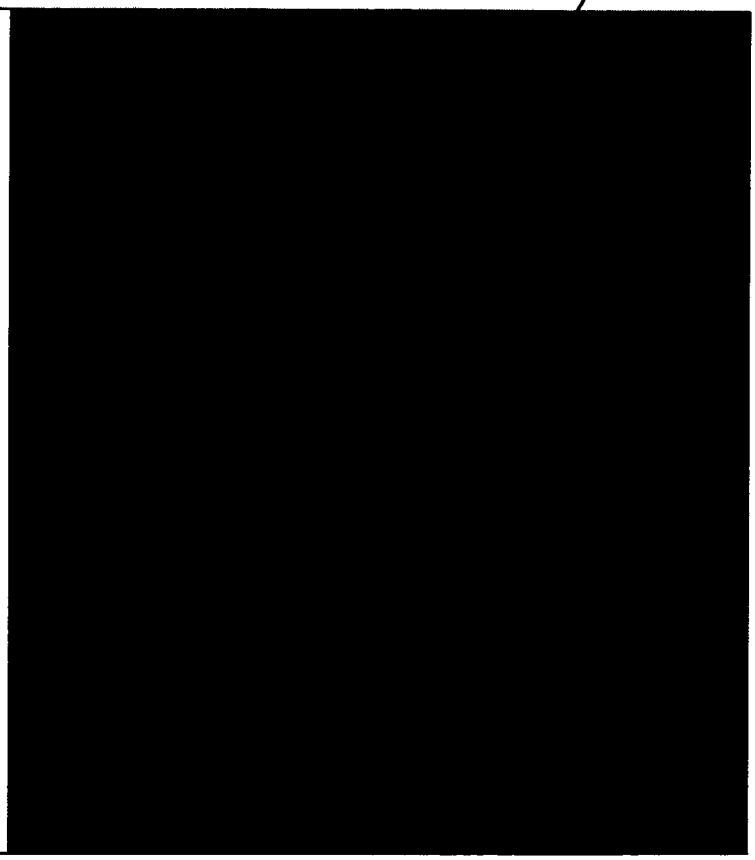
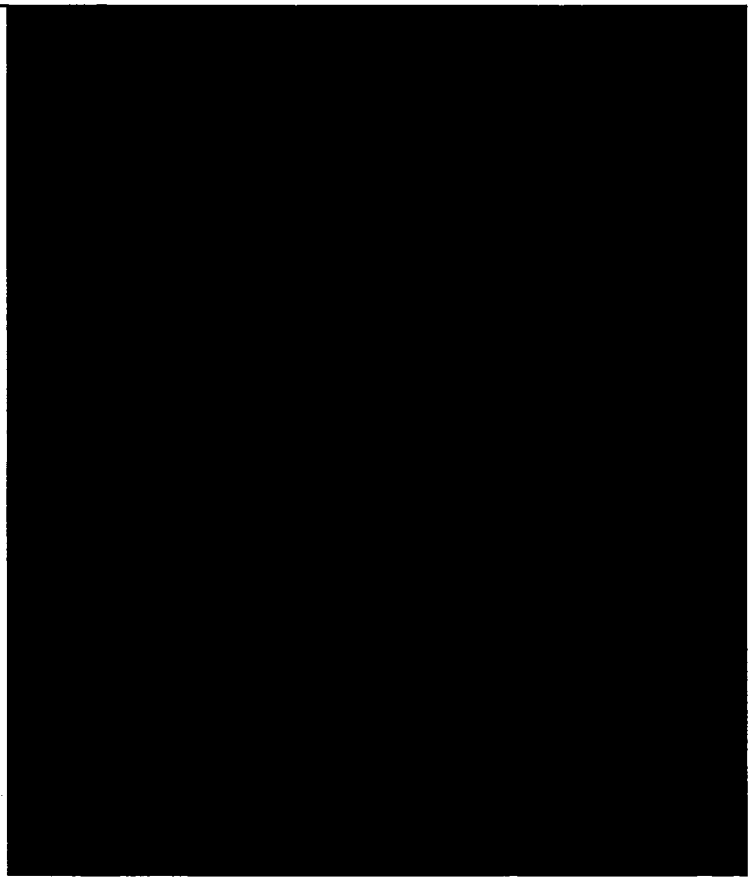


Identification, Assessment and Protection of National Estate Values in Upper North-Eastern NSW CRA Region – Part A Natural Values

A report undertaken for the NSW CRA/RFA Steering Committee

February 1999



Identification, Assessment and Protection of National Estate Values in Upper North-Eastern NSW CRA Region

(Part A – Natural Values)

ENVIRONMENT AUSTRALIA

A report undertaken for the NSW CRA/RFA Steering Committee project numbers NA 59/EH, NA 65/EH

February 1999

Report Status

This report has been prepared as a working paper for the NSW CRA/RFA Steering Committee under the direction of the Environment & 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 by Environment Australia. NSW National Parks and Wildlife Service oversaw and developed the methodology for the identification and assessment of centres of endemism.

EXECUTIVE SUMMARY

This report has been prepared for the joint Commonwealth/State Senior Officials Committee which oversees the comprehensive regional assessments of forests in New South Wales. This report should be read in conjunction with Part B, which summarises the results of the assessments of cultural values in Upper North-eastern NSW.

The comprehensive regional assessments (CRAs) provide the scientific basis on which the State and Commonwealth governments will sign regional forest agreements (RFAs) for the major forests of New South Wales. These agreements will determine the future of the State's forests, providing a balance between conservation and ecologically sustainable use of forest resources.

As defined in the *Australian Heritage Commission Act 1975*, the national estate comprises:

> *those places, being components of the natural environment of Australia, or the cultural environment of Australia, that have aesthetic, historic, scientific or social significance or other special value for future generations as well as for the present community.*

This report was undertaken to document the methodology and rule-sets used to identify potential areas of natural national estate significance. The work was undertaken by Environment Australia (EA) and NSW National Parks and Wildlife Service (NPWS) in consultation with State Forests New South Wales (SFNSW).

The process of identifying potential national estate involved asking a series of expert panels to identify species, known areas or landscape features (such as rock outcrops for example) that met the requirements for national estate criteria. The outputs from these workshops were combined with the result of literature reviews and the experience of previous CRAs to create rule-sets. Where available, separate rule-sets were used for species based analysis and the identification of landscape features or areas. Rule-sets were then applied to data gathered during CRA assessments. The results of different rule-sets were cross-validated to generate the final set of layers. These are expressed in terms of relevant criteria. Areas identified in this report as having potential national estate value are indicative only and are not necessarily the delineated forested areas that will be listed in the Register of the National Estate.

The results of these analyses are presented here.

Note: All area calculations contained in this report are based on grid analysis and are therefore have a minimum resolution, in most cases 100 m (one hectare) for localised values and 500 m (25 hectares) *for extensive values. Consequently all area figures should be regarded as indicative only.*

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1. INTRODUCTION

The development of the Regional Forest Agreement (RFA) between the New South Wales and Commonwealth Governments involves a number of stages. The comprehensive regional assessment (CRA) has involved both governments in a wide array of projects to provide the necessary information to identify forest associated values and determine possible approaches for an RFA. Later stages include the integration of social, economic, environment and heritage values in the region, public consultation and drafting of the RFA.

This report presents the results of the assessment of natural national estate values conducted as part of the CRA and identifies indicative areas of national estate value in the region. The work was conducted as part of the following projects:

"JANIS Conservation Requirements and Natural National Estate Identification, Assessment and Protection for the Upper North East and Lower North East CRA Project". (Conservation requirements will be reported on separately); and

"Extensive Natural National Estate Values for the Upper North East and Lower North East CRA Project".

Under the National Forest Policy Statement (NFPS 1992) Commonwealth, State and Territory Governments agreed to the assessment of national estate values of forests. Attachment 1 of the NSW CRA/RFA Scoping Agreement requires the CRAs to 'identify, assess and document national estate values including natural and cultural heritage in NSW to satisfy Commonwealth obligations under the *Australian Heritage Commission Act 1975*.'

Key points from the Scoping Agreement include:

- Identification to be undertaken jointly by the Australian Heritage Commission (the Commission) and NSW in accordance with national estate criteria for identifying places of significance;
- Values identified and methodologies utilised to be jointly agreed between the Commission and NSW;
- Identification, delineation and mapping of national estate values and places;
- Assessment of current levels of protection of national estate values and places;
- Identification of conservation principles for the protection of national estate values and places;
- Documentation of agreed methodologies; and
- Documentation sufficient for interim listing in the Register of the National Estate (RNE) where appropriate.

As defined in the *Australian Heritage Commission Act 1975*, the national estate comprises:

> *those places, being components of the natural environment of Australia, or the cultural environment of Australia, that have aesthetic, historic, scientific or*

social significance or other special value for future generations as well as for the present community.

The Australian Heritage Commission's responsibility is to identify the national estate and under section 30 of the Act, to advise the Commonwealth Government on the protection of national estate places and the potential impact on national estate values of Commonwealth decision relating to those places. The Act also requires the establishment of the Register of the National Estate. The Register includes places of importance at a local, regional or national level. The identification and assessment of places for listing in the Register is guided by the national estate criteria.

The information documented in this report will be taken into account in delineating national estate places. Areas endorsed by the Australian Heritage Commission (AHC) will be interim listed in the Register of the National Estate. The interim listing of areas will then be advertised and subject to the statutory period of three months allowed for objections and public comment. Interim listing of areas identified through this process is expected to take place after the RFA for Upper North-Eastern NSW is signed.

2. PROCESS

2.1 Criteria

Natural values in Upper North-Eastern NSW CRA region were assessed against the national estate criteria. Identification and treatment of natural values follows three broad subdivisions:

- extensive natural values;
- localised biodiversity values;
- other natural values, including those relating to geology, geomorphology and soils.

In the regional context, assessment of the national estate requires a comparative appraisal of the significance of places having one or more attributes or values. The values are derived from the national estate criteria which are reproduced in Appendix A.

Indicators of significance vary across the national estate natural values and include:

- rarity or threat;
- distribution pattern;
- condition and integrity;
- diversity or richness;
- outstanding example.
- representativeness

2.2 Thresholds

In order to identify areas of potential and indicative significance for natural national estate values a threshold level is set. Areas that exceed this threshold are regarded as meeting the criteria required for national estate listing. Thresholds are set in relation to the significance indicators and are specific to each national estate value. The development of thresholds for national estate significance varies depending on the level of current knowledge about the nature and extent of the values and their distribution in the landscape at a local, regional or national level.

2.3 Data

The area being assessed for natural national estate included all the forested public and private lands in the Upper North-Eastern NSW CRA region. Adjacent areas in Queenslands, western NSW and Lower North-Eastern NSW were used as context information, particularly where area thresholds were used in assessing criteria.

The major data sets used were:

- flora - flora data was provided by the NSW National Parks and Wildlife Service and comprises a subset of the total sum of flora data. This sub-set has had basic validation done including the removal of gross errors. For the purposes of the work conducted for national estate, the data set was taken to have an average spatial reliability of 1 km. The use of point records was avoided because of the problems of spatial uncertainty. This data-set was primarily used for richness analysis analysis.

- fauna - fauna data was provided by the NSW National Parks and Wildlife Service and consisted of NSW Wildlife Atlas data with no reliability or accuracy work conducted on it. Rudimentary auditing on this data-set was conducted by Environment Australia and consisted of culling gross errors and spurious records. An additional CRA fauna data set for priority species was also provided. This data has had reliability and accuracy auditing done on it. Data-sets were taken to have an average spatial reliability of 1 km. The use of point records was avoided because of the problems of spatial uncertainty. These data-sets were primarily used for richness analysis.

- forest ecosystems - the CRA forest ecosystem data-set was used, the version being that provided to the environment and heritage technical committee. This data-set was used to provided forest ecosystem landscape information. The data-set was available in 100 m grid-cells and is the output of forest ecosystem modelling conducted for the CRA This data set was not field validated at the time of report writing.

- disturbance - disturbance was derived from biophysical naturalness generated for wilderness analysis according to the methodology of the National Wilderness Inventory The biophysical naturalness data relies heavily on the CRAFTI aerial photo interpretation of disturbance. Biophysical naturalness was used to generate undisturbed catchments, natural landscapes and was used to filter data in some other analyses.

- old-growth forest - the CRA old-growth forest data-set was used, the version being that provided to the environment and heritage technical committee. This data set was not field validated at the time of report writing.

- geology - 1:250,000 scale digitally captured geology sheet. The data was used to provide geology information to support landscape and forest ecosystem information.

- digital elevation model - 1:25,000 scale digital elevation model. The model was used to provide information on the escarpment, steep areas and general elevational information.

- API - the CRAFTI air photo interpretation (API) project was a major component of the CRA work conducted for Upper North-Eastern NSW. Structural, floristic and disturbance information was captured for all public land and most private land on the escarpment and coastal plain. The API data was used to provide rainforest information, and landscape information such as rock faces, coastal complex and wetlands. This data set was not field validated at the time of report writing.

All mapped indicative national estate natural areas have been digitised and are held in ARC format on a Geographic Information System platform held by Environment Australia. Appendix E lists the data layers that have contributed to the Upper North-Eastern NSW national estate assessment, and the metadata statements for each layer.

2.4 Methodology

The Upper North-Eastern NSW methodology was developed using best available data and may not necessarily form the basis for or be similar to, the formulation of requirements for other CRA regions in NSW. Details of the process by which each of the national estate values was assessed are provided in Section 3.

For extensive natural values, the methodology closely followed the approach adopted in other CRAs. Undisturbed catchments were derived from data provided by the Wild Rivers Database. Natural landscapes were derived from the biophysical naturalness layer used to generate NWI wilderness. Old-growth forest was derived from the draft old-growth forest data provided to the data warehouse. These layers were driven entirely by data.

Areas of indicative potential national estate significance were delineated for local national estate values (ie not extensive natural values) for each criteria (see Attachment A) using the following information:

- Species point locality data based on information provided by experts and literature review (Appendix B);
- Landscape elements nominated by experts as being foci for the particular national estate criteria (Appendix C); and
- Particular sites nominated by experts as being important for criteria (Appendix D).

Experts were consulted during the Conservation Requirements and Response to Disturbance Workshops held between June 1st and 31st July 1998 and were given additional time to submit information outside these forums.

The three data sources were compared (where available) to cross-validate the approaches used and refine and increase confidence in the outcome. Where two or more of the information sources described were available and comparable, the composite of the information was taken (ie, point data was merged with areas nominated by experts and landscape elements nominated by experts).

For species with disjunct ranges, species at the limit of their range, species richness, vegetation community richness, remnant vegetation communities, rare vegetation communities and old-growth forest, no landscape elements were nominated and the analysis was based entirely on species or forest ecosystem data. In this case, data was used to delineate indicative areas and checked for coverage of specific areas identified by experts.

All three data sources were available for rare species, primitive and relictual species, refugia, migratory species and important habitat. For rare species and migratory species, species data adequately covered sites nominated and remained the primary data source used. For primitive and relictual species and refugia, the composite of point data and landscape values was taken, subject to coverage of areas identified by experts.

Most species related values were thresholded by displaying species point location data as a richness map across the landscape. Areas that had concentrations of relevant species more than two standard deviations above the average number of species in the landscape were identified as above threshold. The choice of 2 standard deviations was based on the need to delineate areas of significance that are clearly above the average level of variance in the landscape.

The analysis done for endemic species was conducted seperately by NSW NPWS and the Australian Museum. A detailed description of the methodology used is in the Conservation Requirements Report for Upper North-Eastern NSW.

Principle characteristics of class and successional stages were felt to be best represented through the JANIS criteria

3. EXTENSIVE NATURAL VALUES

The two criteria of relevance to the assessment of extensive natural values are:

National Estate Criterion A.2— 'importance in maintaining existing processes or natural systems at the regional or national scale', and

National Estate Criterion B.1— 'importance for rare, endangered or uncommon flora, fauna, communities, ecosystems, natural landscapes or phenomena, or as a wilderness'.

These are inclusive values, extending broadly across the landscape rather than being confined to single vegetation types, landforms or localities. The values considered in this aspect of the Upper North-East assessment are:

- natural landscapes;
- undisturbed catchments;
- wilderness; and
- old-growth forest.

Assessment of these values resulted in the identification of indicative places of importance for the maintenance of natural processes (such as hydrological processes) at regional and national scales, and places that are of regional importance for maintaining specific natural systems (such as remnant vegetation).

3.1 Wilderness

The assessment of wilderness in the Upper North-East comprehensive regional assessment region of New South Wales utilised both the National Wilderness Inventory methodology developed by the Australian Heritage Commission and wilderness areas identified using the provisions of the New South Wales *Wilderness Act 1997*.

The assessment, identification, declaration and management of wilderness in New South Wales is principally guided by the *New South Wales Wilderness Act 1997*. The criteria for identification of Wilderness under the Wilderness Act are consistent with the National Forest Policy Statement definition of wilderness except that, in addition, the National Forest Policy Statement defines wilderness as being remote from the influences of European settlement.

3.1.1 Method

The National Wilderness Inventory methodology is the adopted standard approach to the assessment of wilderness in Regional Forest Agreements throughout Australia. While a dual identification approach was undertaken in Upper North-East, protection requirements in the Regional Forest Agreement process is linked solely to the National Wilderness Inventory. 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* (JANIS 1997, p.15)

The National Wilderness Inventory is a geographic information system which measures remote and natural values to produce a 'Wilderness Quality' continuum. The National Wilderness Inventory Wilderness Quality is produced from four disturbance indicators, each weighted equally:

- Remoteness from Access;
- Remoteness from Settlement;
- Apparent Naturalness; and
- Biophysical Naturalness.

Each of these indicators is individually updated with the best available data and then combined to measure the Wilderness Quality of an area (see Lesslie and Maslen 1995). 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.

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

Biophysical naturalness

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 National Wilderness Inventory, 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 records;
- regional information on grazing;
- air photo interpretation;
- land tenure;
- grazing leases;
- vegetation communities; and
- mining sites.

In the biophysical naturalness rating scheme, wildfire is considered a natural process, so that areas affected by wildfire can still be given a high biophysical naturalness rating (i.e. 5), unless other disturbances resulted in a lower rating. The rating scheme for BN used in the National Wilderness Inventory is outlined in Table 1. This rating system is for the 'baseline National Wilderness Inventory' and each region has its own rating system applied in consultation with stakeholders.

TABLE 1: BIOPHYSICAL NATURALNESS RATING SCHEME

Indicator Value	National Wilderness Inventory Description for Baseline National Wilderness Inventory
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

The rating scheme adopted for upgrading the BN indicator to assess wilderness values, in the Upper North-East region is shown in Table 2 (Commonwealth and National Parks and Wildlife Service 1997).

TABLE 2: BIOPHYSICAL NATURALNESS RATING SCHEME APPLIED TO UNE NSW

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

* Re-evaluated at time of delineation.

3.1.2 Establishing the threshold

For the purposes of the Upper North-East comprehensive regional assessment , the threshold for indicative national estate wilderness was considered to be equivalent to JANIS Wilderness (JANIS 1997, 15). That is, areas with a minimum "High Wilderness Quality" rating of 12 and above, and a minimum size of 8,000 ha were considered to meet the national estate threshold.

3.1.3 Results

The National Wilderness Inventory upgrade revealed that 13 areas in the Upper North-East region meet the JANIS criteria for defining high quality wilderness (minimum National Wilderness Inventory rating of 12 and a minimum size of 8000 hectares). Spatial distribution of indicative national estate wilderness is represented at Map 2. The combined extent of the thirteen delineated wilderness areas in the UNE region is 302074 hectares, as shown in Table 6.

TABLE 3: LAND TENURE OF SIGNIFICANT NATIONAL ESTATE WILDERNESS VALUES

Place	Total Area (ha)	Area in Reserves (ha)	Proportion in Reserves (%)
Chaelundi	10,319	4,995	48.4
Guy Fawkes River NP (south)	98,696	53,144	53.8
Guy Fawkes River NP (north)	15,388	5,910	38.4
Gibraltar Range /Nymboida	51,032	42,938	84.1
Banyabba	12,989	11,786	90.7
Washpool	60,085	48,825	81.3
Bundjalung	9,672	9,663	99.9
Torrington	38,066	18,367	48.3
Tenterfield Creek (west)	3,413	Nil	Nil
Tenterfield Creek (east)	634	Nil	Nil
Border Ranges NP (mid)	51	Nil	Nil
Border Ranges NP (west)	485	393	81
Border Ranges NP (east)	1,244	671	54
Total	**302,074**	**196692**	**65.1**

3.2 Natural landscapes

Natural landscapes are large, relatively undisturbed areas with topographic and catchment integrity where natural processes continue largely unmodified by human intervention. Natural processes include:

- energy flows;
- nutrient cycling;
- hydrological processes;
- ecological processes such as succession; and
- evolutionary processes such as speciation and extinction.

At a national level, 'natural landscapes' are considered rare, and in those Regional Forest Agreement regions where they are found they have generally been assessed under national estate criterion B.1— *'importance for rare, endangered or uncommon flora, fauna, communities, ecosystems, natural landscapes or phenomena, or as a wilderness'.*

3.2.1 Method

The following measures were used to identify areas of potential natural landscape value:

- naturalness (or level of disturbance indicated by the biophysical naturalness indicator);
- size and;
- integrity in the landscape.

The assessment of natural landscapes was largely based on the biophysical naturalness indicator of the National Wilderness Inventory (method described in section 2.2.1)

3.2.2 Establishing the threshold

Areas of high biophysical naturalness (BN equals 4 or 5) and with an area of 1,000 ha or greater were identified. Areas adjacent to the coast with high biophysical naturalness were identified if greater than 250 ha. The set threshold was chosen to be consistent with the process carried out in the other CRA regions. Older biophysical naturalness layers for areas adjacent to but outside the region were used to allow potential areas on the boundary of the region to be assessed within context. In order to rationalise the identification of areas, identified areas could contain fragmented but not significant areas of disturbance. Boundaries were permitted to include areas of disturbed forest, but not cleared land or substantially modified landscapes such as plantations.

3.2.3 Results

A large number of natural landscapes were identified in Upper North Eastern NSW. They describe a broad arc from the Mount Warning caldera, around the Border Ranges and down the escarpment and associated ranges to the Dorrigo Plateau. Significant natural landscapes occur near Glen Innes and Torrington. Additional areas occur on the coastal plain around Banyabba Nature Reserve, on the coast at Yuraygir and in private property around Grafton. The areas delineated are above the threshold for nomination on the Register of the National Estate and use the best available data from the comprehensive regional assessment for Upper North-Eastern NSW. There is a strong correlation with places already listed on the Register of the National Estate. These areas cover a total of 859,934 ha. Delineated areas of natural landscapes are shown at Map 3.

Over 34% of the total natural landscape area identified as having indicative national estate significance occurs in existing reserve, including national park or nature reserve. 6% of the total area is in state forest (Table 4).

TABLE 4: LAND TENURE OF SIGNIFICANT NATIONAL ESTATE NATURAL LANDSCAPE VALUES

Tenure	Approximate Area (ha)	Proportion of Total (%)
National Park, Nature Reserve or PMP 1.3*	293,866	34.2
Private Land	364,489	42.4
State Forest	54,242	6.3
Leasehold Crown Land	114,821	13.5
Other Crown Land	31,057	3.6

*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)

3.3 Undisturbed catchments

'Undisturbed catchments' are catchments where natural hydrological processes remain essentially unmodified and unimpeded.

3.3.1 Method

The identification of undisturbed catchments was based on an analysis of river flow impediments and the naturalness of the area within the catchment. The assessment is derived from the River Disturbance Index Database (Stein et al 1998) held by the Wilderness and Wild Rivers Group, Environment Australia. The River Disturbance Index is a measure of river/stream quality across sub-catchment areas based on two indicators: Naturalness of Flow Regime Index; and Sub-Catchment Naturalness Index.

Delineation of catchments

Sub-catchments were identified from the wild rivers database, compiled for the wild rivers assessment that formed part of the Upper North-East comprehensive regional assessment. These sub-catchments were used as the basis of the national estate analysis. The database delineates a separate modelled sub-catchment for each stream segment, as defined on the AUSLIG 1:250,000 scale hydrography theme database.

Catchment Naturalness

The River Disturbance Index Database was constructed by establishing a grid across a primary database and calculating scores for sub-catchment condition (Sub-Catchment Naturalness Index) and flow regime indicators (Naturalness of Flow Regime Index). The scores for Sub-Catchment Naturalness Index are combined and adjusted for sub-catchment area to produce a Catchment Naturalness Index. The final River Disturbance Index values combine the Naturalness of Flow Regime Index and the Catchment Naturalness Index.

The primary database is made up of geographical data derived from topographical map series and the National Wilderness Inventory primary database. The National Wilderness Inventory sources provide settlement and infrastructure features, the extent of non-natural land cover and an index of biophysical naturalness (Lesslie and Maslen 1995). Topographical map series provides watercourse data, built-up areas, infrastructure, reservoirs and canals.

The River Disturbance Index was created using guidelines established by an expert panel of government and non-government officials and stakeholders. Panel participants helped develop decision rules on quantifying disturbance and measuring catchment and river naturalness. From these discussions the River Disturbance Index rates sub-catchment areas on a scale from undisturbed (0) to disturbed (1).

3.3.2 Establishing the threshold

Selection of a threshold to capture intact and undisturbed catchments was made on the basis that highly undisturbed catchments occur in the River Disturbance Index range less than or equal to 0.01.

Using geographic information system, the data was filtered to capture all sub-catchments less than or equal to 0.01. Those places falling within these parameters were deemed to have indicative national estate value for undisturbed catchments.

Areas of high biophysical naturalness (BN equals 4 or 5) and with an area of 1,000 ha or greater were identified. The set threshold was chosen to be consistent with the process carried out in the other CRA regions.

Undisturbed catchments that were under 1000 ha along the boundary of the RFA region were investigated to see whether such units were part of a larger undisturbed catchment that extended beyond the region. Older biophysical naturalness layers for areas adjacent to but outside the region were used for this investigation. A lower area threshold of 250 ha was permitted for areas adjacent to the coast. No small boundary units matching either of the instances just specified were identified in Upper North-Eastern NSW.

In order to rationalise the identification of undisturbed catchment areas, boundaries were permitted to include areas of disturbed forest, but not cleared land or substantially modified landscapes such as plantations.

3.3.3 Results

After applying the size threshold of 1,000 ha, 19 indicative undisturbed catchments were identified with an area of approximately 106,319 ha (Table 5, Map 4). The areas identified are above threshold level to warrant national estate listing and have been delineated using best available data from the Upper North-Eastern CRA.

Areas delineated for undisturbed catchments are strongly correlated with existing areas listed on the Register of the National Estate and include Mount Warning, the Border Ranges, Banyabba Nature Reserve, Yuraygir National Park, Washpool National Park and Guy Fawkes National Park.

TABLE 5: INDICATIVE UNDISTURBED CATCHMENT AREAS

Place	Area (ha)
Washpool	44,574
Guy Fawkes (central)	13,259
Banyabba	8,227
Cangai	6,406
Guy Fawkes (North)	5,512
Border Ranges	3,258
Sara River	3,135
Guy Fawkes (South)	2,761
Kangaroo River	2,545
Bald Rock	2,325
Gibraltar Range	2,241
Dalmorton	2,142
Yuraygir	1,835
Henry River	1,828
Wooli Wooli River	1,451
Aberfoyle River	1,402
London Bridge (North of)	1,191
Warra	1,168
Mount Warning	1,078
Total	106,319

TABLE 6: Land Tenure of indicative national estate undisturbed catchment values

Tenure	Approximate Area (ha)	Proportion of Total (%)
National Park, PMP 1.3 or Nature Reserve	91,654	86.2
State Forest	1,439	1.3
Private Land	3,044	2.86
Leasehold Crown Land	7,867	7.4
Other Crown Land	2,315	2.2

*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)

3.4 Old-growth forest

The importance of old-growth forests was assessed in terms of the maintenance of existing natural processes (Sub Criterion A.2)

The comprehensive regional assessment work is guided by the JANIS criteria which defines old-growth forest as 'ecologically mature forest where the effects of disturbances are now negligible' (JANIS 1997, p. 13). Old-growth forests in Australia are considered rare at the national level. Old-growth forests have intrinsic value as the oldest growth-stage of a given vegetation class or community as well as those characteristics, associated with those oldest age class-dominated forests. For example, senescent trees are important for providing nesting and roosting sites for large forest owls and arboreal mammals.

In the Upper North-East comprehensive regional assessment region, comparatively large tracts of old-growth forest are to be found along the escarpment of the great dividing range. Most stands, however, occur in complex mosaics of mature and younger forest on the coastal plain or on accessible parts of the adjacent ranges and escarpment. The most extensive areas of old-growth forest are found in the Guy Fawkes - Washpool area on the escarpment and Torrington National Park on the western edge of the region. Banyabba National Park, Mount Neville Nature Reserve and Sherwood Nature Reserve comprise the largest remaining areas of old-growth forest on the coastal plain and ranges.

The assessment of old-growth forest of indicative national estate value is considered under sub-criterion B.1 (Natural rarity) and sub-criterion A.2 (Continuing processes). Sub-criterion B.1 focuses on examples of old-growth forest for particular forest communities that are rare or uncommon at a regional level, while sub-criterion A2 recognises the importance of old-growth forests for the maintenance of existing natural processes (Appendix A).

3.4.1 Method

The old-growth forest identified according to the JANIS criteria was used as the primary data-set for identification of indicative national estate old-growth forest values in Upper North-East. Detail on the processes used to delineate old-growth forest can be obtained from the CRA Old-growth forest Report. (NPWS 1998)

Areas of indicative national estate old-growth forest significant for ecological processes (under criteria A.2) are considered to be those that have high integrity and natural context (as identified by the National Wilderness Inventory biophysical naturalness index) and above a minimum size threshold to ensure the viability and quality of the forest stand.

3.4.2 Establishing the threshold

The old-growth forest layer was over laid with the natural landscapes and undisturbed catchments layers. It was assumed that within these areas, all old-growth forest regardless of size possess a high level of integrity. Outside areas of natural landscapes and undisturbed catchments, a minimum viable forest patch size threshold of 100 ha was applied.

3.4.3 Results

The process outlined above delineated 641,470 ha of old-growth forest in the Upper North-Eastern CRA region as above threshold. Approximately 35% is in existing reserves and approximately 27% is in State Forest (Table 7). Areas of indicative national estate old-growth forest, identified under sub criterion A.2 are illustrated at Map 5.

TABLE 7: LAND TENURE OF INDICATIVE NATIONAL ESTATE OLD-GROWTH FOREST

Tenure	Approximate Area (ha)	Proportion of Total (%)
National Park, PMP 1.3 or Nature Reserve	229,155	35.7
State Forest	175,519	27.4
Private Land	134,786	21
Leasehold Crown Land	82,411	12.8
Other Crown Land	19558	3

*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. FLORA AND FAUNA VALUES

Flora and Fauna values in Upper North-East were assessed against national estate criteria A.1, A.2, A.3, B.1 and D.1 (Appendix A).

Localised natural flora and fauna values

Sub-Criterion A.1: Importance in the evolution of Australia's natural history

Assessment for values under this sub-criterion involved the identification of places where the present distribution and ecology of flora and fauna of Upper North-Eastern NSW reflect the influence of past evolutionary, climatic and environmental processes. These included places important for:

- endemic flora and fauna;
- flora and fauna with disjunct distributions;
- flora and fauna at the limit of their range;
- flora and fauna refugia; and/or
- relictual and primitive flora and fauna.

4.1 Flora and fauna species endemic to region

Endemic species provide an important insight into the process of evolution of flora and fauna (Sub-criterion A1). Heatwole (1987) noted two processes by which endemism could occur; the first where a species becomes exinct over the bulk of its range except for a small refugia, and secondly, a long period of isolation leading to the evolutionary divergence of species from a common ancester (eg Gondwanic species in Australia). In some cases, biogeographic determinants such as the influence of terrestrial and oceanic climatic influences, soils and localised topographic variation may be the main controlling factors in the development of endemism. In other cases the role of climatic refugia in speciation during periods of climate change are important. For the purposes of the current study, endemic species were regarded as those species with at least 75% of their distribution range confined to Upper and Lower North-Eastern NSW.

The complex environment of northern NSW presents a diversity of habitats for endemic species. For example, Osborne (1991) postulated that the dry forests of the Timbara and Mann rivers and the Gibraltar granite forests may present barriers to movement for some bird species assocated with wet forests of the Washpool area. Several authors have also commented on the importance of rainforest remnants in the region as centres for endemism. Monteith and Todd Davies (1991) in a study of invertebrate diversity in Queensland rainforests observed a high level of endemism between discrete rainforest areas. Main (1991) notes that even small isolates of rainforest in the landscape are significant for rainforest trapdoor spiders, which reach their greatest diversity in North-Eastern NSW. Heatwole (1987) summarised the findings of Kikkawa et al (1979) who studied the relationship of Australian heathlands with their fauna. Heath endemism was generally associated with specialised species more or less restricted to heathland as a result of specialisation,

the presence of specific habitat no longer available elsewhere or species isolated phylogenetically and geographically after heath retreated in past ages.

4.1.1 Method

NSW NPWS formulated a list of endemic species based on expert knowledge. North-East Forest Biodiversity Study models of species habitat, expert knowledge and point data were used to create a matrix and delineate centres of endemism. Each "centre" was defined by a unique group of flora or vertebrate fauna respectively. A separate analysis was undertaken for invertebrates. The analysis was based on available recorded derived from data that has not been collected systematically. The data was weighted for accuracy and reliability. Narrow range endemics were defined for the whole state as those species that occurred within a 2500 km^2 grid that approximated the region. A matrix was created plotting density of endemic species against density of background sampling. A threshold was set for areas with good sampling and a high number of endemic species and all areas that met these criteria following expert review were regarded as above threshold. associated with certain groups of species. For a detailed description of the methodology, see the Conservation Requirements project report for Upper and Lower North-eastern NSW.

.2 Establishing the threshold

Experts agreed that all areas shown in the non-target JANIS analysis of centres of endemism were above threshold.

4.1.3 Results

The Centres of Endemism identified as areas of indicative national estate significance are shown on Map 6. As each area depicted represents unique assemblages of endemic flora, fauna and invertebrates using best available information to the Upper North-East comprehensive regional assessment, all areas identified are above the threshold level warranting national estate listing.

Some of the major localities delineated for endemic species were the Border Ranges and Mount Warning Caldera for flora and fauna, the Big Scrub remnants for flora and fauna, the kangaroo creek sandstone (including Banyabba Nature Reserve) around Grafton for endemic flora, Bundjalung National Park for endemic flora, Torrington National Park, Boonoo Boonoo State Forest and Bald Rock National Park for endemic flora, Washpool National Park for both endemic flora and fauna, and the catchment of Guy Fawkes River for endemic flora and fauna.

Approximately 30% of the total area identified as centres of floristic endemism occurs in national park or nature reserve and 41% of the total area is on private land (Table 8). The Border Ranges, Mount Warning Caldera, Big Scrub remnants, Bald Rock National Park, Boonoo Boonoo National Park, Washpool National Park, Banyabba Nature Reserve, and Bundjalung National Park are indicative of the places identified

in the current work that are places already listed in the Register of the National Estate.

TABLE 8: LAND TENURE OF INDICATIVE NATIONAL ESTATE CENTRES OF ENDEMISM

Tenure	Approximate Area (ha)	Proportion of Total (%)
National Park, PMP 1.3 or Nature Reserve	191,311	30.8
State Forest	116,190	18.7
Private Land	255,937	41.2
Leasehold Crown Land	38,850	0.3%
Other Crown Land	16,832	0.15%

*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 Flora and fauna with disjunct populations

Disjunct populations are those that have become physically separated, resulting in minimal or no gene flow between them. This separation could be caused by a break in a formerly continuous distribution or by long-distance dispersal (jump dispersal) over a barrier. Heatwole (1987) summarised features that could act as barriers including climate, topography, vegetation type and intra or inter-species competition. In North-Eastern NSW, the deeply incised topography, diversity of species, geology, altitudinal range and topography and the movement of tall forests across the Pleistocene landscape in reponse to climate change are all conducive to the development of disjunct populations. (Covacevich 1991, Osborne 1991). Often, a disjunction takes the form of a larger parent or core population and a smaller outlier, or outliers, but in some instances the disjunct populations are of about the same size. Species with disjunct populations can be regarded as being important elements in the evolution of Australian flora and fauna (Sub-criterion A1).

Disjunct species in Upper North-Eastern NSW were taken to be species with highly specific habitat preferences and low powers of dispersal such as frogs and reptiles, species with documented isolated populations within the region, and associated with fragmented habitat, primarily rainforest.

4.2.1 Method

For fauna, workshops were used to identify fauna species with disjunct distributions to provide a species list. Data was derived from surveys conducted for the comprehensive regional assessment and from the NSW NPWS wildlife atlas. 92 fauna species were identified as having disjunct distributions. Literature reviews were also carried out to supplement the workshop responses. For flora, the literature review conducted as part of the flora workshop was used to provide a species list. Data was derived from the validated flora data-set used for comprehensive regional assessments. 227 flora species were identified as having disjunct distributions.

Point location information for all identified species was plotted respectively for flora and fauna on a one kilometre square grid. An analysis was done which then searched for all records of disjunct species within a two kilometre radius around each grid cell. The resultant analysis showed concentrations of disjunct species, for flora and fauna respectively, across the landscape.

4.2.2 Establishing the threshold

The above information was displayed as standard deviations above the mean number of species in the landscape. Two standard deviations above the mean number of species for both flora and fauna was taken to be above threshold.

4.2.3 Results

The areas identified as having indicative national estate significance for species with disjunct populations are delineated on Map 7 for fauna and Map 8 for flora. Areas shown represent concentrations of species with disjunct ranges using relevant best available information to the Upper North-East comprehensive regional assessment All areas identified are significant with regard to Australia's evolutionary history and are above the threshold warranted for national estate listing.

Some of the major areas delineated for species with disjunct populations were the Mount Warning Caldera and Border Ranges for both fauna and flora, the Big Scrub and coastal remnants from Ballina to the border for fauna, the Richmond Range for fauna, Bald Rock National Park for flora, Bundjalung and Yuraygir National Parks for flora and fauna, Demon Nature Reserve for flora and fauna, Washpool National Park for flora and fauna, Guy Fawkes and Cathedral Rock National Parks for flora, Mount Hyland Nature Reserve for flora and fauna, Kangaroo River National Park for flora and fauna, Orara West State Forest for fauna and Wedding Bells State Forest and Moonee Beach Nature Reserve for flora and fauna.

A total of 192,837 ha was identified as above threshold for fauna with disjunct ranges. Nearly 30% of this was on existing reserves, 30% in state forest and 36% on private land. A total of 71,769 was identified above threshold for flora with disjunct ranges. Nearly 53% of this was on existing reserves, 22% in State Forest and 19% in private property (Table 9). The Border Ranges, Mount Warning Caldera, Big Scrub remnants, Bald Rock National Park, Washpool National Park, Banyabba Nature Reserve, Cathedral Rock National Park, Mount Hyland Nature Reserve and Bundjalung National Park are indicative of the places identified in the current work that are places already listed in the Register of the National Estate.

TABLE 9: LAND TENURE OF INDICATIVE NATIONAL ESTATE SPECIES WITH DISJUNCT RANGES

Tenure	Approximate Area (ha)	Proportion of Total (%)
National Park, PMP 1.3 or Nature Reserve		
For Fauna	57,426	29.8
For Flora	37,968	52.9
State Forest		
For Fauna	58,024	30.1
For Flora	15,978	22.3
Private Land		
For Fauna	69,566	36
For Flora	14,023	19.5
Leasehold Crown Land		
For Fauna	1,213	0.6
For Flora	356	0.5
Other Crown Land		
For Fauna	4,509	2.3
For Flora	2,718	3.79

*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)

4.3 Flora and Fauna at the end of their distribution range

Flora and fauna species at the end of their range are those species whose known distribution range terminates within or near the RFA region. The value can reflect broad biogeographic boundaries or past species population movements. Within the context of north-eastern NSW, species at the limit of their range tend to be those species from tropical or sub-tropical Australia whose southern distribution limit occurs in the region, or those species from temperate Australia who reach their northern distribution range limit in the region. There are also some inland species whose distribution does not extend down onto the coastal plain. Distributions and range limits can yield important information relating to past population movements and evolutionary history and species at the end of their range are importance in the evolution of Australian fauna and flora. (Sub-criterion A1).

4.3.1 Method

For fauna, workshops were used to identify fauna and flora species that reach the limit of their range within the region. Literature reviews were also carried out to supplement the workshop responses. Data was derived from surveys conducted for the comprehensive regional assessment, from literature reviews and from the NSW NPWS wildlife atlas. 180 fauna species and 998 flora species were identified as reaching their distribution limit within or in close proximity to the RFA region.

Point location information for all identified species was plotted respectively for flora and fauna on a one kilometre square grid. An analysis was done which then searched

for all records within a two kilometre radius around each grid cell. The resultant analysis showed concentrations of species at the limit of their range for fauna and flora respectively, across the landscape.

4.3.2 Establishing the threshold

The above information was displayed as standard deviations above the mean number of species in the landscape. Two standard deviations above the mean number of species for both flora and fauna was taken to be above threshold.

4.3.3 Results

The areas identified as having indicative national estate significance for species at the limit of their range are delineated on Map 9 for fauna and Map 10 for flora. Areas shown represent concentrations of species at the end of their range using best information available to the Upper North-East comprehensive regional assessment All areas identified are significant with regard to Australia's evolutionary history and are above the threshold warranted for national estate listing.

There was a strong trend in the areas delineated for species at the limit of their range. Both flora and fauna delineated the area of the Mount Warning caldera, the Border Ranges and the Richmond Ranges, contracting to the south along the coast around Bundjalung National Park. The coastal areas further south were also delineated as important for fauna, including Yuraygir National Park, Wedding Bells State Forest and Moonee Beach Nature Reserve. The assessment for fauna also showed the escarpment and ranges as important for species at the limit of the range, including Ewingar State Forest, Washpool National Park, Mount Hyland Nature Reserve and the new parks in Chaelundi and Kangaroo River State Forests. These areas were delineated for flora but for much more discrete areas.

A total of 91,521 ha was identified as above threshold for fauna at the limit of their range. 33% of this was on existing reserves, 18% in state forest and 46% on private land. A total of 210,702 ha was identified above threshold for flora at the end of their range. 32% of this was on existing reserves, 27% in State Forest and 36% in private property (Table 10). The Border Ranges, Mount Warning Caldera, Big Scrub remnants, Washpool National Park, Mount Hyland Nature Reserve, Yuraygir and Bundjalung National Parks are indicative of the places identified in the current work that are places already listed in the Register of the National Estate.

TABLE 10: LAND TENURE OF INDICATIVE NATIONAL ESTATE SPECIES AT THE LIMIT OF THEIR RANGE

Tenure	Approximate Area (ha)	Proportion of Total (%)
National Park, PMP 1.3 or Nature Reserve		
For Fauna	30,338	33.2
For Flora	68,496	32.5
State Forest		
For Fauna	16,634	18.2
For Flora	57,133	27.1
Private Land		
For Fauna	42,419	46.4
For Flora	75,917	36
Leasehold Crown Land		
For Fauna	331	0.4
For Flora	1,575	0.7
Other Crown Land		
For Fauna	666	0.7
For Flora	5,190	2.5

*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)

4.4 Flora and fauna refuges

The sharply incised landscape and variable environments of Upper North-Eastern NSW provide a diverse array of potential refugia. Heatwole (1987) noted the cyclic nature of climate in Australian geological history causing a series of long term wetter and drier periods that result in mesic and xeric species respectively radiating and contracting in the landscape. At the extremes of these cycles, species are restricted to small, favourable microhabitats in the landscape (refugia). Refugia are areas where physical and biological attributes combine to provide an environment that is more resilient to climatic variation, severe fire events and drought, than surrounding areas, and are important centres for the conservation of environmentally sensitive species. As a result, refugia also constitute important sources of genetic variation and are also regarded as important centres for species radiation when conditions become more favourable, for example, Horton (1984) regarded far northern NSW as a refugia of long term significance to speciation in birds.

Refugia can be identified both as short term refuges from current perturbations such as fire, and also long term evolutionary refuges. In the later case, the size of the refugia becomes significant. For example, it has been suggested that landscapes in which rainforests are extensive enough for a core areas to have remained comparatively stable during adverse climatic periods are highly likely to have primitive species or concentrations of narrow range endemic species that have disappeared from smaller rainforest areas in the landscape that shrink or disappear all together (Covacevich 1991).

Nix (1982) identified a number of areas down the east coast with high growth indicies for species with thermal optimums in the range of 10-12°C and threshold temperatures around 0°C, including the edge of the New England and Dorrigo plateaus and the high parts of the Border Ranges. These disjunct areas support cool temperate rainforests and are similar to South-West Tasmania and high altitudes in New Guinea and can be regarded as potential refugia (Nix 1982, Commonwealth 1992). A range of other environments have already been discussed under endemic species and will be discussed under primitive and relictual species.

In summary, refugia are important for maintaining flexibility and adaptability in times of climatic change, as well as providing an insight into the vegetation of a past period, and the biogeographic and evolutionary processes which have shaped the present biota. These areas are generally also important for many species now uncommon elsewhere (Sub-criterion B1, A1, A2 and D1).

4.4.1 Method

The national estate refugia coverage was derived using data from the Upper North-East RFA forest ecosystem coverage, the geology sheet covering northern NSW (1:250,000 scale), and the results of the UNE CRAFTI API project. Experts were asked to nominate environments important as refugia. These were then validated against the areas identified as important for primitive and relictual species and known locations that experts identified as being important for refugia.

Environments delineated included the following:

- riparian, alpine, mallee, rock outcrops, native grasslands, subalpine, heath, banksia, wetlands, swamps, banksia, paperbark, casuarina, sedgelands, and coastal complex.
- all rainforest polygons with eucalypt or non-eucalypt emergents that did not have weed species as an identified component in the API code.
- coastal occurrences of scribbly gum, swamp mahogany or cypress pine.
- all ecosystems described as alpine or subalpine including ecosystems with black sallee or snow gum present.
- Roundleaf Gum with wet heath understorey.
- a richness map of forest ecosystems showing the number of forest ecosystems within two kilometres of each 100m grid cell was used to identify areas of steep environmental gradient.
- A 25 meter digital elevation model (DEM) and geology was used to identify potential sandstone cliff-lines.
- forested areas overlying basalt, rhyolite and andesite (Hitchcock 1997).

4.4.2 Establishing the threshold

Based on expert opinion, all refugia at any scale were important. No threshold was applied.

4.4.3 Results

Areas delineated as refugia are shown on map 11. Areas shown represent habitats nominated by experts as refugia, validated by comparison with the distribution of primitive and relictual species using best information available to the Upper North-East comprehensive regional assessment. All areas identified are significant with regard to Australia's evolutionary history, rare, endangered or uncommon flora and fauna and existing natural systems. The areas shown demonstrate principle characteristics of the range of Australia's environments including wetlands, rainforests and coastal environments and are above the threshold warranted for national estate listing.

Refugia were found across the landscape of North-Eastern NSW. There were, however, concentrations of refugia along the coast around Bundjalung National Park and Yuraygir National Park, including parts of Newfoundland, Candole, Devils Pulpit and Tabbimoble State Forests. A second concentration occurred around the Border Ranges and Mount Warning Caldera and down the Richmond Ranges and Beaury State Forests. Additional concentrations occurred in Washpool National Park, in the area of Torrington National Park and in the area of London Bridge State Forest and Guy Fawkes National Park.

518,680 ha was identified as having potential indicative significance as refugia. Approximately 31% of the total area identified as refugia occurs in national park, flora reserve or nature reserve and 20% occurs on state forest. 38% occurs on private land (see table 11). The Border Ranges, Mount Warning Caldera, Big Scrub remnants, Washpool National Park, Guy Fawkes National Park, Cathedral Rock National Park, Mount Hyland Nature Reserve, Yuraygir and Bundjalung National Parks are indicative of the places identified in the current work that are places already listed in the Register of the National Estate.

TABLE 11: LAND TENURE OF INDICATIVE NATIONAL ESTATE REFUGIA

Tenure	Approximate Area (ha)	Proportion of Total (%)
National Park, PMP 1.3 or Nature Reserve	163,379	31.5
State Forest	107,883	20.8
Private Land	199,793	38.5
Leasehold Crown Land	33,517	6.5
Other Crown Land	13,347	2.6

*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)

4.5 Primitive, relictual, and phylogenetically distinct species

Relictual, phylogenetically distinct and/or Gondwanic flora and fauna species are generally regarded as those that meet one or more of the following criteria:

- species that appear to possess primitive features;
- species that exhibit features that appear to be different or remote from related species; and
- species that appear to be populations left isolated in the landscape by later climatic or environmental changes.

The Rufous Scrub-bird (*Atrichornis rufescens*) is an example of a species generally agreed to have primitive taxonomic features and ancient origins within Australia. (Heatwole 1987). Phylogenetically distinct species were taken to be those species whose taxonomic affinities were unknown or unclear such as the Swamp Wallaby (*Wallabia bicolor*) which does not appear to be closely related to any of the other extant groups in the Macropodidae. (Merchant 1995). The spagnum frogs (Genus *Kyarranus*) are an example of a primitive group with ancient origins which, based on finds from Riversleigh fossil deposits, were once much more widespread but are now restricted to moist environments along the ranges. (Barker et al 1995). Fletcher's Frog (*Lechriodus fletcheri*) and the Southern Angle-headed Dragon (*Hypsilurus spinipes*) are examples of species with possible New Guinean or south-east Asian origins with relictual populations on the east coast, though recent genetic work suggests that *Hypsilurus* may actually have much older African origins. (Hutchinson and Donnellan 1993, Tyler 1994).

North-Eastern NSW provides a wide variety of habitats suited to the persistence of primitive, relictual and phylogenetically distinct species. The diverse range of habitats, large altitudinal gradient and the presence of long-term stable landscapes such as mangroves, heath and rainforests all contribute to the likelihood of persistence of primitive, phylogenetically distinct and relictual species. The wide array of protected microhabitats such as sheltered gullies and rock outcrops also provide contemporary refugia. Floyd (1985) noted that Australian rainforests possessed the greatest concentration of primitive families in the world. Of the 98 primitive angiosperm and gymnosperm genera in Australia, 42 genera are in North-Eastern NSW. Greenslade (1994) noted that Gondwanian relict species and taxa occupying geographically discrete sites such as mountain-tops were a high priority for national estate listing. Covacevich (1991) discussed the common Gondwanic origins of heaths and rainforest and related this to the modern similarities between the herpetofauna of heaths and rainforests in north-eastern NSW.

Primitive, relictual or phylogenetically distinct species are important as indicators of evolutionary history, past or current population movements, evidence of past or current speciation and for evidence of past or current decline (sub-criterion A1, A2).

4.5.1 Method

For fauna, workshops were used to identify fauna species with primitive, relictual or phylogenetically distinct characteristics to provide a species list. Literature reviews were also carried out to supplement the workshop responses. Data from the NSW NPWS wildlife atlas and data collected from CRA surveys were used. 19 primitive species and 25 relictual fauna species were identified. This was only done for fauna as experts did not nominate primitive or relictual flora species.

For flora and invertebrates, environments and known sites were identified through expert workshops and literature review. A coverage was derived using data from the UNE RFA forest ecosystem coverage, the geology sheet covering northern NSW (1:250,000 scale), and the results of the UNE CRAFTI API project. The environments identified were common to those nominated as refugia (see the sub-section on Refugia).

Point location information for all identified species was plotted for fauna on a one kilometre square grid. An analysis was done which then searched for all records within a two kilometre radius around each grid cell. The resultant analysis showed concentrations of primitive, relictual and phylogenetically distinct species across the landscape. This was combined with the landscape analysis conducted for flora and invertebrates to produce the final layer.

4.5.2 Establishing the threshold

The point location data was displayed as standard deviations above the mean number of species in the landscape. Two standard deviations above the mean number of species for fauna was taken to be above threshold.

Based on expert opinion, the primitive and relictual species habitat was thresholded to only show areas greater than 100 ha in area in the landscape. It was felt that the refugia layer was adequate to show the distribution of smaller units in the landscape.

4.5.3 Results

The areas identified as having indicative national estate significance for primitive, relictual and phylogenetically distinct species are delineated on Map 12. Areas shown represent an amalgamation of sites known to be rich in species with primitive, relictual or phylogenetically distinct fauna and or habitats nominated by experts as important for fauna, flora or invertebrates, using the best information available to the Upper North-East comprehensive regional assessment. All areas identified are significant with regard to Australia's evolutionary history and existing natural systems and are above the threshold warranted for national estate listing.

The areas delineated for this value were concentrated in the Border Ranges and Mount Warning Caldera, the Richmond Range, Beaury State Forest, Ewingar State Forest and Washpool National Park, parts of Chaelundi, Kangaroo River, Orara West and Wedding Bells State Forests, and Yuraygir and Bundjalung National Park.

A total of 402,558 ha was identified as above threshold for primitive, relictual and phylogenetically distinct species. 41% of this was on existing reserves, 31% in state forest and 24% on private land. (Table 12). The Border Ranges, Mount Warning Caldera, Washpool National Park, Guy Fawkes National Park, Mount Hyland Nature Reserve, Yuraygir and Bundjalung National Parks are indicative of the places identified in the current work that are places already listed in the Register of the National Estate.

TABLE 12: LAND TENURE OF INDICATIVE NATIONAL ESTATE PRIMITIVE, RELICTUAL AND PHYLOGENETICALLY DISTINCT SPECIES

Tenure	Approximate Area (ha)	Proportion of Total (%)
National Park, PMP 1.3 or Nature Reserve	164,817	40.9
State Forest	126,280	31.4
Private Land	95,093	23.6
Leasehold Crown Land	8,418	2
Other Crown Land	5,005	1.2

*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)

Sub-Criterion A.2: Importance in maintaining existing processes or natural systems at the regional or national scale

The identification of areas of indicative national estate significance under this sub-criterion involves assessment of places important for the maintenance of natural ecosystem processes. These include abiotic processes, for example those related to hydrological and nutrient cycles, and biotic processes; that is those related to the life cycles and interdependence of plant and animal species in the forests, woodlands, heathlands, sedgelands, swamps and wetlands of the region. Values which may be considered include:

- habitat for migratory species
- important wildlife habitat;
- refuges for fauna (see refugia under Sub-criterion A1 above);
- remnant vegetation; and
- places important for vegetation succession.

Places important for undisturbed catchments and old-growth forest are addressed in extensive natural values.

4.6 Migratory species

Migratory species were regarded as those species which undertake a regular migration for breeding or feeding purposes at a regional, interregional, continental or intercontinental scale. In the context of northern NSW, this included bird species listed as JAMBA or CAMBA species as well as inter-regional migrants such as the dollarbird and forest migrants such as the grey-headed flying fox. Such species are important in maintaining existing processes and natural systems and were used to delineate significant wetlands. (Sub-criterion A2 and D1).

4.6.1 Method

Workshops were used to identify fauna species that were known to be migratory and which occurred within the region. Literature reviews were also carried out to supplement the workshop responses, including the inclusion of all species listed under JAMBA and CAMBA. The NSW NPWS wildlife atlas and data from the CRA surveys were used as the primary data source. 146 species were identified as migrants occurring within or visiting the RFA region.

Point location information for all identified species was plotted respectively for flora and fauna on a one kilometre square grid across the region. An analysis was done which then searched for all records within a two kilometre radius around each grid cell. The resultant analysis showed concentrations of migratory species across the landscape.

The site location for the only RAMSAR wetland in the region, Little Llangotholen Nature Reserve was also included.

4.6.2 Establishing the threshold

The above information was displayed as standard deviations above the mean number of species in the landscape. Two standard deviations above the mean number of species was taken to be above threshold. The boundary of Little Llangotholen Nature Reserve was added to the layer.

4.6.3 Results

The areas identified as having indicative national estate significance for migratory species is delineated on Map 13. Areas shown represent sites known to be rich in migratory species, using the best information available to the Upper North-East comprehensive regional assessment. All areas identified are significant with regard to existing natural systems and are above the threshold warranted for national estate listing.

Areas delineated for migratory species were strongly associated with the coastal plain, noticeably, Yuraygir and Bundjalung National Parks, the coastal area around Moonee Beach Nature Reserve, the area between Ballina and Brunswick Heads and the area around Ukerebagh Island Nature Reserve. This was true for both estuarine and

marine species as well as forest species. Inland sites included Whian Whian State Forest, the southern end of the Richmond Range, Washpool National Park and Cathedral Rock National Park. Of particular interest was the fact that Mother-of-Ducks Lagoon Nature Reserve was delineated very strongly as an important site for inland waterfowl.

A total of 138,437 ha was identified as above threshold for migratory species. 23% of this was on existing reserves, 12% in state forest and 59% on private land. (Table 13). The Mount Warning Caldera, Washpool National Park, the area around Moonee Beach Nature Reserve, Yuraygir and Bundjalung National Parks are indicative of the places identified in the current work that are places already listed in the Register of the National Estate.

TABLE 13: LAND TENURE OF INDICATIVE NATIONAL ESTATE MIGRATORY SPECIES

Tenure	Approximate Area (ha)	Proportion of Total (%)
National Park, PMP 1.3 or Nature Reserve	32,310	23.3
State Forest	16,415	11.9
Private Land	81,062	58.6
Leasehold Crown Land	724	0.5
Other Crown Land	6,737	4.9

*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)

4.7 Important habitat

Important fauna habitat is generally regarded as values such as important feeding, breeding or nursery sites or known breeding sites for rare or uncommon fauna. In Upper North-East, important habitat was used to define a number of environments that experts felt were of national estate significance or else that were identified for a wide range of species values. Experts felt that in particular, Upper North-Eastern NSW contained areas with the greatest diversity of macropods and arboreal marsupials in temperate Australia and represented a core areas for the development of tall moist forests in Australia. The Guy Fawkes river catchment and escarpment of the great dividing range were regarded as major, long term corridors in the landscape, a view supported by Heatwole's (1987) discussion on significant corridors and barriers in the landscape. Heatwole (1987) listed the evidence to suggested that the great dividing range has, over geological history, acted as both a corridor for mesic-adapted species along the east coast, and as a significant barrier to the radiation of xeric-adapted species during drier periods from inland Australia. Worboys (1996) also documented the conservation significance of the escarpment as a corridor in time and time as a major continental conservation feature. Horton (1984) also identified south-eastern Queensland and northern NSW as a significant foci for bird speciation in Australia by acting as a major refuge.

The value is important for rare, vulnerable or endangered species, Australia's evolutionary history, demonstrating the principle characteristics of forested

landscapes and ecosystems and is related to maintaining existing processes (Sub-criterion A1, A2, B1 and D1).

4.7.1 Method

Expert opinion was used to identify environmental features that constituted important habitat, and to nominate areas known to be important. A map of the nominated environmental features meeting the expert opinion was generated and validated against areas identified as important habitat. The layer consists of the following:

- all rainforest under 300 m above sea level.
- areas with rainforest, wet forest and grassy forest in a complex within 200m of each other along the escarpment north of Washpool National Park. (Wet types were defined as those with mesic elements in the understorey, dry forest was defined as those with grassy in the description. This was combined with the rainforest described above.).
- the great escarpment (between 300 and 800 m ASL).
- areas with concentrations of winter flowering eucalypts (taken to be eucalypts with more than 50% of their flowering between June and September on average) based on a forest ecosystem analysis and richness across a 100m grid.
- Concentrations of woodlands and dry sclerophyll forest based on forest ecosystem analysis and richness across a 100m grid.

4.7.2 Establishing the threshold

The layer was cut to remove areas that have been cleared or substantially modified using biophysical naturalness values 0 and 1. A 100 ha minimum size was applied to all identified areas with the exception of rainforest, for which there was no minimum size threshold applied because of the importance of lowland remnants.

4.7.3 Results

The areas identified as having indicative national estate significance for important habitat is delineated on Map 14. The areas delineated in this layer are those environments nominated by experts for an array of values relating to important habitat including migratory species, development of tall, moist forests and the diversity of arboreal marsupials and macropods. Areas shown were delineated using the best information available to the Upper North-East comprehensive regional assessment. All areas identified are significant with regard to Australia's evolutionary history, existing natural systems, principle characteristics of forested landscapes and rare or uncommon species and are above the threshold warranted for national estate listing.

The areas delineated for important habitat describe a broad band of forested landscapes from Orara West in the south, across the Dorrigo plateau and Guy Fawkes river catchment north through Washpool and Ewingar to Beaury State Forest and the

Queensland border. The layer then follows the Border Ranges and Richmond Ranges and follows the border almost to the coast. Outlying areas pick up remnant coastal rainforest and areas in the landscape important for richness of woodland or dry sclerophyll forest.

A total of 676,973 ha was identified as above threshold for important habitat. 22% of this was on existing reserves, 31% in state forest and 38% on private land. (Table 14). The major landscapes in the layer include significant sites already nominated on the Register of the National Estate including the Border Ranges and Mount Warning caldera, the national park adjacent to Beaury State Forest, Washpool and Guy Fawkes National Parks.

TABLE 14: LAND TENURE OF INDICATIVE NATIONAL ESTATE IMPORTANT HABITAT

Tenure	Approximate Area (ha)	Proportion of Total (%)
National Park, PMP 1.3 or Nature Reserve	150,207	35.7
State Forest	208,595	27.4
Private Land	255,668	21
Leasehold Crown Land	49,799	7.4
Other Crown Land	9608	1.4

*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)

4.8 Remnant vegetation and rare old-growth forest

Remnant vegetation provides important refuge and recruitment areas for both flora and fauna, and is important in maintaining existing natural systems within disturbed landscapes. Large-scale clearing for agriculture on the coastal plain and west of the great dividing range has removed native vegetation from extensive areas of the region. Much of the remaining forest is fragmented and significant proportions have a long history of commercial forestry operations.

Rare old-growth forest was assessed together with remnant vegetation as many of the conservation issues are closely related. Rare old-growth forest are those old-growth forest communities that are rare or uncommon nationally or within the Upper North-East region, and common forest communities where the levels of disturbance are such that all remaining old-growth forest areas are potentially of national estate significance. Rare, endangered or uncommon old-growth forest communities were identified in Upper North-East as being vegetation communities where old-growth forest as a proportion of the forest community is generally less than 20 per cent (derived from the JANIS criteria and expert advice).

Remnant vegetation is important for demonstrating the principle characteristics of forested landscapes and ecosystems, rare or uncommon species and is related to maintaining existing processes (Sub-criterion A2, B1 and D1).

4.8.1 Method

Remnant vegetation and rare old-growth forest was derived using the following:

- Forest ecosystems whose extant coverage was 10% or less of the estimated pre-1750 area based on data presented by NSW NPWS to the environment heritage and technical committee (EHTC); and

- Forest ecosystems intersected with Biophysical naturalness 4 and 5. Forest ecosystems that had less than 20% of their area covered by undisturbed forest compared with their pre-1750 area were regarded as rare old-growth forest. The forest ecosystems used were those listed in the forest ecosystem table presented as the final data-set at EHTC.

4.8.2 Establishing the threshold

Areas that met the above criteria were identified as above threshold.

4.8.3 Results

The areas identified as having indicative national estate significance for remnant vegetation and rare old-growth forest are delineated on Map 15. The areas delineated in this layer are those identified as significant with regard to existing natural systems, principle characteristics of forested landscapes and rare or uncommon species and are above the threshold warranted for national estate listing.

Remnant vegetation occurs as scattered small units across most of the region, generally clustered around the coastal plain and the tablelands. Concentrations of values occur around the new national park in Kangaroo River State Forest, in Chaelundi State Forest, in the Guy Fawkes-Cathedral Rock area and in Washpool National Park. Additional concentrations occur in private property to the south of Torrington, north-west of Glen Innes and around Single State Forest.

A total of 63,107 ha was identified as above threshold for remnant vegetation and rare old-growth forest. 15% of this was on existing reserves, 19% in state forest and 51% on private land. (Table 15). The major landscapes in the layer include significant sites already nominated on the Register of the National Estate including Cathedral Rock, Washpool and Guy Fawkes National Parks.

TABLE 15: LAND TENURE OF INDICATIVE NATIONAL ESTATE REMNANT VEGETATION AND RARE OLD-GROWTH FOREST

Tenure	Approximate Area (ha)	Proportion of Total (%)
National Park, PMP 1.3 or Nature Reserve	9,823	15.6
State Forest	12,006	19
Private Land	32,141	50.9
Leasehold Crown Land	5,769	9.1
Other Crown Land	3,165	5

*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)

4.9 Vegetation succession

Places that are important for vegetation succession are forest communities that have dynamic examples of succession occurring within them, areas affected by fire (halting primary succession processes), and forest communities recovering from major wildfires. Although it was recognised that specific examples may exist in the region, time and data constraints precluded any specific analysis of vegetation succession for Upper North-East.

Sub-Criterion A.3: Importance in exhibiting unusual richness or diversity of flora

The identification of areas of indicative national estate significance under this sub-criterion involves assessment of places important for diversity and or richness of natural values. The national estate assessment of this value sought to identify areas of particular richness and diversity in the region for:

- species richness (alpha diversity);
- flora community (beta) diversity;
- habitat richness.

4.10 Flora and fauna species richness

Flora and fauna species richness, also known as alpha diversity, is measured as the number of species occurring within an area of a given size. Upper North-Eastern NSW comprises an area of diverse habitats from sub-alpine environments to coastal complexes and sub-tropical rainforest and the region has been widely recognised as an area important for biodiversity. Areas of high species richness can be indicative of sites where repeated species radiation and contraction has occured, identifying centres for refugia and major long-term evolutionary centres for speciation. (Heatwole 1987, Pianka (1981), Kitching 1981, Cogger and Heatwole, 1981, 1984). Species richness is considered under sub-criterion A3 for exhibiting unusual richness or diversity of fauna or flora.

4.10.1 Method

The fauna layer was derived using fauna point data provided by the NPWS wildlife atlas and CRA survey work. 655 species were included in the analysis, excluding introduced species only. The flora layer was derived using flora point data provided by the NPWS derived from atlas, literature review and CRA survey. 1713 species were used in analysis.

Point location information for all identified species was plotted respectively for flora and fauna on a one kilometre square grid. An analysis was done which then searched for all records within a two kilometre radius around each grid cell. The resultant analysis showed concentrations of species for fauna and flora respectively, across the landscape.

This layer was validated by comparing the areas depicted in the layer with areas that experts identified as being important for species richness.

4.10.2 Establishing the threshold

The above information was displayed as standard deviations above the mean number of species in the landscape. Two standard deviations above the mean number of species for both flora and fauna was taken to be above threshold.

4.10.3 Results

The areas identified as having indicative national estate significance for species richness are delineated on Map 16 for fauna and Map 17 for flora. The areas delineated in this layer are areas with high concentrations of species in the landscape, delineated using the best information available to the Upper North-East comprehensive regional assessment. All areas identified are significant with regard to exhibiting unusual richness or diversity of fauna or flora and are above the threshold warranted for national estate listing.

Areas that were delineated for species richness were broadly similar for fauna and flora. Generally speaking, the delineated area ran from the Mount Warning caldera,

across the Border Ranges and down the Richmond Ranges. Areas were delineated down the escarpment in Ewingar, Washpool, Guy Fawkes and Cathedral Rock. Mount Hyland Nature Reserve and Chaelundi State Forest were identified and along the coastal plain, Wedding Bells State Forest, Moonee Beach Nature Reserve, Yuraygir National Park, Bundjalung National Park and the coast north to Brunswick Heads were identified.

A total of 215,960 ha was identified as above threshold for fauna species richness. 29% of this was on existing reserves, 30% in state forest and 36% on private land. A total of 247,291 ha was identified above threshold for flora species richness. 39% of this was on existing reserves, 36% in State Forest and 22% in private property (Table 16). The Mount Warning Caldera, Border Ranges, Washpool National Park, Guy Fawkes, Cathedral Rock, the area around Moonee Beach Nature Reserve, Yuraygir and Bundjalung National Parks are indicative of the places identified in the current work that are places already listed in the Register of the National Estate.

TABLE 16: LAND TENURE OF INDICATIVE NATIONAL ESTATE SPECIES RICHNESS

Tenure	Approximate Area (ha)	Proportion of Total (%)
National Park, PMP 1.3 or Nature Reserve		
For Fauna	62,790	29.1
For Flora	97,702	39.5
State Forest		
For Fauna	64,702	29.96
For Flora	89,449	36.2
Private Land		
For Fauna	77,912	36.1
For Flora	53,495	21.6
Leasehold Crown Land		
For Fauna	2,188	1
For Flora	2,152	0.9
Other Crown Land		
For Fauna	6,013	2.8
For Flora	3,055	1.2

*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)

4.11 Vegetation community richness

Significant plant community richness, or high beta diversity, is often seen in places where, because of sharp environmental gradients or marked changes in soils, drainage or other variables, there are unusually diverse conjunctions or rapid transitions of forest community types. In North-Eastern NSW these environments are typified by the elevation gradient of the great escarpment and associated river gorges, where vegetation communities vary over a comparatively small distance. This value is important for sub-criterion A3, exhibiting unusual richness or diversity of flora.

4.11.1 Method

The CRA forest ecosystem map was used to assess and identify areas above threshold. A 100m grid was laid across the whole of Upper North-Eastern NSW and then the number of forest ecosystems within a radius of two kilometres of each grid cell was calculated. This produced a map of the richness of forest ecosystems across the landscape.

4.11.2 Establishing the threshold

Areas were regarded as being above threshold for vegetation community richness where the number of forest ecosystems in a 100m cell were more than 2 standard deviations above the mean number of forest ecosystems in any cell.

4.11.3 Results

The areas identified as having indicative national estate significance for vegetation community richness are delineated on Map 18. The areas delineated in this layer are areas with high concentrations of vegetation communities in the landscape, delineated using the best information available to the Upper North-East comprehensive regional assessment. All areas identified are significant with regard to exhibiting unusual richness or diversity of flora and are above the threshold warranted for national estate listing.

The areas delineated as above threshold for vegetation community richness are strongly associated with the escarpment of the Great Dividing Range and associated river gorges. Areas delineated include Demon Nature Reserve, Malara State Forest, Washpool National Park, and parts of the Guy Fawkes and Mann river catchments including Grange State Forest, Gibraltar Range and Brother State Forests. Towards the east, areas delineated include Marara State Forest, parts of Cloud's Creek State Forest, Sherwood Nature Reserve and Yuraygir National Park.

A total of 96,802 ha was identified as above threshold for vegetation community richness. 19% of this was on existing reserves, 10% in state forest and 53% on private land. (Table 17). Washpool, Guy Fawkes and Yuraygir National Parks are indicative of the places identified in the current work that are places already listed in the Register of the National Estate.

TABLE 17: LAND TENURE OF INDICATIVE NATIONAL ESTATE VEGETATION COMMUNITY RICHNESS

Tenure	Approximate Area (ha)	Proportion of Total (%)
National Park, PMP 1.3 or Nature Reserve	18,892	19.5
State Forest	9,450	9.8
Private Land	51,002	52.7
Leasehold Crown Land	14,521	15
Other Crown Land	2,937	3

*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)

4.12 Habitat richness

Habitat richness has been defined as areas where, because of environmental gradients, there is an unusual increase in the variety of habitats available. This taken to involve an interaction between vegetation community richness, fauna species richness and flora species richness and is important as an indicator for areas of potential high biodiversity. (Sub-criterion A3).

4.12.1 Method

Habitat richness is a grid coverage derived by adding the areas identified as above threshold for flora and fauna species richness together into a single layer. This combined layer was then combined with the vegetation community richness layer. The areas identified as possessing either a combination of flora and fauna richness or vegetation community richness were regarded as having habitat richness.

4.12.2 Establishing the threshold

Areas that met the above criteria were regarded as being above threshold.

4.12.3 Results

The areas identified as having indicative national estate significance for habitat richness are delineated on Map 19. The areas delineated in this layer are areas with high concentrations of potential habitat richness in the landscape, delineated using the best information available to the Upper North-East comprehensive regional assessment. All areas identified are significant with regard to exhibiting unusual richness or diversity of fauna, flora or vegetation community richness and are above the threshold warranted for national estate listing.

Areas delineated as above threshold were scattered along the coast, the escarpment and associated ranges. Particular areas included the Mount Warning Caldera, Demon Nature Reserve, Washpool National Park, the area between Glen Nevis State Forest and Mann River National Park, Chaelundi and Marengo State Forests, Kangaroo

River State Forest to Sherwood Nature Reserve, and elements along the coast from Yuraygir to Bundjalung National Park.

A total of 188,609 ha was identified as above threshold for habitat richness. 27% of this was on existing reserves, 22% in state forest and 39% on private land. (Table 17). The area delineated included areas of existing National Estate, the major areas being Washpool National Park, the Mount Warning caldera, Yuraygir and Bundjalung National Park.

TABLE 17: LAND TENURE OF INDICATIVE NATIONAL ESTATE HABITAT RICHNESS

Tenure	Approximate Area (ha)	Proportion of Total (%)
National Park, PMP 1.3 or Nature Reserve	52,077	27.6
State Forest	42,584	22.6
Private Land	73,204	38.8
Leasehold Crown Land	14,845	7.9
Other Crown Land	4,805	2.5

*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)

Sub-Criterion B1: Importance for rare, endangered or uncommon flora, fauna, communities, ecosystems, natural landscapes or phenomena, or as a wilderness

This sub-criterion recognises the importance of biotic elements which are rare or uncommon, or have become so through the effects of disturbances or threatening processes. The following values relate to this sub-criterion:

- rare old-growth forest;
- rare and threatened flora and fauna species, and
- rare, threatened or uncommon plant communities.

4.13 Rare old-growth forest

Rare old-growth forest has been dealt with as part of the remnant vegetation layer (see section on sub-criterion A2.

4.14 Rare, threatened or uncommon flora and fauna species and their habitats

For the purposes of this layer, rare species were regarded as species listed on state or commonwealth legislation as rare, vulnerable or endangered. This layer identifies areas of importance to rare, endangered or uncommon species and which are also of significance in maintaining existing processes. (Sub-criterion B1, A2)

4.14.1 Method

The rare species layers for fauna and flora respectively was produced from two separate analysis:

- All Commonwealth and state listed species were used in a neighbourhood analysis that produces a grid coverage where each 1 kilometre grid cell is given a value equating to the total number of species recorded within a 2 kilometre radius of the cell. The resulting 1 kilometre grid provides a map of the concentration of rare species across the landscape.

- The point localities of Commonwealth and state listed endangered species were intersected with forest ecosystem polygons within 500m of their point location.

The two layers were merged and the final data set was intersected with biophysical naturalness value 0 and 1 to remove values in cleared and extensively modified landscapes. The final layer was validated against areas suggested by experts, a selection of species locality points and the results of modelling conducted by NSW NPWS.

4.14.2 Establishing the threshold

One kilometre grid cells with a total number of species greater than or equal to 2 standard deviation above the mean number of species were regarded as above threshold. All point localities of endangered species in a forested or uncleared natural locality were regarded as above threshold.

4.14.3 Results

The areas identified as having indicative national estate significance for rare species are delineated on Map 20 for fauna and Map 21 for flora. This layer delineates areas that are important for endangered species and areas with concentrations of rare and uncommon species. The layer uses the best information available to the Upper North-East comprehensive regional assessment. All areas identified are significant with regard to importance for rare, endangered or uncommon species and maintaining existing natural processes.

The layers for fauna and flora delineated similar but not identical areas in the landscape as being above threshold. Flora and fauna values were identified along the coast from Yuraygir to Brunswick Heads, in the remnant rainforest of the north-east corner of the RFA region, in the Mount Warning caldera and Border Ranges and on the Richmond Range, Washpool and Guy Fawkes National Parks and Chaelundi. Flora values were identified in Torrington, Marara State Forest, Banyabba Nature Reserve, Dalmorton, Wedding Bells, Orara West and Conglomerate State Forests. Fauna values were identified in Demon Nature Reserve, Malara, Ewingar, Banyabba and Gibberagee State Forests.

A total of 288,439 ha was identified as above threshold for rare fauna. 39% of this was on existing reserves, 34% in state forest and 23% on private land. A total of 377,450 ha was identified above threshold for rare flora. 39% of this was on existing reserves, 31% in State Forest and 26% in private property (Table 18). The area delineated included areas of existing National Estate, the major areas being Washpool and Guy Fawkes National Park, the Mount Warning caldera and Border Ranges, Yuraygir and Bundjalung National Park.

TABLE 18: LAND TENURE OF INDICATIVE NATIONAL ESTATE RARE SPECIES

Tenure	Approximate Area (ha)	Proportion of Total (%)
National Park, PMP 1.3 or Nature Reserve		
For Fauna	112,045	38.8
For Flora	146,150	38.7
State Forest		
For Fauna	100,030	34.7
For Flora	118,525	31.4
Private Land		
For Fauna	67,077	23.3
For Flora	96,750	25.6
Leasehold Crown Land		
For Fauna	3,088	1.1
For Flora	6,650	1.8
Other Crown Land		
For Fauna	4044	1.4
For Flora	6,750	1.8

*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)

4.15 Rare, threatened or uncommon vegetation communities

In the Upper North-East comprehensive regional assessment 'forest ecosystems', 'plant communities' and 'forest vegetation types' are all considered to refer to the same vegetation units and are used interchangeably. Rare vegetation communities are important for demonstrating the principle characteristics of forested landscapes and ecosystems, and endangered, rare or uncommon species and is related to maintaining existing processes (Sub-criterion A2, B1 and D1).

4.15.1 Method

The expert workshop that considered the results of the forest ecosystem project identified that all vegetation communities that required a 100% target under JANIS were above threshold for national estate. The distribution of these communities was mapped from the forest ecosystem layer. All occurrences of these ecosystems were regarded as above threshold.

4.16.2 Establishing the threshold

Thresholds were established as discussed above.

4.16.3 Results

The areas identified as having indicative national estate significance for rare vegetation communities are delineated on Map 22. The areas delineated in this layer are rare vegetation communities, identified using the best information available to the Upper North-East comprehensive regional assessment. All areas identified are significant with regard to endangered, rare or uncommon species, demonstrating the principle characteristics of some extremely uncommon vegetation communities and maintaining existing processes. These areas are above the threshold warranted for national estate listing.

The areas above threshold for rare vegetation communities are broadly distributed across the landscape of Upper North-Eastern NSW. There are identified concentrations on the Border Ranges and around the Mount Warning caldera and adjacent lowland rainforest. Large concentrations also occur on the Richmond Range, Ewingar State Forest, Washpool National Park, Mount Hyland Nature Reserve, and Wild Cattle Creek, Moonpar and Orara West State Forests.

A total of 204767 ha was identified as above threshold for rare vegetation communities. 41% of this was on existing reserves, 29% in state forest and 25% on private land. (Table 19). The areas identified as above threshold correlated strongly with places registered on the Register of the National Estate for the Border Ranges, the Mount Warning caldera, Washpool National Park and Mount Hyland Nature Reserve.

TABLE 19: LAND TENURE OF INDICATIVE NATIONAL ESTATE RARE VEGETATION COMMUNITIES

Tenure	Approximate Area (ha)	Proportion of Total (%)
National Park, PMP 1.3 or Nature Reserve	84,062	41
State Forest	58,994	28.8
Private Land	50,760	24.8
Leasehold Crown Land	6,206	3
Other Crown Land	4,447	2.2

*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)

Sub-Criterion D.1: Importance in demonstrating the principal characteristics of the range of landscapes, environments or ecosystems, the attributes of which identify them as being characteristic of their class.

This sub-criterion recognises the significance of identifying and conserving 'representative examples' of the range of features of the Australian environment. The following value was assessed under this sub-criterion.

- flora communities characteristic of their class.

4.16 Principal characteristics of class

Principle characteristics of class recognises the significance of identifying and conserving "representative examples" of the range of landscapes, environments or ecosystems. Although some vegetation communities were considered and it was recognised that representative examples may exist in the region, time and data constraints precluded any comprehensive analysis of principle characteristic of class for envrionments or ecosystems. It should be noted that the work conducted for refugia, migratory species, remnant vegetation, rare vegetation communities, and important habitat identified particular landscape features such as wetlands or rainforest and broader features such as forested landscapes along the great escarpment that should be regarded as some of the best examples in temperate Australia and that the sub-sections dealing with these values have been noted as dealing with D1.

5. OTHER NATURAL VALUES

5.1 Geological and geomorphological and soil values

The identification and assessment of sites of indicative national estate geoheritage significance in the Upper North East comprehensive regional assessment forest region was undertaken as part of a state-wide assessment by Osborne et al (1998).

Areas which may be identified as having geoheritage value (National Estate Criteria A.1, A.2, A.3, B.1, C.1 and D.1) include places important:

- in the evolution of Australian landscapes or climate (A.1);
- in maintaining existing processes or natural systems at the regional or national scale (A.2);
- in exhibiting unusual richness or diversity of landscapes (A.3);
- for rare, endangered or uncommon natural landscapes or
- phenomena (B.1);
- for information contributing to a wider understanding of Australian natural history by virtue of its use as a research site, teaching site, type locality, reference or benchmark site (C.1);
- in demonstrating the principal characteristics of the range of landscapes, environments or ecosystems, the attributes of which identify them as being characteristic of their class (D.1).

5.1.1 Method

The methodology being undertaken for the project includes:

- the development and application of thresholds for national estate assessment purposes based on a review of the significance of the identified sites;
- documentation of potential national estate geoheritage sites;
- sensitivity analysis of all potential national estate geoheritage sites; and
- development of conservation management guidelines for those sites identified

The consultant assessed scientific journals and other published material for place-related information that was likely to identify potential places of geoheritage significance. Published geological maps and topographic maps were examined and potential features of geological significance identified. Other sources of data included contact with various institutions, and contact with numerous experts.

5.1.2 Establishing the threshold

Potential places were listed against the relevant national estate criteria identified in regional reviews undertaken by the consultant. Places were classified into three groups depending on the quality of data on values and location:-

1 - The values and location of the place can be determined from the available data.
2 - There is insufficient data available at this time to the values at the place.
3 - There is insufficient data available as to the location of the place.

The consultant has recommended that because of limitations in the data, including poorly defined locality information and a lack of ground truthing, that it would not be appropriate to threshold the sites. Accordingly, the data will be used as an informing–type layer which can be used to enhance documentation of national estate places identified from other assessments, and as a contextual layer for reserve design.

A lack of suitable data did not mean that these places lack significance or that with more detailed literature or field investigation their status could not be satisfactorily established in the future. However, it was not possible to undertake this further work within the constraints of the CRA assessments.

5.1.3 Results

Of the sites where spatial information was available, 120 Geoheritage sites (unthresholded) were delineated for the Upper North East CRA region, 35 occurring in National Parks, 12 in State Forests, 64 on private land, 7 on vacant crown land, and 2 on leasehold land (See Appendix H). There were some additional sites identified where spatial information was not available. The areas identified as a result of this process are yet to be delineated spatially.

The conservation management guidelines were limited to a 'fragility' ranking. A four step scale was applied to each place, where spatial information was available, corresponding to the extreme ends of the scale used by Dixon et al (1997) to classify sensitivity of sites identified, 1 being highly sensitive to 4 being highly robust for each place report.

5.2 Natural history values

The identification and assessment of sites of indicative national estate natural history significance in the UNE comprehensive regional assessment forest region was undertaken as part of a state-wide assessment by Denny (1998).

Areas which may be identified as having natural history value (National Estate Criteria C.1) include places important *'...for information to contributing to the wider understanding of Australian natural history, by virtue of its use as a research site, teaching site, type locality, reference or benchmark site'.*

5.2.1 Method

Data sources included literature searches of established journals, conference proceedings, contact with various institutions including natural history societies, and contact with numerous experts. The consultant assessed the national estate values of identified places against the national estate criteria by ranking the importance of each site, in terms of its contribution to Australian Natural History. The sites were ranked as having high, moderate or low value as a C1 site of national estate importance.

5.2.2 Establishing the threshold

Various factors were used to derive threshold values for each site type including such elements as the rigour of methodology, accuracy of location, the availability of information and overall reliability of the data sources used. By applying the elements described above, the consultant ranked each site as having high, moderate or low value as a C1 site of national estate importance. On this basis, it was recommended that rejected sites, ie those with a low ranking, were not included in the assessment.

5.2.3 Results

79 Natural History sites (unthresholded) were delineated for the Upper North East CRA region, 24 occurring in National Parks, 10 in State Forests, 43 on private land, and 2 on vacant crown land. 52 of the 79 sites indicated above were identified as being above threshold (See Appendix I). The areas identified as a result of this process are yet to be delineated spatially.

6. PROTECTING NATURAL HERITAGE VALUES AND PLACES IN NSW FORESTS

The existing protective mechanisms for natural heritage values and places in NSW forests is summarised in a table at Appendix F. The table lists the existing off-reserve protective mechanisms and their sensitivity to disturbance.

7. REFERENCES AND BIBLIOGRAPHY

Barker, J, Grigg, GC, and Tyler, MJ 1995
"A field guide to Australian frogs" Surrey Beatty & Sons

Blakers, M, Davies, SJJF, and Reilly, PN 1984
"The Atlas of Australian Birds" The Royal Ornithological Union and Melbourne University Press

Boland, DJ, Brokker, MIH, Chippendale, GM, Hall, N, Hyland, BPM, Johnston, RD, Kleinig, DA and Turner, JD 1984
"Forest Trees of Australia" Thomas Nelson Australia

Brooker, MIH and Kleinig, DA 1990
"Field Guide to Eucalypts Volume 1: South-Eastern Australia" Inkata Press

Cogger, HG, and Heatwole, H (1981)
"The Australian reptiles: origins, biogeography, distribution patterns and island evolution." pg 343-360 in Keast, A (ed) Ecological Biogeography of Australia. The Hague: Junk Vol 2

Cogger, HG, and Heatwole, H (1984)
"The Australian reptiles: origins, biogeography, distribution patterns and island evolution." pgs 343-360 in Archer, M and Clayton, G (eds) Vertebrate Zoogeography and Evolution in Australia. (Animals in time and space). Carlisle: Hesperian Press.

Commonwealth Government of Australia 1992
"Nomination of central eastern rainforests of Australia for inclusion on the World Heritage List" Department of the Arts, Sport, the Environment and Territories.

Covacevich, J, 1991
"Frogs and reptiles of tropical and subtropical eastern Australian rainforests: distribution patterns and conservation" pgs 281-309 in "The Rainforest Legacy - National Rainforests Study, Volume 2 - Flora and Fauna of the Rainforests" Ed G. Werren and P. Kershaw, Australian Government Publishing Service.

Denny, M 1998
"Identification of places of natural history significance in NSW CRA forest regions (2) Sites of potential national estate value" Report to the Environment Forest Taskforce, Mount King Ecological Surveys.

Floyd, AG 1989
"Rainforest Trees of Mainland South-Eastern Australia" Forestry Commission of NSW, Inkata Press.

Ford, J (1982)
"Origin, evolution and speciation of birds specialised to mangroves in Australia." Emu 82, pg 12-23

Forestry Commission of NSW 1989
"Research Note 17: Forest Types in NSW" Forestry Commission of NSW

Greenslade, P
"Heritage listing of invertebrate sites in South-Eastern Australia" pages 67-76 in "Invertebrate Biodiversity and Conservation", Memoirs of the Queensland Museum Vol 36 part 1.

Harden, GJ (Ed) 1990-1993
"Flora of NSW, Volumes 1 to 4" Royal Botanical Gardens, New South Wales University Press

Heatwole, H (1987)
"Major components and distributions of the terrestrial fauna" pgs 101-135 in Dyne, GR and Walton, DW (eds) Fauna of Australia. General Articles. Canberra: Australian Government Publishing Service Vol 1A.

Hitchcock, P 1997
"The natural heritage significance of forests on basaltic soils in Australia (Background and preliminary evaluation" Unpublished report.

Howden, HF (1981)
"Zoogeography od some Australian Coleoptera as exemplified by the Scarabaeoidea. pgs 1007-1035 in Keast, A (ed) Ecological Biogeography of Australia. The Hague: Junk Vol 2

Hutchings, P and Saenger, P (1987)
"Ecology of Mangroves" St Lucia: Queensland University Press

Hutchinson, MN and Donnellan, SC (1993)
"Biogeography and phylogeny of the Squamata." in Glasby, CJ, Ross, GJB, Beesley, PL (eds) (1993) Fauna of Australia Vol 2A Amphibia and Reptilia. Australian Government Publishing Service.

JANIS 1997
"Nationally agreed criteria for the establishment of a comprehensive, adequate and representative reserve system for forests in Australia" Report prepared by the Joint ANZECC/MCFFA national forest policy statement implementation sub-committee., Commonwealth of Australia

Keast, A (1981)
"The evolutionary biogeography of Australian birds." pgs 1584-1635 in Keast, A (ed) Ecological Biogeography of Australia. The Hague: Junk Vol 3

Kikkawa, J and Pearse, K (1969)
"Geographical distribution of land birds in Australia - a numerical analysis" Australian Journal of Zoology 17 pg 821-840

Kikkawa, J Ingram, GJ and Dwyer, PD (1979)
"The vertebrate fauna of Australian heathlands" pg 231-279 in Sprecht, RL (ed) Heathlands and Related Shrublands of the World. A. Descriptive Studies. Amsterdam: Elsevier

Kirsch J (1984)
Marsupial Origins: taxonomic and biological considerations. pgs 627-631 in Archer, M and Clayton, G (eds) Vertebrate Zoogeography and Evolution in Australia. (Animals in time and space). Carlisle: Hesperian Press.

Kitching, RL (1981)
"The geography of the Australian Papilionoidae" pg 977-1005 in Keast, A (ed) Ecological Biogeography in Australia. The Hague: Junk Vol 2

Lesslie, R. and Maslen, M. 1995
National Wilderness Inventory, Australia. Handbook of Procedures, Contents and Usage (second edition). Australian Government Publishing Service for the Australian Heritage Commission, Canberra.

Main, BY, 1991
"Trapdoor spiders" pgs 363-364 in "The Rainforest Legacy - National Rainforests Study, Volume 2 - Flora and Fauna of the Rainforests" Ed G. Werren and P. Kershaw, Australian Government Publishing Service.

Marchant, S and Higgins, PJ (Eds), 1990-1996
"Handbook of Australian, New Zealand and Antarctic Birds Volume 1 to 3" Oxford University Press Australia

Merchant, JC (1995)
"Swamp Wallaby" in Strahan (ed) "Mammals of Australia" Reed Books Australia

Monteith, GB and Todd Davies, V, 1991
"Preliminary account of a survey of arthropods (insects and spiders) along an altitudinal rainforest transect in tropical Queensland" pgs 345-362 in "The Rainforest Legacy - National Rainforests Study, Volume 2 - Flora and Fauna of the Rainforests" Ed G. Werren and P. Kershaw, Australian Government Publishing Service.

Nix, HA 1982
"Environmental determinants of biogeography and evolution in Terra Australis" pgs 47-66 in "Evolution of the Flora and Fauna of Arid Australia" ED WR Barker and PJM Greenslade, Peacock Publishers, Frewville, South Australia

Osborne, RAL, Docker, B, Salem, L. 1998
"Places of geoheritage significance in NSW CRA forest regions" Report to the NSW CRA/RFA Steering Committee.

Osborne, WS 1991
"Birds of rainforest and associated tall open forest environments in the Washpool-Gibraltar Range region of NSW" pgs 209-234 in "The Rainforest Legacy - National Rainforests Study, Volume 2 - Flora and Fauna of the Rainforests" Ed G. Werren and P. Kershaw, Australian Government Publishing Service.

Parnaby, H 1992
"An Interim Guide to Identification of Insectivorous Bats od South-Eastern Australia" Technical Report of the Australian Museum Number 8

Pianka, E (1981)
"Diversity and adaptive radiations of Australian desert lizards." pgs 1375-1392 in Keast, A (ed) Ecological Biogeography of Australia. The Hague: Junk Vol 2

Pianka, E and Schall, J (1984)
"Species densaities of Australian vertebrates." pgs 119-124 in Archer, M and Clayton, G (eds) Vertebrate Zoogeography and Evolution in Australia. (Animals in time and space). Carlisle: Hesperian Press.

Robinson, M 1994
"A Field Guide to Australian Frogs" The Australian Museum and Reed Books Australia

Schuster, MN (1980)
"Origins and historical biogeography of eastern Australian rainforests. Scincidae." pgs 17-21 in Banks, CB and Martin, AA (eds) of the Melbourne Herpetological Symposium. Blackburn. The Dominion Press.

Stanisic, J
"The distribution and patterns of species diversity of land snails in Eastern Australia" pages 207-214 in "Invertebrate Biodiversity and Conservation", Memoirs of the Queensland Museum Vol 36 part 1.

Stein, JL, Stein, JA and Nix HA 1998
The identification of wild rivers - methodology and database development. Centre for Resource and Environmental Studies, Australian National University. Unpublished

Strahan, R 1995
"The Mammals of Australia" The Australian Museum and Reed Books Australia

Tindale, NB (1981)
"The Origin of the Lepidoptera relative to Australia" pg 955-976 in Keast, A (ed) Ecological Biogeography of Australia. The Hague: Junk Vol 2

Tyler, MJ 1994
"Australian Frogs: A Natural History" Reed Books Australia

Tyler, MJ, Watson, GF and Martin, AA (1981)
"The Amphibia: diversity and distribution" pg 1275-1301 in Keast, A (ed) Ecological Biogeography in Australia. The Hague: Junk Vol 2

Worboys, GL 1996
"Conservation corridors and the NSW section of the great escarpment of Eastern Australia" Paper presented at the International Union for the Conservation of Nature, The World Conservation Union Congress, Montreal Canada, October 13-23, 1996.

8. GLOSSARY

Aerial Photo Interpretation (API)
the delineation and identification of landscape features using photos taken from the air that are viewed in pairs using a steroscope to create a three-dimensional image.

Arboreal
tree-dwelling

ARC/INFO
software used to display and analyse spatially represented data.

assemblages
collections of populations of different species that live in the same area.

biodiversity
see biological diversity.

biogeography
the interaction between the biotic (living), and a-biotic (non-living) elements of the world, including climate, topography, geologiy etc.

biological diversity
the variety of all life forms: the different plants, animals and micro-organisms, the genes they contain, and the ecosystems they form. Biological diversity is usually considered at three levels: genetic diversity, species diversity, and ecosystem diversity. It is sometimes considered at the level of landscape diversity.

biophysical
a combination of physical features, such as climate, soils, geology and landforms, and biological features, such as flora and fauna.

biophysical naturalness (BN)
An indicator used in the national wilderness inventory related to the intensity and duration of interference with an ecosystems.

bioregion
a region defined by a combination of biological, social and geographic criteria rather than geopolitical criteria; generally, a system of related, interconnected ecosystems.

bryophytes
liverworts, mosses and hornworts: green, non-vascular land plants without seeds, numbering at least 18 000 species. They are among the simplest of the terrestrial plants but occupy a variety of habitats and show considerable diversity.

CAMBA
China-Australia Migratory Bird Agreement

comprehensive, adequate and representative reserve system
a reserve system displaying the features of comprehensiveness, adequacy and representativeness.
comprehensiveness - the degree to which the full range of ecological communities and their biological diversity is incorporated in the reserve system.
adequacy - the reserve system's ability to maintain the ecological viability and integrity of populations, species and communities.
representativeness - the extent to which areas selected for inclusion in the reserve system are capable of reflecting the known biological diversity and ecological patterns and processes of the ecological community or ecosystem concerned.

clear-felling
a logging system that results in the felling of all standing trees.

comprehensive regional assessment
a joint Commonwealth–State assessment of all forest values - environmental, heritage, economic and social - leading to the establishment of a comprehensive, adequate and representative reserve system, agreements on forest management, and the signing of a regional forest agreement.

conservation
the protection, maintenance, management, sustainable use, restoration and enhancement of the natural environment.

conservation advice and principles
the Australian Heritage Commission has a statutory obligation to provide advice on the protection of the National Estate. The advice is based on conservation principles that are aimed at protecting and maintaining National estate places and values. Advice is available for land management agencies and individuals who own places that have been identified as having National estate value.

context
the position of a feature or area in the landscape relative to the rest of the landscape or topographic features, other vegetation or disturbance. For example, some values such as old-growth forest need to be considered in context; that is, in terms of their relationship to disturbance, other vegetation and the landscape in general.

criteria
used by the Australian Heritage Commission to determine whether places meet the requirements for listing on the Register of the National Estate. The criteria are stipulated in the Australian Heritage Commission Act 1975.

disjunct
populations physically separated from one another; that is, there is no or minimal gene flow between the populations. They are formed over time as a result of the appearance of a barrier in a formerly continuous distribution. Disjunct populations often have features that are distinctive in an evolutionary sense from those of the 'parent' population and in time may become separate species.

disturbance
encompasses a range of factors that affect the condition of natural areas. Disturbance may be natural or human induced. Natural disturbance includes wildfires and rainstorms and is part of natural ecological processes. Human-induced, or 'unnatural', disturbance includes timber harvesting, agricultural clearing, mining and grazing. The factors that are important when considering disturbance are the origin, duration and intensity of the disturbance and its impact on the environment.

disturbance data
records of disturbances such as clearing, grazing, fire or timber harvesting that may affect themes, species or assemblages being assessed.

diversity
a measure of the physical or biological complexity of a system. It refers to a range of features, from artifact scatters to species presence.

ecosystem
a set of normally co-occurring and interacting species associated with a particular setting in the physical environment.

the aggregate of plants, animals and other organisms, and the non-living parts of the environment with which these organisms interact.

a dynamic complex of plant, animal, fungal, and micro-organism communities and the associated non-living environment interacting as an ecological unit.

endemic species
species confined to a specific region or locality.

environmental gradient
a description of the proxmity of different environments. For example, a steep environmental gradient might describe the changes from coastal sands through heath to tall forest over a comparatively short distance.

forest
in the context of the New South Wales–Commonwealth Regional Forest Agreement, an area, incorporating all living and non-living components, that is dominated by trees having usually a single stem and a mature or potential mature stand height exceeding 8 metres and with existing or potential projective cover of overstorey strata about equal to or greater than 5 per cent.

forest associations
a method of classifying forest types based on associations of the dominant tree species in the canopy.

forest community
a vegetation classification that subdivides a forest type by either structure or understorey floristic composition.

forest type
a vegetation classification defined by the dominant overstorey species.

genetic diversity
the variety of genetic information contained in all individual plants, animals and micro-organisms. It occurs within and between populations of species as well as between species.

geoconservation
the identification and protective management of geological, geomorphological and soil features, assemblages, systems and processes (geodiversity) for their intrinsic, ecological or heritage values.

geodiversity
the natural range (diversity) of geological (bedrock), geomorphological (landform) and soil features, assemblages, systems and processes. Geodiversity includes evidence for the history of the earth (evidence of past life, ecosystems and environments) and a range of processes (biological, hydrological and atmospheric) currently acting on rocks, landforms and soils.

geographic information system (GIS)
a system displaying spatially represented data; for example, Idrisi for Windows and ARC/INFO.

geoheritage
those components of geodiversity that are important to humans for purposes other than destructive exploitation; things we would wish to retain for present and future generations.

geology
the scientific study of the bedrock composition of the earth, including its origin, structure, composition, history, and past and present processes. Geological features contribute to geodiversity.

geological characteristics
features and structures associated with the formation of the earth's crust as well as major landform units such as mountains.

geomorphology
the scientific study of landforms - the surface morphology of bedrock substrates - and the past and present processes responsible for landform development. Geomorphological features contribute to geodiversity.

Gondwanan
refers to those characteristics or features relating to an ancient phase of the earth's development, when the land masses of the Southern Hemisphere were joined together. This agglomeration of the southern continents is termed Gondwana.

great escarpment
the eastern fall of the great dividing range which forms a more or less continuous series of ranges that divides the RFA region into eastern coastal areas and western ranges and associated tablelands.

habitat
the place or environment in which an organism naturally occurs.

heritage
encompasses all those things we have inherited from previous generations. Heritage includes places (including national estate places), things (moveable objects) and folklore (customs, songs and sayings).

Interim Biogeographic Regionalisation of Australia (IBRA)
a bioregional framework delineating natural regions in each State and Territory based on biophysical, environmental and vegetation considerations - for example, climate, soils, landform, vegetation, flora and fauna, and land use - that allow cross-border regionalisation.

interim list
the Australian Heritage Commission enters places on the interim National estate list by announcing, in the press and in the Commonwealth Government Gazette, its intention to register those places. Once a place is on the interim list, and before it can be entered on the Register of the National Estate, there is a minimum statutory period of three months during which any person can object to the proposal in writing. If objections are received they must be given due consideration by the Commission, but uppermost consideration must be given to the National estate significance of the place.

isopleth
a line drawn on a map connecting points having the same numerical value of a given variable, analogous to a contour line on a topographic map.

JAMBA
Japan-Australia Migratory Bird Agreement.

JANIS
The national agreed criteria for the establishment of a comprehensive, adequate and representative reserve system for forests in Australia, prepared by the joint ANZECC/MCFFA national forest policy statement implementation sub-committee.

karst
environments with distinctive landforms and drainage characteristics resulting from the relatively high solubility of some rock types, notably limestones and dolomites, in natural waters.

lithology
the general characteristics of rock formations, such as composition and texture, and the sequence in which the formations were laid down.

macropod
the group of marsupials including kangaroos and wallabies.

maintenance
the continuous protective care of the fabric, contents or setting of a place, as distinct from repair. Repair involves restoration or reconstruction.

metadata
information about the content, quality, condition and other characteristics of datasets.

microclimate
the suite of climatic variables (temperature, humidity etc) associated with a small part of an environment such as a river bank, the base of a tree or under a small stand of trees.

national estate
is a collection of places - components of the natural or cultural environment of Australia - that have aesthetic, historic, scientific or social significance or other special value for future generations and for the present community.

national estate values
the aesthetic, historic, scientific or social values attributed to places by the Australian Heritage Commission.

national forest policy statement
The statement that outlines the jointly agreed Commonwealth and State objectives and policies for the future of Australia's public and private forests.

old-growth forest
the National Forest Policy Statement defined old-growth forest as 'forest that is ecologically mature and has been subjected to negligible unnatural disturbance such as logging, roading and clearing'. For the purposes of this assessment, the proposed operational interpretation from JANIS (1996) was used; that is, 'old-growth forest is ecologically mature forest where the effects of disturbances are now negligible'.

paleoclimatic
The climatic conditions (moist, dry, glacial, etc) considered to be associated with a defined area at any point in prehistory.

phylogenetic
referring to the evolutionary line of descent of an individual taxon or groups of taxa.

Pleistocene
a period (epoch) of geological history covering the period from approximately 1.6 million years before present up to 10, 000 years before the present day.

primitiveness
used taxonomically to describe species that have features associated with the evolutionary past of a group. For example, the salamander fish has features rarely found in fish of the southern hemisphere and is regarded as therefore being primitive.

Quaternary
a period of geological history covering the period from approximately 1.6 million years before present up to and including the present day.

RAMSAR
The convention on wetlands of international importance, commonly known as the RAMSAR convention.

rare species
species with small world populations that are not at present endangered or vulnerable but are at risk.

recovery plan
a comprehensive plan that details, schedules and costs all actions deemed necessary to support the recovery of a threatened species or ecological community.

refugia, refuges
biological communities or geographic entities that, because of their moderating structural characteristics or physical isolation, or both, provide a sanctuary to which species or groups of species have retreated or have been confined in response to threatening processes, including climatic change.

regional forest agreement
an agreement, between the Commonwealth and a State or Territory government, for the long-term management and use of forests in a particular region. The purpose is to reduce uncertainty, duplication and fragmentation in government decision making by establishing a durable agreement on the management and use of forests.

Register of the National Estate
the national inventory of places of natural, historic and Aboriginal heritage significance that have been rigorously assessed by the Australian Heritage Commission and deemed worth conserving for present and future generations. The Register serves to notify all Australians, and particularly planners and decision makers, of places of National estate significance.

relictual
used to describe species associated with former ecosystems that have disappeared or have retracted to small pockets. For example, tingle forest contains a number of relictual species that appear to relictual species from Gondwanic rainforests.

richness
a measure of the abundance of individual elements within a particular place. For instance, the species richness of an ecological vegetation class is the number of species that occur within that class. The concept is closely related to diversity.

riparian
associated with river banks.

scoping agreement
an agreement, between the Commonwealth and a State or Territory government, that establishes the broad parameters for regional forest agreements.

selective logging
the logging of a selected portion of a stand of timber, usually according to pre-determined criteria relating to the intensity of the logging and the nature of the stand remaining after logging.

speciation
where a species evolves into a series of new species, normally in response to selection pressures such as changing environment.

species
a group of organisms capable of interbreeding freely with each other.

species diversity
refers to the variety of living species.

succession
the change in vegetation composition over time, one community 'succeeding' over the other. For example, wet forests in areas such as gullies that are protected from fire and other disturbance may eventually become rainforest. This occurs over a long period, in which rainforest species first colonize the understorey and, as the emergent eucalypts die out, rainforest species become the dominant species in the canopy.

taxon (pl. taxa)
the named classification unit to which individuals or species are assigned.

terrestrial
ground-dwelling.

Tertiary
a period (or era) of geological history from about 66 million years before present to 1.6 million years before present.

threshold
the level at which a value is considered acceptable for entry on the Register of the National Estate. Thresholds are developed through scientific assessment or expertise and an analysis of data within a regional context.

type specimen (biological/geological)
the original specimen from which a new species (biological or geological) is scientifically described. The type location is the place where the original type specimen was found.

value
refers to the particulars of a place that have worth, merit or significance.

vascular plant
a plant that possesses a vascular system, the conducting tissue that enables the transport of water, minerals and synthesized food materials throughout the plant and provides mechanical support.

vulnerable species or ecosystems
species or ecosystems that are approaching a reduction in range of 70 per cent or are subject to threatening processes that may cause their loss at the bioregional level.

wet sclerophyll forest
open eucalypt forest with tall trees and a relatively complex understorey of ferns, cycads and shrubs. Replaces dry sclerophyll forest in wetter areas with more fertile soils. Generally in areas with annual rainfall greater than 1000 millimeters.

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.

wilderness quality
a measure of differing levels of human impact on the natural environment, as part of a continuum of remote and natural conditions varying from pristine to urban. Wilderness quality is measured in terms of four variables: remoteness from settlement, remoteness from access, apparent naturalness, and biophysical naturalness.

woodland
a vegetation type dominated by woody vegetation having a mature or potential mature stand height exceeding 5 metres, with an overstorey canopy cover of less than 20 per cent.

APPENDIX A – AUSTRALIAN HERITAGE COMMISSION CRITERIA FOR THE REGISTER OF THE NATIONAL ESTATE

Without limiting the generality of sub-section (1) of the *Australian Heritage Commission Act 1975*, a place that is a component of the natural or cultural environment of Australia is to be taken to be a place included in the national estate if it has significance or other special value for future generations as well as for the present community because of:

Criterion A: Its importance in the course, or pattern, of Australia's natural or cultural history.
A.1 Importance in the evolution of Australian flora, fauna, landscapes or climate.

A.2 Importance in maintaining existing processes or natural systems at the regional or national scale.

A.3 Importance in exhibiting unusual richness or diversity of flora, fauna, landscapes or cultural features.

A.4 Importance for association with events, developments or cultural phases which have had a significant role in the human occupation and evolution of the nation, State, region or community.

Criterion B: Its possession of uncommon, rare or endangered aspects of Australia's natural or cultural history.

B.1 Importance for rare, endangered or uncommon flora, fauna, communities, ecosystems, natural landscapes or phenomena, or as a wilderness.

B.2 Importance in demonstrating a distinctive way of life, custom, process, land-use, function or design no longer practised, in danger of being lost, or of exceptional interest.

Criterion C: Its potential to yield information that will contribute to an understanding of Australia's natural or cultural history.

C.1 Importance for information contributing to a wider understanding of Australian natural history, by virtue of its use as a research site, teaching site, type locality, reference or benchmark site.

C.2 Importance for information contributing to a wider understanding of the history of human occupation of Australia.

Criterion D: Its importance in demonstrating the principal characteristics of:
(i) a class of Australia's natural or cultural places; or
(ii) a class of Australia's natural or cultural environments.

D.1 Importance in demonstrating the principal characteristics of the range of landscapes, environments or ecosystems, the attributes of which identify them as being characteristic of their class.

D.2 Importance in demonstrating the principal characteristics of the range of human activities in the Australian environment (including way of life, custom, process, land-use, function, design or technique).

Criterion E: Its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group.

E.1 Importance for a community for aesthetic characteristics held in high esteem or otherwise valued by the community.

Criterion F: Its importance in demonstrating a high degree of creative or technical achievement at a particular period.

F.1 Importance for its technical, creative, design or artistic excellence, innovation or achievement.

Criterion G: Its strong or special associations with a particular community or cultural group for social, cultural or spiritual reasons.

G.1 Importance as a place highly valued by a community for reasons of religious, spiritual, symbolic, cultural, educational, or social associations.

Criterion H: Its special association with the life or works of a person, or group of persons, of importance in Australia's natural or cultural history.

H.1 Importance for close associations with individuals whose activities have been significant within the history of the nation, State or region.

APPENDIX B – FAUNA AND FLORA LISTS USED IN NATIONAL ESTATE ASSESSMENTS -

Species	Disjunct Range	migratory	Endemic	Range Limit	Primitive Species	Relictual
Australian Brush-turkey				1	1	1
Australasian Grebe						
Oceanites oceanicus		1				
Puffinus pacificus		1				
Puffinus griseus		1				
Puffinus tenuirostris		1				
Puffinus carneipes		1				
Diomedea exulans		1				
Fregata minor		1				
Fregata ariel		1				
Sula leucogaster		1				
Sula sula		1				
Sula dactylatra		1				
Phaethon lepturus		1				
Chlidonias leucoptera		1				
Hydroprogne caspia		1				
Sterna bengalensis		1				
Sterna albifrons		1				
Sterna sumatrana		1				
Sterna anaethetus		1				
Anous stolidus		1				
Stercorarius parasiticus		1				
Arenaria interpres		1				
Pluvialis squatarola		1				
Pluvialis dominica		1				
Charadrius mongolus		1				
Charadrius leschenaultii		1				
Charadrius veredus		1				
Numenius madagascariensis		1				

Species	Disjunct Range	migratory	Endemic	Range Limit	Primitive Species	Relictual
Numenius phaeopus		1				
Numenius minutus		1				
Limosa limosa		1				
Limosa lapponica		1				
Tringa glareola		1				
Tringa incana		1				
Tringa hypoleucos		1				
Tringa nebularia		1				
Tringa stagnatilis		1				
Tringa terek		1				
Xenus cinereus		1				
Calidris ferruginea		1				
Calidris ruficollis		1				
Calidris acuminata		1				
Calidris canutus		1				
Calidris tenuirostris		1				
Calidris alba		1				
Limicola falcinellus		1				
Gallinago hardwickii		1				
Gallinago megala		1				
Rostratula benghalensis		1				
Glareola maldivarum		1				
Plegadis falcinellus		1				
Egretta alba		1				
Egretta sacra		1				
Anas querquedula		1				
Haliaeetus leucogaster		1				
Merops ornatus		1				
Hirundapus caudacutus		1				
Apus pacificus		1				
Cuculus saturatus		1				

Species	Disjunct Range	migratory	Endemic	Range Limit	Primitive Species	Relictual
Phylloscopus borealis		1				
Phalaropus fulicarius		1				
Charadrius dubius		1				
Gallinago stenura		1				
Calonectris leucomelas		1				
Motacilla alba		1				
Motacilla cinerea		1				
Motacilla citreola		1				
Motacilla flava		1				
Hirundo rustica		1				
Chlidonias niger		1				
Tryngites subruficollis		1				
Calidris alpina		1				
Calidris mauri		1				
Calidris bairdii		1				
Tringa totanus		1				
Numenius arquata		1				
Charadrius asiaticus		1				
Hydrophasianus chirurgus		1				
Grus antigone		1				
Crex crex		1				
Rallina fasciata		1				
Anas clypeata		1				
Ixobrychus sinensis		1				
Fregata andrewsi		1				
Oceanodroma leucorhoa		1				
Phalaropus lobatus		1				
Stercorarius longicauda		1				
Philomachus pugnax		1				
Limnodromus semipalmatus		1				
Stercorarius pomarinus		1				

Species	Disjunct Range	migratory	Endemic	Range Limit	Primitive Species	Relictual
Sterna hirundo		1				
Calidris subminuta		1				
Pterodroma solandri		1				
Ardeola ibis		1				
Calidris melanotos		1				
Stercorarius maccormicki		1				
Antechinus flavipes	1			1		
Antechinus stuartii						
Antechinus swansonii						
Aepyprymnus rufescens	1			1	1	1
Charadrius hiaticula		1				
Anomalopus leuckartii	1			1		
Amphibolurus muricatus	1					
Amphibolurus nobbi	1					
Anomalopus verreauxii	1			1		
Austrelaps ramsayi						
Acanthophis antarcticus						
Adelotus brevis	1			1		
Assa darlingtoni	1			1		1
Acrocephalus arundinaceus		1				
Ninox boobook						
Ninox connivens						
Ninox strenua						
Tyto alba						
Emu						
Little Pied Cormorant						
Ornithorhynchus anatinus					1	1
Tachyglossus aculeatus					1	
Dasyurus maculatus						
Dasyurus viverrinus						
Darter						

Species	Disjunct Range	migratory	Endemic	Range Limit	Primitive Species	Relictual
Phascogale tapoatafa	1					
Vespadelus darlingtoni						
Vespadelus troughtoni				1		
Planigale maculata				1		
Pseudocheirus peregrinus pulcher			1	1		
Australian Pelican						
Sminthopsis murina			1			
Isoodon macrourus				1		
Perameles nasuta						
Brown Quail						
Trichosurus vulpecula						
Trichosurus caninus						
Petauroides volans						
Petaurus australis						
Petaurus norfolcensis						
Petaurus breviceps						
Feathertail Glider						
Cercartetus nanus						
Phascolarctos cinereus	1					
Vombatus ursinus	1			1		
Potorous tridactylus	1				1	1
King Quail						
Petrogale penicillata	1					
Thylogale stigmatica	1			1		
Thylogale thetis			1	1		
Wallabia bicolor					1	1
Macropus parma	1		1	1		
Macropus parryi				1		
Macropus dorsalis				1		
Macropus rufogriseus						
Macropus giganteus						

Species	Disjunct Range	migratory	Endemic	Range Limit	Primitive Species	Relictual
Macropus robustus						
Pteropus poliocephalus		1	1			
Pteropus scapulatus		1				
Pteropus alecto		1	1	1		
Nyctimene robinsoni			1	1		1
Syconycteris australis			1			1
Red-backed Button-quail				1		
Rhinolophus megaphyllus						
Saccolaimus flaviventris		1				
Nyctinomus australis						
Mormopterus planiceps						
Mormopterus norfolkensis						
Masked Lapwing						
Mormopterus beccarii						
Nyctophilus timoriensis				1		
Nyctophilus gouldi						
Nyctophilus geoffroyi						
Nyctophilus bifax				1		
Miniopterus schreibersii		1				
Miniopterus australis		1				
Chalinolobus gouldii						
Banded Lapwing						
Chalinolobus morio						
Chalinolobus dwyeri						
Chalinolobus nigrogriseus				1		
Myotis adversus						
Grey Plover		1				
Scotoeanax rueppellii						
Scotorepens greyii						
Scotorepens balstoni						
Scotorepens orion						

Species	Disjunct Range	migratory	Endemic	Range Limit	Primitive Species	Relictual
Kerivoula papuensis						1
Falsistrellus tasmaniensis						
Vespadelus pumilus			1	1		
Vespadelus regulus						
Vespadelus vulturnus						
Rattus fuscipes						
Rattus lutreolis				1		
Painted Button-quail						
Pale Field-rat						
Oriental Plover		1				
Water Rat						
Red-capped Plover						
Mastacomys fuscus						
Pseudomys novaeholliandae	1					
Pseudomys oralis	1		1	1		1
Pseudomys gracilicaudatus	1			1		
Melomys cervinipes	1			1		
Melomys burtoni				1		
Little Curlew	1	1				
Grey-tailed Tattler		1				
Marsh Sandpiper	1	1				
Pale-headed Rosella				1		
Latham's Snipe		1				
Black-breasted Button-quail				1		1
Painted Snipe	1	1				
Comb-crested Jacana	1			1		
Oriental Pratincole		1				
Bush Stone-curlew						
Beach Stone-curlew	1			1		
Brolga				1		
Glossy Ibis		1				

Species	Disjunct Range	migratory	Endemic	Range Limit	Primitive Species	Relictual
Australian White Ibis						
Little Button-quail						
Straw-necked Ibis						
Royal Spoonbill						
Yellow-billed Spoonbill		1				
Black-necked Stork				1		
Little Egret						
Intermediate Egret	1	1				
Great Egret		1				
White-faced Heron						
Pacific Heron		1				
Red-chested Button-quail						
Eastern Reef Egret		1				
Nankeen Night Heron						
Striated Heron	1					
Little Bittern	1					
Black Bittern						
Australasian Bittern	1			1		
Magpie Goose	1			1		
Chelodina longicollis						
Maned Duck						
Elseya latisternum				1		
Black Swan						
Calyptotis ruficauda			1	1		
Emydura signata				1		
Wandering Whistling-Duck	1	1				
Plumed Whistling-Duck						
Australian Shelduck						
Diplodactylus vittatus						
Pacific Black Duck						
Rose-crowned Fruit-dove		1				

Species	Disjunct Range	migratory	Endemic	Range Limit	Primitive Species	Relictual
Chestnut Teal	1			1		
Grey Teal						
Oedura lesueurii	1					
Australasian Shoveler	1					
Oedura robusta				1		
Oedura tryoni	1			1		
Pink-eared Duck	1					
Underwoodisaurus milii						
Underwoodisaurus sphyrurus			1	1		
Freckled Duck	1					
Hardhead						
Blue-billed Duck	1	1				
Delma plebeia				1	1	
Musk Duck						
Lialis burtonis					1	
Pygopus lepidopodus					1	
Pogona barbata						
Spotted Harrier						
Tympanocryptis diemensis						
Swamp Harrier						
Grey Goshawk						
Brown Goshawk						
Eulamprus heatwolei	1			1		
Collared Sparrowhawk						
Diporiphora australis				1		
Red Goshawk				1		
Wedge-tailed Eagle						
Hypsilurus spinipes	1		1	1		1
Little Eagle						
Physignathus lesueurii						
Paradise Riflebird				1		1

Species	Disjunct Range	migratory	Endemic	Range Limit	Primitive Species	Relictual
White-bellied Sea-Eagle		1				
Brahminy Kite						
Varanus gouldii						
Whistling Kite						
Varanus varius						
Varanus rosenbergi	1			1		
Black Kite				1		
Coeranoscincus reticulatus			1	1		
Ophioscincus truncatus			1	1		
Superb Fruit-dove		1		1		
Square-tailed Kite						
Lygisaurus foliorum				1		
Black-breasted Buzzard				1		
Carlia tetradactyla						
Black-shouldered Kite						
Carlia vivax				1		
Channel-billed Cuckoo	1	1				
Cryptoblepharus carnabyi				1		
Letter-winged Kite						
Cryptoblepharus virgatus						
Pacific Baza				1		
Australian Hobby						
Grey Falcon						
Peregrine Falcon						
Ctenotus robustus						
Black Falcon				1		
Ctenotus taeniolatus						
Brown Falcon						
Australian Kestrel						
Egernia cunninghami				1		
Egernia frerei				1		

Species	Disjunct Range	migratory	Endemic	Range Limit	Primitive Species	Relictual
Egernia major				1		
Egernia modesta				1		
Egernia striolata				1		
Egernia whitii	1					
Hemiergis decresiensis				1		
Lampropholis amicula			1	1		
Saproscincus challengeri	1			1		1
Lampropholis delicata						
Lampropholis guichenoti						
Saproscincus mustelinus	1			1		
Lampropholis caligula			1	1		
Pseudemoia entrecasteauxii	1			1		
Bassiana platynota				1		
Cautula zia			1	1		
Ctenotus eurydice			1	1		
Lerista muelleri				1		
Wompoo Fruit-dove		1		1		
Tyto novaehollandiae						
Menetia greyii				1		
Morethia boulengeri				1		
Tyto tenebricosa						
Rainbow Lorikeet						
Saiphos equalis			1	1		
Eulamprus kosciuskoi	1		1	1		
Eulamprus murrayi			1	1		
Eulamprus quoyii						
Calyptotis scutirostrum	1			1		
Eulamprus tenuis						
Scaly-breasted Lorikeet						
Cyclodomorphus casuarinae	1			1		
Hemisphaeriodon gerrardii	1			1		

Species	Disjunct Range	migratory	Endemic	Range Limit	Primitive Species	Relictual
Musk Lorikeet		1				
Tiliqua scincoides						
Trachydosaurus rugosus				1		
Ramphotyphlops nigrescens					1	
Little Lorikeet						
Ramphotyphlops proximus				1	1	
Ramphotyphlops wiedii				1	1	
Double-eyed Fig-parrot		1		1		
Morelia spilota						
Tropidonophis mairii				1		
Boiga irregularis						
Dendrelaphis punctulata						
Red-tailed Black-Cockatoo				1		
Cacophis harriettae				1		
Cacophis krefftii			1	1		
Cacophis squamulosus						
Glossy Black-Cockatoo						
Rhinoplocephalus nigrescens						
Demansia psammophis						
Drysdalia coronoides						
Furina diadema						
Yellow-tailed Black-Cockatoo						
Hemiaspis signata						
Hoplocephalus bitorquatus						
Hoplocephalus bungaroides						
Hoplocephalus stephensii			1	1		
Gang-gang Cockatoo				1		
Notechis scutatus				1		
Saltuarius swaini						
Sulphur-crested Cockatoo						
Pseudechis guttatus				1		

Species	Disjunct Range	migratory	Endemic	Range Limit	Primitive Species	Relictual
Pseudechis porphyriacus						
Pseudonaja textilis						
Topknot Pigeon	1	1				
Little Corella						
Simoselaps australis				1		
Eulamprus martini						
Tropidechis carinatus			1	1		
Galah						
Vermicella annulata						
Cockatiel						
Saproscincus galli			1	1		
Saproscincus rosei			1	1		
Pelamis platurus						
White-headed Pigeon	1	1				
Red-winged Parrot						
Australian King-Parrot						
Liasis maculosus				1	1	
Crimson Rosella						
Eastern Rosella						
Brown Cuckoo-Dove	1					
Mallee Ringneck						
Red-rumped Parrot						
Egernia mcpheei				1		
Aegotheles cristatus						
Litoria pearsoniana				1		
Mixophyes fleayi	1			1		
Turquoise Parrot						
Uperoleia fusca				1		
Litoria littlejohni	1			1		
Heleioporus australiacus			1	1		
Lechriodus fletcheri	1		1	1	1	1

Species	Disjunct Range	migratory	Endemic	Range Limit	Primitive Species	Relictual
Limnodynastes dumerilii					1	
Limnodynastes peronii					1	
Limnodynastes tasmaniensis					1	
Limnodynastes terraereginae					1	
Mixophyes balbus	1			1		
Mixophyes fasciolatus						
Mixophyes iteratus	1			1		
Neobatrachus sudelli	1			1		
Swift Parrot		1				
Paracrinia haswelli	1			1		
Philoria kundagungan	1		1	1	1	1
Philoria loveridgei	1		1	1	1	1
Philoria sphagnicolus			1		1	1
Ground Parrot						
Limnodynastes ornatus				1	1	1
Pseudophryne australis			1	1		
Pseudophryne bibronii						
Pseudophryne coriacea				1		
Tawny Frogmouth						
Crinia parinsignifera				1		
Crinia signifera						
Crinia tinnula	1			1		
Podargus ocellatus				1		
Uperoleia laevigata						
Litoria aurea	1					
Litoria booroolongensis	1					
Litoria brevipalmata	1		1	1		
Litoria caerulea						
Litoria castanea	1		1			
Litoria chloris				1		
Dollarbird		1				

Species	Disjunct Range	migratory	Endemic	Range Limit	Primitive Species	Relictual
Litoria dentata						
Litoria fallax						
Litoria freycineti						
Litoria subglandulosa			1	1		
Litoria gracilenta				1		
Azure Kingfisher						
Litoria jervisiensis	1			1		
Litoria latopalmata						
Litoria lesueuri						
Litoria nasuta				1		
Bar-shouldered Dove				1		
Litoria olongburensis	1			1		
Litoria peronii						
Litoria phyllochroa				1		
Litoria tyleri						
Litoria verreauxii				1		
Litoria piperata			1			
Litoria revelata	1			1		
Laughing Kookaburra						
Forest Kingfisher				1		
Red-backed Kingfisher		1		1		
Sacred Kingfisher						
Collared Kingfisher				1		
Rainbow Bee-eater		1				
Emerald Dove						
White-throated Nightjar						
White-rumped Swiftlet				1		
White-throated Needletail		1				
Fork-tailed Swift		1				
Oriental Cuckoo		1		1		
Pallid Cuckoo		1				

Species	Disjunct Range	migratory	Endemic	Range Limit	Primitive Species	Relictual
Fan-tailed Cuckoo		1				
Brush Cuckoo		1				
Common Bronzewing						
Black-eared Cuckoo		1		1		
Horsfield's Bronze-Cuckoo		1				
Shining Bronze-Cuckoo		1				
Little Bronze-Cuckoo	1	1		1		
Common Koel		1				
Pheasant Coucal				1		
Brush Bronzewing						
Superb Lyrebird				1	1	
Albert's Lyrebird			1		1	
Noisy Pitta	1			1		
Rufous Scrub-bird	1		1		1	1
Welcome Swallow		1				
White-backed Swallow						
Tree Martin		1				
Fairy Martin		1				
Grey Fantail						
Rufous Fantail						
Willie Wagtail						
Leaden Flycatcher		1				
Satin Flycatcher		1				
Restless Flycatcher		1				
Shining Flycatcher	1					
Black-faced Monarch		1				
Spectacled Monarch		1		1		
White-eared Monarch				1		
Jacky Winter						
Scarlet Robin						
Flame Robin				1		

Species	Disjunct Range	migratory	Endemic	Range Limit	Primitive Species	Relictual
Rose Robin						
Hooded Robin						
Eastern Yellow Robin						
Pale-yellow Robin	1		1	1		
Golden Whistler						
Rufous Whistler						
Olive Whistler (ssp macphersonianus)	1					
Grey Shrike-thrush						
Little Shrike-thrush	1			1		
Magpie Lark						
Crested Shrike-tit						
Crested Bellbird				1		
Eastern Whipbird						
Black-faced Cuckoo-shrike						
White-bellied Cuckoo-shrike						
Barred Cuckoo-shrike		1				
Cicadabird						
Crested Pigeon						
White-winged Triller						
Varied Triller						
Figbird						
Logrunner	1		1	1		
Spotted Quail-thrush						
Wonga Pigeon						
Grey-crowned Babbler						
Lewin's Rail	1					
White-throated Gerygone						
Brown Gerygone	1					
Olive-backed Oriole	1					
Large-billed Gerygone						
Buff-banded Rail	1					

Species	Disjunct Range	migratory	Endemic	Range Limit	Primitive Species	Relictual
Mangrove Gerygone				1		
Western Gerygone						
Weebill						
Southern Whiteface				1		
Striated Thornbill						
Yellow Thornbill						
Brown Thornbill						
Buff-rumped Thornbill						
Yellow-rumped Thornbill						
White-browed Scrubwren						
Australian Crake	1			1		
Yellow-throated Scrubwren						
Large-billed Scrubwren						
Chestnut-rumped Heathwren				1		
Baillon's Crake	1					
Speckled Warbler						
Brown Songlark						
Rufous Songlark						
Spotless Crake	1					
Eastern Bristlebird	1					1
Little Grassbird						
Tawny Grassbird						
Clamorous Reed Warbler				1		
Golden-headed Cisticola						
Southern Emu-wren						
Superb Fairy-wren						
Bush-hen	1			1		
Variegated Fairy-wren						
Red-backed Fairy-wren				1		
White-breasted Woodswallow		1				
Masked Woodswallow						

Species	Disjunct Range	migratory	Endemic	Range Limit	Primitive Species	Relictual
White-browed Woodswallow		1				
Dusky Woodswallow		1				
Varied Sittella						
Brown Treecreeper						
White-throated Treecreeper						
Dusky Moorhen						
Red-browed Treecreeper						
Mistletoebird						
Spotted Pardalote						
Silvereye						
White-naped Honeyeater						
White-throated Honeyeater				1		
Purple Swamphen						
Black-chinned Honeyeater				1		
Brown-headed Honeyeater						
Striped Honeyeater						
Scarlet Honeyeater						
Eurasian Coot	1					
Eastern Spinebill						
Tawny-crowned Honeyeater				1		
Brown Honeyeater				1		
Painted Honeyeater		1				
Great Crested Grebe						
Pied Oystercatcher						
Regent Honeyeater	1	1		1		
Lewin's Honeyeater						
Mangrove Honeyeater	1			1		
Fuscous Honeyeater						
Yellow-faced Honeyeater						
White-eared Honeyeater						
Yellow-tufted Honeyeater						

Species	Disjunct Range	migratory	Endemic	Range Limit	Primitive Species	Relictual
Hoary-headed Grebe						
White-plumed Honeyeater						
New Holland Honeyeater						
White-cheeked Honeyeater						
Bell Miner	1			1		
Noisy Miner						
Yellow-throated Miner						
Little Wattlebird						
Red Wattlebird						
Spiny-cheeked Honeyeater						
Blue-faced Honeyeater						
Noisy Friarbird		1				
Little Friarbird	1	1				
Richard's Pipit						
Singing Bushlark						
Diamond Firetail						
Zebra Finch						
Double-barred Finch						
Chestnut-breasted Mannikin	1					
Plum-headed Finch						
Red-browed Finch						
Black-throated Finch				1		
Ornithorhynchus anatinus					1	1
Spangled Drongo						
Green Catbird						
Satin Bowerbird						
Regent Bowerbird			1	1		
Little Crow						
Torresian Crow				1		
White-winged Chough						
Pied Currawong						

Species	Disjunct Range	migratory	Endemic	Range Limit	Primitive Species	Relictual
Pied Butcherbird						
Grey Butcherbird						
Australian Magpie						
Eastern Grass Owl	1					
Bassian Thrush	1			1		
Russet-tailed Thrush	1			1		
Pacific Golden Plover	1	1				
Forest Raven						
Ringed Plover		1				
Stubble Quail						
Philoria sp 1 (undescribed)	1		1	1	1	1
Philoria sp 2 (undescribed)	1		1	1	1	1
Philoria sp 3 (undescribed)	1		1	1	1	1
Mormopterus sp 1						
Scotorepens sp 1						
Elseya georgesi			1	1		
Elseya purvisi			1	1		
Emydura sp1			1	1		
Tympanocryptis lineata pinguicollis						
Elseya sp2 (Gwydir & Namoi Rivers)			1	1		
Emydura sp (Bellingen River)			1	1		
Australian Raven						
Ruff	1	1				
Little Raven						
Great Cormorant						
Little Black Cormorant						
Striated Pardalote						
Cattle Egret		1				
Pied Cormorant						
Black-fronted Plover						
Eulamprus tryoni			1	1		

Species	Disjunct Range	ratory	Endemic	Range Limit	Primitive Species	Relictual
Lampropholis elongata			1	1		
Litoria barringtonensis			1			
Litoria daviesi						
Saltuarius wyberba			1	1		
Saproscincus oriarus "North Coast sp"			1	1		
SUMMARY	92	146	50	180	19	25

Taxon	endemic	disjunct	range limit
Abildgaardia vaginata			1
Acacia acrionastes			
Acacia adunca			1
Acacia amoena			
Acacia aulacocarpa var aulacocarpa			1
Acacia baeuerlenii			1
Acacia bakeri			1
Acacia barringtonensis		1	1
Acacia betchei			1
Acacia binervia			1
Acacia blakei			1
Acacia brownii			1
Acacia brunioides ssp brunioides		1	1
Acacia brunioides ssp granitica		1	1
Acacia bulgaensis			
Acacia burbidgeae			
Acacia bynoeana			
Acacia cangaiensis	1		
Acacia cheelii			1
Acacia chrysotricha	1		
Acacia cognata			1
Acacia complanata			1
Acacia courtii	1		
Acacia cultriformis			
Acacia dangarensis			
Acacia dawsonii		1	
Acacia dealbata			1
Acacia decora			
Acacia decurrens			1
Acacia diphylla			1
Acacia eborensis ms.			1

Taxon	endemic	disjunct	range limit
Acacia echinula			1
Acacia elata			1
Acacia elongata			1
Acacia farnesiana			
Acacia flocktoniae			
Acacia floydii			1
Acacia fulva			
Acacia granitica		1	1
Acacia hispidula		1	
Acacia ingramii			1
Acacia irrorata ssp velutinella	1		
Acacia ixiophylla			
Acacia jonesii			
Acacia juncifolia ssp serpentinicola	1		
Acacia lanigera			1
Acacia latisepala			
Acacia leucoclada ssp argentifolia			
Acacia linearifolia			
Acacia longifolia			1
Acacia macnuttiana			
Acacia matthewii			
Acacia mitchellii		1	1
Acacia montana		1	
Acacia orites (Demon NR metapopulation unit)			1
Acacia orites (northeast metapopulation unit)			
Acacia parramattensis			1
Acacia parvipinnula			1
Acacia pendula			
Acacia podalyriifolia			1
Acacia pruinosa			1
Acacia pubescens			
Acacia pubifolia			
Acacia pycnostachya			
Acacia ruppii	1		
Acacia schinoides			1
Acacia siculiformis		1	1
Acacia tessellata	1		
Acacia torringtonensis			
Acacia viscidula		1	
Acacia williamsiana J. T. Hunter ms.			
Acaena agnipila			

Taxon	endemic	disjunct	range limit
Acalypha capillipes			1
Acalypha eremorum			1
Acianthus amplexicaulis		1	
Acianthus apprimus			1
Acianthus caudatus			1
Acianthus exiguus		1	
Acmena hemilampra			1
Acmena ingens			1
Acomis acoma			
Acradenia euodiiformis			1
Acronychia baeuerlenii			1
Acronychia imperforata			1
Acronychia laevis			1
Acronychia littoralis			1
Acronychia octandra			1
Acronychia pauciflora			1
Acronychia pubescens			1
Acronychia suberosa			1
Acrostichum speciosum			1
Acrotriche serrulata			1
Actinotus gibbonsii			
Actinotus helianthi			
Adenochilus nortonii			1
Adenostemma lavenia			
Adiantum aethiopicum			
Adiantum diaphanum			
Adiantum formosum			
Adiantum hispidulum			
Adiantum silvaticum			
Adiantum silvaticum var glabrum			
Adiantum silvaticum var silvaticum			
Aegiceras corniculatum			
Aeschynomene indica		1	
Agrostis aemula			
Agrostis billardieri			1
Agrostis sp. A			1
Ailanthus triphysa			1
Akania bidwillii			1
Aldrovanda vesiculosa			1
Alectryon diversifolius		1	1
Alectryon forsythii			1

Taxon	endemic	disjunct	range limit
Alectryon subdentatus forma subdentatus			1
Alectryon tomentosus			1
Alexfloydia repens	1		
Alisma plantago-aquatica			1
Allocasuarina defungens	1		
Allocasuarina ophiolitica			
Allocasuarina rupicola			1
Allocasuarina simulans			
Alloteropsis semialata			1
Alloxylon pinnatum		1	1
Almaleea cambagei			
Almaleea paludosa			1
Alphitonia petriei			1
Alstonia constricta			1
Alternanthera nana			
Alternanthera sp. A			
Amorphospermum antilogum			1
Amorphospermum whitei			
Amphibromus pithogastrus			
Amphibromus sinuatus		1	1
Amphipogon strictus			
Amyema bifurcatum var bifurcatum			1
Amyema conspicuum			1
Amyema gaudichaudii			
Amyema quandang			
Amyema scandens			
Ancana stenopetala			1
Angiopteris evecta			1
Angophora costata			1
Angophora exul			
Angophora inopina			
Angophora paludosa			1
Angophora robur			
Angophora woodsiana			1
Anopterus macleayanus			1
Anthocarapa nitidula			1
Aotus lanigera			1
Aotus subglauca var filiformis			
Aotus subglauca var subglauca			1
Apatophyllum constablei			
Aphananthe philippinensis			1

Taxon	endemic	disjunct	range limit
Aponogeton elongatus			1
Archidendron hendersonii			1
Archidendron muellerianum			1
Archirhodomyrtus beckleri			1
Archontophoenix cunninghamiana			
Ardisia bakeri			1
Argophyllum nullumense			1
Aristida acuta			1
Aristida gracilipes			1
Aristida jerichoensis			
Aristida lignosa			
Aristida queenslandica var queenslandica			1
Aristolochia deltantha var laheyana		1	1
Aristolochia praevenosa			
Arrhenechthites mixta			1
Artanema fimbriatum			
Arthraxon hispidus			1
Arthrochilus prolixus			
Arthropodium minus			
Arthropteris palisotii			
Arundinella nepalensis			
Arytera distylis			1
Asperula asthenes	1		
Asperula charophyton			
Asperula gunnii			1
Asperula scoparia			1
Asplenium aethiopicum			
Asplenium harmanii			1
Asplenium trichomanes ssp quadrivalens			1
Asterolasia elegans			
Astroloma humifusum			1
Astroloma pinifolium			1
Astrotricha cordata		1	1
Astrotricha sp. nov. (Mt Boss)			
Atalaya multiflora			1
Atalaya salicifolia			1
Atherosperma moschatum			1
Atriplex semibaccata			
Austrobuxus swainii			
Austrofestuca eriopoda			1
Austrofestuca littoralis			1

Taxon	endemic	disjunct	range limit
Austromyrtus bidwillii			1
Austromyrtus dulcis			1
Austromyrtus fragrantissima			1
Austromyrtus hillii			1
Austromyrtus sp. A			1
Austromyrtus sp.B			1
Austrosteenisia blackii			1
Austrosteenisia glabristyla			1
Avicennia marina			
Babingtonia odontocalyx			
Babingtonia prominens			
Babingtonia silvestris			
Backhousia anisata		1	
Backhousia sciadophora			1
Baeckea gunniana		1	1
Baeckea ramosissima ssp ramosissima			1
Baeckea species C		1	
Baeckea sp. Pyramids (Babingtonia granitica??)			
Baeckea stenophylla			1
Baeckea utilis			1
Baloghia marmorata			1
Banksia cunninghamii ssp A			1
Banksia ericifolia var macrantha			1
Banksia marginata			1
Banksia robur		1	
Bauera rubioides			1
Baumea acuta			
Baumea gunnii		1	
Beilschmiedia elliptica			1
Beilschmiedia obtusifolia			1
Belvisia mucronata			1
Benthamina alyxifolia			1
Berberidopsis beckleri			1
Bertya brownii		1	1
Bertya ingramii	1		
Bertya rosmarinifolia			
Bertya sp. A Cobar-Coolabah			
Beyeria lasiocarpa		1	
Billardiera longiflora			1
Blandfordia grandiflora		1	
Blandfordia nobilis			

Taxon	endemic	disjunct	range limit
Blechnum ambiguum		1	
Blechnum fluviatile		1	1
Blumea lacera			1
Blumea mollis			1
Boehmeria platyphylla var austroqueenslandica			1
Boerhavia dominii			
Bolboschoenus caldwellii			
Bolboschoenus fluviatilis			
Boronia algida			1
Boronia anemonifolia var anemonifolia			1
Boronia chartacea		1	
Boronia falcifolia			1
Boronia fraseri			
Boronia granitica			
Boronia mollis			1
Boronia repanda			1
Boronia rosmarinifolia			1
Boronia rubiginosa		1	1
Boronia safrolifera			1
Boronia serrulata			
Boronia sp. aff. bipinnata Torrington			
Boronia sp. aff. Bolivia Hill			
Boronia sp. aff. microphylla Torrington			
Boronia umbellata	1		1
Bosistoa floydii			
Bosistoa pentacocca			1
Bosistoa selwynii			1
Bosistoa transversa			1
Bossiaea obcordata			
Bossiaea prostrata			
Bossiaea rupicola			1
Bothriochloa biloba			
Bothriochloa bladhii ssp bladhii			
Bouchardatia neurococca			1
Brachycome ascendens			1
Brachycome dissectifolia			1
Brachycome heterodonta var A			
Brachycome multifida var dilatata			1
Brachycome nova-anglica			1
Brachycome radicans		1	1
Brachycome spathulata			1

Taxon	endemic	disjunct	range limit
Brachycome tenuiscapa var pubescens			
Brachyloma saxicola			
Brachyloma scortechinii			1
Bracteantha viscosa			
Brasenia schreberi			
Bridelia exaltata			1
Bruguiera gymnorhiza			1
Brunoniella pumilio			1
Brunoniella spiciflora			
Buchnera gracilis			
Bulbine vagans			1
Bulbophyllum argyropus			1
Bulbophyllum bracteatum			1
Bulbophyllum globuliforme			1
Bulbophyllum lamingtonense (B. caldericola)			1
Bulbophyllum schillerianum			1
Bulbophyllum weinthalii			1
Bulbostylis densa			1
Bulbostylis pyriformis			
Cadellia pentastylis			
Caesalpinia bonduc			1
Caesalpinia scortechinii			1
Caesia alpina			1
Caesia calliantha			1
Caesia parviflora var minor			
Caladenia alata			
Caladenia arenaria - Bald Rock - prob. C. atroclavia		1	1
Caladenia filamentosa var filamentosa			
Caladenia gracilis			1
Caladenia picta			1
Caladenia quadrifaria		1	1
Caladenia sp. C		1	1
Caladenia tesselata			
Caladenia testacea			1
Calamus muelleri			1
Calandrinia eremaea			
Calanthe triplicata			
Callicarpa pedunculata			1
Callistemon acuminatus		1	1
Callistemon comboynensis			1
Callistemon flavovirens			

Taxon	endemic	disjunct	range limit
Callistemon linearis		1	
Callistemon montanus			
Callistemon pachyphyllus			1
Callistemon pungens			
Callistemon rigidus			
Callistemon shiressii			
Callitriche muelleri			
Callitris baileyi			1
Callitris columellaris			1
Callitris endlicheri			
Callitris macleayana			1
Callitris monticola		1	1
Callitris oblonga			1
Callitris rhomboidea			
Calocephalus citreus			
Calochilus grandiflorus			1
Calochilus paludosus			
Calophanoides hygrophiloides			1
Calotis lappulacea			
Calystegia soldanella		1	
Canarium australasicum			1
Canthium lamprophyllum			1
Capparis sarmentosa			
Cardamine gunnii			1
Cardamine lilacina			1
Cardamine sp. Y			1
Carex bichenoviana			1
Carex brownii			
Carex brunnea			
Carex capillacea			
Carex chlorantha			1
Carex echinata		1	1
Carex hubbardii			1
Carex incomitata			1
Carex lophocarpa			1
Carex tereticaulis			1
Carissa ovata			1
Carronia multisepalea			1
Casearia multinervosa			1
Cassia brewsteri var marksiana			1
Cassinia aculeata			1

Taxon	endemic	disjunct	range limit
Cassinia arcuata			1
Cassinia aureonitens		1	1
Cassinia longifolia			
Cassinia sp. B		1	1
Cassinia sp.C	1		
Cassinia sp. D			1
Cassinia subtropica			1
Cassinia trinerva			1
Cassinia uncata			
Cassytha filiformis			1
Cassytha racemosa var muelleri		1	
Castanospermum australe			1
Castanospora alphandii			1
Casuarina cunninghamiana			
Casuarina equisetifolia			1
Caustis blakei			1
Cayratia acris			1
Cayratia eurynema			1
Cenchrus sp. A	1		
Centipeda cunninghamii			
Centranthera cochinchinensis		1	1
Centratherum punctatum ssp australianum			1
Centrolepis strigosa ssp strigosa		1	
Ceratopetalum gummiferum			1
Ceratopteris thalictroides			1
Chamaesyce macgillivrayi			1
Cheilanthes sieberi ssp pseudovellea			
Chenopodium erosum			1
Chiloglottis anaticeps	1		
Chiloglottis diphylla			1
Chiloglottis formicifera			
Chiloglottis palachila			
Chiloglottis platyptera			1
Chiloglottis pluricallata			1
Chiloglottis sp. aff. formicifera (Bald Rock)			
Chiloglottis sp. aff. sphyrnoides (Barrington Tops)			
Chiloglottis sphyrnoides			
Chiloglottis trilabra			1
Chionochloa pallida			1
Chionogentias barringtonensis	1		
Chloanthes stoechadis		1	1

Taxon	endemic	disjunct	range limit
Choretrum sp. A		1	
Choricarpia subargentea			1
Christella hispidula			
Christella parasitica			1
Chrysopogon fallax			
Chrysopogon sylvaticus			1
Cinnamomum virens			1
Citriobatus lancifolius			1
Cladium procerum			
Clematis fawcettii			1
Clematis microphylla			
Cleome viscosa			
Clerodendrum floribundum			1
Clerodendrum inerme			1
Coelospermum paniculatum			1
Coleocarya gracilis			1
Comesperma sphaerocarpum			1
Comesperma sylvestre			1
Commersonia bartramia			1
Conospermum burgessiorum		1	1
Conospermum ellipticum			1
Coopernookia barbata		1	1
Coopernookia chisholmii			1
Coprosma hirtella		1	1
Coprosma nitida			1
Coprosma quadrifida			1
Corchorus cunninghamii			1
Cordyline congesta		1	
Cordyline petiolaris			1
Cordyline rubra			1
Corokia whiteana	1	1	
Correa alba			1
Correa lawrenciana var glandulifera			1
Correa lawrenciana var macrocalyx			
Corybas barbarae			
Corybas fordhamii		1	
Corybas sp. aff. dilatatus (Barrington Tops)			
Corybas undulatus			
Corymbia henryi			1
Corymbia intermedia			1
Corynocarpus rupestris ssp arborescens			1

Taxon	endemic	disjunct	range limit
Corynocarpus rupestris ssp rupestris	1		
Corynotheca licrota			
Craspedia canens			
Crassula colorata			
Crassula decumbens			1
Crassula helmsii			1
Crepidomanes walleri			
Crinum pedunculatum			
Crotalaria medicaginea			
Crotalaria mitchellii ssp laevis		1	
Crotalaria mitchellii ssp mitchellii			
Crotalaria montana			1
Croton acronychioides			1
Croton stigmatosus			1
Crowea exalata			
Cryptandra buxifolia			1
Cryptandra lanosiflora			
Cryptandra longistaminea			1
Cryptandra propinqua			
Cryptandra spinescens			1
Cryptocarya bidwillii			1
Cryptocarya dorrigoensis			
Cryptocarya erythroxylon			1
Cryptocarya floydii		1	
Cryptocarya foetida			1
Cryptocarya foveolata			1
Cryptocarya laevigata			1
Cryptocarya meissneriana			1
Cryptocarya nova-anglica		1	
Cryptocarya triplinervis			1
Cryptocarya williwilliana	1		
Cryptostylis hunteriana			
Cupaniopsis flagelliformis var australis			1
Cupaniopsis foveolata			1
Cupaniopsis newmanii			1
Cupaniopsis parvifolia			1
Cupaniopsis serrata			1
Cuttsia viburnea			1
Cyathea cunninghamii			
Cymbidium canaliculatum		1	
Cymbidium madidum			1

Taxon	endemic	disjunct	range limit
Cynanchum carnosum			1
Cynanchum elegans			1
Cynoglossum suaveolens			
Cyperus aquatilis			1
Cyperus dietrichiae var brevibracteatus			1
Cyperus eglobosus			1
Cyperus filipes			1
Cyperus gunnii ssp gunnii			
Cyperus haspan juncoides			1
Cyperus laevis			1
Cyperus nutans ssp eleusinoides			1
Cyperus odoratus			
Cyperus pilosus			1
Cyperus platystylis			
Cyperus rupicola		1	1
Cyperus scaber			1
Cyperus sculptus			1
Cyperus stradbrokensis			1
Cyperus subulatus			1
Cyperus vaginatus			
Cyphanthera albicans ssp albicans			
Dactyloctenium radulans			
Damasonium minus			
Dampiera lanceolata			
Dampiera sylvestris			
Danthonia carphoides			
Danthonia induta			
Danthonia monticola			1
Danthonia penicillata			
Daphnandra tenuipes	1		
Darwinia biflora			
Darwinia glaucophylla			
Darwinia leptantha			1
Darwinia peduncularis			
Darwinia procera			
Davallia pyxidata			
Davidsonia pruriens var jerseyana			1
Davidsonia sp. A			1
Daviesia arborea			1
Daviesia corymbosa			1
Daviesia elliptica			1

Taxon	endemic	disjunct	range limit
Daviesia mimosoides ssp mimosoides			
Daviesia nova-anglica			1
Daviesia squarrosa			1
Daviesia villifera			1
Daviesia wyattiana		1	
Dendrobium bowmanii			1
Dendrobium dolichophyllum			1
Dendrobium falcorostrum			1
Dendrobium kingianum			1
Dendrobium melaleucaphilum			
Dendrobium monophyllum			1
Dendrobium mortii			1
Dendrobium schneiderae			1
Dendrobium schoeninum			1
Dendrobium speciosum			1
Dendrocnide moroides			1
Dendrophthoe glabrescens			
Denhamia celastroides			1
Denhamia moorei			1
Denhamia pittosporoides ssp pittosporoides			1
Derris involuta			1
Derwentia arenaria			
Derwentia derwentiana ssp derwentiana		1	
Desmodium acanthocladum	1		
Desmodium gangeticum			1
Desmodium heterocarpon var heterocarpon			
Desmodium nemorosum			1
Deyeuxia acuminata		1	
Deyeuxia carinata			1
Deyeuxia decipiens			1
Deyeuxia mckiei			1
Deyeuxia monticola var monticola			1
Deyeuxia quadriseta			1
Dianella crinoides			
Dianella nervosa			1
Dianella tasmanica			1
Dichanthium setosum			
Dichanthium tenue			
Dichelachne sieberiana			
Dichrocephala integrifolia			1
Dicksonia youngiae			1

Taxon	endemic	disjunct	range limit
Dicranopteris linearis			
Digitaria brownii			
Digitaria divaricatissima			
Digitaria leucostachya			1
Dillwynia sieberi			
Dillwynia sp. A			
Dillwynia tenuifolia			
Diospyros fasciculosa			1
Diospyros mabacea	1		
Diospyros major var ebenus			
Diplazium assimile			1
Diplazium dilatatum			1
Diplocyclos palmatus			1
Diploglottis campbellii			1
Dipodium atropurpureum			
Dipodium pulchellum			
Dipodium roseum			
Discaria pubescens			
Diuris abbreviata			1
Diuris aurea			1
Diuris chrysantha			1
Diuris dendrobioides			1
Diuris disposita	1		
Diuris flavescens	1		
Diuris lanceolata			1
Diuris maculata			1
Diuris pedunculata			
Diuris praecox			
Diuris secundiflora ?=D. tricolor	1		
Diuris sp. aff. ochroma (New England)			
Diuris venosa			
Dodonaea boroniifolia			
Dodonaea hirsuta		1	1
Dodonaea lanceolata var subsessilifolia			1
Dodonaea megazyga			
Dodonaea rhombifolia			1
Dodonaea serratifolia			
Dodonaea sinuolata ssp sinuolata			1
Dodonaea stenophylla			
Doodia maxima			1
Doodia media ssp australis			1

Taxon	endemic	disjunct	range limit
Doryanthes excelsa		1	1
Doryanthes palmeri			1
Dracophyllum secundum		1	1
Drymaria cordata ssp diandra			1
Drymophila moorei			1
Drynaria rigidula			1
Dryopoa dives			
Durringtonia paludosa		1	
Dysoxylum mollissimum			1
Dysoxylum rufum			1
Echinochloa colona			
Echinopogon cheelii			1
Echinopogon mckiei			1
Eclipta prostrata			1
Einadia polygonoides			
Elaeocarpus eumundi			1
Elaeocarpus grandis			1
Elaeocarpus holopetalus			1
Elaeocarpus sp. Minyon			
Elaeocarpus williamsianus	1		
Elatine gratioloides			
Elattostachys nervosa			1
Elattostachys xylocarpa			1
Eleocharis atricha			
Eleocharis dulcis			1
Eleocharis equisetina			
Eleocharis pallens			
Eleocharis tetraquetra			
Elyonurus citreus		1	1
Emilia sonchifolia			1
Endiandra compressa			1
Endiandra crassiflora			1
Endiandra floydii			1
Endiandra globosa			1
Endiandra hayesii			1
Endiandra introrsa		1	
Endiandra muelleri ssp bracteata			1
Endiandra muelleri ssp muelleri			1
Endiandra pubens			1
Endiandra virens			1
Enneapogon nigricans			

Taxon	endemic	disjunct	range limit
Enteropogon unispiceus			1
Epacris breviflora			
Epacris calvertiana var calvertiana			1
Epacris coriacea			
Epacris muelleri			
Epacris petrophila		1	1
Epacris purpurascens var purpurascens			
Epilobium gunnianum			1
Epilobium hirtigerum			
Epipogeum roseum			
Eragrostis interrupta			1
Eragrostis lacunaria			
Eragrostis leptocarpa			
Eragrostis microcarpa			1
Eragrostis molybdea			
Eragrostis pubescens			1
Eragrostis trachycarpa			
Eremophila deserti			
Eriachne glabrata			
Eriachne pallescens			1
Eriachne rara			1
Eriocaulon australe			
Eriochilus autumnalis			
Eriochloa pseudoacrotricha			
Eriostemon difformis ssp smithianus			1
Eriostemon ericifolius			
Eriostemon myoporoides ssp conduplicatus		1	1
Eriostemon myoporoides ssp epilosus			
Eriostemon myoporoides ssp myoporoides			
Eriostemon obovalis			
Erodium crinitum			
Eryngium expansum			1
Erythrina vespertilio			1
Erythroxylum australe			1
Eucalyptus acaciiformis			1
Eucalyptus aenea			
Eucalyptus agglomerata			1
Eucalyptus ancophila	1		
Eucalyptus approximans		1	1
Eucalyptus baileyana			1
Eucalyptus bancroftii			1

Taxon	endemic	disjunct	range limit
Eucalyptus banksii			1
Eucalyptus bensonii			
Eucalyptus bicostata			1
Eucalyptus biturbinata			1
Eucalyptus caleyi ssp ovendenii			
Eucalyptus caliginosa			1
Eucalyptus cameronii			1
Eucalyptus camfieldii			
Eucalyptus campanulata			1
Eucalyptus camphora ssp relicta		1	1
Eucalyptus canaliculata	1		
Eucalyptus capitellata			1
Eucalyptus carnea			1
Eucalyptus codonocarpa			1
Eucalyptus conjuncta			
Eucalyptus cypellocarpa			1
Eucalyptus dalrympleana			1
Eucalyptus dissita		1	1
Eucalyptus dives			1
Eucalyptus dorrigoensis			
Eucalyptus dunnii			1
Eucalyptus elliptica			1
Eucalyptus fastigata			1
Eucalyptus fergusonii ssp dorsiventralis			
Eucalyptus fergusonii ssp fergusonii			1
Eucalyptus fracta			
Eucalyptus fusiformis			
Eucalyptus glaucina		1	1
Eucalyptus globoidea			1
Eucalyptus hypostomatica			
Eucalyptus largeana			1
Eucalyptus ligustrina		1	1
Eucalyptus luehmanniana			
Eucalyptus macrorhyncha			
Eucalyptus magnificata			1
Eucalyptus malacoxylon			
Eucalyptus mckieana			1
Eucalyptus melanophloia		1	
Eucalyptus michaeliana		1	
Eucalyptus nicholii			
Eucalyptus nitens			1

Taxon	endemic	disjunct	range limit
Eucalyptus nortonii		1	1
Eucalyptus nova-anglica			1
Eucalyptus olida	1		
Eucalyptus ophitica	1		
Eucalyptus oresbia ms			
Eucalyptus pachycalyx ssp banyabba			
Eucalyptus paniculata ssp matutina	1		
Eucalyptus paniculata ssp paniculata			1
Eucalyptus parramattensis ssp decadens			
Eucalyptus piperita			1
Eucalyptus placita			1
Eucalyptus planchoniana			1
Eucalyptus prominula			
Eucalyptus psammitica	1		
Eucalyptus pumila			
Eucalyptus punctata			1
Eucalyptus pyrocarpa	1		1
Eucalyptus resinifera ssp hemilampra			1
Eucalyptus retinens			1
Eucalyptus rossii			1
Eucalyptus rubida ssp barbigerorum			1
Eucalyptus rudderi	1		
Eucalyptus rummeryi			1
Eucalyptus scias ssp apoda		1	1
Eucalyptus scoparia			1
Eucalyptus scopulorum			
Eucalyptus seeana			1
Eucalyptus serpentinicola	1		
Eucalyptus sp. aff. cypellocarpa (Hillgrove)			
Eucalyptus sp. aff. cypellocarpa (Long Point)			
Eucalyptus stellulata		1	1
Eucalyptus subcaerulea			
Eucalyptus tessellaris			1
Eucalyptus tetrapleura	1		
Eucalyptus tindaliae			1
Eucalyptus williamsiana			1
Eucalyptus youmanii			
Euphorbia psammogeton			
Euphrasia arguta			1
Euphrasia bella		1	1
Euphrasia ciliolata			1

Taxon	endemic	disjunct	range limit
Euphrasia collina ssp muelleri			1
Euphrasia collina ssp paludosa		1	
Euphrasia orthocheila ssp peraspera			
Euphrasia ramulosa			1
Euphrasia ruptura (E. sp. Tamworth)			
Eupomatia bennettii			1
Evolvulus alsinoides			
Excoecaria agallocha			1
Excoecaria dallachyana			1
Exocarpos latifolius			
Exocarya sclerioides			1
Festuca asperula			1
Festuca muelleri			1
Ficus virens var sublanceolata			1
Ficus watkinsiana			1
Fimbristylis bisumbellata			
Fimbristylis cinnamometorum			1
Fimbristylis polytrichoides			
Fimbristylis tristachya			1
Flindersia australis			1
Flindersia bennettiana			1
Flindersia schottiana			1
Flindersia xanthoxyla			1
Floydia praealta			1
Fontainea australis			1
Fontainea oraria	1		
Freycinetia excelsa			1
Fuirena incrassata		1	1
Gahnia insignis		1	1
Gahnia microstachya		1	1
Gahnia radula			1
Gahnia subaequiglumis		1	
Galactia species A			1
Galactia species B			1
Galium binifolium			1
Galium curvihirtum		1	1
Galium liratum			1
Gastrodia sesamoides			
Gaultheria appressa		1	1
Gaultheria viridicarpa ssp merinoensis			1
Gaultheria viridicarpa ssp viridicarpa			

Taxon	endemic	disjunct	range limit
Geijera paniculata			1
Geijera salicifolia			1
Geissois benthamii			1
Genoplesium acuminatum			1
Genoplesium baueri			1
Genoplesium fimbriatum			1
Genoplesium nudiscapum		1	
Genoplesium nudum			1
Genoplesium pumilum			
Genoplesium rufum			
Genoplesium sp. aff. sigmoideum (Gib. Range)			
Gentiana wissmannii			1
Geodorum densiflorum			1
Geranium potentilloides			1
Geranium retrorsum			1
Gingidia harveyana		1	1
Gingidia montana			1
Gleichenia mendellii		1	1
Glinus oppositifolius			1
Glochidion sumatranum			1
Glossostigma diandrum			
Glossostigma elatinoides			1
Glyceria latispicea			1
Glycine canescens		1	
Glycine cyrtoloba		1	1
Glycine latifolia			1
Glycine sp.A		1	1
Gnaphalium gymnocephalum			1
Gompholobium foliolosum		1	
Gompholobium glabratum			1
Gompholobium minus			1
Gompholobium sp.B		1	1
Gonocarpus chinensis ssp verrucosus			
Gonocarpus longifolius			
Gonocarpus salsoloides			1
Gonocormus saxifragoides			1
Goodenia bellidifolia ssp bellidifolia			1
Goodenia fordiana			1
Goodenia glabra			
Goodenia macbarronii			
Goodenia rotundifolia			1

Taxon	endemic	disjunct	range limit
Grammitis stenophylla			
Gratiola pubescens			1
Grevillea acanthifolia ssp stenomera		1	1
Grevillea acerata	1		
Grevillea banyabba	1		
Grevillea beadleana		1	
Grevillea evansiana			
Grevillea granulifera	1		
Grevillea guthrieana - Booral Metapopulation.			
Grevillea guthrieana - Carrai Metapopulation			
Grevillea hilliana			1
Grevillea johnsonii			
Grevillea linsmithii		1	1
Grevillea longifolia			
Grevillea masonii	1		
Grevillea mollis	1		
Grevillea montana			
Grevillea obtusiflora ssp fecunda			
Grevillea obtusiflora ssp obtusiflora			
Grevillea oldei			
Grevillea parviflora ssp parviflora (previously Grevillea linearifolia form D)			
Grevillea quadricauda	1		
Grevillea rhizomatosa	1		
Grevillea scortechinii ssp sarmentosa			
Grevillea shiressii			
Grewia latifolia			1
Guilfoylia monostylis			1
Gymnema pleiadenium			1
Gymnoschoenus sphaerocephalus			1
Gynura drymophila var drymophila (and var glabrifolia)			1
Haemodorum tenuifolium			1
Hakea bakeriana			1
Hakea florulenta			1
Hakea fraseri		1	1
Hakea macrorrhyncha			
Hakea ochroptera		1	1
Hakea sericea			1
Hakea sp. aff. trineura		1	1
Hakea teretifolia			1
Halfordia kendack			1
Haloragis exalata ssp exalata			

Taxon	endemic	disjunct	range limit
Haloragis exalata ssp velutina			
Haloragis serra			1
Harpullia alata			1
Harpullia hillii			1
Harpullia pendula			1
Hedraianthera porphyropetala			1
Hedyotis galioides			
Helichrysum boormanii			1
Helichrysum rutidolepis			1
Helichrysum sp.1 Mt Merino			
Helichrysum sp.2 Point Lookout			
Helicia ferruginea			1
Helmholtzia glaberrima			1
Hemisteptia lyrata			
Hibbertia acuminata	1		
Hibbertia cistoidea			
Hibbertia elata		1	
Hibbertia hermanniifolia			
Hibbertia hexandra		1	1
Hibbertia marginata	1		
Hibbertia procumbens			
Hibbertia rufa			1
Hibbertia villosa			
Hicksbeachia pinnatifolia		1	
Hierochloe rariflora			
Hodgkinsonia ovatiflora			1
Homopholis proluta			
Homoranthus biflorus			
Homoranthus cernuus			
Homoranthus croftianus ms. (JTH)			
Homoranthus darwinioides			
Homoranthus floydii	1		
Homoranthus lunatus	1	1	
Homoranthus prolixus			
Homoranthus virgatus			1
Hovea beckeri			1
Hovea longipes			1
Howittia trilocularis			1
Hoya australis ssp australis			1
Hybanthus vernonii ssp scaber			1
Hybanthus vernonii ssp vernonii		1	1

Taxon	endemic	disjunct	range limit
Hydrocharis dubia			1
Hydrocotyle pedicellosa			1
Hygrophila angustifolia			1
Hymenophyllum rarum			1
Hypoestes floribunda var pubescens			1
Hypolepis elegans			1
Hypoxis pratensis			
Hypserpa decumbens			1
Indigofera adesmiifolia		1	
Indigofera baileyi			1
Indigofera linifolia		1	1
Iphigenia indica		1	1
Ischaemum triticeum			
Isoetes muelleri			
Isoetopsis graminifolia			
Isoglossa eranthemoides	1		
Isolepis aucklandica		1	
Isolepis fluitans		1	
Isolepis gaudichaudiana			1
Isolepis habra			1
Isolepis platycarpa			1
Isolepis producta		1	1
Isopogon mnoraifolius	1		
Isotoma anethifolia		1	1
Isotoma armstrongii			1
Isotoma axillaris		1	
Isotoma fluviatilis ssp borealis		1	
Isotoma fluviatilis ssp fluviatilis			1
Isotropis foliosa			1
Ixora beckleri			1
Jacksonia sp. nov. Bald Knob / Little Plain (JBW)			
Jacksonia stackhousii			1
Jagera pseudorhus var pseudorhus			1
Jasminum dallachii			1
Jasminum volubile			1
Juncus alexandri ssp melanobasis			1
Juncus australis			1
Juncus falcatus			1
Juncus filicaulis			1
Juncus laeviusculus ssp laeviusculus		1	1
Juncus pallidus			1

Taxon	endemic	disjunct	range limit
Juncus pauciflorus			1
Juncus phaeanthus		1	1
Juncus procerus		1	1
Juncus revolutus		1	1
Juncus sandwithii		1	1
Juncus sarophorus			1
Juncus subglaucus		1	
Juncus vaginatus			1
Kennedia prostrata			1
Kennedia retrorsa			
Keraudrenia corollata var denticulata		1	
Knoxia sumatrensis			1
Korthalsella breviarticulata			
Kunzea bracteolata			1
Kunzea capitata			1
Kunzea obovata			1
Kunzea opposita			
Kunzea parvifolia			1
Kunzea rupestris			
Kunzea sp A	1		
Lambertia formosa		1	1
Lasiopetalum ferrugineum var cordatum			
Lasiopetalum ferrugineum var ferrugineum			
Lasiopetalum joyceae			
Lasiopetalum longistamineum			
Lasiopetalum parviflorum			1
Lastreopsis marginans			1
Lastreopsis silvestris			1
Lastreopsis smithiana			1
Lemna trisulca			
Lepiderema pulchella			1
Lepidium fasciculatum		1	
Lepidium hyssopifolium			
Lepidium peregrinum			
Lepidosperma concavum			1
Lepidosperma curtisiae		1	1
Lepidosperma filiforme			1
Lepidosperma latens		1	1
Lepidosperma neesii		1	1
Lepidosperma tortuosum			1
Lepidosperma urophorum			1

Taxon	endemic	disjunct	range limit
Leptinella filicula			1
Leptinella longipes			
Leptomeria drupacea		1	1
Leptopteris fraseri			
Leptorhynchos elongatus			1
Leptorhynchos squamatus			1
Leptospermum argenteum	1		
Leptospermum brachyandrum			1
Leptospermum deanei			
Leptospermum gregarium			1
Leptospermum laevigatum			1
Leptospermum liversidgei			1
Leptospermum petersonii ssp petersonii			1
Leptospermum semibaccatum			1
Leptospermum speciosum			1
Leptospermum spectabile			
Leptospermum variabile			1
Leptospermum whitei			1
Leptostigma reptans		1	1
Lepturus repens			
Lepyrodia caudata			1
Lepyrodia interrupta			1
Lepyrodia leptocaulis			
Lepyrodia muelleri			1
Lepyrodia species A			
Leucopogon attenuatus			1
Leucopogon cicatricatus		1	
Leucopogon confertus	1		
Leucopogon deformis			1
Leucopogon esquamatus			1
Leucopogon fraseri			
Leucopogon hookeri			1
Leucopogon muticus		1	
Leucopogon pilifer		1	1
Leucopogon recurvisepalus			1
Leucopogon rodwayi		1	1
Leucopogon sp. aff. Appressus	1		
Leucopogon sp. aff. fraseri			
Leucopogon sp. aff. setiger (Mt Belmore)			
Leucopogon sp.5 Echo Point Border Ranges			
Leucopogon trichostylus			

Taxon	endemic	disjunct	range limit
Libertia pulchella			1
Lilaeopsis polyantha		1	
Limosella australis			
Lindernia alsinoides			1
Lindsaea brachypoda			1
Lindsaea dimorpha		1	
Lindsaea fraseri			1
Lindsaea incisa		1	1
Linospadix monostachya			1
Linum marginale			
Liparis habenarina			
Liparis simmondsii			1
Lipocarpha microcephala		1	
Lissanthe sapida			
Lissanthe species A			1
Lissanthe sp. A			1
Lissanthe species B			1
Lobelia dentata			1
Lobelia membranacea			
Lomandra brevis			
Lomandra confertifolia ssp rubiginosa			1
Lomandra elongata			1
Lomandra filiformis ssp coriacea		1	
Lomandra filiformis ssp flavior			1
Lomandra fluviatilis			
Lomandra hystrix			1
Lomandra laxa			1
Lomandra spicata			1
Lomatia arborescens			1
Lomatia fraseri			1
Lomatia silaifolia			
Lophostemon confertus			1
Lophostemon suaveolens			1
Ludwigia octovalvis		1	
Ludwigia peploides ssp montevidensis			
Luzula densiflora			1
Luzula modesta		1	1
Lycopodium deuterodensum			
Lycopodium fastigiatum			1
Lygodium microphyllum			1
Lyperanthus nigricans			1

Taxon	endemic	disjunct	range limit
Lysimachia japonica			1
Macadamia tetraphylla			1
Macrothelypteris torresiana			1
Macrozamia communis		1	1
Macrozamia concinna			
Macrozamia fawcettii	1		
Macrozamia johnsonii	1		
Macrozamia pauli-guilielmi ssp flexuosa			1
Macrozamia stenomera			
Marsdenia fraseri			
Marsdenia hemiptera			
Marsdenia liisae			1
Marsdenia lloydii			1
Marsdenia longiloba			1
Marsdenia suaveolens			1
Maytenus bilocularis			1
Mazus pumilio			
Medicosma cunninghamii			
Melaleuca alternifolia			1
Melaleuca biconvexa			1
Melaleuca bracteata			1
Melaleuca deanei			
Melaleuca ericifolia			1
Melaleuca groveana			1
Melaleuca squamea			1
Melaleuca squarrosa			
Melaleuca tamariscina ssp irbyana			1
Melaleuca tortifolia			1
Melastoma affine			1
Melichrus adpressus		1	1
Melichrus sp A			
Melichrus sp. Gibberagee			
Melicope elleryana			1
Melicope erythrococca			1
Melicope vitiflora			1
Melodinus guilfoylei			1
Microcitrus australasica var australasica			1
Micromelum minutum			1
Micromyrtus blakelyi			
Micromyrtus sessilis			
Micromyrtus striata		1	

Taxon	endemic	disjunct	range limit
Microseris lanceolata			
Microstegium nudum			
Microtis rara		1	
Microtrichomanes vitiense			1
Millettia australis			
Millettia megasperma			1
Mimulus gracilis			
Minuria leptophylla			
Mirbelia confertiflora			1
Mirbelia speciosa ssp ringrosei			1
Mischocarpus anodontus			1
Mischocarpus australis			1
Mischocarpus lachnocarpus			
Mischocarpus pyriformis			1
Mitrasacme pygmaea			
Mitrasacme serpyllifolia			1
Momordica balsamina		1	
Monococcus echinophorus			
Monotaxis macrophylla			
Morinda acutifolia			1
Mucuna gigantea			
Muehlenbeckia costata			
Muellerina myrtifolia			1
Myoporum betcheanum			1
Myoporum boninense ssp australe			
Myosotis australis			1
Myosotis exarrhena			1
Myriophyllum alpinum		1	1
Myriophyllum implicatum			
Myriophyllum pedunculatum ssp pedunculatum			1
Myriophyllum striatum			
Neisosperma poweri			1
Neoastelia spectabilis	1		
Nephrolepis cordifolia			1
Neptunia gracilis		1	
Nertera granadensis		1	1
Niemeyera chartacea			1
Notelaea johnsonii			
Notelaea linearis			1
Notelaea sp A			1
Nothofagus moorei		1	

Taxon	endemic	disjunct	range limit
Notothixos incanus			
Nymphaea gigantea			
Nymphoides crenata		1	
Oberonia complanata			1
Oberonia titania			
Ochrosia moorei			1
Ochrosperma citriodorum	1	1	1
Ochrosperma lineare			1
Olax angulata	1		
Olax retusa			1
Olea paniculata			1
Olearia alpicola			1
Olearia argophylla		1	1
Olearia canescens			1
Olearia chrysophylla		1	
Olearia cordata			
Olearia covenyi		1	1
Olearia cydoniifolia		1	
Olearia erubescens		1	
Olearia flocktoniae	1		
Olearia gravis			
Olearia heterocarpa			1
Olearia myrsinoides			1
Olearia oppositifolia	1		
Olearia phlogopappa		1	1
Olearia ramulosa			
Olearia sp. aff. erubescens			
Olearia sp.2 Wollomombi			
Olearia stellulata		1	
Olearia stilwelliae	1		
Olearia tomentosa			1
Opercularia varia			1
Ophioglossum lusitanicum ssp coriaceum			
Ophioglossum pendulum		1	1
Ophioglossum reticulatum			
Oreobolus distichus		1	1
Oreobolus oxycarpus ssp oxycarpus		1	1
Oreomyrrhis ciliata			1
Oreomyrrhis eriopoda			1
Orthoceras strictum			
Ottelia ovalifolia			

Taxon	endemic	disjunct	range limit
Owenia cepiodora			1
Oxylobium ellipticum		1	
Oxylobium pulteneae			1
Oxylobium robustum			1
Oxylobium scandens var obovatum			1
Ozothamnus adnatus			
Ozothamnus argophyllus			1
Ozothamnus bidwillii			1
Ozothamnus ferrugineus			1
Ozothamnus obcordatus ssp major			
Ozothamnus obovatus			1
Ozothamnus rufescens			1
Ozothamnus vagans			1
Ozothamnus whitei		1	
Pandorea baileyana			1
Pandorea jasminoides			1
Panicum lachnophyllum			1
Panicum paludosum			
Papillilabium beckleri			
Parsonsia brownii			1
Parsonsia dorrigoensis		1	1
Parsonsia fulva			1
Parsonsia induplicata			1
Parsonsia largiflorens			
Parsonsia lilacina			1
Parsonsia longipetiolata			1
Parsonsia purpurascens			1
Parsonsia rotata			1
Parsonsia tenuis			1
Parsonsia ventricosa			1
Paspalidium albovillosum			
Paspalidium aversum			
Paspalidium breviflorum			1
Paspalidium constrictum			
Paspalidium gausum			1
Paspalidium grandispiculatum			1
Passiflora cinnabarina		1	1
Patersonia fragilis		1	
Patersonia longifolia			1
Pavetta australiensis			1
Pelargonium inodorum			

Taxon	endemic	disjunct	range limit
Pentaceras australe			1
Peristeranthus hillii			
Persicaria dichotoma			1
Persicaria elatior	1		
Persoonia acuminata		1	1
Persoonia adenantha			1
Persoonia chamaepeuce			1
Persoonia daphnoides			1
Persoonia hirsuta ssp evoluta			
Persoonia hirsuta ssp hirsuta			
Persoonia katerae	1		
Persoonia lanceolata		1	1
Persoonia laurina ssp. laurina			1
Persoonia levis			1
Persoonia linearis			1
Persoonia media			1
Persoonia oleoides	1		
Persoonia procumbens			1
Persoonia rigida			1
Persoonia rufa	1		
Persoonia stradbrokensis			1
Persoonia terminalis ssp terminalis			
Persoonia virgata			1
Persoonia volcanica			1
Petalostigma pubescens			1
Petalostigma triloculare			1
Petermannia cirrosa			1
Phaius australis		1	1
Phaius tankervilliae			1
Phebalium ambiens		1	1
Phebalium dentatum		1	1
Phebalium elatius ssp beckleri		1	1
Phebalium elatius ssp elatius			
Phebalium glandulosum ssp eglandulosum			
Phebalium nottii		1	
Phebalium rotundifolium			
Phebalium squamulosum ssp ozothamnoides			1
Phebalium squamulosum ssp verrucosum	1		1
Phebalium sympetalum			
Phebalium woombye			1
Phyllanthus microcladus			1

Taxon	endemic	disjunct	range limit
Picris evae			
Picris sp. nov.			
Pimelea umbratica			1
Pimelea venosa			
Pipturus argenteus			1
Pisonia aculeata			
Pisonia umbellifera			
Pittosporum oreillyanum			1
Pittosporum rhombifolium			1
Planchonella chartacea			1
Planchonella cotinifolia			1
Planchonella laurifolia			1
Planchonella myrsinoides			1
Planchonella pohlmaniana			
Plantago cladarophylla	1		
Plantago hispida		1	
Plantago palustris	1		
Platysace cleiandii			
Platysace species A			1
Plectranthus alloplectus			1
Plectranthus argentatus		1	1
Plectranthus cremnus			
Plectranthus nitidus			1
Plectranthus sp. 3 Long Gully	1		
Plectranthus sp. Barrington Tops (Chichester)			
Plectranthus sp. Coramba Rd (Nana Creek)			
Plectranthus sp. Dorrigo Mountain			
Plectranthus sp. Kangaroo River			
Plectranthus sp. New Italy			
Plectranthus sp. Nundle			
Plectranthus sp. Pinnacle			
Plectranthus sp. Star Ridge (Orara West)			
Plectranthus suaveolens			
Pleogyne australis			1
Plinthanthesis urvillei		1	1
Plumbago zeylanica			
Pneumatopteris pennigera			
Pneumatopteris sogerensis			1
Podolepis hieracioides		1	1
Podolepis monticola			1
Podolepis neglecta			

Taxon	endemic	disjunct	range limit
Podolobium aestivum	1	1	
Polyalthia nitidissima			1
Polygala linariifolia			
Polyscias sambucifolia ssp C			1
Pomaderris aspera		1	1
Pomaderris betulina			1
Pomaderris bodalla			
Pomaderris brunnea			
Pomaderris costata			
Pomaderris crassifolia			
Pomaderris elliptica			1
Pomaderris eriocephala			
Pomaderris ferruginea			1
Pomaderris helianthemifolia			
Pomaderris intermedia			1
Pomaderris ledifolia			1
Pomaderris nitidula			1
Pomaderris notata			1
Pomaderris pauciflora			
Pomaderris precaria			
Pomaderris prunifolia		1	
Pomaderris queenslandica			1
Pomaderris reperta			
Pomaderris sericea			
Pomaderris subcapitata		1	1
Pomaderris vellea		1	
Poranthera ericifolia			1
Potamophila parviflora	1		
Pothos longipes			1
Prasophyllum australe			
Prasophyllum brevilabre			
Prasophyllum dossenum			
Prasophyllum exilis			1
Prasophyllum flavum			
Prasophyllum odoratum			1
Prasophyllum patens			
Prasophyllum rogersii		1	1
Prasophyllum species A	1		
Prasophyllum striatum			1
Pratia concolor			1
Pratia pedunculata			1

Taxon	endemic	disjunct	range limit
Pratia surrepens		1	1
Premna lignum-vitae			
Prostanthera askania (Syn. P. sp. Strickland State Forest)			
Prostanthera caerulea			1
Prostanthera cryptandroides			
Prostanthera densa			1
Prostanthera discolor			
Prostanthera howelliae		1	1
Prostanthera incana			1
Prostanthera junonis (syn. P. sp. Somersby)			
Prostanthera sp. F Bundjalung National Park	1		
Prostanthera prunelloides		1	1
Prostanthera rhombea		1	
Prostanthera rotundifolia			1
Prostanthera saxicola var major		1	
Prostanthera scutellarioides		1	1
Prostanthera sp. aff. howelliae (Sherwood Nature Reserve)			
Prostanthera spinosa		1	1
Prostanthera staurophylla			
Pseudanthus divaricatissimus			
Pseudanthus orientalis			
Pseudanthus ovalifolius			
Pseudanthus sp. aff. pimeleoides			
Pseudoraphis paradoxa			
Pseudoweinmannia lachnocarpa			1
Psilotum complanatum		1	1
Psoralea tenax			
Psychotria simmondsiana			1
Pteris comans			
Pterocaulon redolens			1
Pterostylis abrupta			1
Pterostylis alveata			1
Pterostylis chaetophora			1
Pterostylis collina			1
Pterostylis cucullata (P. sp. D; P. sp. aff.. cucullata)	1	1	1
Pterostylis cycnocephala			
Pterostylis daintreana			
Pterostylis decurva			1
Pterostylis elegans			

Pterostylis furcata			
Pterostylis gibbosa			
Taxon	endemic	disjunct	range limit
Pterostylis laxa			1
Pterostylis longicurva			
Pterostylis longipetala			1
Pterostylis metcalfei			
Pterostylis mutica			
Pterostylis nigricans			1
Pterostylis ophioglossa			
Pterostylis reflexa			1
Pterostylis rufa			1
Pterostylis russellii			1
Pterostylis sp. aff. alata		1	1
Pterostylis sp. aff. alveata sens lat. (Mt. Duval and New England escarpment)			
Pterostylis sp. aff. cycnocephala			
Pterostylis sp. aff. laxa (Barrington Tops)			
Pterostylis sp. aff. parviflora (Ebor)			
Pterostylis sp. aff. revoluta (Northern Tablelands) - syn. Pterostylis sp. B			
Pterostylis torquata			
Pterostylis truncata			1
Pterostylis woollsii		1	
Pultenaea altissima			1
Pultenaea blakelyi			1
Pultenaea campbellii	1		
Pultenaea cunninghamii			
Pultenaea dentata			
Pultenaea fasciculata		1	1
Pultenaea juniperina var mucronata			1
Pultenaea linophylla			
Pultenaea myrtoides			1
Pultenaea paleacea			1
Pultenaea petiolaris		1	
Pultenaea polifolia			1
Pultenaea pycnocephala			1
Pultenaea sp. aff. flexilis	1		
Pultenaea species B	1		
Pultenaea species J			1
Pultenaea stuartiana			
Pultenaea subspicata			1
Quassia sp. Moonee Creek (Quassia sp. B)			

Quassia sp.A		1	
Quintinia verdonii			1
Randia chartacea			1
Taxon	endemic	disjunct	range limit
Randia moorei			1
Ranunculus pimpinellifolius			1
Rapanea sp. A	1		
Rapanea subsessilis			1
Restio fimbriatus			1
Restio stenocoleus			1
Restio tetraphyllus			
Restio tetraphyllus ssp meiostachyus			
Rhinerrhiza divitiflora			1
Rhizanthella slateri			
Rhizophora stylosa			1
Rhodamnia argentea			1
Rhodamnia maideniana			1
Rhodamnia whiteana			1
Rhodanthe polyphylla			
Rhodosphaera rhodanthema			1
Rhynchosia acuminatissima			1
Rhynchosia minima			
Rhynchospora corymbosa			
Rhynchospora rubra			1
Rhytidosporum procumbens			1
Ricinocarpos speciosus			1
Ripogonum brevifolium			1
Ripogonum discolor			1
Ripogonum elseyanum			1
Rostellularia obtusa			1
Rulingia hermanniifolia			
Rulingia procumbens			
Rulingia prostrata			
Rulingia salviifolia			1
Rutidosis heterogama		1	
Sambucus gaudichaudiana			
Sarcochilus aequalis			1
Sarcochilus australis			1
Sarcochilus ceciliae			1
Sarcochilus dilatatus			1
Sarcochilus fitzgeraldii (Dorrigo, Kunderang, Tweed metapopulations)			
Sarcochilus hartmannii			

Sarcochilus spathulatus			
Sarcochilus weinthalii			1
Sarcopteryx stipata			1
Taxon	endemic	disjunct	range limit
Sarcostemma brunonianum		1	
Sauropus species A			1
Scaevola aemula			1
Scaevola hookeri			1
Schelhammera undulata			1
Schistotylus purpuratus	1		1
Schizachyrium fragile			1
Schizaea rupestris		1	1
Schoenus calostachyus			1
Schoenus latelaminatus		1	
Schoenus lepidosperma ssp pachylepis			1
Schoenus scabripes			1
Schoenus vaginatus			1
Schoenus villosus			
Scleria levis			1
Scleria rugosa			1
Scleria tricuspidata			1
Scutellaria mollis		1	1
Secamone elliptica			1
Selenodesmium elongatum			1
Senecio biserratus			1
Senecio glomeratus			
Senecio gunnii		1	1
Senecio linearifolius			1
Senecio macranthus			1
Senecio picridioides		1	1
Senecio quadridentatus			
Senecio sp. aff. lautus Barrington Tops (swamps)			
Senecio sp. E			1
Senecio tenuiflorus			
Senna acclinis			
Senna aciphylla			
Senna clavigera			
Senna odorata			
Sesbania cannabina var cannabina		1	
Setaria australiensis			1
Sida cordifolia			1
Sida corrugata			

Taxon	endemic	disjunct	range limit
Siphonodon australis			1
Solanum callium			1
Solanum corifolium		1	1
Solanum densevestitum			1
Solanum furfuraceum			1
Solanum inaequilaterum			1
Solanum laciniatum		1	1
Solanum linearifolium			
Solanum nemophilum			1
Solanum opacum			
Solanum papaverifolium			1
Solanum pungetium			1
Solanum vescum			
Solenogyne dominii			1
Solenogyne gunnii		1	1
Sophora fraseri			1
Sophora tomentosa			
Sparganium subglobosum			
Spermacoce brachystema			1
Sphaerolobium minus			
Spirodela punctata			
Sprengelia incarnata			1
Stackhousia spathulata			
Stenocarpus sinuatus			1
Stephania aculeata			1
Sterculia quadrifida			
Stipa densiflora			
Stipa setacea			
Stipa verticillata			
Strangea linearis			1
Streptothamnus moorei			1
Strychnos arborea			
Stuartina hamata			
Stylidium uliginosum			1
Styphelia perileuca			
Styphelia viridis ssp breviflora			1
Styphelia viridis ssp viridis			1
Swainsona fraseri			1
Swainsona monticola			
Swainsona parviflora			
Symphionema paludosum			1

Symplocos baeuerlenii			1
Syzygium corynanthum			1
Syzygium crebrinerve			1
Taxon	endemic	disjunct	range limit
Syzygium hodgkinsoniae			1
Syzygium luehmannii			1
Syzygium moorei			1
Syzygium paniculatum			1
Tabernaemontana pandacaqui			1
Taeniophyllum muelleri			1
Tapeinosperma pseudojambosa			1
Tarenna cameronii			1
Tasmannia glaucifolia	1	1	1
Tasmannia purpurascens	1	1	1
Telopea aspera	1		
Tephrosia baueri			
Tephrosia bidwillii			1
Tephrosia brachyodon		1	
Tephrosia filipes			1
Tephrosia rufula			
Tetraria capillaris			1
Tetratheca ericifolia			1
Tetratheca glandulosa			
Tetratheca juncea			1
Teucrium sp. A			1
Teucrium sp. D			
Thelionema grande			
Thelymitra circumsepta		1	1
Thelymitra cyanea			1
Thelymitra fragrans		1	
Thesium australe		1	
Thismia rodwayi			
Thysanotus juncifolius			1
Tinospora smilacina			1
Tinospora tinosporoides			1
Todea barbara			
Toechima dasyrrhache			1
Toechima tenax			1
Trachymene anisocarpa		1	1
Trachymene procumbens			
Tragia novae-hollandiae			1
Trichosanthes subvelutina			

Taxon	endemic	disjunct	range limit
Tricoryne anceps ssp pterocau			1
Tricoryne simplex			1
Tricostularia pauciflora		1	1
Triglochin multifructum			
Tripladenia cunninghamii			1
Triplarina imbricata			
Triumfetta rhomboidea			1
Triunia youngiana			1
Trochocarpa sp. A	1		1
Turraea pubescens			1
Tylophora barbata			1
Tylophora benthamii			1
Tylophora grandiflora			1
Tylophora linearis			
Tylophora paniculata			1
Tylophora woollsii		1	
Typha domingensis			
Typha orientalis			
Typhonium brownii			
Typhonium eliosurum		1	1
Uncinia nemoralis			1
Uncinia tenella			1
Urochloa foliosa			1
Urochloa piligera			
Uromyrtus australis	1		
Uromyrtus sp. 1 (Lamington)			1
Utricularia aurea			1
Utricularia australis			1
Utricularia biloba			
Utricularia caerulea			1
Utricularia gibba			
Utricularia monanthos		1	1
Utricularia uniflora			1
Velleia montana		1	1
Velleia perfoliata			
Veronica gracilis		1	
Veronica notabilis			1
Veronica serpyllifolia			
Veronica species B	1		
Vesselowskya rubifolia	1	1	1
Vetiveria filipes		1	

Vigna lanceolata			
Vigna luteola			1
Vigna marina			1
Taxon	endemic	disjunct	range limit
Vigna vexillata			
Viola caleyana			1
Vitex trifolia var trifolia			1
Vittadinia dissecta			
Vittadinia hispidula			
Vittadinia muelleri			
Vittadinia sulcata			
Vittadinia tenuissima			
Wahlenbergia ceracea		1	1
Wahlenbergia glabra			1
Wahlenbergia graniticola			
Wahlenbergia littoricola		1	
Wahlenbergia luteola			1
Wahlenbergia scopulicola			1
Wahlenbergia sp. 4 Point Lookout			
Westringia amabilis			
Westringia blakeana			1
Westringia glabra			
Westringia longifolia			1
Westringia sericea			1
Wilkiea austroqueenslandica			1
Wilkiea macrophylla			1
Xanthorrhoea malacophylla			1
Xylosma terrae-reginae			1
Xyris gracilis ssp gracilis			1
Zannichellia palustris			
Zanthoxylum brachyacanthum			1
Zeuxine oblonga			1
Zieria adenodonta			1
Zieria floydii			
Zieria fraseri ssp A			1
Zieria furfuracea			
Zieria hindii	1		

Taxon	endemic	disjunct	range limit
Zieria involucrata			
Zieria lasiocaulis			
Zieria pilosa			1
Zieria prostrata	1		
Zieria smithii (Diggers Headland Form)			
Zieria species K		1	
Zornia floribunda		1	1
Zornia muriculata		1	
Summary	89	227	998

APPENDIX C – SUMMARY OF LANDSCAPE VALUES IDENTIFIED BY EXPERTS

Value in Landscape	Rare Species	Endemic	Important Habitat	Primitive/ Relictual	Refugia	Migratory Species	Disjunct Species or Species at Limits of their Range	Species Richness	Habitat Richness/ Wildlife Habitat
SUMMARY Landscape values	• All rainforests • All E. tereticornis • Escarpment Forest	• Rainforest above 700m • Dry Rainforest • Headwater areas. • Riparian rainforest and wet sclerophyll forest. • Wetlands etc. • Alpine grasslands and Sub-alpine areas in Barrington Tops • Rock Outcrops (Tweed Shield and Macleay and Guy Fawkes gorges) • Granite (Dorrigo plateau, Ebor volcano, Cathedral Rock, Torrington, Gibralter Range, New England batholith, Hanging Rock at Nundle and Tuggelo). • Trachyte (Dorrigo Plateau and Ebor volcano). • Serpentinite (Watchimbark, Curricabark and Baryulgil).	• Sub tropical rainforest under 300m asl • Headwater areas. • Riparian rainforest and wet sclerophyll forest. • Wetlands etc. • Great escarpment • Forested Catchments • Areas dominated by winter-flowering eucalypts for nectivorous species.	• All Rainforest (Flora) • Nothofagus Rainforest. • Wetlands etc. • Wet Sclerophyll Forest below 300m asl. • Alpine grasslands	• All rainforest. • Wetlands etc. • Steep environmental gradients in dry forests • Sandstone Escarpments • Overlap between the western slopes and plains • Forested remnants of coastal plains and tablelands forest ecosystemsd as refugia from current environ. peturbations.	• Rainforests within 10 km of coast. • Wetlands etc. within 10 km of the coast. • Banksia and Melaleuca within 10 km of coast. • E. tereticornis within 10 km of coast. • Areas dominated by winter-flowering eucalypts for nectivorous species. • Identify all RAMSAR/ CAMBA Sites	• Nil	• Nil	• All rainforest • Great Escarpment. • Sub-alpine areas • Wetlands etc. • The rainforest-wet sclerophyll forest - grassy open forest complex in Richmond Range, Ewingar, Washpool and Gibralter Range.

Value in Landscape	Rare Species	Endemic	Important Habitat	Primitive/ Relictual	Refugia	Migratory Species	Disjunct Species or Species at Limits of their Range	Species Richness	Habitat Richness/ Wildlife Habitat
SUMMARY Landscape values (Continued)	•	• Dry open forest with heathy u/s on Glenreagh/Coadale Sandstone • Basalt areas in Barrington Tops. • Metasediment areas in Gibralter Ranges				•			• Forested areas and adajcent grassy open areas in the Upper Clarence through Richmond Range to Wallaby Creek in the North

APPENDIX D – SUMMARY OF AREAS IDENTIFIED BY EXPERTS

Value in Landscape	Rare Species	Endemic	Important Habitat	Primitive/ Relictual	Refugia	Migratory Species	Disjunct Species or Species at Limits of their Range	Species Richness	Habitat Richness/ Wildlife Habitat
SUMMARY Named Locations	Important locations are: • Billinudgel • Canbol • Bungellun • Area between Ballina and Lennox Head. • Gibralter Range • Washpool, • Timbarra Plateau • Barrington Tops • Carrai Plateau • Chaelundi and Dorrigo • Upper Hastings, Werrikimbe and Wingham • MacPherson Range • Richmond Range • New England and Styx River • Candole and Coast Range.	Rainforest in: Tweed Shield Richmond River Dorrigo Plateau Ebor Volcano Barrington Tops Focal Peak Volcano Important locations are: • Gibralter Ranges • Washpool • Timbarra Plateau • Barrington Tops • Carrai Plateau • Chaelundi/Dorrigo • Upper Hastings, Werrikimbe and Wingham	Important locations are: • Gibralter Range • Washpool • Timbarra Plateau • Barrington Tops • Carrai Plateau • Chaelundi and Dorrigo • Upper Hastings, Werrikimbe and Wingham • MacPherson Range • Richmond Range • New England and Styx River • Candole and Coast Range • Volcanoes east of Gibralter, Barrington Tops and Mt Warning		Rainforest in Tweed Shield Dorrigo Plateau Ebor Volcano Focal Peak Volcano Gibralter Ranges	Important locations are: • Billinudgel • Canbol • Bungellun • Area between Ballina and Lennox Head.			Important locations (for terrestrial mamals only) are: • Richmond Range • Candole and Coast Range • Clarence Valley • Myall Lakes (Lower Catchment).

Discrete Identification by Experts:
Willi Willi Caves - near Kemspey. Bat experts suggested that all forested areas within a 60 km radius of Willi Willi caves were of national significance. Willi Willi caves is the largest known maternity roost for the two migratory bat species *Miniopterus schreibersii* and *M. australis* in NSW. The 60 km radius was calculated using the known average maximum population at the cave of pregnant and lactating females, their apparent maximum foraging range and density, and the promixity of caves of similar importance on the Carrai Plateau (included within the 60 km radius).

The Gibralter Range, Washpool and Ewingar forest areas represent among the best development of moist eucalypt forests in the world. Some experts consider NE NSW as the centre of evolutionary development of such types. The area also represents the best development of species richness for arboreal marsupials and macropods in NE in large spatial units.

APPENDIX E – LIST OF DATA LAYERS THAT CONTRIBUTED TO NATIONAL ESTATE ANALYSIS

Data Set	Agency
Wildlife Atlas (fauna locality records)	NSW NPWS (Internal Data-Set)
Priority Fauna (fauna locality records)	NSW NPWS (CRA Data-Set)
Flora (flora locality records)	NSW NPWS (CRA Data-Set)
Endemic Flora (GIS shape)	NSW NPWS (CRA Data-Set)
Endemic Flora (GIS grid)	NSW NPWS (CRA Data-Set)
Endemic Fauna (GIS grid)	NSW NPWS (CRA Data-Set)
Endemic Invertebrates (GIS Grid)	Australian Museum (CRA Data-Set)
Forest Ecosystems	NSW NPWS (CRA Data-Set)
Old-growth forest	NSW NPWS (CRA Data-Set)
Digital Elevation Model 1:25,000 (GIS grid)	
Geology 1:250,000 (GIS grid)	
Biophysical Naturalness 1:250,000	Environment Australia (Internal Data-Set)
CRAFTI Project (Aerial Photo Interpretation)	CRA Data-Set
Wild Rivers Disturbance Index	Environment Australia (Jointly owned Commonwealth Government Data-Set)

APPENDIX F – EXISTING PROTECTIVE MECHANISMS FOR NATURAL NATIONAL ESTATE VALUES IN NSW

National Estate Values	JANIS related value	Sensitivity[a] and resilience[b] to forestry activities covered by the RFA	Percentage of value on public land in reserves			Existing off-reserve protection mechanisms
			Formal Reserve	Informal Reserve	Formal Reserves as a Result of 1998 NSW Decision	
Wilderness (A.2, B.1)	Yes*	High sensitivity to unnatural disturbance. Low resilience to forestry activities	39.2	N/A	39.2	*Wilderness Act 1977.*
Oldgrowth forest and rare old-growth forest (A.2 & B.1)	Yes*	High sensitivity to logging, grazing, unnatural fire and other forestry activities. Low resilience to forestry activities	35.7%	12.2%	48.5%	*Threatened Species Conservation Act 1995 (TSCA), Environmental Planning and Assessment Act 1979 (EPA Act), National Parks and Wildlife Act 1974, Endangered Species Protection Act 1992 (ESP Act); Native Vegetation Conservation Act* 1997 Conservation Protocols, Forest Management Zoning (FMZs), and Management Plans
Vegetation Communities Characteristic of their Class (D.1)	Yes*	High sensitivity to logging, grazing, unnatural fire and other forestry activities. Low resilience to forestry activities	N/A	N/A	N/A	*Threatened Species Conservation Act 1995 (TSCA); Environmental Planning and Assessment Act 1979 (EPA Act), National Parks and Wildlife Act 1974, Endangered Species Protection Act 1992 (ESP Act); Native Vegetation Conservation Act* 1997 Conservation Protocols, Forest Management Zoning (FMZs)., and Management Plans.

[a] Sensitivity – to disturbance, relates to extent of loss or diminution in a value due to the effects of disturbance.
[b] Resilience – relates to the extent of likely recovery of a diminished value, and to the time and management effort required to achieve this recovery.
* JANIS values for which there were explicit numerical targets.

National Estate Values	JANIS related value	Sensitivity[a] and resilience[b] to forestry activities covered by the RFA	Percentage of value on public land in reserves			Existing off-reserve protection mechanisms
			Formal Reserve	Informal Reserve	Formal Reserves as a Result of 1998 NSW Decision	
Vegetation Succession (A.2)	Yes	High sensitivity to logging, grazing, unnatural fire and other forestry activities. Low resilience to forestry activities	N/A	N/A	N/A	*Threatened Species Conservation Act 1995 (TSCA)*, *Environmental Planning and Assessment Act 1979 (EPA Act)*, *National Parks and Wildlife Act 1974*, *Endangered Species Protection Act 1992 (ESP Act)*; Conservation Protocols, , Forest Management Zoning (FMZs). and Management Plans
Natural landscapes (A.2 & B.1)	No	High sensitivity to logging, grazing, unnatural fire and other forestry activities. Low resilience to forestry activities	34.2%	3.8%	38.2%	*The Heritage Act 1977, Wilderness Act 1977.*
Undisturbed catchments	No	High sensitivity to logging, grazing, unnatural fire and other forestry activities. Low resilience to forestry activities	86.2%	0.9%	88.9%	*The Heritage Act 1977, Wilderness Act 1977.*

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[b] Resilience – relates to the extent of likely recovery of a diminished value, and to the time and management effort required to achieve this recovery.

National Estate Values	JANIS related value	Sensitivity[a] and resilience[b] to forestry activities covered by the RFA	Percentage of value on public land in reserves			Existing off-reserve protection mechanisms
			Formal Reserve	Informal Reserve	Formal Reserves as a Result of 1998 NSW Decision	
Flora and fauna refugia (A.1 & A.2)	Yes?	High sensitivity to logging, grazing, unnatural fire and other forestry activities. Low resilience to forestry activities	31.5%	16.2%	43.3%	*Threatened Species Conservation Act 1995 (TSCA)*, *Environmental Planning and Assessment Act 1979 (EPA Act)*, *National Parks and Wildlife Act 1974*, *Endangered Species Protection Act 1992 (ESP Act)*; Conservation Protocols, Forest Management Zoning (FMZs), and Management Plans
Migratory Species	No	High sensitivity to logging, grazing, fire and other forestry activities. Low resilience to forestry activities	23.3%	7.7%	31.3%	*RAMSAR, CAMBA* and *JAMBA* convention and agreements on migratory and wetland species, *Threatened Species Conservation Act 1995 (TSCA)*, *Environmental Planning and Assessment Act 1979 (EPA Act)*, *National Parks and Wildlife Act 1974*, *Endangered Species Protection Act 1992 (ESP Act)*; Conservation Protocols, Forest Management Zoning (FMZs)., and Management Plans

[a] Sensitivity – to disturbance, relates to extent of loss or diminution in a value due to the effects of disturbance.

[b] Resilience – relates to the extent of likely recovery of a diminished value, and to the time and management effort required to achieve this recovery.

National Estate Values	JANIS related value	Sensitivity[a] and resilience[b] to forestry activities covered by the RFA	Percentage of value on public land in reserves			Existing off-reserve protection mechanisms
			Formal Reserve	Informal Reserve	Formal Reserves as a Result of 1998 NSW Decision	
Primitive and relictual species (A.1)	Yes	High sensitivity to logging, grazing, unnatural fire and other forestry activities. Low resilience to forestry activities	40.9%	18.3%	58.3%	*Threatened Species Conservation Act 1995 (TSCA)*, *Environmental Planning and Assessment Act 1979 (EPA Act)*, *National Parks and Wildlife Act 1974*, *Endangered Species Protection Act 1992 (ESP Act)*; Conservation Protocols, Forest Management Zoning (FMZs), and Management Plans
Species at the limits of their distribution range (A.1)	No	Value is dependent on individual species response. Species sensitive to logging, grazing, and unnatural fire are at particular risk.	Fauna: 33.2% Flora: 32.5%	14.5% 16.5%	47.9% 49.1%	*Threatened Species Conservation Act 1995 (TSCA)*, *Environmental Planning and Assessment Act 1979 (EPA Act)*, *National Parks and Wildlife Act 1974*, *Endangered Species Protection Act 1992 (ESP Act)*; Conservation Protocols, Forest Management Zoning (FMZs)., and Management Plans

[a] Sensitivity – to disturbance, relates to extent of loss or diminution in a value due to the effects of disturbance.
[b] Resilience – relates to the extent of likely recovery of a diminished value, and to the time and management effort required to achieve this recovery.

National Estate Values	JANIS related value	Sensitivity[a] and resilience[b] to forestry activities covered by the RFA	Percentage of value on public land in reserves			Existing off-reserve protection mechanisms
			Formal Reserve	Informal Reserve	Formal Reserves as a Result of 1998 NSW Decision	
Habitat richness	No	Sensitivity and resilience varies depending on the habitat. Habitat types sensitive to logging, grazing, and unnatural fire are at particular risk.	27.6%	13.9%	42.2%	*Environmental Planning and Assessment Act 1979 (EPA Act)*, Conservation Protocols, Forest Management Zoning (FMZs). and Management Plans
Vegetation community richness		High sensitivity to logging, grazing, unnatural fire and other forestry activities. Medium resilience to forestry activities	19.5%	5.7%	25.4%	*Environmental Planning and Assessment Act 1979 (EPA Act)*, Conservation Protocols, Forest Management Zoning (FMZs). and Management Plans
Species richness (A.3)	Yes	High sensitivity to logging, grazing, unnatural fire and other forestry activities. Medium resilience to forestry activities	Fauna: 29.1% Flora: 39.5%	16.3% 19%	43.98% 61.1%	*Environmental Planning and Assessment Act 1979 (EPA Act)*, Conservation Protocols, Forest Management Zoning (FMZs). and Management Plans

[a] Sensitivity – to disturbance, relates to extent of loss or diminution in a value due to the effects of disturbance.
[b] Resilience – relates to the extent of likely recovery of a diminished value, and to the time and management effort required to achieve this recovery.

National Estate Values	JANIS related value	Sensitivity[a] and resilience[b] to forestry activities covered by the RFA	Percentage of value on public land in reserves			Existing off-reserve protection mechanisms
			Formal Reserve	Informal Reserve	Formal Reserves as a Result of 1998 NSW Decision	
Important habitat (A.2)	Yes	Sensitivity and resilience varies depending on the species and habitat required. Species sensitive to logging, grazing and unnatural fire are at particular risk.	22.2%	14.3%	32.5%	*Threatened Species Conservation Act 1995 (TSCA)*, *Environmental Planning and Assessment Act 1979 (EPA Act)*, *National Parks and Wildlife Act 1974*, *Endangered Species Protection Act 1992 (ESP Act)*; Conservation Protocols, Forest Management Zoning (FMZs), and Management Plans
Remnant vegetation (A.2)	Yes	High sensitivity to logging, grazing, unnatural fire and other forestry activities. Low resilience to forestry activities	15.6%	10.1%	22.9%	*Native Vegetation Conservation Act* 1997, *Protection of the Environment Operations Act 1997*, *Threatened Species Conservation Act 1995 (TSCA)*, *Environmental Planning and Assessment Act 1979 (EPA Act)*, *National Parks and Wildlife Act 1974*, *Endangered Species Protection Act 1992 (ESP Act)*; Conservation Protocols, and Management Plans, Forest Management Zoning (FMZs).

[a] Sensitivity – to disturbance, relates to extent of loss or diminution in a value due to the effects of disturbance.
[b] Resilience – relates to the extent of likely recovery of a diminished value, and to the time and management effort required to achieve this recovery.

National Estate Values	JANIS related value	Sensitivity[a] and resilience[b] to forestry activities covered by the RFA	Percentage of value on public land in reserves			Existing off-reserve protection mechanisms
			Formal Reserve	Informal Reserve	Formal Reserves as a Result of 1998 NSW Decision	
Species with disjunct ranges (A.1)	No	Sensitivity and resilience varies depending on the species and habitat required. Species sensitive to logging, grazing, and unnatural fire are at particular risk.	Fauna: 29.8% Flora: 52.9%	17.4% 15.6%	47.5% 69.6%	*Threatened Species Conservation Act 1995 (TSCA)*, *Environmental Planning and Assessment Act 1979 (EPA Act)*, *National Parks and Wildlife Act 1974*, *Endangered Species Protection Act 1992 (ESP Act)*; Conservation Protocols, Forest Management Zoning (FMZs), and Management Plans.
Centres of endemism – flora and fauna (A.1)	Yes	Value is dependent on individual species response. Species sensitive to logging, grazing, and unnatural fire are at particular risk.	30.8%	11.6%	43.6%	*Threatened Species Conservation Act 1995 (TSCA)*, *Environmental Planning and Assessment Act 1979 (EPA Act)*, *National Parks and Wildlife Act 1974*, *Endangered Species Protection Act 1992 (ESP Act)*; Conservation Protocols, Forest Management Zoning (FMZs), and Management Plans

[a] Sensitivity – to disturbance, relates to extent of loss or diminution in a value due to the effects of disturbance.
[b] Resilience – relates to the extent of likely recovery of a diminished value, and to the time and management effort required to achieve this recovery.

National Estate Values	JANIS related value	Sensitivity[a] and resilience[b] to forestry activities covered by the RFA	Percentage of value on public land in reserves			Existing off-reserve protection mechanisms
			Formal Reserve	Informal Reserve	Formal Reserves as a Result of 1998 NSW Decision	
Rare, uncommon or threatened species		Sensitivity and resilience varies depending on the species and habitat required. Species sensitive to logging, grazing, and unnatural fire are at particular risk.	Fauna: 38.8% Flora: 38.7%	18.1% 16.1%	56.2% 53.8%	*Threatened Species Conservation Act 1995 (TSCA)*, *Environmental Planning and Assessment Act 1979 (EPA Act)*, *National Parks and Wildlife Act 1974*, *Endangered Species Protection Act 1992 (ESP Act)*; *Native Vegetation Conservation Act* 1997 Conservation Protocols, Forest Management Zoning (FMZs)., and Management Plans
Rare vegetation communities (B.1)	Yes*	High sensitivity to logging, grazing, unnatural fire and other forestry activities. Low resilience to forestry activities	41%	26.6%	59.5%	*Threatened Species Conservation Act 1995 (TSCA)*, *Environmental Planning and Assessment Act 1979 (EPA Act)*, *National Parks and Wildlife Act 1974*, *Endangered Species Protection Act 1992 (ESP Act)*; *Native Vegetation Conservation Act* 1997 Conservation Protocols, Forest Management Zoning (FMZs)., and Management Plans

[a] Sensitivity – to disturbance, relates to extent of loss or diminution in a value due to the effects of disturbance.
[b] Resilience – relates to the extent of likely recovery of a diminished value, and to the time and management effort required to achieve this recovery.

National Estate Values	JANIS related value	Sensitivity[a] and resilience[b] to forestry activities covered by the RFA	Percentage of value on public land in reserves			Existing off-reserve protection mechanisms
			Formal Reserve	Informal Reserve	Formal Reserves as a Result of 1998 NSW Decision	
Natural History Sites - Type localities for species and research, teaching and benchmark sites (C.1)	No	Sensitivity and resilience varies depending on the species and habitat required. Species sensitive to logging, grazing, and unnatural fire are at particular risk. Value is also dependent on individual site purpose. Sites sensitive to logging, grazing, and unnatural fire are at particular risk.	-	-	-	*Threatened Species Conservation Act 1995 (TSCA), Crown Lands Act (1989), Heritage Act 1977, Soil Conservation Act 1938 Environmental Planning and Assessment Act 1979 (EPA Act Native Vegetation Conservation Act* 1997, *Protection of the Environment Operations Act 1997, Clean Water Act (1970)*
Geoconservation values (A1, A2, A.3, B.1, C.1, C.2, D.1, H.1)	No	Values are generally not sensitive to most forest uses, however some surface values are sensitive to soil disturbance and fire.	-	-	-	*Crown Lands Act (1989), Heritage Act 1977, Soil Conservation Act 1938 Environmental Planning and Assessment Act 1979 (EPA Act Native Vegetation Conservation Act* 1997, *Protection of the Environment Operations Act 1997, Clean Water Act (1970)*

[a] Sensitivity – to disturbance, relates to extent of loss or diminution in a value due to the effects of disturbance.
[b] Resilience – relates to the extent of likely recovery of a diminished value, and to the time and management effort required to achieve this recovery.

APPENDIX G – LIST OF EXPERTS CONSULTED IN ASSESSMENT OF NATURAL NATIONAL ESTATE VALUES IN NSW

Forest Ecosystems
Andrew Benwell, Independent Expert
Douglas Binns, State Forests of NSW, Agency Expert
Carmel Flint, NSW NPWS, Agency Expert
Phil Gilmour, Independent Expert
Stephanie Horton, Independent Expert Barbara Stewart, Independent Expert

Fauna
Keith Cherry, NSW NPWS, Agency Expert
Mark Fitzgerald, NSW NPWS, Agency Expert
Phil Gibbons, Independent Expert
Sandy Gilmore, NSW NPWS, Agency Expert
Glenn Hoye, Independent Expert
Rod Kavanagh, State Forests of NSW, Agency Expert
Ross Knowles, NSW NPWS, Agency Expert
Brad Law, State Forests of NSW, Agency Expert
Frank Lemckert, State Forests of NSW, Agency Expert
Michael Mahoney, Independent Expert
Dave Milledge, Independant Expert
Harry Recher, Independent Expert
Jim Shields, State Forests of NSW, Agency Expert
Ross Saddlier , Independent Expert
Andrew Smith , Independent Expert

Flora
Stephen Bell, Independent Expert
Andrew Benwell, Independent Expert
Phil Gilmour, Independent Expert
Stephanie Horton, Independent Expert Barbara Stewart, Independent Expert
R. John Hunter, NSW NPWS, Agency Expert Peter Richards, NSW NPWS, Agency Expert Paul Sheringham, NSW NPWS, Agency Expert
Douglas Binns, State Forests of NSW, Agency Expert

Geoheritage
Armstrong Osborne, Consultant

Natural History Sites
Martin Denny, Consultant

Additional Persons Consulted
Dailan Pugh, Nature Conservation Council
Simon Bennett, Environment Australia

Simon Clarke,Nature Conservation Council
Martin Robinson, Australian Museum
Mike Rowe, Australian Museum
Bruce Cummings, Environment Australia
Rolan Eberhard, Environment Australia
Tara Harris, Enviornment Australia
Michael O'Brien, Environment Australia
Geoff Moore, NSW National Parks and Wildlife Service

APPENDIX H – SITES IDENTIFIED WITH SPATIAL INFORMATION FOR GEOHERITAGE

TYPE	CRITERIA	Data Status	Fragility
FOSSIL SITE - Plant macrof	H1,A1,C1	1	2
SHELLS FROM KITCHEN MIDDEN	A1	2	3
SHELLS FROM KITCHEN MIDDEN	A1	2	3
CALCIC BASALT	D1	1	4
WETLANDS	A2	1	3
WETLANDS	A2	1	3
WETLANDS	A2	1	3
SEDIMENTOLOGY - Red Cliff	A1	1	3
LIMBURGITE	D1	1	4
WETLANDS	A2	1	3
WETLANDS	A2	1	3
WETLANDS	A2	1	3
WETLANDS	A2	1	3
WETLANDS	A2	1	3
WETLANDS	A2	1	3
WETLANDS	A2	1	3
WETLANDS	A2	1	3
WETLANDS	A2	1	3
WETLANDS	A2	1	3
WETLANDS	A2	1	3
WETLANDS	A2	1	3
WETLANDS	A2	1	3
WETLANDS	A2	1	3
WETLANDS	A2	1	3
SEDIMENTOLOGY - Red Cliff	A1	1	3
WETLANDS	A2	2	3
WETLANDS	A2	2	3
BASALT CAP	A1	2	4
BANDED JASPER	AI, D1	2	3
DUNES (Qs)	A2, D1	2	3
LATERITE	A1	2	3
HISTORIC LIME KILN	H1	1	2
TERTIARY STRATIGRAPHY	A1	1	3
K-AR DATING OF BASALT	A1, C1	1	3

TYPE	CRITERIA	Data Status	Fragility
FOSSIL SITE - Plant macrof	A1,B1,C1	1	2
FOSSIL SITE - Plant macrof	A1, B1,C	1	2
FOSSIL SITE - Plant macrof	A1, B1,C	1	2
EPITHERMAL SILVER-GOLD	D1	2	3
EPITHERMAL SILVER-GOLD	D1	2	3
CMB OUTLIER (Jlr)	A1	2	4
CMB OUTLIER (Jlr)	A1	2	3
DOLERITE INTRUDING GRANITE	A1	2	3
WATERFALL IN GRANITE	D1	2	3
WATERFALL IN GRANITE	D1	1	3
WATERFALL	D1	1	3
HETEROLITHIC BRECCIA	D1	1	3
VOLCANIC LANDFORM - Brecci	D1	1	3
LAVA SEQUENCE/LAVA FLOW	A1	1	4
STRUCTURE - Columnar joint	D1	1	3
WATERFALL	D1	1	3
PORPHYRITIC OR ANDESITIC B	D1	1	
WATERFALL	D1	1	3
WATERFALL	D1	1	3
ALLUVIAL TIN	D1	2	2
WETLANDS	A2	1	3
WETLANDS	A2	1	3
WETLANDS	A2	1	3
WETLANDS	A2	1	3
WETLANDS	A2	1	3
STRUCTURE/DEFORMATION - Be	A1	1	
MEGABRECCIA	A1	1	3
FOSSIL SITE - Wood	B	1	2
RESIDUAL BASALT FLOW	A1	1	4
FOSSIL SITE - Plant macrof	A1,B1,C1	1	2

FOSSIL SITE - Plant macrof	A1,B1,C1	1	2
TYPE	**CRITERIA**	**Data Status**	**Fragility**
K-AR DATING SITE	A1, C1	1	3
WATERFALL	D1	1	3
CLIFFS	D1	1	3
LAVA VENT	A1	1	3
LAVA VENT	A1	1	3
LAVA VENT	A1	1	3
LAVA VENT	A1	1	3
LAVA VENT	A1	1	3
LAVA VENT	A1	1	3
LAVA VENT	A1	1	3
LAVA VENT	A1	1	3
LAVA VENT	A1	1	3
CLIFFS	D1	1	3
DIATOMACEOUS EARTH DEPOSIT	A1	1	3
WATERFALL	D1	1	3
WATERFALL	D1	1	3
BASALT FLOWS - bole sandwi	A1	1	3
SHIELD VOLCANO	D1	1	4
SHEILD VOLCANO	D1	1	4
SHIELD VOLCANO	D1	1	4
GORGE	D1	1	3
GORGE	D1	1	3
WATERFALL	D1	1	3
GORGE	D1	1	3
GORGE	D1	1	3
TRUNCATIONS	D1	1	2
DISRUPTED LAYERS	D1	1	2
TRUNCATIONS	D1	1	2
WELL BEDDED TUFF	D1	1	2
LONG WAVE LENGTH/LOW WAVE	D1	1	2
TRUNCATIONS	D1	1	2
WAVY BEDDING	D1	1	2
ESTUARINE WETLANDS	A2	1	3
DUNE FORMATION	D1	1	3
INTERBARRIER CREEK	D1	1	3
ESTUARINE WETLANDS	A2	1	3
ESTUARINE WETLANDS	A2	1	3
INTERBARRIER CREEK	D1	1	3

INTERBARRIER CREEK	D1	1	3
WETLANDS	A2	1	3
TYPE	**CRITERIA**	**Data Status**	**Fragility**
ESTUARINE WETLANDS	A2	1	3
COLUMNAR BASALT	A1, D1	1	3
WETLANDS	A2	1	3
AURIFEROUS BEACH SANDS	D1	2	3
FOSSIL SITE - Coral reef	A1, B1,C	1	2
OXBOWS	D1	2	
SANDSTONE LANDFORM	D1	2	4
SANDSTONE LANDFORM	D1	2	4
CARBONACEOUS SANDROCK (Czw	D1	2	3
CAINOZOIC SEDIIMENT (Czs)	A1, D1	2	3
CAINOZOIC SEDIIMENT (Czs)	A1, D1	2	3
FOSSIL SITE - Vertebrate	C1	1	2
FOSSIL SITE - Invertebrate	C1	1	2
FOSSIL SITE - Plant	C1	1	2
FOSSIL SITE - Plant	C1	1	2
TYPE LOCALITY	C1	1	3
TYPE SECTION	C1	1	3
TYPE SECTION	C1	1	3
TYPE SECTION	C1	1	3
TYPE SECTION	C1	1	3
TYPE SECTION	C1	1	3
TYPE LOCALITY	C1	1	3
TYPE SECTION	C1	1	3

APPENDIX I – SITES IDENTIFIED WITH SPATIAL INFORMATION FOR OTHER NATURAL HISTORY SITES

TYPE	NAME	LATITUDE	LONGITUDE
Threatened Fauna	Elaeocarpus williamsianus	-28.4500	153.4300
Threatened Fauna	Acronychia littoralis	-28.5300	153.5500
Threatened Fauna	Endiandra hayesii	-28.6200	153.4000
Threatened Fauna	Corokia whiteana	-28.6300	153.3200
Threatened Fauna	Hibbertia marginata	-29.3300	152.8500
Threatened Fauna	Acacia ruppi	-29.5800	152.7700
Threatened Fauna	Olax angulata	-29.7800	153.2700
Threatened Fauna	Corynocarpus rupestris ssp. rupestris	-29.8000	153.0700
Threatened Fauna	Haloragis exalata	-29.8700	152.4500
Threatened Fauna	Eucalyptus mckieana	-30.0200	151.5000
Threatened Fauna	Grevillea beadleana	-30.0500	152.3500
Threatened Fauna	Boronia umbellata	-30.0500	153.0500
TYPE	NAME	LATITUDE	LONGITUDE
Threatened Flora	Elaeocarpus williamsianus	-28.4500	153.4300
Threatened Flora	Acronychia littoralis	-28.5300	153.5500
Threatened Flora	Endiandra hayesii	-28.6200	153.4000
Threatened Flora	Corokia whiteana	-28.6300	153.3200
Threatened Flora	Hibbertia marginata	-29.3300	152.8500
Threatened Flora	Acacia ruppi	-29.5800	152.7700
Threatened Flora	Olax angulata	-29.7800	153.2700
Threatened Flora	Corynocarpus rupestris ssp. rupestris	-29.8000	153.0700
Threatened Flora	Haloragis exalata	-29.8700	152.4500
Threatened Flora	Eucalyptus mckieana	-30.0200	151.5000
Threatened Flora	Grevillea beadleana	-30.0500	152.3500

Threatened Flora	Boronia umbellata	-30.0500	153.0500
TYPE	NAME	LATITUDE	LONGITUDE
Mammal	Chalinolobus dwyeri	-30	151.0200
Mammal	Antechinus stuartii	-30	152.3500
TYPE	NAME	LATITUDE	LONGITUDE
Lichen	Pannaria crenulata	-28.4000	153.2700
TYPE	NAME	LATITUDE	LONGITUDE
Reference Sites	Boatharbour	-28.320	153.350
Reference Sites	Long Creek	-28.330	152.870
Reference Sites	Booyong	-28.450	153.270
Reference Sites	Billinudgel	-28.510	153.130
Reference Sites	Mt Nardi	-28.550	153.283
Reference Sites	Kyogle	-28.620	153.000
Reference Sites	Protestors Falls	-28.670	153.280
Reference Sites	Terania Creek	-28.670	153.280
Reference Sites	Ballina	-28.870	153.570
Reference Sites	Desert Creek	-29.270	152.420
Reference Sites	Iluka NR	-29.400	153.350
Reference Sites	Susan Island	-29.680	152.920
Reference Sites	Susan Island	-29.680	152.920
Reference Sites	London Bridge SF	-29.830	152.250
Reference Sites	Coutts Crossing	-29.830	152.880
Reference Sites	CSIRO Nth Sites	-29.910	152.900
Reference Sites	CSIRO Nth Sites	-29.930	152.410
Reference Sites	CSIRO Nth Sites	-29.960	152.370
Reference Sites	CSIRO Nth Sites	-29.990	152.340
Reference Sites	Chaelundi SF	-30.050	152.350
Reference Sites	CSIRO Nth Sites	-30.060	153.010

Reference Sites	Clouds Creek	-30.080	152.630
Reference Sites	CSIRO Nth Sites	-30.130	152.970
Reference Sites	Bucca Bucca Creek	-30.130	153.020
Reference Sites	CSIRO Nth Sites	-30.160	152.970
Reference Sites	CSIRO Nth Sites	-30.170	152.960
Reference Sites	CSIRO Nth Sites	-30.210	152.990
Reference Sites	Bruxner Park	-30.250	153.120
TYPE	NAME	LATITUDE	LONGITUDE
Insects	Australocyon variegatus	-28.36666667	153.0833333
Insects	Australocyon variegatus	-28.36666667	153.0833333
Insects	Australocyon variegatus	-28.36666667	153.0833333
Insects	Ceronocyton obscurum	-28.36666667	153.0833333
Insects	Australocyon weiri	-28.36666667	153.0833333
Insects	Australocyon variegatus	-28.48333333	152.3833333
Insects	Australocyon nanus	-28.48333333	152.3833333
Insects	Cenebriophilus subcostatus	-28.48333333	152.3833333
Insects	Palophagus australiensis	-28.48333333	152.3833333
Insects	Ceronocyton obscurum	-28.48333333	152.3833333
Insects	Australocyon variegatus	-28.80000000	152.9833333
Insects	Australocyon nanus	-28.80000000	152.9833333
Insects	Pilocnema nigra	-28.80000000	152.9833333
Insects	Cenebriophilus subcostatus	-28.80000000	152.9833333
Insects	Amphistomus trispiculatus	-29.50000000	152.2833333
Insects	Amphistomus trispiculatus	-29.50000000	152.2833333
Insects	Demarziella scarpensis	-29.50000000	152.2833333
Insects	Onthophagus kiambram	-29.50000000	152.2833333

Insects	Demarziella scarpensis	-29.50000000	152.2833333
Insects	Amphistomus speculifer	-29.50000000	152.2833333
Insects	Austroargiolestes alpinus	-30.40000000	152.3500000
Insects	Argiolestes griseus	-30.40000000	152.3500000
Insects	Notoaeschna geminata	-30.40000000	152.3500000
Insects	Austroargiolestes icteromelas	-30.40000000	152.3500000
TYPE	NAME	LATITUDE	LONGITUDE
Arachnids	Ixamatus caldera	-28.47	153.13
Arachnids	Ixamatus candidus	-29.05	152.03
Arachnids	Australothele nambucca	-30.37	153.10
TYPE	NAME	LATITUDE	LONGITUDE
Research Sites	Wallaby Creek	-28.480	152.45
Research Sites	Iluka NR	-29.400	153.35

Queensland

Murwillumbah

Woodenbong

Kyogle

Lismore

Casino

Richmond River

Tenterfield

Clarence River

Pacific Hwy

Grafton

PACIFIC OCEAN

Glen Innes

New England Hwy

Guyra

Coffs Harbour

Dorrigo

New South Wales

UPPER NORTH EAST

Comprehensive Regional Assessment

MAP 1

Existing Areas Listed on the Register of the National Estate

- Existing Areas Listed on the Register of the National Estate
- National Parks and Reserves
- State Forest
- RFA Boundary
- Rivers
- Roads

SOURCES:
NSW UNE CRA National Estate Assessments - Environment Australia
NSW UNE Regional Forest Agreement - Upper North East RFA Boundary - 1998
TOPO 250K - AUSLIG
Drainage and Roads - LIC
Places - AUSLIG

PRODUCED BY
Environment Australia - Version: 28 April 1999

File Reference: ne_rne

Locality Map

Scale 1:335000

5 0 5 10 15 20 25
Kilometres

Projection - AMG Zone 56

Queensland

Woodenbong

Murwillumbah

Kyogle

Lismore

Casino

Tenterfield

Richmond River

Pacific Hwy

Clarence River

Grafton

PACIFIC OCEAN

Glen Innes

New England Hwy

Guyra

Coffs Harbour

Dorrigo

New South Wales

UPPER NORTH EAST

Comprehensive Regional Assessment

MAP 2

Areas Meeting Wilderness Criteria

- Areas Meeting Wilderness Criteria
- National Parks and Reserves
- State Forest
- RFA Boundary
- Rivers
- Roads

SOURCES:
NSW UNE CRA National Estate Assessments - Environment Australia
NSW UNE Regional Forest Agreement - Upper North East RFA Boundary - 1998
TOPO 250K - AUSLIG
Drainage and Roads - LIC
Places - AUSLIG

PRODUCED BY
Environment Australia - Version: 28 April 1999
File Reference: ne_wild

Locality Map

Scale 1:335000

5 0 5 10 15 20 25
Kilometres

Projection - AMG Zone 56

Queensland

Woodenbong

Murwillumbah

Kyogle

Lismore

Casino

Richmond River

Tenterfield

Pacific Hwy

Clarence River

Grafton

PACIFIC OCEAN

Glen Innes

New England Hwy

Guyra

Dorrigo

Coffs Harbour

New South Wales

UPPER NORTH EAST

Comprehensive Regional Assessment

MAP 3

Areas Above Threshold For Natural Landscapes

- Areas Above Threshold for Natural Landscapes
- National Parks and Reserves
- State Forest
- RFA Boundary
- Rivers
- Roads

SOURCES:
NSW UNE CRA National Estate Assessments - Environment Australia
NSW UNE Regional Forest Agreement - Upper North East RFA Boundary - 1998
TOPO 250K - AUSLIG
Drainage and Roads - LIC
Places - AUSLIG

PRODUCED BY
Environment Australia - Version: 30 April 1999
File Reference: ne_natlan

Locality Map

Scale 1:335000

5 0 5 10 15 20 25
Kilometres

Projection - AMG Zone 56

Queensland

Woodenbong

Murwillumbah

Kyogle

Lismore

Casino

Tenterfield

Richmond River

Pacific Hwy

Clarence River

Grafton

PACIFIC OCEAN

Glen Innes

New England Hwy

Guyra

Coffs Harbour

Dorrigo

New South Wales

UPPER NORTH EAST

Comprehensive Regional Assessment

MAP 4

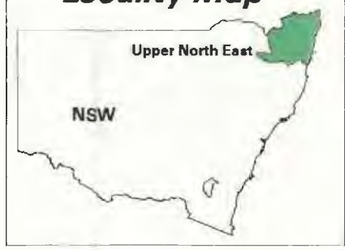
Areas Above Threshold For Undisturbed Catchments

- Areas Above Threshold for Undisturbed Catchments
- National Parks and Reserves
- State Forest
- RFA Boundary
- Rivers
- Roads

SOURCES:
NSW UNE CRA National Estate Assessments - Environment Australia
NSW UNE Regional Forest Agreement - Upper North East RFA Boundary - 1998
TOPO 250K - AUSLIG
Drainage and Roads - LIC
Places - AUSLIG

PRODUCED BY
Environment Australia - Version: 30 April 1999
File Reference: ne_uncat

Locality Map



Scale 1:335000

5 0 5 10 15 20 25

Kilometres

Projection - AMG Zone 56

Queensland

Murwillumbah
Woodenbong
Kyogle
Lismore
Casino
Richmond River
Tenterfield
Pacific Hwy
Clarence River
Grafton
PACIFIC OCEAN
Glen Innes
New England Hwy
Guyra
Coffs Harbour
Dorrigo

New South Wales

UPPER NORTH EAST

Comprehensive Regional Assessment

MAP 5

Areas Above Threshold For National Estate Old-Growth Forest

- Areas Above Threshold for National Estate Old-Growth Forest
- National Parks and Reserves
- State Forest
- RFA Boundary
- Rivers
- Roads

SOURCES:
NSW UNE CRA National Estate Assessments - Environment Australia
NSW UNE Regional Forest Agreement - Upper North East RFA Boundary - 1998
TOPO 250K - AUSLIG
Drainage and Roads - LIC
Places - AUSLIG

PRODUCED BY
Environment Australia - Version: 21 April 1999
File Reference: ne_neog

Locality Map

Scale 1:335000

5 0 5 10 15 20 25
Kilometres

Projection - AMG Zone 56

Queensland

Woodenbong

Murwillumbah

Kyogle

Lismore

Casino

Tenterfield

Richmond River

Pacific HWY

Clarence River

Grafton

PACIFIC OCEAN

Glen Innes

New England Hwy

Guyra

Coffs Harbour

Dorrigo

New South Wales

UPPER NORTH EAST

Comprehensive Regional Assessment

MAP 6

Areas Above Threshold For Centres of Endemism

- Areas Above Threshold for Centres of Endemism
- National Parks and Reserves
- State Forest
- RFA Boundary
- Rivers
- Roads

SOURCES:
NSW UNE CRA National Estate Assessments - Environment Australia
NSW UNE Regional Forest Agreement - Upper North East RFA Boundary - 1998
TOPO 250K - AUSLIG
Drainage and Roads - LIC
Places - AUSLIG

PRODUCED BY
Environment Australia - Version: 29 April 1999
File Reference: ne_centend

Locality Map

Scale 1:335000

5 0 5 10 15 20 25
Kilometres

Projection - AMG Zone 56

Queensland

Woodenbong

Murwillumbah

Kyogle

Lismore

Casino

Tenterfield

Clarence River

Pacific Hwy

Grafton

PACIFIC OCEAN

Glen Innes

New England Hwy

Guyra

Dorrigo

Coffs Harbour

New South Wales

UPPER NORTH EAST

Comprehensive Regional Assessment

MAP 7

Areas Above Threshold For Fauna With Disjunct Populations

- Areas Above Threshold for Fauna with Disjunct Populations
- National Parks and Reserves
- State Forest
- RFA Boundary
- Rivers
- Roads

SOURCES:
NSW UNE CRA National Estate Assessments - Environment Australia
NSW UNE Regional Forest Agreement - Upper North East RFA Boundary - 1998
TOPO 250K - AUSLIG
Drainage and Roads - LIC
Places - AUSLIG

PRODUCED BY
Environment Australia - Version: 30 April 1999
File Reference: ne_dsjfn

Locality Map

Scale 1:335000

5 0 5 10 15 20 25
Kilometres

Projection - AMG Zone 56

Queensland

Woodenbong

Murwillumbah

Kyogle

Lismore

Casino

Tenterfield

Richmond River

Pacific Hwy

Clarence River

Grafton

PACIFIC OCEAN

Glen Innes

New England Hwy

Guyra

Coffs Harbour

Dorrigo

New South Wales

UPPER NORTH EAST

Comprehensive Regional Assessment

MAP 8

Areas Above Threshold For Flora With Disjunct Populations

- Areas Above Threshold for Flora with Disjunct Populations
- National Parks and Reserves
- State Forest
- RFA Boundary
- Rivers
- Roads

SOURCES:
NSW UNE CRA National Estate Assessments - Environment Australia
NSW UNE Regional Forest Agreement - Upper North East RFA Boundary - 1998
TOPO 250K - AUSLIG
Drainage and Roads - LIC
Places - AUSLIG

PRODUCED BY
Environment Australia - Version: 21 April 1999
File Reference: ne_dsjfl

Locality Map

Scale 1:335000

5 0 5 10 15 20 25

Kilometres

Projection - AMG Zone 56

Queensland

Woodenbong

Murwillumbah

Kyogle

Casino

Tenterfield

Clarence River

Grafton

PACIFIC OCEAN

Glen Innes

New England Hwy

Guyra

Dorrigo

Coffs Harbour

New South Wales

UPPER NORTH EAST

Comprehensive Regional Assessment

MAP 9

Areas Above Threshold For Fauna At The Limit Of Their Range

- Areas Above Threshold for Fauna at the Limit of their Range
- National Parks and Reserves
- State Forest
- RFA Boundary
- Rivers
- Roads

SOURCES:
NSW UNE CRA National Estate Assessments - Environment Australia
NSW UNE Regional Forest Agreement - Upper North East RFA Boundary - 1998
TOPO 250K - AUSLIG
Drainage and Roads - LIC
Places - AUSLIG

PRODUCED BY
Environment Australia - Version: 21 April 1999
File Reference: ne_limfn

Locality Map

Scale 1:335000

5 0 5 10 15 20 25
Kilometres

Projection - AMG Zone 56

Queensland

Woodenbong

Murwillumbah

Kyogle

Lismore

Casino

Tenterfield

Clarence River

Pacific Hwy

New England Hwy

Grafton

Glen Innes

Guyra

Coffs Harbour

Dorrigo

PACIFIC OCEAN

New South Wales

UPPER NORTH EAST

Comprehensive Regional Assessment

MAP 10

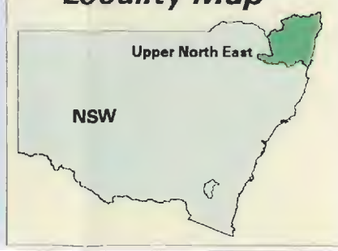
Areas Above Threshold For Flora At The Limit Of Their Range

- Areas Above Threshold for Flora at the Limit of their Range
- National Parks and Reserves
- State Forest
- RFA Boundary
- Rivers
- Roads

SOURCES:
NSW UNE CRA National Estate Assessments - Environment Australia
NSW UNE Regional Forest Agreement - Upper North East RFA Boundary - 1998
TOPO 250K - AUSLIG
Drainage and Roads - LIC
Places - AUSLIG

PRODUCED BY
Environment Australia - Version: 21 April 1999
File Reference: ne_limfl

Locality Map



Scale 1:335000

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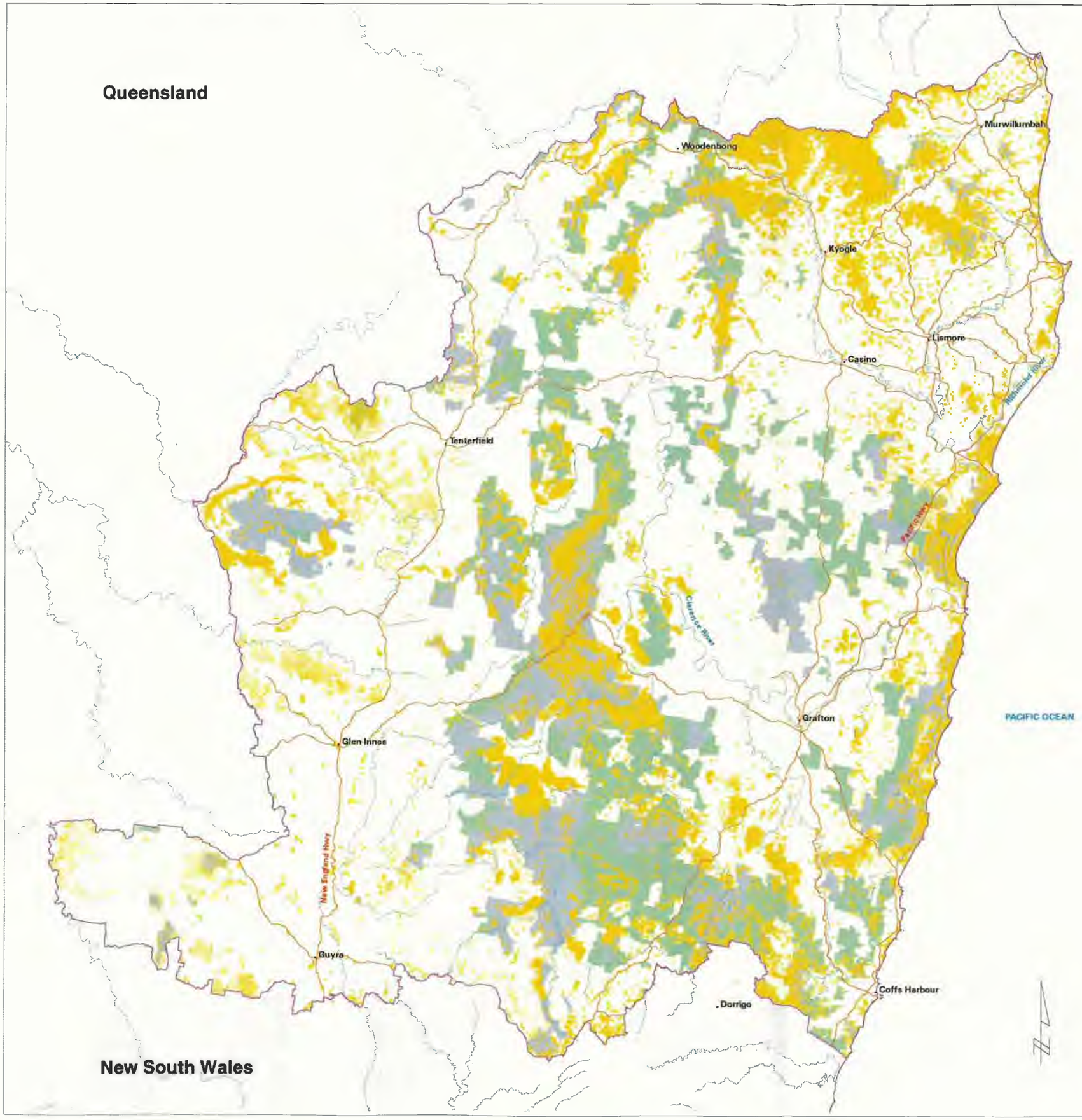
Kilometres

Projection - AMG Zone 56



UPPER NORTH EAST

Comprehensive Regional Assessment

MAP 11

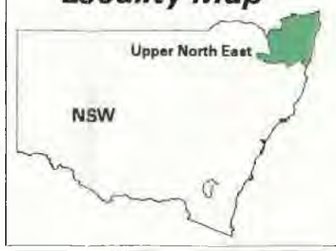
Areas Above Threshold For Refugia

- Areas Above Threshold for Refugia
- National Parks and Reserves
- State Forest
- RFA Boundary
- Rivers
- Roads

SOURCES:
NSW UNE CRA National Estate Assessments - Environment Australia
NSW UNE Regional Forest Agreement - Upper North East RFA Boundary - 1998
TOPO 250K - AUSLIG
Drainage and Roads - LIC
Places - AUSLIG

PRODUCED BY
Environment Australia - Version: 21 April 1999
File Reference: ne_refug

Locality Map



Scale 1:335000

5 0 5 10 15 20 25
Kilometres

Projection - AMG Zone 56

Queensland

Woodenbong

Murwillumbah

Kyogle

Lismore

Casino

Tenterfield

Richmond River

Pacific HWY

Clarence River

Grafton

PACIFIC OCEAN

Glen Innes

New England Hwy

Guyra

Coffs Harbour

Dorrigo

New South Wales

UPPER NORTH EAST

Comprehensive Regional Assessment

MAP 12

Areas Above Threshold For Primitive, Relictual and Phylogenetically Distinct Species

- Areas Above Threshold for Primitive, Relictual and Phylogenetically Distinct Species
- National Parks and Reserves
- State Forest
- RFA Boundary
- Rivers
- Roads

SOURCES:
NSW UNE CRA National Estate Assessments - Environment Australia
NSW UNE Regional Forest Agreement - Upper North East RFA Boundary - 1998
TOPO 250K - AUSLIG
Drainage and Roads - LIC
Places - AUSLIG

PRODUCED BY
Environment Australia - Version: 27 April 1999
File Reference: ne_prmrl

Locality Map

Scale 1:335000

5 0 5 10 15 20 25
Kilometres

Projection - AMG Zone 56

Queensland

Woodenbong

Murwillumbah

Kyogle

Lismore

Casino

Tenterfield

Clarence River

Pacific Hwy

Nthn Rivers Rail

Grafton

PACIFIC OCEAN

Glen Innes

New England Hwy

Guyra

Coffs Harbour

Dorrigo

New South Wales

UPPER NORTH EAST

Comprehensive Regional Assessment

MAP 13

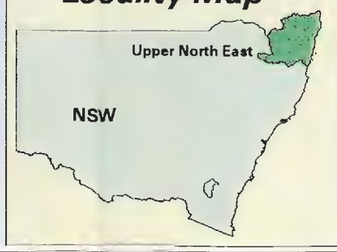
Areas Above Threshold For Migratory Species

- Areas Above Threshold for Migratory Species
- National Parks and Reserves
- State Forest
- RFA Boundary
- Rivers
- Roads

SOURCES:
NSW UNE CRA National Estate Assessments - Environment Australia
NSW UNE Regional Forest Agreement - Upper North East RFA Boundary - 1998
TOPO 250K - AUSLIG
Drainage and Roads - LIC
Places - AUSLIG

PRODUCED BY
Environment Australia - Version: 27 April 1999
File Reference: ne_migr

Locality Map



Scale 1:335000

5 0 5 10 15 20 25

Kilometres

Projection - AMG Zone 56

Queensland

Murwillumbah

Woodenbong

Kyogle

Lismore

Casino

Richmond River

Tenterfield

Pacific Highway

Clarence River

Grafton

PACIFIC OCEAN

Glen Innes

New England Hwy

Guyra

Coffs Harbour

Dorrigo

New South Wales

UPPER NORTH EAST

Comprehensive Regional Assessment

MAP 14

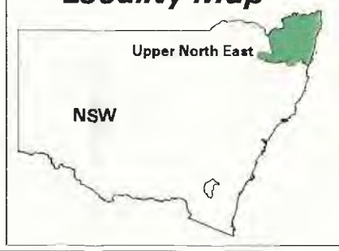
Areas Above Threshold For Important Habitat

- Areas Above Threshold for Important Habitat
- National Parks and Reserves
- State Forest
- RFA Boundary
- Rivers
- Roads

SOURCES:
NSW UNE CRA National Estate Assessments - Environment Australia
NSW UNE Regional Forest Agreement - Upper North East RFA Boundary - 1998
TOPO 250K - AUSLIG
Drainage and Roads - LIC
Places - AUSLIG

PRODUCED BY
Environment Australia - Version: 27 April 1999
File Reference: ne_imphb

Locality Map



Scale 1:335000

5 0 5 10 15 20 25

Kilometres

Projection - AMG Zone 56

Queensland

Murwillumbah
Woodenbong
Kyogle
Lismore
Casino
Tenterfield
Richmond River
Clarence River
Pacific Hwy
Glen Innes
New England Hwy
Grafton
PACIFIC OCEAN
Guyra
Coffs Harbour
Dorrigo

New South Wales

UPPER NORTH EAST

Comprehensive Regional Assessment

MAP 15

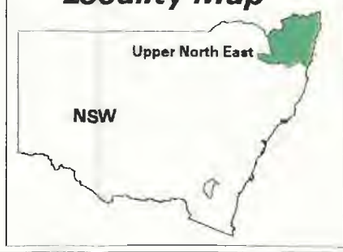
Areas Above Threshold For Remnant Vegetation and Rare Old-Growth Forest

- Areas Above Threshold for Remnant Vegetation and Rare Old-Growth Forest
- National Parks and Reserves
- State Forest
- RFA Boundary
- Rivers
- Roads

SOURCES:
NSW UNE CRA National Estate Assessments - Environment Australia
NSW UNE Regional Forest Agreement - Upper North East RFA Boundary - 1998
TOPO 250K - AUSLIG
Drainage and Roads - LIC
Places - AUSLIG

PRODUCED BY
Environment Australia - Version: 27 April 1999
File Reference: ne_remvg

Locality Map



Scale 1:335000

5 0 5 10 15 20 25
Kilometres

Projection - AMG Zone 56

Queensland

Woodenbong

Murwillumbah

Kyogle

Lismore

Casino

Tenterfield

Clarence River

Pacific Hwy

Grafton

PACIFIC OCEAN

Glen Innes

New England Hwy

Guyra

Dorrigo

Coffs Harbour

New South Wales

UPPER NORTH EAST

Comprehensive Regional Assessment

MAP 16

Areas Above Threshold For Fauna Species Richness

- Areas Above Threshold for Fauna Species Richness
- National Parks and Reserves
- State Forest
- RFA Boundary
- Rivers
- Roads

SOURCES:
NSW UNE CRA National Estate Assessments - Environment Australia
NSW UNE Regional Forest Agreement - Upper North East RFA Boundary - 1998
TOPO 250K - AUSLIG
Drainage and Roads - LIC
Places - AUSLIG

PRODUCED BY
Environment Australia - Version: 27 April 1999
File Reference: ne_fnrch

Locality Map

Scale 1:335000

5 0 5 10 15 20 25
Kilometres

Projection - AMG Zone 56

Queensland

Murwillumbah

Woodenbong

Kyogle

Lismore

Casino

Tenterfield

Richmond River

Pacific Hwy

Clarence River

Grafton

PACIFIC OCEAN

Glen Innes

New England Hwy

Guyra

Coffs Harbour

Dorrigo

New South Wales

UPPER NORTH EAST

Comprehensive Regional Assessment

MAP 17

Areas Above Threshold For Flora Species Richness

- Areas Above Threshold for Flora Species Richness
- National Parks and Reserves
- State Forest
- RFA Boundary
- Rivers
- Roads

SOURCES:
NSW UNE CRA National Estate Assessments - Environment Australia
NSW UNE Regional Forest Agreement - Upper North East RFA Boundary - 1998
TOPO 250K - AUSLIG
Drainage and Roads - LIC
Places - AUSLIG

PRODUCED BY
Environment Australia - Version: 27 April 1999
File Reference: ne_flrch

Locality Map

Scale 1:335000

5 0 5 10 15 20 25
Kilometres

Projection - AMG Zone 56

Queensland

Woodenbong

Murwillumbah

Kyogle

Lismore

Casino

Richmond River

Tenterfield

Pacific Hwy

Clarence River

Grafton

PACIFIC OCEAN

Glen Innes

New England Hwy

Guyra

Coffs Harbour

Dorrigo

New South Wales

UPPER NORTH EAST

Comprehensive Regional Assessment

MAP 18

Areas Above Threshold For Vegetation Community Richness

- Areas Above Threshold for Vegetation Community Richness
- National Parks and Reserves
- State Forest
- RFA Boundary
- Rivers
- Roads

SOURCES:
NSW UNE CRA National Estate Assessments - Environment Australia
NSW UNE Regional Forest Agreement - Upper North East RFA Boundary - 1998
TOPO 250K - AUSLIG
Drainage and Roads - LIC
Places - AUSLIG

PRODUCED BY
Environment Australia - Version: 27 April 1999
File Reference: ne_vgrch

Locality Map

Scale 1:335000

5 0 5 10 15 20 25

Kilometres

Projection - AMG Zone 56

Queensland

Woodenbong

Murwillumbah

Kyogle

Lismore

Casino

Tenterfield

Richmond River

Pacific Hwy

Clarence River

Grafton

PACIFIC OCEAN

Glen Innes

New England Hwy

Guyra

Coffs Harbour

Dorrigo

New South Wales

UPPER NORTH EAST

Comprehensive Regional Assessment

MAP 19

Areas Above Threshold For Habitat Richness

- Areas Above Threshold for Habitat Richness
- National Parks and Reserves
- State Forest
- RFA Boundary
- Rivers
- Roads

SOURCES:
NSW UNE CRA National Estate Assessments - Environment Australia
NSW UNE Regional Forest Agreement - Upper North East RFA Boundary - 1998
TOPO 250K - AUSLIG
Drainage and Roads - LIC
Places - AUSLIG

PRODUCED BY
Environment Australia - Version: 27 April 1999
File Reference: ne_hbrch

Locality Map

Scale 1:335000

5 0 5 10 15 20 25
Kilometres

Projection - AMG Zone 56

Queensland

Woodenbong

Murwillumbah

Kyogle

Lismore

Casino

Tenterfield

Clarence River

Pacific Hwy

Grafton

PACIFIC OCEAN

Glen Innes

New England Hwy

Guyra

Coffs Harbour

Dorrigo

New South Wales

UPPER NORTH EAST

Comprehensive Regional Assessment

MAP 20

Areas Above Threshold For Rare Fauna

- Areas Above Threshold for Rare Fauna
- National Parks and Reserves
- State Forest
- RFA Boundary
- Rivers
- Roads

SOURCES:
NSW UNE CRA National Estate Assessments - Environment Australia
NSW UNE Regional Forest Agreement - Upper North East RFA Boundary - 1998
TOPO 250K - AUSLIG
Drainage and Roads - LIC
Places - AUSLIG

PRODUCED BY
Environment Australia - Version: 28 April 1999
File Reference: ne_rarfn

Locality Map

Scale 1:335000

5 0 5 10 15 20 25
Kilometres

Projection - AMG Zone 56

Queensland

Murwillumbah
Woodenbong
Kyogle
Lismore
Casino
Tenterfield
Richmond River
Clarence River
Grafton
PACIFIC OCEAN
Glen Innes
New England Hwy
Guyra
Coffs Harbour
Dorrigo

New South Wales

UPPER NORTH EAST

Comprehensive Regional Assessment

MAP 21

Areas Above Threshold For Rare Flora

- Areas Above Threshold for Rare Flora
- National Parks and Reserves
- State Forest
- RFA Boundary
- Rivers
- Roads

SOURCES:
NSW UNE CRA National Estate Assessments - Environment Australia
NSW UNE Regional Forest Agreement - Upper North East RFA Boundary - 1998
TOPO 250K - AUSLIG
Drainage and Roads - LIC
Places - AUSLIG

PRODUCED BY
Environment Australia - Version: 28 April 1999
File Reference: ne_rarvfl

Locality Map

Scale 1:335000

5 0 5 10 15 20 25
Kilometres

Projection - AMG Zone 56

Queensland

Murwillumbah

Woodenbong

Kyogle

Casino

Lismore

Tenterfield

Richmond River

Clarence River

Grafton

PACIFIC OCEAN

Glen Innes

New England Hwy

Guyra

Coffs Harbour

Dorrigo

New South Wales

UPPER NORTH EAST

Comprehensive Regional Assessment

MAP 22

Areas Above Threshold For Rare Vegetation Communities

- Areas Above Threshold for Rare Vegetaion Communities
- National Parks and Reserves
- State Forest
- RFA Boundary
- Rivers
- Roads

SOURCES:
NSW UNE CRA National Estate Assessments - Environment Australia
NSW UNE Regional Forest Agreement - Upper North East RFA Boundary - 1998
TOPO 250K - AUSLIG
Drainage and Roads - LIC
Places - AUSLIG

PRODUCED BY
Environment Australia - Version: 28 April 1999
File Reference: ne_rarvg

Locality Map

Scale 1:335000

5 0 5 10 15 20 25

Kilometres

Projection - AMG Zone 56

Queensland

Murwillumbah
Woodenbong
Kyogle
Lismore
Casino
Tenterfield
Richmond River
Pacific Hwy
Clarence River
Grafton
PACIFIC OCEAN
Glen Innes
New England Hwy
Guyra
Coffs Harbour
Dorrigo

New South Wales

UPPER NORTH EAST

Comprehensive Regional Assessment

MAP 23

Areas Above Threshold For Geoheritage

- Areas Above Threshold for Geoheritage
- National Parks and Reserves
- State Forest
- RFA Boundary
- Rivers
- Roads

SOURCES:
NSW UNE CRA National Estate Assessments - Environment Australia
NSW UNE Regional Forest Agreement - Upper North East RFA Boundary - 1998
TOPO 250K - AUSLIG
Drainage and Roads - LIC
Places - AUSLIG

PRODUCED BY
Environment Australia - Version: 30 April 1999
File Reference: ne_geoher

Locality Map

Scale 1:335000

5 0 5 10 15 20 25
Kilometres

Projection - AMG Zone 56

Queensland

Woodenbong

Murwillumbah

Kyogle

Lismore

Casino

Tenterfield

Richmond River

Pacific Hwy

Clarence River

Grafton

PACIFIC OCEAN

Glen Innes

New England Hwy

Guyra

Coffs Harbour

Dorrigo

New South Wales

UPPER NORTH EAST

Comprehensive Regional Assessment

MAP 24

Areas Above Threshold For Natural History

- Areas Above Threshold for Natural History
- National Parks and Reserves
- State Forest
- RFA Boundary
- Rivers
- Roads

SOURCES:
NSW UNE CRA National Estate Assessments - Environment Australia
NSW UNE Regional Forest Agreement - Upper North East RFA Boundary - 1998
TOPO 250K - AUSLIG
Drainage and Roads - LIC
Places - AUSLIG

PRODUCED BY
Environment Australia - Version: 30 April 1999
File Reference: ne_nathist

Locality Map

Scale 1:335000

5 0 5 10 15 20 25
Kilometres

Projection - AMG Zone 56