

Condition and integrity assessment of natural heritage places

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Cover image

Birds nest ferns in rainforest near Cairns, QLD
Photo by Mike Trenerry

Preface

This report was commissioned by the Department of Sustainability, Environment, Water, Population and Communities to help inform the Australia State of the Environment (SoE) 2011 report. As part of ensuring its scientific credibility, this report has been independently peer reviewed.

The Minister for Environment is required, under the *Environment Protection and Biodiversity Conservation Act 1999*, to table a report in Parliament every five years on the State of the Environment.

The Australia State of the Environment (SoE) 2011 report is a substantive, hardcopy report compiled by an independent committee appointed by the Minister for Environment. The report is an assessment of the current condition of the Australian environment, the pressures on it and the drivers of those pressures. It details management initiatives in place to address environmental concerns and the effectiveness of those initiatives.

The main purpose of SoE 2011 is to provide relevant and useful information on environmental issues to the public and decision-makers, in order to raise awareness and support more informed environmental management decisions that lead to more sustainable use and effective conservation of environmental assets.

The 2011 SoE report, commissioned technical reports and other supplementary products are available online at www.environment.gov.au/soe.

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EXECUTIVE SUMMARY

The purpose of the study was to assess the condition and integrity of natural heritage places for the 2011 Commonwealth State of Environment Report, Indicator NCH-05. The assessment of natural heritage places undertaken for this study has focussed on the identified natural heritage values and their current condition and integrity. A sample of 75 places located on public and private lands in Australia was assessed. These places include a range of formal reserves from iconic World Heritage places to private conservation places. Each place has its own natural heritage significance.

These places were chosen from 16 World Heritage places, 30 National Heritage places, 41 places on the Commonwealth Heritage list, 2127 places on the Register of the National estate and other natural heritage places such as botanic gardens, wildlife conservancies and private conservation places. Many of these places form part of the National Reserve System, which includes more than 9,300 protected areas. In all, over 98 million hectares are protected - nearly 13 per cent of Australia (DSEWPaC 2011).

The indicator for the Commonwealth's State of Environment reporting process - *NCH-05 Physical condition and integrity of a sample of natural heritage places* has been assessed by collecting data on a range of natural heritage values, environmental threats and management plans for these places.

The study has analysed the condition and integrity of natural heritage places by reviewing factors including:

- natural heritage values;
- threats including fire, erosion, climate change & weeds,
- threatened species presence;
- place use, including recreational and other activities;
- current documented management regimes; and
- wildfire and weather events.

The condition and integrity assessment has focussed on different tenures and jurisdictions. The purpose has been to enable comparison between places and jurisdictions and to identify trends in place condition and management effort. The sample size was restricted to 75 sites and represents the identified values, condition and integrity of those places. As the sample size is small, it does not represent a statistically valid sample of the values, condition and integrity of all natural heritage places.

Current Condition and Integrity of Natural Heritage Places

Natural heritage places assessed for this study face threats from natural and anthropogenic induced factors. Impacts from weather events and wildfires have affected natural heritage values of places, although the nature and extent of these impacts varies from place to place. The study did not identify any definitive impacts from climate change as these impacts are difficult to detect without longer term ongoing focussed studies.

Improving threatened species management as well as threats from pests and weeds and soil erosion remain as challenges to the condition and integrity of natural heritage places in Australia. Appropriate management frameworks for improving the condition and integrity of natural heritage places that are subject to monitoring and review were inconsistently applied between jurisdictions. However, informal arrangement for management of places may exist but these were not detected by the desktop exercise undertaken for this study.

The sample size for this study was limited and the information only provides an indication of the condition of those natural heritage places surveyed. The sample was designed to provide a representation of places on different place listings, jurisdictions and bioregions. There was “unknown” data for many places as the information was not readily available during survey. This reflects the limitation of the desktop nature of this study and the limited timeframe for the study to be completed. However, phone interviews were undertaken with land managers for half of all sites.

This study indicates that places on the World Heritage List and National Heritage List identified threats to their condition and integrity. In particular, they have higher place use than other place types surveyed, with likely impacts, including higher soil erosion impacts from tracks and roads. Places on the Register of the National Estate and “other” places have less identified threats to their condition. Private conservation places also face threats from invasive species, pests and soil erosion as identified in the survey.

It is considered that management planning frameworks indicate an intent for a strategic approach to management of the place. This does not mean that lack of plans lead to poor outcomes, but existence of management planning provides a framework for appropriate management to occur, which may lead to better outcomes.

Management plans for around 60% of places on the World Heritage List had either no management plans or plans that are older than 1999. However, 30% of the World Heritage List places did have up-to-date management planning frameworks subject to review. This reflects the World Heritage List sample chosen for the study as some management plans, such as bushfire, are not necessary for some places as they are located in desert environments. Places on the National Heritage List indicated moderate ratings for management planning with plans in place but not subject to regular review. Places on private lands however recorded low risk ratings for management planning as they had current plans subject to review. Private conservancy places also had low risk ratings of places as they had up-to-date management plans subject to regular review.

Places in NSW and Victoria recorded a higher number of threats to condition than did other States. This reflects the environmental pressures and visitation rates of natural heritage places in these States. Places in South Australia and the ACT recorded the lowest number of threats.

Management planning for jurisdictions indicated that the Northern Territory and NSW had the highest number of places with management planning frameworks. Western Australia, Queensland and South Australia had the highest number of places not having management planning frameworks for places. However, Victoria, Western Australia and Queensland had the highest number of places where the information about management planning frameworks was not readily available as part of the study. This may mean that management plans either were not accessible as part of this study or there were no plans for these places in these jurisdictions. State and Territory jurisdictions are not necessarily responsible for the management of all places within their jurisdictions however as the Australian Government also administers some parks and reserves within jurisdictions as does local government.

Sections 7, 8 and 9 include a data summary, conclusions and case studies on 4 natural heritage places subject to this study.

1 INTRODUCTION

Environmental Resources Management Australia Pty Ltd ('ERM') has been commissioned by the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) to prepare information on the current condition and integrity of natural heritage places in Australia. The condition assessment is being undertaken to gather information to support the 2011 State of Environment Report (SoE).

1.1 WHAT IS NATURAL HERITAGE?

Natural heritage includes aspects of biodiversity and geological heritage valued by humans for their contribution to a sense of identity and place (Lennon *et al* 2001)

Natural heritage is defined in the Australian Natural Heritage Charter (Australian Heritage Commission 2002).

'Natural heritage significance means the importance of ecosystems, biological diversity and geodiversity for their existence value, and/or for present or future generations of Australians in terms of their scientific, social, aesthetic and life support value.'

The values contained in the charter include:

- biodiversity value (the variability among living organisms and includes the diversity of ecosystems and diversity within and between species);
- geodiversity value (range of geology (bedrock), geomorphological (landform) and soil features, assemblages, systems and processes);
- existence value (the intrinsic value that living organisms, earth processes and ecosystems have beyond the social, economic or cultural values held by humans);
- natural integrity (the degree to which a place or ecosystem retains its natural biodiversity and geodiversity);
- scientific value (a place's known or potential ability to reveal further information); and
- aesthetic value (natural aesthetic value relates to the forms and features of the natural environment that are perceived as beautiful).

These values have been applied to a range of natural places in Australia and include a range of public and private lands. Registers of these lands are kept to signify World, National, Commonwealth and local heritages places. A range of other public and private lands have not been assessed formally for these values, but they still have intrinsic natural heritage values.

1.2

PROJECT DESCRIPTION

The project seeks to obtain information on the condition and integrity of a range of natural heritage places in Australia. A sample of natural heritage places across all tenures were surveyed including World, National, Commonwealth, State and Local Natural Heritage places in Australia. Particular emphasis was made on an equal range of places across each State or Territory and was further stratified by IBRA¹ region where possible. The survey provides a simple overview of the condition and integrity of a sample of Australia's natural heritage places, and allows trends in the health of that heritage to be identified. A total of 75 places were surveyed to enable efficient data collection within the timeframes available for the study.

There is currently no agreed measure for assessing the condition and integrity of natural heritage places in Australia with the exception of the periodic reporting requirements of the World Heritage Convention. The 2006 SoE Report provided a simple overview of the condition and integrity of heritage places, with no specific data available for Indicator *NCH-05 Physical condition and integrity of a sample of natural heritage places*. This study has been designed as a baseline for future assessment of the condition and integrity of natural heritage places and the results will be analysed for publication against Indicator NCH-05 for the 2011 SoE Report.

The 2011 SoE Report will be the fourth in an ongoing series of five-yearly reports building on the experience in reporting on the state of the environment. The 2011 report is due to be tabled in Parliament by 31 December 2011.

1.3

INDICATOR NCH-05 PHYSICAL CONDITION AND INTEGRITY OF A SAMPLE OF NATURAL HERITAGE PLACES

The indicator NCH-05 refers to the physical condition and integrity of natural heritage places. The purpose of the indicator is to provide an indication of the condition and integrity of the heritage places so that they are managed adequately to be of benefit to future generations.

¹ IBRA – Interim Biogeographic Regionalisation of Australia. *This system classifies biodiversity value based on geography throughout Australia. It has been used to identify areas of high conservation significance in building the national reserve system and identifying under represented ecosystems in the reserve system.*

Integrity refers to the health of the identified heritage values of the place (DSEWPaC 2011). In addition, the World Heritage Convention (UNESCO 1972) defines integrity as “*a measure of the wholeness and intactness of the natural heritage and its attributes. Examining the conditions of integrity therefore requires assessing the extent to which the property:*

- a) Includes all elements necessary to express its outstanding universal value;*
- b) Is of adequate size to ensure the complete representation of the features and processes which convey the properties significance;*
- c) Suffers from adverse effects of development and/or neglect.*

ERM have undertaken an analysis that considers the impacts from human activities on c) above.

Condition refers to the current physical condition of the place (DSEWPaC 2011). It includes the existing state of the place and environmental factors that influence its health, including issues such as invasive species, erosion, effects of human exploitation and development, including around the boundary of the property. Condition also can refer to the management efforts being made to minimise the impacts of these activities.

Monitoring the physical condition and integrity of heritage places and items provides useful information to land managers on the pressures and influences that might be acting on the natural heritage place.

A comparison was undertaken with the indicators and goals for natural heritage between jurisdictions. *Table 1.1* provides a comparison of the indicators prepared for State of environment reporting for States and jurisdictions in Australia in comparison with the Commonwealth. *Table 1.2* provides information on indicators and goals that are listed by States and Territories and are different to those listed by the Commonwealth.

Table 1.1 Comparison of Indicators between the Commonwealth, States and Territories

Commonwealth Indicators	NSW	SA	Vic	Qld	NT	WA	ACT	Tas
<i>NCH-01 Process of listing, area and distribution of identified natural heritage places.</i>	X	X	X	X	X	X	X	X
<i>NCH-03 Process of listing, area and distribution of identified historic heritage places.</i>	X	X	X	X	X	X	X	X
<i>NCH-05 Physical condition and integrity of a sample of natural heritage places.</i>	X	X		X	X	X		X
<i>NCH-09 Funding provided to heritage and other agencies for natural heritage places.</i>	X	X						
<i>NCH-13 Changes in heritage legislation.</i>								
<i>NCH-19 Number of volunteers trained by heritage organisations and institutions.</i>								
<i>NCH-21 Number of local government heritage advisors.</i>								
<i>NCH-22 Number of professional heritage employees in government agencies.</i>								
<i>NCH-23 Surveys of community awareness of heritage places and objects and their conservation.</i>	X	X	X	X	X	X	X	X
X denotes that the indicator is used by the jurisdiction								

Table 1.2 *Additional indicators and goals listed by State and Territories*

Jurisdiction Indicators / Goals	NSW	SA	Vic	Qld	NT	WA	ACT	Tas
<i>Number, area and comprehensiveness of natural heritage listings.</i>	X	X	X	X	X	X		X
<i>Level of objections to proposed protection of natural heritage.</i>						X		
<i>Level of development pressures on natural heritage.</i>	X			X	X	X		
<i>Conserve and protect the natural heritage values.</i>	X	X		X	X			X
<i>Actively manage threats and, where possible, sources of key external pressures on the park system in cooperation with the community.</i>	X							X
<i>Plan and carry out activities in parks to minimise key pressures on natural heritage values and ecological systems.</i>	X							X
<i>Recognise and celebrate the diversity of heritage and acknowledge the places and objects which are special to the community.</i>			X					
<i>Better coordinate heritage resources across government agencies.</i>			X					
<i>Interpret the state/Territories heritage stories for all locals and visitors and ensure that the linkages between natural and cultural heritage are understood.</i>			X					
<i>Number of places removed from the Heritage Register.</i>				X				
<i>X denotes that the indicator is used by the jurisdiction</i>								

1.4 AIMS AND OBJECTIVES

This report aims to identify trends in the condition and integrity of natural heritage places in Australia against Indicator NCH-05 for the 2011 SoE Report.

The objectives of this report include:

- develop a baseline measure for assessing the condition and integrity of natural heritage places in Australia;
- select a representative sample of natural heritage places across all tenures including World, National, Commonwealth, State and Local Natural Heritage places in Australia; and
- identify trends in the health of natural heritage places in Australia for the 2011 SoE Report.

ABBREVIATIONS AND DEFINITIONS

ACT - Australian Capital Territory

CAPAD - Collaborative Australian Protected Areas Database

CHL - Commonwealth Heritage List

CRA - Comprehensive Regional Assessment

DSEWPaC - Department of Sustainability, Environment, Water, Population and Communities

EEC - Endangered Ecological Community listed under the EPBC Act

IBRA - Interim Biogeographic Regionalisation of Australia

Jurisdiction - means Commonwealth, State or Territory

NES - National Environmental Significance

NHL - National Heritage List

NSW - New South Wales

NT - Northern Territory

Place - means natural heritage place

QLD - Queensland

RNE - Register of the National Estate

RNESDB - Register of the National Estate Spatial Database

SA - South Australia

TAS - Tasmania

Tenure - means a place assessed as part of this study

Threatened Species - Means a species listed under the EPBC Act as threatened

VIC - Victoria

WA - Western Australia

WHL - World Heritage List

METHODOLOGY

The methodology used in this report follows the following structure:

1. Identify sample of natural heritage places;
2. Identify parameters to measure the condition and integrity of natural heritage places;
3. Prepare data recording approach;
4. Collect data from relevant sources;
5. Confirm data and fill data gaps through targeted phone survey;
6. Data analysis; and
7. Reporting and case studies.

3.1**SAMPLE SELECTION**

The purpose of the sample selection was to obtain a sample of 75 natural heritage places across Australia. Seventy five places were chosen as the sample size to enable efficient collection of data within the timeframe available and as requested by DSEWPac.

To enable a representative sample to be chosen of natural heritage places, the sample selection was based on stratification across States and Territories and across the differing tenure types of the natural heritage areas, as shown in *Table 3.1*.

Table 3.1 *Proposed Stratification of Sample*

	NSW	QLD	VIC	WA	SA	TAS	NT	ACT	Total
World Heritage List	1	1	1	1	1	1	1	0	7
National Heritage List	2	2	2	2	2	2	2	1	15
Commonwealth Heritage List	2	2	2	2	2	2	2	1	15
Register of the National Estate	3	3	3	3	3	3	2	2	22
Other¹	1	1	1	1	1	1	1	1	8
Private Land Conservation	1	1	1	1	1	1	1	1	8
Total	10	10	10	10	10	10	9	6	75

1. Includes Bush Heritage, Australian Wildlife Conservancy, National Trust and Indigenous Protected Areas.

Pre Selection of Sample

A number of data sources were accessed during the sample selection phase. These sources were used to form the initial compilation of data from which the sample of 75 places was chosen. Data included online databases from DSEWPaC's Discover Information Geographically Website (<http://www.environment.gov.au/metadateexplorer/>). Databases accessed included:

- Australia, World Heritage Areas Spatial Database ;
- National Heritage List Spatial Database (NHL);
- Commonwealth Heritage List Spatial Database (CHL);
- Australia, Register of the National Estate (RNE) - Spatial Database (RNESDB); and
- Collaborative Australian Protected Areas Database - CAPAD 2008-external.

Some of the data from these online databases included places that had been listed for values other than natural heritage. As this data was not relevant to this exercise it was excluded prior to the selection process.

Information about private land conservation places was obtained from the data managers from Bush Heritage, Australian Wildlife Conservancy and the National Trust. These geodatabases included shapefiles of reserve locations and also some general information of the reserves including name, area and location.

Contact was made with State and Territory governments to obtain information regarding private land conservation areas. Information was supplied to ERM on five places in Queensland, Victoria and NSW. Information on two additional places was provided from Tasmania and South Australia. The information provided about each place was provided to ERM by State and Territory governments with the consent of the land holder.

There is no single national register of geoheritage places in Australia. Geoheritage information was obtained from the Geological Society of Australia who supplied information for Western Australia, South Australia and Victoria. Information was also obtained from reports prepared for the Comprehensive Regional Assessment (CRA) process for South East Queensland and NSW. Information on geoheritage was also contained within the RNESDB for all States and Territories, excluding Queensland.

Once the relevant data was collected from all sources it was compiled using ArcGIS to spatially list all places that overlapped (so that places selected would not be chosen twice from two differing land tenures). Each place was also listed against the State it was located in and the Interim Biogeographic Regionalisation of Australia (IBRA) region in which each place was found. This data was then exported into an Excel spreadsheet for place selection.

The sample was then chosen using a simple data filter in the Excel spreadsheet. These places were filtered based on the proposed stratification of sample (see *Table 3.1* above). A hierarchy of selection in relation to tenure was developed so that duplication of places in the sample selection was avoided. The hierarchy was in order of world heritage, national heritage, commonwealth heritage, register of the national estate, 'other' and private conservation places, where world heritage was the highest and private conservation places the lowest.

As required by the stratification, an emphasis was placed on an equal range of places across each State and Territory and was further stratified by IBRA region within each State or Territory where possible to represent different IBRA regions. Where a place was unable to be chosen from the preferred tenure within a particular State or Territory due to there being limited places within that State or Territory an alternative place was chosen from the selected tenure from an Australian external Territory. In cases where alternative places were unable to be chosen from the same tenure from an external Territory places were alternatively chosen from a different tenure within that particular State or Territory.

Smaller sub-places were chosen from some of the much larger conservation areas for the ease of collecting data. These smaller sub-places were chosen from the CAPAD that overlapped with the larger places from the WHL, NHL and CHL.

After the initial selection of the 75 places the list was provided to DSEWPaC to determine the suitability of the sample. It was noted that places on registers with a status other than 'listed' or 'registered' should be disregarded. In light of this 8 places were changed from the initial sample.

Final Sample Selection

The final selection of the 75 places was as follows:

- Seven places were chosen from the WHL. One place was chosen from each State and Territory (excluding ACT and Victoria) and one place was chosen from an external Territory due to there being no listed natural world heritage areas within Victoria.
- Thirteen places were chosen from the NHL. Two places were chosen from each State and Territory, with the exception of the ACT where one place was chosen and the NT where none were chosen. Fifteen places were proposed to be chosen from the NHL. However, the two places that were to be chosen from the NT were limited due to the places being chosen for other tenures. These two places were alternatively chosen from the CHL and the RNE within the NT.
- Fifteen places were chosen from the CHL. Two places were chosen from each State and Territory, with the exception of the ACT, where one place was chosen. One of the places chosen from the CHL in NT was a replacement place for the NHL, mentioned above. For this reason there were limited places from the CHL available to be chosen within the NT, therefore one place from the RNE was used as a replacement for this place.
- Twenty five places were chosen from the RNE. Three places were chosen from each State and Territory, with the exception of the NT, where four places were chosen. Three of the places chosen from the RNE were chosen as replacement places, one for the NHL, CHL and 'Other' tenures.
- Seven places were chosen from 'Other' places (the 'Other' tenure includes Bush Heritage Places, Australian Wildlife Conservancy Places, National Trust Places, and Indigenous Protected areas). One place was chosen from each State and Territory, with the exception of the ACT where there was no place available from this tenure. Alternatively the place for the ACT was replaced by one from the RNE.
- Eight private land conservation places were chosen. One place was chosen from each State and Territory.

After the sample of 75 places was selected the sample was cross-checked against a list of known geoheritage places to confirm that the sample included a representative number of places from geologically important areas. A total of 26 places were chosen based on their geoheritage value. A list of the final places sampled is at *Annex A*.

Table 3.2 *Final Stratification of Sample*

	NSW	QLD	VIC	WA	SA	TAS	NT	ACT	EXT	Total
World Heritage List	1	1	0	1	1	1	1	0	1	7
National Heritage List	2	2	2	2	2	2	0	1	0	13
Commonwealth Heritage List	2	2	2	2	2	2	2	1	0	15
Register of the National Estate	3	3	3	4	2	3	4	3	0	25
Other¹	1	1	1	1	1	1	1	0	0	7
Private Land Conservation	1	1	1	1	1	1	1	1	0	8
Total	10	10	9	11	9	10	9	6	1	75
1. Includes Bush Heritage, Australian Wildlife Conservancy, National Trust and Indigenous Protected Areas.										

3.2

DATA PARAMETERS

ERM chose data parameters to be collected during the data collection phase of the study. These parameters were chosen to enable recording of data to determine the condition and integrity of natural heritage places during the desktop and targeted phone interview phases of the study.

The data parameters chosen included:

- place information including place reservation type, jurisdiction, tenure, location, tenure and ownership;
- pressures on the current health and condition of natural heritage places including biodiversity status, place use, fire, erosion, climate change and weed invasion;
- determination of natural heritage values of places against criteria; and
- integrity of management from current documented management regimes.

Annex B outlines the full set of data parameters chosen for the study.

These data parameters provide baseline data on the condition and integrity of natural heritage places surveyed for this study. The current condition of natural heritage values is reflected in data collected on current pressures on these natural heritage places. The integrity of the place is reflected in the health and management of the place and the determination of natural heritage values. *Table 3.3* Outlines the data parameter themes used and the reasons why the parameters were selected.

Table 3.3 *Data parameters chosen and reasons for selection.*

Data Parameter Type	Reason Selected
Natural Heritage Criteria	To identify the natural heritage criteria for 'outstanding' or 'significant' natural heritage value for each place.
Geological Importance	To identify the number of places with geological importance.
EPBC Act Search (threatened species, migratory species, endangered ecological communities)	To obtain the total number for each of the Matters of NES, with the potential to occur within each place.
Place Access (restricted/public)	Identify the likely impact of place access on condition and integrity of the place.
Place Use (including recreational and other activities)	Identify the likely impact from recreation and other activities on condition and integrity of each place.
Length of Roads and Walking Tracks	Identify total area of a place with potential to be impacted by erosion and/or sedimentation.
Invasive and Pest Species	Identify the number of species that may cause harm to the condition of a place.
Impacts from Climate Change	Provide an indication of the likely impacts from climate change on the condition and integrity of natural heritage values of a place.
Controlled Fire History of the Place (Last 5-years)	Identify the potential fire risk within a place and recorded fire history from controlled burning.
Wild Fire History of the Place (Last 5-years)	Identify wildfire impacts to the condition of a place over the past five years. It is noted that appropriate fire regimes are required to maintain ecological values.
Evidence of Erosion (streambank, roadside, beach, tracks, gully, wind, mass movement, sheet).	Identify erosion impacts to the condition of a place. This parameter gives an indication of the likely landscape effects and water quality impacts downstream if sediments enter waterways.
Evidence of Sedimentation form Run-off (road culverts, dams, streambanks, tracks)	Identify sedimentation impacts to the condition of a place. This parameter gives an indication of the likely landscape effects and water quality impacts downstream if sediments enter waterways.
Weather events occurred within the area over the past 5 years? (flood, cyclone, high wind, high rainfall, other)	Identify the number of places with the occurrence of weather events over the past five years and the potential impact to the condition of a place. Weather events in this instance were defined as those events that caused damage to the place through wind, flood or other impacts from storm events.
Bushfire Management Plan (year, recommended review, management regimes)	Identify the current existence of a bushfire management plan and classify the potential bush fire risk of a place. Existence of a bushfire management plans gives an indication of the likely strategic approach to bushfire management at the place. It is considered that effective bushfire management is required to be undertaken in a strategic and coordinated fashion.
Erosion and Sedimentation Management Plan (year, recommended review, management regimes)	Identify the current existence of an erosion and sedimentation management plan and classify the potential risk of erosion and sedimentation within a place.
Threatened Species Management Plan (year,	Identify the current existence of a threatened species management planning and classify the potential risk to

Data Parameter Type	Reason Selected
recommended review, management regimes)	threatened species within a place.
Heritage Management Plan (year, recommended review, management regimes)	Identify the current existence of a heritage management plan and classify the potential risk to the condition of heritage values of a place.
Other Management Plans.	Identify any further management regimes within a place. This includes plans for invasive species or cultural heritage management.

3.3 *DEVELOPMENT OF INFORMATION SPREADSHEET*

ERM developed an information spreadsheet to ensure consistent data collection during the data collection phase.

This spreadsheet was designed to record information during the data collection phase and was constructed in Microsoft Excel. The information was collated during desktop and phone interviews. Data was entered directly into the spreadsheet by users. *Section 3.4* below outlines ERM's data analysis approach.

3.4 *DATA COLLECTION*

3.4.1 *Desktop Research*

Data collection for 75 natural heritage places in Australia was undertaken by five consultants from 22 March to 5 April 2011. Initial data parameters were collected using the pre-selection data comprised by ArcGIS.

Each natural heritage place was identified by the tenure from which it was selected including World Heritage, National Heritage, Commonwealth Heritage, Register of the National Estate, Private Land Conservation and "other" (Bush Heritage, Australian Wildlife Conservancy, National Trust, Indigenous Protected Areas). Additional listings on other registers were also identified for the place. The online Australian Heritage Database maintained by DSWEPaC was initially accessed to obtain a summary statement of natural heritage criteria for each natural heritage place, including the:

- World Heritage List;
- National Heritage List;
- Commonwealth Heritage List; and
- Register of the National Estate.

Databases for Private Land Conservation, "Other" tenures and geoheritage were unavailable.

World Heritage Criteria

Places listed on the World and National heritage registers represent the “jewels in the crown” of natural heritage places in Australia. World heritage places are identified through similar but differing criteria set by UNESCO (UNESCO 2011). The world heritage criteria for natural heritage places include:

- i. to contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance;
- ii. to be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features;
- iii. to be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals;
- iv. to contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

Natural Heritage Criteria

For a natural heritage place to be listed on a Heritage List or Register of the National Estate the place is assessed against a number of criteria for ‘outstanding’ or ‘significant’ heritage values. A place can be listed as a natural heritage place if it is found to be **outstanding** or **significant** for one or more of the criteria. The requirements for the Heritage Lists and Register of National Estate include to:

- be entered on the World Heritage List a place must have 'outstanding' natural universal heritage value against one or more criteria;
- reach the threshold for the National Heritage List a place must have ‘outstanding’ heritage value to the nation against one or more criteria;
- be entered on the Commonwealth Heritage List a place must have 'significant' heritage value against one or more criteria; and
- be listed on the Register of National Estate a place must have ‘significant’ heritage value against one or more criteria.

The natural heritage criteria for each natural heritage place was identified by the criteria in which it was entered onto the World Heritage List, National Heritage List, Commonwealth Heritage List or Register of the National Estate and placed into nine categories for each criteria.

- a) **Processes** - the place has significant heritage value because of the place's importance in the course, or pattern, of Australia's natural or cultural history;
- b) **Rarity** - the place has significant heritage value because of the place's possession of uncommon, rare or endangered aspects of Australia's natural or cultural history;
- c) **Research** - the place has significant heritage value because of the place's potential to yield information that will contribute to an understanding of Australia's natural or cultural history;
- d) **Characteristic Values** - the place has significant heritage value because of the place's importance in demonstrating the principal characteristics of:
 - i) a class of Australia's natural or cultural places; or
 - ii) a class of Australia's natural or cultural environments;
- e) **e) Aesthetic Characteristics** - the place has significant heritage value because of the place's importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
- f) **Technical Achievement** - the place has significant heritage value because of the place's importance in demonstrating a high degree of creative or technical achievement at a particular period;
- g) **Social Value** - the place has significant heritage value because of the place's strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;
- h) **Significant People** - the place has significant heritage value because of the place's special association with the life or works of a person, or group of persons, of importance in Australia's natural or cultural history; and
- i) **Tradition** - the place has significant heritage value because of the place's importance as part of Indigenous tradition.

Vegetation Mapping

Existing vegetation mapping of the each natural heritage place was obtained from the key authority for the place. From the vegetation mapping, the dominant vegetation for each place was identified using a broad vegetation classification. Online sources include:

- Local Councils;
- Queensland Department of Environment and Resource Management;
- Parks Victoria;

Condition and integrity assessment of natural heritage places

- NSW Department of Environment, Climate Change and Water;
- WA Department of Environment and Conservation;
- NT Natural Resources, Environment, The Arts and Sport;
- Parks South Australia;
- Parks and Wildlife Tasmania; and
- Management Plans for each place.

Matters of National Environmental Significance

The online Protected Matters Search Tool for Matters of National Environmental Significance (NES) listed under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) was accessed to obtain the total number for each of the following data parameters with the potential to occur within each natural heritage place. This included:

- threatened flora;
- threatened fauna;
- migratory species;
- Endangered Ecological Communities;
- pest species; and
- invasive species.

Place Specific Information

The online search engine *Google* was accessed to locate place specific websites for each natural heritage place. The places were utilised to obtain place specific information including place access, place use, length of road and trail networks, fire history, evidence of erosion and/or sedimentation and weather events. Various combinations of search words were entered to *Google* to refine the searches. *Annex C* contained a bibliography of the places visited for the study.

The websites included:

- place specific web page;
- recent published articles;
- professional reports;

- relevant government agencies;
- local fire and emergency service;
- regional and local newspapers;
- State and Territory tourism groups;
- Australian Broadcasting Corporation; and
- Bureau of Meteorology;

Management Plans

Existing management plans for each natural heritage place were obtained from the land manager or owner for each place. The online search engine *Google* was also accessed to locate specific management plans for each natural heritage place. Various combinations of search words were entered to *Google* to refine the searches. Management plans included:

- weed and pest management;
- bushfire control;
- erosion and sedimentation management;
- threatened species management; and
- heritage management.

3.4.2 *Targeted Questionnaire and Telephone Interview*

Natural heritage places with identified data gaps were flagged during the desktop review requiring further information to be collected through a targeted questionnaire and telephone interview. A targeted questionnaire and telephone interview process was undertaken to verify data for 50% of the total sample of natural heritage places.

The questionnaire and interviews occurred with relevant landowners or managers of properties of relevance. This approach aimed at validating the data collected in the desktop review and fill in significant data gaps where they were identified. This approach was undertaken in consultation with DSEWPaC and permission to contact private landowners was obtained where required.

Phone surveys were undertaken with all land managers for “Private” tenure and “Other” places. All other places chosen for phone interview were those where the desktop review highlighted a paucity of information available through desktop searches.

Table 3.4 and Table 3.5 indicate the number of phone interviews undertaken for each tenure type and jurisdiction.

Table 3.4 *Percentage of phone interviews undertake for tenure types*

Tenure	Phone Interview Completed
WHL	43%
NHL	23%
CHL	40%
RNE	48%
Other	57%
Private	100%
Average	52%

Table 3.5 *Percentage of phone interviews undertaken for jurisdictions*

Jurisdiction (Exc. EXT)	Phone Interview
NSW	40%
QLD	70%
VIC	40%
SA	67%
WA	55%
TAS	20%
NT	67%
ACT	50%
Average	52%

3.5 *COMPARATIVE AND STATISTICAL ANALYSIS*

3.5.1 *Matters of National Environmental Significance*

Matters of NES provide information on the listed species, communities and threats as defined under the EPBC Act. This data provides an indication of the current condition and integrity of the places' biodiversity values.

The average, minimum and maximum values for all places and jurisdictions for Matters of NES were determined. This was undertaken for threatened flora and fauna, endangered ecological communities and migratory species.

This data represents the places that were surveyed and provides a baseline for information on the matters of NES present at the time of the survey.

3.5.2 *Use of Natural Heritage Places*

Data collected on use of natural heritage places provides an indication of the likely impacts from human activities on the place. This data indicates current pressures on the condition and integrity of the natural heritage places assessed. The level of impact on the places natural heritage values was considered by ranking the relative impact of each activity type.

Data was collected on places use including camping, bush-walking, fishing, boating rock climbing, picnicking, four-wheel driving and other uses. Other place uses identified during the survey included bird watching, commercial tours, military training, research, horse riding, swimming, cycling, hunting and skiing.

Places were ranked based on the percentage of use recorded at the place for each place use criteria.

3.5.3 *Management of Natural Heritage Places*

Documented management plans for natural heritage places indicate the current formal management arrangements for the place. This information provides an indication of the current integrity of management arrangements. However, the data collected does not reflect information on informal management arrangements or where management plans could not be found during the survey.

A rating for a documented management plan for natural heritage places was applied to enable comparison of results against other parameters within the sample. The data was allocated a score out of ten according to whether the natural heritage place had a current management plan and if the management plan was subject to review. It was considered that management plans older than 1999 did have some value to the management of the site and achieved a lower score than if the management plan was more current (2011 - 2005) A higher rating was achieved where the management plan for the place had a recommended review. *Table 3.6* outlines the rating scores allocated for plans of management.

The existence of management planning frameworks indicate an intent for a strategic approach to management of the place. This does not mean that the lack of plans lead to poor outcomes, but existence of management planning provides a framework for appropriate management to occur, which may lead to better outcomes.

Table 3.6 *Ratings for Plans of Management*

Data Parameters	Score out of 10
Yes - place has a Management Plan	5/10
No - place does not have a Management Plan	0/10
Review date	5/10
Management Plan date between 2011 - 2006	10/10
Management Plan date between 2005 - 1999	5/10
Management Plan older than 1999	1/10
<i>Maximum score available is 20 points</i>	

3.5.4 *Recommended Maintenance Regimes*

Recommended maintenance regimes provide an indication of the frequency of maintenance for each place and therefore the integrity of management arrangements contained within management plans. These maintenance regimes were documented in management plans and included things such as maintaining fire trails, ongoing weed and pest management.

A rating for frequency of recommended maintenance regimes of natural heritage places was applied to the data to enable a comparison of results within the sample. The data was allocated a score out of ten according to whether the place manager or owner for the natural heritage place had recommended annual, monthly or ongoing maintenance regimes outlined in management plans. Places where a management plan could not be verified were recorded as "unknown". Table 3.7 outlines the rating allocated for maintenance regimes.

The existence of maintenance regimes in management plans indicate an intent for a strategic approach to management of the place. This does not mean that lack of maintenance regimes lead to poor outcomes, but existence of maintenance regimes provide a framework for appropriate management to occur, which may lead to better outcomes.

Table 3.7 *Rating for Recommended Maintenance Regimes*

Frequency of Recommended Maintenance Regimes	Rating out of 5
<i>Annually</i>	3/5
<i>Monthly</i>	5/5
<i>Ongoing</i>	4/5
<i>>Annually</i>	2/5
<i>Unknown</i>	2/5
<i>None</i>	0/5
<i>Total score available was 5 points.</i>	

3.5.5 *Total Management Values*

Values of 'high', 'moderate', 'low' and 'unknown' were given to each management plan type based on the total plan score derived from the ratings of plans of management and recommended maintenance regimes. A value of 'unknown' was used for any management plan where there was no available information recorded about the existence of a plan through the desktop review unless it was confirmed by phone interview. *Table 4.8* outlines the value allocated to the scores for each management plan.

Overall total management values were also obtained for each place using the same allocation as in *Table 3.8*. These values were based on total management scores for each place. Total management scores for each place were determined by averaging the score. The total management value was determined to have 'insufficient data' and not calculated if any of the management plans for the place had a value of 'unknown'.

Table 3.8 *Total Management Values*

Management Value	Score Ranges
<i>High</i>	<10
<i>Moderate</i>	>=10 and <20
<i>Low</i>	>=20

3.5.6 *Erosion*

Table 3.9 outlines the rating allocated for erosion. Values of 'high', 'moderate', 'low' and 'unknown' were given to each place based on the erosion ratings in *Table 3.9*. The value of 'unknown' was assigned to a place if there was no data available on erosion for the place. 'Low' was used for any place with a rating score of five or less. 'Moderate' was allocated to all places with a score larger than five and that did not include Mass Movement, Gully or Sheet erosion. A value of 'high' was assigned to any place which had Mass Movement, Gully or Sheet erosion present.

Table 3.9 *Rating for Erosion*

Data Parameters	Score out of 10
Track	2/10
Roadside	2/10
Wind	4/10
Beach	3/10
Streambank	5/10
Sheet	8/10
Gully	9/10
Mass Movement	10/10

3.6

ISSUES IDENTIFIED DURING DATA COLLECTION

Commonwealth Heritage List

Limited data was obtained during the desktop research phase for natural heritage places managed by the Department of Defence on the Commonwealth Heritage List. This was because the information was not provided by Defence place managers. These places are subject to restricted information due to the nature of defence facilities. Publicly available information on these places was used during the survey phase.

'Unknown' As a Response

Unknown was recorded as a response where an assessment of condition or management of a natural heritage place was recorded as "no" but was not confirmed with the place manager during phone interview. This was because information collected through the internet search does not confirm that a management plan was, or was not available for the place. Management plans maybe available for the places in hard copy form.

Sample Size

The sample size chosen for this study (75) limits the conclusions that can be made about the range of places across tenures and jurisdictions. The information contained therefore reflects the current data available for the places sampled. As the sample size is small, it does not represent a statistically valid sample of the values, condition and integrity of all natural heritage places.

4

RESULTS

4.1

ANALYSIS OF DATA

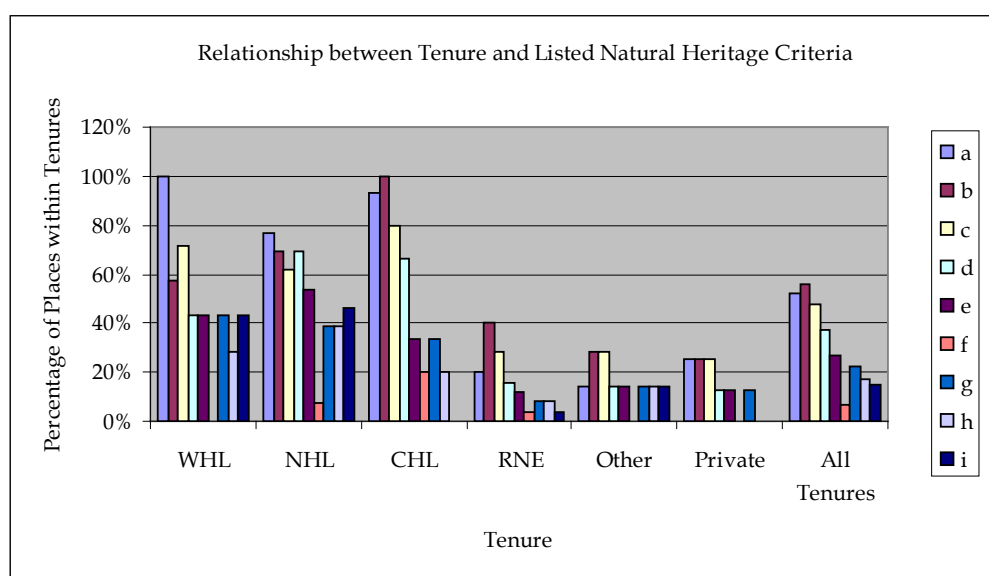
4.1.1

Natural Heritage Criteria

Natural heritage criteria were recorded for all places assessed during the data collection phase where a natural heritage assessment had taken place or where the values were identified in the literature search. This included collecting information undertaken on natural heritage assessments undertaken by the Commonwealth as required by the *EPBC Act*.

The data identified that places listed on the WHL, CHL and NHL met the most number of criteria. This is as expected as these places have undertaken formal assessments against the natural heritage criteria as required by legislation (except WHL). Other tenures are generally not required to be assessed against natural heritage criteria and as such did not record assessed heritage values. There was no data identified for the majority of “other” and “private” places. This also would be expected as these places have not been subject to formal assessment processes for natural heritage, however where values were identified during the literature search, these were recorded. The relationship between tenure and listed natural heritage criteria is shown in *Figure 4.1* and *Table 4.1*.

Figure 4.1 Relationship between Tenure and Listed Natural Heritage Criteria



a) Processes; b) Rarity; c) Research; d); Characteristic Values; e) Aesthetic Characteristics; f) Technical Achievement; g) Social Value; h) Significant People; and i) Tradition

Table 4.1 Relationship between Tenure and Listed Natural Heritage Criteria

Tenure	Natural Heritage Criteria (listed)								
	a	b	c	d	e	f	g	h	i
WHL	100%	57%	71%	43%	43%	0%	43%	29%	43%
NHL	77%	69%	62%	69%	54%	8%	38%	38%	46%
CHL	93%	100%	80%	67%	33%	20%	33%	20%	0%
RNE	20%	40%	28%	16%	12%	4%	8%	8%	4%
Other	14%	29%	29%	14%	14%	0%	14%	14%	14%
Private	25%	25%	25%	13%	13%	0%	13%	0%	0%
All Tenures	52%	56%	48%	37%	27%	7%	23%	17%	15%
a) Processes; b) Rarity; c) Research; d) Characteristic Values; e) Aesthetic Characteristics; f) Technical Achievement; g) Social Value; h) Significant People; and i) Tradition									

4.1.2 Matters of National Environmental Significance

Matters of NES for each place were sampled to provide an indication of biodiversity values of the place and across tenures. State and territory threatened species listings were not considered as part of the study. Matters of NES include commonwealth listed threatened flora, threatened fauna, migratory species and endangered ecological communities. The number of each of these matters was recorded for each place during the desktop survey.

Overall, biodiversity values represented by the presence of Matters of NES were highest amongst CHL and NHL places. Given the small sample size, it is difficult to draw conclusions on the representativeness of the data of all places. The data reflects the places chosen in the sample and their location in the landscape. For example, places chosen for the WHL listings included the Australian Fossil Mammal places and Willandra Lakes region. These places have less biodiversity values than other places on the WHL, such as the Blue Mountains and Rainforests of Gondwana. The sample size for the CHL and NHL was larger however, enabling a greater representation of places across different bioregions, therefore reflecting areas of higher biodiversity. The information provides a baseline for information on the biodiversity values and threats of the places sampled.

Data on the mean and range of values (maximum and minimum) recorded for each Matter of NES is discussed and shown below.

Threatened Flora

Threatened flora listed under the Commonwealth EPBC Act was identified through MNES searches. Threatened flora records identified on all tenures indicated that places on the NHL, CHL and other places contained the most number of threatened flora compared to other tenure types. The maximum number of species was highest for these tenures, however “Other” places recorded a lower maximum value. WHL places sampled recorded the lowest number of threatened species. This is likely as the places chosen did not represent the places of the highest biodiversity value on the WHL. Larger sample sizes for the NHL and CHL enable a greater spread of places and reflect the diversity of places chosen.

The relationship between tenure and threatened flora is shown in *Figure 4.2* and *Table 4.2*.

Figure 4.2 *Relationship between Tenure and Threatened Flora*

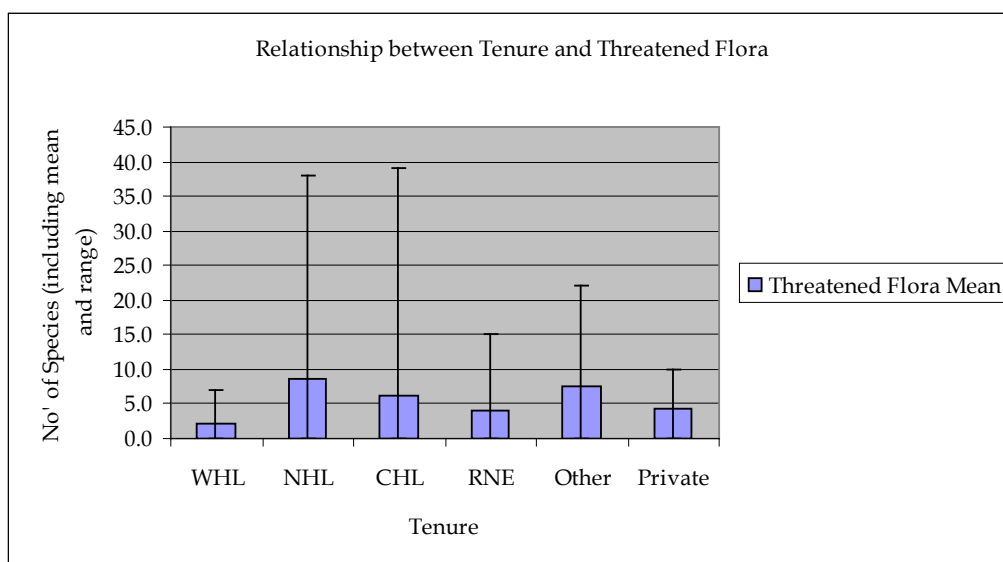


Table 4.2 *Relationship between Tenure and Threatened Flora*

Tenure	Threatened Flora Mean	Threatened Flora Maximum	Threatened Flora Minimum
WHL	2.1	7	0
NHL	8.6	38	0
CHL	6.2	39	0
RNE	4.0	15	0
Other	7.4	22	0
Private	4.3	10	0

Threatened Fauna

Threatened fauna listed under the EPBC Act were identified from MNES searches. Threatened fauna records identified on tenures indicated that places on the NHL, CHL and other places contained higher numbers of threatened species records compared to other tenure types. The maximum number of species was highest for NHL, RNE and "Other" places. Similarly to flora, WHL places sampled recorded the lowest number of threatened species records. This reflects the threatened fauna likely to occur within the sample and the bioregions represented. As discussed in the section on threatened flora, this was because the sample was likely to represent areas of lower biodiversity than other places on the WHL. Places identified on the RNE on the CHL and other had lower values for threatened fauna.

The relationship between tenure and threatened fauna is shown in *Figure 4.3* and *Table 4.3*.

Figure 4.3 *Relationship between Tenure and Threatened Fauna*

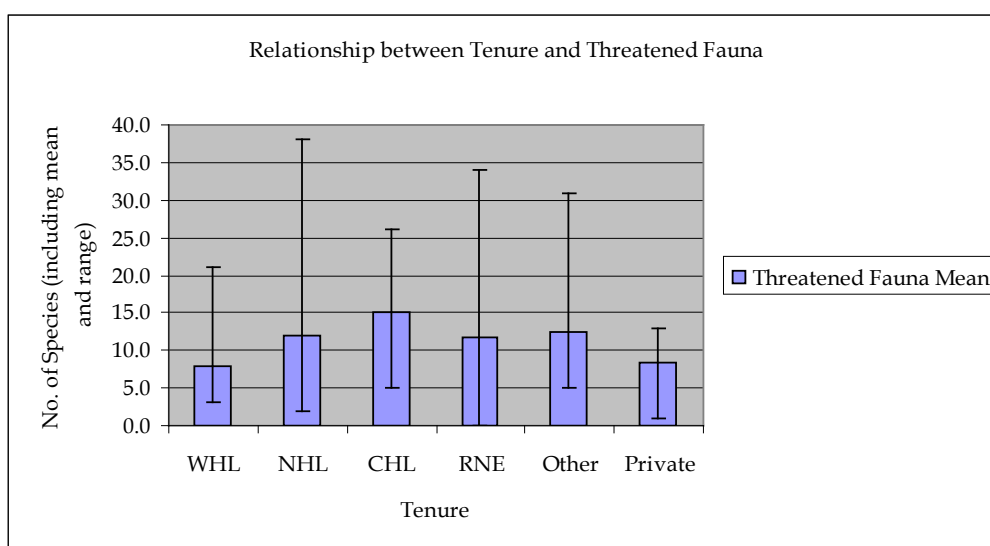


Table 4.3 *Relationship between Tenure and Threatened Fauna*

Tenure	Threatened Fauna Mean	Threatened Fauna Maximum	Threatened Fauna Minimum
WHL	8.0	21	3
NHL	12.0	38	2
CHL	15.1	26	5
RNE	11.7	34	0
Other	12.4	31	5
Private	8.4	13	1

Migratory Species

Migratory species identified on tenures indicated that places on CHL and “Other” places contained the most number compared to other tenure types. The maximum number of species was highest for these tenures. WHL and private places sampled recorded the lowest number of migratory species. Places chosen for the survey for the CHL favoured places closer to marine environments, hence the number of migratory species identified was higher. This reflects the sample chosen and there was no deliberate bias to choose places closer to marine areas.

The relationship between tenure and migratory species is shown in *Figure 4.4* and *Table 4.4*.

Figure 4.4 *Relationship between Tenure and Migratory Species*

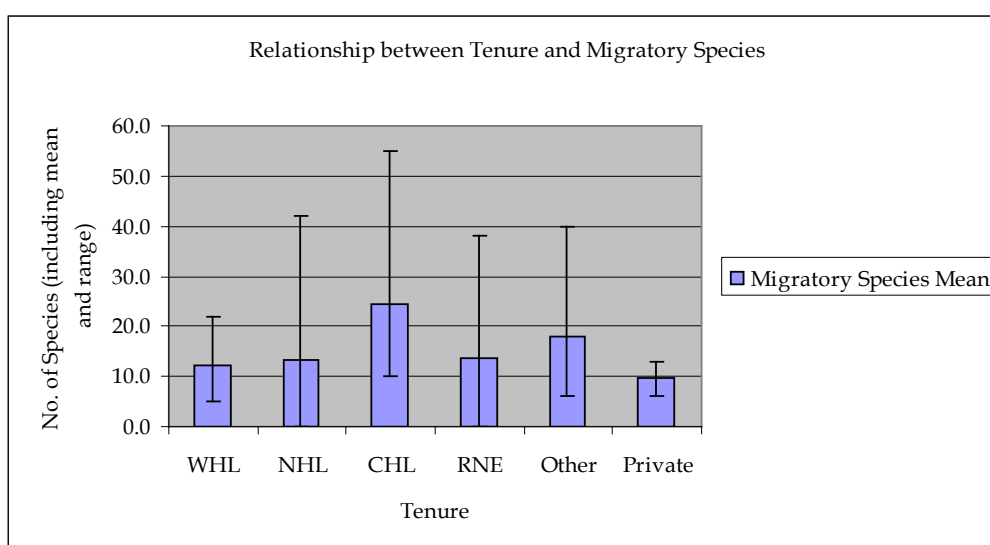


Table 4.4 *Relationship between Tenure and Migratory Species*

Tenure	Migratory Species Mean	Migratory Species Maximum	Migratory Species Minimum
WHL	12.1	22	5
NHL	13.3	42	0
CHL	24.3	55	10
RNE	13.6	38	0
Other	18.0	40	6
Private	9.9	13	6

Endangered Ecological Communities

Endangered Ecological Communities (EEC) is defined as those ecological communities listed under the Commonwealth EPBC Act as endangered. EECs identified on tenures indicated that places on the NHL and private places contained the most number of EEC's compared to other tenure types. The maximum number of communities was highest for the NHL and RNE, however private places also recorded highest maximums. This is likely as the places chosen for the sample represent degraded landscapes that are more likely to contain EECs.

The relationship between tenure and endangered ecological communities is shown in *Figure 4.5* and *Table 4.5*.

Figure 4.5 *Relationship between Tenure and Endangered Ecological Communities*

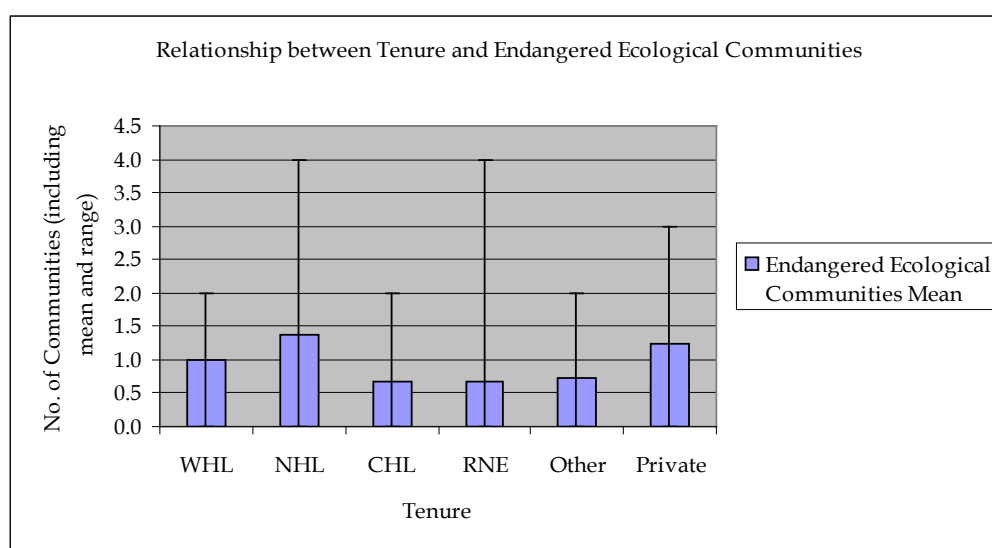


Table 4.5 *Relationship between Tenure and Endangered Ecological Communities*

Tenure	EEC's Mean	EEC's Maximum	EEC's Minimum
WHL	1.0	2	0
NHL	1.4	4	0
CHL	0.7	2	0
RNE	0.7	4	0
Other	0.7	2	0
Private	1.3	3	0

4.1.3 *Species Richness and Species Endemism (ANHAT Data)*

Data was provided by DSEWPac from the Australian Natural Heritage Assessment Tool (ANHAT) database for species richness and species endemism for all places surveyed.

The ANHAT is a map-supported database that helps identify and prioritise areas for their natural heritage significance, focusing on biodiversity. Significance is determined based on rigorous comparisons of specific natural values. To add a place to the National Heritage List it must be shown to have "outstanding heritage value to the nation". This requires a assessment of significance against other places in Australia with similar values.

ANHAT uses a dataset from Australia for locations of native species and uses information to derive scores for species richness and species endemism. This information can be used for comparative analysis between places to give an indication of where the greatest biodiversity can be found and also identify areas of high species endemism to give an understanding of the evolutionary biological heritage of species.

The data indicates that of the places surveyed, places on the CHL, private had NHL had the highest level of species richness and endemism. This information is consistent with the information contained above which identifies these places as having the highest number of threatened species and migratory species. However the data for endangered ecological communities does not correlate to the ANHAT data. The ANHAT data is derived from threatened species records and as such, it would be expected that this information would indicate similar results for each place type.

The relationship between tenure and endangered ecological communities is shown in *Figures 4.6 and 4.7* and *Tables 4.6 and 4.7*.

Figure 4.6 Relationship between Tenure and Species Richness (ANHAT)

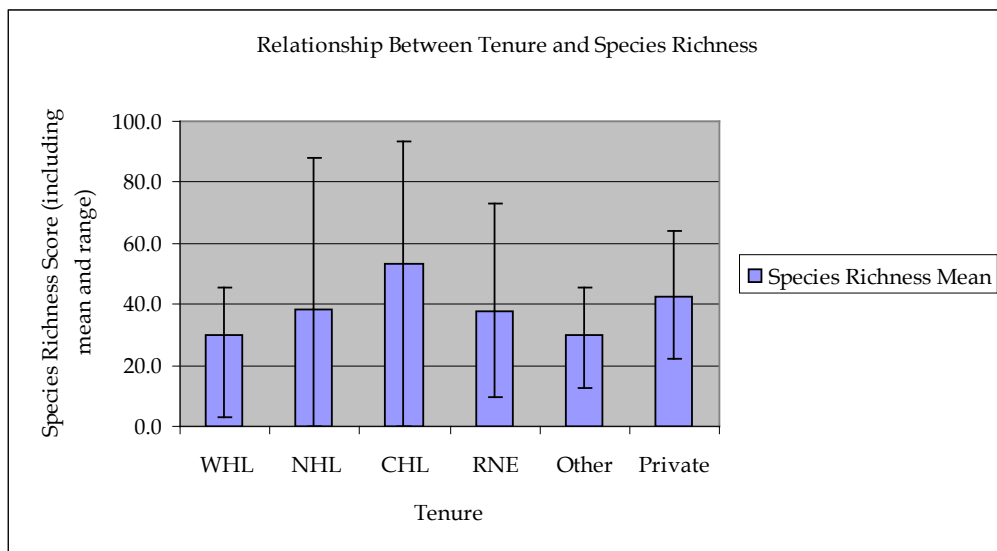


Figure 4.7 Relationship between Tenure and Species Endemism (ANHAT)

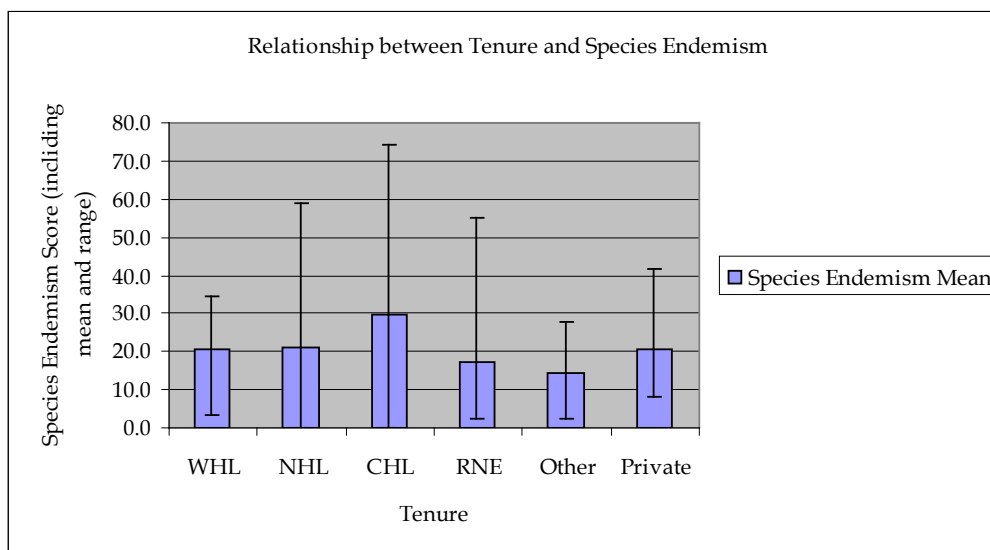


Table 4.6 Relationship between Tenure and Species Richness Value

Tenure	Species Richness Value
WHL	2.8
NHL	0.0
CHL	0.0
RNE	9.6
Other	12.3
Private	22.1

Table 4.7 Relationship between Tenure and Species Endemism Value

Tenure	Species Endemism Value
WHL	3.6
NHL	0.0
CHL	0.0
RNE	2.5
Other	2.6
Private	8.1

4.1.4 *Climate Change*

Data was collected on likely climate change impacts at the places surveyed. This data provides an indication of the likely impacts from climate change on the condition and integrity of natural heritage values of the place. The data collected related to any documented evidence that the place has had changes in temperature, vegetation change or sea level rise attributable to climate change.

Data collected on climate change did not provide conclusive results on the likely impact on places. Most places did not have information on climate change impacts and the results were therefore classified as unknown. Some anecdotal evidence about the impacts of climate change was noted at five places. However this was not supported by data.

Two places had a specific research activity occurring on the place in relation to climate change. One place was listed on the Commonwealth Heritage list in Tasmania and the other place was a private land conservancy place ('other').

The impact of climate change on natural heritage places is likely to result in subtle changes to the ecological values of the places from changes in temperature and rainfall over time. The effects of these potential changes are likely to occur in the long term and will only be identified through long term monitoring.

4.1.5 *Use of Natural Heritage Places*

Human use of natural heritage places provides an indication of the likely impact on condition and integrity of the place. Human uses included bush walking, picnicking, camping, four wheel driving, rock climbing, fishing and boating. Of the places sampled, 34.6% were identified as having restricted access, 8% were identified as having combined access and 50.6% were identified as having unrestricted access. In addition, 6.6% of places were identified to have insufficient data due to the lack of available information.

The data indicated that 61% of places assessed contain bushwalking tracks for public use and 52% of places contain picnicking facilities across all tenures and jurisdictions. Bushwalking and picnicking are likely to be low impact activities and are identified as having minimal impact on the current condition of a natural heritage place.

Camping facilities occur in 35% of the places assessed across all tenures and jurisdictions. Camping has been identified as a likely moderate impact activity. This is because the activity can lead to high localised impacts to the current condition of a natural heritage place from latrines, litter, fire and faunal habitat removal if not managed appropriately.

The data also indicated that 13% of places assessed are used for rock climbing and 17% allow four-wheel-driving activities across all tenures and states and territories. Rock climbing and four-wheel-driving activities have been classified as likely high impact activities as they have the potential to impact on the current condition of natural heritage places from soil disturbance, erosion, sedimentation and faunal habitat damage if not managed appropriately. Rock climbing is likely to have localised impacts on cliffs and caves which are habitat for cryptic species such as bats and reptiles.

Fishing and boating activities occur in 58% of places assessed across all tenures and jurisdictions. Fishing and boating have been classified as moderate impact activities and have the potential to impact on the current condition of natural heritage place as they may impact on specific fish species, cause amenity impacts such as noise and anchoring damage if not managed appropriately. However, the level of impact from these activities is likely to be localised.

Natural heritage places listed on the WHL and “other” tenures contained the highest number of low impact activities including bushwalking and picnicking. Natural heritage places listed on the CHL contained the lowest number of low impact activities as they are generally not able to be accessed by the public. Natural heritage places listed on the NHL and WHL contained the highest number of high impact activities including four-wheel-driving and rock climbing followed by the RNE. Natural heritage places listed on the CHL and “private” tenures contained the lowest number of high impact activities.

It should be noted that the sample size for WHL places is small and consists of six places. Two of the places chosen for assessment for the WHL allow four-wheel-driving and include Purnululu and Tasmania Wilderness Area. Purnululu includes the Bungle Bungle Ranges in North Western Australia and allows four-wheel-driving tours and is only accessible by four-wheel drive. The Tasmania Wilderness Area allows recreation vehicles on limited tracks within the place.

Places in SA and NSW recorded the highest number of low impact activities followed by places listed in WA. The ACT and Queensland recorded the lowest number of low impact activities. WA and the NT recorded the highest number of high impact activities followed by places listed in Victoria and SA. NSW, SA and Queensland recorded the lowest number of low impact activities. These places are managed by both State and Commonwealth governments.

The relationship between tenure and total place use is shown in *Figure 4.6* and *Table 4.6*. The relationship between jurisdiction and place use for individual place uses is shown in *Figure 4.7* and *Table 4.7*.

Figure 4.8 Relationship between Tenure and Place Use

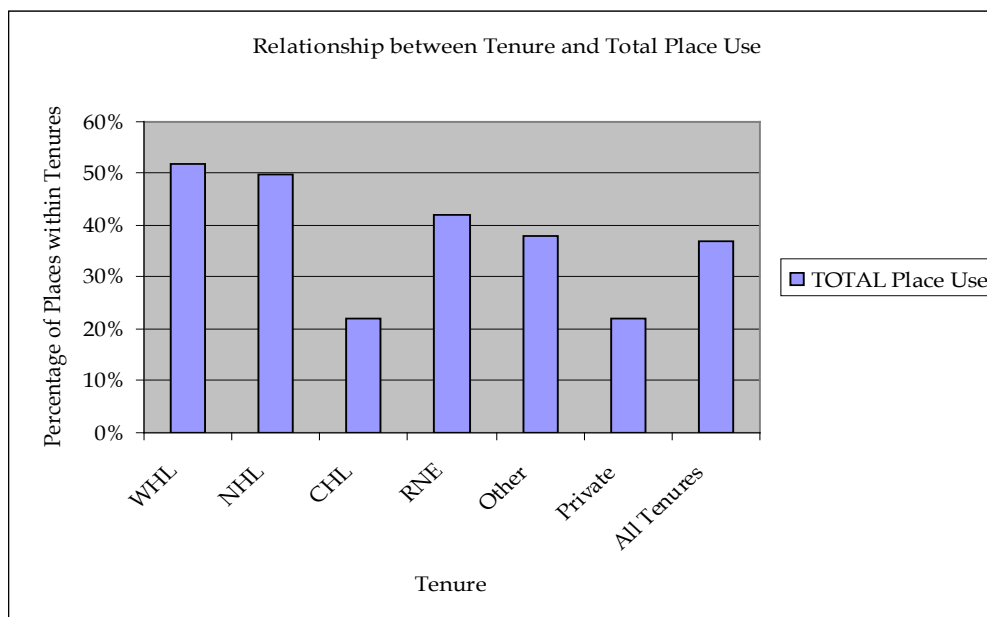


Table 4.8 Relationship between Tenure and Place Use

Tenure	Place Use								TOTAL Place Use
	Camping	Bush-walking	Fishing	Boating	Rock Climbing	Picnicking	4WD	Other*	
WHL (7)	43%	100%	14%	29%	29%	86%	29%	86%	52%
NHL (13)	62%	77%	31%	31%	38%	62%	15%	85%	50%
CHL (15)	13%	27%	20%	20%	0%	27%	7%	60%	22%
RNE (25)	40%	60%	52%	28%	12%	56%	24%	60%	42%
Other (7)	14%	100%	43%	29%	0%	57%	14%	43%	38%
Private (8)	25%	38%	13%	13%	0%	38%	13%	38%	22%
ALL (75)	35%	61%	33%	25%	13%	52%	17%	63%	37%

* Includes: bird watching, commercial tours, military training, research, horse riding, swimming, cycling, hunting and skiing.

Figure 4.9 Relationship between Jurisdiction and Place Use

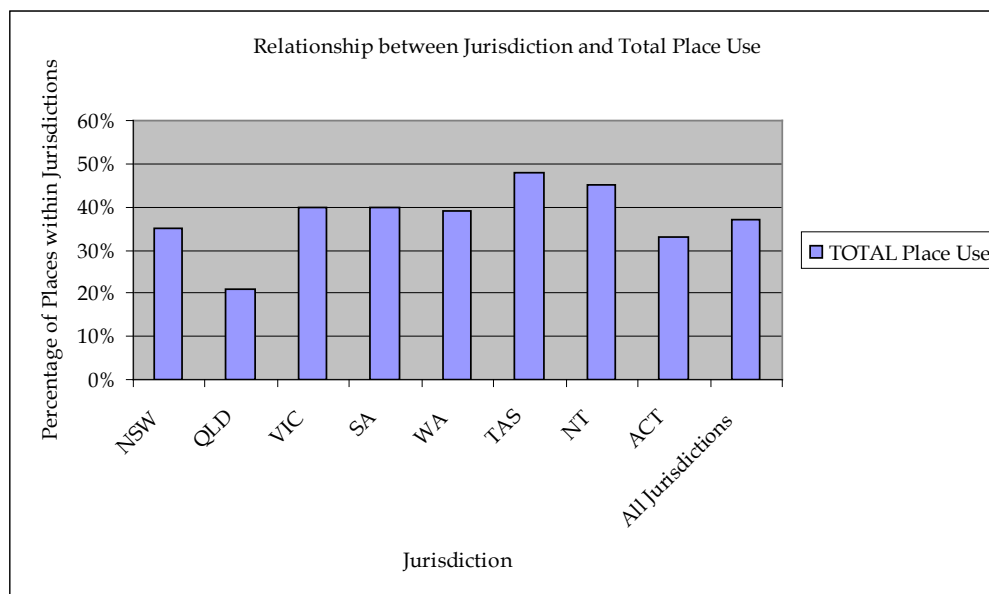


Table 4.9 Relationship between Jurisdiction and Place Use

Jurisdictions (Excl. EXT)	Place Use								TOTAL Place Use
	Camping	Bush- walking	Fishing	Boating	Rock Climbing	Picnicking	4WDing	Other*	
NSW (10)	40%	70%	10%	10%	10%	70%	0%	70%	35%
QLD (10)	20%	60%	0%	0%	0%	30%	0%	60%	21%
VIC (9)	33%	44%	44%	56%	22%	44%	22%	56%	40%
SA (10)	44%	78%	22%	22%	0%	67%	33%	56%	40%
WA (10)	36%	73%	36%	0%	36%	55%	27%	45%	39%
TAS (10)	30%	60%	70%	50%	20%	50%	10%	90%	48%
NT (9)	44%	56%	56%	33%	0%	56%	44%	67%	45%
ACT (6)	33%	33%	33%	33%	17%	50%	0%	67%	33%
ALL (75)	35%	61%	33%	25%	13%	52%	17%	63%	37%

* Includes: bird watching, commercial tours, military training, research, horse riding, swimming, cycling, hunting and skiing.

4.1.6 *Management of Natural Heritage Places*

The management of natural heritage places was assessed based on whether places had management plans for weed and pest management, erosion and sedimentation control, bushfire management, threatened species management and natural heritage management. These categories of management have been assessed as both a combined management score and individually below. This is based on the data collected to identify the presence of management frameworks for each place.

A high, moderate or low ranking was allocated to the heritage places as an indication of existing formal management arrangements. This used the data collected to rate the presence of management planning frameworks and combined to give an overall rating. A low ranking place has a current management plan (1999 – 2011), monthly or ongoing maintenance regimes planned for at least one of the management types assessed and is subject to regular review. A moderate rating has a current management plan (1999 – 2011) and annual management regimes planned for at least one of the management types assessed. A high ranking place did not have a management plan or had a management plan older than 1999. The place was recorded as “unknown” if no management plan was identified during the desktop and phone interview phase. All places where a management plan was not identified during the desktop were recorded as an unknown unless it was confirmed during the phone interview that a plan did not exist. The study did not document other management arrangements that may occur at the place not included in a management plan.

Management arrangements for natural heritage places are undertaken by State and territory as well as Commonwealth Governments. Private land conservation sites are undertaken by land owners or private conservancies.

Weed and Pest Management

Weed and pest management plans can provide arrangements to identify and prevent the spread of weed and pest species. They also provide details for the implementation of weed and pest control programs and also can identify monitoring and reporting requirements. The management of weed and pest species within the natural heritage places assessed was evaluated by the identification of an existing formal weed and pest management plan and arrangements for each place. Other weed and pest control activities may occur at each place but this information was not readily available for each place.

The data revealed that 13% of heritage places assessed were low rated, 28% were moderate rated and 33% were high rated as formal management plans for weed and pest species across all tenures and jurisdictions were not in place. In addition, 17% of places were identified to have insufficient data (“unknown”) due to lack of information on management plans for weed and pest management during the desktop and phone interview phase.

Natural heritage places listed on the WHL and “Private Tenures” contained the most low rated places assessed. Natural heritage places listed on the NHL and “private” tenure contained the highest number of moderate rated places assessed. Natural heritage places listed on the WHL and CHL contained the highest number of high rated places assessed. Places listed on the NHL and CHL listed the highest number of “unknown”.

Queensland and the NT recorded the highest number of low rated places followed by places in ACT. Tasmania recorded the highest number of moderate rated places followed by places in NSW and Victoria. WA recorded the highest number of high rated places followed by places in SA. Queensland and the ACT recorded the highest number of “unknown”.

The relationship between tenure and weed and pest management is shown in *Figure 4.8* and *Table 4.8*. The relationship between jurisdiction and weed and pest management is shown in *Figure 4.9* and *Table 4.9*.

Figure 4.10 Relationship between Tenure and Weed and Pest Management

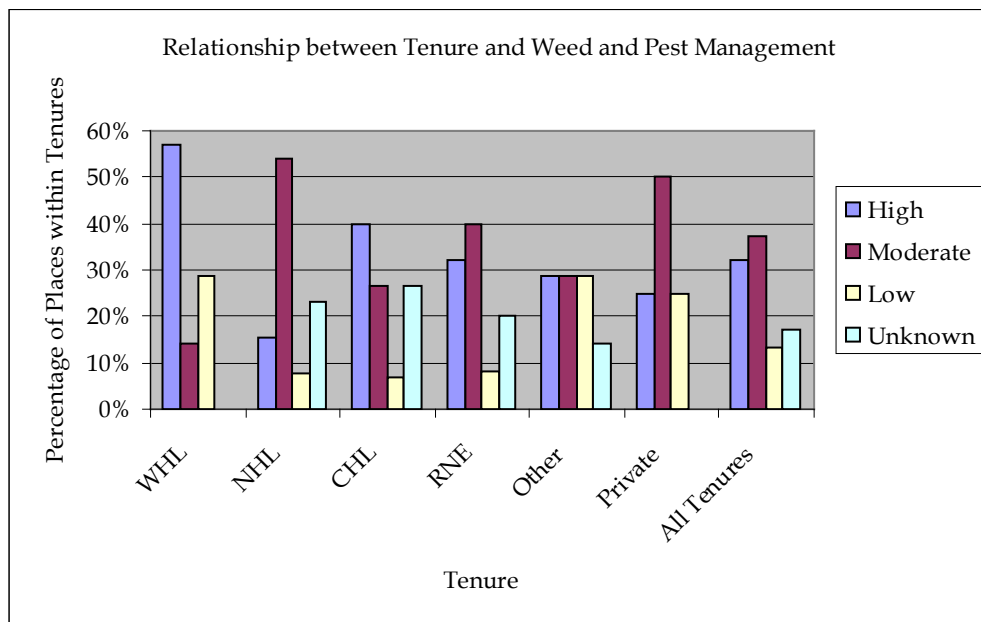


Table 4.10 Relationship between Tenure and Weed and Pest Management

Tenure	Weed and Pest Management of Sample			
	High	Moderate	Low	Unknown
WHL (7)	57%	14%	29%	0%
NHL (13)	15%	54%	8%	23%
CHL (15)	39%	27%	7%	27%
RNE (25)	32%	40%	8%	20%
Other (7)	29%	29%	29%	13%
Private (8)	25%	50%	25%	0%
All Tenures (75)	33%	37%	13%	17%

High - No management plan or older than 1999
Moderate - Current management plan but no regular review
Low - Current management plan and subject to regular review
Unknown -Management plan could not be found during desktop and not confirmed by phone interview

Figure 4.11 Relationship between Jurisdiction and Weed and Pest Management

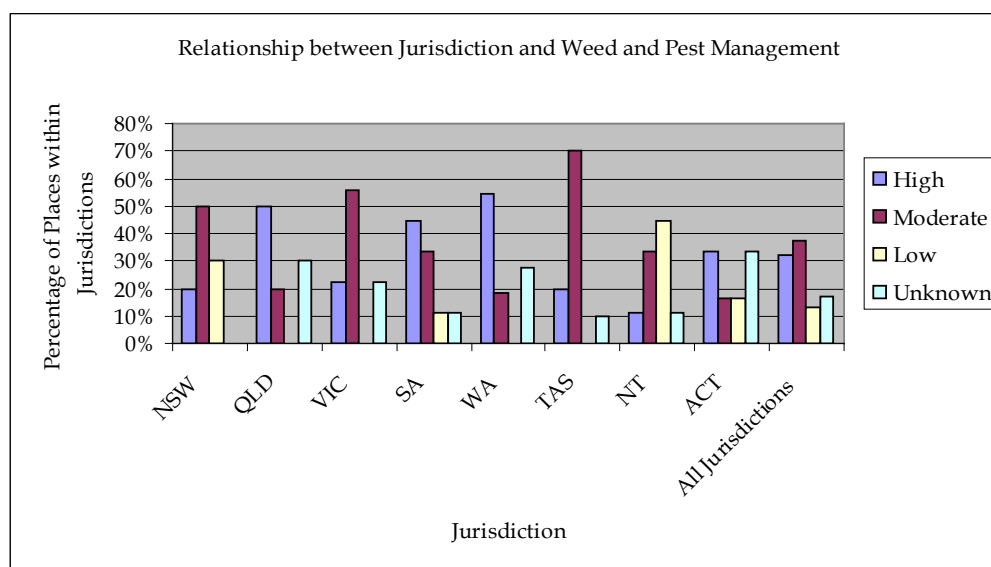


Table 4.11 Relationship between Jurisdiction and Weed and Pest Management

Jurisdiction	Weed and Pest Management of Sample			
	High	Moderate	Low	Unknown
NSW (10)	20%	50%	30%	0%
QLD(10)	50%	20%	0%	30%
VIC (9)	22%	56%	0%	22%
SA (10)	45%	33%	11%	11%
WA (10)	55%	18%	0%	27%
TAS (10)	20%	70%	0%	10%
NT (9)	11%	33%	45%	11%
ACT (6)	33%	17%	17%	33%
All Jurisdictions (75)	33%	37%	13%	17%
High – No management plan or older than 1999				
Moderate – Current management plan but no regular review				
Low – Current management plan and subject to regular review				
Unknown – Management plan could not be found during desktop and not confirmed by phone interview				

Bushfire Management

Bushfire hazard reduction management aims to protect life, property and the environment from the effects of wild fires. Appropriate fire regimes are necessary for the adequate function of some Australian ecosystems. It is achieved by applying appropriate bushfire hazard reduction techniques to protect natural resources, including native ecosystems and productive lands (NSW Rural Fire Service, 2011). The management of bushfire within the natural heritage places assessed was evaluated by the identification of existing formal bushfire management plans.

The data revealed that 9% of natural heritage places assessed are low rated, 33% are moderate rated and 35% are high rated for management plans across all tenures and jurisdictions. In addition, 23% of places were identified to have insufficient data due to formal arrangements for bushfire management and bushfire history being unknown. Informal arrangements for hazard reduction or undocumented approaches were not considered in the information collected. Additionally, not all places would benefit from a hazard reduction as fire would be unlikely to occur at the place. These places are included in the data for “unknown”.

Natural heritage places listed as “Other” and “Private” tenure contained the highest number of low rated places assessed. Natural heritage places listed on NHL and “private” tenure contained the most number of moderate rated places. Natural heritage places listed on WHL contained the most number of high rated places assessed followed by places listed on the RNE and CHL. It should be noted that places chosen from the WHL included places including the Australian Fossil Mammal Sites and Willandra Lakes which are generally not threatened by wildfire and as such management planning is not necessary. The CHL and RNE also listed the highest number of “unknowns”.

The NT recorded the highest number of low rated places followed by places in the NSW. NSW and Tasmania recorded the highest number of moderate rated places followed by places in Victoria. Queensland and WA recorded the highest number of high rated places followed by places in SA. Victoria and ACT listed the highest number of “unknown”.

The relationship between tenure and bushfire management is shown in *Figure 4.10* and *Table 4.10*. The relationship between jurisdiction and bushfire management is shown in *Figure 4.11* and *Table 4.11*.

Figure 4.12 Relationship between Tenure and Bushfire Management

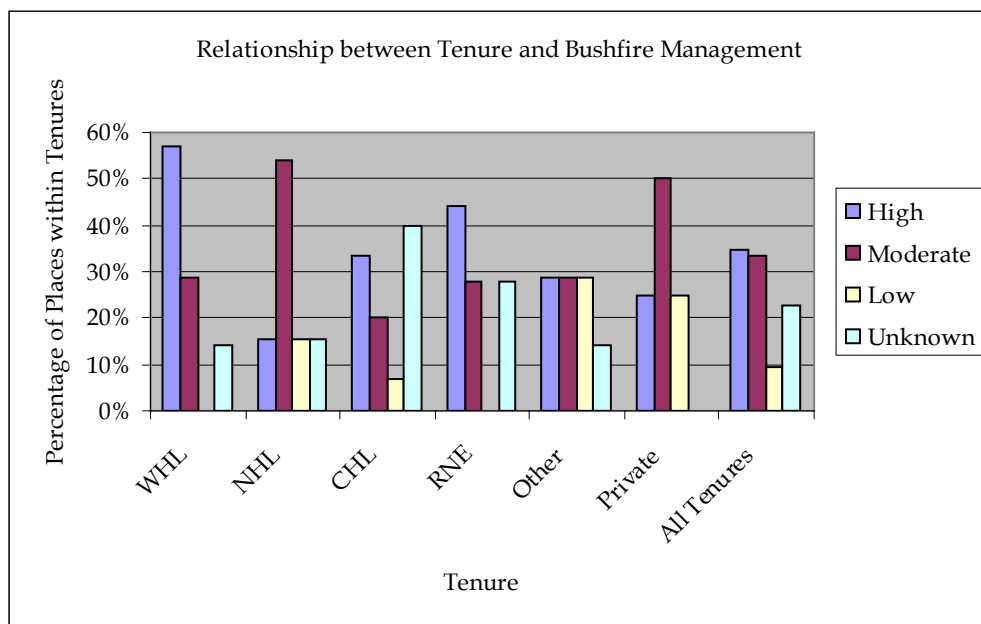


Table 4.12 Relationship between Tenure and Bushfire Management

Tenure	Bushfire Management of Sample			
	High	Moderate	Low	Unknown
WHL (7)	57%	29%	0%	14%
NHL (13)	15%	55%	15%	15%
CHL (15)	33%	20%	7%	40%
RNE (25)	44%	28%	0%	28%
Other (7)	29%	29%	29%	13%
Private (8)	25%	50%	25%	0%
All Tenures (75)	35%	33%	9%	23%

High - No management plan or older than 1999
Moderate - Current management plan
Low - Current management plan and subject to regular review
Unknown - Management plan could not be found during desktop and not confirmed by phone interview

Figure 4.13 Relationship between Jurisdiction and Bushfire Management

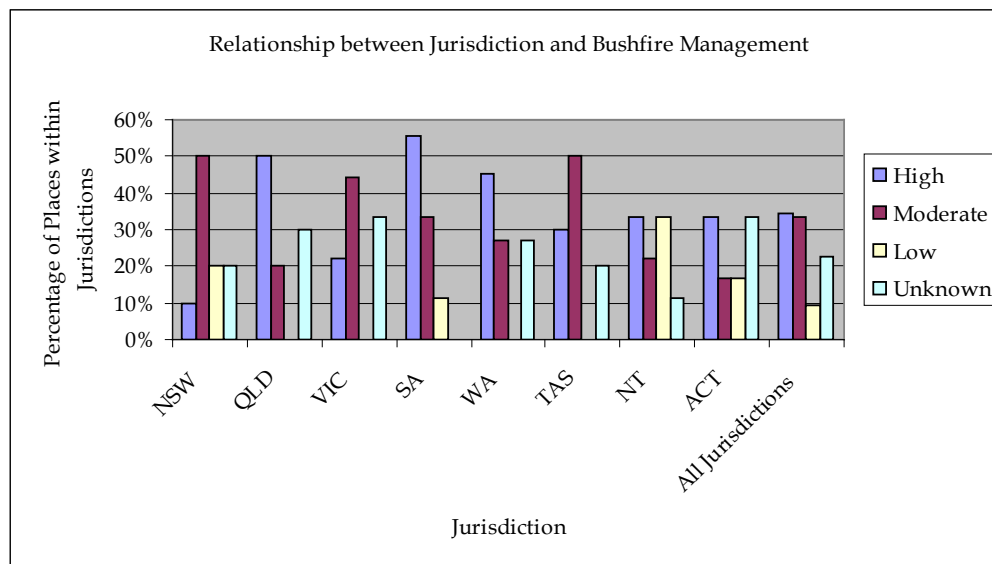


Table 4.13 Relationship between Jurisdiction and Bushfire Management

Jurisdiction	Bushfire Management of Sample			
	High	Moderate	Low	Unknown
NSW (10)	10%	50%	20%	20%
QLD (10)	50%	20%	0%	30%
VIC (9)	22%	44%	0%	34%
SA (10)	56%	33%	11%	0%
WA (10)	46%	27%	0%	27%
TAS (10)	30%	50%	0%	20%
NT (9)	33%	22%	33%	12%
ACT (6)	33%	17%	17%	33%
All Jurisdictions (75)	35%	33%	9%	23%
High – No management plan or older than 1999				
Moderate – Current management plan				
Low – Current management plan and subject to regular review				
Unknown – Management plan could not be found during desktop and not confirmed by phone interview				

Erosion and Sedimentation Management

Erosion and sedimentation management plans can be used to specify the environmental management requirements and strategies for erosion and sediment control within a place. They can also aim to prevent significant unnatural erosion or sedimentation within the place. The management of erosion and sedimentation within the natural heritage places was evaluated by the identification of existing formal erosion and sedimentation management plan for each place. Adequate sediment and erosion planning provides an indication of the intent to appropriately manage a natural heritage place and provides a framework for ongoing management and maintenance.

The data revealed that 11% of natural heritage places assessed are low rated, 24% are moderate rated and 32% are high rated. In addition, 33% of places were identified to have insufficient data due to formal arrangements for erosion and sedimentation control being unknown.

Natural heritage places listed on the "other" and "private" tenure contained the most number of low and moderate rated places assessed. Natural heritage places listed on the NHL and CHL contained the highest number of high rated places assessed. The NHL and CHL also recorded the highest number of "unknown".

NSW recorded the highest number of low rated places followed by places in SA. SA recorded the highest number of moderate rated places followed by places in NSW. SA recorded the highest number of high rated places followed by places in Queensland. Victoria recorded the highest rate of places where management arrangements were recorded as "unknown".

The relationship between tenure and erosion and sedimentation management is shown in *Figure 4.12* and *Table 4.12*. The relationship between jurisdiction and erosion and sedimentation management is shown in *Figure 4.13* and *Table 4.13*.

Figure 4.14 Relationship between Tenure and Erosion and Sedimentation Management

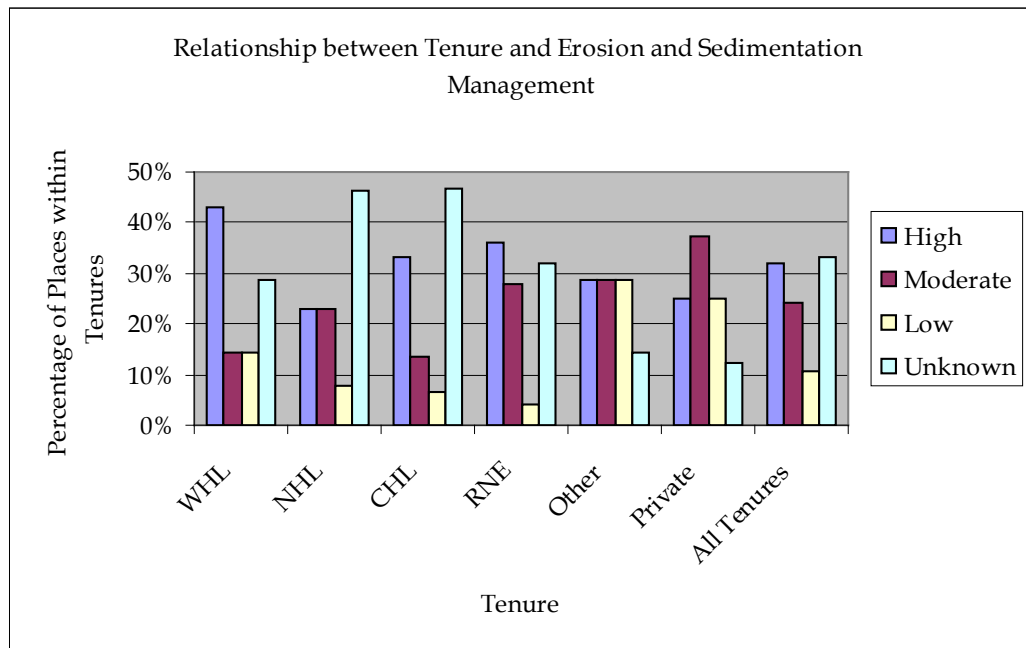


Table 4.14 Relationship between Tenure and Erosion and Sedimentation Management

Tenure	Erosion and Sedimentation Management of Sample			
	High	Moderate	Low	Unknown
WHL (7)	43%	14%	14%	29%
NHL (13)	23%	23%	8%	46%
CHL (15)	33%	13%	7%	47%
RNE (25)	36%	28%	4%	32%
Other (7)	29%	29%	29%	13%
Private (8)	25%	38%	25%	12%
All Tenures (75)	32%	24%	11%	33%

High - No management plan or older than 1999
 Moderate - Current management plan
 Low - Current management plan and subject to regular review
 Unknown - Management plan could not be found during desktop and not confirmed by phone interview

Figure 4.15 Relationship between Jurisdiction and Erosion and Sedimentation Management

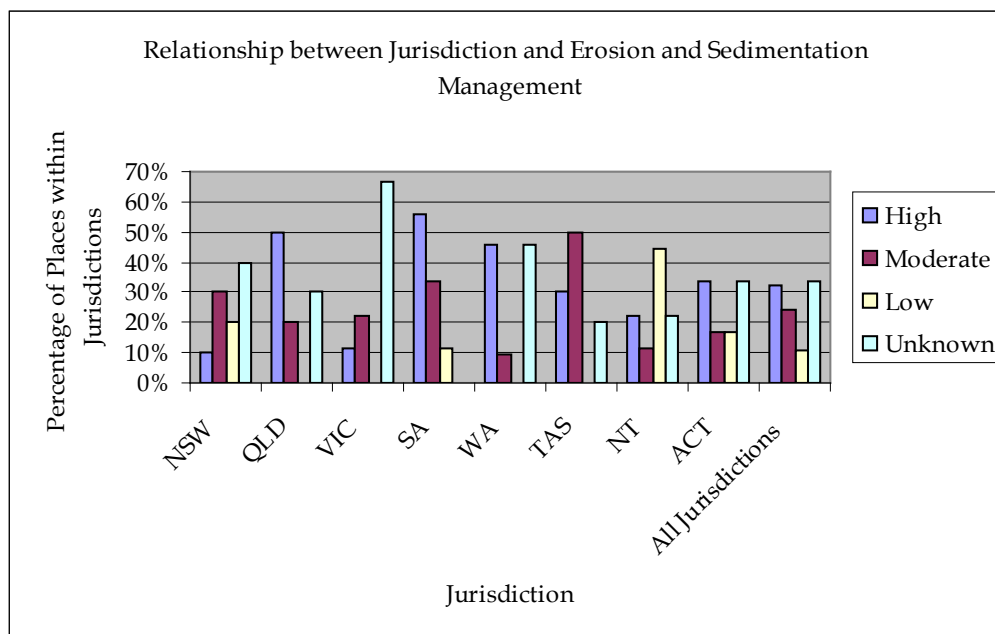


Table 4.15 Relationship between Jurisdiction and Erosion and Sedimentation Management

Jurisdiction	Erosion and Sedimentation Management of Sample			
	High	Moderate	Low	Unknown
NSW (10)	10%	30%	20%	40%
QUEENSLAND (10)	50%	20%	0%	30%
VIC (9)	11%	22%	0%	67%
SA (10)	56%	33%	11%	0%
WA (10)	45%	10%	0%	45%
TAS (10)	30%	50%	0%	20%
NT (9)	22%	12%	44%	22%
ACT (6)	33%	17%	17%	33%
All Jurisdictions (75)	32%	24%	11%	33%
High - No management plan or older than 1999				
Moderate - Current management plan but no regular review				
Low - Current management plan and subject to regular review				
Unknown - Management plan could not be found during desktop and not confirmed by phone interview				

Threatened Species Management

Threatened species management plans at natural heritage places can assist in threatened species management and recovery planning when implemented. Appropriate bushfire management, weed control measures and vegetation restoration can provide practical strategies for the protection of threatened species and the management and enhancement of habitat. The management of threatened species within the natural heritage places assessed was evaluated by the identification of existing formal threatened species management plans for each place. Appropriate management arrangements through management plans can maintain and enhance natural heritage values if funded and implemented. Other threatened species recovery plans that may exist for species at a State or Federal level and were applicable to the place were also documented.

The data revealed that 9% of heritage places assessed are low rated, 31% are moderate rated and 32% are high rated across all tenures and jurisdictions. In addition, 28% of places were identified to have insufficient data due to formal arrangements for threatened species management being unknown.

Natural heritage places listed on the NHL contained the highest number of low rated places assessed followed by places listed on “other”. Natural heritage places listed on the CHL contained the highest number of moderate rated places assessed followed by places listed as “other”. Natural heritage places listed as “private” contained the highest number of high rated places assessed followed by places listed on “WHL”. The CHL and RNE listed the most number of places listed as “unknown”.

Places in NSW recorded the highest number of low rated places followed by places in the ACT. The NT recorded the highest number of moderate rated places followed by places in NSW and Tasmania. Queensland recorded the highest number of high rated places followed by places in SA and ACT. Victoria and the ACT had the highest number of “unknown”. The relationship between tenure and threatened species management is shown in *Figure 4.14* and *Table 4.14*. The relationship between jurisdiction and threatened species management is shown in *Figure 4.15* and *Table 4.15*.

It should be noted that Commonwealth, state, territory and local governments are responsible for the management of a range of natural heritage places. Not all places within a state are managed by the respective state or territory government and maybe managed by Commonwealth or local governments.

Figure 4.16 Relationship between Tenure and Threatened Species Management

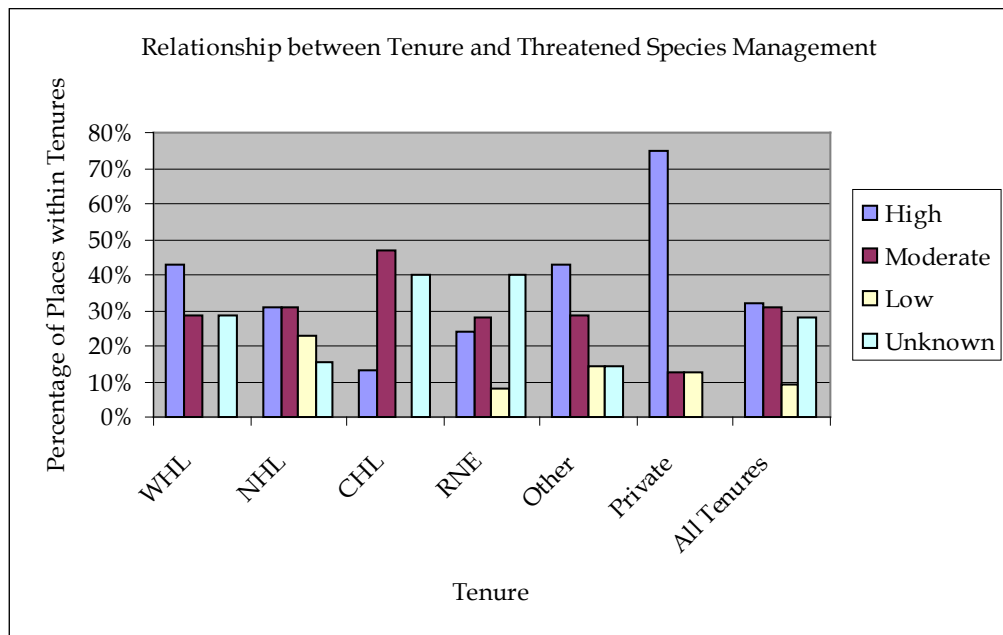


Table 4.16 Relationship between Tenure and Threatened Species Management

Tenure	Threatened Species Management of Sample			
	High	Moderate	Low	Unknown
WHL (7)	42%	29%	0%	29%
NHL (13)	31%	31%	23%	15%
CHL (15)	13%	47%	0%	40%
RNE (25)	24%	28%	8%	40%
Other (7)	43%	29%	14%	14%
Private (8)	74%	13%	13%	0%
All Tenures (75)	32%	31%	9%	28%

High - No management plan or older than 1999
Moderate - Current management plan but no regular review
Low - Current management plan and subject to regular review
Unknown - Management plan could not be found during desktop and not confirmed by phone interview

Figure 4.17 Relationship between Jurisdiction and Threatened Species Management

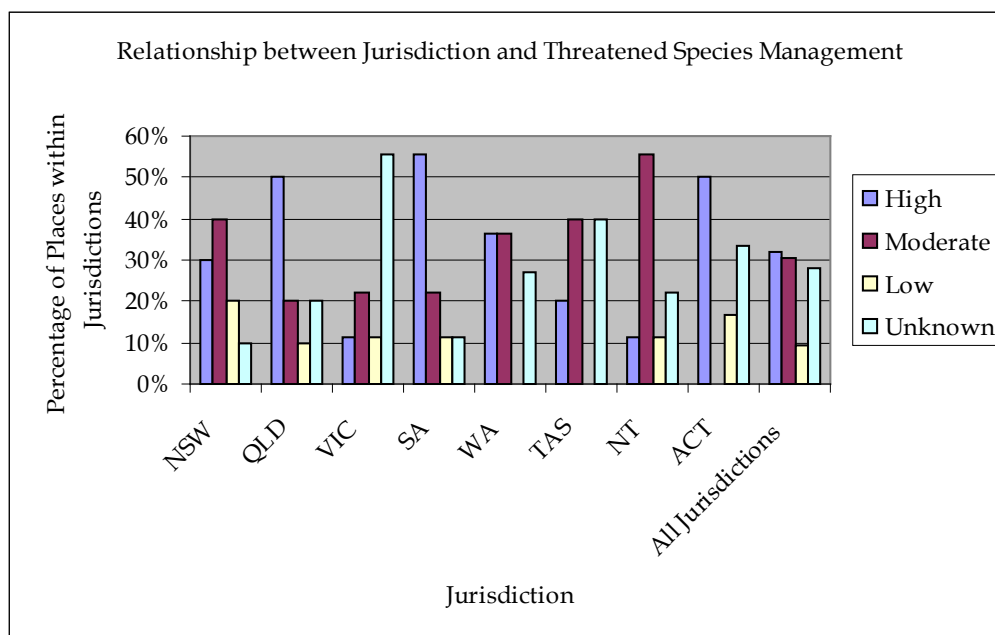


Table 4.17 Relationship between Jurisdiction and Threatened Species Management

Jurisdiction	Threatened Species Management of Sample			
	High	Moderate	Low	Unknown
NSW (10)	30%	40%	20%	10%
QLD (10)	50%	20%	10%	20%
VIC (9)	11%	22%	11%	56%
SA (10)	56%	22%	11%	11%
WA (10)	36%	36%	0%	28%
TAS (10)	20%	40%	0%	40%
NT (9)	11%	56%	11%	22%
ACT (6)	50%	0%	17%	33%
All Jurisdictions (75)	32%	31%	9%	28%
High – No management plan or older than 1999				
Moderate – Current management plan but no regular review				
Low – Current management plan and subject to regular review				
Unknown – Management plan could not be found during desktop and not confirmed by phone interview				

Natural Heritage Management

Natural heritage management plans aim to provide an understanding of the heritage values of the place, inform future management of the place and the conservation of the natural heritage values. The management of heritage values within the natural heritage places assessed was evaluated by the identification of existing formal heritage management plan for each place.

The data revealed that 9% of heritage places assessed are low rated, 27% are moderate rated and 31% are high rated across all tenures and jurisdictions. In addition, 33% of places were identified to have insufficient data due to formal arrangements for heritage management being unknown.

Natural heritage places listed on the “other” tenures contained the highest number of low rated places assessed followed by places listed on the CHL. Natural heritage places listed on NHL contained the highest number of moderate rated places assessed followed by places listed on the WHL. Natural heritage places listed on “other” tenure contained the highest number of high rated places assessed followed by places listed as “private” tenure. Heritage management planning is unlikely to be a priority for private lands however. Most natural heritage management frameworks exist for Commonwealth properties as they are required to have heritage management plans under the *EPBC Act*. The WHL and CHL contained the highest number of “unknowns”.

The NT recorded the highest number of low rated places followed by places in the ACT. NSW recorded the highest number of moderate rated places followed by places in SA. The ACT recorded the highest number of high rated places followed by places in WA. WA and Victoria had the highest number of “unknown”.

The relationship between tenure and heritage management is shown in *Figure 4.16* and *Table 4.16*. The relationship between jurisdiction and heritage management is shown in *Figure 4.17* and *Table 4.17*.

It should be noted that Commonwealth, state, territory and local governments are responsible for the management of a range of natural heritage places. Not all places within a state are managed by the respective state or territory government and maybe managed by Commonwealth or local governments.

Figure 4.18 Relationship between Tenure and Heritage Management

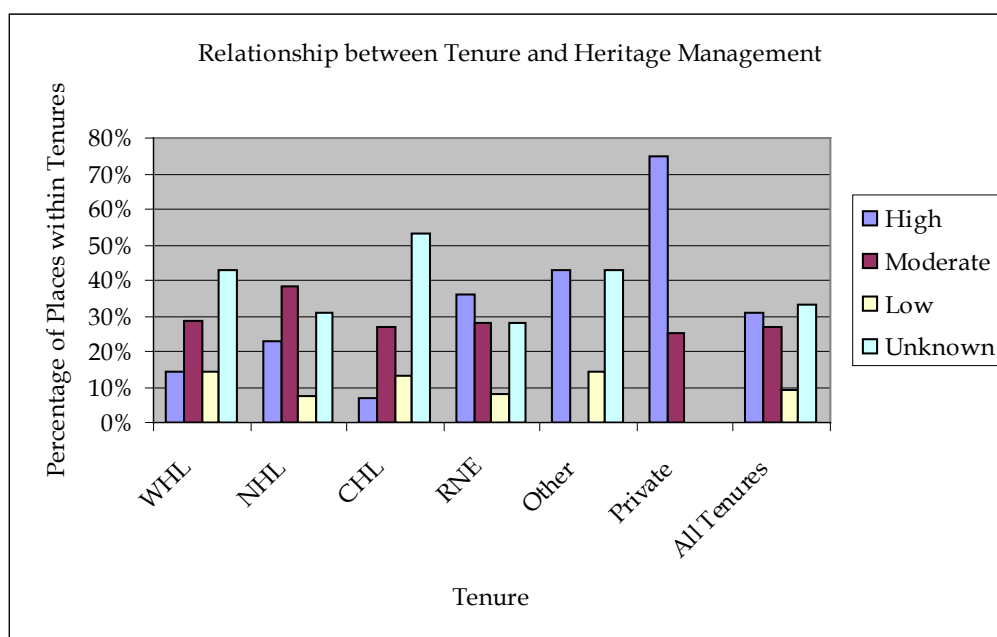


Table 4.18 Relationship between Tenure and Heritage Management

Tenure	Heritage Management of Sample			
	High	Moderate	Low	Unknown
WHL (7)	14%	29%	14%	43%
NHL (13)	23%	38%	8%	31%
CHL (15)	7%	27%	13%	53%
RNE (25)	36%	28%	8%	28%
Other (7)	43%	0%	14%	43%
Private (8)	75%	25%	0%	0%
All Tenures (75)	31%	27%	9%	33%

High - No management plan or older than 1999
Moderate - Current management plan but no regular review
Low - Current management plan and subject to regular review
Unknown - Management plan could not be found during desktop and not confirmed by phone interview

Figure 4.19 Relationship between Jurisdiction and Heritage Management

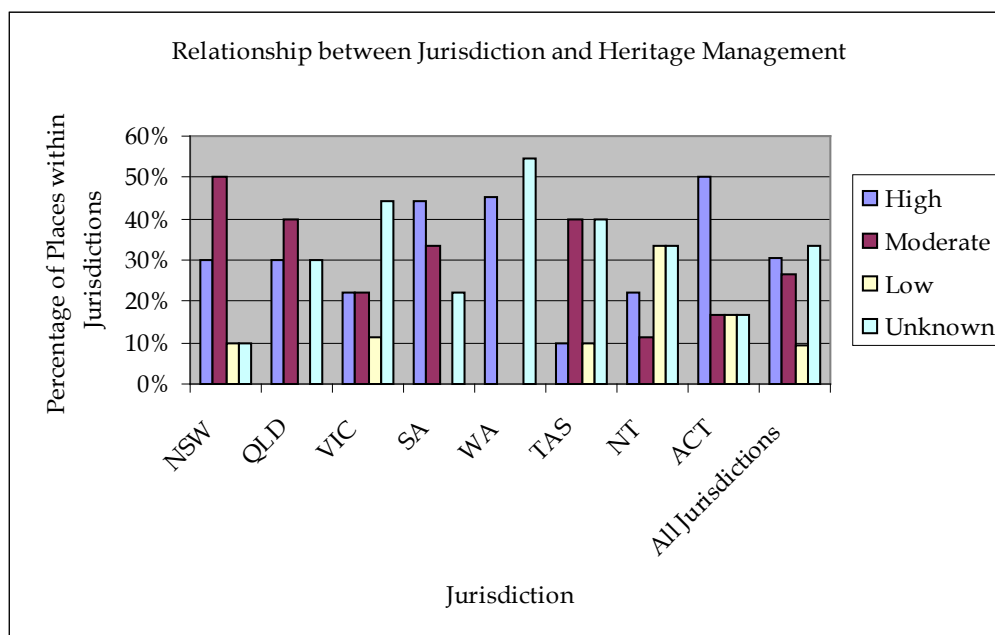


Table 4.19 Relationship between Jurisdiction and Heritage Management

Jurisdiction	Heritage Management of Sample			
	High	Moderate	Low	Unknown
NSW (10)	30%	50%	10%	10%
QLD (10)	30%	40%	0%	30%
VIC (9)	22%	22%	12%	44%
SA (10)	44%	33%	0%	23%
WA (10)	45%	0%	0%	55%
TAS (10)	10%	40%	10%	40%
NT (9)	22%	12%	33%	33%
ACT (6)	49%	17%	17%	17%
All Jurisdictions (75)	31%	27%	9%	33%
High – No management plan or older than 1999				
Moderate – Current management plan but no regular review				
Low – Current management plan and subject to regular review				
Unknown – Management plan could not be found during desktop and not confirmed by phone interview				

4.1.7 Condition of Natural Heritage Places in Australia

The condition of natural heritage places was assessed by five impact types including weather events and wild fire over the past five years and the presence of invasive species, pest species and erosion within a place. The relationship between these data parameters and the condition of the natural heritage place assessed is discussed below.

Weather Events and Wild Fire

Weather events and wild fire are external impacts that can impact on the places values through damage to species habitats, waterways and infrastructure. These events are often unmanageable from a land manager's perspective and are difficult to cater for in management strategies. Weather events have the potential to cause damage, serious social disruption or loss of human life (Stephenson D.B, 2008). Types of weather events vary depending on the latitude, altitude, topography, and atmospheric conditions of a place and were assessed by the occurrence of events at a place including high wind, cyclones, high rainfall and floods. Weather events were recorded for this study if they had damaged natural heritage values of the place.

The data revealed that 45% of heritage places assessed had weather events occur over the past five years and 45% of places had none recorded across all tenures and jurisdictions. In addition, 10% of places were identified to have insufficient data due to information not being available.

Natural heritage places listed on the WHL had the highest number places assessed with weather events occurring over the past five years followed by places listed as “private” tenure. Natural heritage places listed on the NHL had the lowest number of natural heritage places assessed followed by places listed on the CHL.

The NT recorded the highest number of places assessed with weather events occurring followed by places in NSW. Tasmania recorded the lowest number of places assessed with weather events followed by places in WA.

A wild fire is defined as an uncontrollable fire spreading through vegetative fuels, exposing and possibly consuming vegetation and structures. It is influenced by three main elements including weather, topography and fuels. The five main causes of wild fire include smoking, arson and miscellaneous incidents such as power lines, fireworks and glass refraction (NSW Rural Fire Service, 2005). Wild fire impacts for natural heritage places assessed were identified by the occurrence within a place over the past five years.

The data revealed that 24% of heritage places assessed had at least one wild fire event occur over the past five years and 67% of places had none recorded across all tenures and jurisdictions. In addition, 9% of places were identified to have insufficient data due to information not being available.

Natural heritage places listed on the CHL had the highest number of natural heritage places assessed with a wild fire occurring over the past five years followed by places listed on the NHL. Natural heritage places listed on the WHL and as “other” tenure had the lowest number of natural heritage places assessed followed by places listed on the RNE.

The NT recorded the highest number of places assessed with wild fires occurring, followed by places in WA. Queensland recorded the lowest number of places assessed followed by places in Victoria. The relationship between tenure, weather events and wild fire is shown in *Figure 4.18* and *Table 4.18*. The relationship between jurisdiction weather events and wild fire is shown in *Figure 4.19* and *Table 5.19*.

Figure 4.20 Tenure, Weather Events and Wild Fire for place type

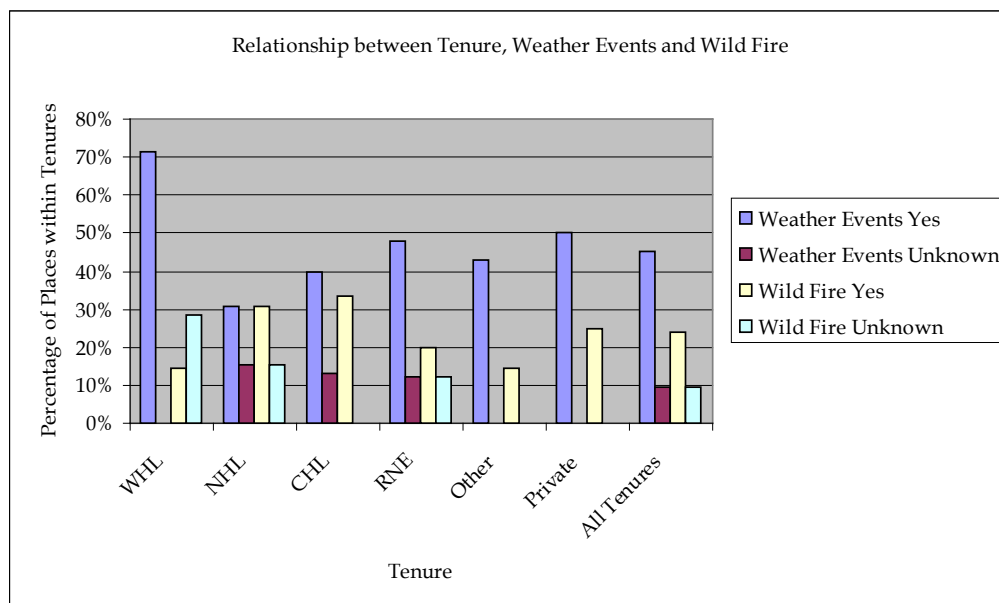


Table 4.20 Relationship between Tenure, Weather Events and Wild Fire

Tenure	Weather Events		Wild Fire	
	Yes	Unknown	Yes	Unknown
WHL (7)	71%	0%	14%	29%
NHL (13)	31%	15%	31%	15%
CHL (15)	40%	13%	33%	0%
RNE (25)	48%	12%	20%	12%
Other (7)	43%	0%	14%	0%
Private (8)	50%	0%	25%	0%
All Tenures (75)	45%	10%	24%	9%

Figure 4.21 Relationship between Jurisdiction, Weather Events and Wild Fire

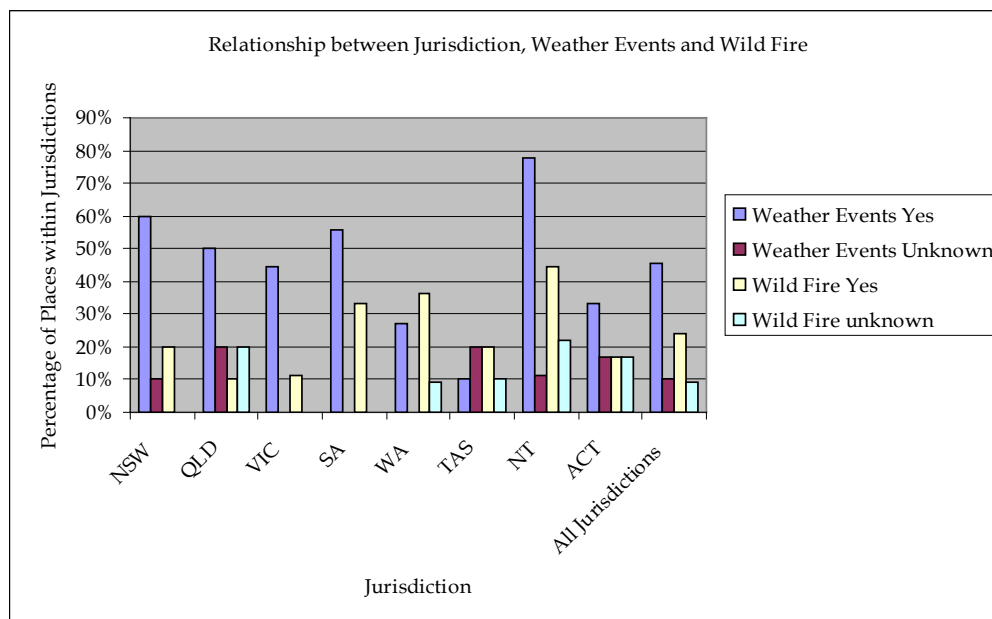


Table 4.21 Relationship between Jurisdiction, Weather Events and Wild Fire

Jurisdiction	Extreme Weather Impact		Wildfire	
	Yes	Unknown	Yes	Unknown
NSW (10)	60%	10%	20%	0%
QLD (10)	50%	20%	10%	20%
VIC (9)	44%	0%	11%	0%
SA (10)	56%	0%	33%	0%
WA (10)	27%	0%	36%	9%
TAS (10)	10%	20%	20%	10%
NT (9)	78%	11%	44%	22%
ACT (6)	33%	17%	17%	17%
All Jurisdictions (75)	45%	10%	24%	9%

Invasive Species

An invasive species is defined for this assessment as a flora species that does not naturally occur in a region and whose introduction may cause harm to the condition of a place (Elton C.S, 2000). The presence of invasive species for each place was sampled to provide an indication of condition of the place and across tenures. The number of invasive species was recorded for each place.

The information provides a baseline for information on the presence of invasive species of the places sampled. Data on the mean and range of values recorded for each tenure is discussed and shown below.

Invasive species identified on tenures indicated that places on the NHL and “other” tenures contained the highest number compared to other tenure types. WHL places sampled recorded the lowest number of invasive species. The maximum number of invasive native species recorded was 12. The relationship between tenure and invasive species is shown in *Figure 4.20* and *Table 4.20*.

Figure 4.22 *Relationship between Tenure and Invasive Species*

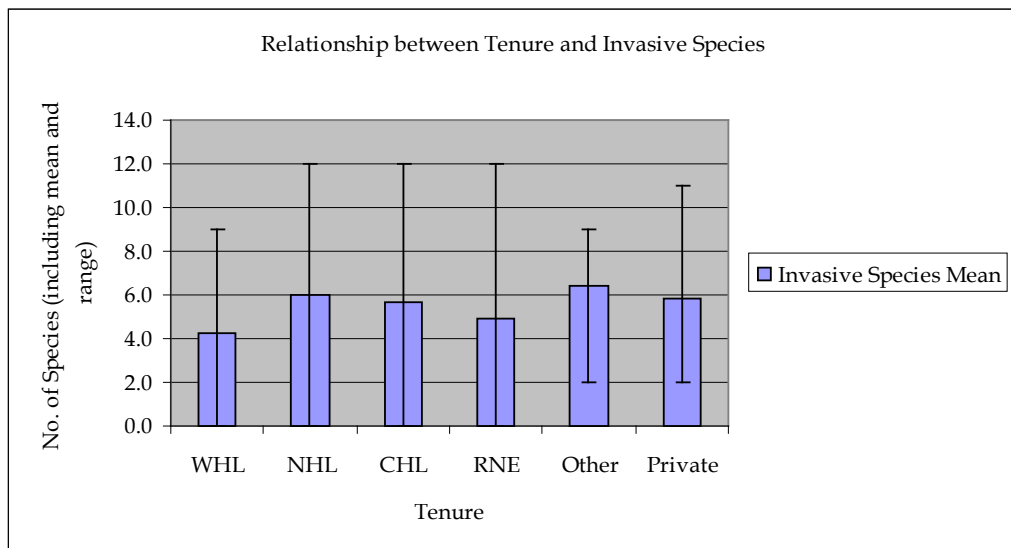


Table 4.22 Relationship between Tenure and Invasive Species

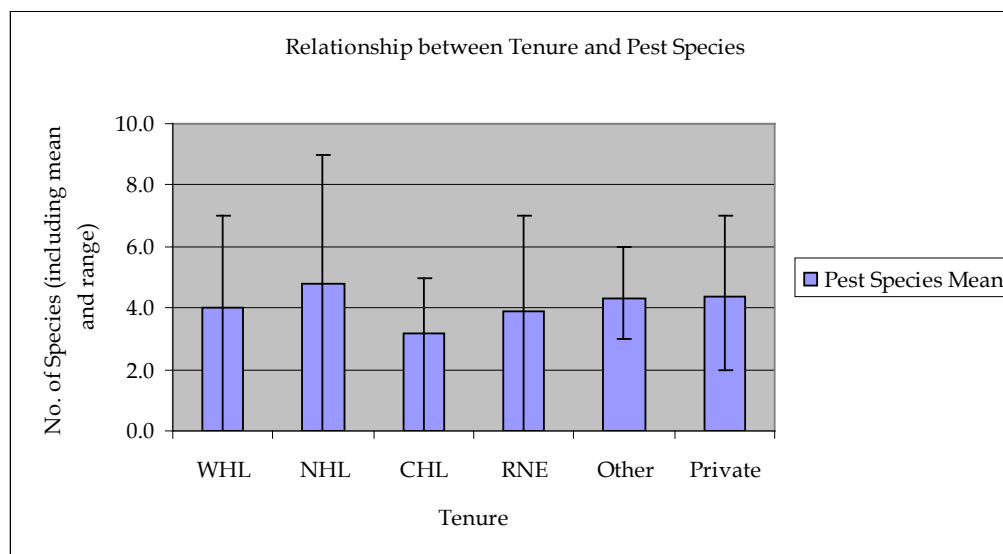
Tenure	Invasive Species Mean	Invasive Species Maximum	Invasive Species Minimum
WHL	4.3	9	0
NHL	6.0	12	0
CHL	5.7	12	0
RNE	4.9	12	0
Other	6.4	9	2
Private	5.9	11	2

Pest Species

A pest species is defined for this assessment as a fauna species that does not naturally occur in a region and whose introduction causes significant impact to the condition of a place to a place or has an impact on native fauna species presence (Elton C.S, 2000). The presence of pest species for each place was sampled to provide an indication of condition of the place and across tenures. The number of pest species was recorded for each place.

The information provides a baseline for information on the presence of pest species of the places sampled. Data on the mean and range of values recorded for each tenure is discussed and shown below.

Pest species identified on tenures indicated that places on the NHL and “private” tenures contained the highest number compared to other tenure types. CHL places sampled recorded the lowest number of invasive species. The maximum number of pest species recorded was nine. The relationship between tenure and pest species is shown in *Figure 4.21* and *Table 4.21*.

Figure 4.23 Relationship between Tenure and Pest Species**Table 4.23** Relationship between Tenure and Pest Species

Tenure	Pest Species Mean	Pest Species Maximum	Pest Species Minimum
WHL	4.0	7	0
NHL	4.8	9	0
CHL	3.2	5	0
RNE	3.9	7	0
Other	4.3	6	3
Private	4.4	7	2

Erosion

Erosion is defined for this assessment as the process by which the surface of the earth is worn away by the action of water, wind, vehicles and recreational activities (Montgomery D.R, 2007). The presence of erosion for each place was sampled to provide an indication of condition of the place and across tenures and jurisdictions. An erosion impact for natural heritage places assessed was identified by the occurrence of eight types of erosion within a place including streambank, roadside, beach, tracks, gully, wind, mass movement and sheet erosion.

A high, moderate or low risk score was allocated to the heritage places assessed as an indication of erosion impact within a place. A low risk place contains no evidence of erosion or minor evidence of minimal impact erosion types such as roadside, track or beach erosion. A moderate risk place contains evidence of intermediate impact erosion types such as wind, streambank erosion. A high risk place contains evidence of severe impact erosion types such as mass movement, sheet and gully erosion.

The data revealed that 19% of heritage places assessed are low risk, 19% are moderate risk and 22% are high risk of potential occurrence of erosion across all tenures and jurisdictions. In addition, 40% of places were identified to have insufficient data due to information being inaccessible.

Natural heritage places listed as “other” tenure contained the highest number of low risk places assessed followed by places listed on the RNE. Natural heritage places listed on the WHL contained the highest number of moderate risk places assessed followed by places listed on the CHL. Natural heritage places listed as “private” tenure contained the highest number of high risk places assessed.

Queensland recorded the highest number of low risk places. SA recorded the highest number of moderate risk places followed by places in NSW. The NT recorded the highest number of high risk places followed by places in the ACT.

The relationship between tenure and erosion is shown in *Figure 4.22* and *Table 4.22*. The relationship between jurisdiction and erosion is shown in *Figure 4.23* and *Table 4.23*.

Figure 4.24 Relationship between Tenure and Erosion

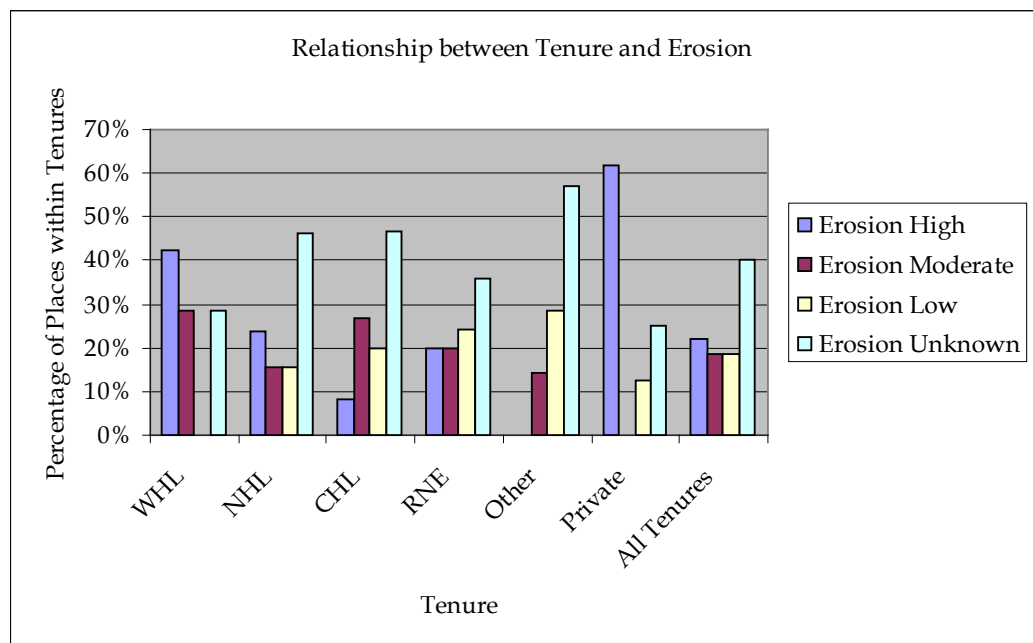


Table 4.24 Relationship between Tenure and Erosion

Tenure	Erosion			
	High	Moderate	Low	Unknown
WHL (7)	42%	29%	0%	29%
NHL (13)	24%	15%	15%	46%
CHL (15)	8%	27%	20%	47%
RNE (25)	20%	20%	24%	36%
Other (7)	0%	14%	29%	57%
Private (8)	62%	0%	13%	25%
All Tenures (75)	22%	19%	19%	40%
<p>Low - contains no evidence of erosion or minor evidence of minimal impact erosion types such as roadside, track or beach erosion.</p> <p>Moderate - contains evidence of intermediate impact erosion types such as wind, streambank erosion.</p> <p>High - contains evidence of severe impact erosion types such as mass movement, sheet and gully erosion.</p>				

Figure 4.25 Relationship between Jurisdiction and Erosion

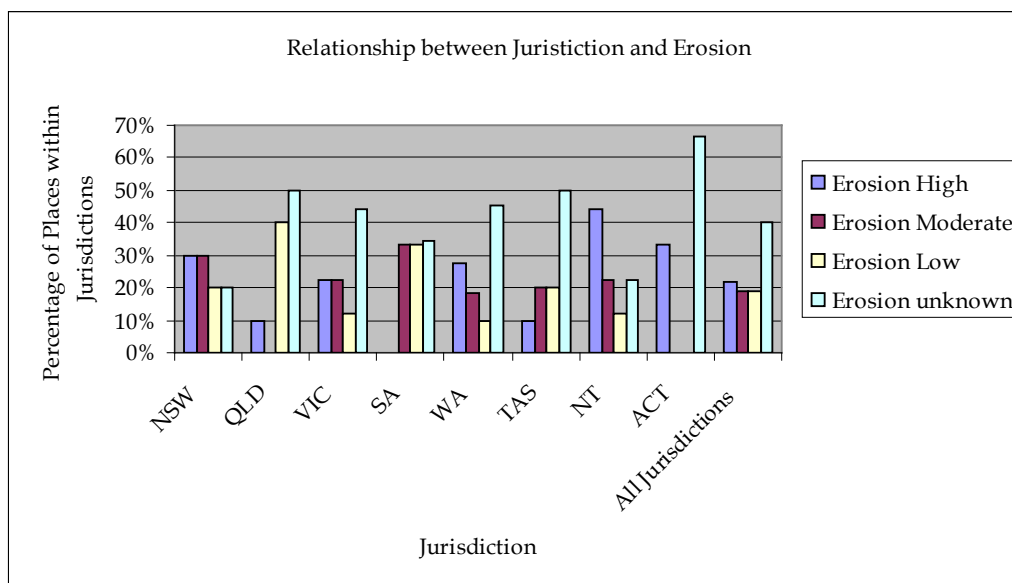


Table 4.25 Relationship between Jurisdiction and Erosion

Jurisdiction	Erosion			
	High	Moderate	Low	Unknown
NSW (10)	30%	30%	20%	20%
QUEENSLAND (10)	10%	0%	40%	50%
VIC (9)	22%	22%	12%	44%
SA (10)	0%	33%	33%	34%
WA (10)	27%	18%	10%	45%
TAS (10)	10%	20%	20%	50%
NT (9)	44%	22%	12%	22%
ACT (6)	33%	0%	0%	67%
All Jurisdictions (75)	22%	19%	19%	40%

Low - contains no evidence of erosion or minor evidence of minimal impact erosion types such as roadside, track or beach erosion.

Moderate - contains evidence of intermediate impact erosion types such as wind, streambank erosion.

High - contains evidence of severe impact erosion types such as mass movement, sheet and gully erosion.

Unknown - data was not readily available on soil erosion at the place

4.1.8

Geoheritage Condition

The condition of geoheritage places was determined by looking at the impact on the places selected in terms of extreme weather events, wild fire and soil erosion. These assessment criteria were chosen as they are more likely to impact on the geoheritage condition of places than storm, fire and soil erosion impacts.

Weather Events and Wild Fire

Weather events and wild fire are external impacts not caused by humans. These events are often unmanageable from a land manager’s perspective, although wild fire can be managed by appropriate hazard reduction activities. Extreme weather events of natural heritage places were assessed by the occurrence of events at a place including high wind, cyclones, high rainfall and floods. Wild fire impacts were identified by the occurrence within a place over the past five years.

The data revealed that 38% of geoheritage places assessed had weather events occur over the past five years compared to 45% of all natural heritage places assessed. In addition, 15% of geoheritage places assessed had a wild fire occur over the past five years compared to 19% of all natural heritage places assessed. It also must be noted that 15% of places were identified to have insufficient data for extreme weather and 19% for wild fire due to information being inaccessible. The relationship between geoheritage, weather events and wild fire is shown in *Figure 4.24* and *Table 4.24*.

Figure 4.26 Relationship between Geoheritage, Weather Events and Wild Fire

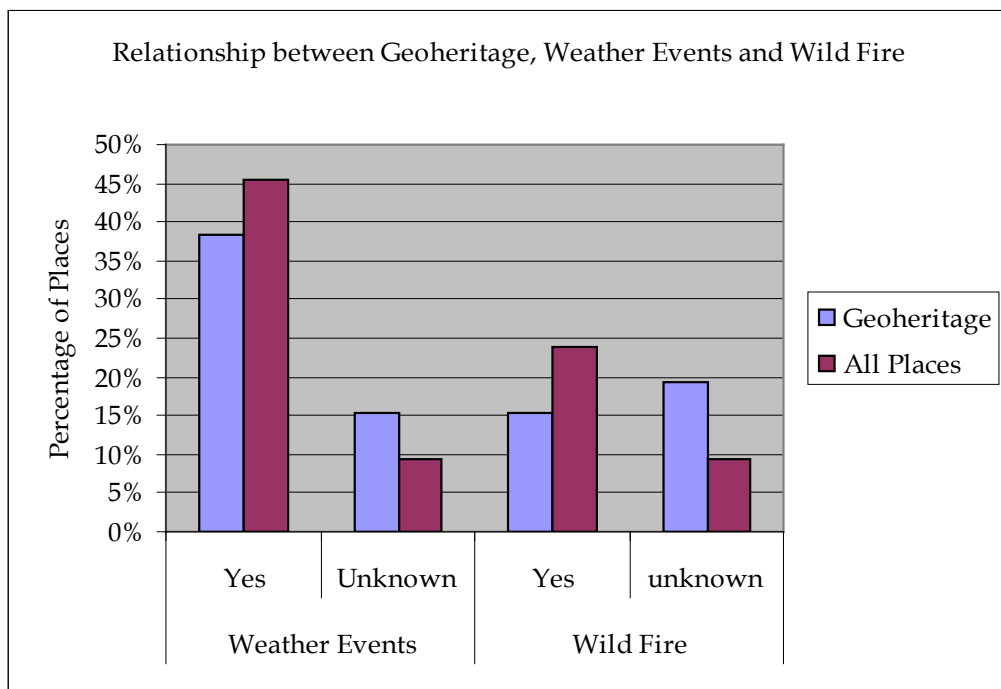


Table 4.26 Relationship between Geoheritage, Extreme Weather and Wild Fire

	Weather Events		Wild Fire	
	Yes	Unknown	Yes	unknown
Geoheritage	38%	15%	15%	19%
All Places	45%	9%	24%	9%

Erosion

The presence of erosion for each place was sampled to provide an indication of condition of the place. An erosion impact for natural heritage places assessed was identified by the occurrence of eight types of erosion within a place including streambank, roadside, beach, tracks, gully, wind, mass movement and sheet erosion.

A high, moderate or low risk score was allocated to the heritage places assessed as an indication of erosion impact within a place. A low risk place contains no evidence of erosion or minor evidence of minimal impact erosion types such as roadside, track or beach erosion. A moderate risk place contains evidence of intermediate impact erosion types such as wind, streambank erosion. A high risk place contains evidence of severe impact erosion types such as mass movement, sheet and gully erosion.

The data revealed that 12% of geoheritage places assessed are low risk compared to 19% of all natural heritage places assessed, 23% are moderate risk compared to 23% of all places assessed and 22% are high risk compared to 29% of all places assessed. In addition, 42% of geoheritage places were unknown due to data not being available compared to 36% of all places. The relationship between geoheritage and erosion is shown in *Figure 4.25* and *Table 4.25*.

Figure 4.27 Relationship between Geoheritage and Erosion

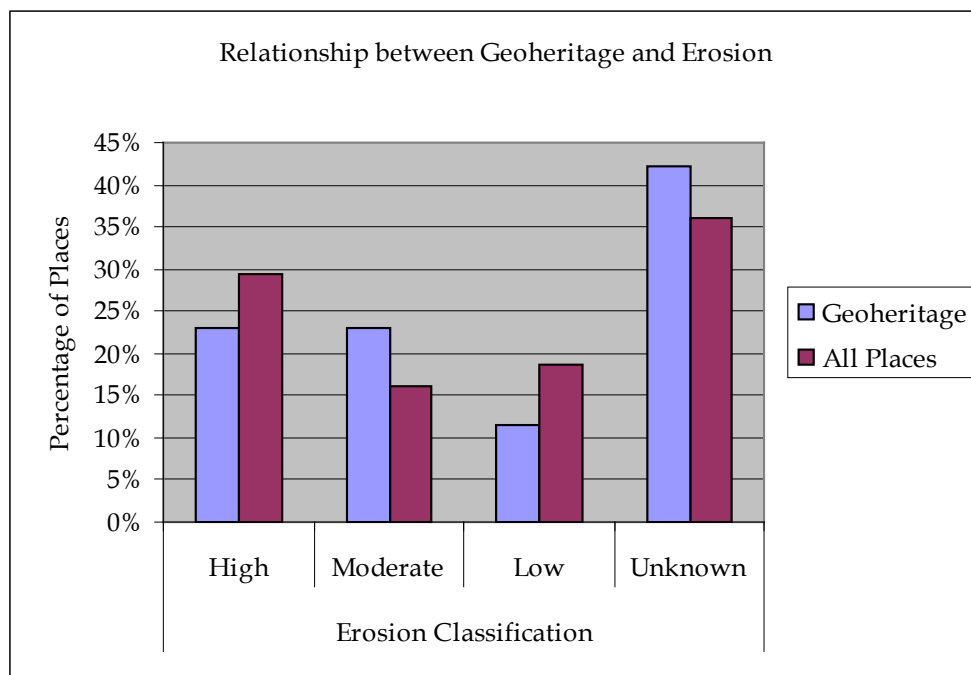


Table 4.27 Relationship between Geoheritage and Erosion

	Erosion			
	High	Moderate	Low	Unknown
Geoheritage	23%	23%	12%	42%
All Places	29%	16%	19%	36%

Low - contains no evidence of erosion or minor evidence of minimal impact erosion types such as roadside, track or beach erosion.

Moderate - contains evidence of intermediate impact erosion types such as wind, streambank erosion.

High - contains evidence of severe impact erosion types such as mass movement, sheet and gully erosion.

Unknown - data was not readily available on soil erosion at the place

5 DATA SUMMARY

Table 5.1 Relationship between Tenure and Condition Value

Tenure	Yes	Unknown	Yes	Unknown	Mean	Mean	Mean	High	Mod	Low	Unknown	Total
WHL	71%	0%	14%	29%	5.1	4.3	4.0	42%	29%	0%	29%	52%
NHL	31%	15%	31%	15%	10.3	6.0	4.8	24%	15%	15%	46%	50%
CHL	40%	13%	33%	0%	10.6	5.7	3.2	8%	26%	20%	46%	22%
RNE	48%	12%	20%	12%	7.8	4.9	3.9	20%	20%	24%	36%	42%
Other	43%	0%	14%	0%	9.9	6.4	4.3	0%	14%	29%	57%	38%
Private	50%	0%	25%	0%	6.3	5.9	4.4	62%	0%	13%	25%	22%
	Weather		Wild Fire		Threatened Species (Total)	Invasive Species	Pest Species	Soil Erosion				Place Use
<p>Weather -Indicates the number of places as a percentage of the sample where a weather event occurred during the previous 5 years.</p> <p>Wild Fire - Indicates the number of places as a percentage of the sample where a wild fire occurred during the previous 5 years.</p> <p>Unknown - Data was not readily available on weather events or wild fire for the place</p>					<p>Threatened Species - Mean value of the number of threatened species from NES search conducted for the places.</p> <p>Invasive Species - Mean value of the number of invasive species from NES search conducted for the places.</p> <p>Pest Species - Mean value of the number of pest species from the NES search conducted for the places.</p>			<p>Low - Contains no evidence of erosion or minor evidence of minimal impact erosion</p> <p>Moderate - Contains evidence of intermediate impact erosion types such as wind, stream bank erosion.</p> <p>High - Contains evidence of severe impact erosion types such as mass movement, sheet and gully erosion.</p> <p>Unknown - Data was not readily available on soil erosion at the place</p>				Overall place usage score based on the proportioned total of place use activities for each place
High	Moderate	Low	High unknown									

Table 5.2 Relationship between Jurisdiction and Each Condition Value

Jurisdiction	Yes	Uknown	Yes	Unknown	Mean	Mean	Mean	High	Mod	Low	Unknown	Total
NSW	60%	10%	20%	0%	12.9	7.6	5.6	30%	30%	20%	20%	35%
QLD	50%	20%	10%	20%	12.9	7.6	5.6	10%	0%	40%	50%	21%
VIC	44%	0%	11%	0%	13.4	9.8	3.6	22%	22%	12%	44%	40%
SA	56%	0%	33%	0%	5.8	4.9	5.1	0%	33%	33%	34%	40%
WA	27%	0%	36%	9%	8.3	3.7	3.5	27%	18%	10%	45%	39%
TAS	10%	20%	20%	10%	10.8	4.0	2.5	10%	20%	20%	50%	48%
NT	78%	11%	44%	22%	4.8	3.8	3.8	44%	22%	12%	22%	45%
ACT	33%	17%	17%	17%	6.1	4.7	3.3	33%	0%	0%	67%	33%
	Weather		Wild Fire		Threatened Species (Total)	Invasive Species	Pest Species	Soil Erosion			Place Use	
<p>Weather -Indicates the number of places as a percentage of the sample where a weather event occurred during the previous 5 years.</p> <p>Wild Fire - Indicates the number of places as a percentage of the sample where a wild fire occurred during the previous 5 years.</p> <p>Unknown - Data was not readily available on weather events or wild fire for the place</p>					<p>Threatened Species - Mean value of the number of threatened species from NES search conducted for the places.</p> <p>Invasive Species - Mean value of the number of invasive species from NES search conducted for the places.</p> <p>Pest Species - Mean value of the number of pest species from the NES search conducted for the places.</p>			<p>Low - Contains no evidence of erosion or minor evidence of minimal impact erosion</p> <p>Moderate - Contains evidence of intermediate impact erosion types such as wind, stream bank erosion.</p> <p>High - Contains evidence of severe impact erosion types such as mass movement, sheet and gully erosion.</p> <p>Unknown - Data was not readily available on soil erosion at the place.</p>			Overall place usage score based on the proportion of place use activities for each place	
High	Moderate	Low	High unknown									

Table 5.3 Relationship between Tenure and Management Planning

Tenure	High	Mod	Low	Ukn	High	Mod	Low	Ukn	High	Mod	Low	Ukn	High	Mod	Low	Ukn	High	Mod	Low	Ukn
WHL	57%	14%	29%	0%	57%	29%	0%	14%	43%	14%	14%	29%	43%	29%	0%	29%	14%	29%	14%	43%
NHL	15%	54%	8%	23%	15%	54%	15%	15%	23%	23%	8%	46%	31%	31%	23%	15%	23%	38%	8%	31%
CHL	40%	27%	7%	27%	33%	20%	7%	40%	33%	13%	7%	47%	13%	47%	0%	40%	7%	27%	13%	53%
RNE	32%	40%	8%	20%	44%	28%	0%	28%	36%	28%	4%	32%	24%	28%	8%	40%	36%	28%	8%	28%
Other	29%	29%	29%	14%	29%	29%	29%	14%	29%	29%	29%	14%	43%	29%	14%	14%	43%	0%	14%	43%
Private	25%	50%	25%	0%	25%	50%	25%	0%	25%	38%	25%	13%	75%	13%	13%	0%	75%	25%	0%	0%
	Weed and Pest Management				Bushfire Management				Erosion and Sedimentation Management				Threatened Species Management				Heritage Management			
High - No management plan or older than 1999																				
Moderate - Current management plan but no regular review																				
Low - Current management plan and subject to regular review																				
Ukn - Management plan could not be found during desktop and not confirmed by phone interview																				
High		Moderate		Low		High unknown														

Table 5.4 Relationship between Jurisdiction and Management Planning

Jurisdiction	High	Mod	Low	Ukn	High	Mod	Low	Ukn	High	Mod	Low	Ukn	High	Mod	Low	Ukn	High	Mod	Low	Ukn
NSW	20%	50%	30%	0%	10%	50%	20%	20%	10%	30%	20%	40%	30%	40%	20%	10%	30%	50%	10%	10%
QLD	50%	20%	0%	30%	50%	20%	0%	30%	50%	20%	0%	30%	50%	20%	10%	20%	30%	40%	0%	30%
VIC	22%	56%	0%	22%	22%	44%	0%	33%	11%	22%	0%	67%	11%	22%	11%	56%	22%	22%	11%	44%
SA	44%	33%	11%	11%	56%	33%	11%	0%	56%	33%	11%	0%	56%	22%	11%	11%	44%	33%	0%	22%
WA	55%	18%	0%	27%	45%	27%	0%	27%	45%	9%	0%	45%	36%	36%	0%	27%	45%	0%	0%	55%
TAS	20%	70%	0%	10%	30%	50%	0%	20%	30%	50%	0%	20%	20%	40%	0%	40%	10%	40%	10%	40%
NT	11%	33%	44%	11%	33%	22%	33%	11%	22%	11%	44%	22%	11%	56%	11%	22%	22%	11%	33%	33%
ACT	33%	17%	17%	33%	33%	17%	17%	33%	33%	17%	17%	33%	50%	0%	17%	33%	50%	17%	17%	17%
	Weed and Pest Management				Bushfire Management				Erosion and Sedimentation Management				Threatened Species Management				Heritage Management			
High - No management plan or older than 1999 Moderate - Current management plan but no regular review Low - Current management plan and subject to regular review Ukn - Unknown: Management plan could not be found during desktop and not confirmed by phone interview																				
High		Moderate		Low		High unknown														

CONCLUSIONS

The assessment of natural heritage places undertaken for this project has focussed on the current condition and integrity of 75 places located on public and private lands in Australia. These places include a range of formal reserves from iconic World Heritage places to private conservation places.

These places were chosen from 16 World Heritage places, 30 National Heritage places, 41 places on the Commonwealth Heritage list, 2127 places on the Register of the National estate and other natural heritage places such as botanic gardens, wildlife conservancies and private conservation places.

The indicator for the Commonwealth's State of Environment reporting process - *NCH-05 Physical condition and integrity of a sample of natural heritage places* has been assessed by collecting data on a range of natural heritage values, environmental threats and management plans for these places. The study is the first step toward the development of an approach for reporting on the condition and integrity of natural heritage places. The assessment provides a snapshot of the condition and integrity of a selection of 75 natural heritage places that could be used as a basis for reporting trends in future SoE reporting

The focus of the study has been to look at the condition of places by reviewing current factors such as: natural heritage values; threats including fire, erosion, climate change, weeds, threatened species and use; and the places current documented management regimes. Information on the effects from external factors such as wildfire and weather events has also been recorded. This information is used as a surrogate to give an indication of the current condition and management of the places.

The condition and integrity assessment has focussed on different tenures and jurisdictions. This provides an ability to review condition and integrity of the places surveyed in terms of their listing on registers but also against the places' documented management regimes undertaken by land managers.

Management Frameworks

Australian, State and Territory national park agencies undertake the majority of management activities for the places surveyed for public lands. These arrangements are complex and vary between jurisdictions. Places managed include places on the World heritage List, National Heritage List, Commonwealth Heritage List and Register of the National Estate. Commonwealth Heritage listed places tend to be places managed by Commonwealth agencies, including the Department of Defence. Private lands are managed by private wildlife conservancies and land owners. These places may also be subject to private land conservation covenants under both State and Federal legislation.

All places surveyed for this study have existing frameworks to protect their condition and integrity. State and Commonwealth legislative requirements exist to protect places through formal reservation, including policy arrangements that manage and restrict use, undertake wildfire hazard reduction regimes, pest and invasive species management. Threatened species recovery planning also exists at a State and Commonwealth level, aimed at designing actions to recover populations of threatened species and their habitats. Natural heritage assessments have occurred for the majority of places on the World heritage List, National Heritage List, and Commonwealth Heritage List. These assessment processes have occurred as required under legislation or as part of the listing process for the place.

Management effort is also different for places, dependent on fund allocations grants and donations. Commonwealth, States and Territories have varying levels of management effort to manage natural heritage places. For example, NSW and Victoria are the only States that undertake comprehensive reviews of their national park estates through State of the Parks reporting (NSW DECCW 2004; Vic DSE 2007). These reports are designed to provide an assessment of the values of the parks and report on wide ranging threats to the condition and integrity of the reserve systems. NSW also is developing an environmental management system (EMS) to complement and provide continual improvement frameworks for management of places (NSW DECCW 2011). Private land conservancies and other private places concentrate management efforts, often with the view to preserve biodiversity that is particularly threatened and not represented in public reserve systems (Australian Wildlife Conservancy, 2011).

Resource allocation for management of natural heritage places is generally through direct funding by governments for reserve systems and grants and private funding arrangements for private conservation of places. Philanthropic organisations also provide funding for public and private natural heritage places.

Outcomes from management are difficult to measure over time due to the dynamic nature of the environment. Changes to places in response to threats can also be subtle and may only be detected in the medium to long term. Impacts from wildfire and weather events however can have high impacts in the short term.

Measuring outcomes of current condition and integrity of each place requires an analysis of each place against a set benchmark of condition, taking into account temporal and spatial changes in the landscape. Identification of threats and management responses however provides an approach to identify the current condition and integrity of places. It provides a snapshot that can be refined and measured over time.

Current Condition and Integrity of Natural Heritage Places

The condition and integrity assessment undertaken for this study has been based upon the presence of external factors on the places values (weather and fire events); the presence of threatened species; and threats to the condition of the place, including invasive species; pest species; erosion; and place use. Management frameworks have also been documented for these threats. These values and management frameworks have been ranked against jurisdictions and tenures to provide a snapshot of the places condition against relative rankings to other places sampled.

The sample size for this study was limited and the information only provides an indication of the natural heritage condition of those places surveyed. There was also “unknown” data for many places, as the information was not readily available during survey.

This study indicates that places on the World Heritage List and National Heritage List have a greater number of threats to their condition than other places. In particular, they have higher place uses with likely impacts, including higher soil erosion impacts. This is likely to reflect the places chosen for the study as these places are likely to be subject particular threats such as erosion. Places on the Register of the National Estate and “other” places have less identified threats to their condition. Private conservation places also face threats from invasive species, pests and soil erosion as identified in the survey.

These results are supported by the management frameworks in place with places with around 60% of places the World Heritage List having either no management plans or plans that are older than 1999. However, 30% of the World Heritage List places did have up-to-date management planning frameworks subject to review. Places on the National Heritage List indicated moderate ratings for management planning with plans in place but not subject to regular review. Places on private lands however recorded low risk ratings for management planning as they had current plans subject to review. Private conservancy places also had low risk ratings of places as they had up-to-date management plans subject to regular review.

Places in NSW and Victoria recorded a higher number of threats to condition than did other States. This is likely as these States have higher populations and likely higher visitation rates, leading to higher disturbance. Places in South Australia and the ACT recorded the lowest number of threats. Management planning for jurisdictions indicated that the Northern Territory and NSW had management planning frameworks in place. However places in Western Australia, Queensland and South Australia had the highest number of places not having management planning frameworks. Victoria, Western Australia and Queensland had the highest number of places where the information about management planning frameworks was not readily available. This means that these management plans were not detected by this study or they do not exist. It should be noted that management responsibility lies with Commonwealth, State, territory, local governments and private entities within jurisdictions.

Geoheritage places recorded consistent values as other places for condition and management planning, however with higher values for unknown information. Soil erosion risk was ranked as medium for these places. The sample of geoheritage places includes a mixture of different landscape types and this is reflected in the results. It should be noted that there is not one single national register for geoheritage places in Australia.

Natural heritage places assessed for this study face threats from natural and human induced factors. Impacts from weather events and wildfires have affected natural heritage values of places, although the nature and extent of these impacts varies. The study did not identify any definitive impacts from climate change as these impacts are difficult to detect in the short term without ongoing focussed studies. Improving threatened species management as well as threats from soil erosion, pest and weeds remain as challenges to the condition and integrity of natural heritage places. Developing appropriate management frameworks that are subject to monitoring and review should be considered for all jurisdictions responsible for management.

Specific case studies for four natural heritage places were chosen to provide information on specific places from the World Heritage List (Macquarie Island); National Heritage List (Warrumbungle National Park) and (Porongurup National Park) and Register of the National Estate (Lake Woods). These case studies provide examples of the variability on the condition and integrity of natural heritage places encountered during this study. These case studies are outlined at *Section 9* of this report.

Recommendations

State and Commonwealth jurisdictions charged with managing natural heritage places should ensure that appropriate management planning frameworks are subject to review, include regular monitoring and reporting on the condition and integrity of natural heritage places. Appropriate resourcing for the implementation of these plans is also essential to ensure outcomes are achieved. The results of the study show differences in how places are managed within jurisdictions .

The high number of places where information was unavailable during this study is likely due to three reasons: that information is not publicly available; the information management framework is informal; or the information does not exist for places. Formal arrangements for information access should be developed and regularly reviewed for natural heritage places and be made publicly available where appropriate, however this is likely to be costly. This will increase transparency and ensure continual improvement of data collection and dissemination.

The limited time available to undertake this study restricted the ability for information to be confirmed with land managers and land owners. Although half of all places had a phone interview, information not readily accessible through internet searches may have been missed. Some tenures and jurisdictions recorded “unknown” data for both risk factors and management planning frameworks. Future studies should aim to collect information from places using a survey technique with all landowners, either through written methods or phone survey to ensure appropriate data capture.

The identification of these places in determining the sample was problematic. The information available is out-of-date and inconsistently managed across jurisdictions.

CASE STUDIES

Four cases studies of natural heritage places were chosen to provide an indication of the current condition and integrity of these places. They were chosen to provide information places from the World Heritage List (Macquarie Island); National Heritage List (Warrumbungle National Park) and (Porongurup National Park) and Register of the National Estate (Lake Woods).

Places on the Commonwealth Heritage List, “other” and Private Land Conservation places were not considered for case studies as these places are subject to privacy provisions for information that is not publicly available.

7.1 MACQUARIE ISLAND

7.1.1 Introduction

Macquarie Island is situated approximately 1500 kilometres (km) south east of Tasmania. The main island is approximately 34 km long and 5.5 km wide at its broadest point. There are several small outlying islets as part of the reserve including Judge Islet and Bishop and Clerk Islets. The total area of Macquarie Island is 12 800 hectares (ha) (Tasmania Parks and Wildlife Service, 2008)

Macquarie Island is a National Park with protection extending to 12 nautical miles offshore from the low water mark. The dominant vegetation type within the place is native grasslands (Tasmania Parks and Wildlife Service, 2008).

In 1997 Macquarie Island was listed as a World Heritage Area. Macquarie Island is a place of outstanding geological and natural values on a global scale. The island is identified as being listed under the following natural heritage criteria:

- Processes;
- Rarity;
- Research; and
- Characteristic.

There are no permanent human inhabitants on Macquarie Island. Access is restricted and the only access to the island is by sea. The place can be accessed by the public during daylight hours and allows limited recreational activities including bushwalking and boating (only for access purposes) (Tasmania Parks and Wildlife Service, 2008)

Matters of NES

A search of the EPBC Protected Matters database identified two endangered ecological communities, two threatened flora species, 21 threatened fauna species, and 22 migratory species with the potential to occur within the place.

7.1.2 Condition

There have been no records of wild fire or controlled burning within the place over the past five years. Evidence of erosion has been observed throughout the island including streambank, beach, mass movement and sheet erosion. The place is considered high risk due to the presence of severe impact erosion types such as mass movement and sheet erosion.

Weather events have also been recorded over the past five years within the place including high wind and high rainfall. However, these types of weather events are typical for Macquarie Island (BoM, 2011) and there were no impacts to the natural heritage values of the place. Number of flood events was unknown due to unobtainable information.

Three pest fauna species and an unknown number of invasive flora species have been previously recorded within the place. In recent years rabbit damage to vegetation on Macquarie Island has resulted in serious vegetation changes and impacting on burrowing seabirds that require vegetation cover around their breeding habitat. Rodents are also having a significant impact on the island, with ship rats in particular eating the eggs and chicks of burrow-nesting petrels (Tasmania Parks and Wildlife Service 2007). A ranking for condition of the place is summarised in *Table 7.1*

Table 7.1 Ranking of Condition

Condition	Weed	Pest	Fire	Erosion
Ranking	Unknown	High	Low	High

7.1.3 Management

Macquarie Island contains a weed and pest management plan developed in 2007 and recommended for review in 2009. A detailed management regime is undertaken monthly for the control of rabbits, rats and mice within the place. The success of the management regimes are also monitored monthly.

Macquarie Island does not have a bushfire management plan in place due to the low risk of wild fire occurring within the place. Weed and pest management plans exist for the island. A recent program to eradicate pest fauna has been implemented on the island.

The place is considered a low risk place for management due to the place having a current management plan (1999 – 2011) and monthly management

regimes undertaken for at least one of the management types assessed. A ranking for management of the place is summarised in *Table 7.2*

Table 7.2 *Ranking of Place Management*

Management	Weed & Pest	Fire	Erosion and Sedimentation	Heritage
Ranking	Low	Not Applicable	High	Unknown

7.1.4 *Threats*

The main threats to Macquarie Island include:

- three pest species and an unknown number of invasive species have been previously recorded within the place;
- evidence of severe impact erosion types such as mass movement and sheet erosion; and
- lack of a erosion and sedimentation management plan.

7.2 *WARRUMBUNGLE NATIONAL PARK*

7.2.1 *Introduction*

Warrumbungle National Park is situated approximately 34 km west of Coonabarabran in New South Wales. The total area of Warrumbungle National Park is 21 534 ha and covering much of the Warrumbungle Range. The dominant vegetation type within the place is Dry Sclerophyll Forest (Warrumbungle National Park Visitors Centre, 2011).

In 2006 Warrumbungle National Park was listed as a National Heritage Area. Warrumbungle National Park is a place of outstanding geological and natural values on a national scale. The place contains the remnants of the extinct Warrumbungle Volcano which began its life 17 million years ago and provides an important habitat for a range of native Australian flora and fauna

The place is identified as being listed under the following natural heritage criteria:

- Processes;
- Characteristic;
- Aesthetic; and
- Tradition.

Warrumbungle National Park can be accessed by the public at all times of the year and allows recreational activities including bushwalking, rock climbing (permits required), picnicking, bird watching and camping (Warrumbungle National Park Visitors Centre, 2011).

Matters of NES

A search of the EPBC Protected Matters database identified four endangered ecological communities, four threatened flora species, 11 threatened fauna species, and 12 migratory species with the potential to occur within the place.

7.2.2

Condition

Controlled burning is used within the place on an annual basis as a fuel reducing agent and to provide a range of vegetation age classes. There have been no records of wild fire within the place over the past five years. Evidence of erosion has been observed along tracks and roads. However, no other forms of erosion were evident within the place. The place is considered low risk due to the presence of minimal impact erosion types such as track and roadside erosion (NSW NPWS, 1997).

Extreme weather events have also been recorded over the past five years within the place including high wind and flooding. It is unknown if there were any impacts to the natural heritage values of the place (ABC News, 2011).

Six pest species and four invasive species have been previously recorded within the place. Weeds are a particular problem in areas previously cleared or grazed for farming practices. Introduced animals found in the place include rabbits, foxes, feral cats and dogs, goats and pigs. Rabbits are the largest concern due to their affect on revegetation programs (NSW NPWS, 1997). A ranking for condition of the place is summarised in *Table 7.3*.

Table 7.3 *Ranking of Place Condition*

Condition	Weed	Pest	Fire	Erosion
Ranking	High	High	Low	Low

7.2.3 *Management*

Warrumbungle National Park contains two management plans for the place including an overall place management plan and a fire management plan. The *Warrumbungle National Park New Plan of Management* includes management actions for weed and pest species and heritage values. The plan was developed in 1997 and there is no recommended date for review. Annual maintenance regimes are undertaken on the management of weed and pest species and heritage values of the place. The success of the management regimes are also monitored annually. The *Warrumbungle National Park Fire Management Plan* was developed in 2001 and was recommended for review in 2006. It is unknown if a current fire management plan is available or if an erosion and sedimentation plan for the place.

Warrumbungle National Park does not have a place species threatened species management plan. However, the place is mentioned in the Brush-tailed Rock Wallaby and Regent Honeyeater Recovery Plans and these species are managed through these plans.

The place is considered a moderate ranking place for management due to the place having a current management plan (1999 – 2011) and annual management regimes undertaken for at least one of the management types assessed. A ranking for management of the place is summarised in *Table 7.4*.

Table 7.4 *Ranking of Place Management*

Management	Weed & Pest	Fire	Erosion and Sedimentation	Heritage
Ranking	Moderate	Moderate	Unknown	Moderate

7.2.4 *Threats*

The main threats to Warrumbungle National Park include:

- evidence of erosion has been observed along tracks and roads, but is identified as a low risk;
- six pest species and four invasive species have been previously recorded within the place;
- extreme weather events have also been recorded over the past five years within the place including high wind and flooding;
- it is unknown if a current fire management plan is available; and
- it is unknown if an erosion and sedimentation management plan exists for the place.

7.3 PORONGURUP NATIONAL PARK

7.3.1 Introduction

Porongurup National Park is situated approximately 360 km southeast of Perth in Western Australia. The total area of Porongurup National Park is 2658 ha and 670 metres at its highest point. The dominant vegetation type within the place is Wet Sclerophyll Forest (Department of Environment and Conservation, 2009).

In 2009 Porongurup National Park was listed as a National Heritage Area. Porongurup National Park is a place of outstanding geological and natural values on a national scale. The place contains distinctive granite domes which are the remains of the ancient Porongurup pluton which was a bubble molten rock that rose from the Earth's core and pushed upwards into the overlying base rock of the park (Department of Environment and Conservation, 2009).

The place is identified as being listed under the following natural heritage criteria:

- Processes; and
- Characteristic.

Porongurup National Park can be accessed by the public at all times of the year and allows recreational activities including bushwalking, rock climbing, picnicking and abseiling (Department of Environment and Conservation, 2009).

Matters of NES

A search of the EPBC Protected Matters database identified no endangered ecological communities, 11 threatened flora species, 10 threatened fauna species, and six migratory species with the potential to occur within the place.

7.3.2 Condition

In February 2007 approximately 2400 hectares of the National Park were burnt by wild fire resulting in a significant loss of habitat for many fauna species. The fire started outside the park and quickly spread through grassland into Jarrah Forest, Marri Forest and Karri Forest burning approximately 90 per cent of the parks total area (DSEWPaC, 2011). There is currently no known policy for controlled burning within the place.

No extreme weather events have been recorded over the past five years within Porongurup National Park and evidence of erosion is unknown due to information being unavailable.

Five pest species and 113 invasive species have been previously recorded within the place. Weeds present a significant challenge for park management as the 2007 wild fire has stimulated the growth of many weed seeds laying dormant in the soil. The Red Fox (*Vulpes vulpes*) has previously had an impact on native fauna species within the place. However, an ongoing fox baiting program has enabled native fauna numbers to increase within the region (Department of Environment and Conservation, 2009). A ranking for condition of the place is summarised in *Table 7.5*.

Table 7.5 *Ranking of Place Condition*

Condition	Weed	Pest	Fire	Erosion
Ranking	High	Moderate	High	Low

7.3.3 *Management*

Porongurup National Park contains an overall place management plan, *Stirling Range National Park and Porongurup National Park Management Plan*, which includes management actions for weed and pest species, bushfire, heritage values, threatened species, erosion and sedimentation control. Ongoing maintenance regimes are undertaken on the management of weed and pest species of the place. The success of the management regimes are also monitored annually. The overall management plan for the place identifies commitment to develop a place specific weed and pest management plan. There is limited available information for bushfire management within the plan and no known policy for controlled burning within the place (Department of Conservation and Land Management, 1999).

The place is considered a low risk place for management due to the place having a current management plan (1999 - 2011) and ongoing management regimes undertaken for at least one of the management types assessed. However, due to the lack of bushfire management the place has the potential to be a moderate risk place. A risk ranking for management of the place is summarised in *Table 7.6*.

Table 7.6 *Ranking of Place Management*

Management	Weed & Pest	Fire	Erosion and Sedimentation	Heritage
Risk Ranking	Low	High	Moderate	Moderate

7.3.4 *Threats*

The main threats to Porongurup National Park include:

- in 2007 approximately 90 per cent of the parks total area was impacted by wild fire;
- five pest species and 113 invasive species have been previously recorded within the place; and
- no known policy for controlled burning within the place.

7.4 LAKE WOODS

7.4.1 *Introduction*

Lake Woods is a large ephemeral wetland located on the western edge of the Barkly Tableland approximately 220 km north of Tennant Creek in the Northern Territory. The Lake most frequently occupies an area of approximately 35 000 ha. However, during periods of high rainfall it can reach approximately 85 000 ha to 100 000 ha in area. The dominant vegetation type within the place includes grasses and sedges (Northern Territory Government, 2011).

In 1980 Lake Woods was listed on the Register of the National Estate. Lake Woods is recognised as one of the largest temporary freshwater lakes in the Northern Territory and tropical Australia. When conditions are suitable, the lake supports more than 100 000 waterbirds including internationally significant numbers of Plumed Whistling-Duck (*Dendrocygna eytoni*) and provides breeding places for several colonies of waterbird species including Egrets (*Ardea* sp.), Cormorants (*Phalacrocorax* sp.) and spoonbills (*Platalea* sp.) (Northern Territory Government, 2011).

The place is identified as being listed under the following natural heritage criteria:

- Processes; and
- Research.

Lake Woods can be accessed by the public at all times of the year and permits unrestricted recreational boating and fishing which has the potential to disturb significant waterbird breeding colonies within the place. Adjacent landholders cattle are mustered off the Lake annually (Northern Territory Government, 2011).

Matters of NES

A search of the EPBC Protected Matters database identified no endangered ecological communities, no threatened flora species, three threatened fauna species, and ten migratory species with the potential to occur within the place.

7.4.2 Condition

There have been no records of wild fire or controlled burning within the place over the past five years. Evidence of streambank erosion has been observed within the northern portion of the place due to cattle mustering. The place is considered moderate risk due to the presence of intermediate impact erosion types such as streambank erosion (Northern Territory Government, 2011).

Extreme weather events have also been recorded over the past five years within the place including high rainfall and floods. However, these types of weather events are typical for Lake Woods and complement the natural heritage values of the place (Northern Territory Government, 2011).

Three pest species and four invasive species have been previously recorded within the place. Jerusalem Thorn (*Parkinsonia aculeate*) is widespread in the northern part of the lake and creek system and represents a major condition issue. Cattle access has caused erosion of creek banks and infestation by weeds has limited regeneration of native plant species within the place (Northern Territory Government, 2011). A ranking for condition of the place is summarised in *Table 7.7*.

Table 7.7 Ranking of Place Condition

Condition	Weed	Pest	Fire	Erosion
Risk Ranking	Moderate	Moderate	Not Applicable	Moderate

7.4.3 Management

Lake Woods contains an overall Conservation Management Plan developed in conjunction with of the Department of Natural Resources, Environment, The Arts and Sport (NRETAS) and landholder using Ramsar guidelines which includes management actions for weed and pest species, heritage values, threatened species, erosion and sedimentation control.

The plan was developed in 2010 and is recommended for review in 2015. Ongoing maintenance regimes are undertaken on the management of weed and pest species and threatened species within the place. The success of the management regimes are also monitored annually. In addition, aerial and ground surveys of waterbirds are conducted opportunistically by Wetlands International after major flood events and fire in the tropical savannas is mapped continuously under the North Australia Fire Information Project (Fisher, A pers. comm, 8 April 2011).

The place is considered a low risk place for management due to the place having a current management plan (1999 - 2011) and ongoing management regimes undertaken for at least one of the management types assessed. A risk ranking for management of the place is summarised in *Table 7.8*.

Table 7.8 *Ranking of Place Management*

Management	Weed & Pest	Fire	Erosion and Sedimentation	Heritage
Risk Ranking	Low	Low	Low	Low

7.4.4 *Threats*

The main threats to Lake Woods include:

- unrestricted recreational boating and fishing which has the potential to disturb significant waterbird breeding colonies within the place;
- evidence that adjacent landholders cattle are causing streambank erosion; and
- Jerusalem Thorn is widespread in the northern part of the Lake and creek system and represents a major condition issue.

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ANNEX A

List of Places Sampled

(listed separately)

Annex B

Data Parameters

(listed separately)

Annex C

Bibliography

(listed separately)