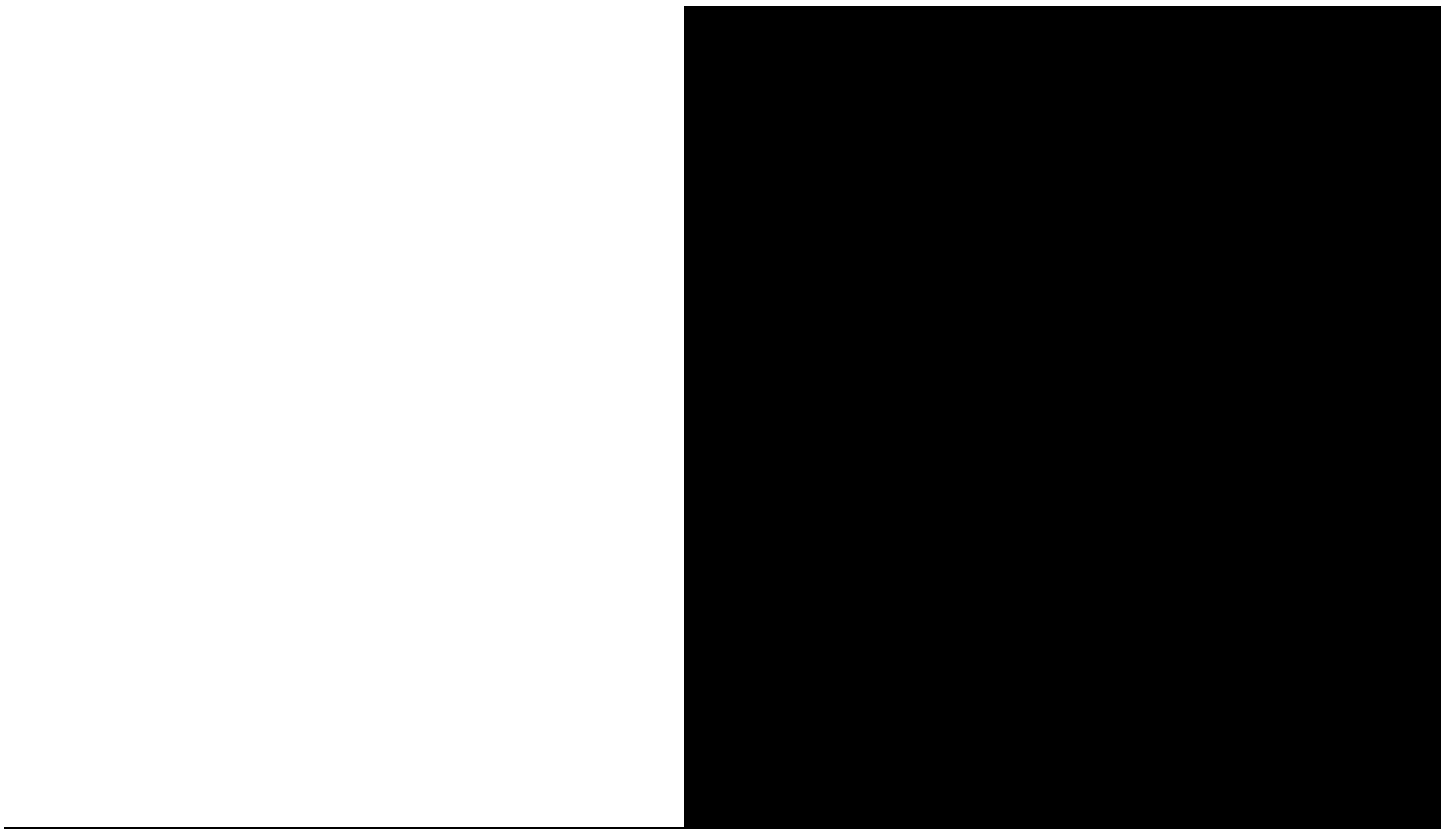
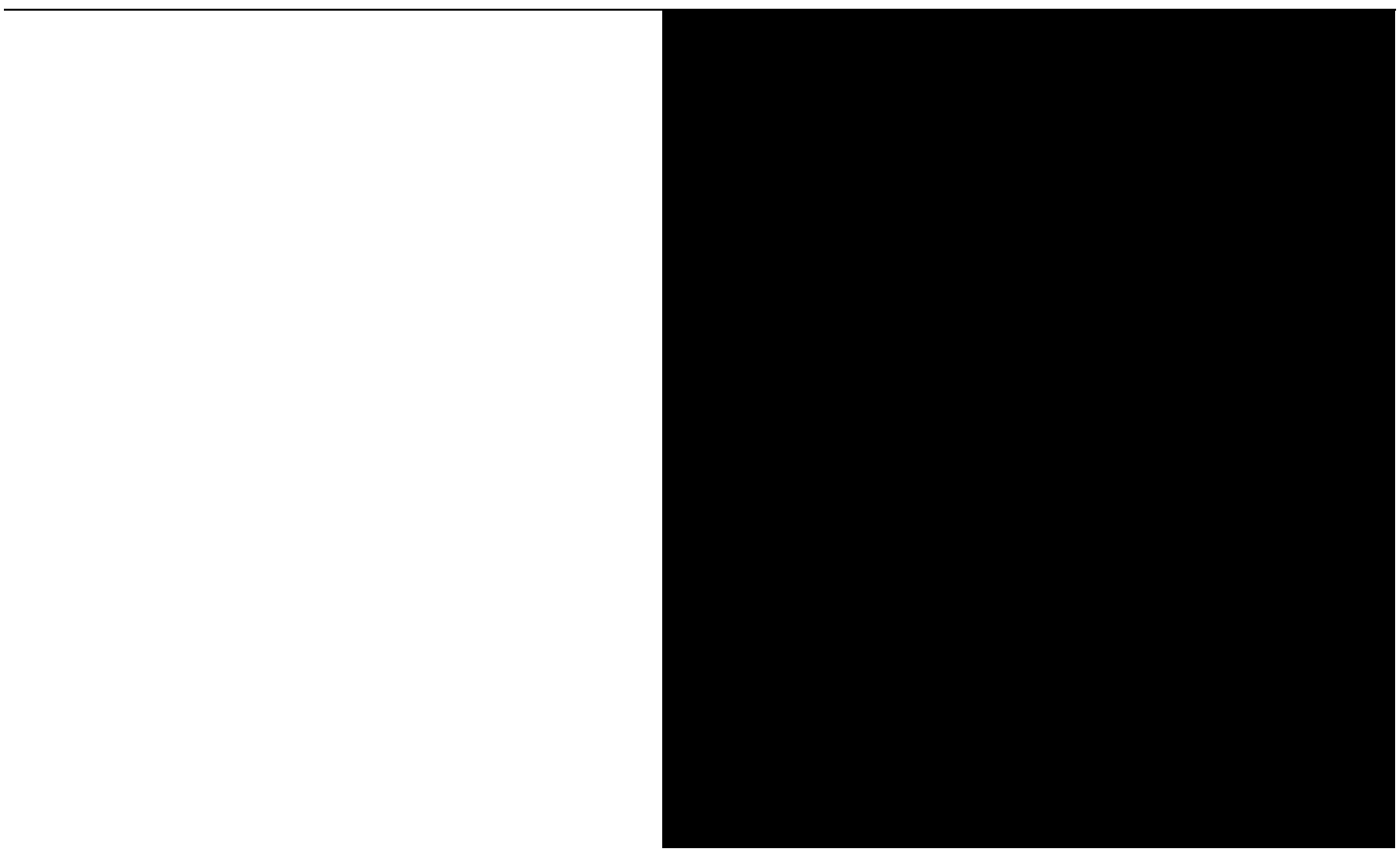


Wilderness assessment - Southern

A project undertaken as part of the NSW Comprehensive Regional Assessment
February 2000



WILDERNESS ASSESSMENT - SOUTHERN

NEW SOUTH WALES NATIONAL PARKS AND WILDLIFE SERVICE
&
ENVIRONMENT AUSTRALIA

A project undertaken as part of the
NSW Comprehensive Regional Assessment
Project Identifier NS 07/EH

February 2000

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The project has been overseen and the methodology has been developed through the Environment and Heritage Technical Committee, which includes representatives from the New South Wales and Commonwealth Governments and stakeholder groups.

This report documents the Wilderness Assessment undertaken for the National Wilderness Inventory, and combines the Environment Australia and the NSW National Parks and Wildlife Service Wilderness Assessment reports under the NSW *Wilderness Act, 1987*.

Disclaimer
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1. ABBREVIATIONS

AHC	Australian Heritage Commission
ANZECC	Australia and New Zealand Environmental Conservation Committee
API	Aerial Photographic Interpretation
BOGMP	Broad Old Growth Mapping Project
CAR	comprehensive, adequate, representative
CRA	Comprehensive Regional Assessment
CRAFTI	CRA Air Photo Interpretation
DLWC	Department of Land and Water Conservation
EA	Environment Australia
EHTC	Environment and Heritage Technical Committee
GIS	Geographic Information System
Landsat TM	Landsat Thematic Mapping
MCFFA	Ministry for Conservation, Forests, Fisheries and Aquaculture
NFPS	National Forest Policy Statement
NSW NPWS	New South Wales National Parks and Wildlife Service
IAP	Interim Assessment Process
JANIS Criteria	Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia, a report by the Joint ANZECC/MCFFA National Forest Policy Statement Implementation Sub-committee
LIC	Land Information Centre
NWI	National Wilderness Inventory
PIW	Provisionally Identified Wilderness
RACAC	Resource and Conservation Assessment Council
RFA	Regional Forest Agreement
SFNSW	State Forests of NSW
TSI	Timber Stand Improvement
WQ	Wilderness Quality

2. EXECUTIVE SUMMARY

This report describes a project undertaken as part of the comprehensive regional assessments (CRAs) of forests in New South Wales. The CRAs provide the scientific basis for regional forest agreements (RFAs) for major forest areas of New South Wales. These agreements will determine the future of these forests, providing a balance between conservation and ecologically sustainable use of forest resources.

The NSW and Commonwealth governments signed a Scoping Agreement in 1996 to achieve RFAs. Development of RFAs is the primary mechanism for implementing the National Forest Policy Statement (NFPS), also agreed to between the Commonwealth and State governments (Commonwealth, 1992). The Scoping Agreement commits the State and Commonwealth governments to undertake a series of comprehensive regional assessments (CRAs) to create a comprehensive, adequate and representative (CAR) reserve system. A significant conservation aim of the NFPS is the CAR reserve system to protect biodiversity, old growth forests and wilderness. The Scoping Agreement commits both governments to both assess and delineate wilderness that is consistent with nationally agreed criteria (Commonwealth, 1997). The identification of wilderness as determined under the NSW *Wilderness Act, 1987* is also required under the Scoping Agreement. The products of these assessments are used to develop a CAR forest reserve system.

While a dual State/Commonwealth approach is undertaken, protection requirements in the CRA process are linked solely to the (federal) National Wilderness Inventory (NWI). The nationally agreed criteria stipulate that ninety percent, or more if practicable, of the area of high quality wilderness that meets minimum area requirements should be protected in reserves. High quality wilderness is defined as having a minimum NWI rating of 12 and a minimum size of 8000 hectares (Commonwealth, 1997).

The NWI is a geographic information system which analyses wilderness values across the Australian landscape using a set of indicators to measure the remoteness and naturalness. The Commonwealth Government is the lead agency for compiling the NWI, using disturbance information provided by state government agencies.

The NSW *Wilderness Act* assessment methodology also measures ‘naturalness’, but additionally considers potential for restoration to a natural state. Size and the ability of an area to provide opportunities for solitude and self-reliant recreation are also evaluated. The NSW National Parks &Wildlife Service (NPWS) is responsible for assessments under the Wilderness Act.

Both the State and Commonwealth components of the wilderness assessment project for the Southern CRA are described in this report.

3. BACKGROUND

This report details wilderness assessment within the Southern CRA region undertaken during 1998/99. The report explains the various federal and state assessment procedures, as applicable to this project, and earlier assessments undertaken within the study areas. The assessments and results for this project are described. This report does not duplicate the Southern CRA Wilderness Assessment Report or Summary and Analysis of Submissions Report, both of which will be produced for the Region.

3.1 NATIONAL FOREST POLICY STATEMENT

> Wilderness: land that, together with its plant and animal communities, is in a state that has not been substantially modified by, and is remote from, the influences of European settlement or is capable of being restored to such a state; is of sufficient size to make its maintenance in such a state feasible; and is capable of providing opportunities for solitude and self-reliant recreation (Commonwealth of Australia, 1992).

The National Forest Policy Statement (NFPS) sets out the process for undertaking joint Commonwealth and State/Territory Comprehensive Regional Assessments (CRAs) of the natural, cultural, economic and social values of Australia's forests as the basis for negotiation of Regional Forest Agreements (RFAs). RFAs are to be developed between the States/Territories and the Commonwealth and will encompass the establishment and management of a forest reserve system which is comprehensive, adequate and representative (CAR). These goals are based on the concept of ecologically sustainable development, with the dual aims of conserving the natural and cultural values of forested areas and developing a dynamic internationally competitive forest products industry. A major conservation aim of the forest reserve system is to protect biodiversity, old-growth forests and wilderness values (Commonwealth, 1992, 1997).

In accordance with the NFPS, the Governments agreed to the development of National Forest Reserve Criteria. These criteria form the basis of CRAs and guide the establishment of the CAR reserve system within the RFA process (Commonwealth, 1997).

3.2 NATIONALLY AGREED (JANIS) CRITERIA FOR A FOREST RESERVE SYSTEM

Implementation of the conservation initiatives of the NFPS, and in particular the creation of a CAR forest reserve system, is governed by the Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia (Commonwealth, 1997). These criteria were developed by the Joint ANZECC/MCFFA National Forest Policy Statement Implementation Sub-committee (JANIS), and apply to all forested regions of Australia.

The JANIS criteria which deal specifically with wilderness identification and assessment in the CRA/RFA process are as follows:

- potential areas (of high quality wilderness) will have a minimum National Wilderness Inventory (NWI) rating of 12. In addition, minimum thresholds for each of the wilderness quality indicators will be set within a regional context. These thresholds will consider the importance of the indicators, and in particular the biophysical naturalness component as a primary indicator;
- 8000 ha is generally considered the minimum viable area for forested wilderness. However, lower thresholds may apply to areas adjoining the sea or wilderness areas in neighbouring CRA regions;
- the presence of 'nodal' areas with higher wilderness quality may provide an indication of their significance and may guide the future management of identified wilderness areas;
- other factors which are not considered in determining the NWI rating may need to be considered in determining wilderness quality. These factors may include the impacts of exotic plants and feral animals on biophysical naturalness; and
- as forest and non-forest vegetation types form a mosaic, non-forest vegetation types may be included within largely-forested wilderness areas.

The criterion which applies to wilderness protection is:

- 'ninety percent, or more if practicable, of the area of high quality wilderness that meets minimum area requirements should be protected in reserves'.

The JANIS report includes the following guidelines for determining appropriate boundaries for areas of high quality wilderness:

- potential areas identified using the NWI database will be considered in a regional context to ensure their viability as wilderness, including considerations of shape;
- both ecological and management features such as topography, water catchment boundaries, roads and other transport routes, may be useful when delineating boundaries; and
- wilderness values will need to be maintained by appropriate management and design of wilderness areas.

3.3 INTERIM ASSESSMENT PROCESS

During 1995/96, the NSW Government undertook the Interim Assessment Process (IAP) for forested public lands as a first step towards implementing the NFPS and developing a CAR reserve system. This was a scientific assessment, coordinated by a NSW Government body, the Resource and Conservation Assessment Council (RACAC), to 'identify on a regional basis those forests that may need to be set aside from logging for inclusion in a Comprehensive, Adequate and Representative reserve system' (RACAC, 1996).

Wilderness protection figured prominently in the IAP, to the extent that several new or expanded wilderness areas were reserved or declared in NSW as part of the IAP outcomes. A number of potential wilderness areas, known as Provisionally Identified Wilderness (PIW), were also delineated during the IAP for later detailed investigation during CRAs.

3.4 RFA SCOPING AGREEMENT

In 1996, the Commonwealth and NSW Governments endorsed a Scoping Agreement for all NSW RFAs, whereby they agreed to utilise the JANIS criteria in developing a CAR reserve system. The Agreement outlines the individual assessments required for the CRA component of each RFA. With regards to wilderness, it states that:

> *'this assessment will include wilderness areas identified under the provisions of the NSW* Wilderness Act, *1987 in addition to the National Wilderness Inventory (NWI) analysis of wilderness in the region';* and
>
> *'the NWI analysis will be refined by the application of disturbance information from old-growth forest surveys, improved information on the nature of road access and additional information of relevance.'*

The Agreement also lists two wilderness-related map outputs required for each CRA. These are:

1. a map showing all wilderness areas identified under the provisions of the *Wilderness Act,* 1987 and of NWI wilderness quality and size above agreed thresholds (as defined by JANIS); and

2. a map identifying rational boundaries for protection of wilderness values.

Subsequent to the signing of the Scoping Agreement, a committee was formed (known as the Environment and Heritage Technical Committee [EHTC]) to develop a technical framework for the planning of the regional assessments outlined in the Agreement and to oversee the assessment projects.

The Committee's report (EHTC, 1997), reiterates the JANIS wilderness requirements, stating that there is no inherent conflict between the NWI and *Wilderness Act* methodologies. In particular, it notes that both approaches recognise the need to establish rational boundaries for wilderness areas;

'An approach which takes management decisions (such as regenerating clearings or closing roads) into consideration is consistent with the Wilderness Act *and NFPS definition of wilderness and will directly influence the future values of NWI indicators. The emphasis is on identifying rational and manageable boundaries for wilderness areas.'*

The EHTC report describes a general strategy for addressing the JANIS wilderness requirements which employs, 'a transparent two stage process based on capability (criteria satisfaction) and suitability (logical boundaries and long-term management requirements)':

1. For areas already identified as wilderness under the *Wilderness Act* investigations will be brief and aimed at validating the NWI wilderness indicators. It is recognised that some areas of existing identified and declared wilderness areas will not meet the NWI 12 threshold. Such areas however meet the requirements of the *Wilderness Act* and may represent lower quality wilderness, be capable of restoration or be needed for management purposes.

2. For areas identified as having significant wilderness qualities by the NWI outside the existing NSW identified wilderness and/or areas that have been proposed (but not yet assessed) under the Wilderness Act, a more detailed assessment will be conducted to meet the requirements of the *Wilderness Act* as well as validating the NWI wilderness indicators. Assessments will be consistent with previous assessments conducted in NSW, involving

aerial inspections, ground truthing, consideration of past land uses and all other relevant data. It will include assessments of wilderness-based recreational values and landscape integrity. Where necessary to maintain the integrity of wilderness values and establish rational boundaries, disturbed areas which can be restored to a natural state within a reasonable timeframe and areas needed for wilderness management purposes may be included within identified wilderness boundaries.

4. METHODS

4.1 NATIONAL WILDERNESS INVENTORY

The NWI is a computer-based mapping system which conceives wilderness as being part of a spectrum of remote and natural conditions which vary in intensity from undisturbed to urban (Lesslie and Taylor, 1985).

4.1.1 Indices of Wilderness Quality

The NWI measures wilderness quality across the landscape by using four wilderness quality 'indicators' that represent the two attributes of wilderness; remoteness and naturalness. The indicators are derived from the definition of wilderness quality as the extent to which a location is remote from and undisturbed by the influence of modern technological society. These indicators are:

- Remoteness from Settlement - remoteness from places of permanent occupation;
- Remoteness from Access - remoteness from established access routes;
- Apparent Naturalness - the degree to which the landscape is free from the presence of permanent structures associated with modern technological society; and
- Biophysical Naturalness - the degree to which the natural environment is free from biophysical disturbance caused by the influence of modern technological society.

Fundamental to the NWI is the creation of two databases; a primary database and a wilderness quality database. The primary database consists of a wide range of geographical information and forms the basis of the NWI analysis.

4.1.2 Primary Database

The primary data required for wilderness analysis consists of detailed infrastructure and land use information as outlined in Tables 1 & 2. The storage of this data within the NWI Primary and Wilderness databases is described in full in the NWI Handbook (Lesslie and Maslen, 1995).

Table 1:Primary Data Layers used by NWI

Primary Data Layer	Description	Usage
Land cover	All polygonal land cover information; including natural cover, cultural cover, built up areas, reservoirs etc.	Establishes areas for wilderness quality survey (natural areas), and in calculating Remoteness from Access, Remoteness from Settlement, Apparent Naturalness, and Biophysical Naturalness.
Lines	All linear information required for wilderness analysis; including roads and tracks, railways, and other linear infrastructure.	For use in calculating Remoteness from Access and Apparent Naturalness.
Points	All point features required for wilderness analysis, including settlements, buildings, other point infrastructure.	For use in calculating Remoteness from Access, Remoteness from Settlement and Apparent Naturalness.

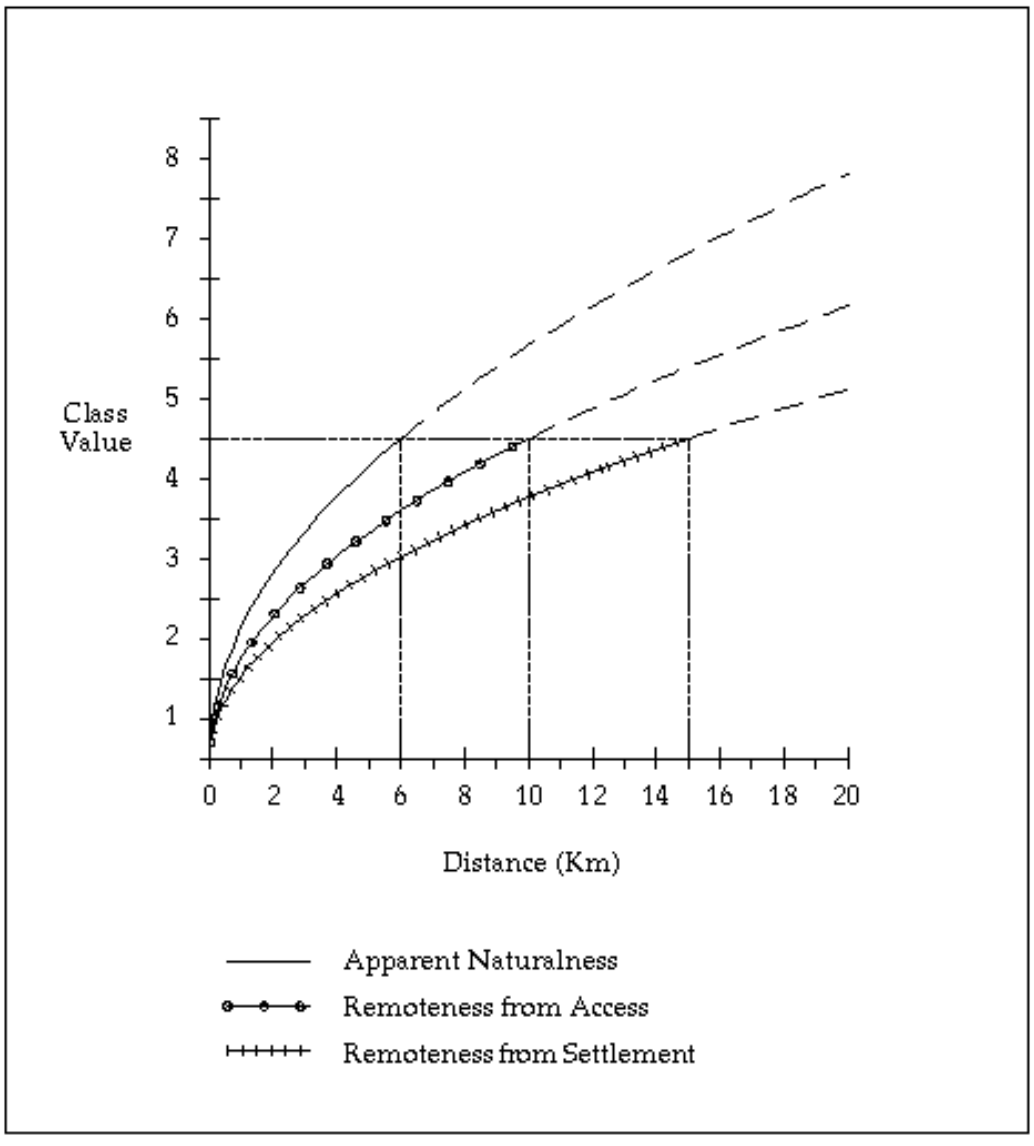
Table 1:Proposed Primary Data Sources for updating NWI in Southern

Primary Data Layer	Data Provider	Source	Date	Scale
API Growth Stages	NSW NPWS	Aerial Photo interpretation	1986-1997	1:25000
API disturbance codes	NSW NPWS	Aerial Photo Interpretation	1986-1997	1:25000
SF Management History Logging Records	State Forests of NSW	Forest Management Records	to1998	1:15,000
SF Management History Unmapped Logging Records	State Forests of NSW	Forest Management Records	to1998	1:15,000
SF Management History Grazing leases	State Forests of NSW	Forest Management Records	to1998	1:15,000
SF Management History TSI records	State Forests of NSW	Forest Management Records	to1998	1:15,000
LIC Roads	NSW NPWS	LIC Roads Maps	to 1997	1:100,000
SF Operational Roads	State Forests of NSW	SFNSW Maps	to 1998	1:15,000

4.1.3 Wilderness Quality Database

The information contained in the Primary Database is utilised to create the Wilderness Quality Database. For each of the three distance-based wilderness indicators, primary data is graded according to its associated impact. The Remoteness from Access and Remoteness from Settlement indicators utilise four categories or grades of impact, whilst three grades are used in determining Apparent Naturalness (Figure 1).

Figure 1: Classification of Distance Based Indicator Values



The analysis process for deriving the three distance-based indicators is outlined below, as a sequence of four steps. (For a detailed description of this process refer to the National Wilderness Inventory - Handbook of Procedures, Content and Usage, Lesslie and Maslen, 1995.).

1. Grading feature impacts - For each indicator, point, line and polygon features are grouped into the appropriate impact grade (for example, Remoteness from Access grades 1 to 4).
2. Distance Calculation - Distance (in metres) is calculated between each sample point and the nearest feature in each grouped coverage generated above.
3. Minimum Weighted Distance Calculation - For each indicator, the distance measures are standardised using a weighting factor that reflects the grade of impact. This, in effect, converts all distances to be equivalent to those of high impacting features. The minimum, effectively the closest, of the standardised distances is recorded.
4. Indicator Classification - Minimum standardised distances are classified to produce consistent Remoteness from Settlement, Remoteness from Access, and Apparent Naturalness classes, with values of 0 to at least 5.

The fourth indicator, Biophysical Naturalness (BN), is based upon the assumption that the degree of change sustained by an ecosystem is directly related to the intensity and duration of interference. For the NWI, land use considerations are generally restricted to the grazing of stock, the treatment and harvesting of timber and agricultural land practices, such as cropping. However, where more reliable data is available, information on a range of other disturbances is also included.

The types of disturbance data typically used to derive the BN layer includes information on:

- timber harvesting
- regional information on grazing
- Aerial photographic interpretation (API)
- land tenure
- grazing leases
- vegetation communities
- mining sites.

Table 1:Biophysical Naturalness Rating Sceme

Indicator Value	NWI Descriptor for Southern regional update
5 High	No evident disturbance from grazing or logging; natural water bodies, API code of 'nil disturbance'.
4	Non-intensive disturbance in Rainforest*; unmapped logging events with no API evidence of disturbance; other forest management events considered to have made minimal impact.
3	Grazing lease (SF only) with pasture grasses present, weeds present, some evidence of logging from API and associated logging records.
2	Intensive record of disturbance in Rainforest*; some multiple logging records, evidence of logging from API.
1 Low	Multiple, recent and intensive logging records with evidence of disturbance in API.
0	Agricultural, urban and developed land, pine and other exotic plantations, reservoirs.

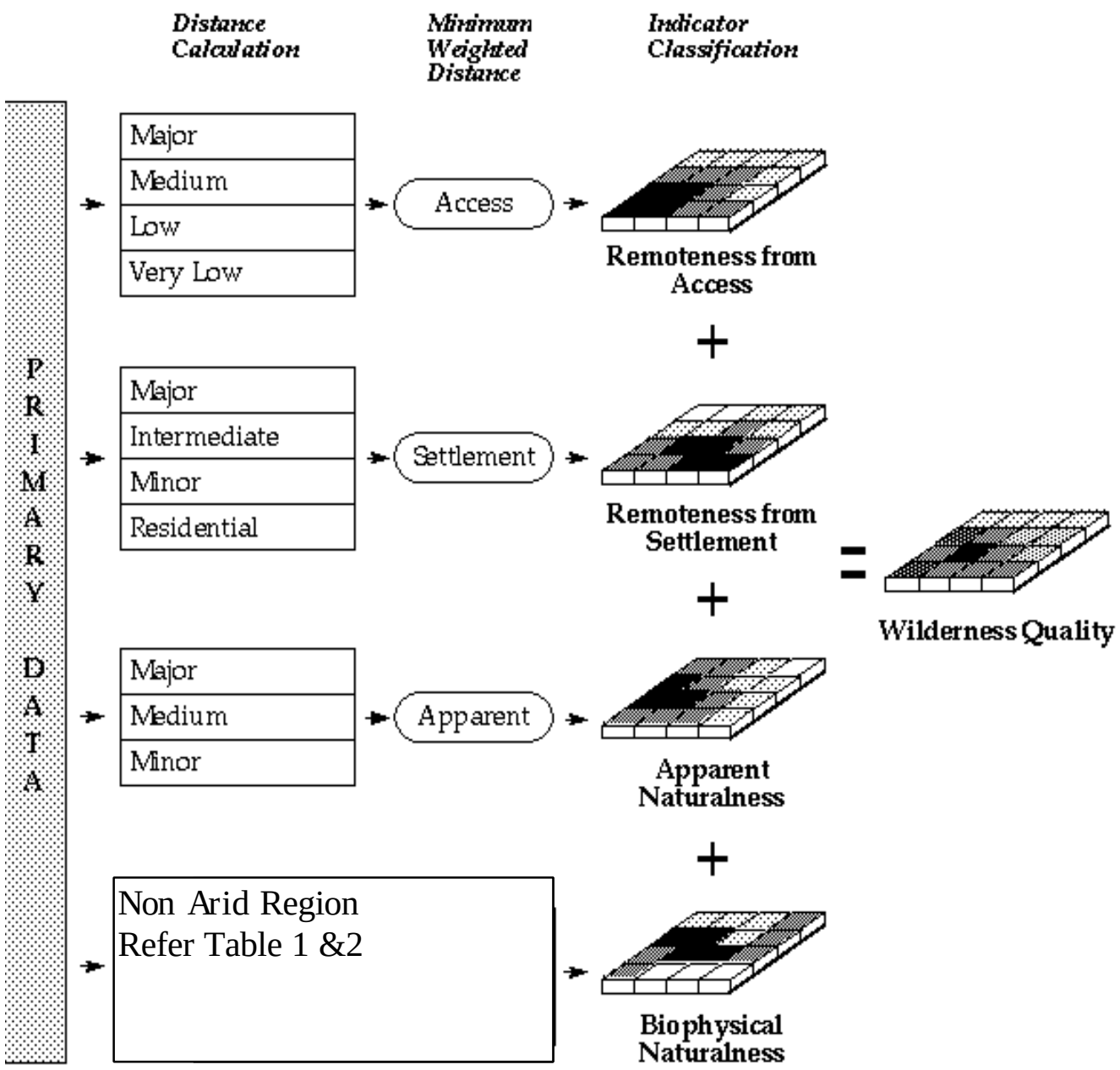
* Re-evaluated at time of delineation.

4.1.4 Deriving Wilderness Quality

A total wilderness quality (WQ) index is produced by summing the standardised values obtained for the three distance-based wilderness quality indicators, truncated at a maximum of class 5, and the Biophysical Naturalness value. The standard process is additive, resulting in a total wilderness quality scale ranging from a minimum value of 0 to a maximum value of 20 assigned to each grid cell covering the region. This procedure rests on the assumption that each indicator contributes independently and equally to total wilderness quality. The process of deriving a total wilderness quality index is illustrated in Figure 2.

Each grid cell across the project area is assigned a value for each of the NWI indicators. Areas with WQ index equal to or above 12 are considered significant. The presence of areas of very high NWI value, termed 'nodal areas' (ie NWI > WQ 12), can help in assessing the significance of potential areas.

Figure 2: Deriving Wilderness Quality



4.1.5 Delineation of NWI High Quality Wilderness in the southern CRA region

The rules used in delineating rational and manageable boundaries for wilderness areas in the Southern CRA Region followed the rules set in the JANIS policy document. Delineation followed stakeholder comment on draft NWI maps followed by consultation with NPWS to provide further field information and expert input from the Australian Heritage Commission (AHC). The rules were as follows:

- all wilderness areas should have a low perimeter-to-area ratio, except for those on the border of the CRA region which abut other High Quality Wilderness;

- wherever possible boundaries should include complete catchments and the entirety of distinctive topographic features such as massifs, plateau, gorges and escarpments;
- where the use of natural features is impossible, boundaries should follow features or infrastructure which are clearly identifiable 'on the ground', such as permanent roads, National Park boundary fences or vegetation/cleared land interfaces;
- boundaries should be set to include buffers, wherever possible, to protect high quality wilderness from future disturbances on adjacent land;
- boundaries should be set at a minimal distance (20 m) from bordering roads and other disturbed sites;
- relatively small disturbed areas which are capable of being restored may be included within a delineated wilderness if to do so would:
  1. enhance the wilderness quality of the surrounding or adjacent wilderness; or
  2. result in the amalgamation of otherwise separate nodes of high quality wilderness;
- boundaries associated with impoundments should follow the high water mark; and
- the use of point-to-point straight lines or contour lines, which are not apparent 'on the ground', should be avoided wherever possible.

Some small areas of wilderness rating 11 or 10 were included in the delineation; just as some areas of wilderness quality 12 were excluded from the 'rational boundaries'.

4.2 NSW *WILDERNESS ACT*

The assessment, identification, declaration and management of wilderness in NSW is principally guided by the NSW *Wilderness Act,* 1987. Under this Act the NSW National Parks and Wildlife Service (NPWS) may investigate any areas proposed for wilderness values. The Director-General of the NSW NPWS may accept an area for investigation in response to a public proposal. Such a proposal may be made by any person, body or organisation, even though they may not be the owner of the land concerned. The Act provides that, wherever possible, landowners affected by a public wilderness proposal are notified of the proposal and assessment process.

Whilst a range of formal definitions and individual perceptions exists regarding what constitutes wilderness, the only definition relevant to the CRA/RFA process is that contained within the NSW *Wilderness Act, 1987*. Section 6 (1) reads as follows:

> *'An area of land shall not be identified as wilderness by the Director-General unless the Director-General is of the opinion that:*
>
> *(a) the area is, together with its plant and animal communities, in a state that has not been substantially modified by humans and their works or is capable of being restored to such a state;*
>
> *(b) the area is of a sufficient size to make its maintenance in such a state feasible; and*
>
> *(c) the area is capable of providing opportunities for solitude and appropriate self-reliant recreation'.*

Section 6(2) of the Act elaborates these requirements as follows:

> *'In forming an opinion under subsection (1), the Director-General may consider any relevant circumstance, including:*
>
> *(a) the period of time within which the area of land could reasonably be restored to a substantially unmodified state;*
>
> *(b) whether, despite development which would otherwise render it unsuitable, the area of land is needed for the management of an existing or proposed wilderness area; and*
>
> *(c) any written representations received by the Director-General from any person (including a statutory authority) as to whether the area of land should be identified as wilderness'.*

The Act thus acknowledges the reality of localised disturbances and incompatible land uses, topography, on-ground management factors, the pattern of varying degrees of wilderness values across a landscape, and other 'real world' issues in the wilderness identification process. It provides for areas that, at the present time, do not meet the wilderness criteria but could be expected to do so within a 'reasonable' time with the application of appropriate restoration measures. It also provides for some areas that do not meet the wilderness criteria, but are required to protect the integrity of a wilderness area or for management purposes, to be identified as wilderness.

Further clarification and explanation of the legislative definition of wilderness is provided by Section 9 of the Act, which deals with the management principles for wilderness areas, and states as follows:

> *'A wilderness area shall be managed so as:*
>
> *(a) to restore (if applicable) and to protect the unmodified state of the area and its plant and animal communities;*
>
> *(b) to preserve the capacity of the area to evolve in the absence of significant human interference; and*
>
> *(c) to permit opportunities for solitude and appropriate self-reliant recreation'.*

On this legislative basis, wilderness in New South Wales can reasonably be taken to be those areas that are:

- not substantially disturbed or modified, or are capable of being restored to this state within a reasonable time;
- large enough to be maintained in this substantially undisturbed state; and
- capable of providing opportunities for solitude and appropriate self-reliant recreation.

None of these attributes are unique to wilderness, but it is their occurrence together in a natural area that defines wilderness.

On completion of the assessment process the Director-General of the NSW NPWS will determine an identified wilderness area, that is, an area meeting the requirements of the Act as described above. The Act requires an assessment to be undertaken by the NSW NPWS, and advice provided to the Minister for the Environment, in relation to a public wilderness proposal within two years of receipt of the proposal.

The wilderness assessment process is undertaken independent of land tenure, and any resulting identified wilderness may include freehold or leasehold land. However it is stated Government policy, reiterated on several occasions, that private land cannot be resumed for wilderness declaration. Neither can wilderness be declared over freehold or leasehold Crown land without the landholder's explicit consent. Wilderness identification simply represents the formal recognition of the wilderness quality of an area of land, and in the case of private lands has no influence on how that land is managed. In particular, it does not restrict the existing legal access to, or use of, an area of private land by its owners.

An identified wilderness area is presented, along with other information from the assessment process, in a Wilderness Assessment Report, which is then exhibited for public comment. The criteria for identification of wilderness under the *Wilderness Act* are consistent with the NFPS definition of wilderness except that the NFPS definition includes remoteness from the influences of European settlement.

4.2.1 Discussion of Assessment Criteria

The assessment of wilderness nominations utilises four key indicators, which reflect the legislative attributes for wilderness. These indicators are:

- naturalness
- restorability
- size
- opportunities for solitude and recreation.

4.2.1.1 Naturalness

Objective measurement of the naturalness of any system is difficult. Naturalness of an area is its persistence in a state substantially unmodified by modern technological society. This is one of the three key criteria for wilderness identification as set down in the Act.

The definition of wilderness as derived from the Act places these areas towards the least modified end of the spectrum of land uses and human impacts on the landscape, but without making the claim that these areas are pristine and totally untouched. The Act's provision regarding the ability of an area to be restored to an essentially unchanged natural state also indicates that some degree of human modification, within the bounds of restoration within a reasonable time frame, can be tolerated within an identified wilderness in the short term. Hence the naturalness component of a wilderness assessment is not a test of the presence or absence of modifications, but an assessment of the degree of modification, within an apparently natural area. These modifications may be from past land uses and activities, present or continuing land uses and activities, or both.

The modifications or disturbances that are evident in an area are considered in terms of their effects on, or changes to, the key components of the ecosystems that determine an area's naturalness. Changes in structure and composition, usually of vegetation communities, are the most easily measured of these components. Undisturbed areas are usually evidenced by the presence of a substantially unmodified cover of native vegetation (Helman *et al*. 1976; Wilderness Working Group 1986). The focus on the impacts of European humans and their works means that the issue of landscape modification by Aboriginal people over the longer-term is not considered in the legislative definition and identification of wilderness areas in NSW.

Two methods have been used previously for categorising the degree of naturalness in wilderness surveys:

1. Laut *et al*. (1977) developed four broad descriptive categories of native vegetation disturbance:

   Undisturbed natural: vegetation by and large in its natural state; if it has been disturbed (such as due to cutting or grazing) this has taken place sufficiently long ago for substantial recovery to have occurred;

   Disturbed natural: vegetation used for limited-impact activities (such as selective timber harvesting or light grazing) but where the original composition and structure remain basically intact, and vegetation is likely to recover within a relatively short period should any disturbances cease;

   Degraded natural: vegetation has been intensively used, its basic structure has changed and recovery is likely to be a long process if possible at all; however there has been no direct

or deliberate attempt by humans to replace native species with introduced species or to effect change through fertilisers; and

Cultural: native vegetation largely or completely replaced by an exotic vegetation (such as pine plantation or introduced pastures).

2. Lesslie *et al*. (1987) have developed a procedure which is 'essentially descriptive and couched in terms of a hierarchy of degrees of biophysical alteration'. This procedure is based on five classes of naturalness:

Unused by European people: no apparent loss of ecosystem integrity;

Low intensity use, now ceased: structure of vegetation and/or soils relatively stable under disturbance; perturbed but not under significant stress;

High intensity use, now ceased: structuring vegetation and/or soils relatively sensitive to disturbance; perturbed but not under significant stress;

Low intensity use, continuing: structuring vegetation and/or soils relatively stable under disturbance; perturbed and under stress; and

High intensity use, continuing: structuring vegetation and/or soils relatively sensitive to disturbance; perturbed and under stress.

Both systems are qualitative and require a degree of subjective assessment. The method of Lesslie *et al*. places an more explicit emphasis on the sensitivity of an area to disturbance.

The extent of modification by humans and their works, and the ability of an area to be restored to a substantially unmodified state, has been assessed using the following criteria:

- the extent of substantially unmodified vegetation cover;
- the extent and location of modified areas and known past or continuing disturbances;
- the degree of modification evident; and
- the possibility of restoration of modified areas.

4.2.1.2 Restoration

Section 6(1)(a) of the Act allows for the identification as wilderness of areas which are 'capable of being restored' to a wilderness condition. In forming an opinion on this matter the Director-General may consider 'the period of time within which the area of land could reasonably be restored to a substantially unmodified state'.

Restoration requires determining an end point (Cairns 1986). The Act defines this point as being in a state that is 'substantially unmodified'. In considering when this has been achieved, or whether it is capable of being achieved, a number of factors are pertinent including:

- biological relevance - the desired state must be a realistic measure of community or ecosystem condition;
- legal relevance - it must be a condition which meets the requirements of the Act; and
- social relevance - it must be a condition meaningful to a range of users.

In applying the criteria areas are assessed against a reference point within the study site and which meets the criteria for wilderness.

4.2.1.3 Size

Section 6(1)(b) of the Act requires that an identified Wilderness area be of sufficient size to enable its maintenance in a substantially unmodified state.

A number of principles relating to the size of natural areas and protected area design offer a useful framework for interpretation of the size requirements of the Act. These include the following:

- a large natural area is more likely to capture and maintain the diversity of features, species and genes within a region than a small area;
- a large proportion of any remaining area of highly fragmented habitats should be targeted for protection in order to avert (or at least minimise) the biotic collapse which models suggest can occur in such systems;
- large fragments will often be the only refuge for species which exist at low densities or who are habitat specialists;
- large fragments often serve as sources of immigrants for marginal populations in neighbouring small fragments;
- the trend is for large fragments to be eroded unless protected (Wilcove *et al*. 1986);
- small parcels of habitat require more active and costly management to ensure that wildlife populations maintain their full complement of genes, species and functions (Ryan 1992), without any guarantee of success (Wolke 1991); and
- small parcels are more able to be invaded by exotic plant and animal species and impacted by broad area disturbance such as fire.

Essentially, declaration of larger areas will increase the probability of sustaining a ‘natural’ and ‘unmodified’ state in the long term. Such areas are also more likely to contain greater biotic values.

4.2.1.4 Solitude and Recreation

There have been several approaches to defining recreational and experiential indicators for wilderness on the basis of size or remoteness (Helman *et al*. 1976; Lesslie *et al*. 1987). However, the Act requires only that wilderness areas be ‘capable of providing opportunities for solitude and appropriate self-reliant recreation’.

Appropriate self-reliant recreation is not defined in the Act but it can reasonably be taken to mean any form of recreation which does not utilise motorised/mechanised or other forms of assisted transport and which does not diminish the biological integrity of an area.

4.2.2 Previous Assessments under the NSW *Wilderness Act, 1987*

Four areas within the Southern CRA region, Pilot, Byadbo, Jagungal and Bogong Peaks were declared wilderness in 1982 under the *National Parks & Wildlife Act*, 1974 and were subsequently declared under the *Wilderness Act, 1987* in 1992. Six further areas within the

Southern CRA region, Kanangra-Boyd, Ettrema, Budawang, Deua, Goobarragandra and Bimberi have been assessed and identified as wilderness in accordance with the *Wilderness Act,* 1987. The total area of the 6 identified wilderness areas is approximately 370 806 ha, of which 296 201 ha are declared. These areas are listed in Table 4 and shown in Figure 3.

Table 1:Identified Wilderness in Southern CRA Region - December 1999

Identified Wilderness	Area (ha)	Area declared (ha)	Area Identified but not Declared (ha)	Percentage declared
Kanangra-Boyd	63 297	59 630	3 666	94%
Ettrema	83 155	66 939	16 216	80%
Budawang	81 975	76 028	5 947	93%
Deua	76 010	35 831	40 203	47%
Goobarragandra	35 001	30 219	4 781	86%
Bimberi (excl. ACT)	31 367	27 575	3 792	88%
TOTAL	**370 806**	**296 201**	**74 606**	**80%**

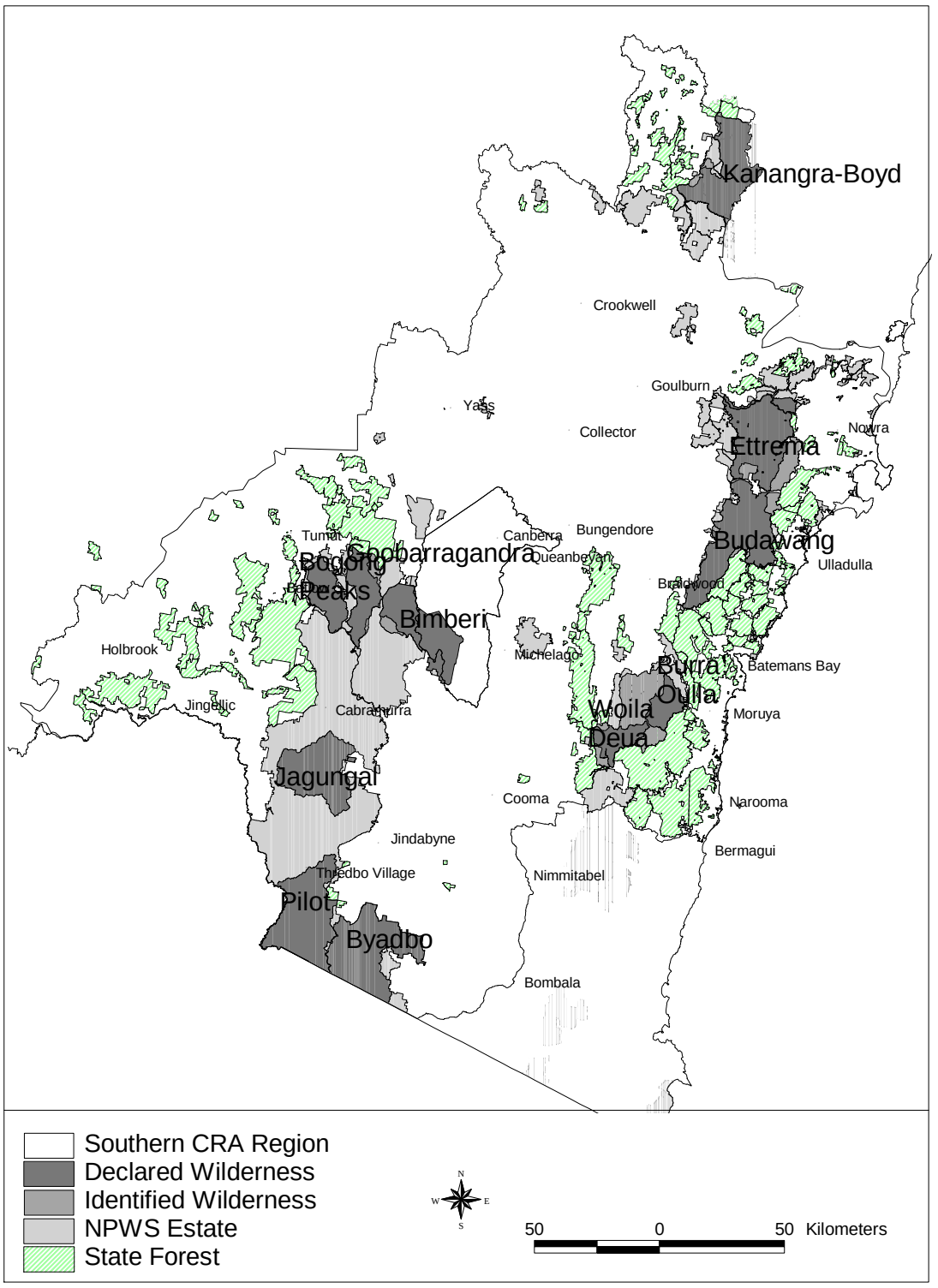
Table 5 shows all the Declared Wilderness areas under the National Parks & Wildlife Act (1974) and the NSW *Wilderness Act, 1987* with dates and sizes (hectares) of each area and any later additions.

Table 1:Declared Wilderness in Southern CRA Region.

Wilderness area	Reserve name	Declaration date (Wilderness Act, NP&W Act)	Area (ha)	Total area Declared (ha)
Kanangra-Boyd				
Kanangra-Boyd	Blue Mountains NP, Kanangra-Boyd NP	21 Feb 1997	63 297	63 297
Ettrema				
Ettrema	Morton NP	10 April 1992	60 000	
Ettrema addns	Morton NP	12 April 1996	4 380	
Ettrema addns	Morton NP	18 October 1996	1 800	
Ettrema addns	Morton NP	15 August 1997	16	66 196
Budawang				
Budawang	Morton NP, Budawang NP	12 April 1996	68 000	
Budawang addns	Budawang NP	9 August 1996	122	
Budawang addns	Budawang NP	30 August 1996	36	
Budawang addns	Budawang NP	5 July 1996	1704	
Budawang addns	Budawang NP	26 September 1997	400	70 262
Deua				
Burra Oulla	Deua NP	14 September 1994	17 800	
Burra Oulla addn	Deua NP	14 June 1996	670	17 800
Woila Deua	Deua NP	14 September 1994	18 031	18 031
Goobarragandra				
Goobarragandra	Kosciuszko NP	12 April 1996	27 000	
Goobarragandra addns	Kosciuszko NP	5 July 1996	2 238	29 238
Bimberi				
Bimberi	Kosciuszko NP, Bimberi NR	14 September 1994	22 750	
Bimberi	Scabby Range NR	12 April 1996	4 466	27 216
Bogong Peaks				
Bogong Peaks, under NPWS Act & Wilderness Act	Kosciuszko NP	29 October 1982, 6 March 1992.	25 600	
Bogong Peaks	Kosciuszko NP	14 September 1994	1 825	27 425
Pilot under NPWS Act & Wilderness Act	Kosciuszko NP	29 October 1982, 6 March 1992.	77 530	77 530
Jagungal under NPWS Act & Wilderness Act	Kosciuszko NP	29 October 1982, 6 March 1992.	61 945	61 945
Byadbo under NPWS Act & Wilderness Act	Kosciuszko NP	29 October 1982, 6 March 1992.	78 121	78 121
Total Declared Wilderness				**584 464**

Note:
Areas are based on figures published in the NSW Government Gazette to nearest hectare. Areas are approximate may be inaccurate by 1000 ha or more.

Figure 3: Existing Identified and Declared Wilderness in Southern CRA Region



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4.2.3 Assessment Methodology

As detailed in the project specifications endorsed by the EHTC, project objectives are as follows:

> To undertake wilderness assessment as required by the RFA Scoping Agreement. In particular, with respect to the NSW *Wilderness Act*, 1987, the project aims to:
>
> **NWI**
> 1. collate and validate disturbance information for use by the Commonwealth in the refinement of the National Wilderness Inventory (NWI), and produce maps of delineated areas of high quality wilderness as defined by JANIS criteria.
>
> **NSW *Wilderness Act* 1987**
> 2. assess all current community wilderness proposals and all additional ares identified by a desktop assessment as likely to meet the criteria of the Act.

The project proposal specifies that wilderness will be assessed in accordance with the revised wilderness assessment methodology, detailed in the draft 'Guidelines for Undertaking Wilderness Assessment in NSW' (NSW NPWS - Draft Version, 1998). The proposal further stated that "the revised method will be presented to EHTC by NSW NPWS", ideally as part of a joint NSW NPWS and EA workshop. Such a workshop was held on 21 Sept 1999 and attended by representatives of stakeholder groups.

4.2.3.1 Project Outputs

- Assess all community proposals and other candidate areas against the criteria of the Act
- Update a GIS layer of areas identified and/or declared as wilderness under the Act
- Updated NWI database
- GIS layer of delineated high quality wilderness areas

4.2.3.2 Delineation of Wilderness Assessment Study Areas

In accordance with the NPWS draft Guidelines for undertaking wilderness assessment in NSW, the desktop assessment of wilderness involved the derivation of a GIS layer of 'candidate' wilderness areas, or Wilderness Assessment Study Areas (WASA's). This assessment comprised of declared and identified wilderness, provisionally identified wilderness (PIW), old growth forest (OGF) and deferred forest areas (DFA), the latter area from the earlier Interim Forest Assessment.

Large and contiguous forest areas, (not fragmented by roading or clearing) that were considered to be substantially unmodified (SU), were delineated. Delineated areas also included natural non-forest, such as water bodies, cliff lines, heathland and wetland, plus some areas that were considered modified but restorable within a reasonable time frame (MR) and mosaics of SU/MR, such as well-developed post logging regeneration interspersed with old growth forest. Vegetation cover appearing substantially modified (SM), such as recently logged forest and mosaics of MR/SM, were excluded except where this would unduly complicate management.

Preliminary API and reference to GIS layers for disturbance and growth stage (i.e. Broad Old Growth Mapping Project (BOGMP) and Logging History) directed the placement of the delineated assessment area boundary to maximise the inclusion of SU whilst excluding areas of

SM, SM/MR and MR (unless likely to be required for management purposes). The total contribution of MR and SM did not exceed 25% and 10% respectively. Delineated boundaries of were then digitised in Arcview GIS format.

4.2.3.3 Available Datasets

NSW NPWS Southern Zone conducted an internal review of wilderness assessment boundaries against other GIS layers (Table 6). The boundaries were also checked against recent logging records (e.g. SFNSW harvest plans). Boundaries were further refined following receipt of updated digital information in ArcView GIS format, including the following datasets: drainage, roading, tenure, old growth forest (CRAFTI), logging history; public submissions (point data); the results of field and aerial assessments carried out Feb-June.

Table 1:Datasets used in NSW NPWS internal review of wilderness assessment boundaries

Dataset	Disturbance type(s)	Geographical coverage	Data format	Dataset author
CRA Air Photo Interpretation	Clearing, logging, grazing, fire, weeds	All tenures	GIS	NPWS
CRA Management History Mapping project ('MANHIC')	Logging, fire	SFNSW estate	GIS	SFNSW
Grazing history	Grazing	Areas of state forest transferred to NPWS estate	GIS	NPWS
LIC roads	Roads, tracks	All tenures	GIS	Land Information Centre (LIC)
SFNSW roads	Roads, tracks	SFNSW estate	GIS	SFNSW
1:25 000 / 1: 50 000 topographic maps	Clearing, structures (dwellings, shelters), aqueducts, fences, powerlines, water races)	All tenures	Hard copy	Central mapping Authority (CMA)

Table 7 lists the data layers used in this assessment. Attributes of each data layer were classified for derivation of wilderness quality across the study area.

The derivation of growth stage classes from CRA Air Photo Interpretation (CRAFTI) and Broad Oldgrowth Mapping (BOGMP) projects incorporated site quality data (incorporating forest ecosystems), disturbance information from MANHIST and CRAFTI, and logging history records from the IAP.

Table 1:Datasets used in the derivation of wilderness quality classes

Attribute	Data source	Mapped coverage	Digital

			coverage
Forest structure	BOGMP 1996	Public forest	Southern
Forest structure	CRAFTI 1998/9	All tenure (excludes non-forest)	Southern
Broad vegetation type	Eastern Bushlands d'base 1992	Complete coverage	Southern
Forest ecosystems	CRA 1998/9	Complete coverage	Southern
Disturbance tags	CRAFTI 1998/9	All structural polygons except regrowth	Southern
Roads	AUSLIG 1998/9	Complete coverage	Southern

4.2.3.4 Expert Panel

Naturalness is the most complex of the Act's three criteria. This project engaged an expert panel to assist in the derivation of decision rules for application to the collated and collected disturbance data for four of the most challenging disturbance types: logging; grazing; weeds and fire. Expert ecologists were selected on the basis of their detailed ecological understanding of disturbance factors relevant to the study area. A list of contributing experts and their credentials is provided in Appendix 1. This project did not compensate contributing experts, although efforts were made to minimise their out-of-pocket expenses.

Expert opinion was used to derive rules that could be used to classify parts of the study area as Substantially Unmodified (SU), Modified but Restorable (MR) or Substantially Modified (SM). The experts provided information on the disturbance thresholds and restorability of environments within the study area following various disturbance regimes. Experts were briefed on the attributes, including limitations, of the available disturbance data before they offered their opinions. They were asked to consider each disturbance regime within two sub-regions of the Southern CRA Region ('tablelands' and 'coast'), and for three site qualities within each sub-region (low, medium and high). In the case of fire, experts recommended that a distinction between 'alpine' and 'not alpine' was more useful than site quality *per se*, and this alternative choice was used. A numerical derivation of decision rules was used, so that differing ecological viewpoints could be given equal weight.

Each ecologist was asked to complete a series of decision tables (similar to decision trees) designed to elucidate 'thresholds' above which disturbance regimes were considered to move between the disturbance categories of SU, MR and SM. Each ecologist allocated ten points across the SU, MR and MM categories for each disturbance regime. For example, where the disturbance was considered to be 'SU' in all instances, all ten points were allocated to this classification. In many instances, however, a particular disturbance could fall into more than one class, because of uncertainties beyond the scope of the decision tables, and the ten points could be allocated correspondingly. The numerical scoring thus facilitated flexibility in the assignment of disturbance regimes.

The contributors' numerical scores for each classification were averaged for each row of each decision table, and the classification with the highest score was assigned to that disturbance regime. Where two or more classifications shared the modal score, the most disturbed category was used. In a type of abbreviated 'Delphi' technique, the results were reviewed by the contributing ecologists and any disagreements were resolved by NPWS in discussion with all contributors. Unlike the true Delphi method, this process was not continued until all participants were satisfied with all the results. The briefer method was required to meet CRA timelines.
Many rows of the decision tables led to the same classification. Such rows were simplified as far as possible. Each rule was coded as a Spatial Analyst query and applied to relevant GIS datasets.

The information and instructions provided to the expert ecologists is presented in Appendix 2.

4.2.3.5 Landholder Notification

The project proposal specifies that:

'As per requirements of the Wilderness Act, private landholders within the areas under assessment will be notified. Key stakeholders, neighbours and relevant land management agencies or groups will also be contacted. Landholders, land managers and the local community will be approached for information about the areas under investigation. Broader consultation will be undertaken under the Regional Forest Forums'

An MS Excel database was established by NSW NPWS Southern Zone Natural Heritage Unit in order to store and analyse information from submissions received from owners of land affected by wilderness proposals and members of the public responding to letters of notification and media releases. Site specific details from public submissions were converted to ArcView GIS point data for consideration during the assessment process.

4.2.3.6 Delineation and refinement of wilderness capability layer

The expert and NPWS-derived decision rules were applied to GIS datasets via 'queries' in Spatial Analyst. Where two or more disturbance types overlapped, the more severe disturbance classification prevailed. The resulting disturbance layer mapped the areas into four classes: SU, MR, SM and 'no data'. The disturbance map was printed on clear film and overlaid on topographic maps annotated with non-digital disturbance information.

The decision rules defining wilderness quality classes are presented in Appendix 3. The GIS procedures for deriving wilderness quality classes are also detailed and a summary of the codes allocated to attributes of each data layer is also provided.

In the determination of 'sufficient size', a minimum area of 15 000 ha applies for stand-alone wilderness areas in the assessment of Wilderness Capability for CRAs (NSW NPWS, 1998). Under the NWI, thresholds of 5000 ha for coastal and 8000 ha for non-coastal wilderness areas apply, with exceptions for smaller areas contiguous with existing declared or identified wilderness areas, or for larger areas within regions where wilderness is extensive.

Roading was considered in the determination of 'opportunities for solitude' and 'degree of modification'. Highways and major access roads were considered incompatible with wilderness values and areas were excluded if such roads intersected the assessment area. Wilderness areas may include minor roads and tracks if they are not required for public access, are overgrown and no longer in use, could be restored, or are likely to be required for management purposes.

The rules followed for the delineation and refinement of wilderness assessment areas are shown in Table 8.

Table 1:Rules for delineation and refinement of wilderness assessment areas

Include in assessment area	Exclude from assessment area	General principles
Wherever possible boundaries should include complete catchments, massifs, plateaux,	Areas obviously substantially modified - e.g. cleared, agricultural, urban and other	Where use of natural features is inappropriate, boundaries should follow features clearly identifiable

gorges and escarpments.	developments, areas fragmented by dense roading.	in the field such as roads, transmission lines, fence lines or vegetation / cleared land interfaces.
All types of natural cover - e.g. rivers, lakes, waterfalls, dunes and rock outcrops as well as all forms of native vegetation.	Extensive areas that are modified but not considered restorable within a reasonable time frame - e.g. readily accessible and repeatedly logged lowland / coastal forests.	Low perimeter: area ratios are preferred for wilderness areas.
Areas modified but restorable - e.g. minor walking tracks, post-logging regeneration.	Exclude areas considered modified and not restorable within a reasonable time frame - e.g. mosaics of Substantially Modified / Modified Restorable land.	Wherever possible boundaries should be set to include buffers which protect wilderness from future disturbances on adjacent land.
Large, substantially unmodified areas - e.g. large contiguous patches of old growth forest, natural non-forest areas.	Areas considered Substantially Unmodified but which do not meet size thresholds.	Delineate areas for assessment according to threshold of 15 000 ha under the NSW *Wilderness Act, 1987*.
Minor infrastructure features - e.g. ruins, trig points - may be included in wilderness areas.		Delineate areas according to a minimum threshold of 8000 ha for non-coastal and 5000 ha for coastal areas for contribution to the NWI, or 15 000 ha for NSW *Wilderness Act* assessment.

4.2.3.7 Field assessment

Ground-based assessment

In order to make best use of the limited time available for field assessment, survey sites targeted representative samples of wilderness quality classes and areas with conflicting information or data gaps. Assessment sites were marked on topographic maps and an appropriate survey route determined. The type of validation procedure was dependent upon access (i.e. less accessible areas were validated using API) and the availability of additional GIS layers.

Field data were collected along transects using a standardised proforma which included location (GPS / AMG), site conditions (e.g. geography, slope, aspect), naturalness (vegetation cover, structure, growth stage), disturbance (type and intensity), roading (type and level of impact) and naturalness indicators. Notes were made on opportunities for solitude and self-reliant recreation and an overview of wilderness values. Indicative photographs were taken and reference points marked onto topographic maps. Assessment proformas were collated for subsequent data entry and analysis.

Aerial assessment

Light planes and helicopters were employed for approximately 8 days of rapid aerial assessment of the potential wilderness areas distributed throughout the Southern CRA region. Waypoints were taken for target areas and entered into a GPS for navigation. During the flights notes were made on any evidence of recent logging, roading or clearing, the appropriateness of the proposed boundary and the integrity of the forest canopy (i.e. contiguity, patchiness).

4.2.3.8 Presentation of methodology to EHTC

A joint presentation was made by Environment Australia (EA) and NSW NPWS to representatives of stakeholder groups on 21st September 1999. The presentation by EA focused on decision rules used to derive categories for biophysical naturalness and NWI ratings. The NSW NPWS Wilderness Conservation Unit described suitability and capability assessment, as they relate to the Act.

The NSW NPWS Southern Zone Natural Heritage Unit presented their assessment of wilderness in the Southern CRA regions according to the project requirements. Both the capability and suitability assessments had been fast-tracked to meet CRA timelines, which had precluded detailed analysis of the entire region for wilderness values. The assessment had used readily available and compatible digital datasets which, once combined, provided complete coverage of the entire study area.

A summary of the outcomes from the assessment methodology workshop was also presented. The summary showed:

- primary datasets used in deriving a GIS wilderness quality landscape layer;
- secondary (contextual) datasets used in assessing wilderness values; and
- procedures for using fauna models in the determination of biodiversity values in wilderness areas.

Agreement was sought on where to draw the line between wilderness and non-wilderness according to the proportions of wilderness quality classes in an area. The following thresholds were generally accepted:

Substantially Unmodified	>75%
Modified but Restorable	<25%
Substantially Modified	<10%

5. RESULTS

5.1 NATIONAL WILDERNESS INVENTORY

The NWI update revealed that seventeen areas in the Southern CRA region meet the JANIS criteria for 'high quality wilderness' (minimum NWI rating of 12 and a minimum size of 8000 hectares) (Table 10). One area is less than 8,000 ha in extent in NSW, but adjoins similar lands across the ACT border. The JANIS criteria are met when the contiguous area in the ACT is taken into account.

The combined extent of the seventeen delineated wilderness areas in the Southern region is 860,400 hectares (Table 9). The metadata for delineated NWI are provided in Appendix 4.

Wilderness areas identified as NWI wilderness quality and size above agreed thresholds (as defined by JANIS) are displayed, with the existingreserve layer, in Figure 4. Figure 5 identifies the rational boundaries for protection of NWI wilderness values against the underlying tenure.

Table 1:Extent of NWI High Quality Wilderness in Dedicated Reserves

NWI Number	Place	Total Area (ha)	Area in Reserves (NP/NR only) (ha)	Proportion in Reserves (NP/NR only) (%)
1	Ettrema (Morton NP)	124,300	97,800	78.7
2	Budawang (Morton/Budawang NPs)	86,200	80,900	93.9
3	Brindabella NP	15,300	9,100	59.5
4	Goobarragandra (Kosciuszko NP)	56,900	50,700	89.1
5	Bogong Peaks (Kosciuszko NP)	34,500	34,100	98.8
6	Bimberi (Bimberi NR)	35,700	34,300	96.1
7	Buckenbowra	17,600	4,500	25.6
8	Tantangara (Kosciuszko NP)	22,500	22,500	100
9	Deua (Deua NP)	101,000	74,000	73.3
10	Clear Range	2,400	0	0
11	Tabletop (Kosciuszko NP)	25,300	25,100	99.2
12	Jagungal (Kosciuszko NP)	81,600	80,200	98.3
13	Wadbilliga (Wadbilliga NP)	29,500	20,500	69.5
14	Youngal (Kosciuszko NP)	20,300	19,900	98
15	Geehi (Kosciuszko NP)	31,000	31,000	100
16	Pilot (Kosciuszko NP)	88,000	85,600	97.3
17	Byadbo (Kosciuszko NP)	88,300	80,400	91.1
	Total	860,400	750,700	87.3

NB: figures are indicative only. Only polygons that meet NWI criteria are shown.

Some areas adjoin the ACT. Wilderness values are continued into ACT so that minimum size criteria are met.

Figure 4: Delineated NWI with Reserve Layer

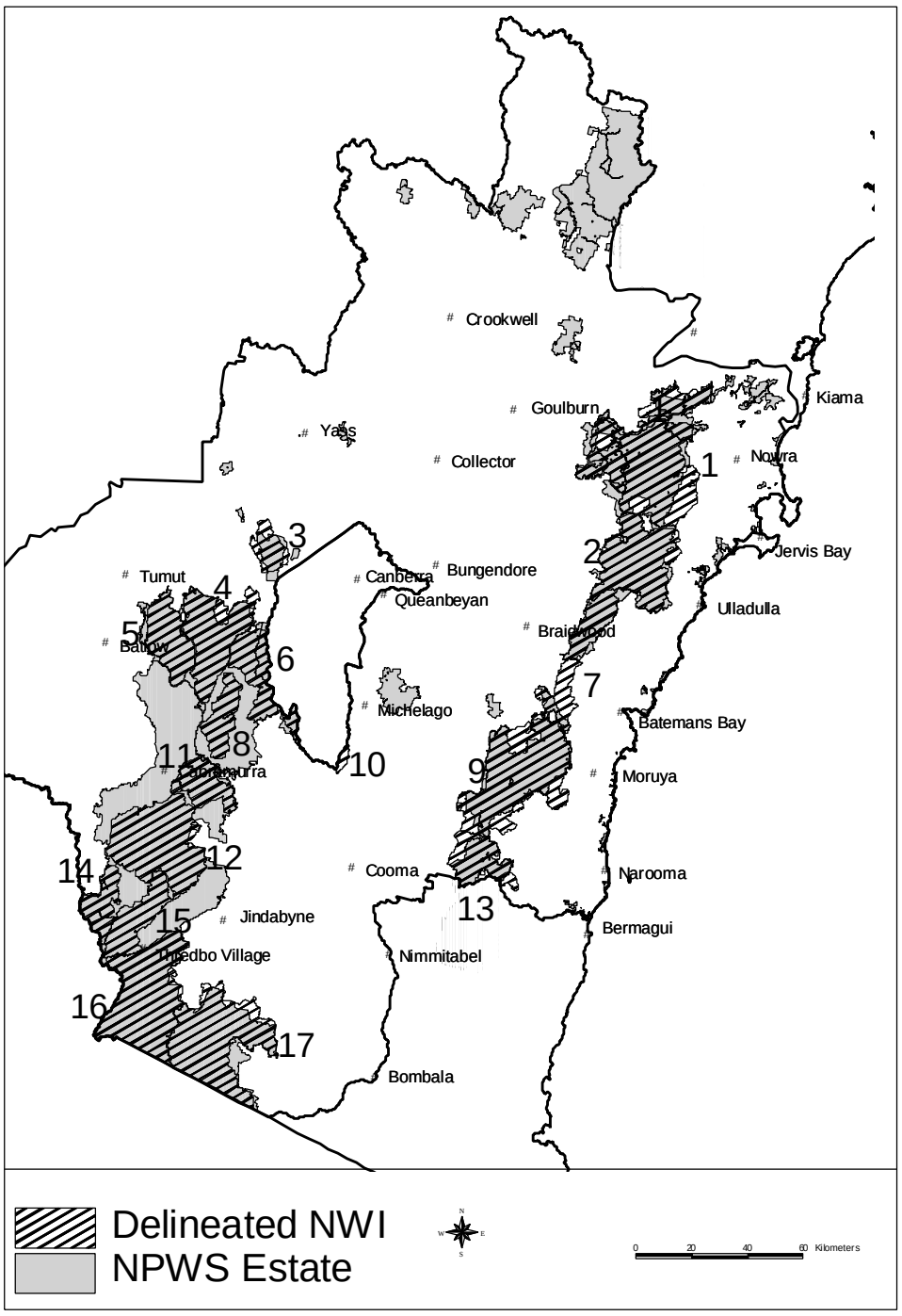

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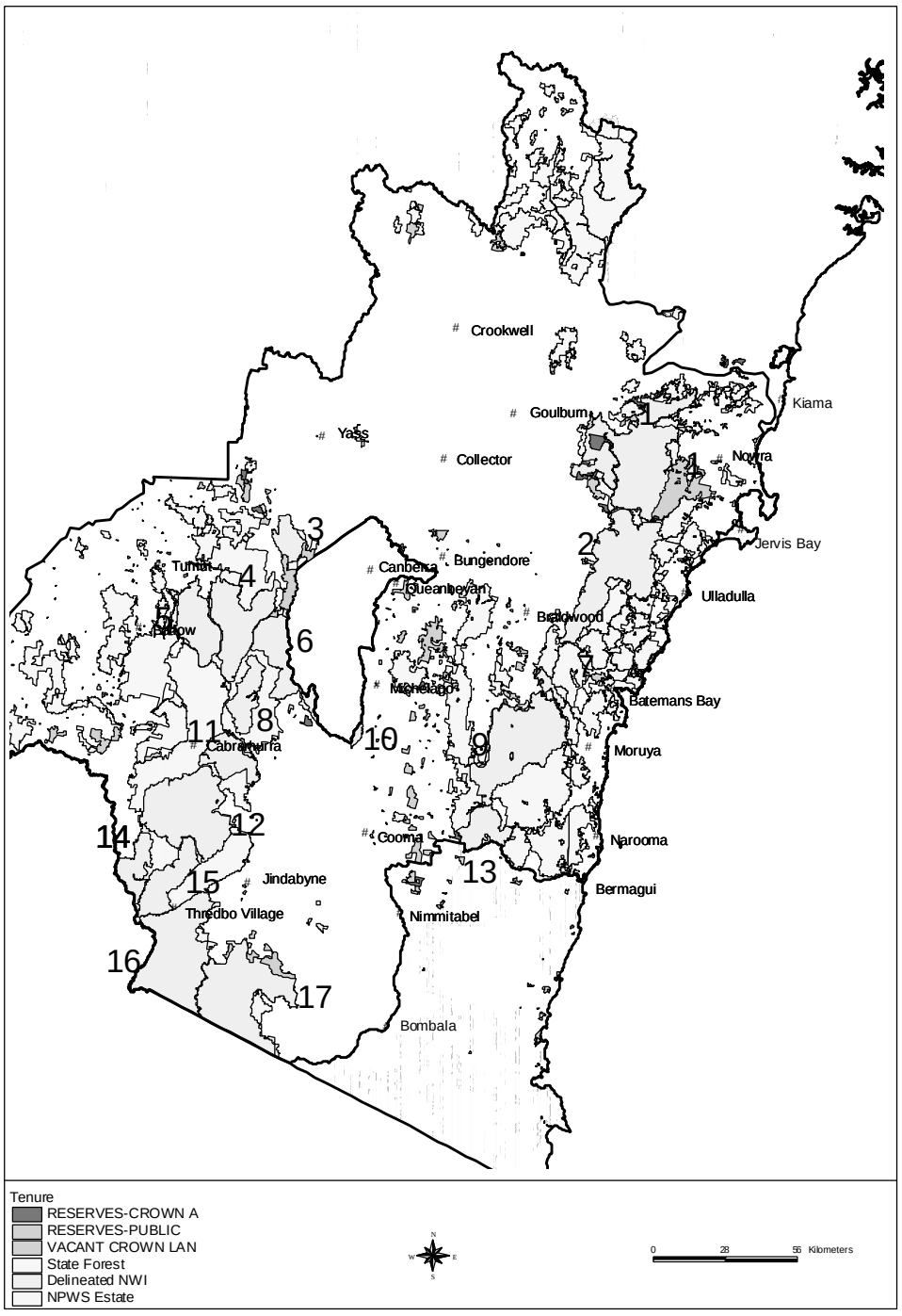
Figure 5: Delineated NWI with Tenure



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5.2 NSW WILDERNESS ACT

Areas assessed as meeting the *Wilderness Act* criteria were labelled Provisionally Identified Wilderness (PIW). This status allows for changes based on additional information on wilderness quality that may be presented as part of the CRA negotiations. Upon adoption of the Wilderness Assessment Report (in prep.) the Director General of the NSW NPWS will formally identify these areas as wilderness.

Based on the assessments undertaken in accordance with the *Wilderness Act, 1987* as part of the CRA process, the Murruin, Buckenbowra, Tuross, Indi, Western Fall, Tabletop and Brindabella areas were provisionally identified as wilderness. Areas adjoining the existing Identified Wilderness Areas of Ettrema, Deua, Byadbo, Pilot, Jagungal, Goobarragandra, Bogong Peaks and Bimberi were also provisionally identified as wilderness. All PIW is shown in Figure 6.

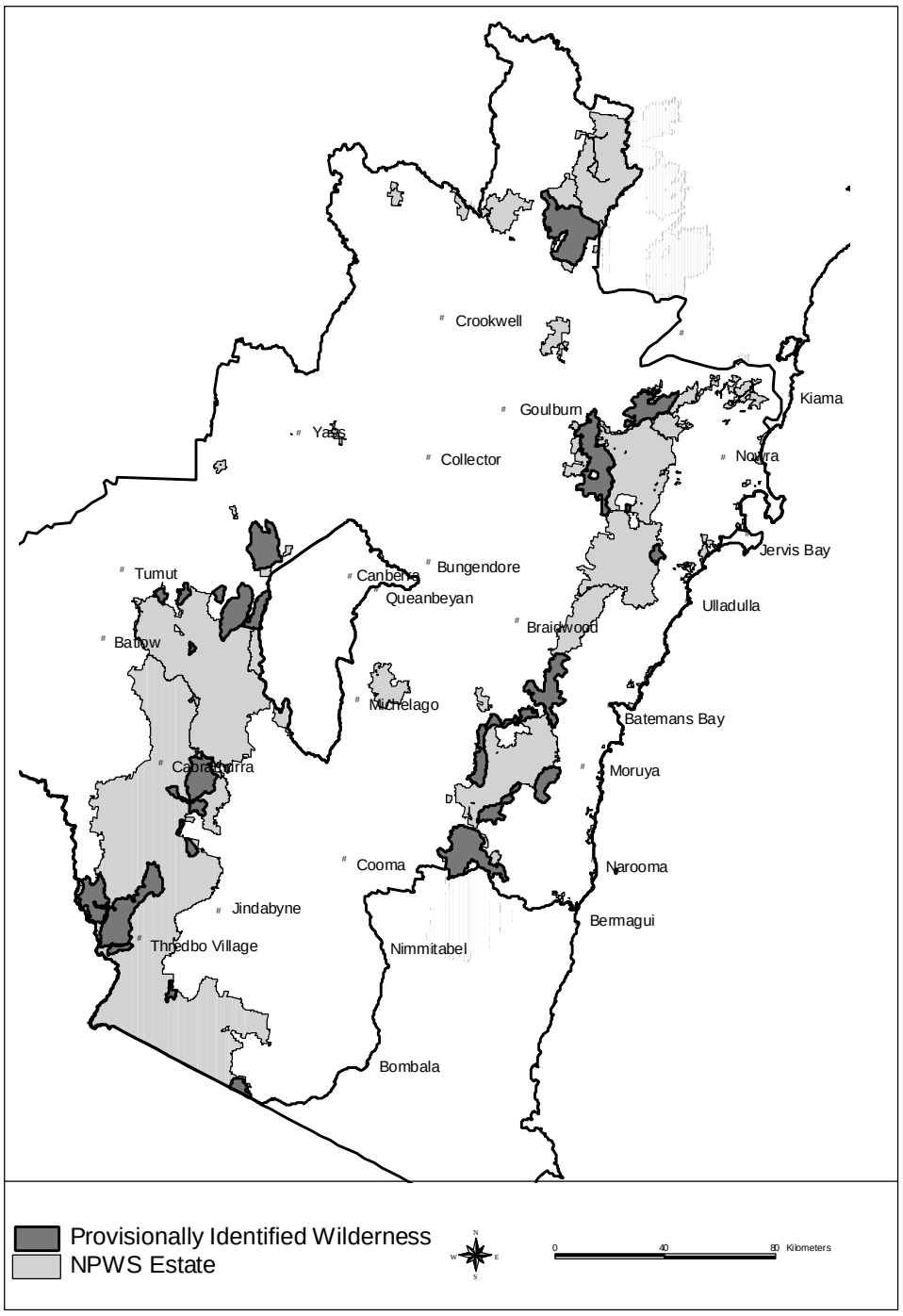
These areas total 231 584 ha. Table 10 shows land tenure for the 27 PIW areas.

Table 1:Land tenure of PIW areas in Southern (>15 000 ha, or smaller additions to existing areas).

PIW Name	Type	National Park	State Forest	Crown Land	Other	Total PIW (ha)
Ettrema Addition (North)	Addn.to Ettrema	9,295	1,460	1,457	191	**12,403**
Ettrema Addition (North-SW)	Addn.to Ettrema				485	**485**
Ettrema Addition (West)	Addn.to Ettrema	18,276		5,607	898	**24,781**
Ettrema Addition (South)	Addn.to Ettrema	2		13	417	**432**
Budawang	Addn. to Budawang	1	2,050		0	**2,051**
Buckenbowra	PIW	4,150	10,204	525	318	**15,197**
Deua Addition (West)	Addn. to Deua	9,343	164	979	1,685	**12,171**
Tuross	PIW	18,128	4,932	19	141	**23,220**
Buckyjumba	Addn. to Deua	51	6,149		13	**6,213**
Donalds Ck	Addn. to Deua	11	6,500	1	1	**6,512**
Byadbo Addition	Addn. to Byadbo	2,828		4	23	**2,855**
Pilot Addition (East)	Addn. to Pilot	1,361			0	**1,361**
Pilot Addition (North)	Addn. to Pilot	1,873			0	**1,873**
Indi	PIW	10,697		912	148	**11,757**
Western Fall	PIW	24,333			0	**24,333**
Jagungal Addition (North-east)	Addn. to Jagungal	3,925			2	**3,927**
Jagungal Addition (East)	Addn. to Jagungal	507		0	0	**507**
Jagungal Addition (South-east)	Addn. to Jagungal	1,619			0	**1,619**
Tabletop	PIW	12,600			0	**12,600**
Goobarragandra Ad'n (West)	Addn. to Goob.	625			0	**625**
Goobarragandra Ad'n (Nth-west)	Addn. to Goob.	1,965	2	1	10	**1,977**
Bramina	Addn. to Goob.	9,400	1,173	1,054	1,335	**12,962**
Emu Flat	Addn. to Goob.		1,566		0	**1,566**
Bimberi Addition	Addn. to Bimberi	1,409		3,535	566	**5,510**
Bogong Peaks Addition	Addn. to Bogong Peaks	1,584			0	**1,584**
Brindabella	PIW	9,932		3,300	1,765	**14,997**
Murruin	PIW	26,253	8	383	1,422	**28,066**
TOTAL		**170,168**	**34,208**	**17,789**	**9,419**	**231,584**

*Areas are from a variety of land tenure data sources and may be subject to error.

Figure 6: Provisionally Identified Wilderness (PIW), NSW Wilderness Act.



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6. CONCLUSION

6.1 RESERVATION STATUS OF JANIS NWI OUTCOMES

To determine the reservation status of JANIS high quality wilderness, the delineated areas of NWI high quality wilderness were intersected with the existing land tenure boundaries. This integration found that approximately 750 400 hectares (87%) of the approximate 860 400 hectares of delineated wilderness are currently within dedicated reserves (Table 11).

Table 1:Extent of NWI in different Land Tenures

NWI Number	.1 Place	National Park or Nature Reserve	State Forest	Timber Reserve	Purchased National Park	Private Land	Vacant Crown Land	Lease-hold Crown Land	Crown Reserve
1	Ettrema (Morton NP)	31000	0	0	0	0	0	0	0
2	Budawang (Morton/Budawang NPs)	85700	1700	0	0	300	0	200	0
3	Brindabella NP	97800	2800	0	0	3600	0	3500	16600
4	Goobarragandra (Kosciuszko NP)	80200	0	0	0	700	0	700	100
5	Bogong Peaks (Kosciuszko NP)	0	0	500	0	600	0	1200	0
6	Bimberi (Bimberi NR)	74000	17800	0	0	4500	0	4000	700
7	Buckenbowra	50700	4500	0	0	800	0	900	100
8	Tantangara (Kosciuszko NP)	34100	0	0	0	300	0	0	100
9	Deua (Deua NP)	9100	0	400	0	2500	0	200	3000
10	Clear Range	80900	3300	0	0	1300	0	700	0
11	Tabletop (Kosciuszko NP)	34300	0	0	0	700	0	500	100
12	Jagungal (Kosciuszko NP)	20200	7900	0	200	1200	0	0	0
13	Wadbilliga (Wadbilliga NP)	80400	0	0	0	1200	0	1500	5200
14	Youngal (Kosciuszko NP)	4500	11500	0	0	900	0	0	600
15	Geehi (Kosciuszko NP)	22500	0	0	0	0	0	0	0
16	Pilot (Kosciuszko NP)	19900	0	0	0	100	0	0	300
17	Byadbo (Kosciuszko NP)	25100	0	0	0	100	0	0	0
Total		750400	49500	900	200	18800	0	13400	26800

NB: figures are indicative only

The delineated wilderness quality layer for the Southern CRA region exists within various tenures but for the most part coincides with existing dedicated reserves.

The protection of wilderness according to the JANIS criteria requires that 'ninety percent, or more if practicable, of the area of high quality wilderness that meet minimum area requirements should be protected in reserves'.

6.2 OUTCOMES FOR REGIONAL FOREST AGREEMENTS

Both the NWI 12+ and NSW *Wilderness Act* Provisionally Identified Wilderness layers were provided to the Southern CRA negotiations.

Seventeen areas of NWI in the Southern CRA Region meet the JANIS criteria for high quality wilderness, with 87% falling within existing reserves.

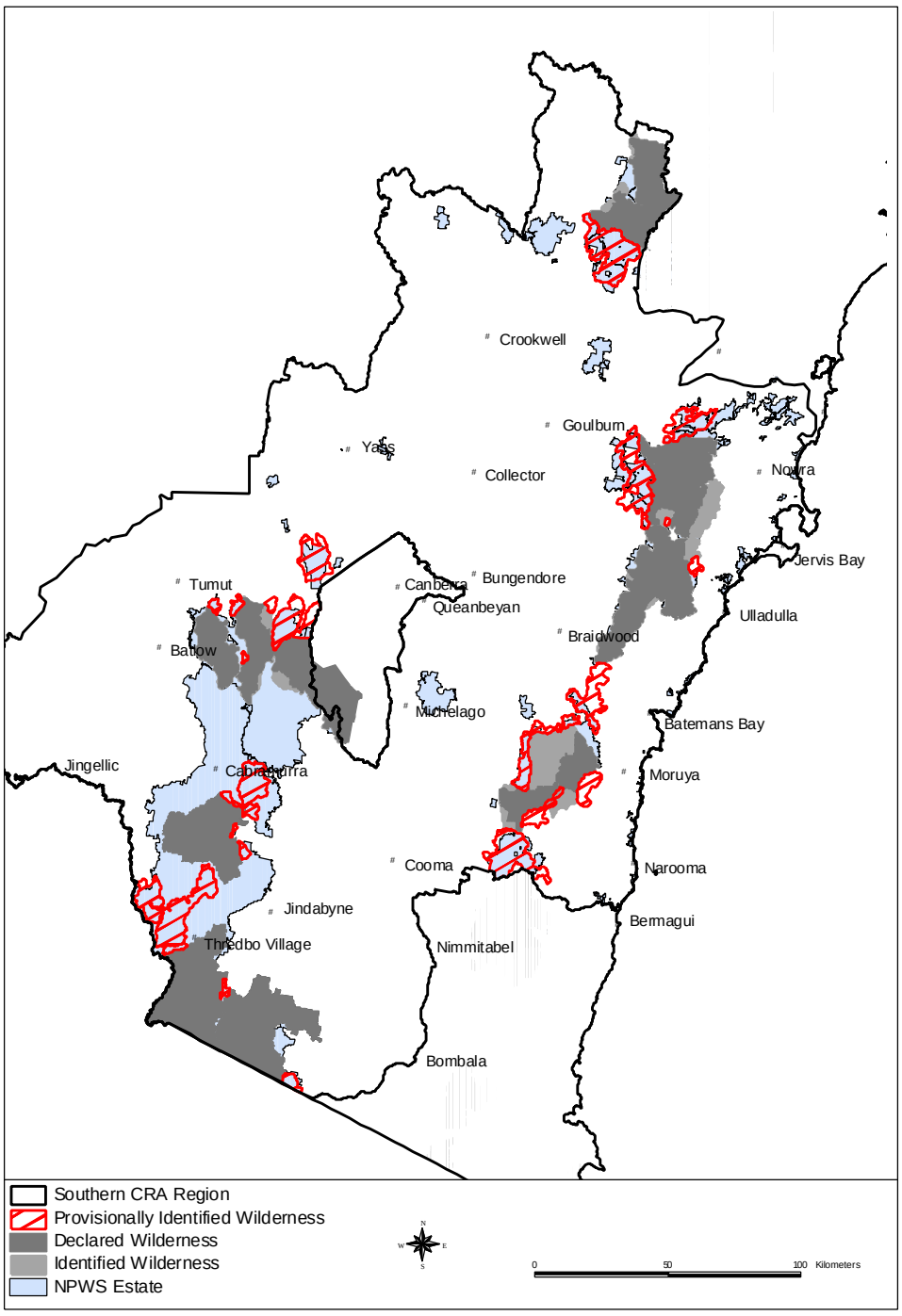
Optimal protection of wilderness values in Southern NSW requires that a minimum of 90% of NWI high quality wilderness be reserved. While the minimum wilderness reservation requirements of JANIS (90%) are likely to be met following RFA outcomes, a practicability assessment (or other validation) would need to be conducted if a reservation level less than 100% is sought.

Optimal protection of wilderness values in the Southern region will require that all areas of NWI high quality wilderness are reserved. Where this is impractical (e.g. private land) other protective mechanisms will be required. Although identified wilderness, under the Wilderness Act, is not formally taken into account in determining reservation targets under JANIS, it should be considered when determining boundaries which maximise the protection of NWI high quality wilderness and in the application of reserve design criteria.

6.3 COMPLETION OF WILDERNESS ASSESSMENT UNDER THE NSW WILDERNESS ACT, 1987

The wilderness assessments conducted in the Southern CRA Region satisfied the requirements of the *Wilderness Act, 1987*. Assessment reports will be placed on public exhibition and submissions will be analysed and documented in a 'Summary and Analysis of Submissions Report'. This report will then be provided to Cabinet to aid their final decisions making in regard to wilderness identification. Figure 7 shows areas of PIW, Identified and Declared Wilderness within Southern CRA Region.

Figure 7: PIW, Identified and Declared Wilderness – Southern CRA Region



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8. APPENDICIES

8.1 APPENDIX 1 - EXPERT CREDENTIALS FOR DECISION RULE DERIVATION

8.1.1

The six members of the Expert Panel have supplied the following information, summarising their qualifications, experience and expertise in ecological fields relevant to wilderness assessment.

Bob Bridges, SFNSW
Position: Planning Manager

Bob Bridges currently holds the position of Planning Manager with State Forests of NSW (SFNSW). His background is mainly in forestry research and management. Bob spent 17 years as Research Forester based at State Forests South Coast Research Centre. In this position he was responsible for research into silviculture of forest types and effects of logging and fire on forestry issues. He spent three years as a research officer based at SFNSW Research Division and was responsible for research into fire effects in forests. Bob currently has seven years experience as a Planning Manager with State Forests of NSW in both Southern and South Coast Regions.
SFNSW
PO Box 42
Batemans Bay NSW 2536

Michael Doherty,CSIRO Wildlife and Ecology
Position: Experimental Scientist (botany/plant ecology).

Michael Doherty holds an Honours Degree in Science from the University of Sydney, majoring in plant ecology. His expertise is in plant identification, vegetation surveys, conservation assessment of plant species and communities including rare plant surveys. Michael is also skilled in the analysis and manipulation of ecological data from vegetation surveys using a variety of exploratory data analysis and statistical packages. In addition, Michael has extensive field experience in the temperate coastal, escarpment and tableland forests and associated communities of New South Wales and East Gippsland as well as a detailed knowledge of the distribution, ecology and taxonomy of the plant species of south-eastern Australia. Michael also has a good working knowledge of the vegetation of southeastern Australia generally, including southern Queensland, Victoria and Tasmania. Prior to his work at CSIRO, Michael has worked for the New South Wales National Parks and Wildlife Service and the National Herbarium of New South Wales. He has been involved in a variety of projects in southern NSW, mapping vegetation and assessing the impacts of logging and fire on forest communities. Additionally, as a keen bushwalker, Michael has first hand experience of wilderness, having walked in all of the major wilderness areas in southern NSW.

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'Gungahlin'
GPO Box 284
Canberra ACT 2601

Roger Good, NSW National Parks & Wildlife Service
Position: A/Manager, Natural Heritage Unit, Southern Zone.

Roger Good has a professional life that currently spans 36 years. Although three years were spent working in Head Office NSW National Parks and Wildlife Service, Roger spent the other 33 years of his career working in southern NSW, which equipped him with diverse knowledge of the region. Roger worked in Cooma for ten years as a Soil Conservationist and three years as a Botanist/Research Officer. He spent six years as a Research Scientist at the CSIRO, and worked as a Senior Project Officer in Southern Zone NSW NPWS – the unit in which he is now Acting Manager. Roger has a special interest in fire research and management and during 1978-79 he developed a computer-based fire management model, the first of its kind. He has undertaken many soil, vegetation and erosion surveys in the Southeast and Southwest of the State. Roger has undertaken and supervised a number of wilderness assessments and as part of this, was involved in the development of the 'Brogo Assessment' approach. Roger is currently a member of the Riverina Highlands Vegetation Management Committee and the Murrumbidgee River Management Committee.
Southern Zone
NSW National Parks & Wildlife Service
PO Box 2115
Queanbeyan NSW 2620

Roger Lembit: Environmental Consultant

Roger Lembit is an environmental consultant with particular expertise in flora surveys and threatened species assessment. Roger is a member of the Ecological Society of Australia and has had a long history of involvement in wilderness conservation and assessment. His experience with wilderness includes work for the Australian Conservation Foundation, Australian Heritage Commission and The Wilderness Society in assessment of wilderness in various parts of Australia.
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Janet Leversha, University of Ballarat
Position: : Assistant Manager - Projects, Centre for Environmental Management.

Janet Leversha is Assistant Manager of the Centre for Environmental Management at the University of Ballarat, where she is responsible for project management. She has a first class honours degree in environmental management at the University of Ballarat and is an experienced botanist with skills in vegetation classification and remnant vegetation assessment. Her expertise also lies in natural resources and protected area management. During her current position, Janet has played key roles in several projects throughout Victoria. These include a detailed vegetation survey and development of management prescriptions for main roads in the Mitchell Shire in Victoria, assessment of koala habitat for Parks Victoria and the development of threatened flora and fauna guidelines and zoning for the Mid-Gippsland Forest Management Plan. Prior to this position, Janet worked for the Department of Conservation and Natural Resources in Victoria as a Forest Management Planner. Her special skills include project management, scientific report writing, ecological assessment and environmental assessment. Janet is the Coordinator of Friends of Werribee Gorge and Long Forest Mallee Inc. and is a member of the Indigenous Flora and Fauna Association.

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Martin Westbrooke, University of Ballarat

Position: Director, Centre for Environmental Management.

Associate Professor Martin Westbrooke has a significant research profile in the field of plant ecology, with particular reference to arid zone plant ecology and the ecology of disturbed communities. His tertiary qualifications include B.Sc. (Botany) London, Litt.B. (Ecology) UNE and M.Sc. (Ecology) LaTrobe. Martin has conducted a number of research projects in arid areas of Australia including Mallee Cliffs National Park, Mungo National Park and many pastoral leases (Morcom and Westbrooke 1990, Westbrooke 1991, Westbrooke and Miller 1995, Westbrooke *et al* 1998). In addition to 20 years tertiary teaching and research experience, Martin has field experience in flora and fauna surveys and the study of remnant vegetation. He has linked his vegetation research with its significance to faunal habitat (Hadden and Westbrooke 1996). His involvement and research in these areas has led to his involvement in a number of significant committees in order to provide an ecological perspective. These include the Kangaroo Technical Advisory Committee, the Lower Darling District NPWS Advisory Committee, the Grasslands Research Advisory Group, the Willandra Lakes World Heritage Area Technical and Scientific Advisory Committee and the Victorian National Parks Advisory Committee. In 1994 he was awarded an ARC Joint Industry Research Grant to investigate the application of Geographic Information Systems (GIS) to strategic weed management. Martin has also written many commissioned reports relating to management of the natural environment.

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8.2 APPENDIX 2 - INSTRUCTIONS AND BACKGROUND INFORMATION PROVIDED TO EXPERT ECOLOGISTS

Dear

Thank you very much for participating in the wilderness assessment project for the NSW Southern Region Comprehensive Regional Assessment.

Land which is identified as wilderness must be large and generally not modified by modern humans and their works, or able to be restored to such a state. You are being asked, as an expert ecologist, to apply your understanding of ecosystems' responses to to disturbance by commenting on the use of available data to determine the 'naturalness' of forested areas in southern NSW and the restorability of any past disturbances. This will aid the NPWS in deciding which parts of the study area support wilderness values.

The attached document outlines the way in which expert ecological knowledge will be used to interpret the naturalness criterion of the *Wilderness Act 1987*, and proformas are provided to structure your input across various disturbance types, parts of the study area and site qualities. Assessment of 'naturalness' and 'restorability' is clearly a complex issue and you are welcome to provide additional advice not catered for by the attached proformas. We will endeavour to incorporate your views into the assessment process, although constraints of available time and data will apply.

Due to the tight timeframe for this project, responses should be faxed or posted to reach me by Tuesday, August 10 1999.

Thank you once again for your assistance.

Derivation of Draft Decision Rules For Southern CRA Wilderness Assessment

Background

Wilderness is legislated and managed in NSW according to the *Wilderness Act 1987*. The current Comprehensive Regional Assessment for southern NSW incorporates wilderness assessment as an integral part of land use planning for the forested public land of this region. A total of 17 areas are being assessed as either new wilderness areas or additions to existing wilderness

.

The NSW National Parks and Wildlife Service (NPWS) is responsible for wilderness assessment in NSW. Assessment is a two-stage process: capability assessment determines those areas that are capable of meeting the criteria set down in the Act, and hence which can be 'identified' as wilderness. This is followed by suitability assessment which overlays the identified wilderness with socio-economic and management factors to determine what part, if any, of the identified wilderness should be 'declared' as wilderness.

The rest of this document concerns only the capability stage of the assessment process.

Wilderness capability criteria

The Act provides only a broad indication of the degree of disturbance acceptable within identified wilderness (see Box 1). The modifications or disturbances that are evident in an area may be considered in terms of their effects on the key components of the ecosystems that determine an area's naturalness - these are ecosystem functioning (such as nutrient cycling), structure (the spatial arrangement or distribution of species), composition (such as species diversity, abundance, age-class range), and successional patterns (changes over time). Changes in ecosystem structure and composition, especially of vegetation communities, are the most easily measured of these components, although they are not necessarily the most important.

In order to operationalise the criteria of the Act, it is necessary to establish 'disturbance thresholds' which can be applied to relevant datasets as part of the assessment process. This can be achieved by asking experts to assign 'naturalness categories' to various disturbance types known from the study area. For this project we have selected the naturalness categories described by Laut *et al*. (1977). An excerpt from this paper, defining each disturbance category, is provided at Attachment 1. Figure 1 shows the relationship between the Act and the naturalness categories of Laut *et al*.

Both the Act and the system of Laut *et al*. are qualitative and require a degree of subjective assessment. The Laut *et al*. system incorporates the potential for an area to recover from previous disturbance, a consideration which is relevant to the present assessment, since wilderness is identified and declared in perpetuity.

Methodology

Several disturbance datasets will be used by this project. We propose to apply decision rules to each dataset in order to assign Laut *et al*. disturbance categories across the landscape. It is important to note that the decision rules will be used only for the capability assessment. The NPWS will refine the resultant map of disturbance categories to produce a rational boundary for identification, before undertaking the suitability phase of the assessment. Capability rationalisation will address issues such as size and configuration of disturbance. For example, some Substantially Modified areas may be reclassified as Modified but Restorable, based on local knowledge. Further small areas of Substantially Modified may be identified as wilderness if the areas is required for management purposes.

Box 1: *Wilderness Act* 1987

Section 6 (1) of the Act provides the criteria to be used in identifying wilderness in NSW:

'An area of land shall not be identified as wilderness by the Director-General unless the Director-General is of the opinion that:

(a) the area is, together with its plant and animal communities, in a state that has not been substantially modified by humans and their works or is capable of being restored to such a state;

(b) the area is of a sufficient size to make its maintenance in such a state feasible; and

(c) the area is capable of providing opportunities for solitude and appropriate self-reliant recreation'.

Section 6(2) of the Act enlarges and elaborates these requirements as follows:

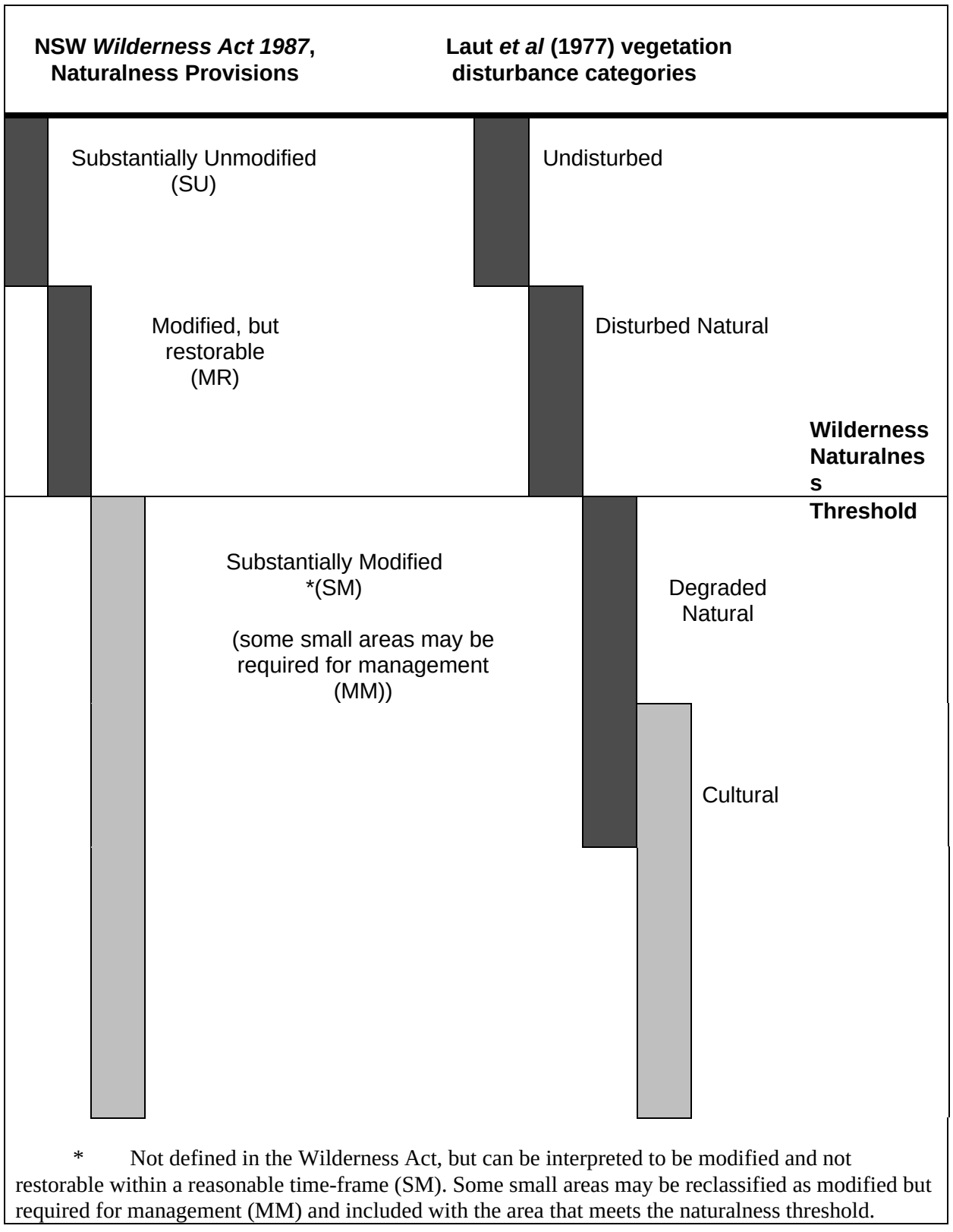
'In forming an opinion under subsection (1), the Director-General may consider any relevant circumstance, including:

(a) the period of time within which the area of land could reasonably be restored to a substantially unmodified state;

(b) whether, despite development which would otherwise render it unsuitable, the area of land is needed for the management of an existing or proposed wilderness area; and

(c) any written representations received by the Director-General from any person (including a statutory authority) as to whether the area of land should be identified as wilderness'.

Figure 1: Relationship between *Wilderness Act* and Laut *et al.* (1977) categories



* Not defined in the Wilderness Act, but can be interpreted to be modified and not restorable within a reasonable time-frame (SM). Some small areas may be reclassified as modified but required for management (MM) and included with the area that meets the naturalness threshold.

Available data

The CRA process has already generated several GIS data layers which will be useful for wilderness capability assessment. In addition to these extensive data layers, the wilderness project has undertaken ground-based and aerial surveys, targeting areas likely to show evidence of past disturbance. Table 1 outlines available datasets. Attachment 2 provides more detailed information on the fields within each dataset.

Table 1: Disturbance datasets available to the Southern CRA wilderness assessment

Dataset	Format	* Description
Fire history	GIS	* NPWS and SFNSW tenures only. Includes date and measure of intensity.
Logging history	GIS	* SFNSW tenure only. Includes m^3/ha of quota sawlog and pulp removed, date and type of operation.
Grazing	GIS	All tenures. From recent ground-based field inspections.
Weeds	GIS	Info. recorded during recent ground-based and aerial surveys. Local knowledge.
Growth stage	GIS	All tenures. From API.
Floristic information	GIS	'Forest ecosystem' level. All tenures. From API. Does not include exotics, but includes early succession natives.
All of the above	GIS / marked on topographic maps	Information provided by NPWS staff, landholders and via recent field inspections.

see Attachment 3 for further details of these datasets

Derivation of decision rules - expert opinion

The attached proformas seek to establish disturbance threshold values for lands of various site quality across the CRA Region. Responses will be combined to provide 'most likely' threshold values. The threshold values will then be applied to the data layers to allocate a naturalness category to each parcel of land.

Guidelines for completing the proformas

- There is a separate proforma for each major disturbance type: weeds, fire, logging and grazing. Please provide information on as many types as you can.
- Indicate (top right corner) which part(s) of the CRA Region and which Site Quality(s) the proforma applies to. Please photocopy more proformas if necessary.
- Use the paper by Laut *et al*. in conjunction with Figure 1 to form your ideas of how you will assign disturbances to the naturalness provisions of the Act.
- Each proforma shows options for two or more disturbance fields relevant to the subject disturbance type. Work across each row, noting only the shaded options. At the end of the row, allocate a score out of 10 to each of the three naturalness categories. For example, on the Weeds proforma you might consider that an Exotic plant which is Non-invasive falls 7/10 into the Modified but Restorable category and

3/10 into the Substantially Modified category. It is vital that you consider only ecological factors when making your decision - socio-economic issues are not used at this stage of the assessment.

- Note that the proformas do not allow consideration of the extent of the disturbance, or the proportion of the assessment area which it covers. This is not a serious shortcoming, as issues of the feasibility of restoration and manageability will be addressed in the suitability stage of the assessment.
- When you have finished, please fill in the Checksheet, and post the Checksheet plus your completed proformas in the pre-paid envelope. Responses are required by Thursday 12th August. Faxed copies are acceptable.
- Please contact me if you need further information, or would like to know more about the process.

Thankyou very much for taking part!

ATTACHMENT 1: EXCERPT FROM LAUT ET AL. 1977

Undisturbed natural: vegetation by and large in its natural state; if it has been disturbed, eg. due to cutting or grazing, this has taken place sufficiently long ago for substantial recovery to have occurred;

Disturbed natural: vegetation used, eg. for selective timber harvesting or light grazing, but original composition and structure basically intact, and vegetation likely to recover within a relatively short period should disturbance cease;

Degraded natural: vegetation has been intensively used, its basic structure has changed and recovery is likely to be a long process if possible at all; no direct or deliberate attempt by management to replace native species with introduced species or to effect change through fertilizers;

Cultural: natural vegetation largely or completely replaced by vegetation introduced by management to increase productivity above that of the original vegetation; often associated with additional inputs such as nutrients, water, cultivation and weedicides.

Laut, P., Heyligers, P.C., Keig, G., Laffler, E., Margules, C., Scott, R.M. and Sullivan, M.E. 1977, *Environments of South Australia*, CSIRO Division of Land Use Research, Canberra.

ATTACHMENT 2 : FIELDS CONTAINED WITHIN AVAILABLE DATASETS

SFNSW logging history

Attribute Field List
Code, Year, Cpt No,Cpt2, Sf No, MA, Start Year, End Year, Event, Type, Product, Quota vol, Other vol, Total vol, Species/Veg, Map, Scale, Source Type, Map Source, Source Location, Reliability, Comments.

Attribute Field Description
Code=Unique Identifier links to GIS layer
Year=Year the event ended
Cpt No=Current compartment number
Cpt2=Other Compartment Number
Sf No= State Forest number
MA=Management Area
Start Year=Date the event started
End Year=Date the event finished
Event=Nature of event - Logging or silviculture
Type=type of event
- HARV=harvest operation
- CLEAR=harvest operation then cleared and planted
- HARVF=Post fire harvest
- HARVU=harvest operation confirmed with unspecified volume
- TSI=formally treated
- PLT=area planted
- TREAT=treatment

Products=Products taken
- Q=quota
- SAL=salvage
- PSM=post poles girders, sleepers and mining
- UPM=smalls, pulp, masonite and mis
- V=veneer
- U=unspecified
- Nil=no product
- INT=integrated operation
- ALL=all products
- BWD=brushwood

Quota vol=quota volume harvested (gross in cubic metres)
Other vol=volume of products other than quota harvested in an operation (in cubic metres)
Total vol, total volume of all products taken (cubic metres)
Species/Veg=species/vegetation types
Map=whether the event mapped delimits a net area (y=yes;n=no) where 'n' the event is mapped to the whole compartment
Scale=the scale of the source map, eg 25000=1:25000; imperial scales are converted to metric
Source type=the source of the data eg volumes etc which may come from hard copy reports in compartment histories or from existing databases such as FAMIS, Forsale etc.
Map source=the source of the mapped information eg compartment history, summary map, harvesting plan etc
Source location=the location of the source data (which office, shed or store room the original is located in)
Reliability=the reliability of the combined data as per reliability index (1=good;5=bad),
Comments=additional comments which may help understand the history of the evnet.

SFNSW fire history

Attribute Field List

Code, Sf No, Cpt No, Region, MA, Fire No, Fire Type, Start Date, End Date, Category, FDR, Severity, Total area, Area SF, Area NP, Area Other, Forest Type, Other Tenures, Mapped, Source Map Type, Source Map Scale, Comments, Source Location.

Attribute Field Description

Code=Unique Identifier links to GIS layer
Sf No= State Forest number
Cpt No=Current compartment number
Region=CRA Region
MA=Management Area
Fire No= District Fire Number(as per report)
Fire Type=Type of Fire
- w=wildfire
- h/p=hazard reduction or prescribed burn

Start Date=Date the event started
End Date=Date the event ended
Category=The category of Fire (as per report)
FDR=Fire Danger Rating
Severity=Fire Severity
- Light
- Moderate
- Severe

Total Area=Total Area Burnt in hectares
Area SF=Total Area of State Forest Burnt in hectares
Area NP=Total Area of National Park burnt in hectares
Area Other= Total Area of Other Tenure Burnt in hectares
Forest Type=Forest Type
Other Tenures=Any other tenure affected by the fire
Mapped=Whether the event has been mapped
Source Map Type=Type of map from which the event was sourced (ie NPWS Fire Atlas or Compartment Histories)
Source Map Scale=The scale of the source map
Comments=Additional comments
Source Location=The location of the source data.

8.3 APPENDIX 3 - EXPERT PANEL DERIVED DECISION RULES

Expert panel derived decision rules

(i) Grazing, all sub-regions, all site qualities

Years since last event	Structural intensity	Floristic intensity	Final classn.
< 2		Understorey intact	MR
		Some native understorey	MR
		No native understorey	SM
> 2		Understorey intact	SU

(ii) Weeds, all sub-regions, all site qualities

Origin of plants	Colonisation	Final classn.
Native, local	N/a	SU
Native, non-local	Non-invasive	MR
Native, non-local	Invasive	SM
Exotic	Non-invasive	MR
Exotic	Invasive	SM

(iii) Logging, all sub-regions, low site quality

No. logging events in last 25 years	Total volume removed (quota + pulp) (m^3/ha)	Post logging treatment	Final classn.
1			MR
2 - 3	< 51		MR
2 - 3	51 - 70	Yes	MR
2 - 3	51 - 70	No	SM
2 - 3	> 70		SM
4 - 6	< 31		MR
4 - 6	> 30		SM
> 6			SM

(iv) Logging, all sub-regions, medium and high site quality

No. logging events in last 25 years	Total volume removed (quota + pulp) (m^3/ha)	Post logging treatment	Final classn.

1	< 51	Yes	SU
1	< 51	No	MR
1	> 50		MR
2 - 3	< 51		MR
2 - 3	> 50	Yes	MR
2 - 3	> 50	No	SM
4 - 6	< 11		MR
4 - 6	> 10		SM
> 6			SM

(v) Fire, all site qualities

Alpine / subalpine	**No. of fires in last 25 years**	**Min. no. years between fires**	**Most severe fire**	**Vegetation type**	**Final classn.**
	1				SU
	2	< 10		Heath	SM
	2	< 10		DOF	MR
	2	< 10		WOF	MR
	2	< 5		RF	SU
No	2	< 5		Grassland	SU
Yes	2	< 5		Grassland	MR
	2	> 4 and < 10		Heath	SM
	2	> 4 and < 10		WOF	MR
	2	> 4 and < 10		DOF	MR
	2	> 4 and < 10		RF	SU
Yes	2	> 4 and < 10		Grassland	SU
No	2	> 4 and < 10		Grassland	MR
	2	> 9		WOF	SU
	2	> 9		DOF	SU
	2	> 9		Heath	SU
Yes	2	> 9		Grassland	SU
No	2	> 9		Grassland	MR
	2	> 9		RF	SU
	3			Grassland	SU

NB rules for 3 fires not in grassland, and 3+ fires in any veg type, were derived in consultation with Michael Doherty (CSIRO) in response to actual occurrences in the data.

NPWS-derived decision rules

Decision rules for some less ecologically complex datasets were derived by NPWS. The rules were based on those used in previous wilderness assessments and are shown below.

(i) Clearing

Map as SU unless:	
API code = '> 30% regrowth'	MR
Clearing < 40 ha incl. > 25% API regrowth	MR
Clearing (non-regenerating) < 30% mapped as regrowth	SM

(ii) Dams

Excavated	MR
Rock or earth wall	MR
Concrete	SM

(iii) Linear infrastructure

Power lines with wooden poles, no cables	MR
Power lines with metal pylons	SM
Treat power easements as linear clearings:	
Vegetated and < 2 m wide	SU
Vegetated and > 2 m wide	MR
Bare earth	SM
Aqueducts	N/a – excluded from WASAs
All water races	MR
Functional fences	MR
Dysfunctional fences	SU

(v) Mining

< 30% surface area disturbed	MR
> 30% surface area disturbed	SM

(vi) Roads

A: SFNSW estate

This dataset uses two classification systems, one for roads in Bateman's Bay and Nowra Management Areas and another for Narooma, Queanbeyan, Badja and Moss Vale Management Areas. The classifications have nine and seven classes, respectively, and rank roads and tracks in order of decreasing width / permanence. Thus class 1 roads are sealed and two or more lanes wide, whilst temporary foot or vehicle tracks with a natural surface are at the other end of the scale.

So that a single rule set could be applied to all road data, SFNSW assigned the two SFNSW classifications to corresponding LIC road classes (Appendix 7).

Area 1: Bateman's Bay and Nowra Management Areas

Area 2: Narooma, Queanbeyan, Badja and Moss Vale Management Areas

1. Classify according to tables below.

Class in SF Roads theme (B. Bay area ONLY)	Laut classification
1 - 5	SM
6 - 9	MR

Class in SF Roads theme (Narooma area ONLY)	Laut classification
1 - 4	SM
5 - 6	MR
7	SU

1. Reclassify SU to MR where > 10% of 100 ha is covered by SU roads
2. Use field data to update the SF Roads theme where available.

PART B: Non-SF roads

Dirt tracks/little used (separate wheel ruts)	SU
Dirt track, 2 – 4m wide moderate use	MR
Sealed or dirt > 4m with substantial infrastructure	SM

(vii) Non-vehicular tracks

Vegetated < 30 cm wide	SU
Vegetated > 30 cm wide	MR
Bare earth	MR
Any steps, drainage etc.	MR
Intermittently used dwellings	MR
Permanent dwellings	SM

The expert and NPWS-derived decision rules were applied to GIS datasets via ‘queries’ in Spatial Analyst. Where two or more disturbance types overlapped, the more severe disturbance classification prevailed. The resulting disturbance layer mapped the WASAs into four classes: SU, MR, SM and ‘no data’. The disturbance map was printed on clear film and overlaid on topographic maps annotated with non-digital disturbance information.

8.4 APPENDIX 4 - METADATA STATEMENTS - NWI

8.4.1

METADATA CATEGORY	CORE METADATA ELEMENT	DESCRIPTION
DATASET	**Title**	NSW Southern Region Comprehensive Regional Assessment (CRA) Region - National Wilderness Inventory (NWI) Delineated Boundary
	Custodian	Environment Australia
	Jurisdiction	Australia
	CRA Project Name	Wilderness Assessment – Southern
	CRA Project Number	
CONTACT ADDRESS	**Contact organisation**	NSW Environment Forest Taskforce
	Contact position	NWI Co-ordinator
	Mail Address 1	GPO Box 787
	Mail Address 2	
	Suburb/Place/Locality	Canberra
	State/Locality 2	ACT
	Country	Australia
	Postcode	2601
	Telephone	(02) 6250 0236
	Facsimile	(02) 6250 0350
	Electronic mail address	rod.noworjee@ea.gov.au
DESCRIPTION	**Abstract**	The delineated boundary of the National Wilderness Inventory (NWI) database for NSW Southern, defines the boundary of high quality wilderness according to the definition in the JANIS criteria. (See Notes below). This is where wilderness quality >12 and area is > 8,000 ha, or 5,000ha on the coast.
	Search Word	Land Cover, Heritage, Wilderness, Forest, Disturbance, Human Environment, Land Use Survey, GIS.
	Geographic Extent Name(s)	NSW Southern RFA Region
	Geographic Extent Polygon(s)	
	Type of feature	Polygon
	Attribute/Field List	Nwi_delin-id
	Attribute/Field Description	Nwi_delin-id: identifies the NWI polygons
	Scale/Resolution	1:100, 000
DATASET CURRENCY	**Beginning date**	August 1999
	Ending date	November 1999
DATASET STATUS	**Progress**	complete
	Maintenance and update frequency	As required
DATASET ENVIRONMENT	**Software**	Arc/Info

	Computer Operating System	UNIX
	Dataset Size	1 Mb
ACCESS	**Stored Data Format**	Digital polygons (Arc/info)
	Available format types	ArcView shapefile
	Access constraints	Publicly available with written permission of the custodian. Acknowledgment and Data Agreements are required.
DATA QUALITY	**Lineage**	The Southern CRA region delineated wilderness is the result of the NWI algorithm plus stakeholder and expert input to define final boundaries. Input data includes - Management history (State Forest 1999) - API , floristic and structural - Roading data (State Forest and LIC) - Settlement data (AUSLIG) The National Wilderness Inventory was run using the above datasets and decision rules set for the Upper North East CRA region. NWI Wilderness Quality 12 and above of 8,000 ha and above was reviewed and submitted to stakeholders for comment. Local knowledge of terrain from NSW NPWS, SF and EHTC stakeholders was incorporated as part of the comment phase. Polygons were delineated by overlaying Topo 1:100,000 map sheets ad NPWS tenure to derive "rational boundaries". Final delineation was performed by experts within the Wilderness and Wild Rivers Branch of the Australian Heritage Commission. Data for the NWI was the best available at September 1999 though some datasets may have been sourced prior to this date. Refer to the Southern CRA Report 1999 for further information.
	Positional accuracy	1:100,000
	Attribute accuracy	Attribute accuracy is unknown. No ground truthing or further tests were completed by EA. However, attributes from the NWI database, from which this layer has been derived are classified according to feature codes as described in the National Wilderness Inventory Handbook, Second Edition, 1995. Verification of feature codes was done at summary level (ie grades of impact) using expert knowledge and results of interim analysis.
	Logical consistency	Topological checks undertaken in Arc/Info, all source data checked prior to analysis, some allowance given to dangles in line data, otherwise consistency ensured. NWI database point data consistency ensured through Arc/Info.

	Completeness	Complete for the Southern CRA region.
NOTES	**Notes**	Refer to National Wilderness Inventory Handbook of Procedures, Content and Usage, Second Edition, Australian Government Publishing Service, Canberra, May 1995. Refer to "Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia" - A report by the Joint ANZECC/MCFFA National Forest Policy Statement Implementation Sub-committee. Commonwealth of Australia, 1997. Additional metadata: National Wilderness Inventory (NWI) Database Southern Comprehensive Regional Assessment (CRA) Region. Dataset name: nwidelin
METADATA DATE	**Metadata date**	25 November 1999
METADATA COMPLETED BY	**Metadata sheet compiled by**	Rodney Nowrojee – Environment Forest Taskforce Environment Australia
FURTHER INFORMATION	**Further information**	