Wilderness Assessment - Eden Region

A report undertaken for the NSW CRA/RFA Steering Committee

7 May 1998

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NSW NATIONAL PARKS AND WILDLIFE SERVICE SOUTHERN ZONE NATURAL HERITAGE UNIT

A report undertaken for the NSW CRA/RFA Steering Committee project number NE 25/EH

7 May 1998

Report Status

This report has been prepared as a working paper for the NSW CRA/RFA Steering Committee under the direction of the Environment and Heritage Technical Committee. It is recognised that it may contain errors that require correction but it is released to be consistent with the principle that information related to the comprehensive regional assessment process in New South Wales will be made publicly available.

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This project has been jointly funded by the New South Wales and Commonwealth Governments. The work undertaken within this project has been managed by the joint NSW / Commonwealth CRA/RFA Steering Committee which includes representatives from the NSW and Commonwealth Governments and stakeholder groups.

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

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1. EXECUTIVE SUMMARY

The NSW and Commonwealth governments signed a Scoping Agreement in 1996 to achieve Regional Forest Agreements (RFAs). Development of RFAs is the primary mechanism for implementing the National Forest Policy Statement (NFPS) also agreed to between the Commonwealth and State governments (Commonwealth, 1992).

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

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

The National Wilderness Inventory (NWI) is a geographic information system which analyses wilderness values across the Australian landscape by using a set of indicators to measure the essential attributes of wilderness - remoteness and naturalness. While the *Wilderness Act* methodology also measures the naturalness of a place, it also considers the potential to restore an area to a natural state. Size, and the ability of an area to provide opportunities to experience solitude and undertake self-reliant recreation are also evaluated.

In the Eden CRA region, both assessment approaches utilised the best available resource and disturbance data, including information on old growth forests, and logging and roading histories. The NWI upgrade revealed that three areas in the Eden region (Brogo, Nadgee and Genoa) currently meet the national criteria. Assessments under the *Wilderness Act* identified the same three areas, all though with different boundaries. The combined extent of the three delineated areas of “high quality wilderness” is 90877 hectares (Brogo - 66442 hectares; Nadgee - 16907 hectares; Genoa - 7528 hectares). Of this, 87142 hectares or 96% is within dedicated reserves. Although this reservation level meets the minimum wilderness protection target, the relevant technical framework document for NSW CRA/RFA assessments (EHTC, 1997) requires that, *a practicability assessment will need to be conducted if a reservation level less than 100% is sought*.

Currently, a total of 56,982 hectares has been declared (or approved for declaration) under the NSW *Wilderness Act 1987*, in the Eden CRA Region. This consists of the existing Brogo (31,997 hectares), Nadgee (18,885 hectares), and Genoa (6,100 hectares) wilderness areas.

The boundaries of wilderness areas identified under the provisions of the *Wilderness Act* should be considered in determining boundaries which maximise the protection of “high quality wilderness”.

1. BACKGROUND

1.1 NATIONAL FOREST POLICY STATEMENT

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

The National Forest Policy Statement (NFPS) sets out the process for undertaking joint Commonwealth and State/Territory Comprehensive Regional Assessments (CRAs) of natural and 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 they 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 is 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 comprehensive regional assessments (CRAs) and guide the establishment of the CAR reserve system within the RFA process (Commonwealth, 1997).

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

Implementation of the conservation initiatives of the NFPS, 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:

- *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 the regional context. These thresholds will take into account the importance of the indicators, and in particular the biophysical naturalness component as a primary indicator;*
- *the guideline for size which is considered generally appropriate for areas encompassing forested wilderness is 8000 hectares. However, thresholds of less than 8000 hectares may apply to areas contiguous with the sea or which adjoin wilderness areas in adjacent regions;*
- *the presence of "nodal" areas with higher wilderness quality may provide an indication of their significance and may guide the future management of identified wilderness areas;*
- *other factors which are not considered in determining the NWI rating may need to be considered, in determining wilderness quality. These factors may include the impacts of exotic*

plants and feral animals on biophysical naturalness; and

- *as forest and non-forest vegetation types form a mosaic, non-forest vegetation types may be included within largely-forested wilderness areas.*

The criterion which applies to wilderness protection is:

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

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

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

1.3 INTERIM ASSESSMENT PROCESS

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

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

The IAP was intended to precede the more detailed investigations of the CRA process in NSW. It is intended that its findings will be incorporated into the RFAs developed for individual regions.

1.4 RFA SCOPING AGREEMENT

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

- 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);
- a map identifying rational boundaries for protection of wilderness values; and
- 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 oversee the planning of the regional assessments outlined in the Agreement and to develop a technical framework for undertaking this work.

The Committee's report (EHTC, 1997), reiterates the JANIS wilderness requirements, stating that there is no inherent conflict between the NWI and *Wilderness Act* methodologies. In particular, it notes that both approaches recognise the need to establish rational boundaries for wilderness areas, *"An approach which takes management decisions (such as regenerating clearings or closing roads) into consideration is consistent with the*

Wilderness Act and NFPS definition of wilderness and will directly influence the future values of NWI indicators. The emphasis is on identifying rational and manageable boundaries for wilderness areas."

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

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

2. METHODS

2.1 INTRODUCTION

As noted earlier, the NSW RFA Scoping Agreement stipulates that wilderness identification in the CRA process should utilise both the National Wilderness Inventory (NWI) methodology and wilderness areas identified using the provisions of the NSW *Wilderness Act 1987*. This Section provides a summary of both of these approaches.

2.2 NATIONAL WILDERNESS INVENTORY

The National Wilderness Inventory (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).

2.2.1 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 undisturbed by the influence of modern technological society. These indicators are:

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

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

2.2.2 Primary Database

The primary data required for wilderness analysis consists of detailed infrastructure and land use information as outlined in Table 1. (The storage of this data within the NWI Geographic Information System (GIS) is described in the NWI Handbook [Lesslie and Maslen, 1995].)

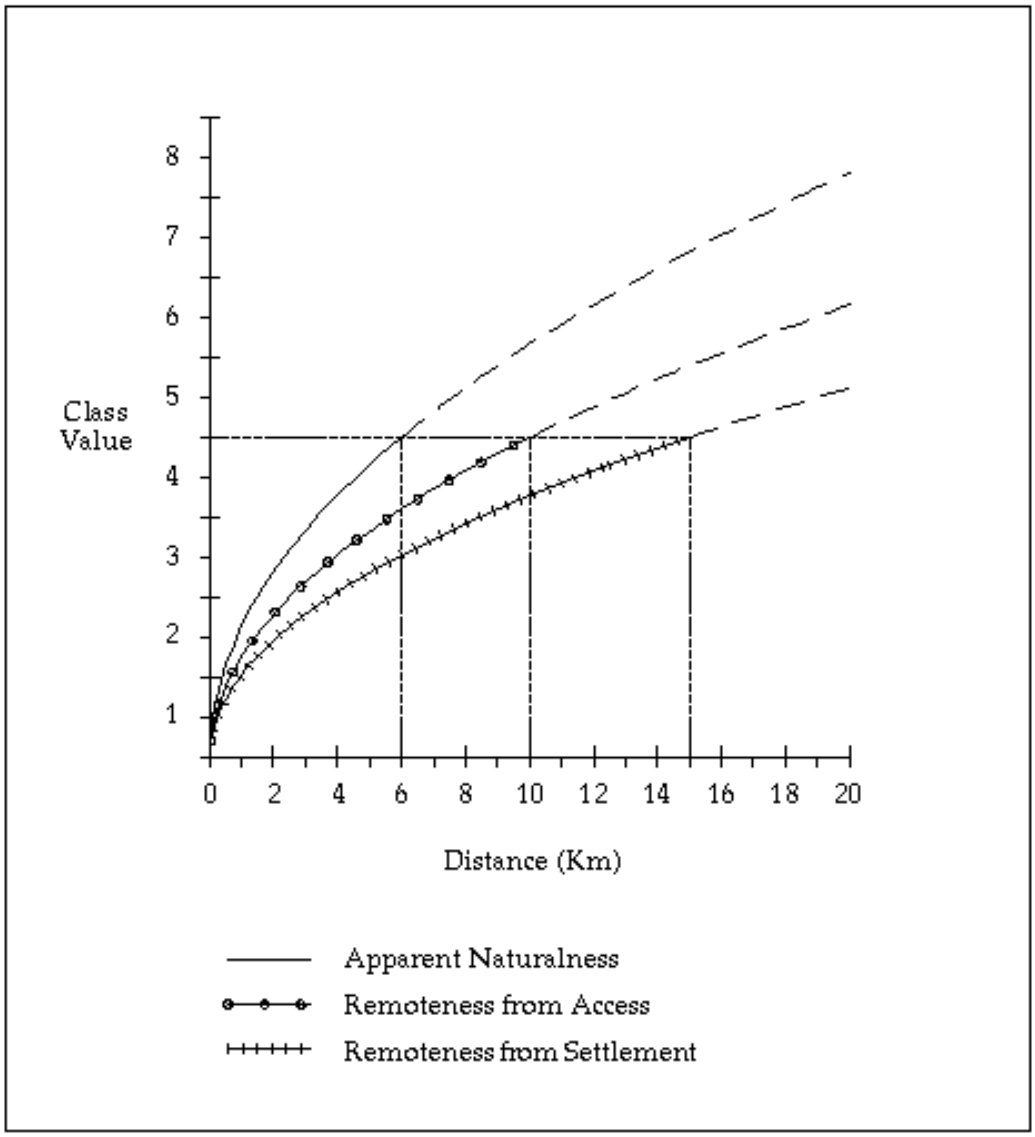
2.2.3 Wilderness Quality Database

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).

TABLE 1: PRIMARY DATA LAYERS

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

Figure 1- The Classification of Distance Based Indicator Values



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

Grading feature impacts

For each indicator, point, line and polygon features are grouped into the appropriate impact grade (for example, Remoteness from Access grades 1 to 4).

Distance Calculation

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

Minimum Weighted Distance Calculation

For each indicator, the distance measures are standardised using a weighting factor that reflects the grade of impact. This, in effect, converts all distances to be equivalent to those of high impacting features. The minimum, effectively the closest, of the standardised distances is recorded.

Indicator Classification

Minimum standardised distances are classified to produce consistent Remoteness from Settlement, Remoteness from Access, and Apparent Naturalness classes, with values of 0 to at least 5.

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

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

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

The rating scheme for Biophysical Naturalness used in the NWI is outlined in Table 2.

TABLE 2: BIOPHYSICAL NATURALNESS RATING SCHEME.

Indicator Value	NWI Descriptor for baseline NWI
5 High	Unlogged and ungrazed
4	Unlogged and ungrazed for at least (60)* years; excluding clear-felled and intensively grazed areas
3	Selective single logging; irregular grazing within preceding (60)* years
2	Light / Moderate grazing; repeated selective logging within preceding (60)* years
1 Low	Clear-fell logging operations and / or intensive grazing
0	Agricultural, urban and developed land, pine and other exotic plantations, reservoirs.

* threshold period may vary between regions

2.2.4 Deriving Wilderness Quality

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

The process of deriving a total wilderness quality index is illustrated in Figure 2.

Each grid cell across the project area is assigned a value for each of the NWI indicators. Areas with WQ index equal to or above 12.0 are considered significant. The presence of areas of very high NWI value, termed 'nodal areas' (that is, NWI > WQ 12), can help in assessing the significance of potential areas.

2.3 UPDATING THE NATIONAL WILDERNESS INVENTORY IN THE EDEN REGION

As stated previously, the NWI values for the Eden region were required to be updated as part of the CRA/RFA process.

The rating scheme adopted for upgrading the Biophysical Naturalness indicator in the Eden region is as shown in Table 3. The data layers used for this update are shown in Table 4.

TABLE 3: BIOPHYSICAL NATURALNESS RATING SCHEME AS APPLIED TO THE EDEN REGION

Indicator Value	NWI Descriptor for Eden regional update
5 High	No evident disturbance from grazing or logging; natural water bodies.
4	Record of pre-1960 selective logging; windthrow; evidence of logging from API and senescence dominant with no associated logging records; disturbance not obvious from satellite imagery.
3	Grazing (Brogo only); evidence of logging from API and senescence 10-30% and evident regrowth with no associated logging records.
2	Clear-fell or integrated logging records with evidence of regrowth and/or some senescence.
1 Low	Clear-fell logging and pre-1982 "integrated logging" with minimum seed trees left; recent logging, still evident on satellite images.
0	Agricultural, urban and developed land, pine and other exotic plantations, reservoirs.

2.3.1 Delineating NWI High Quality Wilderness in Eden

Delineation of identified areas 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:

- wilderness areas should preferably have a low perimeter-to-area ratio;
- 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 “on the ground”, 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 (20m) 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 “on the ground” 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.

Figure 2: Deriving Wilderness Quality

TABLE 4: PRIMARY DATA SOURCES FOR UPDATING NWI IN EDEN

Primary Data Layer	Data Provider	Source	Scale
API Old Growth Stages data	NSW NPWS	Aerial Photo interpretation	1:25000
API Floristic data	NSW NPWS	Aerial Photo Interpretation	1:25000
Logging History	State Forests of NSW		1:15,000
Logging History-updated from Landsat TM	Environment Australia - ERIN	Landsat Imagery	Landsat TM 30m
Brogo Wilderness Assessment - Logging History	NSW NPWS / State Forests of NSW	State Forests Harvest Plan Records	1:15,000
LIC Roads	NSW NPWS		1:100,000
SF Operational Roads	State Forests of NSW	SFNSW Maps	1:25,000
Eastern Bushlands database	NSW NPWS	Landsat Imagery	Landsat TM 100m

2.4 IDENTIFIED WILDERNESS - NSW WILDERNESS ACT

The assessment, identification, declaration and management of wilderness in NSW is principally guided by the *NSW Wilderness Act 1987*

Under this Act the National Parks and Wildlife Service (NPWS) may investigate any areas proposed for wilderness values. The Director-General of the NPWS may accept an area for investigation in response to a public proposal. Such a proposal may be made by any person, body or organisation, even though they may not be the owner of the land concerned. The Act ensures that, wherever possible, the owners of any lands included within a public wilderness proposal are notified of the proposal and assessment process.

While there exists a range of formal definitions and individual perceptions regarding what constitutes wilderness, the only definition of wilderness relevant to the CRA/RFA process is that contained within the *NSW Wilderness Act 1987*.

Section 6 (1) of the Act provides a definition:

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

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

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

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

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

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

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

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

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

This subsection of the Act 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 input of appropriate restoration measures to be identified as wilderness.. 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 which 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 makes it a wilderness.

On completion of the assessment process the Director-General of the NPWS will determine an *identified wilderness area*, that is an area meeting the wilderness requirements of the Act as described above. The Act requires the Director-General of the NPWS to conduct an assessment, and provide advice to the Minister for the Environment, in relation to a public wilderness proposal within a two year time frame.

The wilderness assessment process is undertaken independent of land tenure, and any resulting *identified* wilderness may include private lands (freehold or leasehold). However it is stated Government policy, reiterated on several occasions, that there is no resumption of private land for wilderness *declaration*. Wilderness cannot be *declared* over freehold or leasehold Crown land without a landholder's explicit consent. Wilderness *identification* simply represents the formal recognition of the wilderness quality of an area of land only, and in the case of private lands has no influence on how that land is managed. In particular, it does not restrict the existing legal access to, or use of, an area of private land by its owners.

An *identified* wilderness area is presented, along with other information from the assessment process, in a Wilderness Assessment Report which is then exhibited for public comment.

The criteria for identification of wilderness under the Wilderness Act are consistent with the NFPS definition of wilderness except that, in addition, the NFPS defines wilderness as being remote from the influences of European settlement.

2.4.1 Assessment Criteria under the *Wilderness Act 1987*

The method developed to assess 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. Such areas are usually evidenced by the presence of a substantially unmodified cover of native vegetation (Helman *et al.* 1976; Wilderness Working Group 1986).

Therefore, any measurement of the naturalness of an area is not a test of the absence or presence of modification but instead is an assessment of the degree of modification. Additionally, focusing on the impacts of European humans and their works, the question of possible landscape modifications by Aboriginal people over the longer-term is also not an issue in the legislative definition and identification of wilderness areas.

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 provisions regarding the ability of an area to be restored to an essentially unchanged natural state also indicates that some degree of human modification, within the bounds of restoration within a reasonable time frame, can be tolerated within an identified wilderness in the short term. Hence the naturalness component of a wilderness assessment is not a test of the presence or absence of modifications, but an assessment of the degree of modification, within an apparently natural area. These modifications may be from past land uses and activities, present or continuing land uses and activities, or both.

The modifications or disturbances that are evident in an area are considered in terms of their effects on, or changes to, the key components of the ecosystems that determine an area's naturalness. Changes in structure and composition usually of vegetation communities, are the most easily measured of these components.

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

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

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

- Disturbed Natural: vegetation used for limited-impact activities (such as selective timber harvesting or light grazing) but where the original composition and structure remain basically intact, and vegetation is likely to recover within a relatively short period should any disturbances cease;
- Degraded Natural: vegetation has been intensively used, its basic structure has changed and recovery is likely to be a long process if possible at all; however there has been no direct or deliberate attempt by humans to replace native species with introduced species or to effect change through fertilisers; and
- Cultural: native vegetation largely or completely replaced by an exotic vegetation (such as pine plantation or introduced pastures).

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. Lesslie *et al.'s* method places an emphasis on the current intensity of disturbance and 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 which already occurs 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 on 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); and
- 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).
- small parcels are more able to be invaded by exotic plant and animal species and impacted by broad area disturbance such as fire.

Essentially, the aim in capturing larger areas will allow a greater 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 a number of approaches to defining the recreational and experiential indicators for wilderness on the basis of size or remoteness (Helman *et al.* 1976; Lesslie *et al.* 1987). However the Act only requires wilderness areas to 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 firstly does not utilise motorised/mechanised or other forms of assisted transport. Secondly it which does not diminish the biological integrity of an area..

2.5 PREVIOUS NSW WILDERNESS ACT (1987) ASSESSMENTS IN THE EDEN REGION

Within the Eden CRA region four areas have previously been assessed and identified as wilderness. These are: Genoa, Nadgee, Coolangubra, and Brogo.

The Nadgee wilderness was identified in 1991 Subsequently 13,775 hectares of the identified wilderness was declared in 1994. As a result of the interim Assessment Process a further 2,150 hectares of the original identified wilderness was incorporated into the existing Nadgee wilderness and declared in July 1997. A further 2,960 hectares of the identified wilderness was State forest, this area has since been transferred into Nature reserve and its declaration as wilderness is pending.

The Genoa and Coolangubra Identified wilderness areas were assessed together in 1989. The assessment identified approximately 25000 hectares of land known as the Coolangubra wilderness , this comprised of much of Nalbaugh National Park, and areas of Coolangubra, Nalbaugh and Bondi State forests. To date no part of the Coolangubra area has been declared wilderness. The Genoa identified wilderness within Nungatta National Park comprising 6100 hectares was declared in 1992.

The original Brogo wilderness 31997 hectares was declared under Section 59 of the National Parks and Wildlife Act 1974 in 1983 and gazetted under Section 8 (1a) of the Wilderness Act in 1992. Figure 3 indicates those areas of identified and declared wilderness under the Wilderness Act 1987.

Figure 3: NSW Identified and Declared Wilderness with Tenure prior to January 98

2.6 ASSESSMENT OF THE ADDITIONS TO BROGO WILDERNESS

The only wilderness assessment undertaken within the Eden region has been the additions to the existing Brogo Wilderness. All other nominated or identified areas within the Eden CRA region have previously been assessed under the Wilderness Act 1987 and therefore were not reassessed.

A public nomination was received by the Director -General of NPWS outlining that the areas surrounding the existing Brogo Wilderness should be assessed for their wilderness qualities. This nomination included areas outside the Eden CRA boundary, however as they were proposed as additions to existing Brogo the complete nomination was assessed. Parts of the nomination which fall outside the Eden CRA region are to be included in the Southern CRA region.

The Brogo Wilderness Study Area covers more than 65900 hectares. It is predominantly public land, a few crown leases which were included in the public wilderness proposals and minor areas of freehold land.

The Study Area includes those parts of Wadbilliga National Park, and South-East Forests National Park (Bemboka Section) considered to have high wilderness values. It also covers part of Wandella, Murrabrine and Glenbog State Forests, including Illawambra and Paddys Creek Flora reserves.

In accordance with the requirements of the Wilderness Act 1987, the additions to the Brogo wilderness were assessed using the requirements under Section 6 of the Act, mainly naturalness, size, and ability to provide solitude and self reliant recreation.

Naturalness Assessment

The naturalness assessment of the study area employed a three-tiered methodology (Figure 4). This method used an analytical approach based on weighting past land use disturbance and ecosystem recovery or recoverability to classify an area into one of the four Laut et al. categories (and incorporating a consideration of restorability) which were, in turn, related to the naturalness provisions of the Act.

As discussed, the Wilderness Act 1987 specifies three classes of naturalness in relation to wilderness identification, these are:

- substantially unmodified;
- modified, but capable of restoration within a reasonable time; and
- modified and not capable of restoration in a reasonable time, but needed for management purposes.

By exclusion the Act also recognises lands that are “substantially modified” and so, generally, not able to be identified as wilderness.

As explained in section 2.3, Laut et al. (1977) recognises four categories of vegetation disturbance or naturalness, namely:

- “undisturbed natural”
- “disturbed natural”
- “degraded natural”
- “cultural”.

Description of the Analytical Weighting System

All known disturbances (past and present) that were likely to effect the naturalness of a site were identified throughout the entire study area. Each type of disturbance was given an independent disturbance (or impact) and recovery or recoverability weighting. A Delphi approach was taken where a numerical figure was assigned to each criteria against which a ranking value was given to each area. Delphi is a systematic process of obtaining and processing expert judgements (McAllister 1990) and can also be used to reduce the bias of individual evaluators.

Quantification of information and values is useful because it provides for a repetitive evaluation between different observers (Usher 1986) and sites; it is more reliable than most systems; it is capable of ranking sites in order of importance and is less vulnerable to dispute (Goodfellow & Peterken 1981).

Disturbance weightings between 1 and 30 were finalised by an expert panel - 1 correlating to minimal disturbance of a site’s natural ecosystem, to 30 indicating extreme ecosystem disturbance.

Recoverability weightings between 1 and 10 were determined, again by the expert panel, according to the estimated time required for the

"naturalness" of an ecosystem to return - 1 indicating minimal time, to 10 indicating a period in excess 25 years being necessary for acceptable ecosystem recovery. Recoverability weightings are a function of the time taken for an ecosystem to recover, from the disturbance in question, to an acceptable degree of naturalness. The actual application of recoverability weightings also considered the age of the disturbance in question (Table 5).

As the native vegetation is reasonably homogenous across the whole study area, the same disturbance and recoverability weightings were able to be applied across the area as a whole.

Where a disturbance weighting was recognised as impacting an area's naturalness, either a present disturbance or a past disturbance from which the area was yet to adequately recover, then the relevant disturbance weighting and correlating recoverability weighting were multiplied. The resulting value, referred to as an "impact weighting" indicates the compounded effect of disturbance and recoverability for that activity and the time since its occurrence at the site in question. Multiple impacts could be identified and assessed for the same area. For example an area may have been subject to past logging as well as a human-modified fire regime and also be subject to current recreational use. In such cases the relevant impact weightings for each disturbance were simply added for those areas where the disturbances physically overlap.

Disturbances were first addressed at a regional or overview scale within the study area. This discriminated between those areas that could readily be determined as being within or outside the of acceptable naturalness limits (as discussed below). All areas were then subject to more detailed investigation, focused largely on these previously identified areas of disturbance. As a result these areas of disturbance (including cumulative disturbances) were refined and localised, and many parts of the areas initially assessed as too disturbed were subsequently considered to fall within acceptable naturalness limits. The result of this process was a range of impact weightings allocated to site specific areas of known disturbance (including cumulative disturbances where appropriate) across the entire study area.

This range of analytically derived impact weighting's was then matched to the four disturbance categories described by Laut et al. through (Figure 4):

- the application of expert local knowledge to identify acceptable cumulative impact thresholds for each Laut *et al.* disturbance category, within the context of the study area's ecosystems and local conditions; and
- consideration of the impacts generally accepted within each Laut et al. category in previous NPWS wilderness assessments.

The following forms of development or land use and their attendant disturbances have been considered as acceptable for identification as wilderness - subject to a commitment to removal and the restoration of wilderness values where necessary or appropriate - in previous NPWS wilderness assessments. Such disturbances include:

- four-wheel drive tracks, logging tracks, or mining tracks;
- fence lines, minor tanks, or bores;
- sparse, intermittent, or seasonal grazing;
- past light selective logging in limited areas;
- more intensive developments or land uses, such as clearings or past settlements, where limited in size and surrounded by less disturbed lands; and
- more intensive developments or modified areas that are capable of restoration within a reasonable time frame.

Such disturbances have previously been included in Laut *et al.'s* "disturbed natural" category or, less often, classed as "degraded natural" but considered capable of restoration.

The resultant match of analytically derived impact weightings to Laut *et al.* categories, specific to the Brogo wilderness study area , is as follows:

- "undisturbed natural" equated to an impact weighting range of 50 to 100;
- "disturbed natural" equated to 80 to 220;
- "degraded natural" equated to 185 to 555; and
- the "cultural" classification equated to the higher end of the "degraded natural" range, and above (and was not addressed in detail as these areas were considered to already be well beyond any wilderness identification threshold).

TABLE 5: DISTURBANCES AND RESPECTIVE IMPACTS WEIGHTING WITHIN THE BROGO WILDERNESS ASSESSMENT

Impact	Source of Impact	Range of Impact Weighting Rating for each Disturbance	Range of Recoverability Weighting for each Disturbance
Fire (no. since 1970)	1,fire,2 fires, 3 fires, 4 fires, 5 fires	0-30	1-10
Logging	minor	2-30	1-10
	light selective logging		
	moderate selective logging		
	heavy logging (pulp and sawlog)		
Grazing (non-cleared)	open range	1-6	2-5
	seasonal		
	continuous		
Agriculture	native pasture	1-20	2-10
	native fenced		
	chemically improved		
	physically improved		
	apiary		
Cultural Sites	domestic (e.g. hut ruins)	1-3	1-3
	industry (e.g. gold mine)		
Recreation (activity)	bushwalking	1-5	1-5
	horseriding		
	4WDing		
	2WDing		
Access Tracks	bridle/walking	2-10	1-5
	4WDing		
	2WDing		

There is an obvious overlapping of impact weightings when matched to Laut *et al.'s* disturbance categories. This can be explained chiefly by the fire and logging disturbances and the weighting scales applied to each. Fire and logging are considered to be the major broad-area ecosystem disturbances within the study area, and so were the major determinants of which Laut *et al*. category a disturbed area represented. The consideration of other disturbances, in addition to fire and logging, produced the overlap and flexibility in the categorisation as evident above. The increasingly wide impact weightings evident in the progressively more disturbed Laut *et al.* categories is consistent with the observed reality of the escalation of ecosystem disturbance in those areas subject to a diversity of activities and their impacts. Conversely only a narrow range of impact weightings, from a more limited set of disturbances, was considered acceptable within the less disturbed Laut *et al.* categories.

As discussed in Section 2.3, Laut *et al.'s* native vegetation disturbance categories provide a means of expressing the naturalness criteria of the Wilderness Act 1987 as a set of workable or operational criteria. This requires that Laut *et al.'s* categories, as applied across and specific to the Brogo wilderness study area, be related or matched to the assessment of naturalness as legislatively relevant under the Act.

As shown on Figure 4, areas that could be classed substantially unmodified under the Act are well represented by Laut *et al.'s* "undisturbed natural" category and, depending on the type and age of the disturbances involved, the less modified end of the "disturbed natural" category. Lands which the Act considers as modified, but restorable, principally equate to the Laut *et al.* "disturbed natural" category and, again depending on the type and age of the disturbances, a very small range at the less modified end of the "degraded natural" category.

This match of legislative descriptions and operational criteria effectively placed the threshold for wilderness value at around the total impact weighting range of 200 to 250. This

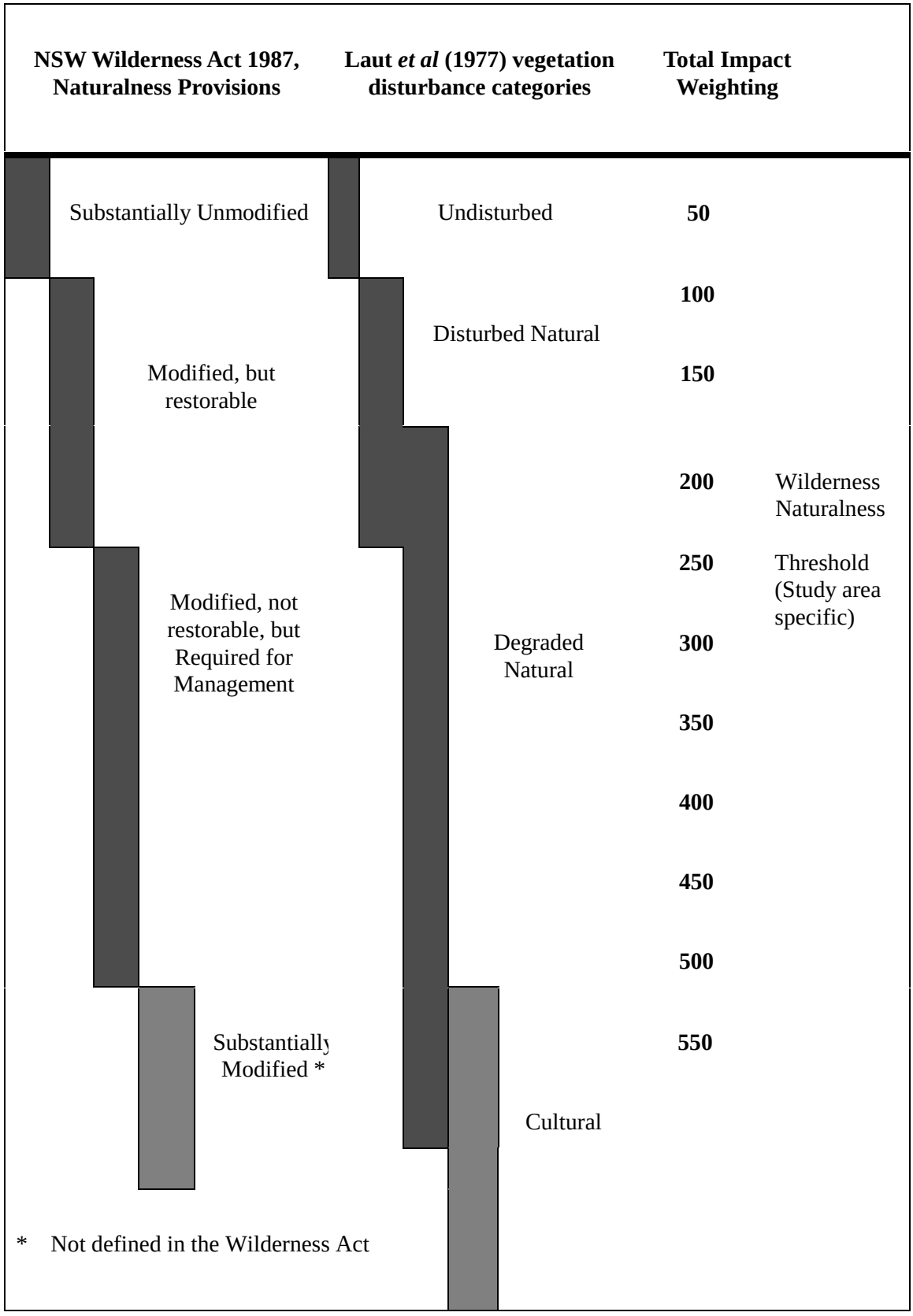
threshold represents the more modified end of the "disturbed natural" category and much less impacted end of the "degraded natural" category. Areas with a cumulative impact weighting of less than 250 were considered to already meet the naturalness criteria for wilderness identification, or were capable of doing so within a reasonable period. Areas having a cumulative impact weighting over 250 were considered to not meet the naturalness criteria for wilderness identification, even following consideration of the Act's restoration provisions. (It should be stressed that this threshold is specific to the Brogo study area, and will vary in other regions where differing environmental conditions and past land uses prevail.)

It should be noted that this wilderness "naturalness" threshold of 200 to 250 represents only the lower, least disturbed, end of the entire natural lands spectrum as described by Laut *et al.*. Many areas that would appear natural to the majority of people, and classed under Laut *et al.* as "degraded natural", are beyond the acceptable limits of naturalness for wilderness identification. This is entirely consistent with the position of wilderness at the least disturbed and modified end of the land use spectrum, including otherwise natural lands, as discussed previously in Section 2.

As also shown on Figure 4 although not meeting the criteria (and 250 threshold) for naturalness, areas classed by the Act as modified but required for management purposes may occur throughout Laut *et al.'s* "degraded natural" and, possibly, the "cultural" categories.

The remaining two criteria for size and solitude, have been assessed as meeting these criteria as the area assessed are merely additions to the existing Brogo wilderness, which has previously met both these criteria.

Figure 4: Relationship of Wilderness Act Definitions, Laut* et al *(1977) Categories, and Analytically - Derived Impact Weightings on the Assessment of Naturalness (Specific to Brogo Wilderness Study Area)



3. RESULTS

3.1 DELINEATED NWI RESULTS

The NWI upgrade revealed that three areas in the Eden region (Brogo, Nadgee and Genoa) meet the JANIS criteria for defining "high quality wilderness" (minimum NWI rating of 12 and a minimum size of 8000 hectares). The NSW component of Genoa meets the minimum size threshold when considered together with the adjoining wilderness area in Victoria.

The combined extent of the three delineated wilderness areas in the Eden region is 90876.5 hectares (Brogo - 66442 hectares; Nadgee - 16906 hectares; Genoa - 7528 hectares), as shown in Figure 5.

The metadata for delineated NWI is provided in the Appendix.

3.1.1 Assessment of the Additions to the Brogo Wilderness

Based on the findings of the wilderness assessment documented in the preceding sections, and consistent with the requirements of Section 6 of the *Wilderness Act 1987*, the bulk of the Brogo Wilderness Study Area has been provisionally identified by the Director-General of NPWS as meeting the criteria for wilderness. This area is referred to as the Provisionally Identified Additions to the Brogo Wilderness. (hereafter referred to as the Provisionally Identified Wilderness Additions).

The Provisionally Identified Wilderness Additions incorporate the majority of the central sections of Wadbilliga National Park, almost all of South-East Forests National Park (Bemboka Section) excluding a small section in the south western, the greater part of Murrabrine State Forest. The northern section of Wadbilliga National Park, and the western portion of Wandella State Forest whilst assessed under this process will require further consideration in the Southern CRA region.

The Provisionally Identified Wilderness Additions (Figure 6) is approximately 44067 hectares across three types of land tenure as shown in Table 6.

TABLE 6: LAND TENURE WITHIN THE PROVISIONALLY IDENTIFIED WILDERNESS ADDITIONS WITHIN EDEN CRA REGION

Tenure	Area (ha)*
Wadbilliga National Park	22305
South-East Forests National Park (Bemboka Section)	14716
SUB TOTAL	37021
Murrabrine State Forest	6553
Other	493
TOTAL PROVISIONALLY IDENTIFIED ADDITIONS	44067

*Area cited have been taken from a variety of land tenure data soures and may be subject to minor variations

Figure 5: Map of Delineated and Undelineated NWI in the Eden Region as at September 1997

Figure 6: Provisionally Identified Additions to Brogo Wilderness as at December 1997

4. CONCLUSION

4.1 CONSERVATION OUTCOMES OF NWI WILDERNESS UNDER JANIS

To determine the reservation status for JANIS high quality wilderness, the delineated areas of NWI high quality wilderness were intersected with the existing land tenure boundaries (Figure 7). This integration found that 87142 hectares of the 90877 hectares (96%) are currently within dedicated reserves (Tables 6 and 7).

As discussed above, for management purposes, the delineation of high quality wilderness may incorporate non-high quality wilderness. As a result, there is a small portion of private land included in the delineated NWI area in Genoa. There is also a small portion of State forest within the Nadgee NWI area. Within the Brogo NWI Wilderness area there are small pockets of freehold/leasehold land, other crown land, and a portion of Murrabrine State Forest (Figure 7).

TABLE 6: EXTENT OF NWI HIGH QUALITY WILDERNESS IN DEDICATED RESERVES

Place	Total Area (ha)	Area in Reserves (ha)	Proportion in Reserves (%)
Brogo	66442	63128	95
Nadgee	16907	16887	99
Genoa	7528	7127	95
Total	90877	87142	96

TABLE 7: EXTENT OF NWI HIGH QUALITY WILDERNESS ON DIFFERENT LAND TENURES

Tenure	Brogo (ha)	Nadgee (ha)	Genoa (ha)
National Park or Nature Reserve	63128	16887	7127
State Forest	2664	19	0
PMP 1.3*	294	0	0
Other Crown Land	208	1	0
Private Land	108	0	400
Reserved Crown Land	29	0	0
Leasehold Crown Land	11	0	1

*PMP 1.3 is the State Forests of NSW Preferred Management Priority Classification for areas reserved as Flora Reserves and Forest Preserves (Forestry Commission of NSW 1993)

4.2 CONSERVATION OUTCOMES OF IDENTIFIED WILDERNESS UNDER THE WILDERNESS ACT

The assessment of the Additions to the Brogo Wilderness conducted in the Eden CRA region have met all the requirements of the *Wilderness Act 1987*. The resulting report for the assessed area are to be submitted for public comment and then approved by the Director General. Until approval by the Director General all areas are provisionally identified wilderness areas.

As previously stated the Additions to the Brogo Wilderness was the only area assessed under the CRA process, all other areas had been previously assessed under the NSW legislation. Figure 8 indicates all areas of Provisionally identified and declared wilderness within the Eden CRA region.

Further areas bordering the Eden CRA region which have been nominated or identified will be assessed under the CRA process for the remaining regions.

4.3 OUTCOMES FOR REGIONAL FOREST AGREEMENTS

While the minimum wilderness reservation requirements of JANIS have been met, the EHTC report requires that, “A practicability (or validation) assessment will need to be conducted if a reservation level less than 100% is sought.”. There is no practicable constraint to achieving the maximum target of 100%.

None of the three delineated areas of high quality wilderness are currently located entirely within dedicated reserves. The majority of Murrabrine State Forest, within the delineated Brogo wilderness, represents the largest single unreserved area of high quality wilderness.

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

As previously stated the target for wilderness in the Eden CRA has been set by the JANIS criteria. Therefore the areas identified as wilderness under the Wilderness Act have not been taken into consideration. To ensure maximum wilderness protection the identified wilderness layer 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 identified wilderness areas should be given primacy in reserve design (Figure 9).

Figure 7: Delineated NWI overlaid with Tenure Layer

Figure 8: Provisionally Identified and Declared Wilderness with Tenure

Figure 9: NSW Identified and Declared wilderness areas with Delineated NWI

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6. APPENDIX

6.1 METADATA STATEMENTS

Title	**National Wilderness Inventory Delineated Boundary Eden Region NSW**
Custodian	Environment Australia
Contact Organisation	Wilderness and Wild Rivers Section
Contact Position	NWI Co-ordinator
Mail Address	GPO Box 1567
City	Canberra
State	ACT
Post Code	2601
Telephone	(02) 6217 2014
Facsimile	(02) 6217 2000
Electronic Mail Address	NWI.Communal@dest.gov.au
Description	The delineated boundary of the National Wilderness Inventory (NWI) database, according to the JANIS criteria for inclusion in the Eden CRA Wilderness Report.
Keywords	Land Cover, Heritage, Wilderness, Forest, Disturbance, Human Environment, Land Use Survey, GIS.
Dataset Polygon	xmin: 148.5, ymin: -36, xmax: 150, ymax: -37.5
Non-digital Form	Maps, published and produced for specific projects.
Digital Format Specification	ARC/INFO -polygons
Lineage	Eden region NWI update Wilderness Quality 12 and above of 8,000 ha and above was scaled to 1:100,000. (The area of WQ 12 and above which abutted Genoa, Victoria, was included as an area over 8,000ha.) The resultant polygons were delineated by overlaying Topo 1:100,000 map sheets, LIC roads (buffered by 50m) and NPWS and State Forests tenure to derive "rational boundaries". Local knowledge of terrain from NSW NPWS officers was also used. Data for the NWI was the best available at 19 September 1997 but some datasets may have been sourced prior to this date. Refer to the Eden CRA Report for reasons to explain delineation choices specific to the Eden update.
Positional Accuracy	NWI Delineated Boundaries - 1:100,000 The final coverage is in AMG55 projection (units meters).
Attribute Accuracy	Attributes are classified according to feature codes as described in the National Wilderness Inventory Handbook, Second Edition, 1995. Verification of feature codes done at summary level (i.e. grades of impact) using expert knowledge and results of interim analysis.
Logical Consistency	Topological checks undertaken by ARC/INFO, all source data checked prior to analysis, some allowance given to dangles in line data, otherwise consistency ensured. NWI database point data consistency ensured through ARC/INFO.
Completeness	Database covers all natural land cover areas only, and all records contain standard NWI attributes.
Beginning Date	September 1997
Ending Date	current
Status	Complete. Updated in co-operation with state regional projects.
Access Constraints	Unrestricted. Permission, Acknowledgment and Data Agreements are required.
Metadata Date	September 1997

Further Information	

Title	**National Wilderness Inventory Database (NWI)** **Eden Region NSW**
Custodian	Environment Australia
Contact Organisation	Wilderness and Wild Rivers Section
Contact Position	NWI Co-ordinator
Mail Address	GPO Box 1567
City	Canberra
State	ACT
Post Code	2601
Telephone	(02) 6217 2014
Facsimile	(02) 6217 2000
Electronic Mail Address	NWI.Communal@dest.gov.au
Description	The description of the data for the Eden region is in accord with the National project outlined below. The Australian National Wilderness Inventory is an environmental database and a set of modelling procedures which are designed to assist in the planning and management of remote and natural lands in Australia. NWI survey work is implemented by measuring variation in Wilderness Quality across the landscape using four Wilderness Quality 'indicators' that represent the two essential attributes of wilderness: remoteness and naturalness. These are derived from the definition of Wilderness Quality as the extent to which a location is remote from and undisturbed by the influence of modern development. Indicators are: Remoteness from Settlement, Remoteness from Access, Apparent Naturalness and Biophysical Naturalness. The NWI database is constructed by establishing a lattice of sampling points across all areas selected for inclusion in the survey. A range of measurements are calculated for each sampling point which are then processed to produce values for each of the four wilderness quality indicators. These indicators are, in turn, processed to produce a total wilderness quality index. The NWI database consists of all measurements used to derive wilderness indicator values, the wilderness indicator values themselves, and a final Wilderness Quality index.
Keywords	Land Cover, Heritage, Wilderness, Forest, Disturbance, Human Environment, Land Use Survey, GIS, NWI.
Dataset Polygon	xmin: 148.5, ymin: -36, xmax: 150, ymax: -37.5
Non-digital Form	Maps, published and produced for specific projects.
Digital Format Specification	ARC/INFO - grids.
Lineage	Eden region baseline data was collected from 1:250,000 scale National Topographic Map Series (digitised by the NWI team). Updated roads (NSW LIC) at 1:100,000; Operational roads (NSW State Forests) at 1:25,000; API floristics and Growth Stage layers (NSW NPWS) from Landsat at 100m; Eastern bushlands (NSW NPWS) from Landsat at 100m; Coups layer to 1996 (NSW State Forests) at 1:15,000; Coups Layer to 1997 (Environment Australia) from Landsat TM at 30m; and Brogo logging history (NSW NPWS) at 1:15,000. Data was the best available at 19 September 1997 but some datasets may have been sourced prior to this date. Refer to the National Wilderness Inventory Handbook, Second Edition, 1995. Australian Heritage Commission for a complete detailed account of the basic methodology used for the national database. The Eden CRA Report gives an account of the ratings for Biophysical Naturalness specific to the Eden update.
Positional Accuracy	Remoteness from Settlement - 1:250,000 Remoteness from Access - 1:100,000 Apparent naturalness - 1: 250,000 Biophysical Naturalness - 1:25,000 Wilderness Quality - 1:250,000 The final Grids are in AMG55 projection (units meters).

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Attribute Accuracy	Attributes are classified according to feature codes as described in the National Wilderness Inventory Handbook, Second Edition, 1995. Verification of feature codes done at summary level (i.e. grades of impact) using expert knowledge and results of interim analysis.
Logical Consistency	Topological checks undertaken by ARC/INFO, all source data checked prior to analysis, some allowance given to dangles in line data, otherwise consistency ensured. NWI database point data consistency ensured through ARC/INFO.
Completeness	Database covers all natural land cover areas only, and all records contain standard NWI attributes.
Beginning Date	1986
Ending Date	Current at September 1997
Status	Complete.- Updated in co-operation with state regional projects.
Access Constraints	Unrestricted. Permission, Acknowledgment and Data Agreements are required.
Metadata Date	September 1997
Further Information	Contact primary data custodians to confirm accuracy in "Lineage" and "Positional Accuracy" sections.