB1	79,347
St Vincent	EYB2	97,625
Eyre Hills	EYB3	342,916
Talia	EYB4	604,614
Eyre Mallee	EYB5	814,971
Tieyon, Finke P3	FIN3	1,115,187
Pedirka	FIN4	846,645
Mount Lofty Ranges	FLB1	46,420
Broughton	FLB2	105,753
Olary Spur	FLB3	1,973,208
Southern Flinders	FLB4	1,802,137
Northern Flinders	FLB5	1,683,211
Myall Plains	GAW1	941,674
Gawler Volcanics	GAW2	1,746,437
Gawler Lakes	GAW3	2,184,487
Arcoona Plateau	GAW4	1,161,403
Kingoonya	GAW5	4,916,542
Eastern, Maralinga	GVD3	7,478,068
Kintore	GVD4	4,380,217
Tallaringa	GVD5	3,646,280
Yellabinna	GVD6	4,457,236
Hampton	HAM	44,530
Kangaroo Island	KAN1	209,065
Fleurieu	KAN2	45,362
South Olary Plain, Murray Basin Sands	MDD1	1,847,962
Murray Mallee	MDD2	463,937
Murray Lakes and Coorong	MDD3	35,643
Lowan Mallee	MDD4	488,660
Wimmera	MDD5	6,764
Bridgewater	NCP1	64,042

Glenelg Plain	NCP2	18,486
Lucindale	NCP3	95,546
Tintinara	NCP4	136,133
Northern band, Carlisle	NUL1	720,361
Central band, Nullabor Plain	NUL2	4,095,771
Yalata	NUL3	1,125,929
Murray Scroll Belt	RIV6	100,720
Simpson Desert	SSD2	2,186,264
Dieri	SSD3	3,526,726
Warriner	SSD4	926,707
Strzelecki Desert, Western Dunefields	SSD5	4,758,515
Breakaways, Stony Plains	STP1	4,362,197
Oodnadatta	STP2	4,581,093
Murnpeowie	STP3	2,946,544
Peake-Dennison Inlier	STP4	256,293
Macumba	STP5	1,009,006
Mount Gambier	VVP2	3,819

**Table 14: Summary Statistics for Interim Vegetation Extent in NRM regions for SA.**

<b>NRM</b>	<b>Vegetation Area (Hectares)</b>
Adelaide and Mount Lofty Ranges	74,239
Alinytjara Wilurara	28,095,357
Eyre Peninsula	2,333,277
Kangaroo Island	209,104
Northern and Yorke	1,156,825
SA Arid Lands	48,953,224
SA Murray Darling Basin	3,050,167
South East (SA)	551,514

**Table 15: Summary Statistics for Interim Vegetation Extent in SA .**

<b>Region</b>	<b>Vegetation Area (Hectares)</b>
South Australia	84,416,131

## 6. SUMMARY

In summary the delivery of the statistics for South Australia for the 2004 national baseline will be through Web Feature Services using ESRI products as defined with the NLWRA. The mapping will be delivered using a Web Map Service. If the web services are not accessible the data will be supplied.

The mapping will be delivered for South Australian usage as five layers:

- Native Vegetation Cover 1990
- Native Vegetation Cover 1995
- Native Vegetation Cover 2004
- SA Vegetation Type 2004
- Structural Vegetation Classes 2004

This project has improved the native vegetation cover data by detecting 52,201, 54,543 and 56,855 hectares of woody vegetation clearance for 1990, 1995 and 2004 respectively. The process has improved the data but more work is needed to address the areas not included. The non-woody components need to be assessed to determine their appropriateness in the mapping.

## 7. REFERENCES

Barson, M. M. and Kitchin, M. (1996). Remote Sensing of Agricultural Land Cover for the Australian Continent. *Proceedings of the 8<sup>th</sup> Australasian Remote Sensing Conference, Canberra, Australia*, Vol 2:122-127.

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