Wilderness assessment project - UNE and LNE

A project undertaken as part of the NSW Comprehensive Regional Assessments

December 1998

WILDERNESS ASSESSMENT PROJECT - UNE AND LNE

NEW SOUTH WALES NATIONAL PARKS AND WILDLIFE SERVICE

A project undertaken as part of the
NSW Comprehensive Regional Assessments
Project number NA 33/EH

December 1998

For more information and for information on access to data contact the:

Resource and Conservation Division, Department of Urban Affairs and Planning

GPO Box 3927
SYDNEY NSW 2001

Phone: (02) 9228 3166
Fax: (02) 9228 4967

Forests Taskforce, Department of the Prime Minister and Cabinet

3-5 National Circuit
BARTON ACT 2600

Phone**:** 1800 650 983
Fax: (02) 6271 5511

ISBN 1 74029 0372

This project has been jointly funded by the New South Wales and Commonwealth Governments and managed through the Resource and Conservation Division, Department of Urban Affairs and Planning, and the Forests Taskforce, Department of the Prime Minister and Cabinet.

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 addresses the Conservation Requirements for wilderness under the JANIS criteria. It is not the report of the NSW National Parks and Wildlife Service under the NSW Wilderness Act (1987).

CONTENTS

EXECUTIVE SUMMARY xi

1. BACKGROUND 1
1.1 NATIONAL FOREST POLICY STATEMENT 1
1.2 NATIONALLY AGREED (JANIS) CRITERIA FOR A FOREST RESERVE SYSTEM 1
1.3 INTERIM ASSESSMENT PROCESS 2
1.4 RFA SCOPING AGREEMENT 3
1.5 NSW PROVSIONALLY IDENTIFIED WILDERNESS 4

2. METHODS 5
2.1 INTRODUCTION 5
2.2 NATIONAL WILDERNESS INVENTORY 5
2.3 NSW WILDERNESS ACT (1987) 14
2.4 PREVIOUS ASSESSMENTS UNDER THE NSW WILDERNESS ACT (1987) 18
2.5 ASSESSMENT OF WILDERNESS VALUES IN UNE AND LNE (EXCL. YENGO) 25
2.6 ASSESSMENT OF WILDERNESS VALUES - YENGO 34

3. RESULTS 38
3.1 UPPER NORTH EAST REGION 38
3.2 LOWER NORTH EAST REGION 44

4. CONCLUSION 51
4.1 JANIS WILDERNESS TARGET 51
4.2 NSW WILDERNESS ACT ASSESSMENT 56

REFERENCES 57

FIGURES

FIGURE 1: CLASSIFICATION OF DISTANCE BASED INDICATOR VALUES 10
FIGURE 2: DERIVATION OF NWI WILDERNESS QUALITY 12
FIGURE 3: EXISTING IDENTIFIED AND DECLARED WILDERNESS - UNE 20
FIGURE 4: EXISTING IDENTIFIED AND DECLARED WILDERNESS - LNE 22
FIGURE 5: DELINEATED WILDERNESS (NWI) - UNE 39
FIGURE 6: PROVISIONALLY IDENTIFIED WILDERNESS - UNE 41
FIGURE 7: DELINEATED WILDERNESS (NWI SURROGATE) - LNE 46
FIGURE 8: PROVISIONALLY IDENTIFIED WILDERNESS (PIW) - LNE 48
FIGURE 9: DELINEATED WILDERNESS (NWI) RESERVATION STATUS - UNE 52
FIGURE 10: DELINEATED WILDERNESS (NWI SURROGATE) RESERVATION STATUS- LNE 54
FIGURE 11: PIW, IDENTIFIED AND DECLARED WILDERNESS - UNE 587
FIGURE 12: PIW, IDENTIFIED AND DECLARED WILDERNESS - LNE 59

TABLES

TABLE 1: PRIMARY DATA LAYERS USED BY THE NWI 7
TABLE 2: PROPOSED PRIMARY DATA SOURCES FOR UPDATING NWI IN LNE AND UNE 7
TABLE 3: BIOPHYSICAL NATURALNESS RATING SCHEME 11
TABLE 4: BIOPHYSICAL NATURALNESS DECISION RULES FOR UNE AND LNE 11
TABLE 5: IDENTIFIED WILDERNESS - DECEMBER 1998 19
TABLE 6: DECLARED WILDERNESS IN UNE AND LNE 24
TABLE 7: OBSERVABLE AND MEASURABLE ATTRIBUTES OF WILDERNESS AREAS 28
TABLE 8: DATASETS USED IN NSW NPWS INTERNAL REVIEW OF WILDERNESS ASSESSMENT BOUNDARIES 31
TABLE 9: RULES FOR DELINEATION AND REFINEMENT OF WILDERNESS ASSESSMENT AREAS 32
TABLE 10: DATASETS USED IN THE DERIVATION OF WILDERNESS QUALITY CLASSES 33
TABLE 11: FINAL WILDERNESS QUALITY CLASSES 34
TABLE 12 -DISTURBANCE THRESHOLDS FOR YENGO WILDERNESS ASSESSMENT 37
TABLE 13: LAND TENURE OF DELINEATED NWI AREAS IN UNE 38
TABLE 14: LAND TENURE OF PIW AREAS IN UNE (>15 000 HA, OR SMALLER ADDITIONS TO EXISTING AREAS) 44
TABLE 15: AREAL EXTENT AND LAND TENURE FOR NWI SURROGATE WILDERNESS IN LNE 48
TABLE 16: EXTENT OF NWI HIGH QUALITY WILDERNESS IN RESERVES - UNE 51
TABLE 17: EXTENT OF DELINEATED NWI SURROGATE WILDERNESS IN RESERVES - LNE 56

Appendix 1: Key to wilderness quality classes; GIS procedures
Appendix 2: Notes from stakeholder workshop 14 July 1998
Appendix 3: Assessment of naturalness, Yengo National Park / Parr State Recreation Area

ABBREVIATIONS

BOGMP	Broad Old Growth Mapping Project
CAR	comprehensive, adequate, representative
CRA	Comprehensive Regional Assessment
CRAFTI	CRA Air Photo Interpretation
DLWC	Dept. of Land and Water Conservation
EA	Environment Australia
EHTC	Environment and Heritage Technical Committee
GIS	Geographic Information System
Landsat TM	Landsat Thematic Mapping
LNE	Lower North East CRA Region
NEFBS	North East Forests Biodiversity Study
NFPS	National Forest Policy Statement
NSW NPWS	New South Wales National Parks and Wildlife Service
IAP	Interim Assessment Process
JANIS	Joint ANZECC/MCFFA National Forest Policy Statement Implementation Sub-committee
NWI	National Wilderness Inventory
PIW	Provisionally Identified Wilderness
RACAC	Resource and Conservation Assessment Council
RFA	Regional Forest Agreement
UNE	Upper North East CRA Region

EXECUTIVE SUMMARY

1.2.1 Wilderness Assessment

NA 33/EH

This working paper 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.

1.2.2 Objectives

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 assessment and 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 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).

1.2.3 The project requires the assessment of all current community wilderness nominations and all additional areas likely to meet the criteria of the NSW Wilderness Act. Areas meeting the criteria are delineated as Provisionally Identified Wilderness, which are used in the development of a CAR reserve system. Formal wilderness identification under the Wilderness Act takes places following decisions on additional reserve establishment.

1.2.4 Methods

The NWI is a geographic information system that analyses wilderness values across the Australian landscape using a set of indicators to measure the essential attributes of wilderness - remoteness and naturalness. To determine the existing reservation status of JANIS high quality wilderness (i.e. prior to CRA negotiations), the delineated areas of NWI high quality wilderness for the UNE and the NSW NPWS alternative assessment of high quality wilderness for the LNE were intersected with land tenure boundaries

On September 1 1998 the Commonwealth Government temporarily withdrew from the CRA process. Prior to their withdrawal the Commonwealth Government was the lead agency for compiling the NWI, using disturbance information provided by state government agencies. Following the withdrawal, the NSW State government continued with the wilderness assessment process by using available information and a similar methodology to that adopted by the Commonwealth to conduct a surrogate NWI assessment.

Provisionally Identified Wilderness (PIW) was derived by classifying relevant data according to a detailed set of decision rules. Three categories were derived; substantially unmodified, modified and restorable and substantially modified. Those parts of the assessment area classified as substantially modified and some areas on the perimeter of the assessment area classified as modified restorable were then excluded. Resulting standalone areas under 15 000 hectares were rejected.

State Capable Wilderness was derived in a similar manner to PIW areas, however areas were required to be larger than 8 000 hectares, or 5 000 hectares where adjacent to the coast. Areas greater than 15 000 hectares were rejected, as these were already represented by the PIW areas.

1.2.5 Key results and products

Fifty-seven percent (173 851 ha) of the NWI delineated wilderness in the UNE is currently within dedicated reserves (at October 1998, prior to CRA negotiations). For LNE, approximately eighty-one percent (534 093 ha) of the NSW NPWS surrogate NWI is currently similarly reserved.

In the UNE CRA region, two standalone areas and additions to three existing identified wilderness areas were delineated as PIWs. These five areas in total comprise 55 019 ha. Two further standalone areas, an area adjacent to the Queensland border and a forth area straddling the LNE/UNE CRA region boundary, were delineated as State Capable Wilderness. These four areas in total comprise 28 446 ha.

In the LNE CRA region, two standalone areas and additions to three existing identified wilderness areas were delineated as PIWs. These five areas in total comprise 143 853 ha. Two further standalone areas and the area straddling the LNE/UNE CRA region boundary were delineated as State Capable Wilderness. These three areas in total comprise 27 121 ha.

The NSW Wilderness Act assessment is still underway, however the delineation of PIW for the development of reserves is complete. Completion of the assessment by the NSW NPWS in accordance with the Wilderness Act and State Government policies will occur following the CRA. This will include identification of areas that meet the wilderness criteria, public

consultation on the declaration of areas as wilderness, NSW Government consideration of public comments and finally, a decision on wilderness declaration.

2. BACKGROUND

This report details the assessment of potential wilderness areas within the Upper North East (UNE) and Lower North East (LNE) CRA regions during 1998. 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 individual Assessment Reports or Analysis of Submissions Reports that will be produced under the NSW Wilderness Act (1987).

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).

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 that 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 that 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.

[redacted]

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 in 1996 during the IAP for later detailed investigation during CRAs.

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 three 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);

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

3. a map of rational boundary options for wilderness areas.

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 employ '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, are capable of restoration or are 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 nominated (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.

[redacted]

In October 1997, the NSW Government decided that formal identification of wilderness under the NSW Wilderness Act would occur after CRA negotiations and the development of CAR reserve options, but prior to NSW Government decisions at the conclusion of the CRA. Provisionally Identified Wilderness (PIW) would be delineated that includes areas that would meet the NSW Wilderness Act criteria. PIWs would be provided to assist with the development of a CAR reserve system as areas that meet the NSW Wilderness Act criteria. This allows additional disturbance information collected during CRA negotiations to be incorporated into the final area formally identified as wilderness.

As a result, completion of the wilderness assessments conducted in the UNE and LNE regions to satisfy the requirements of the NSW Wilderness Act (1987) would occur following the CRA negotiations and prior to NSW Government decisions on the CRA.

Further NSW Government decisions in September and October 1998 determined that the formal identification of wilderness under the NSW Wilderness Act would be delayed until after NSW Government decisions on the CRA. The results of the NSW assessment and identification would then be displayed for public comment.

This report documents the results of the assessment up to the delineation of PIWs.

3. METHODS

As noted earlier, the NSW RFA Scoping Agreement stipulates that wilderness identification in the CRA process should utilise both the NWI methodology and wilderness areas identified using the provisions of the NSW Wilderness Act (1987). A summary of each approach follows.

The Commonwealth Government withdrew from participation in the CRA process on September 1, 1998 following the calling of the Federal election. At that point the NWI had reached the following stages:

Upper North East region
The NWI had been completed to the stage of key stakeholder review and refinement of the final delineated wilderness areas. The Commonwealth provided no further documentation.

3.2.1 Lower North East region

The NWI had not been completed nor any delineation or documentation made available to stakeholders. The State Government proceeded with the CRA process using the earlier NWI delineation (1995) and a methodology consistent with the NSW Wilderness Act (1987) which best replicated the NWI process.

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).

No documentation was provided for the derivation of the NWI layer for north-east NSW undertaken by Environment Australia (EA), because of the Commonwealth's withdrawal from the CRA process. However, a standard methodology was adopted for all CRA regions, and the outline provided below is based on documentation provided for the Eden region. It assumed that the data inputs, assessment processes and decision rules were similar for north-east NSW.

3.3.1 Indices of wilderness quality

The NWI measures wilderness quality across the landscape by using four wilderness quality 'indicators' that represent the two essential 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 uninfluenced by modern technological society.

NWI INDICATORS OF WILDERNESS QUALITY	
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
Biophysical Naturalness from	the degree to which the natural environment is free 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.

3.3.2 Primary Database

This database contains a wide range of geographical information The primary data required for wilderness analysis comprise detailed infrastructure and land use information as outlined in Table 1. (The storage of these data within the NWI Geographic Information System (GIS) is described in the NWI Handbook [Lesslie and Maslen, 1995].)

TABLE 1: PRIMARY DATA LAYERS USED BY THE 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). Used to calculate the four wilderness quality indices.
Lines	All linear information required for wilderness assessment, including roads and tracks, railways and other linear infrastructure.	Used to calculate Remoteness from Access and Apparent Naturalness.
Points	All point features required for wilderness assessment, including settlements, buildings and other point infrastructure.	Used to calculate Remoteness from Access, Remoteness from Settlement and Apparent Naturalness.

NWI values for UNE and LNE required updating as part of the CRA/RFA process. Proposed primary data sources for updating the NWI in UNE and LNE are shown in Table 2.

TABLE 2: PROPOSED PRIMARY DATA SOURCES FOR UPDATING NWI IN LNE AND UNE

Primary data layer	Data provider	Source	Scale
API growth stage data	NSW NPWS	CRAFTI project	1: 25 000
API floristic data	NSW NPWS	CRAFTI project	1: 25 000
Logging history	SFNSW	CRA Management History project	
Regional logging history - compartment data	SFNSW	SFNSW harvest planning records	
Grazing records	SFNSW	CRA Management History project	
Mining records	SFNSW	CRA Management History project	
LIC roads	CRA process		1:100 000
Other access info. (e.g. SFNSW Operational Roads)	SFNSW	SFNSW maps	1:25 000
Other digitised infrastructure data			
Revised tenure layer including Identified Wilderness boundaries	NSW NPWS, SFNSW		

Note: the above data layers were proposed for use in the NWI upgrade by Environment Australia. Documentation has not been provided as to which layers were actually used.

3.3.3 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).

The analysis process for deriving the three distance-based indicators is outlined below. For a detailed description of this process see Lesslie and Maslen, 1995.

Step 1 - grading of feature impacts
For each indicator, point, line and polygon features are grouped into the appropriate impact grade (for example, Remoteness from Access is graded 1 to 4).

Step 2 - distance calculation
Distance (in metres) is calculated between each sample point and the nearest feature in each grouped coverage generated above.

Step 3 - calculation of minimum weighted distance
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.

Step 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 grazing by stock and timber harvesting. However, where more reliable data are available, information on a range of other disturbances is also included.

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

- timber harvesting
- regional information on grazing
- air photo interpretation
- land tenure
- grazing leases
- vegetation communities
- mining sites.

Table 3 outlines the rating scheme for Biophysical Naturalness used in the NWI. Tables 4 details the rules used to assign BN features to the classes shown in Table 3.

FIGURE 1: CLASSIFICATION OF DISTANCE BASED INDICATOR VALUES

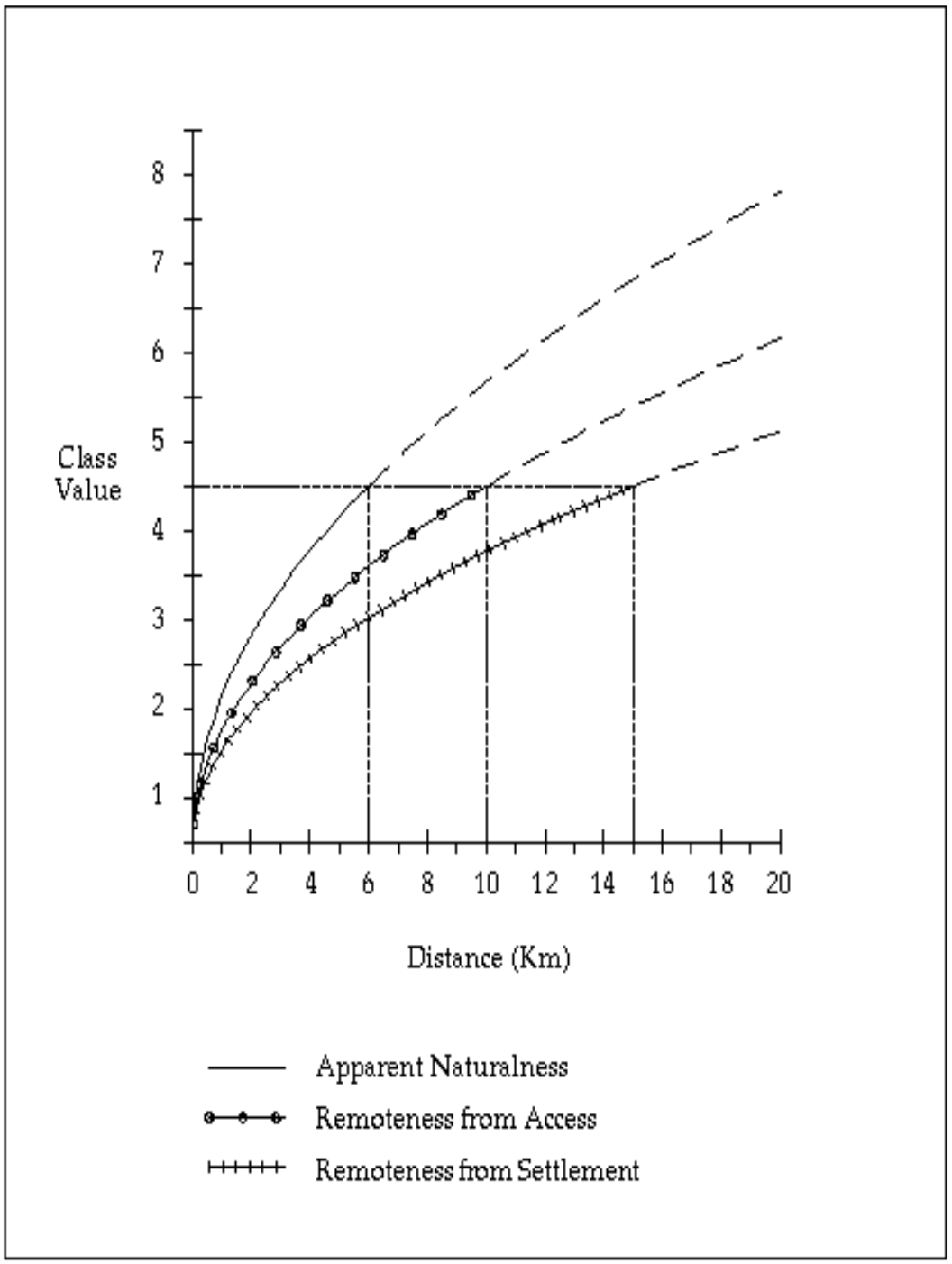


TABLE 3: BIOPHYSICAL NATURALNESS RATING SCHEME

Indicator value	NWI descriptor for baseline NWI
5 high	Unlogged and ungrazed.
4	Unlogged and ungrazed for > 60* yrs, excl. clear-felled or intensively grazed areas.
3	Single selective logging, irregular grazing within preceding 60* years.
2	Light/moderate grazing, repeated selective logging within last 60* years.
1 Low	Clear-fell logging and/or intensive grazing.
0	Agricultural, urban, developed land, pine and other exotic plantations, reservoirs.

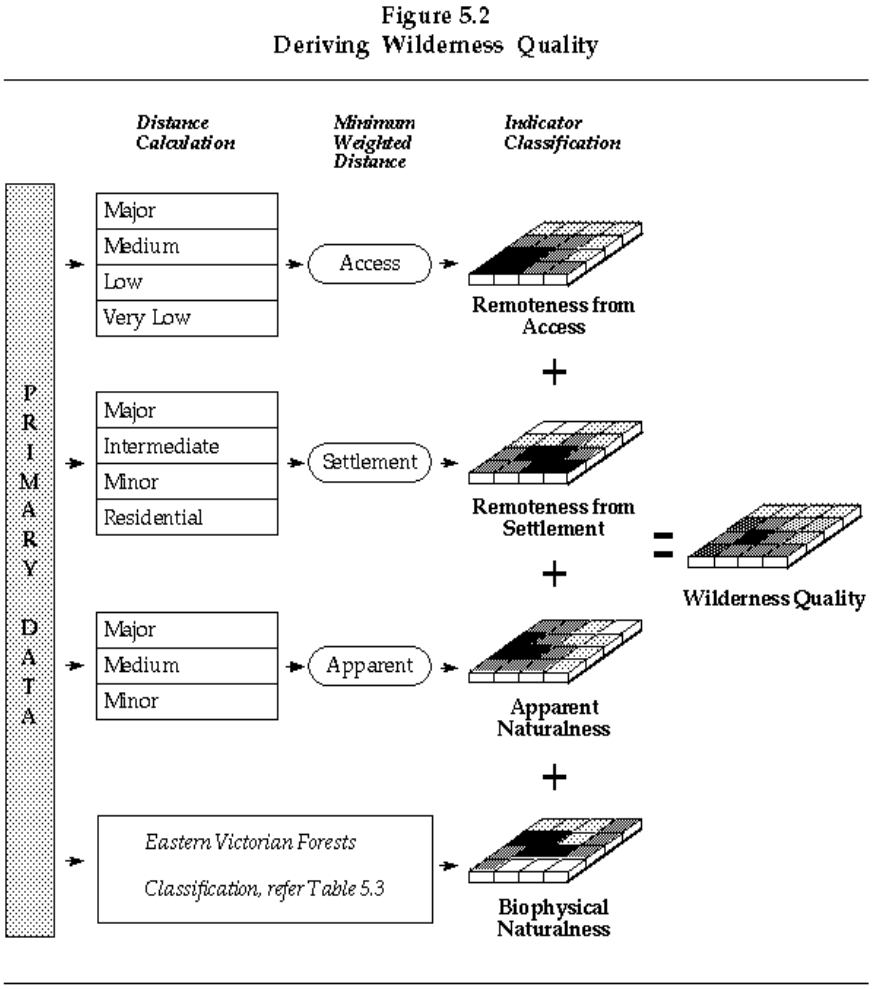
* threshold period may vary between regions.

TABLE 4: BIOPHYSICAL NATURALNESS DECISION RULES FOR UNE AND LNE

Rule	Comments
General	- Assume undisturbed if no record of disturbance is available (incl. unmapped logging) - If there is no disturbance record, assume API polygons with high regrowth content are natural (e.g. wildfire). - Data validation is primarily between Mgt History activities (logging and TSI layers) and API growth structure layer. - Satellite imagery used to rectify any conflicts in information from 1980 - API disturbance indicator (except recent logging) used to validate Mgt History records but not to indicate disturbance by 'modern technological disturbance'. - Mgt History data without API disturbance can only lower BN from 5 to 4. Unmapped data are not assessed without other evidence. - Landsat TM data used to validate disturbance information from 1980; shows severity as well as extent of logging.
Grazing	- API 'pasture grass' is only indicative of grazing where it coincides with a grazing lease or Occupational Permit. - Permits and leases are not indicative of grazing impacts unless there is also evidence of pasture grasses.
Logging / treatment	UNE API growth stage mapping used to assess the intensity of logging events in the Mgt History project - UNE API disturbance indicators used to assess reliability of logging events in the Mgt History project - 1970 cut-off for mechanisation of forestry mgt practices for UNE (as indicated by NSW NPWS) - Mgt History project 'unmapped' logging treated as anecdotal and is unrated unless lack of disturbance is evident from other sources - Mgt History project data coded '1999' treated as for 'unmapped' - API disturbance code for 'recent logging' overrides all other codes - API disturbance code for 'older logging' not used explicitly but appears in growth stages (advice from NSW NPWS Northern Zone)
Plantation	- API 'special features' used for both native and exotic. Official CRA plantation layer not yet finalised
Weeds	- Lantana and other weeds rated equally as disturbance indicator, but not as exotics since land is not necessarily 100% altered - 'weeds' code in Special Features are treated as exotics, as the polygon is 100% affected
Mining	- Gold mining considered a disturbance impact only if other disturbance (e.g. roads) is also linked to the site - Mining in coastal areas could be sand mining, therefore evidence of clearing will reduce BN value to 0
Fire	- Fire is not treated as a disturbance as it is inconsistently recorded and often cannot be distinguished from a 'natural' event

Notes on Table 4:
1. Native non-forest is considered as an equal part of wilderness assessment and disturbance impacts are rated accordingly.
2. Logging intensity is estimated by type of harvest, type of forest and management practices (from Mgt History project).

FIGURE 2: DERIVATION OF NWI WILDERNESS QUALITY



3.3.4 Derivation of 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 GIS 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 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 a WQ index equal to or above 12.0 are considered significant. These 'nodal areas' can help in assessing the significance of potential wilderness areas.

3.3.5 Delineation of NWI High Quality Wilderness

Delineation of high quality wilderness areas using the NWI was guided by the JANIS report and the Technical Framework for environment and heritage assessments in the NSW CRA/RFA process (EHTC, 1997). In accordance with these reports, the process concentrated on identifying rational and manageable boundaries for wilderness areas.

The following set of rules was adhered to in delineating wilderness boundaries:

- a low perimeter to area ratio is preferred;
- wherever possible boundaries should include complete catchments and the entirety of distinctive topographic features such as massifs, plateaux, gorges and escarpments;
- where the use of natural features is inappropriate, boundaries should follow features or infrastructure which are clearly identifiable in the field, such as roads, transmission lines, fence lines, 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:
    - enhance the wilderness quality of the surrounding or adjacent wilderness; or
    - 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 in the field should be avoided wherever possible.

Although the delineation process aimed to capture all land of 'high quality wilderness' within wilderness boundaries, in some instances small areas were excluded due to shape and viability considerations. Conversely, in other places, small areas of relatively low wilderness quality were incorporated within boundaries.

The assessment, identification, declaration and management of wilderness in NSW are 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. Any person, body or organisation may make such a proposal, 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 required for management purposes, to also 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 wilderness 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.

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 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.

3.4.1 Assessment criteria under the Wilderness Act (1987)

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

- naturalness
- restoration

- size
- solitude and recreation.

Naturalness

Objective measurement of 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 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 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 peoples 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 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 a 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.

Restoration

Section 6(1)(a) of the Act allows for the identification of areas as wilderness 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.

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.

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.

[redacted]

Eleven areas within the UNE and LNE CRA regions have previously been assessed and identified as wilderness in accordance with the Wilderness Act (1987). These areas are listed in Table 5 and shown in Figures 3 and 4. The total area of Identified Wilderness is approximately 804 729 ha (313 795 ha in UNE and 490 934 ha in LNE).

Of the 11 Identified Wilderness Areas, all or part of eight areas has been declared as wilderness under the Act. Declaration of further parts of the identified Washpool, Bindery-Mann, Guy Fawkes and Werrikimbe wilderness areas is currently pending. The total area declared, or

approved for declaration, is approximately 376 281 ha. Declared Wilderness areas are listed in Table 6.

To date, no parts of the identified Levers Plateau, Binghi, and Wollemi wilderness areas have become declared wilderness. The assessment reports for the identified Wollemi and Binghi Wilderness were publicly exhibited in 1997 and 1992 respectively. The Levers Plateau wilderness assessment report is scheduled to be on exhibition in the near future. A decision on declaration of all or part of Wollemi and Levers Plateau identified wildernesses will be made separately from the CRA process.

TABLE 5: IDENTIFIED WILDERNESS - DECEMBER 1998

CRA region	Identified Wilderness	Area (ha)	Area declared (ha)	Percentage declared
UNE	Bindery-Mann	52 996	43 638	82
	Binghi	34 227	0	0
	Guy Fawkes	121 953	47 825	39
	Levers Plateau	15 372	0	0
	Lost World	19 663	16 208	82
	Washpool	69 584	47 784	69
Sub-total		**313 795**	**155 455**	**49**
LNE	Barrington	61 978	54 382	88
	Macleay Gorges	167 375	54 753	33
	New England	59 753	54 367	91
	Werrikimbe	68 048	57 324	84
	Wollemi (part)	133 780	0	0
Sub-total		**490 934**	**220 826**	**45**
TOTAL		**804 729**	**376 281**	**47**

FIGURE 3: EXISTING IDENTIFIED AND DECLARED WILDERNESS - UNE

blank page follows colour map

FIGURE 4: EXISTING IDENTIFIED AND DECLARED WILDERNESS - LNE

blank page follows colour map

TABLE 6: DECLARED WILDERNESS IN UNE AND LNE

Wilderness area	Reserve name	Declaration date (Wilderness Act, NP&W Act)	Area (ha)	Total area (ha)
Barrington				
Barrington	Barrington Tops NP	12 April 96	30 700	
Chichester addn.	Barrington Tops NP	21 June 96	1 090	
Kerripit Beech FR addn.	Barrington Tops NP	5 July 96	243	
IAP addns.	Barrington Tops NP, Mt Royal NP	7 March 97	21 750	
IAP addns.	Barrington Tops NP	27 June 97	1 100	54 883
Bindery-Mann				
Mann	Nymboida NP	6 March 92	18 998	
Cooraldooral	Gibraltar Range NP	2 July 82 (NP&W Act only)	4 000	
Dandhara	Gibraltar Range NP	2 July 82 (NP&W Act only)	2 400	
IAP addns.	*Nymboida and Gibraltar Range NP*	*pending*	*18 240*	*43 638*
Guy Fawkes				
Guy Fawkes	Guy Fawkes River NP	14 September 94	29 625	
IAP addns.	*Guy Fawkes River NP*	*pending*	*18 200*	*47 825*
Lost World				
Lost World	Border Ranges NP, Limpinwood NR	14 April 94	8 583	8 583
Warrazambil				
Warrazambil	Border Ranges NP	12 April 96	7 000	7 000
Macleay Gorges				
Macleay Gorges	Oxley Wild Rivers NP	12 April 96	50 000	
IAP addns.	Oxley Wild Rivers NP	3 July 98	3 400	53 400
New England				
New England	New England NP	6 March 92	28 477	
IAP addns.	New England NP	20 November 98	25 890	54 367
Washpool				
Washpool	Washpool NP	17 May 85	24 500	
Washpool addn.	Washpool NP	14 September 94	2 450	
Haystack	Gibraltar Range NP	2 July 92	2 900	
Haystack addn.	Gibraltar Range NP	14 Sept 94	1 125	
IAP addns	Washpool NP	20 November 98	17 400	48 375
Werrikimbe				
Werrikimbe	Werrikimbe NP	12 April 96	26 500	
IAP addns	Werrikimbe NP	20 November 98	900	27 400
Willi Willi				
Willi Willi	Willi Willi NP	20 November 98	19 620	19 620
Kunderang				
Kunderang	Oxley Wild Rivers NP	20 November 98	14 160	14 160
Total (11 Wilderness Areas, including addns.)				**379 201**
Pending declarations (in italics)				***36 440***
Total Declared Wilderness (excl. pending)				**342 761**

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

3.6.1 Background

As detailed in the specifications for the Wilderness Assessment Project for UNE and LNE, this project has two main objectives:

1. under the Wilderness Act 1987, to conduct a desktop assessment of the region to identify areas likely to meet wilderness criteria that have not already been proposed by the community; conduct assessments of the community wilderness proposals and areas identified in the desktop assessment; produce assessment reports for each identified wilderness area under investigation; formulate management boundary options; and compile a digital database of areas identified and/or declared as wilderness under the Act; and

2. as input to the NWI, to collate and audit relevant information to update and refine the NWI; to delineate areas of high quality wilderness; to determine current reservation levels in the CRA region; and to prepare additional maps of high quality wilderness areas for National Estate assessment reports.

Assessments were conducted by NSW NPWS Northern Zone, except for the Yengo area that was assessed by Sydney Zone.

3.6.2 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.'

3.6.3 Public submissions database

An MS Excel database was established by NSW NPWS Northern 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 Archview GIS point data for direct correlation with assessment area boundaries.

3.6.4 Project requirements for wilderness assessment in UNE / LNE

Workshops

The project proposal specifies that:

'If data layers for the NWI are overdue, NPWS will consider holding a separate workshop or stakeholder review specific to the NSW Wilderness Act assessment methodology and program.'

Because data layers for NWI were overdue, namely API growth stage and floristic layers and Disturbance History Mapping for the UNE/LNE CRA Regions, a one day workshop was held

by NSW NPWS Northern Zone on 25 May 1998 and attended by representatives from NSW NPWS, SFNSW, Environment Australia, Dr John Duggin (Professor of Natural Resources, University of New England), and Keith Kendall (independent fauna consultant).

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 states that NSW NPWS will present the revised method to EHTC, ideally as part of a joint NSW NPWS and EA workshop. Such a workshop was held on 13 July 1998 and attended by representatives of stakeholder groups

Project outputs

The project undertook to make the following contributions to the NWI:

- Incorporation of data, including validated disturbance data, into the NWI
- Delineation of boundaries of NWI high quality wilderness for the UNE and LNE CRA regions
- Produce a GIS layer of delineated high quality wilderness areas; and
- Quantification of reservation level of delineated high quality wilderness areas

The project also undertook to make the following contributions to an assessment under the NSW Wilderness Act (1987):

- 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
- Update NWI database
- Produce a GIS layer of delineated high quality wilderness areas

3.6.5 Wilderness assessment methodology workshop - 25 May 1998

Workshop participants were invited to comment on the definitions of wilderness and to debate the following topics: disturbance regimes which affect wilderness values, distinction between pre and post 1750 anthropogenic disturbance events, size thresholds, observable and measurable aspects of wilderness, and activities deemed 'self-reliant' or 'appropriate' for wilderness (Appendix 1).

An attempt was made to identify and describe each end of the 'wilderness spectrum', i.e. definitions of substantially modified and substantially unmodified, however no consensus was reached. A proposition was put forward that pre-1750 vegetation patterns and processes could be interpreted as 'substantially unmodified', however this was refuted by some workshop participants. Agreement was reached that it is possible to use forest growth stage (i.e. structural integrity) as an indication of the degree of modification of forest structure, although as with all data sources used for conducting the wilderness assessment, this criterion cannot be used in isolation. Forest growth stage / structure information is available for UNE and LNE regions from the Broad Old Growth Mapping Project (BOGMP) and more recently, the CRA Aerial Photograph Interpretation Project (CRAFTI).

Agreement was also reached that a number of disturbance events have the capacity to substantially modify an area, possibly to such an extent that restoration within a reasonable time frame is precluded. The following examples were cited: quarries and mine sites; pasture improvement; intensive logging; plantations (including native forests effectively converted to plantations); high densities of exotic species; and significant roading (e.g. dense road networks and highways).

General agreement was also reached that it is not possible to distinguish between impacts to an ecosystem that result from 'natural' disturbance events and impacts resulting from post-1750 anthropogenic disturbance events, with the exception of mine sites and quarries which are clearly post-1750 disturbance types. Where the distinction is less obvious, it will be necessary to look at a range of criteria in order to cross-validate the disturbance event as either naturally occurring or the result of recent human activities. Areas of disturbance that cannot be readily classified as either will fall into the precautionary rule of inclusion rather than exclusion.

With regards to the impacts of disturbance events and ecosystem recoverability, the point was made that it is important to take account of the type, intensity, extent and context of the disturbance event. For example, recent logging is considered more intensive than earlier selective logging; and small, isolated but intense disturbance events in areas that are surrounded by contiguous and relatively unmodified forest are not as significant as widespread and intense disturbance events that occur in a fragmented ecosystem.

Agreement was reached on the definition of a 'reasonable time frame' as being an ecological time frame (which will differ between forest communities) and that the time frame is set by the period it takes for a community to be deemed as being no longer substantially modified. The point was raised that the recovery of a disturbed ecosystem also depends on the resources available for assisting regeneration.

Sufficient size was considered dependent upon the vegetation type and the buffering it affords from edge effects and the level of disturbance in adjoining areas. It was recommended that in determining if an area is of sufficient size, the area be considered in its context, its overall size and connectivity, and the viability of endangered populations. As a guide, the following size criteria were agreed to: 5000 ha for coastal areas and 8000 ha for non coastal areas. An area that falls below the minimum size criterion can in some circumstances be included for wilderness assessment if adequate justification is provided (e.g. large core habitat for space-dependent and disturbance-sensitive fauna; results from recent field investigations).

The concept of solitude was considered dependent upon the extent of disturbance impacts (if present), and occasional noise from high altitude aircraft was cited as an example of a low impact disturbance to solitude.

Appropriate self-reliant recreation was considered to be activities that are 'unaided' and 'low-impact', e.g. bushwalking, swimming, and bird watching.

The workshop listed observable and measurable aspects of wilderness as they relate to the criteria specified in the Act (i.e. degree of modification). Consensus was reached on the attributes listed in Table 7. The workshop also nominated digital data layers that could be used to conduct an assessment of these criteria.

TABLE 7: OBSERVABLE AND MEASURABLE ATTRIBUTES OF WILDERNESS AREAS

Attribute	Observable / measurable feature
Composition	- exotic species (weeds and feral animals) - diversity of floristic and faunal assemblages - presence of sensitive taxa
Structure	- forest growth stage
Geography	- rivers - water quality and flow - geomorphology
Disturbance	- fire regimes - roading, mining, clearing, grazing - infrastructure (dams, powerlines, dwellings) - apiary

Several additional datasets were listed as potentially available for wilderness assessment by the workshop:

- mapping of forest management history (draft version) by SFNSW in ArcInfo;
- roading, settlement classes (infrastructure across all tenures), held by Environment Australia in Archview;
- woody / non-woody vegetation (all NSW forests) - Environment Australia to provide additional information;
- Landsat Thematic Mapping compiled for the North East Forests Biodiversity Study (NEFBS), available in WinERMS GIS at 1:100 000 (incorporated into the woody / non-woody vegetation study);
- NSW NPWS catchment data;
- Dept. Land and Water Conservation (DLWC) high conservation rivers assessment;
- Wild Rivers - available from Environment Australia; and
- PIW digital layer for the IAP for SFNSW and Public Land tenures.

3.6.6 Presentation of revised methodology to stakeholders - 13 July 1998

A joint presentation was made by Environment Australia (EA) and NSW NPWS to representatives of stakeholder groups on 13 July 1998. 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 presented their assessment of wilderness in the UNE / LNE 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 that, once combined, provided complete coverage of the entire study area.

A summary of the outcomes from the wilderness assessment methodology workshop was also presented. The summary showed the 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 an appropriate threshold values for wilderness quality classes, particularly for the minimum proportion of an area which should be 'substantially unmodified' in order for the area to be classed as wilderness. The following thresholds were generally accepted:

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

3.6.7 Thresholds for Provisionally Identified Wilderness

In mid 1998, a minimum size of 15 000 ha for stand-alone PIWs was adopted. This is consistent with the minimum size of stand-alone wilderness areas identified under the Act to date, and takes account of the JANIS provision for larger wilderness areas to be identified in regions where wilderness is relatively common.

It was also decided that at least 90% of each PIW area must be classed as substantially unmodified.

The thresholds adopted following the assessment methodology workshop and the stakeholder presentation were generally applied to delineate State Capable Wilderness areas. State Capable Wilderness areas are areas smaller than PIWs that may possibly meet the Wilderness Act criteria. This will not be determined until after the CRA when the Director-General decides which areas should be identified as wilderness.

The size limit for State Capable Wilderness areas (8 000 ha for non-coastal and 5 000 ha for coastal areas) is equivalent to size limits used to delineate high quality wilderness under the NWI, but is substantially lower than the limit used in past wilderness assessments under the NSW Wilderness Act. These areas were also provided to assist with the development of a CAR reserve system.

3.6.8 Desktop assessment

The desktop assessment of wilderness involved the derivation of a GIS layer of 'candidate' wilderness areas comprising declared and identified wilderness (IW), IAP provisionally identified wilderness (PIW), old growth forest (OGF) and deferred forest areas (DFA). This base layer (grid format) and line features for PIW and Declared wilderness, major roads and rivers were printed onto transparent overlays at 1:100 000 scale for direct reference to same scale Landsat TM satellite imagery covering the UNE and LNE regions.

Large and contiguous forest areas, (not fragmented by roading or clearing) that were considered to be substantially unmodified (SU), were delineated and marked onto the transparent overlays. Delineated areas 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. Land 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. 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). Delineated boundaries were then digitised in Win-ERMS GIS format.

3.6.9 Delineation and refinement of wilderness assessment areas

NSW NPWS conducted an internal review of wilderness assessment boundaries against other Win-ERMS layers (Table 8). 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 Archview 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 13 – 30 July 1998 and the Wilderness Quality Landscape Layer derived from GIS analysis.

TABLE 8: DATASETS USED IN NSW NPWS INTERNAL REVIEW OF WILDERNESS ASSESSMENT BOUNDARIES

Data used
Broad Old Growth Mapping Project (BOGMP) 1995
North East Forest Biodiversity Study (NEFBS) Disturbance History 1992
Recent logging history under licence from S.120 of the National Parks and Wildlife Act (1974), post Timber Industry (Interim Protection) Act (1992)
Landsat TM 1990
Colour aerial photography for limited areas
Expert opinion based on field experience
Unavailable data
CRA Aerial Photographic Interpretation (CRAFTI project)
MANHIST - most recent SFNSW logging history database
Colour aerial photography for many areas

3.6.10 Delineation and refinement of wilderness capability layer

Desktop outcomes and nominated wilderness assessment areas were further assessed for wilderness capability in readiness for identification under the Act. An area of land can only be identified as wilderness if it is capable of supporting wilderness values, namely the area is in a state that has not been substantially modified by humans and their works, or can be restored to this state; is of a sufficient size to make its maintenance in such a state feasible; and is capable of providing opportunities for solitude and appropriate self-reliant recreation (section 6(1) of the Act).

Thresholds of the Substantially Unmodified category were applied to determine the degree of modification. These thresholds approximate ‘high quality wilderness’ as delineated by an NWI score of at least 12.

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 9.

TABLE 9: 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, gorges and escarpments.	Areas obviously substantially modified - e.g. cleared, agricultural, urban and other developments, areas fragmented by dense roading.	Where use of natural features is inappropriate, boundaries should follow features clearly identifiable 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 partially disturbed land that protects 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 for Provisionally Identified Wilderness.
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 and determining of State Capable Wilderness.

3.6.11 Field assessment

Ground-based assessment

In order to make best use of the limited time available for field assessment, survey sites were targeted towards representative samples of wilderness quality classes and to areas with conflicting information or data gaps. Assessment sites were marked on laminated 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 and included location (GPS / AMG), site conditions (e.g. geography, slope, aspect), naturalness (vegetation cover, structure, growth stage), disturbance (type, level and recoverability), 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

A helicopter was employed for two days of rapid aerial assessment of the potential wilderness areas distributed throughout the nine million hectare UNE / LNE CRA region. GPS points 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, the integrity of the forest canopy (i.e. contiguity, patchiness), the presence of waterfalls or notable geomorphic features, and the recoverability of disturbed areas estimated. Video footage and still photographs were taken for each assessment area.

3.6.12 Derivation of wilderness quality landscape layer

The Environmental Systems Research Institute (ESRI) GIS software Archview (version 3.0a) and the companion Spatial Analyst module were adopted as standard for the CRA process. A range of Archview and Spatial Analyst analysis tools were used in the derivation of a contextual landscape layer showing wilderness quality for the entire study region. See Appendix 1 for details.

Archview data layers

Table 10 lists the data layers used in this assessment.

Attributes of each data layer were classified into classes suitable for derivation of wilderness quality classes across the study area. As an indicator of levels of modification, growth stage classes from the CRAFTI project for UNE and BOGMP for LNE were weighted and intersected along with other available digital datasets for disturbance and naturalness to provide a complete landscape coverage of wilderness quality classes across the entire UNE and LNE CRA regions.

The derivation of growth stage classes from CRAFTI and BOGMP projects incorporated site quality data (interpretability of growth stage classes), disturbance information from MANHIST and CRAFTI for UNE, and logging history records from the IAP for LNE.

TABLE 10: DATASETS USED IN THE DERIVATION OF WILDERNESS QUALITY CLASSES

Attribute	Data source	Mapped coverage	Digital coverage
Forest structure	BOGMP 1996	Public forest	LNE
Forest structure	CRAFTI 1998	All tenure (excludes non-forest)	UNE
Broad vegetation type	Eastern Bushlands d'base 1992	Complete coverage	UNE and LNE
Forest ecosystems	CRA 1998	Complete coverage	UNE and LNE
Ruggedness	CRA 1998	Complete coverage	UNE and LNE
Disturbance tags	CRAFTI 1998	All structural polygons except regrowth	UNE
Mine sites	DMR 1998	Complete coverage	UNE and LNE
Roads	AUSLIG 1998	Complete coverage	UNE and LNE

Data analysis in Archview

Analysis scripts were written and compiled in 'Avenue', the Archview coding language. The order of datasets within the scripts reflects the weighting assigned to each data layer. Precedence was given to the most recent datasets with complete coverage of the UNE / LNE regions and to datasets with a high level of resolution. For example, for gridcells where no forest growth stage data were available, the next listed dataset provided a value for this variable. Priority was also given to a particular attribute if it is better represented (i.e. higher resolution) within another data layer by reclassifying the data to reflect the priorities (e.g. reclassify CRAFTI to show disturbance classes only), and listing the reclassified layer in the syntax before other layers. In effect, the last data layer listed in the syntax provided a base layer, onto which data from other layers were stacked in turn, finishing with the first layer listed in the script.

The classes selected from each data layer as representing 'observable and measurable' attributes of wilderness are listed in Appendix 1. The merged digital layer provides complete coverage of wilderness quality across the study region, with values ranging from 1 to 5 and classes for 'natural no disturbance data' and 'cleared' included in order to distinguish areas without vegetation cover from disturbed forest.

The decision rules defining wilderness quality classes are also presented in Appendix 1. The rules are formatted similar to a dichotomous key. 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.

TABLE 11: FINAL WILDERNESS QUALITY CLASSES

Value	Code	Wilderness quality class
1	SM	Substantially Modified
2	SM / MR	Substantially Modified / Modified but Restorable
3	MR	Modified but Restorable
4	MR / SU	Modified but Restorable / Substantially Unmodified
5	SU	Substantially Unmodified

3.6.13 Determination of Provisionally Identified Wilderness and State Capable Wilderness

Provisionally Identified Wilderness (PIW) was derived by excluding those parts of the assessment area classified as SM and some areas on the perimeter of the assessment area classified as SU and MR. Areas smaller than 15 000 hectares were excluded.

State Capable Wilderness was derived by excluding those parts of the assessment area classified as SM and some areas on the perimeter of the assessment area classified as SU and MR. Areas smaller than 8 000 hectares, or 5 000 hectares where adjacent to the coast, were excluded.

As a general guide areas were required to have >90 % of their area in value classes 4 and 5, not greater than 10% of value class 3 and minor areas of value classes 1 and 2.

Assessment of the Yengo area was generally similar to that for the rest of LNE. The following sections describe aspects of the assessment methodology which differed.

3.7.1 Determination of assessment area

The Commonwealth produced the NWI in June 1997. The assessment area was derived from lands with an NWI Wilderness Quality Index of at least 12, Landsat images from 1994 showing vegetation condition and disturbance, plus areas determined by NSW NPWS in 1994 as the MacDonald and Mt. Isobel Wilderness Areas. The assessment area therefore comprised predominantly natural lands, mostly composed of Yengo National Park and Parr State

Recreation Area. The area covers 134 116 ha and includes small areas of Vacant Crown Land, leasehold and freehold land.

3.7.2 Determination of disturbance thresholds

An 'Expert Panel' was convened to assess the impacts of disturbance within the assessment area. The panel met for one day and comprised seven people (NSW NPWS and others) with the following expertise:

- knowledge of logging locations and practices in the last 25 - 30 years;
- representative of local landowners;
- ecological knowledge of vegetation;
- field experience of fire history, native plants and animals, and impacts of weeds and feral animals;
- knowledge of other previous land uses e.g. grazing, trail construction, bush rock removal.

The panel agreed on descriptions of each type and level of disturbance ('disturbance thresholds' - see Table 12). Three levels of disturbance (or naturalness categories) were used - 'Substantially Unmodified' (SU), 'Modified but Restorable' (MR), and 'Substantially Modified' (SM). Eight types of disturbance were identified:

- logging
- roads, vehicle tracks, walking tracks and bridle trails
- mining and quarrying
- clearing, grazing and agriculture
- utilities and other infrastructure
- fire
- weeds
- bushrock removal.

3.7.3 Assessment of disturbance and mapping of naturalness categories

The locations and level of disturbance in the area were assessed using the following information:

- satellite images (Landsat TM images of September 1994 and March 1995);
- air photos (January 1994);
- SFNSW harvesting plans for logging operations in the 1970s and 1980s;
- records of wildfires from the last 20 - 25 years and records of prescribed fires for the last 10 years;
- advice from landowners about agricultural practices and other activities on their land;
- history of land uses described in other reports of the area;
- advice from NSW NPWS staff familiar with the historical land uses of the area and involved in the current management of Yengo National Park and Parr State Recreation Area;

- advice from members of Expert Panel; and
- field observation of disturbed and regenerating areas.

Using these sources of information, disturbed locations within the assessment area were classified as either 'Substantially Modified' (SM) or 'Modified but Restorable' (MR). These locations are shown in Appendix 3. Parts of the assessment area which were not disturbed, or were not sufficiently disturbed to be classified as SM or MR, were classified as 'Substantially Unmodified' (SU).

3.7.4 Determination of Provisionally Identified Wilderness

Provisionally Identified Wilderness (PIW) was derived by excluding those parts of the assessment area classified as SM and some areas on the perimeter of the assessment area classified as MR.

TABLE 12 -DISTURBANCE THRESHOLDS FOR YENGO WILDERNESS ASSESSMENT

	Naturalness categories		
Type of disturbance	**Substantially Unmodified (SU)**	**Modified but Restorable (MR)**	**Substantially Modified (SM)**
Logging	No evidence of recent logging (e.g. for 25-30 yrs) or only selectively logged.	Recently logged (< 25 yrs ago) or evidence of heavier logging (weeds, stumps, log dumps), or hardwood forest with dense rainforest understorey logged < 50 yrs ago.	Evidence of intensive, recent logging (dense weeds and no evidence of regrowth through weeds, few mature trees, vegetation mainly regrowth)
Roads, vehicle trails, walking tracks and bridle trails	Walking tracks, unformed vehicle trails with no cut and fill which are not obvious due to regeneration since last use; rehabilitated fire control lines; low use bridle trails with little marking.	Fire trails and 2WD roads with natural/local surface material and minor cut and fill, or with extensive cut and fill but no longer obvious or contributing to disturbance; fire control lines with incomplete rehabilitation; bridle trails with many markings.	Sealed roads; fire trails and 2WD roads with imported material and /or extensive cut and fill where disturbance is obvious.
Mining and quarrying	Minor (< 1 ha) gravel stripping or quarry with advanced regrowth.	Minor (< 1 ha) gravel stripping or quarry with poor/no regrowth; or larger quarried area (> 1 ha) with advanced regrowth.	Major (> 1 ha) quarry with poor/no regrowth.
Clearing, grazing and agriculture	Cleared area < 5 ha with advanced regrowth of native species with few weeds.	Cleared area < 50ha with established regrowth of native species or with some advanced regrowth and moderate weeds; or cleared area < 5 ha with little regrowth or moderate weed infestation.	Cleared area > 50 ha or smaller cleared area with little regrowth and /or heavy weed infestation.
Utilities and other infrastructure	Minor or unmaintained structures from disused farm/habitation in natural decay; disused power/telegraph poles.	Currently used or maintained farm structures, visitor facilities and power/telegraph poles capable of removal.	Major power lines and buildings only capable of removal at high cost and major disturbance.
Fire	No visible affects on vegetation structure & floristics from hazard reduction or wildfires; or regrowth vegetation from single fire event	Evidence of frequent fire regime on structure or floristics but capable of recovery if protected from fire.	Evidence of impacts of frequent fires e.g. weed infestations, soil erosion, altered floristics.
Weeds	Nil weeds/scattered individuals of less invasive species.	Moderate or scattered infestations which are not preventing native plant regeneration.	Major weed infestation (dominates native vegetation).
Bushrock removal	Nil or negligible rock removal.	Moderate rock removal with little reduction of naturalness quality.	Intense rock removal with high reduction of naturalness quality.

4. RESULTS

4.2.1 Delineated NWI results for UNE

The NSW NPWS digitised the delineated NWI high quality wilderness provided by Environment Australia to the NSW Government as working maps, following review and refinement by stakeholders.

Nine areas in the UNE region met the JANIS criteria for 'high quality wilderness' (minimum NWI rating of 12 and a minimum size of 8000 hectares). The NSW component of Mt Ballow and Stanthorpe met the minimum size threshold when considered together with the adjoining wilderness areas in Queensland. The total extent of the nine delineated areas in the UNE Region is 304 438 ha. Delineated NWI Wilderness for UNE is shown in Figure 5. Table 13 shows land tenure for each area.

TABLE 13: LAND TENURE OF DELINEATED NWI AREAS IN UNE

		* Area (ha)							
NWI area	**Type**	**NP**	**NPP**	**SFN**	**TR**	**CNL**	**CNR**	**Other**	**Total**
Bindery-Mann	Addn.	42 369	0	4 126	0	2 983	0	966	50 444
Binghi	New	18 454	0	528	0	13 180	595	5 310	38 067
Banyabba	New	11 775	0	297	0	0	64	884	13 020
Bundjalung	New	10 749	0	72	0	0	0	278	11 099
Chandlers Ck	New	4 573	0	4 952	0	0	0	16	9 541
Guy Fawkes	Addn.	54 295	4 566	5 539	60	40 808	3 038	8 041	116 347
Mt Ballow[1]	New	0	0	1 165	0	0	0	0	1 165
Stanthorpe[1]	New	0	0	0	0	1 860	0	1 578	3 438
Washpool	Addn.	50 090	0	2 346	0	4 303	2 017	2 561	61 317
TOTALS		**192 305**	**4 566**	**19 025**	**60**	**63 134**	**5 714**	**19 634**	**304 438**

* Areas are from a variety of land tenure data sources and may be subject to minor variations.
NP = National Park (including Nature Reserves and State Recreation Areas); NPP = National Park (purchased); SFN = State Forest (native); TR = Timber Reserve; CN L= Crown Lease; CNR = Crown Reserve; Other = private;
[1] Occurs within both UNE and Queensland. Only UNE component included.

4.2.2 Provisionally Identified Wilderness results for UNE

Based on the assessments undertaken in accordance with the Wilderness Act (1987) as part of the CRA process, the Banyabba and Chandlers Creek areas were provisionally identified as wilderness by NSW NPWS. Smaller areas adjoining the existing Identified Wilderness Areas of Washpool (Billilimbra addition), Bindery-Mann (Bindery addition) and Guy Fawkes (Mann addition) were also provisionally identified as wilderness. These areas are referred to as PIW as

assessed under the Act, and in total comprise 55 019 ha in the UNE CRA region. PIW for UNE is shown in Figure 6. Table 14 shows land tenure for the five PIW areas in UNE.

FIGURE 5: DELINEATED WILDERNESS (NWI) - UNE

Blank page follows colour map

FIGURE 6: PROVISIONALLY IDENTIFIED WILDERNESS (PIW) - UNE

Blank page follows colour map

TABLE 14: LAND TENURE OF PIW AREAS IN UNE (>15 000 HA, OR SMALLER ADDITIONS TO EXISTING AREAS)

		* Area (ha)					
PIW	**Type**	**NP**	**SFN**	**CNL**	**CNR**	**Other**	**Total**
Banyabba	New	16 800	1 509	0	686	10	19 005
Billilimbra	Addn. to Washpool	13	1 456	3	0	0	1 472
Bindery	Addn. to Bindery-Mann	3	4 051	3	0	0	4 057
Chandler's Ck	New	9 074	9 146	0	0	63	18 283
Mann	Addn. to Guy Fawkes	5 587	4 704	487	186	1 238	12 202

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

4.2.3 State Capable Wilderness Results for UNE

Based on the assessments undertaken in accordance with the Wilderness Act (1987) as part of the CRA process, the Bundjalung (10 992 ha) and Timbarra (11 990 ha) areas were determined as State Capable Wilderness areas by NSW NPWS. Part of Cathedral Rocks (3 525 ha) and Mt Ballow (1 939 ha) areas that lie within UNE were also determined as State Capable Wilderness areas. These areas are referred to as State Capable Wilderness, possibly capable of meeting the wilderness criteria under the Act, and in total comprise 28 446 ha in the UNE CRA region.

4.3.1 Alternative NWI assessment results for LNE

The alternative assessment of 'high quality wilderness' (NWI surrogate) included the following wilderness categories:

- *Currently Identified Wilderness* (Wilderness Act 1987) which included the following areas: New England, Macleay Gorges, Werrikimbe, Barrington and part of Wollemi Wilderness area (see Table 5). Total 490 934 ha.

- *Provisionally Identified Wilderness (see 3.2.2 below)*.

- *State Capable Wilderness (see 3.2.3 below).*

The delineated NWI surrogate wilderness in LNE is shown in Figure 7. Table 15 shows the area and land tenure of the latter two categories.

4.3.2 Provisionally Identified Wilderness results for LNE

These areas are referred to as:

Based on the assessments undertaken in accordance with the Wilderness Act 1987 as part of the CRA process, the Stockyard Creek and Yengo areas have been provisionally identified by NSW NPWS. Additional areas adjoining the existing identified wilderness areas of Macleay Gorges (namely Styx River and Brittle Gum Forest additions), Werrikimbe (Doyles River

addition) and Barrington (Barrington addition) were also been provisionally identified as wilderness. These areas are referred to as PIW as assessed under the Act, and in total comprise 143,853 ha in the LNE CRA region. PIW for LNE is shown in Figure 8. Table 15 shows land tenure for the six PIW areas in LNE.

4.3.3 State Capable Wilderness results for LNE

Based on the assessments undertaken in accordance with the Wilderness Act (1987) as part of the CRA process, Limeburners Creek (8 370) and Mummel Gulf (11 785 ha) were determined as State Capable Wilderness Areas by NSW NPWS. Part the Cathedral Rocks (6 966 ha) area within LNE was also determined as State Capable Wilderness areas. These areas are referred to as State Capable Wilderness, possibly capable of meeting the wilderness criteria under the Act, and in total comprise 27 121 ha in the LNE CRA region. Table 15 shows land tenure for the three State Capable Wilderness areas in LNE.

FIGURE 7: DELINEATED WILDERNESS (NWI SURROGATE) - LNE

Blank page follows colour map

FIGURE 8: PROVISIONALLY IDENTIFIED WILDERNESS (PIW) - LNE

Blank page follows colour map

TABLE 15: AREAL EXTENT AND LAND TENURE FOR NWI SURROGATE WILDERNESS IN LNE

		* Area (ha)									
PIW	**Type**	**NP**	**NPP**	**SFN**	**PMP 13**	**TR**	**SFS**	**CNL**	**CNR**	**Other**	**Total**
PIW in UNE / LNE > 15 000 ha, or addns. to existing wilderness areas											
Barrington	Addn. to Barrington	52	0	1 241	58	0	0	0	0	0	1 351
Brittle Gum Forest	Addn. to Macleay Gorges	10	0	1 401	253	0	0	0	0	0	1 664
Doyles River	Addn. to Werrikimbe	1 407	0	9 699	2	0	0	153	3	874	12138
Stockyard Ck.	New	7	0	4 319	2 319	165	0	3 643	4 682	2 199	17334
Styx River	Addn. to Macleay Gorges	1 102	0	4 871	0	0	0	0	26	20	6 019
Yengo	New	101972	91	0	0	0	0	33	1 639	1 612	105347
State Capable Wilderness < 15 000 ha											
Cathedral Rock[1]	New	2 741	0	3 606	0	0	0	105	323	191	6 966
Limeburners Ck.	New	8 334	0	0	0	0	0	0	0	36	8 370
Mummel Gulf	New	0	0	10553	1 012	0	21	0	0	199	11785
TOTALS		**115625**	**91**	**35690**	**3644**	**165**	**21**	**3934**	**6673**	**5131**	**170 974**

*Areas taken from a variety of land tenure data sources and may be subject to minor variations.

NP = National Park (including Nature Reserves and State Recreation Areas); NPP = National Park (purchased); SFN = State Forest (native); SFS = State Forest softwood; TR = Timber reserve; CNL = Crown Lease; CNR = Crown reserve; Other = private; PMP 1.3 = SFNSW Preferred Management Priority Classification for areas reserved as Flora Reserves and Forest Preserves (Forestry Commission of NSW 1993).

[1] Occurs within both UNE and LNE CRA regions – only LNE component included

5. CONCLUSION

The national agreement targets in relation to wilderness are provided in the JANIS report. It seeks the following target for the establishment of a CAR forest reserve system:

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

To determine the existing reservation status of JANIS high quality wilderness (i.e. prior to CRA negotiations), the delineated areas of NWI high quality wilderness for the UNE and the NSW NPWS alternative assessment of high quality wilderness for the LNE were intersected with land tenure boundaries (Figures 9 and 10). State Recreation Areas were not regarded as meeting the definition of a dedicated reserve since mining is permitted in these areas.

Fifty-seven percent (173 851 ha) of the NWI delineated wilderness in the UNE is currently within dedicated reserves (Table 16).

For LNE, approximately eighty-nine percent of the existing identified wilderness areas is within dedicated reserves (i.e. NSW NPWS estate) and sixty-four percent (109 641 ha) of the NWI surrogate (high quality wilderness delineated during this project) is similarly reserved (Table 17). Therefore, eighty-one percent (534 093 ha) of the NSW NPWS alternative assessment of high wilderness quality in the LNE is currently within dedicated reserves.

Tables 16 and 17 also show the area delineated as CRA PIW under the Wilderness Act, and where relevant, existing Identified Wilderness.

TABLE 16: EXTENT OF NWI HIGH QUALITY WILDERNESS IN RESERVES - UNE

NWI area	Type	Total area (ha)	Area reserved (ha)	% reserved	NSW NPWS CRA PIW and existing IW
Banyabba	New	13 020	11 775	90	19 005[2]
Bindery-Mann	Addn.	50 444	42 369	84	57 052[3]
Binghi	New	38 067	0[1]	0	34 227[4]
Bundjalung	New	11 099	10 749	97	10 992[2]
Chandler's Ck.	New	9 541	4 573	48	18 283[2]
Guy Fawkes	Addn.	116 347	54 295	51	134 155[3]
Mt Ballow	New	1 165	0	0	0
Stanthorpe	New	3 438	0	0	0
Washpool	Addn.	61 317	50 090	82	71 056[3]
TOTALS		**304 438**	**173 851**	**57**	**344 770**

[1] State Recreation Areas excluded.
[2] Comprises CRA PIW only.
[3] Comprises CRA PIW and existing Identified Wilderness.

[4] Comprises existing Identified Wilderness only.

FIGURE 9: DELINEATED WILDERNESS (NWI) RESERVATION STATUS - UNE

Blank page follows colour map

FIGURE 10: DELINEATED WILDERNESS (NWI SURROGATE) RESERVATION STATUS- LNE

Blank page follows colour map

TABLE 17: EXTENT OF DELINEATED NWI SURROGATE WILDERNESS IN RESERVES - LNE

		Area currently reserved	
NSW NPWS delineated area	**Area (ha)**	**ha**	**%**
Identified Wilderness			
New England	60 319	56 488	94
Macleay Gorges	167 375	112 537	67
Werrikimbe	68 048	59 935	88
Barrington	61 978	61 551	99
Wollemi[1]	133 780	132 551	99
CRA Provisionally Identified Wilderness and State Capable Wilderness			
Cathedral Rock[2] (new)	6 914	2 810	41
Styx River (addn.)	6 018	1 096	18
Brittle Gum Forest (addn.)	1 664	4	0
Stockyard Ck. (new)	17 333	4	0
Mummel Gulf (new)	11 784	0	0
Doyles River (addn.)	12 139	1 407	12
Limeburners Ck. (new)	8 369	8 362	100
Barrington (addn.)	1 351	48	4
Yengo (new)	105 347	97 300[3]	92
TOTALS	**662 419**	**534 093**	**81**

[1] Only area within LNE CRA region included.
[2] Occurs within both UNE and LNE CRA regions - only LNE component included.
[3] State Recreation Areas excluded.

None of the State Capable Wilderness areas are currently located entirely within dedicated reserves. Stockyard Creek, Mummel Gulf and the Doyles River (addition to Werrikimbe) all represent large unreserved areas of high quality wilderness.

Optimal protection of wilderness values in the UNE and LNE regions will require that all areas of NWI high quality wilderness be reserved. Where this is impractical (e.g. private land) other protective mechanisms will be required.

[redacted]

To ensure maximum wilderness protection of identified wilderness, Provisionally Identified Wilderness (PIW) and State Capable Wilderness, these boundaries should be included as contextual information in negotiating reserve design. As such, where two or more parcels of land of similar conservation value occur, those that fall within these layers should be selected.

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.

The wilderness assessments conducted in the UNE and LNE regions will be completed by the NSW NPWS to satisfy the requirements of the Wilderness Act (1987). Assessment reports will be displayed for public comment. New identified areas will be considered from areas classed as PIW, State Capable Wilderness and any additional areas found to meet the wilderness criteria. The future status of identified wilderness will be resolved by the NSW Government after the CRA. Figures 11 and 12 show areas of PIW, Identified and Declared Wilderness within UNE and LNE, respectively.

Following formal identification, NPWS will conduct public consultation on the wilderness declaration of newly identified areas. The NSW Government will then consider public comments and finally make a decision on areas for declaration as wilderness.

FIGURE 11: PIW, IDENTIFIED AND DECLARED WILDERNESS - UNE

Blank page follows colour map

FIGURE 12: PIW, IDENTIFIED AND DECLARED WILDERNESS - LNE

Blank page follows colour map

REFERENCES

Cairns, J.1986. Restoration, Reclamation and Regeneration of Degraded or Destroyed Ecosystems. In Soule. M.(Ed.) *Conservation Biology. The Science of Scarcity and Diversity*. Sinauer Associates Inc., Massachusetts, USA.

Commonwealth of Australia 1992. *National Forest Policy Statement - a new focus for Australia's forests.* Advance Press Pty Ltd, Perth.

Commonwealth of Australia 1997. *Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia.* Joint ANZECC/MCFF- a National Forest Policy Statement Implementation Sub-committee (JANIS). Canberra.

Environment and Heritage Technical Committee 1997. *Technical framework for environment and heritage assessments in the NSW CRA/RFA process*. Resource and Conservation Assessment Directorate, NSW Dept. Urban Affairs and Planning, Sydney.

Goodfellow, S. and Peterken, G.F. 1981. A method for survey assessment of woodlands for nature conservation using maps and species lists; the example of the Norfolk woodlands. *Biological Conservation*. **21(2):** 177-95.

Helman, P.M., Jones, A.D., Pigram, J.J.J. and Smith, J.M.B. 1976. *Wilderness in Australia - Eastern New South Wales and south-eastern Queensland*. University of New England Press, Armidale.

Helman, P, 1981. *Wild and Scenic Rivers: A Preliminary Study of NSW.* NSW National Parks and Wildlife Service.

Higgs, A.J. and Usher, M.B. 1980. Should National Parks be Large or Small?. *Nature* **285:** 568-9.

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.

Lesslie, R.G., Mackey, B.G. and Preece, K.M. 1987. *A Computer Based Methodology for the Survey of Wilderness in Australia*. Consultant's report to the Australian Heritage Commission.

Lesslie, R and Maslen, M. 1995. *National Wilderness Inventory - Handbook of Procedures, Content and Usage, 2nd Edition.* Australian Heritage Commission, Canberra.

Lesslie, R and Taylor, S. 1985. The wilderness continuum concept and its implications for wilderness preservation policy. *Biological Conservation* **32:** 309-33.

Lesslie, R.G., Taylor, D. and Maslin M. 1994. The National Wilderness Inventory. In Barton, W. (Ed.), *Wilderness: the future - Papers from the Fourth National Wilderness Conference Envirobook, Sydney*. Pp 29-41.

McAllister, D.M 1996. *Evaluation in environmental planning: assessing environmental, social, economic, and political trade-offs.* MIT, Cambridge.

Ryan, J.C. 1992. Conserving Biological Diversity. In Starke, L. (Ed.) *State of the World*. Earthscan Publications, London.

Resource and Conservation Assessment Council 1996. *Draft Interim Forestry Assessment Report*. NSW Dept. Urban Affairs and Planning, Sydney.

Usher, M.B 1986. Wildlife conservation evaluation: attributes, criteria and values. In Usher, M. (Ed), *Wildlife Conservation Evaluation*. Chapman and Hall, London.

Wilcove, D.S., McLellan, C.H. and Dobson, A.P. 1986. Habitat Fragmentation in the Temperate Zone. In Soule, M. (Ed.), *Conservation and Biology - the Science of Scarcity and Diversity*. Sinauer Associates Inc., Massachusetts, USA.

Wilderness Working Group 1986. *Report of the Wilderness Working Group to the Minister for Planning and Environment.* New South Wales Government, Sydney.

Wolke, H. 1991. *Wilderness on the Rocks.* Ned Ludd Books, Tucson, Arizona, USA.