Establishing an interim national baseline 2004 to assess change in native vegetation extent

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Executive summary

The interim native vegetation extent dataset (AusVeg 2004) has been compiled from datasets supplied by state and territory agencies.

The interim AusVeg 2004 dataset shows that the extent of native vegetation in 2004 was 88 per cent of the land area of Australia or 676 million hectares. There are limitations in deriving accurate native vegetation extent estimates from state and territory datasets. Estimates are also affected by varying methods and standards for describing and mapping native vegetation, along with variations in surveys, classifications and differing scales.

Agricultural development has changed large areas of southern and eastern Australian landscapes from perennial native vegetation to crops, improved pastures and horticulture. This has resulted in the production of food and fibre and the fragmentation of native forests, losses of habitat for rare and threatened species, soil degradation, increased dryland salinity, decreased water and air quality. These impacts highlight the need for timely and accurate national reporting on native vegetation extent, enabling government, industry groups and the wider community to make informed decisions on native vegetation management.

Previous attempts to report on the extent of Australia’s native vegetation have focussed on particular needs such as describing and mapping the uses of native vegetation (i.e. land use) for assessing human health and well being. Another focus has been on mapping structurally intact native vegetation communities (i.e. ecological integrity) for assigning priorities for biodiversity conservation. The National Natural Resources Management Monitoring and Evaluation Framework reporting processes, as well as other jurisdictional policies and programs, have identified a need for an agreed native vegetation baseline for monitoring and reporting of native vegetation extent changes.

Different national estimates of the extent of Australia’s native vegetation have been derived using vegetation related datasets. Native vegetation extent estimates may be derived from many sources including vegetation type mapping, land use type mapping and the integration of vegetation and land use type mapping. These produce different estimates.

Work is needed to overcome inconsistencies along some of the state and territory borders. Additional work is required to develop a nationally agreed definition for native vegetation, as well as standardised methods for describing, mapping and reporting native vegetation clearing. Accurate estimates of the native vegetation baseline extent will make it possible to provide high quality assessments for reporting on the location of native vegetation types, their extent and condition in national reports such as the State of the Environment and State of the Forests.

Accurate information on vegetation extent and condition is required to enable improved priority setting, more targeted investment and measurable performance across activities including sustainable farming practices, revegetation to repair and maintain ecological resilience and the enhancement of remnant native vegetation for habitat protection.
### Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>AAC</td>
<td>Audit Advisory Council</td>
</tr>
<tr>
<td>DAFF</td>
<td>Australian Government Department of Agriculture, Fisheries and Forestry</td>
</tr>
<tr>
<td>DEWHA</td>
<td>Australian Government Department of the Environment, Water, Heritage and the Arts</td>
</tr>
<tr>
<td>AGNRM</td>
<td>Australian Government Natural Resource Management</td>
</tr>
<tr>
<td>ARO</td>
<td>Australia’s Resources On-line</td>
</tr>
<tr>
<td>AUSLIG</td>
<td>Australian Surveying and Mapping Group</td>
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<tr>
<td>BRS</td>
<td>Bureau of Rural Sciences</td>
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<tr>
<td>CMA</td>
<td>Catchment Management Authority</td>
</tr>
<tr>
<td>DAFWA</td>
<td>Department of Agriculture and Food Western Australia</td>
</tr>
<tr>
<td>DECC</td>
<td>NSW Department of Environment and Climate Change</td>
</tr>
<tr>
<td>DPIW Tas</td>
<td>Tasmanian Department of Primary Industries and Water</td>
</tr>
<tr>
<td>DEH</td>
<td>South Australian Department of Environment and Heritage</td>
</tr>
<tr>
<td>DERM</td>
<td>Queensland Department of Environment and Resource Management</td>
</tr>
<tr>
<td>DSE</td>
<td>Victorian Department of Sustainability and Environment</td>
</tr>
<tr>
<td>ELZ</td>
<td>Extensive Land Use Zone</td>
</tr>
<tr>
<td>ESCAVI</td>
<td>Executive Steering Committee for Australian Vegetation Information</td>
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<tr>
<td>FPC</td>
<td>Foliage Projective Cover</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographic Information System</td>
</tr>
<tr>
<td>IBRA</td>
<td>Interim Biogeographic Regionalisation for Australia</td>
</tr>
<tr>
<td>ILZ</td>
<td>Intensive Land Use Zone</td>
</tr>
<tr>
<td>Landsat TM</td>
<td>Landsat Thematic Mapper</td>
</tr>
<tr>
<td>LUMP</td>
<td>Land Use Mapping Project</td>
</tr>
<tr>
<td>MVEP</td>
<td>Monitoring Vegetation Extent Project</td>
</tr>
<tr>
<td>NCC</td>
<td>National Coordinating Committee</td>
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<tr>
<td>NDVI</td>
<td>Normalised Difference Vegetation Index</td>
</tr>
<tr>
<td>NLWRA</td>
<td>National Land and Water Resources Audit</td>
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<tr>
<td>NM&amp;EF</td>
<td>National Natural Resource Management Monitoring and Evaluation Framework</td>
</tr>
<tr>
<td>NRETAS</td>
<td>Northern Territory Department of Natural Resources, Environment, the Arts and Sport</td>
</tr>
<tr>
<td>NVIS</td>
<td>National Vegetation Information System</td>
</tr>
<tr>
<td>SLATS</td>
<td>Statewide Landcover and Trees Study</td>
</tr>
<tr>
<td>TASVEG</td>
<td>Tasmanian Vegetation</td>
</tr>
<tr>
<td>WFS</td>
<td>Web Feature Service</td>
</tr>
<tr>
<td>WMS</td>
<td>Web Map Service</td>
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<tr>
<td>DAF</td>
<td>Western Australian Department of Agriculture and Food</td>
</tr>
</tbody>
</table>
Introduction

Large areas of native vegetation have been modified, replaced or removed since the late 1700s to meet changing social-ecological needs and aspirations of European settlement in Australia (Walker et al. 2006). The need for information about the type, extent and change and condition of Australia’s native vegetation has been identified in numerous national, state, territory and regional reporting processes. These include the State of the Forests, State of the Environment and National Natural Resource Management Monitoring and Evaluation Framework. Vegetation information is also important for other national, state, territory and regional policies and programs. To date, despite these requirements there is no agreed consistent national approach to monitoring and reporting mapped information on the extent and changes in Australia’s native vegetation.

Australia does not have an agreed national definition for ‘native vegetation’ or a standard method for describing and mapping the extent of native vegetative cover. Responsibility for collecting and classifying native vegetation has generally rested with the states and territories. During the 1970s through to the 1980s national coordination for the development of standards and guidelines including definitions was largely the domain of CSIRO and the Australian Government’s Australian Biological Resources Study (ABRS). In the mid 1980s the ABRS proposed a national definition as part of the guidelines for the ABRS vegetation mapping program (R Hnatiuk [Bonsai] pers. comm., 2 March 2009). However, the guidelines were not agreed and implemented by all state and territory agencies.

In the 1980s and 1990s responsibility for developing vegetation standards and guidelines moved away from CSIRO and the ABRS program to state and territory governments. The Australian Government departments responsible for environment, forestry and agriculture provide national coordination, including the sponsorship for national datasets, that is, the National Forest Inventory and the National Vegetation Information System (Thackway 2007). At the same time two national steering committees—National Forest Inventory (NFI) and Executive Committee for Australian Vegetation Information (ESCAVI) were established to provide forums for developing nationally consistent approaches. This brief history is presented in Table 1.

Table 1. National coordination arrangements for Australia’s vegetation information

<table>
<thead>
<tr>
<th>Themes</th>
<th>1960s to 1970s</th>
<th>1980s</th>
<th>1990s to present</th>
</tr>
</thead>
<tbody>
<tr>
<td>Datasets</td>
<td>ABRS(^1)</td>
<td>ABRS, AUSLIG(^2)</td>
<td>National Forest Inventory, National Vegetation Information System</td>
</tr>
<tr>
<td>Guidelines for survey, classification and mapping</td>
<td>CSIRO and ABRS</td>
<td>CSIRO, ABRS, states and territories</td>
<td>Australian Government, states and territories, NFISC(^3), ESCAVI(^4)</td>
</tr>
<tr>
<td>Mapping Programs</td>
<td>CSIRO and ABRS</td>
<td>ABRS, AUSLIG, states and territories</td>
<td>Australian Government, states and territories, and regional bodies</td>
</tr>
<tr>
<td>Data Custodian</td>
<td>CSIRO and ABRS</td>
<td>CSIRO, ABRS, AUSLIG, states and territories</td>
<td>Australian Government, states and territories, and regional bodies</td>
</tr>
<tr>
<td>Lead Agency/ies</td>
<td>CSIRO and ABRS</td>
<td>ABRS, AUSLIG, states and territories</td>
<td>Australian Government, states and territories, NFISC, ESCAVI</td>
</tr>
</tbody>
</table>

\(^1\)Australian Biological Resources Study  
\(^2\)Australian Surveying Land and Information Group  
\(^3\)National Forest Inventory Steering Committee  
\(^4\)Executive Steering Committee for Australian Vegetation Information

Based on Thackway (2007)
In short, compilation of national forests and vegetation datasets relies on datasets developed and supplied by the state and territory agencies. These datasets have been developed to meet state definitions of native vegetation and state reporting requirements, which may not always completely satisfy national reporting needs.

There are three aspects to vegetation change: extent (i.e. change in cover across the landscape), type (i.e. change in species associations), and condition (i.e. change in characteristics of a vegetation type) (NLWRA 2007). This report explores the development of an agreed approach to monitoring change in vegetation extent.

National monitoring of the change in extent of native vegetation requires a ‘baseline’ i.e. that the extent at a particular time (e.g. 2004) be defined and changes be consistently measured relative to that baseline. This requires agreement on the definition of native vegetation and standards for assessing and reporting available native vegetation maps and datasets.

Establishment of targets and assessment of progress towards them is not possible without the establishment of a baseline against which to measure. Processes for establishing authoritative baselines and implementing monitoring systems for regular evaluation and reporting of progress need to be determined. National consistency in reporting resource condition and trend is required to allow comprehensive statements on the health of the nation’s land, water and biodiversity resources and to allow evaluation of the effectiveness of current and future investment programs.

Three approaches have been used to derive estimates of the extent of native vegetation using published vegetation-related datasets including vegetation or land use ‘type’ maps or a combination of both. As can be expected, these sources generate different estimates of the extent of native vegetation. Table 2 compares three approaches that have been used to derive estimates of the area of Australia’s native vegetation extent:

1. vegetation type mapping
2. land use type mapping
3. the integration of vegetation and land use type mapping.

<table>
<thead>
<tr>
<th>State</th>
<th>Extent derived from DEWHA 2006</th>
<th>Extent derived from BRS circa 2000–01</th>
<th>Extent derived from BRS circa 2003</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Area (ha)</td>
<td>Proportion %</td>
<td>Area (ha)</td>
</tr>
<tr>
<td>ACT</td>
<td>125 744</td>
<td>53</td>
<td>159 913</td>
</tr>
<tr>
<td>NSW</td>
<td>53 670 622</td>
<td>67</td>
<td>64 930 524</td>
</tr>
<tr>
<td>NT</td>
<td>133 425 199</td>
<td>99</td>
<td>132 663 262</td>
</tr>
<tr>
<td>Qld</td>
<td>141 406 254</td>
<td>82</td>
<td>162 959 977</td>
</tr>
<tr>
<td>SA</td>
<td>84 483 326</td>
<td>86</td>
<td>87 311 214</td>
</tr>
<tr>
<td>Tas.</td>
<td>5 058 795</td>
<td>74</td>
<td>5 369 389</td>
</tr>
<tr>
<td>Vic.</td>
<td>8 460 257</td>
<td>37</td>
<td>13 095 628</td>
</tr>
<tr>
<td>WA</td>
<td>229 632 168</td>
<td>91</td>
<td>234 110 307</td>
</tr>
<tr>
<td>Total</td>
<td>656 262 365</td>
<td>85.3</td>
<td>700 600 214</td>
</tr>
</tbody>
</table>

Note: Percentages are based on the land area of each state or territory.

1 vegetation type mapping from the National Vegetation Information System
2 land use type mapping from the National Land Use Dataset
3 integration of vegetation and land use type mapping from the Integrated Vegetation Information

Establishing an interim national baseline 2004 to assess change in native vegetation extent 2
The first approach derives vegetation extent from mapping of native major vegetation groups, a subsidiary of the National Vegetation Information System (DEWR 2007). This mapping is a national collation of different scales and time periods. Mapped hectare areas were calculated as a percentage of the land area of the state or territory, including islands within their jurisdiction, for example Jervis Bay was included with NSW. This approach determined the extent of Australia’s native vegetation to be approximately 85 per cent.

The second approach uses land use type mapping that is a reinterpretation of the 1:1 000 000 scale national land use dataset (Bureau of Rural Sciences 2006). This method infers the native vegetation extent by summing the extent of non-native vegetation and non-vegetation (8.8 per cent) and subtracting that estimate from the total area of Australia for each jurisdiction. This showed that 91.2 per cent of Australia could be reported as native vegetation (DAFF 2008).

The third approach integrates vegetation and land use type mapping using the National Vegetation Information System (NVIS) framework (Thackway et al. 2004), which uses data on all vegetation (native and non-native), naturally bare ground and land where the vegetation has been removed. Vegetation data was reinterpreted and collated from six national datasets: Agricultural Land Cover Change; Forests of Australia 2003; 1996–97 Land Use of Australia Version 2; National Land and Water Resources Audit (NLWRA 2001); Land Use Mapping at the Catchment Scale; and National Vegetation Information System 2000. This vegetation information is published in the Bureau’s Integrated Vegetation On-Line (http://adl.brs.gov.au/mapserv/intveg/index.html). This method showed that native vegetation covered 83 per cent of Australia.

The wide range of estimates demonstrates the difficulty in making comprehensive, consistent and regular statements regarding the extent of Australian native vegetation and highlights the need for an agreed definition of ‘native vegetation’ and consistent method/s for classifying it across Australia. The National Land & Water Resources Audit and the Bureau of Rural Sciences Land and Forest Sciences Program, implemented a project to describe and map Australia’s native vegetation extent and to establish an interim vegetation extent baseline for 2004. The project was supported by Australian state governments through the Executive Steering Committee for Australian Vegetation Information (ESCAVI).

A set of national vegetation indicators was developed under the National Natural Resource Monitoring and Evaluation Framework (NM&EF) (Table 3) to guide monitoring and reporting (NLWRA 2007). While the primary focus of this project brief and forthcoming state projects addressed information products for indicator 1 under the NM&EF, ESCAVI views these four indicators as part of a continuum of vegetation and land cover information which may be required for a full assessment of vegetation in the landscape.

Table 3. Set of indicators under National Natural Resource Management Monitoring and Evaluation Framework (NM&EF)

<table>
<thead>
<tr>
<th>The matter for target:</th>
<th>Native Vegetation Communities’ Integrity</th>
</tr>
</thead>
<tbody>
<tr>
<td>The indicator headings:</td>
<td>• Native vegetation extent and distribution</td>
</tr>
<tr>
<td></td>
<td>• Native vegetation condition</td>
</tr>
<tr>
<td>The indicators:</td>
<td>1. The extent of each present native vegetation type by IBRA(^1) subregion measured in hectares.</td>
</tr>
<tr>
<td></td>
<td>2. The extent of each priority native vegetation type by IBRA subregion measured in hectares.</td>
</tr>
<tr>
<td></td>
<td>3. The proportion remaining of each native vegetation type by IBRA subregion measured as a percentage of the estimated pre-European extent.</td>
</tr>
<tr>
<td></td>
<td>4. The proportion of each native vegetation type in each IBRA subregion that is estimated to be in specified condition classes based on a selected set of attributes.</td>
</tr>
</tbody>
</table>

\(^1\)Interim Biogeographic Regionalisation for Australia
Initial discussions with ESCAVI members regarding the capacity to report against indicator 1, suggest that existing vegetation mapping and inventory databases (including the nationally collated NVIS database) are not suitable. This relates mainly to the databases reflecting current knowledge of vegetation resources. As such temporal comparisons between collations show changes in the information base rather than real on-ground changes to native vegetation.

A baseline of native vegetation extent and distribution is essential for both setting and measuring progress towards regional targets. At the time this project was commenced Queensland was the only jurisdiction that had a native vegetation extent monitoring and reporting system in place.

In this report we outline a method for estimating the national extent of native vegetation as a baseline, and the issues associated with measuring changes relative to that baseline. We discuss issues of accuracy of estimates that arise when compiling datasets that were developed to meet state and territory legislative and administrative arrangements. The relative merits of the approach compared to the previously available post hoc approaches that were based on deriving the extent of native vegetation from maps of native vegetation communities (only structurally intact native vegetation in some jurisdictions), land use or integrated land use/vegetation are investigated.
Method

Each jurisdiction implemented a project to provide the Australian Government with information on the extent of native vegetation using the following project specification developed by the NLWRA and BRS.

1. Identify the current status of native vegetation extent mapping in the jurisdiction.
2. Determine an appropriate method for updating existing mapping information to an extent baseline for around June 2004.
3. Determine a process for reassessing the native vegetation extent at time intervals appropriate to reporting against the indicator—including initially for June 2006.
4. Develop a project brief and work plan of specific tasks and activities which will allow publication of agreed native vegetation baseline extent and distribution products and national collation and reporting by the Audit in June 2007.
5. Consider issues associated with, and implement, web service based publication of baseline extent and distribution products to agreed schema specifications for access by the Audit’s Australia’s Resources Online application.
6. Determine data access and licensing requirements for use of baseline data and products by a wide range of potential users including the Australian Government and regional natural resource management authorities; also include consideration of agreement requirements for access to web based services.
7. Give consideration to projects and resources required to provide indicator products that address the extent of priority native vegetation type indicator.

Definition of ‘native vegetation’

At the commencement of the project, NLWRA and BRS accepted that each state and territory would undertake native vegetation extent projects that would be consistent with their own jurisdiction’s legislated definition of native vegetation and that these definitions would lead to inconsistencies when compiling the final national extent baseline. New South Wales (NSW) undertook the project on behalf of the Australian Capital Territory (ACT). While there may be definitions of native vegetation used for specific projects and data gathering, for example the National Forest Inventory, NLWRA and Native Vegetation Information Systems, some states and territories have specific definitions of native vegetation to satisfy requirements within particular legislation, whilst some jurisdictions do not define native vegetation. The primary driver for defining native vegetation has been to regulate the clearing of vegetation, increase or maintain biodiversity, manage protected areas, and manage the commercial harvesting of native vegetation (for the purposes of grazing or harvesting) amongst other rationale. The information contained in Table 4 was compiled from web sources. These legislative mechanisms provide the basis for state and territory native vegetation mapping programs which have contributed spatial data used in this report. It should be noted that there is no definition of ‘native vegetation’ at the national level that can be used by all states and territories in lieu of their own legislation. The Commonwealth’s Environment Protection and Biodiversity Conservation Act 1999 relates to ecological communities and does not provide a definition of native vegetation.

State and territory methods

This section synthesises information provided by the states and territories on how they derived their respective 2004 native vegetation extent baselines. Coverage of the continent was complete for each reporting state, except South Australia (SA), which only reported for the southern-most regions that are in the intensive land use zone where agriculture (apart from primarily grazing uses) occurs. It was assumed that native vegetation had not been removed from the rangelands.
New South Wales and ACT

The NSW and ACT native vegetation extent 2004 dataset was derived by combining defined woody and non-woody vegetation extent using an interim map of foliage projected cover (FPC), and the defined vegetation nativeness based on the NSW and ACT’s Land Use Mapping Program (DECC 2008).

In the first dataset, vegetation was separated into either woody or non-woody using the Statewide Landcover and Trees Study (SLATS) method (Dept NRW 2008) which had recently been applied to NSW. SLATS uses Landsat Thematic Mapper (TM) and Enhanced Thematic Mapper (ETM) data to produce vegetation change data. The intermediate FPC data layers were used as indicators of woody and non-woody presence and extent. The interim FPC product used by NSW was derived from a four epoch Foliage Projective Cover (FPC) predicted from state wide Landsat layers centred on mid-summer 2000, 2002, 2004 and 2006. Water bodies were removed from the vegetation extent dataset.

The classification of the vegetation into either native or exotic (referred to here as non-native) was based on available land use data sourced from DECC’s draft NSW Land Use Mapping Program. These data were derived from various sources over a number of years, covering individual map tiles of varying scales. These data required merging into a state wide dataset.

The native vegetation extent layer was created by combining the derived woody/non-woody extent and nativeness datasets using simple raster modelling in ArcGIS Spatial Analyst. This allowed the FPC derived vegetation extent layer to be attributed as native or non-native. Note that these grids did not represent vegetation extent; they defined where in the landscape vegetation could be attributed for nativeness, if found to be present at a site through an independent extent mapping exercise. The FPC derived vegetation extent data was used to fill in the unclassified pixels in the land use data coverage.

Northern Territory

The Northern Territory (NT) native vegetation extent 2004 dataset was derived from several datasets intersected to mask non-native areas. The datasets used for NT Native Vegetation Extent baseline-Version 1 included: Native Vegetation Clearing Dataset, NVIS V3 vegetation mapping and LUMP—Land Use Mapping Project of the NT, 2003 (NRETA 2008). Each of the datasets was mapped at various scales to suit their purpose.

Multiple datasets were used to derive the Native Vegetation Clearing coverage. These included pastoral land records 1992 and BRS data 1990–95. Clearing was defined as all areas where ‘native’ vegetation has undergone any land cover change due to removal by mechanical or chemical means, but not including the removal of vegetation by grazing animals. The original source of the data is satellite imagery, derived from 25 m and 50 m Landsat data, which equates to an on-ground scale of 1:100 000. The mapped clearing-dataset was derived by a number of band ratios (including NDVI and difference imaging) that highlights cleared lands. The rest of the Territory is updated every two years with the data provided from the National Carbon Accounting System dataset (Department of Climate Change 2008).

The NVIS V3 vegetation dataset for the NT is a composite of a number of vegetation and land unit survey maps that were recoded and re-attributed for the NVIS (NLWRA 2001).

The LUMP of NT (2003) maps the peri-urban intensive agricultural and urban zones around Darwin, Katherine and Alice Springs (mapping scale 1:25 000), the Northern Agricultural Zone mostly comprising the Katherine – Daly Region (mapping scale 1:100 000); whilst the pastoral zone and the remainder of the NT (mapping scale 1:250 000). The LUMP-2003 dataset does not define areas of native versus non-native vegetation as per this project. The final map of native vegetation extent 2004 used limited on-ground checking. Consequently it cannot be expected that all areas within the dataset correspond with the above ‘native vegetation’ definition and the extent and location of this problem could not be mapped.
### Table 4. State and territory legislative definitions of ‘native vegetation’

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Legislation</th>
<th>Definition of native vegetation</th>
</tr>
</thead>
</table>
| Commonwealth | Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act 1999) | The EPBC Act 1999 uses the phrase *ecological communities* instead of native vegetation and defines *ecological communities* as the extent in nature in the Australian jurisdiction of an assemblage of native species that:
1. inhabits a particular area in nature
2. meets the additional criteria specified in the regulations (if any) made for the purposes of this definition.’
This Act is the Commonwealth mechanism for national biodiversity conservation and environment protection. |
| ACT | Nature Conservation Act 1980 | *Native vegetation*, in relation to an area, means any of the following kinds of vegetation indigenous to the area:
1. trees
2. understorey plants
3. groundcover consisting of any kind of grass or herbaceous vegetation
4. plants occurring in a wetland or stream. |
| NSW | Native Vegetation Act 2003 | For the purposes of this Act, *native vegetation* means any of the following types of indigenous vegetation:
1. trees (including any sapling or shrub, or any scrub)
2. understorey plants
3. groundcover (being any type of herbaceous vegetation)
4. plants occurring in a wetland.
Vegetation is ‘indigenous’ if it is of a species of vegetation, or if it comprises species of vegetation, that existed in the state before European settlement.
For the purposes of this Act, ‘native vegetation’ does not include any mangroves, seagrasses or any other type of marine vegetation to which section 205 of the Fisheries Management Act 1994 applies. |
| NT | Territory Parks and Wildlife Conservation Act 2001 refers to indigenous plants. | *Indigenous to Australia*, in relation to animals or plants, includes:
1. migratory animals that periodically or occasionally migrate to or visit Australia or the coastal waters of Australia
2. animals or plants introduced into Australia (including the coastal waters of Australia), directly or indirectly, by Aboriginals before the year 1788.
*Indigenous to the Territory*, in relation to animals or plants, includes:
1. migratory animals that periodically or occasionally visit the Territory or the coastal waters within the jurisdictional limits of the Territory
2. animals or plants introduced into the Territory (including the coastal waters of the Territory), directly or indirectly, by Aboriginals before the year 1788. |

1 Underlining is used to denote the words from the respective legislation in each jurisdiction

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6
<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Legislation</th>
<th>Definition of native vegetation¹</th>
</tr>
</thead>
</table>
| Qld          | Vegetation Management Act 1999, Land Act 1994 and Integrated Planning Act 1997 | There is no definition of native vegetation in Queensland legislation. Vegetation is a native tree or plant other than the following:  
1. grass or non-woody herbage  
2. a plant within a grassland regional ecosystem prescribed under a regulation  
3. a mangrove. |
| SA           | Native Vegetation Regulations 2003, Native Vegetation Act 1991, The Development Act 1993 | For the purposes of the Act and these regulations, native vegetation includes a dead tree of a species indigenous to South Australia if:  
1. the diameter of the trunk of the tree at 300 millimetres from the base of the tree is:  
1.1 in the case of a tree located on Kangaroo Island—300 millimetres or more  
1.2 in any other case—600 millimetres or more.  
2. the tree provides or has the potential to provide, or is a part of a group of trees or other plants (whether alive or dead) that provides, or has the potential to provide, a habitat for animals of a listed threatened species under the Environment Protection and Biodiversity Conservation Act 1999.  
Native vegetation means a plant or plants of a species indigenous to South Australia including a plant or plants growing in or under waters of the sea but does not include:  
1. a plant or part of a plant that is dead unless the plant, or part of the plant, is of a class declared by regulation to be included in this definition.  
2. a plant intentionally sown or planted by a person unless the person was acting:  
2.1 in compliance with a condition imposed by the Council under this Act or by the Native Vegetation Authority under the repealed Act, or with the order of a court under this Act or the repealed Act  
2.2 in pursuance of a proposal approved by the Council under Part 4 Division 2  
2.3 in compliance with a condition imposed by a Minister, statutory authority or prescribed person or body under:  
2.3.1 the River Murray Act 2003  
2.3.2 the Water Resources Act 1997  
2.3.3 any other Act prescribed by the regulations for the purposes of this paragraph. |

Establishing an interim national baseline 2004 to assess change in native vegetation extent
<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Legislation</th>
<th>Definition of native vegetation¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>WA</td>
<td><strong>Environmental Protection Act 1986</strong>&lt;br&gt;<strong>Environmental Protection (Clearing of Native Vegetation) Regulations 2004</strong></td>
<td><em>Native vegetation</em> means indigenous aquatic or terrestrial vegetation, and includes dead vegetation unless that dead vegetation is of a class declared by regulation to be excluded from this definition but does not include vegetation in a plantation.</td>
</tr>
<tr>
<td></td>
<td><strong>Intentionally sown, planted or propagated vegetation — section 51A</strong>&lt;br&gt;The definition of ‘native vegetation’ in section 51A of the Act includes indigenous aquatic or terrestrial vegetation that was intentionally planted if:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. the planting was funded (wholly or partly): 1.1. by a person who was not the owner of the land 1.2. for the purpose of biodiversity conservation or land conservation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. one of the following is in effect in relation to the vegetation: 2.1. a conservation covenant or agreement to reserve under section 30B of the <em>Soil and Land Conservation Act 1945</em> 2.2. a covenant to conserve under section 21A of the <em>National Trust of Australia (W.A.) Act 1964</em> 2.3. a restrictive covenant to conserve under section 129BA of the <em>Transfer of Land Act 1893</em> 2.4. some other form of binding undertaking to establish and maintain, or maintain, the vegetation.</td>
<td></td>
</tr>
</tbody>
</table>
Queensland

The Queensland (Qld) native vegetation extent 2004 dataset was derived from the 2003 state wide ‘Remnant Vegetation Cover’ dataset and represents a delineation of remnant vegetation, cleared areas and other features from Landsat TM imagery (Wilson 2007). The ‘remnant vegetation cover’ for individual 1:250 000 map sheets are a state wide coverage. Remnant vegetation was manually digitised using Landsat imagery. Linework was validated in the field and from aerial photographs c.1960s. In some cases the remnant vegetation cover used the change detection data and/or foliage protection cover (woody coverage—SLATS, Department of Natural Resources and Water (2008)) as additional indicators of remnant, cleared and disturbed areas (Wilson 2007).

South Australia

The South Australian native vegetation extent 2004 dataset was derived from a 2004 classification of land cover using Landsat imagery, where seven classes were mapped as either pasture, urban, bare, water, plantation, orchard, and woody native vegetation (Smith 2008). The project verified the SA Department for Environment and Heritage’s (DEH) existing woody native vegetation mapping data in the agricultural regions for the years 1990, 1995 and 2004. The dataset specifically covered the south and south east areas of the State.

The method was originally developed for the Agricultural Land Cover Change project (Barson et al. 2000). During the classification process, a number of ground truthing aids were utilised. These included ortho-rectified aerial photography and layers contained within the SA DEH Department’s geographic information system (GIS) database (SDE). The classes of ‘Urban’, ‘Plantation’ and ‘Orchard’ were excluded. The other classes were classified using aerial photography as a reference.

The native vegetation extent dataset 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 per cent and height parameters of >2 m. For the purposes of the final native vegetation extent baseline, these mapped areas were included in the overall native vegetation cover data.

The woody areas that were not being detected from the land cover classification were checked using the raw satellite images and aerial photography for comparison to check for differences. The extent data was not able to verify the non-woody component and this will remain unknown within SA’s native vegetation cover for the specified years until better tools are available. It is acknowledged that the native vegetation cover is not complete; some regions require more work to estimate gaps in native vegetation extent but the existing woody data are correct for 2004.

The following limitations apply to the SA’s native vegetation extent dataset:

- Only a small portion of the State was included in dataset.
- 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’.

Establishing an interim national baseline 2004 to assess change in native vegetation extent
Tasmania

The Tasmanian 2005 vegetation extent dataset was derived using Landsat imagery for the interval 2000 to 2005 using a change detection process and applying these changes to TASVEG mapping to provide a 2005 vegetation extent (native and non-native) (Tasmanian Department of Primary Industry and Water 2008).

Developing the Tasmanian 2005 vegetation extent dataset was undertaken in two stages. First, a method was developed and trialled to monitor the extent and change of forest vegetation state wide under the project titled Monitoring Vegetation Extent Project (MVEP; Faulkner et al. 2008). Second, the non-forest change component was completed and the extents of both the forest and non-forest change detection for the interval 2000 to 2005 were applied to the TASVEG mapping to generate a 2005 vegetation baseline across all vegetation types in Tasmania (TAS.). Using Landsat TM imagery for 2000 and 2005 supplied by the National Carbon Accounting System a trial area was divided into stratified zones to increase the accuracy of the classification routines (Furby 2002; Caccetta et al. 2000).

The 2000, 2002 and 2005 images were classified into seven separate classes: woody vegetation, native grassland, cropping and pasture, other woody vegetation, bare soil, urban and water. QuickBird imagery and digital orthophotos replaced Landsat TM if they were available. The method described above was implemented state wide to derive the TAS. 2005 vegetation extent dataset. The final state wide change layer was also referred to as the provisional TASVEG_change_2005 which was re-coded into three categories: native vegetation, non-native vegetation and non-vegetation and reported against IBRA V5 and Natural Resource Management Regions.

Victoria

The Victorian native vegetation 2005 extent dataset was created from Landsat imagery taken between 1989 and 2005, from many thousands of ground-truthing points and from other relevant spatial data and expert validation (Department of Sustainability and Environment 2008). The dataset categorises the landscape into eight classes ranging from 'highly likely native vegetation' through to 'unlikely to support native vegetation'. Three broad steps were used to create NV2005_EXTENT:

1. Creation of a tree cover density (dense, thin and sparse classes) dataset from Landsat and SPOT 2.5 panchromatic imagery from the year 2000.
2. Creation of a classified vegetation cover surface from three modelled datasets of probability of different vegetation structural types from Landsat imagery. This produced a combination of unique cover types (likely woody cover, likely grassland cover, possible grassland cover and likely chenopod shrubland cover).
3. Final vegetation extent dataset.

The final vegetation dataset was classified as a number of simplified vegetation extent classes’ categories:
- unlikely to support native vegetation
- possibly native vegetation
- highly likely native vegetation—grassy
- highly likely native vegetation—woody
- highly likely native vegetation—structurally modified
- wetland habitat
- artificial impoundment
- exotic woody vegetation.
Western Australia

The Western Australian native vegetation extent 2004 dataset was derived through on-screen digitising (Geomedia Professional V6.0). Native vegetation extent was captured using a common project base containing an archive of digital orthophotos and a reference set of vegetation cover change datasets (derived from Landsat imagery) delivered through web map services (Department of Agriculture and Food Western Australia 2007).

In the rangelands region, only small areas have been cleared primarily for town sites, mines and irrigation. However we acknowledge that native vegetation over much of the rangelands may occur in an altered state from the original pre-European state, being affected by fire and various past and present land use regimes. Areas cleared for various reasons were drawn from existing datasets such as irrigated areas at Carnarvon and Kununurra (mapped by the Department of Agriculture and Food Western Australia (DAFWA)), mine sites (mapped by the Department of Industry and Resources) and were drawn from the existing MINDEX and Historical Mines datasets.

The project involved a series of tasks that were integrated to derive the baseline dataset and maintenance procedures. Three steps were involved:

1. **Mapping native vegetation in the Intensive Land use Zone (ILZ).**
   
   Completion of the 1:20 000 scale native vegetation extent mapping for the south-western agricultural area (the Intensive Land use Zone or ILZ) commenced in 2006 using an extensive archive of digital orthophoto mosaics held by LandGate (formerly Department of Land Information Western Australia). Vegetation cover from the Land Monitor Program at LandGate was used to identify potential changes between the aerial photograph date and the 2004 baseline.

2. **Mapping native vegetation in the Extensive Land use Zone (ELZ).**
   
   This task used a combination of satellite imagery, data from the clearing applications database, fire scar mapping and land use mapping to extend the native vegetation extent dataset into the Extensive Land use Zone (ELZ). Clearing of native vegetation in this zone is dominated by mining activities, with smaller areas cleared for urban, industrial and horticultural land uses (e.g. horticulture developments at the Ord and Gascoyne Rivers). Areas in the ELZ outside those cleared for various land uses were mapped as carrying native vegetation, recognising that this native vegetation may be very sparse, or heavily modified with introduced fodder species or altered by changed burning regimes.

3. **Generating a Web Map Service (WMS) and Web Feature Service (WFS).**
   
   The third task involved the generation of a WMS and WFS to enable dynamic exchange of the baseline dataset with Australia’s Resource On-Line (ARO).
Results

The geographic location of ‘native vegetation’, as variously defined by each state and territory is shown in Figure 1. This is a view of the ‘native vegetation 2004 extent baseline’ compiled from datasets supplied by the states and territories. The compiled dataset hereafter is referred to as the interim AusVeg 2004 dataset. A metadata record has been developed for the interim AusVeg 2004 dataset and is available on request from the custodian of the dataset, the Bureau of Rural Sciences.

Figure 1. Interim AusVeg dataset 2004

Source: Data supplied by the States and territories.

Naturally bare areas (i.e. non-vegetated cover types) including bare soil, rock, salt lakes and mud flats have all been labelled and reported as components of the native vegetation extent. Areas depicted as white in Figure 1 represent areas where native vegetation has been completely replaced with other vegetated land cover types including cereal crops and horticulture as well as fodder and pastures. Figure 1 includes areas where the native vegetation has been replaced (i.e. non-vegetated cover types). This replacement includes water reservoirs, urban areas and infrastructure.

Figure 1 shows obvious linear features along some state borders which in the main are artefacts of the differences in the definition and standards between the respective state and territory agencies. Table 5 shows the area of native vegetation reported by each state and territory. In 2004 there was over 676 million hectares of native vegetation covering 88 per cent of the country. Given the lack of consistency in the definitions and methods used in each jurisdiction the interim AusVeg 2004 dataset (Figure 1) is presented as an expanded map, rather than as a seamless dataset.
Table 5 shows large differences in native vegetation extent among the states and territories ranging from a low of 47 per cent for Victoria to a high of 99 per cent for the Northern Territory. WA and NT both have over 90 per cent of their area recorded as native vegetation, that is 93 per cent and 99 per cent respectively.

Table 5. Area of native vegetation reported by each State and Territory in the AusVeg 2004 dataset

<table>
<thead>
<tr>
<th>State/territory</th>
<th>Interim baseline date</th>
<th>Date reported</th>
<th>Total area (ha)</th>
<th>Extent of native vegetation (ha)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACT</td>
<td>2004</td>
<td>2008</td>
<td>235 726</td>
<td>127 913</td>
<td>55</td>
</tr>
<tr>
<td>NSW</td>
<td>2004</td>
<td>2008</td>
<td>80 102 152</td>
<td>69 980 691</td>
<td>87</td>
</tr>
<tr>
<td>NT</td>
<td>2004</td>
<td>2007</td>
<td>134 313 828</td>
<td>132 421 716</td>
<td>99</td>
</tr>
<tr>
<td>Qld</td>
<td>2003</td>
<td>2006</td>
<td>172 939 770</td>
<td>139 819 766</td>
<td>81</td>
</tr>
<tr>
<td>SA</td>
<td>2004</td>
<td>2007</td>
<td>98 432 191</td>
<td>84 416 131</td>
<td>86</td>
</tr>
<tr>
<td>Tas</td>
<td>2005</td>
<td>2008</td>
<td>6 859 319</td>
<td>5 071 672</td>
<td>74</td>
</tr>
<tr>
<td>Vic</td>
<td>2005</td>
<td>2008</td>
<td>22 687 003</td>
<td>10 569 891</td>
<td>47</td>
</tr>
<tr>
<td>WA</td>
<td>2004</td>
<td>2007</td>
<td>252 701 298</td>
<td>234 288 141</td>
<td>93</td>
</tr>
</tbody>
</table>
Discussion

Comparisons between 2004 and previous estimates

The varying methods by which datasets have been collected by state and territory jurisdictions both for the interim AusVeg 2004 dataset and other datasets in support of land use (2000/2001) and integrated vegetation and land use (2003) datasets make direct comparison of native vegetation extent difficult.

Several of the states and territories were cautious about comparing data found in the AusVeg 2004 dataset with previous estimates of extent of native vegetation because the differences are due to a number of factors that cannot be immediately determined from the extent data alone. For example, differences could be due to fire, clearing or regeneration. As well, new technologies make it difficult to compare more recent and older data. There does not appear to be a system whereby older timelines can be upgraded, or newer ones modified, so that changes over time can be monitored in a consistent and meaningful way. These limitations make it difficult to produce a national overview of change in the extent of native vegetation.

Relationships between extent, type and condition

Few jurisdictions reported on the importance of understanding the relationships between native vegetation extent, native vegetation types and the condition of these types, though Queensland did report on work to develop benchmarks for use with condition as well as further work on testing methods for assessing condition. NSW also noted the potential to use a combination of existing databases in assessing condition for some vegetation types.

None of the state and territory reports that describe the approach used to derive native vegetation extent discuss the need to subsequently review and revise methods that are used to contribute to the national vegetation type and condition datasets. This project has shown that gathering information on native vegetation extent needs to consider what effect changes in land use and vegetation management have on vegetation extent, type and condition. A nationally accepted definition of ‘native vegetation’ will be necessary for this process to begin. As Figure 1 shows there is a need to align the datasets and resolve differences between them.

Further work is needed to assess the extent and condition of native vegetation types in some localities. For example, extensive seeding of native pastures with exotic pasture species across much of the arid zone and northern Australia and extensive invasion by exotic weeds such as Acacia nilotica have not been considered in development of this national dataset. Vegetation with high densities of exotic and naturalised species cannot at present be differentiated within the existing state and territory native vegetation datasets. While two areas may be regarded as having native vegetation, e.g. the world heritage area of south-western Tasmania and the Kimberley Ranges region of northern Western Australia, these are not in the same condition class because grazing with domestic livestock in the Kimberley Ranges region has significantly modified these areas. In Tasmania stock are not present on the west coast so the vegetation is in a relatively natural condition. Some jurisdictions e.g. Queensland and New South Wales use minimum percentage composition of native species (e.g. 50 per cent) found at a site and represented at a landscape level compared to non-native species in determining whether a patch of vegetation is ‘native’ or not.

Need for protocol for updating NVIS

Discussions within the national coordinating committee for Australian vegetation data and information, ESCAVI, have identified the need for an approach/protocol to reconcile existing NVIS data with the Interim AusVeg dataset 2004 and future updates of changes in native vegetation extent. In Northern Territory, Queensland and Tasmania this is already accounted for in the data supplied to the Australian Government but there are some issues with other
jurisdictions. Previous discussions in ESCAVI have resolved to reclassify all existing data in the NVIS database into one of three classes: native, non-native and non-vegetated. However this is yet to be implemented. The introduction of a fourth class, mixed native and exotic would provide the opportunity to reflect the on-ground reality of an expected large and arbitrary group which would be otherwise lost in either of the other groups. To address current inconsistencies an agreed protocol for the updating of NVIS would provide significant benefits to a consistent national native vegetation baseline dataset, both the baseline and subsequent updates. ESCAVI, at its meeting in Toowoomba in 2008, agreed on the need to better describe current inconsistencies, and to set out a clear process for their resolution over time, and to develop a clear protocol for NVIS updating as a precursor to the next NVIS collation/version.

Defining appropriate data reporting information

The levels of detail of the final national dataset range from 1:25 000, 1:50 000 to 1:250 000. Some projects described in detail the methods they used, down to the pixel level, when defining boundaries of each patch of native vegetation. Other reports did not describe these aspects.

All states and territories reported on the area of native vegetation within their jurisdictions as close to 2004 as possible. The variation around 2004 appears to be about one year at most. Reasons for this variation include regular data gathering as part of long standing programs and the need to get cloud free coverage for all areas using remote sensing techniques.

The methods used to determine the ‘extent’ of ‘native vegetation’ varied between jurisdictions. Some states, such as Queensland and Tasmania have a central, comprehensive program of mapping and reporting on all native vegetation. Queensland uses its ‘SLATS’ program to provide information on tree dominated vegetation. In addition to this, Queensland’s vegetation mapping programs have provided coverage for much of the state down to the vegetation type (association) level of detail. This has been done at various scales depending on location. For example, in Queensland the vegetation type data is not consistently monitored so it cannot be used to determine changes in vegetation extent. Tasmania uses the TASVEG program, backed by vegetation mapping and forest type map coverages. The SLATS program is now being implemented in NSW.

In NSW and WA, a number of different agencies provide inputs into the data collation that produces the comprehensive state wide data set on native vegetation extent. The criteria used to define native vegetation vary between agencies according to their particular needs.

The area and distribution of native vegetation for New South Wales were derived from a land use dataset. While such estimates can result in errors when viewed at regional and local levels, at statewide levels such an approach provides a working approximation of native vegetation given the lack of detailed on ground native vegetation control and reference plot datasets.

Victoria provides a qualitatively different approach to providing information on extent of native vegetation. The polygons used to calculate area statements meet a specified minimum level of probability that they are native vegetation. The effects of expert judgements in translating and compiling relevant datasets to create statewide inputs in the Interim AusVeg dataset 2004 was noted by several states and territories. For example, South Australia filtered the data to remove classification errors. However, the filtering also removed small patches of correctly labelled native vegetation. Western Australia provided information showing the impact on estimating the area of native vegetation using higher resolution mapping, compared with the coarser imagery used previously.

Need for national standards for mapping native vegetation extent

It is evident in the compilation of the interim AusVeg 2004 dataset that there is no nationally agreed or implemented standard definition of what constitutes ‘native vegetation’. Different jurisdictions provide varying definitions of native vegetation for specific purposes or to meet particular legislative requirements. The use of different definitions and the methods used to
implement these are problematic to national reporting as well as public understanding of the extent of ‘native vegetation’ within sub-national jurisdictions.

Each jurisdiction has different needs with respect to a number of criteria guiding what to include and exclude from the core dataset of ‘native vegetation’. There are conceptual issues such as how much non-native vegetation is allowed to occur in a map unit before the unit is no longer classified as ‘native vegetation’. The corollary of this is how much native vegetation is needed in a vegetation patch that contains non-native plants before the patch is classified as ‘native vegetation’. These issues are usually guided by policy with the jurisdiction and often these needs do not encompass the production of statewide, let alone national, datasets of consistent information.

Some states adopt rules that include regenerating native vegetation in the ‘native vegetation’ data, only after the regeneration meets criteria such as: did the regeneration begin before or after a key date or has the regeneration reached a threshold height?

In order to overcome the difficulties and inconsistencies when compiling meaningful national datasets from state and territory datasets, some national programs rely primarily on centralised remote sensing approaches to establish consistent national vegetation-related datasets. For particular applications, such as the National Carbon Accounting System (Department of Climate Change 2008), these national datasets are ‘fit for purpose’ by having a consistent definition of forest vegetation for use in national and international reporting. This highlights the limitations of utilising specific purpose datasets in other vegetation mapping programs. Before composite state and territory and national datasets can be used for other purposes they must first be validated, i.e. how well do these data meet these other needs e.g. mapping the extent and change of Australia’s native vegetation.

Lacking a nationally consistent definition and procedures for describing and mapping native vegetation means that every time a new national update dataset and status report is required a new body of work must be undertaken both in each jurisdiction and nationally. As a result, the national compilations are likely to be developed using different approaches in each jurisdiction. The risk of such an approach is that it is likely that national updates cannot be reliably compared. In addition, the preparation and production of each national update is likely to mean the re-establishment of business rules and workflows that are specific to each update than having a repeatable and reliable program for updating. All users of a AusVeg 2004 dataset baseline and the regular updates of change relative to the baseline would benefit from a single, biologically-based definition of ‘native vegetation’ and common procedures implemented in each jurisdiction to satisfy that guideline. This would not only allow users to define which subset in the time series they are interested in but also allow the trend information to be reliably identified within a consistent landscape context.

Arguably though, as this report has shown, legislation at the state and territory levels has provided the driver for developing vegetation mapping programs. Agreement to a consistent national definition for native vegetation and implementation of complementary vegetation mapping programs would require extensive consultation and coordination between all Australian governments.

**Dynamic access to baseline and updates of change**

At present, the nationally coordinated vegetation spatial data systems are predicated on periodic refreshing by the states and territories of their datasets to one or more central vegetation-related geospatial databases (e.g. NVIS, NFI, land cover and/or land use) in order to produce national level statistics. Existing decentralised systems developed for herbarium information could be readily adapted to provide datasets of native vegetation extent and cover change of native vegetation. This would enable each agency to maintain and update its own vegetation records, but still allow users to tap into them to produce products whenever required. It would also remove the need for large, centrally held datasets, whilst ensuring that the latest available data is always accessible.
User expectations have risen considerably with the widespread access to programs such as Google Maps. It is an obligation on the custodians of Australian vegetation information to bring their systems up to levels where vegetation information can be easily accessed in these publically preferred visualisation mechanisms.

It is important not to overlook the costs of developing vegetation information systems. At the outset it requires access of highly specialised staff with knowledge of both vegetation and computing, as well as the regular updating of information to reflect time-marked sets of data. There must also be administrative mechanisms to ensure continual maintenance of reciprocal coordinated systems between agencies and jurisdictions of information exchange and wider access to the information by both the public and research institutions.

**Estimates derived from mapping native vegetation communities versus land cover**

Historically most landscape mapping of native vegetation extent relied on remote sensing (mostly air photo interpretation) to accurately delineate structurally intact vegetation. For example, many vegetation maps included in the NVIS database, and used for national reporting in the NLWRA’s 2001 Native Vegetation Assessment (NLWRA 2001), only map native vegetation types that are structurally intact rather than modified and transformed native vegetation types.

Mapping nativeness is difficult, especially with the use of remotely sensed, pattern recognition from single date imagery as this leads to a bias towards woody vegetation and other types with clear pattern. Very few vegetation maps in the NVIS database map the extent of all vegetation found across the whole landscape.

Alternatively, some agencies have taken a whole of landscape approach to mapping vegetation extent and have procedures in place to map all landcover types including structurally intact native vegetation, and have derived native vegetation and non-native vegetation (e.g. NSW DECC). These procedures often include consideration of woody and non-woody vegetation cover, as well as native and non-native vegetation types. Examples of these procedures developed for detecting vegetation across the whole of landscape include mapping of woody vegetation (i.e. FPC), bare ground index, the greenness of vegetation (i.e. NDVI) and how the land is used, i.e. land use types. While these vegetation-related indices provide repeatable methodologies that depend on the classification of satellite datasets, they lack the discrimination required to identify fine scale vegetation communities. In the case of FPC, the index detects all woody vegetation, not just structurally intact or relatively natural vegetation communities. FPC measures observed in highly modified and fragmented landscapes will detect more vegetation than a process used to map structurally intact native vegetation.

There are obvious differences that occur between the vegetation extent datasets due to the mapping approaches and the standards for determining and assigning nativeness. There are many approaches to mapping native vegetation communities. Methods developed for mapping vegetation communities rely on site based surveys which collect data on either the full species list present in all strata or they record the dominant species in the over, mid or ground layers (Thackway et al. 2008 and Hnatiuk et al. 2009). Data that is compiled from mapping approaches which rely on mapping native vegetation communities cannot be compared to those that are based on land cover. The mapping of native vegetation communities is likely to provide more accurate nativeness assignment than the land cover approaches, where nativeness is assigned using surrogate land use types.
Conclusions

Compilation of the interim AusVeg 2004 dataset has highlighted a number of shortcomings in the underlying definitions of native vegetation and methods used to map and compile the extent of native vegetation at the statewide levels.

Within the limitation of the definitions and methods used, the results showed that there were over 676 million hectares of native vegetation, covering 88 per cent of the Australian continent (Table 2). The interim AusVeg dataset 2004 is dependant on definitions of native vegetation used by each state/territory which are not nationally equivalent (Table 4). However, there are issues of non-comparable definitions and what was mapped by the state and territory governments as native vegetation, the interim AusVeg 2004 dataset is best used only within each jurisdiction and not at the consolidated national level.

Moving beyond the interim AusVeg 2004 dataset requires clearer definition of the specific data needs for reporting and interpretation of indicators. This involves recognition of, and support for, roles and responsibilities in data collection, management, monitoring and reporting and assessment. Strategic and coordinated investment is essential to ensure that the required data are repeatedly collected using standardised methods and are made available at least cost to all users. A number of areas have been identified where future developments can address limitations in data quality.
References

AGDAFF (Australian Government Department of Agriculture, Fisheries and Forestry) 2008, *Australia’s Agricultural Industries at a glance*, Department of Agriculture, Fisheries and Forestry, Canberra.


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