# BIOREGIONALISATION OF EASTERN NEW SOUTH WALES

**A SYSTEM OF REGIONS, SUB-REGIONS AND PROVINCES**

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### BIOREGIONALISATION OF EASTERN NEW SOUTH WALES

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# BIOREGIONALISATION OF EASTERN NEW SOUTH WALES

**SOUTHERN, CENTRAL AND NORTHERN COASTAL LANDS AND TABLELANDS**

**INTRODUCTION**

#### GENERAL APPROACH

A system describing the biogeographic characteristics of Australia was developed by the Australian Nature Conservation Agency (now Environment Australia) in 1995. “An Interim Biogeographic Regionalisation for Australia” (IBRA, Thackway and Cresswell, 1995[[1]](#footnote-1)) describes 80 biogeographic regions in terms of their natural attributes (e.g. climate, lithology/geology, landform, vegetation, land use). The IBRA regions are considered a ‘first step in the development of a common conservation planning framework for establishing an agreed classfication of the major ecosystems in Australia” (p.21, Thackway and Cresswell, 1995).

Although considered ‘interim’, the biogeographic regions are now extensively used by many government agencies to provide a consistent system for describing the natural features of Australia. Unfortunately, the IBRA regions are relatively large and do not always provide a detailed enough framework for conservation, and other planning.

There are 17 IBRA regions describing New South Wales. Those within western NSW are based upon the 12 natural regions developed by Morgan and Terrey (1992) for the National Parks Association of NSW. Those within eastern NSW were based upon natural regions developed by the NPWS. Although the natural regions for western NSW are divided into smaller bioregions (Sub-Regions and Provinces by Morgan and Terrey, and land systems by the Soil Conservation Service of NSW, 1991[[2]](#footnote-2)), there is no such system available for the eastern part of the State. The present report attempts to address this deficiency.

The “Bioregionalisation of Eastern New South Wales” is an extension of the study of Western New South Wales undertaken by Morgan and Terrey[[3]](#footnote-3) in 1992. Consequently, it is important to ensure as much continuity as possible between the described biogeographic regions developed for Western NSW, and those developed for the eastern part of the State.

The regions of Western NSW are primarily based upon differences in the geology. Morgan and Terrey initially divided Western NSW into three geological strata (Quaternary deposits; Mesozoic bedrock; Palaeozoic and Pre-Cambrian/Igneous rocks and sediments). These three divisions are then divided into seven divisions, based on the type of sediments and rocks, and on geological divisions (New England Fold Belt, Lachlan Fold Belt and Central Craton). Further divisions based upon a combination of geological characteristics, climate differences, soil types, landforms and vegetation produced 12 Natural Regions. Each Natural Region is further broken down into Sub-regions and Provinces using a process based upon dominant geology and landforms. The 12 Natural Regions are those adopted by Environment Australia to develop the Interim Biogeographic Regionalisation for Australia (IBRA) Regions. These are the 12 IBRA regions within western NSW, as shown in Figure 1.

figure1As will be seen, use of geological characteristics as a primary determinant of the bioregions within the eastern part of NSW is not as successful. Rather, other factors have been used to determine the bioregions of the coastal lands and tablelands.

The primary determinant of bioregions in eastern NSW is considered to be relief and altitude. Unlike the western part, which is characterised by low relief, eastern NSW contains a large mountain range (Great Dividing Range) which occupies much of the project area between the Queensland and Victorian borders. The general landform pattern is a coastline mainly comprising land of relatively low relief, then a series of hills and a steep rise (“Great Escarpment”) to a series of undulating and flat tablelands, or steep mountains, which gradually decline in altitude towards the west to form the western slopes and plains. However, this is not always so, with steeper hills adjoining the coast in some places, or broad valleys stretching from the coast to far inland e.g. Hunter Valley. Several other abiotic characteristics are considered as determinants of the bioregions. These are geology, soils, regolith and climate.

geologynswAs can be seen in the distribution of bedrock in NSW (Figure 2), the geological pattern within most of western NSW is relatively simple. Cenozoic Sediment dominates the far western regions, with a greater complexity of other bedrock types occurring towards the eastern parts of western NSW. In contrast to the far western regions, there is a higher pattern of complexity of the bedrock within eastern NSW. Figure 2 shows these differences in complexity.

The distribution of soils within NSW shows a pattern that is relatively complex throughout the State. Although there are several large areas of a single soil type in western NSW e.g. Massive Red and Yellow Earths, Calcareous Earths, Coarsely Cracking Grey and Brown Clays, most soil types are distributed within the State in a greater complexity than geological types. However, soil types are considered as important determinators of biodiversity, and need to be considered when developing and/or describing bioregions.

The third abiotic factor examined was regolith. Regolith is defined as “The layer or mantle of loose, non-cohesive or cohesive rock material, of whatever origin, that nearly everywhere forms the surface of the land and rests on bedrock. It comprises rock wastes of all sorts; volcanic ash; glacial drift; alluvium; windblown deposits; accumulations of vegetation, such as peat; and soil”[[4]](#footnote-4). The distribution of regolith does not appear to form as complex patterns as geology and soils. Also, there appears to be some correlation between some of the natural regions in western NSW and regolith coverage e.g. the boundaries of Darling Riverine Plain are similar to the Walgett regolith division, and the Riverina natural region is similar to the Murray regolith division.

Another factor to be considered, because of the size of the project area, was climate. Most of the project area is within the warm temperate climatic zone i.e. no noticeable winter and year-round rainfall, with the northern part influenced by the tropical zone i.e. seasonality in mean daily temperature and rainfall concentrated in the summer months[[5]](#footnote-5). Henry Nix classes the eastern (coastal) edge of the project area as “Megathermal seasonal – Torresian”, and the remainder of the area as “Mesotherm/microtherm seasonal – Bassian”[[6]](#footnote-6). Meso-, mega- and microtherm are terms used by Nix to describe the optimal photosynthetic responses by plants. Megatherm plant groups have an optimal photosynthetic response at temperatures between 26 and 33oC; mesotherm plants respond optimally between 19 and 22oC, and microthermal plants respond optimally between 10 and 14oC. Thus the coastal edge has a higher temperature range, and higher temperatures, than the remainder (tablelands and slopes) of the project area.

The Koppen Classification of climatic types places the project area into the Temperate Moist Climates, with the northern and western part of the area classed as “Uniform rainfall; long hot summer, mild winter”. The southern part, and part of the northern tablelands, of the project area are classed as “Uniform rainfall; long, warm summer, cool winter”, with a small part of the Alps classed as “Uniform rainfall; short, cool summer, cold winter”[[7]](#footnote-7). Although not as pronounced as the differences found in western NSW, climate plays a part in the development of bioregions.

Consequently, the bioregionalisation of eastern NSW was modeled on the following factors: relief, altitude, climate and regolith. Soils, geology and pre-1750 vegetation cover were also taken into account during the development and description of the bioregions.

#### THE PROJECT AREA

The project area is that part of NSW not placed into regions in the Morgan and Terrey study. The eastern boundary of the Morgan and Terrey study was the western fall of the Dividing Range and this was used as the western boundary for the eastern NSW bioregionalisation project. Initially, the eastern border drawn on a map produced by Morgan and Terrey was digitized to obtain the western boundary of the project area. However, it was found to be more accurate to model an electronic version of the IBRA regions of NSW. The IBRA regions database was manipulated to eliminate those regions developed by Morgan and Terrey i.e. the 12 western IBRA regions, and the boundaries of remaining eastern six regions were dissolved to provide a single polygon representing the project area. The six IBRA regions are Australian Alps, South Eastern Corner, South Eastern Highlands, Sydney Basin, North Coast and New England Tableland (these are described in the following sections).

#### METHODOLOGY

Details of the methods used in this project are provided in Appendix 1. Most of the analysis of the data was undertaken using a Geographic Information System, Arc-View, with most data provided (under licence) from various sources in a digitized format. The degree of conservation of each province was determined using the criteria recommended in the JANIS report i.e. a minimum of 15% of each province should be represented within conservation reserves. Although the JANIS report focused upon the degree of conservation of forest communities, the 15% minimum adopted in that report has been utilized as a fair criteria for the extent of bioregional conservation.

The information used in the present study was derived from the most recent data sets. Maps of geology, soils, relief and regolith do not change over time, and data sets derived in the 1960’s could be used in this project. Information about present-day land cover and modeled vegetation were as recent as possible, with the land cover database being derived in the early 1990’s whilst the modeled vegetation (pre-1750’s vegetation) was derived in 1996 and 1997. A description of the land cover categories is provided in Appendix 2. Some of the data is continually being revised e.g. extent of conservation reserves, and it will be necessary to utilize the most recent data sets if the project is re-visited. For this report, the Service Estate dataset obtained from the NPWS was for January, 2001, and contained the recent acquisitions by the Service as a consequence of the forestry agreements.

To ensure a range of agencies and individuals associated with bioregional planning and conservation were involved with the present project, 20 copies of the draft final report were provided for comment. Ten responses were obtained that provided important information to the final report. Responses were provided by the following:

Phil Redpath, Department of Land and Water Conservation

Roger Good, NPWS, Southern Zone

Ann Jelinek, Environment Australia

Richard Thackway, Bureau of Rural Sciences

Steve Hill, Cooperative Research Centre for Landscape Evolution and Mineral Exploration, University of Canberra

Bruce Wilson, Queensland Herbarium, Environmental Protection Agency

Colin Pain, Australian Geological Survey Organisation

Rex Bowen, RACAC

Simon Ferrier, NPWS, Northern Region

Robert Pressey, NPWS, Northern Region

David Keith, NPWS

*COMPARISON WITH MORGAN AND TERREY REPORT*

The setting-out of the Morgan and Terrey report has been followed as closely as possible. However, much of the data used in the present project provided greater detail than that derived for western NSW. Morgan and Terrey were not able to derive the proportion of each parameter (e.g. soils, geology, land cover, and vegetation) in each sub-region and province. It was also possible to accurately map the distribution of each parameter within each province, and to locate each sub-region and province within NSW using electronic versions of topographic maps. The data was stored electronically allowing other parties to readily use the information.

Because the project area was significantly smaller in this study, when compared to the western NSW project area, and there appeared to be greater variation in the biophysical characteristics, the number of sub-regions and provinces is higher and their sizes are smaller. There are 15 sub-regions and 56 provinces in western NSW, and 49 sub-regions and 91 provinces in eastern NSW.

The remainder of the report describes the sub-regions and provinces within eastern NSW. There is a section devoted to each of the six IBRA regions within eastern NSW, and these sections define and describe the sub-regions and provinces in each region. The final section of the report discusses the findings of the study and assesses the conservation status of eastern NSW.

*ACKNOWLEDGEMENTS*

There are many people to thank for their contributions to and support of this project. The members of two Steering Committees have provided valuable assistance and encouragement over the years, whilst the National Parks Association of NSW Inc. has successfully wrestled with the administrative problems (thank you, Kristy MacDonald)

Many agencies have supplied data and advice to this project, including the Department of Land and Water Conservation (John Hill); National Resource Information Centre, Bureau of Resource Sciences (Simon Veitch and Christine Atyeo); National Parks and Wildlife Service (Mark Cameron, Robert Mezzatesta, Simon Ferrier, Nic Gellie); and Environment Australia (Nicki Fitzgerald). Victoria Throp from the NSW Heritage Office has been particularly patient and supportive over the years. To all that have helped, I give my thanks.

**IBRA REGION 1: AUSTRALIAN ALPS (429 km2)[[8]](#footnote-8)**

Australian Alps IBRA Region is defined as “A series of high elevation plateaux capping the South Eastern Highlands and the southern tablelands of NSW. The geology consists of granitic and basalitic rocks. Vegetation is dominated by alpine herbfields, and other treeless communities, snow gum woodlands and montane forests dominated by alpine ash.”[[9]](#footnote-9) The proportion of soil types and rock types within this Region are shown in Table 1, and the location of this Region, with the two Sub-regions is given in the map below.

# TABLE 1: Soil Types and Rock Types in Australian Alps Region

**SOIL TYPES**:

Deep Structured Red Clay Loams 1%

Shallow Loams 97%

Yellow and Red Texture Contrast Soils 2%

**ROCK TYPES:**

##### Basalt, minor acid volcanics <1%

##### Sandstone, siltstone, shale, chert, limestone (Palaeozoic Sediments) 39%

Granitic rocks 48%

Acid and intermediate volcanics and pyroclastics 10%

Schist, phyllite, sandstone, mudstone (Palaeozoic Sediments) 2%

# REGION 1: AUSTRALIAN ALPS – KEY TO SUB-REGIONS AND PROVINCES

|  |  |  |  |
| --- | --- | --- | --- |
|  | SUB-REGIONS |  | PROVINCES |
| Relief: Greater than 360m. Very high mountains | **SNOWY MOUNTAINS PEAKS** | Mountainous country with steep slopes, above 1000m (Snowy[[10]](#footnote-10)) | **MOUNT KOSCIUSZKO 1Aa** |
|  |  | Mountainous country with steep slopes, below 1000m (Snowy) | **YARRANGOBILLY 1Ab** |
| Relief: 90-180/5-30m. Moderate hills and undulating plains | **SNOWY HILLS WEST** | Mountainous country with steep slopes and a multicyclic erosional landscape of hills and plains dissected by stream valleys (Snowy and Eucumbene) | **SNOWY HILLS WEST 1B** |

**australianalps**

**1A: SNOWY MOUNTAINS PEAKS SUB-REGION (392923ha)**

This Sub-Region occupies most of the Australian Alps Region (91%) and is characterised by very high mountains (over 1500m) with steep relief (greater than 360m). Mount Kosciuszko (2229m) is within this Sub-Region. The landscape is dominated by mountainous country with numerous V-shaped valleys, and narrow stream valleys with some small flood plains.

Major ski resorts are located within the south-eastern part (Perisher Village, Thredbo Village, and Guthega), and Kiandra and Yarrangobilly are located in the northern part of this Sub-Region. There are several reservoirs (part of the Snowy Mountains Scheme) within the Sub-Region. These include Tooma, Tumut Pond and Tantangara Reservoirs (based on Tumut and Murrumbidgee Rivers). The major part of the Sub-Region is conserved within Koscuiszko National Park. There is a small area on the western edge of this Sub-Region outside the National Park. This area is used for stock grazing and some forestry (exotic pine plantations). There are two Provinces within this Sub-Region: Mount Kosciuszko and Yarrangobilly.

# CHARACTERISTICS OF SNOWY MOUNTAINS PEAKS SUB-REGION

|  |  |
| --- | --- |
| Geology | Acid/Intermediate Volcanics and Intrusives 57%; Basic Volcanics 1%; Palaeozoic Sediments 42% |
| Soils | Shallow Loams 99%; Yellow and Red Texture Contrast Soils and Deep Structured Red Clay Loams 1% |
| Vegetation | Tall alpine herbfields and heathland communities in the higher altitudes. Within the lower altitudes the dominant vegetation is Snow Gum (*E. pauciflora*)woodlands, in association with other eucalypts e.g. Ribbon Gum, Candlebark, Mountain Gum, Tingiri Gum and Alpine Ash, and a dense understorey of cold adapted heath shrubs |
| Present-day Cover | Cleared 27%; Disturbed dry forest 3%; Disturbed moist forest 4%; Dry forest and Sub-alpine woodland 12%; Moist forest 51%; Frost hollows 2%; Rocky outcrops 1% |
| Conservation Areas | Kosciuszko NP 364419ha; Scabby Range NR 2011ha; Bimari NR (6486ha) TOTAL 94.9% |

snomtnpeakprov1Aa: Mount Kosciuszko Province (133838ha)

Mountainous country with steep slopes, V-shaped valleys and narrow stream valleys with small floodplains, and small open flats mainly above 1000m altitude. Deeply weathered granite with exposed granite masses. Contains the highest mountain peaks in Australia, as well as the headwaters of north-flowing Tumut River and south-flowing Snowy and Geehi Rivers.

# CHARACTERISTICS OF MOUNT KOSCIUSZKO PROVINCE

|  |  |
| --- | --- |
| **Geology** | Acid/Intermediate Intrusives 67%; Palaeozoic Sediments 33% |
| **Soils** | Shallow Loams 100% |
| **Present-day Cover** | Dry Forest and Woodland 51%; Frost Hollows 19%; Moist Forest 15%; Alpine Complex 9%; Disturbed Forest 5% |
| **Conservation Areas** | Kosciuszko NP 127,524ha TOTAL 95.2% |

1Ab Yarrangobilly Province (259085ha)

Mountainous country with steep slopes, V-shaped valleys and narrow stream valleys with small floodplains, and small open flats below 1000m altitude. Deeply weathered granite with exposed granite masses. Contains Snowy Mountains Highway, Tumut River, Kiandra and Yarrangobilly Caves, as well as several reservoirs.

# CHARACTERISTICS OF YARRANGOBILLY PROVINCE

|  |  |
| --- | --- |
| Geology | Palaeozoic Sediments 48%; Acid/Intermediate Intrusives 35%; Acid/Intermediate Volcanics 16%; Basic Volcanics 1% |
| **Soils** | Shallow Loams 98%; Deep Structured Red Clay Loams 2% |
| **Present-day Cover** | Moist Forest 60%; Dry Forests and Woodlands 23%; Frost Hollows 12%; Disturbed Forest 2%; Cleared 2%; Water bodies etc 1% |
| **Conservation Areas** | Kosciuszko NP 236895ha; Bimberi NR 6486ha; Scabby Range NR 2011ha TOTAL 94.7% |

**1B: SNOWY HILLS WEST SUB-REGION (374km2)**

This part of the Region has a lower relief than the Snowy Mountains Peaks Sub-Region, and is dominated by hills of a moderate relief (between 90 and 180m), with some areas of undulating and irregular plains (relief between 5 and 30m). There is a small area of steeper hills (relief 180-360m) at the south-eastern edge of the Snowy Mountains Peaks Sub-Region. This Sub-Region can be described as a landscape of hills and hillocky areas with intervening areas of dissected plains, with the whole area traversed and dissected by variously incised stream valleys.

**CHARACTERISTICS OF SNOWY HILLS WEST SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Acid/Intermediate Intrusions 68%; Palaeozoic Sediments 32% |
| **Soils** | Shallow Loams 74%; Yellow and Red Texture Contrast Soils 26% |
| **Present-day Cover** | Moist Forest 51%; Cleared 27%; Dry Forests and Woodlands 12%; Disturbed Dry and Moist Forests 7%; Frost Hollows 2%; Rocky Outcrops 1% |
| **Conservation Areas** | Koscuiszko NP 8403ha; Scabby Range NR 2708ha TOTAL 29.7% |

About 70% of the southern parts of this Sub-Region are within Kosciuszko National Park, whilst about 10% of the northern part is within Scabby Range Nature Reserve. The remainder of the land in the northern part is predominantly cleared and used for stock grazing.

**IBRA REGION 2: SOUTH EAST CORNER (13171 km2)**

Defined as “A series of deeply dissected near coastal ranges composed of Devonian granites and Palaeozoic sediments, inland of a series of gently undulating terraces (piedmont downs) composed of Tertiary sediments and flanked by Quaternary coastal plains, dunefields and inlets.”[[11]](#footnote-11) The major soil types are of low fertility, with some higher fertility soils (Deep Structured Red Clay Loams and Deep Black Cracking Clays) in the Region. The proportion of soil types and rock types within this Region are given in Table 2, and the location of this Region, with the Sub-regions, is given in the map below.

**TABLE 2: Soil Types and Rock Types in the South East Corner Region**

**SOIL TYPES:**

Shallow Loams 29%

Yellow and Red Texture Contrast Soils 21%

Stony Sandy Soils 16%

Deep Structured Red Clay Loams 15%

Massive Red and Yellow Earths 2%

Deep Black Cracking Clays 1%

Undescribed 6%

**ROCK TYPES:**

Sandstone, siltstone, shale, chert, limestone (Palaeozoic Sediments) 58%

Granitic rocks 40%

##### Acid and intermediate volcanics and pyroclastics 2%

secsubregions

The South East Corner is shared by two States, with the major part in Victoria. The Region is in two parts in New South Wales. The western part is located along the NSW-Victorian border west of Delegate and south of Dalgety. It is adjacent to the Australian Alps Region i.e. to the main part of the Snowy Mountains. The eastern part of the South East Corner Region is located along the coast from the Victorian border to north of Batemans Bay. This part of the Region extends inland as far as Bombala and Araluen and includes much of the lower eastern slopes of the Great Escarpment in southern NSW. Mountain peaks include Pigeon House (719m), Mount Imlay (886m) and Wolumla Mountain (886m).

The climate of this region is strongly influenced by depressions associated with the Tasman Sea and the close proximity of the coast to the Great Dividing Range. Vegetation comprises high elevation woodlands, wet sclerophyll forests interspersed with rain-shadow woodlands in eastern parts of the Snowy River Valley. Lowland and coastal sclerophyll forests, woodlands, warm temperate rainforest and coastal communities occur in lower altitudinal areas. In NSW, 11% of this region is under agriculture, with about 78% of the region being classed as “parks, timber and shrublands”[[12]](#footnote-12).

This region is called the East Gippsland natural region in Victoria, and is divided into four major physiographic units - elevated tablelands; dissected ridges; outwash plains, and coastal dunes. This classification of the Region infers a simple east-west gradation from high plateaux to steeply dissected escarpment to low altitude coastal plains to a coastal complex of dunes, headlands, inlets etc. However, there is considerable variation in landforms throughout the region, with areas of high relief being found next to the coast, and broad open valleys, with little relief, associated with the escarpment. This region comprises eight Sub-Regions and 14 Provinces.

# KEY TO SUB-REGIONS AND PROVINCES OF THE SOUTH EAST CORNER

|  |  |  |  |
| --- | --- | --- | --- |
|  | SUB-REGIONS |  | PROVINCES |
| Relief: 90-180m. Coastal ranges and valleys | **2A BEGA VALLEY** | Coastal ranges with steep slopes, sharp ridges and v-shaped valleys near the Great Escarpment (South Coast) | **GLENBOG 2Aa** |
|  |  | Gently undulating granite hills, broad shallow valleys and alluvial flats associated with Bega River (Bega) | **BEGA 2Ab** |
| Relief: 90-180m. Coastal ranges and plains extending to the coast | **2B EDEN HILLS** | A coastal lowland strip east of the Great Escarpment with beach barrier systems, estuaries, lakes, and alluvial floodplains (South Coast) | **EDEN HILLS 2B** |
| Relief: 5-180m. Moderate to low hills and plainsland extending north from the Victorian Border | **2C SNOWY HILLS EAST** | Multicyclic erosional landscape of hills with dissected plains and mountainous terrain associated with the Snowy River (Eucumbene and Snowy River) | **SNOWY HILLS EAST 2C** |

|  |  |  |  |
| --- | --- | --- | --- |
|  | SUB-REGIONS |  | PROVINCES |
| Relief: 180-360m. Mountains with steep slopes and valleys extending north from the Victorian Border | **2D SNOWY MOUNTAINS EAST** | Multicyclic erosional landscape of hills with dissected plains and incised stream valleys (Eucumbene) | **ROCK FLAT 2Da** |
|  |  | Mountainous country with steep slopes, v-shaped valleys and narrow stream valleys with small floodplains (Snowy) | **BONDI 2Db** |
| Relief: 180-360m. High mountains associated with Snowy River | **2E SNOWY MOUNTAINS WEST** | Mountainous country with steep slopes, v-shaped valleys and narrow stream valleys (Snowy) | **BYADO-CHARCOAL 2Ea** |
|  |  | Steep-sided v-shaped deeply incised gorge of the Snowy River (Snowy River) | **SNOWY RIVER VALLEY 2Eb** |
| Relief: 0-90m. Undulating plainsland, low hills and coastal landscapes | **2F SOUTH COAST** | Coastal strip with beach barrier systems, lakes, estuaries and alluvial floodplains of coastal rivers (South Coast) | **SOUTHERN COAST 2Fa** |
|  |  | Gently undulating low hills and plains and broad shallow valleys within a coastal strip at Batemans Bay (South Coast) | **MOGO 2Fb** |

|  |  |  |  |
| --- | --- | --- | --- |
|  | SUB-REGIONS |  | PROVINCES |
| Relief: 180-360m. Steep to very steep mountains with v-shaped valleys along the Great Escarpment | **2G SOUTHERN ESCARPMENT NORTH** | Steep mountains and valleys at altitude mainly above 500m (South Coast) | **DEUA 2Ga** |
|  |  | Steep mountains and valleys at altitude mainly below 500m (South Coast) | **BODALLA 2Gb** |
| Relief: 180-360m. Steep to very steep mountains with v-shaped valleys along the Great Escarpment | **2H SOUTHERN ESCARPMENT SOUTH** | Steep mountains and valleys at altitude mainly above 500m (South Coast) | **COOLONGUBRA 2Ha** |
|  |  | Steep mountains and valleys at altitude mainly below 500m (South Coast and Bega) | **PAMBULA 2Hb** |

**2A BEGA VALLEY SUB-REGION (1390 km2)**

The Bega Valley Sub-Region occupies 10% of the Region and is located inland from Tathra. The Sub-Region comprises gently undulating hills with a relief of 90 to 180m (“Coastal Ranges”), with broad shallow valleys and alluvial flats associated with the Bega River. The hills extend from the coast to west of Bemboka, with a small amount of coastal landscape near Tathra. There are several rivers traversing this Sub-Region. The Brogo and Bemboka Rivers form the Bega River near the coast and enter the sea north of Tathra. There are several major towns in the Sub-Region: Tathra, Bega, Kameruka, Candelo, Cobargo and Bemboka. Stock grazing, dairy and forestry are major industries in the Bega Valley Sub-Region.

**CHARACTERISTICS OF THE BEGA VALLEY SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Acid/Intermediate Intrusives 82%; Palaeozoic Sediments 18% |
| **Soils** | Yellow and Red Texture Contrast Soils, 63%;Shallow Loams, 16%; Stony Sandy Loams, 14% |
| **Present-day Cover** | Cleared Land 48%; Dry Forest and Woodland 26%; Dry Forest dominating Moist Forest 8%; Moist Forest 5%; Moist Forest tending to Dry 2%; Severely Disturbed Forest 10%; Urban, Water Bodies, Integrated Logging 1%. |
| **Conservation Areas** | Wadbilliga NP (10892ha); Mimosa Rocks NP (1759ha); Bournda NP (201ha), Bournda NR (380ha); South East Forest NP (22259ha) TOTAL 25.5% |

**begavalleyprov2Aa Glenbog Province (64573 ha)**

Coastal ranges with steep slopes, sharp ridges and V-shaped valleys at the base of the Great Escarpment. Located in the western half of the Sub-Region and contains several State Forests (e.g. Glenbog, Bemboka).

**CHARACTERISTICS OF THE GLENBOG PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments 32%; Acid/Intermediate Intrusives 68% |
| **Soils** | Shallow Loams 33%; Stony Sandy Loams 30%; Yellow and Red Texture Contrast Soils 28%; Deep Structured Red Clay Loams 7%; Well Structured Red and Brown Earths 2% |
| **1750 Vegetation** | Lowland Granite Communities (*A.floribunda, E.tereticornis, E.globoidea*) 62%; Scarp Forests (*E.sieberi, E.fastigata, E.cypellocarpa*) 12%; Southern Lowland Forests (*E.longifolia, E.muelleriana, A.floribunda*) 10% |
| **Present-day Cover** | Dry Forest 62%; Moist Forest 14%; Cleared 14%; Disturbed Forests 10% |
| **Conservation Reserves** | Wadbilliga NP (10398ha); Mimosa Rocks NP (1228ha); Bournda NR (268ha); Bournda NP (197ha); South East Forest NP (22258ha) TOTAL 53.2% |

**2Ab Bega Province (73235 ha)**

Gently undulating hills, broad shallow valleys and alluvial flats associated with the Bega River. Some steeper hills west of Bega (Meringola Peak, 408m). Forms the major part of the Bega Valley and contains the towns of Bega, Bemboka and Candelo.

**CHARACTERISTICS OF THE BEGA PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Acid/Intermediate Intrusives 95%; Palaeozoic Sediments 5% |
| **Soils** | Yellow and Red Texture Contrast Soils 96%; Deep Structured Red Clay Loams 2%; Well Structured Red and Brown Earths 2% |
| **1750 Vegetation** | Lowland Granite Communities (*A.floribunda, E.tereticornis, E.globoidea*) 80%; Southern Lowland Forests (*E.longifolia, E.muelleriana, A.floribunda*) 12% |
| **Present-day Cover** | Cleared 80%; Dry and Moist Forests 10%; Severely Disturbed Forests 10% |
| **Conservation Areas** | Bournda NR (112ha); Mimosa Rocks NP (54ha); Wadbilliga NP (494ha) TOTAL 0.9% |

**2B EDEN HILLS SUB-REGION (1234 km2)**

Eden Hills Sub-Region is in the south-eastern corner of NSW and is bounded by the Victorian border on the south and the Pacific Ocean on the east. It lies to the south of Eden, with Timbillica in the southern part of the Sub-Region. This Sub-Region occupies about 10% of the Region and comprises gently undulating hills with a relief of 90 to 180m (“Coastal Ranges”), with broad valleys associated with rivers. The Sub-Region also incorporates a coastal lowland strip with beach barrier systems, estuaries, lakes, and alluvial floodplains. The main rivers within the Sub-Region are: Wallagarough River (drains south into Mallacoota Inlet), Wog Wog River, Towamba River, Wonboyn River, Merika River and Nadgee River. There are numerous peaks within Eden Hills, including Mount Imlay (886m). The major vegetation cover comprises several coastal eucalypt communities, which have been described in numerous publications[[13]](#footnote-13). There are no Provinces in this Sub-Region.

**CHARACTERISTICS OF THE EDEN HILLS SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments 65%; Acid/Intermediate Intrusives and Volcanics 35% |
| **Soils** | Shallow Loams 37%; Well Structured Red and Brown Earths 35%; Stony Sandy Loams 16%; Massive Red and Yellow Earths, 11%; Yellow and Red Texture Contrast Soils, 1% |
| **Present-day Cover** | Dry forest and woodland (51%), Dry and moist forest mix (35%), Moist forest (4%), Cleared (2%); Integrated logged forest (6%), Water bodies and other minor communities (~2%) |
| **Conservation Areas** | Ben Boyd NP (5078ha), Mt Imlay NP (4711ha), Nadgee NR (20420ha); Davidson Whaling Station Historic Site (25ha); Eagles Claw NR (4ha); South East Forest NP (1402ha) TOTAL 25.6% |

**edenhills2C SNOWY HILLS EAST SUB-REGION (635 km2)**

Located south of Dalgety and west of Delegate, the Snowy Hills East Sub-Region is a relatively small area of erosional landscape of hills and hillocky areas with intervening areas of dissected plains and incised stream valleys. The relief for this Sub-Region is classed as moderate hills (relief 90-180m), with undulating or irregular plainslands (relief 5-30m). There are some low hills (relief 30-90m) in the southern part of the Sub-Region. The Sub-Region occupies about 5% of the Region. Snowy Hills East adjoins the steeper Snowy Mountains West Sub-Region and is part of lessening in relief in a northwards direction (adjoins Eucumbene Hills in the northern South Eastern Highlands Region). The Snowy River traverses the middle, and the Delegate River crosses the southern part, of the Sub-Region. Two small towns (Numble Vale and Jimenbuen) occur in the Snowy Hills East Sub-Region. There are no provinces in this Sub-Region.

**CHARACTERISTICS OF THE SNOWY HILLS EAST SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (49%); Acid/Intermediate Intrusives (51%). |
| **Soils** | Yellow and Red Texture Contrast Soils (72%); Shallow Loams (28%) |
| **Vegetation** | Dry sclerophyll forest and woodland that are dominated by the variety of eucalypts e.g. snow gum, scribbly gum, red stringybark and black sally. Steep-sided hills along the Snowy River support a tall woodland community of white box and white cypress pine (*Eucalyptus albens-Callitris glaucophylla)* with a dense shrub stratum, particularly on moister soils. |
| **Present-day Cover** | Cleared (68%); dry forest and woodlands (24%); Disturbed forest and woodland and integrated logging (8%) |
| **Conservation Reserves** | Kosciuszko NP (3118ha) TOTAL 4.9% |

**snohillseastsub2D SNOWY MOUNTAINS EAST SUB-REGION (317 km2)**

This Sub-Region occupies a small part of the Region (about 2%) and is located to the east of Great Dividing Range (Snowy Mountains). It is bounded on the east by the Monaro Highway and in the south by the Victorian border. Snowy Mountains East is east of Delegate and south of Bombala, and the town of Rockton is located on its eastern boundary. Watercourses drain to the west into Delegate River and to the east into Wog Wog River. The Sub-Region can be described as mountainous country with steep slopes (relief 180-360m), with some V-shaped valleys and associated small floodplains. The main vegetation is dry sclerophyll forest and woodland which are dominated by the variety of eucalypts e.g. snow gum, scribbly gum, red stringybark and black sally. This Sub-Region is extensively used for logging, grazing and exotic forests (varieties of pine). There are two Provinces within this Sub-Region.

**CHARACTERISTICS OF THE SNOWY MOUNTAINS EAST SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (69%); Acid/Intermediate Intrusives (31%) |
| **Soils** | Yellow and Red Texture Contrast Soils (71%); Stony Sandy Loams (29%) |
| **Present-day Cover** | Cleared (25%); Planted with exotic forests (27%); Severely disturbed forests (34%); Dry forest (13%); Dry and moist forest mix (less than 1%) |
| **Conservation Areas** | South East Forest NP (1675ha); Bondi Gulf NR (1891ha) TOTAL 11.2% |

**snomtnseastsub2Da Rock Flat Province (7594 ha)**

Located in the northern end of the Sub-Region, Rock Flat is characterised by a multicyclic erosional landscape of hills and hillocky areas with dissected undulating plains and incised stream valleys. It lies on the southern end of the South Coast Range to the east of Mila within the upper catchment of east-flowing rivers e.g. Wog Wog River.

**CHARACTERISTICS OF THE ROCK FLAT PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (92%); Acid/Intermediate Intrusives (8%) |
| **Soils** | Yellow and Red Texture Contrast Soils (100%) |
| **1750 Vegetation** | Cold, Dry Tableland Forests (*E.dives, E.viminalis, E.pauciflora*) 50%; Tableland Moist Forest (*E.cypellocarpa, E.ovata, E.globoidea*) 39%; Eden Mid-Altitude Forests (*E.cypellocarpa, E.ovata, E.globoidea*) 11% |
| **Present-day Cover** | Exotic forests and disturbed forests (54%); Cleared (43%); Dry Forests (3%) |
| **Conservation Areas** | Bondi Gulf NR (822ha) TOTAL 10.8% |

**2Db Bondi Province (24091 ha)**

Mountainous country with steep slopes, V-shaped valleys and narrow stream valleys with small floodplains. Small open flats and valley plains at higher latitudes. Its southern boundary is the NSW-Victorian border and the Province contains Rockton and Mount Tennyson. Forms the upper catchment for easterly flowing (Genoa River) and westerly-flowing rivers (Delegate River).

**CHARACTERISTICS OF THE BONDI PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (62%); Acid/Intermediate Intrusives (38%) |
| **Soils** | Yellow and Red Texture Contrast Soils (61%); Stony and Sandy Loams (39%) |
| **1750 Vegetation** | Eden Mid-Altitude Forests (*E.cypellocarpa, E.ovata, E.globoidea*) 45%; Tableland Moist Forest (*E.fastigata, E.viminalis, E.radiata*) 41% |
| **Present-day Cover** | Exotic and disturbed forests (65%); Dry forests and woodlands (16%); Cleared (19%) |
| **Conservation Areas** | South East Forest NP (1664ha); Bondi Gulf NR (1081ha)  TOTAL 11.4% |

**2E SNOWY MOUNTAINS WEST SUB-REGION (1411 km2)**

This Sub-Region occupies 11% of the Region, and is located south of the Snowy Hills East Sub-Region (and Dalgety) and east of the Australian Alps Region. Most of the Sub-Region comprises a steep-sided gorge associated with the Snowy River flowing westward then southward through Snowy Mountains West. Other rivers in the Sub-Region are the easterly flowing Jacobs River and Moyangul River. The landscape for this Sub-Region is high mountains (relief 180-360m) with several mountain peaks e.g. Black Jack Mountain (1173m) and The Pilot (1880m), and deeply incised river valleys.

**CHARACTERISTICS OF THE SNOWY MOUNTAINS WEST SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (52%); Acid/Intermediate Intrusives (48%) |
| **Soils** | Shallow Loams (92%); Yellow and Red Texture Contrast Soils (8%) |
| **Vegetation** | Drier communities are dominated by Ribbon Gum, Broad-leaved Peppermint and Brittle Gum whilst the wetter forests on higher slopes are dominated by Alpine Ash, Mountain Gum and Snow Gum. |
| **Present-day Cover** | Woodlands (43%), Dry forest (30%), White cypress pine woodland (10%), Moist forests (8%), Cleared (8%), Acacia scrub and frost hollows (1%) |
| **Conservation Areas** | Kosciuszko National Park (111961ha) TOTAL 79% |

**snomtnswestsub**

**2Ea Byadbo-Charcoal Province (54079ha)**

Byadbo-Charcoal Province is formed from two areas within the Sub-Region. The province comprises high altitude, steep hills to the east and to the west of Snowy River Valley. The Province is mountainous country with steep slopes and narrow valleys formed by streams flowing into the Snowy River. High mountains such as The Pilot (1880m, part of the Charcoal Ranges), Byadbo Mountain and Black Jack Mountain (1173m) dominate the landscape.

**CHARACTERISTICS OF THE BYADBO-CHARCOAL PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (71%); Acid/Intermediate Intrusives (29%) |
| **Soils** | Shallow Loams (92%); Yellow and Red Texture Contrast Soils (8%) |
| **Present-day Cover** | Dry Forests and Woodlands (75%); Moist Forests (20%); Cleared and disturbed forests (3%); Frost hollows and acacia scrub (2%) |
| **Conservation Areas** | Kosciuszko NP (50686ha) TOTAL 93.7% |

**2Eb Snowy River Valley Province (86987ha)**

Steep sided V-shaped gorge and alluvial plains formed from the Snowy River, partly used for cattle grazing (“High Mountain Country”).

**CHARACTERISTICS OF THE SNOWY RIVER VALLEY PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Acid/Intermediate Intrusives (60%); Palaeozoic Sediments (40%) |
| **Soils** | Shallow Loams (95%); Yellow and Red Texture Contrast Soils (5%) |
| **Present-day Cover** | Dry Forests and Woodlands (92%); Moist Forests (2%); Cleared and disturbed forests (8%) |
| **Conservation Areas** | Kosciuszko NP (58859ha) TOTAL 67.7% |

**2F SOUTH COAST SUB-REGION (737 km2)**

South Coast is a long narrow Sub-Region that extends along the coast between Nadgee Cove and Batemans Bay, occupying only 5% of the Region. It is not continuous, as there are many places where other Sub-Regions of steeper relief form the coastline. The landscape for the South Coast Sub-Region is dominated by undulating or irregular plainslands with a relief between 0 and 6m, with some low hills of relief between 30 and 90m. The Sub-Region also contains beach barrier systems with numerous lakes and beach dunes, as well as extensive alluvial floodplains associated with major coastal rivers. Although its eastern margin is close to the coast, the western boundary extends as far inland as Nelligen at the northern end of the Sub-Region. There are numerous major towns within this Sub-Region, such as Batemans Bay, Moruya, Narooma, Bermagui, Tathra, Merimbula and Eden.

**CHARACTERISTICS OF THE SOUTH COAST SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (89%); Acid/Intermediate Intrusives (8%). |
| **Soils** | Deep Structured Red Clay Loams (82%); Massive Red and Yellow Earths (2%); Shallow Loams (2%); Well Structured Red and Brown Earths (2%); Yellow and Red Texture Contrast Soils (5%) |
| **Vegetation** | See CSIRO[[14]](#footnote-14) publications |
| **Present-day Cover** | Moist and Dry forests and Woodlands (74%); Water bodies (5%); Cleared land (13%); Disturbed forest and woodland (3%); Urban systems (2%) |
| **Conservation Areas** | Murramarang NP (805ha); Illawong NR (52ha); Eurobodalla NP (922ha); Mimosa Rocks NP (1583ha); Bournda NP (588ha); Ben Boyd NP (2256ha); Nadgee NR (778ha); Biamanga NP (1ha); Cullendulla Creek NR (2ha) TOTAL 9.4% |

**sthcoastsub2Fa Southern Coast Province (21160ha)**

Coastal plains with estuaries, beach barrier systems, freshwater and estuarine lakes, lagoons, sand dunes, headlands and rock platforms. Includes many coastal towns between Batemans Bay and the Victorian border.

**CHARACTERISTICS OF THE SOUTHERN COAST PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (92%); Acid/Intermediate Intrusives and Volcanics (8%) |
| **Soils** | Deep Structured Red Clay Loams (62%); Yellow and Red Texture Contrast Soils (15%); Well Structured Red and Brown Earths (9%); Shallow Loams (8%): Massive Red and Yellow Earths (6%) |
| **1750 Vegetation** | Southern Lowland Forests (*E.longifolia, E.muelleriana, Angophora floribunda)* 53%;  *E.maculata* Forests 15%; Dry Coastal Forests (*E.globoidea, E.gummifera, Angophora floribunda*) 12% |
| **Present-day Cover** | Dry Forests and Woodlands (57%); Cleared (24%); Waterbodies and Coastal Complex (7%); Moist Forests (6%); Disturbed forests and urban (6%) |
| **Conservation Reserves** | Ben Boyd NP (2256ha); Bournda NP (588ha); Eurobodalla NP (500ha); Mimosa Rocks NP (1583ha); Murramarang NP (348ha); Nadgee NR (778ha); Biamanga NP (1ha); Cullendulla Creek NR (2ha)  TOTAL 28.6% |

**2Fb Mogo Province (52475ha)**

A relatively fertile area of low hills and plains at the northern end of the Sub-Region, located inland from Batemans Bay, near Nelligen. This Province forms part of the lower slopes east of the Great Escarpment.

**CHARACTERISTICS OF THE MOGO PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (89%); Acid/Intermediate Intrusives (11%) |
| **Soils** | Deep Structural Red Clay Loams (99%); Yellow and Red Texture Contrast Soils (1%) |
| **1750 Vegetation** | *E.maculata* Forests 60%; Dry Coastal Forests (*E.globoidea, E.gummifera, Angophora floribunda*) 22% |
| **Present-day Cover** | Dry Forests and Woodlands (71%); Cleared (9%); Moist Forests (7%); Disturbed forests and urban (7%); Water bodies (6%) |
| **Conservation Areas** | Murramorang NP (457ha); Illawong NR (52ha); Eurobodalla NP (422ha) TOTAL 1.8% |

**2G SOUTHERN ESCARPMENT NORTH SUB-REGION (5274 km2)**

This is the largest Sub-Region in the IBRA Region, occupying 40% of the South East Corner Region. The Sub-Region extends from Bega to Ulladulla, both along and slightly inland of the coast. The western boundary extends from Mongarlowe to Araluen, to just east of Nimmitabel. The Sub-Region covers much of the Eurobodalla Region studied by CSIRO[[15]](#footnote-15). Although not essentially the “Great Escarpment”, the Sub-Region forms the steep lower slopes of this feature, as well as the steep hills and mountains associated with the southern coastal lands.

The Southern Escarpment North Sub-Region comprises steep mountainous country, with a relief between 180 and 360m. The land is incised by numerous east-flowing rivers (e.g. Tuross River, Clyde River, Deua River, and Moruya River), forming V-shaped valleys. The mountains are steeper towards the western edge of the Sub-Region, where the influence of the Great Escarpment is accentuated. There are numerous mountain peaks in this Sub-Region, such as Pigeon House (719m), Wandera Mountain (581m), Mount Dromedary and Mumbulla Mountain (772m).

**CHARACTERISTICS OF SOUTHERN ESCARPMENT NORTH SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (79%); Acid/Intermediate Intrusives (20%); Acid/Intermediate Volcanics (1%) |
| **Soils** | Well Structured Red and Brown Earths (23%); Deep Structured Red Clay Loams (24%); Shallow Loams (25%); Massive Red and Yellow Earths (2%); Stony Sandy Soils (8%); Yellow and Red Textured Soils (5%) |
| **Vegetation** | See CSIRO[[16]](#footnote-16) publications and the description of the Pigeon House region[[17]](#footnote-17) |
| **Present-day Cover** | Dry forest and woodland (60%); Moist forest (22%); Cleared (10%); Disturbed forest (5%); Acacia scrub, *Allocasuarina nana* heath, plateau complex, urban, rocky outcrops and water bodies (3%) |
| **Conservation Areas** | Morton NP (15491ha); Budawang NP (23756ha); Deua NP (132371ha); Eurobodalla NP (1022ha); Wadbilliga NP (61343ha); Goura NR (629ha); Wallaga Lake NP (1263ha); Bermaguee NR (875ha); Biamanga NP (13585ha); Mimosa Rocks NP (1851ha); South East Forest NP (5256ha) TOTAL 36.9% |

sthescnthsub**2Ga Deua Province (333526ha)**

The defining features of this Province are steep mountains and valleys at an altitude mainly above 500m. The relief is from 180m to above 360m i.e. steep to very steep mountains, with the steeper elements along the western edge of the Province, where it joins the Southern Highlands. The Province includes the upper catchments of several easterly flowing rivers (e.g. Tuross, Moruya and Clyde Rivers) and west-flowing rivers (e.g. Mongarlowe River). Wadbilliga Mountains are within this Province.

**CHARACTERISTICS OF THE DEUA PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (80%); Acid/Intermediate Intrusives (20%) |
| **Soils** | Shallow Loams (39%); Well Structured Red and Brown Earths (30%); Stony Sandy Loams (12%); Yellow and Red Texture Contrast Soils (9%); Deep Structured Red Clay Loams (6%); Massive Red and Yellow Earths (3%) |
| **1750 Vegetation** | Mid-Altitude Forests (*E.sieberi, E.Muelleriana, E.cypellocarpa*) 30%; Scarp Forests (*E.sieberi, E.fastigata, E.cypellocarpa*) 16%; Lowland Granite Communities (*A. floribunda, E.teriticornis, E.globoidea*) 16%; Dry Coastal Forests (*E.globoidea, E.gummifera, A.floribunda*) 9% |
| **Present-day Cover** | Dry Forests and Woodlands (57%); Moist Forests (26%); Cleared (6%); Disturbed Forests (6%); Plateau Complex, Acacia scrub, heath, rocky outcrops (5%) |
| **Conservation Areas** | Biamanga NP (4273ha); Budawang NP (23756ha); Deua NP (62916ha); Morton NP (14653ha); South East Forest NP (5256ha); Wadbilliga NP (61042ha) TOTAL 51.5% |

**2Gb Bodalla Province (193834ha)**

The defining features of this Province are steep mountains and valleys at an altitude mainly below 500m. This Province is in the eastern half of the Sub-Region and its eastern border extends to the Pacific Ocean in some parts. The Province is characterised by steep mountains, with narrow valleys, and some broader shallow valleys associated with coastal rivers. Steep cliffs overlooking the ocean at some places (e.g. Tuross Head, Cape Dromedary) and several mountains (e.g. Wandera Mountain, 581m, Pigeon House, 719m).

**CHARACTERISTICS OF THE BODALLA PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (79%); Acid/Intermediate Intrusives (19%); Acid/Intermediate Volcanics (2%) |
| **Soils** | Deep Structured Red Clay Loams (71%); Well Structured Red and Brown Earths (15%); Yellow and Red texture Contrast Soils (6%); Shallow Loams (5%); Stony Sandy Loams (3%) |
| **1750 Vegetation** | Southern Lowland Forests (*E.longifolia, E.muelleriana, A.floribunda*) 42%; Dry Coastal Forests (*E.longifolia, E.muelleriana, A.floribunda*) 22%; *E.maculata* Forests 16% |
| **Present-day Cover** | Dry Forests and Woodlands (64%); Moist Forests (11%); Cleared (17%); Disturbed Forests (6%); Water Bodies (1%) |
| **Conservation Areas** | Bermaguee NR (875ha); Biamanga NP (9312ha); Deua NP (6442ha); Eurobodalla NP (1022ha); Goura NR (629ha); Mimosa Rocks NP (1851ha); Morton NP (838ha); Wadbilliga NP (301ha); Wallaga Lake NP (1263ha) TOTAL 11.6% |

**2H SOUTHERN ESCARPMENT SOUTH SUB-REGION (2170 km2)**

The second largest Sub-Region, Southern Escarpment South occupies 16% of the South East Corner Region. This Sub-Region has the Victorian border as its southern boundary and extends north to Candelo. The Sub-Region reaches the coast at Merimbula, between Eden and Tathra, where the Pacific Highway passes. However, the Sub-Region is mainly located inland, as far as Bombala. The Monaro Highway forms part of the western boundary. Towamba and Wog Wog Rivers pass through this Sub-Region.

The Southern escarpment South Sub-Region is similar in landform to the Southern Escarpment North Sub-Region i.e. steep mountainous country (relief: 180 to above 360m) forming part of the Great escarpment and the coastal lands to the east. Like the northern section, the major rivers form steep-sided valleys and there are several mountain peaks within the Sub-Region (Wog Wog Mountain, Wolumla Mountain).

**CHARACTERISTICS OF THE SOUTHERN ESCARPMENT SOUTH SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Acid/Intermediate Intrusives (70%); Palaeozoic Sediments (24%); Acid/Intermediate Volcanics (6%) |
| **Soils** | Stony Sandy Soils (55%); Yellow and Red Texture Contrast Soils (19%); Shallow Loams (15%); Well Structured Red Clay Loams (7%); Massive Red and Yellow Earths (3%); Deep Black Cracking Clays (1%) |
| **Vegetation** | Dry rainforest, warm and temperate rainforest, temperate layered forest, Brown Barrel (*E. fastigata*) forest, mixed highland forest, alluvial herb forest, swamp forest, gully forest, riparian scrub, dry western woodland, escarpment gorge woodland, sandstone plateau forest, moist ridge forest, white ash forest, montane heath, yertchuk heath woodland, tableland ridge woodland, montane sclerophyll forest and upland swamps. |
| **Present-day Cover** | Dry forest and moist forest (67%); Cleared (13%) Disturbed Forests (15%); Exotic Forests (5%) |
| **Conservation Areas** | Bournda NR (5706ha); Bournda NP (1362ha); Ben Boyd NP (2408ha); Egan Peaks NR (2037ha); South East Forest NP (40162ha); Bell Bird Creek NR (56ha) TOTAL 23.8% |

**sthescsthsub**

**2Ha Coolongubra Province (182417ha)**

This Province has its southern boundary as the Victorian border and forms part of the Great Escarpment. It is characterised by steep mountains and V-valleys at altitudes mainly above 500m. Several easterly flowing rivers originate in this Province, including the Genoa River in Victoria.

**CHARACTERISTICS OF THE COOLONGUBRA PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (17%); Acid/Intermediate Intrusives (80%); Acid/Intermediate Volcanics (3%) |
| **Soils** | Stony Sandy Loams (66%); Yellow and Red Texture Contrast Soils (18%); Shallow Loams (9%); Well Structured Red and Brown Earths (6%); Deep Black Cracking Clays (1%) |
| **1750 Vegetation** | Lowland Granite Communities (*A.floribunda, E.tereticornis, E.globoidea*) 25%; Mid-Altitude Forests (*E.sieberi, E.muelleriana, E.cypellocarpa*) 20%; Scarp Forests (*E.sieberi, E.fastigata, E.cypellocarpa*) 12%; Eden Mid-Altitude Forests (*E.cypellocarpa, E.ovata, E.globoidea*) 29% |
| **Present-day Cover** | Dry Forests (71%); Cleared (13%); Disturbed Dry Forests (11%); Moist Forest (5%) |
| **Conservation Areas** | Egan Peaks NR (2037ha); South East Forest NP (39671ha) TOTAL 22.9% |

**2Hb Pambula Province (34563ha)**

Part of the Sub-Region next to the coast between Merimbula and Eden. Although close to the coast the landscape is steep mountains and dissected valleys, but at altitudes less than 500m.

**CHARACTERISTICS OF THE PAMBULA PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (61%); Acid/Intermediate Intrusives (15%); Acid/Intermediate Volcanics (24%) |
| **Soils** | Yellow and Red Texture Contrast Soils (16%); Shallow Loams (46%); Well Structured Red and Brown Earths (14%); Massive Red and Yellow Earths (24%) |
| **1750 Vegetation** | Southern Lowland Forests (*E.longifolia, E.muelleriana, A.floribunda*) 72%; Lowland Granite Communities (*A.floribunda, E.tericornis, E.globoidea*) 15% |
| **Present-day Cover** | Dry Forests (64%); Cleared (27%); Disturbed Dry Forests (6%); Moist Forest (1%); Water Bodies (2%) |
| **Conservation Areas** | Bournda NR (5706ha); Bournda NP (1362ha); Ben Boyd NP (2408ha); Bell Bird Creek NR (56ha); South East Forest NP (491ha)  TOTAL 29.0% |

**IBRA REGION 3: SOUTH EASTERN HIGHLANDS (51242 km2)**

The South Eastern Highlands Region is a relatively large area of land with the Victorian border as its southern boundary and its northern boundary north of Lithgow. Its western boundary forms the eastern edge of the western New South Wales study area of Morgan and Terrey. This Region has been described as “Steep dissected and rugged ranges extending across southern and eastern Victoria[[18]](#footnote-18) and southern NSW. Geology is predominantly Palaeozoic rocks and Mesozoic rocks. Vegetation is predominantly wet and dry sclerophyll forests, woodland, minor cool temperate rainforest and minor grassland and herbaceous communities”[[19]](#footnote-19). About 50% of the Region is used for agriculture, and 42% is classed as “parks, timber and shrublands”[[20]](#footnote-20).

The major soil types are the moderately fertile Massive Red and Yellow Earths and Yellow and Red Texture Contrast Soils, and the low fertility Shallow Loams. The dominant rock types are those derived from the Devonian-Carboniferous Period (Palaeozoic Sediments) and from the Permian Period (Acid/Intermediate Intrusives). The proportion of soil types and rock types within this Region are given in Table 3, and the location of this Region, with the Sub-regions is given in the following map.

**TABLE 3: Soil Types and Rock Types in the South Eastern Highlands Region**

**SOIL TYPES:**

Shallow Loams 25%

Yellow and Red Texture Contrast Soils 34%

Stony Sandy Loams 1%

Deep Structured Red Clay Loams 4%

Massive Red and Yellow Earths 27%

Deep Black Cracking Clays 4%

Coarsely Cracking Grey and Brown Clays 2%

Deep Alluvial Loams 1%

**ROCK TYPES:**

Sandstone, siltstone, shale, chert, limestone (Palaeozoic Sediments) 53%

Granitic rocks 30%

Acid and intermediate volcanics and pyroclastics 7%

Basic volcanics and lavas (basalts) 9%

seh+subregionsThere are contrasting landscapes within this Region. As well as several steep mountainous areas there are also areas with little relief i.e. plainsland. Although altitudes do not reach those found in the Australian Alps Region, there are several peaks throughout the Region. These include Hudsons Peak (1231m), Yarrow Peak (1080m), Bimberi Peak (1910m) and Mount Guouogang (1290m). Due the position of this Region within southern NSW, there are several upper catchments for rivers that run either westwards, eastwards, northwards or to the south. These will be described within the relevant Sub-Region.

There are 11 Sub-Regions and 27 Provinces within the South Eastern Highlands Region.

# KEY TO SUB-REGIONS AND PROVINCES OF THE SOUTH EASTERN HIGHLANDS IBRA REGION

|  |  |  |  |
| --- | --- | --- | --- |
|  | SUB-REGIONS |  | PROVINCES |
| Relief: 5-90m. Low to moderate hills and undulating plainslands on western edge of region | TUMUT PLAINS | Undulating plainslands with isolated low hills and tors (Snowy and Harden) | TUMORRAMA 3Aa |
|  |  | Low hilly terrain with some landslips on steeper slopes (Snowy) associated with Tumut River | **BLOWERING 3Ab** |
| Relief: Greater than 360m. Steep high mountains and ridges (altitude mainly above 1000m) | **SOUTHERN BLUE MOUNTAINS** | Hilly rocky mountainous part of tablelands with basaltic knolls and ridges (Crookwell and Braidwood) | **TARALGA 3Ba** |
|  |  | Dissected sandstone plateau with steep ridges, cliffs and canyons (Blue Mountains) | **KANANGRA 3Bb** |

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|  | SUB-REGIONS |  | PROVINCES |
|  |  | Steep hilly country with gorges and steep valley-side slopes associated with Abercrombie River (Macquarie Range and Abercrombie) | **ABERCROMIE 3Bc** |
| Relief: 360m and greater. Steep high mountains mainly above 1000m, at the west of the region | **SOUTHERN ESCARPMENT WEST** | Mountains with steep slopes and v-shaped valleys associated with Murray River (Snowy) | **MURRAY 3Ca** |
|  |  | Very steep mountains and valleys associated with Bago Range (Snowy) | **BOGONG 3Cb** |
| Relief: 90-180m. Moderate to low hills and moderate dissected plateau | **EUCUMBENE HILLS** | Multicyclic erosional landscape of hills and dissected plains, with incised stream valleys (Eucumbene) | **EUCUMBENE 3Da** |
|  |  | Broad basalt filled palaeoplain, with gently undulating surface cut by valleys (Monaro) | **MONARO 3Db** |

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|  | SUB-REGIONS |  | PROVINCES |
| Relief: 0-90m. Undulating plainsland and low hills | **CANBERRA PLAINS** | Smooth plains and very gently sloping basins forming Lake George (Canberra) | **LAKE GEORGE 3Ea** |
|  |  | Undulating plainslands and tableland with broad shallow valleys and very gently sloping basins, contains Lake Bathurst (Canberra and Braidwood) | **TARAGO 3Eb** |
|  |  | Undulating plainslands and tableland with broad shallow valleys and low hills (Canberra, Crookwell and Braidwood) | **WOLLONDILLY 3Ec** |
|  |  | Undulating plainslands with low swampy flats (Crookwell) | **CROOKWELL 3Ed** |
| Relief: 30-360m. Mainly moderate hills with high steep mountains on escarpment edge (Budawang Range) | **BRAIDWOOD HILLS** | Undulating tableland with broad shallow valleys, with isolated and rolling hills and moderately steep slopes. Associated with upper catchment of Shoalhaven River (Braidwood and Tallaganda) | **SHOALHAVEN VALLEY 3Ha** |

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|  | SUB-REGIONS |  | PROVINCES |
|  |  | Steep hills and mountains and dissected sandstone plateau associated with Budawang Range along the eastern edge of the sub-region (Ettrema and South Coast) | **BUDAWANG 3Hb** |
| Relief: 90-180m. Moderate hills sloping onto plains in the west | **BATLOW HILLS** | Hilly country to the west of the region (Snowy) | **BATLOW HILLS 3I** |
| Relief: 30-180m. Low to moderate hills with undulating to hilly ridge tops and narrow valleys | **BATHURST HILLS** | Strongly undulating to hilly country with some rugged ranges and mountains (Bathurst) | **WINBURNDALE 4Ja** |
|  |  | Hilly range and steep valleys, with tors and gravelly ridges, and rock outcrops (Macquarie Range) | **MACQUARIE**  **RANGE 3Jb** |
|  |  | Low hilly range and undulating to hilly ridge tops (Bathurst and Macquarie Range) | **BLACK SPRINGS 3Jc** |
| Relief: 5-90m. Undulating plains and low hills associated with Bathurst Valley (Macquarie River) | **BATHURST PLAINS** | Flood plains and low hills surrounding Macquarie River (Bathurst) | **BATHURST PLAINS 3K** |

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|  | SUB-REGIONS |  | PROVINCES |
| Relief: 360m and above. Steep mountains with deeply incised river valleys | **CANBERRA MOUNTAINS** | Sharp ridges and mountainous country with v-shaped valleys at edge of escarpment (South Coast and Tallaganda) | **MINUMA 3Fa** |
|  |  | Steep-sided mountain range with narrow ridges and incised narrow stream valleys (Tinderry, Eucumbene and Canberra) | **KYBEYAN 3Fb** |
|  |  | Slightly lower relief of steep hills, with some basalt valleys (South Coast, Eucumbene and Monaro) | **MILA 3Fc** |
| Relief: 30-90m. Low to moderate hills, with broad valley plains and some steep hills in the south | **CANBERRA HILLS** | Hilly graben (rift valley), with broad valley and undulating surface and lower slopes of Tinderry and Brindadella Ranges (Bredbo and Tinderry) | **RIFT VALLEY 3Ga** |
|  |  | Stepped rolling hills with plains and sloping basins (Canberra) | **CANBERRA 3Gb** |
|  |  | Undulating landscape of low to moderate relief, with rolling hills and swampy flats (Canberra and Crookwell) | **BINDA 3Gc** |
|  |  | Undulating to rolling country with some hilly ridges (Harden) | **YASS 3Gd** |

**3A TUMUT PLAINS SUB-REGION (572 km2)**

This small Sub-Region (about 1% of the Region) is located along the western edge of the Region. Tumut Plains Sub-Region is located north of Batlow and Talbingo, and west of Wee Jasper, with Tumut on its western edge. Tumut River flows through the Sub-Region (part of Blowering Reservoir is within the Sub-Region) and Bogong Mountains at the eastern edge. Snowy Mountains Highway passes through the Sub-Region, between Tumut and Talbingo.

The defining landform is undulating to rolling country (relief 30-90m), with some hilly ridges and knolls dotted with tors. Some of the Sub-Region is of even lower relief (plainsland, 5-30m). Basically, this Sub-Region is typical of the south-western slopes.

**CHARACTERISTICS OF THE TUMUT PLAINS SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (46%); Acid/Intermediate Intrusives (53%) |
| **Soils** | Yellow and Red Texture Contrast Soils (63%); Shallow Loams (30%); Deep Alluvial Loams (7%) |
| **Present-day Cover** | Cleared (37%); Exotic Forests (30%); Disturbed Forests (8%); Dry Forests (14%); Moist Forests (8%); Water Bodies (5%, Blowering Reservoir) |
| **Conservation Areas** | Kosciuszko National Park. (4809ha) TOTAL 8.4% |

**tumutplainsub**

**3Aa Tumorrama Province (31733ha)**

Located within the northern half of the Sub-Region, Tumorrama Province is characterised by undulating to rolling country with isolated low hills and tors. Contains the towns of Tumorrama and Adjungbilly, the eastern slopes of Honeysuckle Range and part of the upper catchment of the Murrumbidgee River.

**CHARACTERISTICS OF THE TUMORRAMA PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Acid/Intermediate Intrusives (90%); Palaeozoic Sediments (8%); Acid/Intermediate Volcanics (2%) |
| **Soils** | Unknown |
| **Present-day Cover** | Disturbed Forests (61%); Cleared (34%); Dry Forests (4%); Water Bodies (1%) |
| **Conservation Areas** | None TOTAL 0% |

**3Ab Blowering Province (25440ha)**

Located between Tumut and Blowering and characterised by undulating low hilly terrain with some landslips on steeper slopes associated with Tumut River. Contains Blowering Reservoir.

**CHARACTERISTICS OF THE BLOWERING PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Acid/Intermediate Intrusives (2%); Palaeozoic Sediments (97%); Basic Volcanics (1%) |
| **Soils** | Shallow Loams (57%); Yellow and Red texture Contrast Soils (27%); Deep Alluvial Loams (16%) |
| **Present-day Cover** | Disturbed Forests (12%); Cleared (42%); Dry Forests (26%); Moist Forests (9%); Water Bodies (11%, Blowering Reservoir) |
| **Conservation Areas** | Kosciuszko NP (4808ha) TOTAL 18.9% |

**3B SOUTHERN BLUE MOUNTAINS SUB-REGION (3349 km2)**

A small part of the Region (6%), Southern Blue Mountains Sub-Region is located south of Katoomba and north of Goulburn. It includes Jenolan Caves, Wombeyan Caves, Edith and Taralga. Coxs River, Abercrombie River and Kowmung River are within the Sub-Region, as is the upper catchment for Lake Burragorang. There are mountain peaks with heights ranging from 342m (Mount Shivering) to 1290m (Mount Guouogang).

The defining landform is steep high mountains and mountain ridges (relief greater than 360m). The Sub-Region is described as dissected sandstone plateau of moderate to strong relief with sandstone pillars, ledges, steep ridges, cliffs, canyons and narrow sandy valleys.

**CHARACTERISTICS OF THE SOUTHERN BLUE MOUNTAINS SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (63%); Acid/Intermediate Volcanics (21%); Acid/Intermediate Intrusives (8%); Basic Volcanics and Lavas (8%) |
| **Soils** | Shallow Loams (67%);Deep Structured Red Clay Loams (10%); Massive Red and Yellow Earths (16%); Yellow and Red Texture Contrast Soils (6%) |
| **Present-day Cover** | Dry forests and woodlands (65%); Moist forest (3%); Degraded Grasslands (5%); Disturbed forests (12%); Exotic forest (3%); Rocky complex etc (12%) |
| **Conservation Areas** | Abercrombie River NP (2226ha); Blue Mountains NP (67191ha); Kanangra-Boyd NP (64960ha); Tarlo River NP (497ha); Yarranderie SRA (5372ha) TOTAL 41.9% |

**sthbluemtnsub3Ba Taralga Province (70159ha)**

Located at the southern end of the Sub-Region and characterised by undulating plainslands and tableland with broad shallow valleys and very gently sloping basins, with some very steep mountains and ridges and basalt outcroppings.

**CHARACTERISTICS OF THE TARALGA PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (40%); Acid/Intermediate Volcanics (31%); Basic Volcanics and Lavas (29%) |
| **Soils** | Shallow Loams (56%);Deep Structured Red Clay Loams (33%); Massive Red and Yellow Earths (4%); Yellow and Red Texture Contrast Soils (7%) |
| **Present-day Cover** | Dry Forest (67%); Cleared and Disturbed (28%); Non-forest System (5%) |
| **Conservation Areas** | Tarlo River NP (497ha) TOTAL 0.7% |

**3Bb Kanangra Province (143958ha)**

Located between Jenolan Caves and Wombeyan Caves and characterised by dissected sandstone plateau with steep ridges, cliffs and canyons and narrow sandy valleys. Contains the upper catchments of the Kowmung and Wollondilly Rivers.

**CHARACTERISTICS OF THE KANANGRA PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (61%); Acid/Intermediate Intrusives (11%); Acid/Intermediate Volcanics (27%); Basic Volcanics and Lavas (1%) |
| **Soils** | Shallow Loams (88%); Massive Red and Yellow Earths (2%); Yellow and Red Texture Contrast Soils (10%) |
| **Present-day Cover** | Dry Forest (65%); Cleared and Disturbed (13%); Moist Forest (7%); Non-forest System (7%); Rocky Complex (8%) |
| **Conservation Areas** | Blue Mountains NP (45853ha); Kanangra-Boyd NP (57230ha); Yerranderie SRA (5372ha) TOTAL 75.3% |

**3Bc Abercrombie Province (114752ha)**

Steep hilly country with gorges and steep valley-side slopes and ridges associated with the Abercrombie River. Located between Edith and Golspie and containing Mount Werong (370m).

**CHARACTERISTICS OF THE ABERCROMBIE PROVINCE**

|  |  |
| --- | --- |
| Geology | Palaeozoic Sediments (78%); Acid/Intermediate Intrusives (8%); Acid/Intermediate Volcanics (9%); Basic Volcanics and Lavas (5%) |
| Soils | Shallow Loams (46%); Massive Red and Yellow Earths (44%); Yellow and Red Texture Contrast Soils (1%); Deep Structured Red Clay Loams (9%) |
| Present-day Cover | Dry Forest (60%); Cleared and Disturbed (26%); Non-forest System (14%) |
| Conservation Areas | Abercrombie River NP (2226ha); Blue Mountains NP (21338ha); Kanangra-Boyd NP (7730ha) TOTAL 27.3% |

**3C SOUTHERN ESCARPMENT WEST SUB-REGION (7335 km2)**

Southern Escarpment West Sub-Region occupies a relatively large part of the southern half of the Region (14% of the Region). The Australian Alps Region forms the eastern boundary, and the Victorian border forms the southern boundary. The western boundary is part of the eastern edge of the western NSW study area of Morgan and Terrey. The northern edge of the Sub-Region is at Wee Jasper, and a small part of Snowy Mountains West is in the Australian Capital Territory.

The defining landform for this Sub-Region is the steep high mountains, with relief greater than 360m i.e. similar to the Snowy Mountains Peaks Sub-Region in the Australian Alps Region. Although not as high in altitude as the Australian Alps, there are several mountain peaks within the Sub-Region e.g. Bimeri Peak (1910m), Brindabella Mountain, Mount Nimbo. The Bago Range, Bogong Mountains and Maracle Range are within this Sub-Region. Part of Blowering Reservoir and Talbingo Reservoir are in the Snowy Mountains West Sub-Region. Both of these reservoirs are fed by the westerly flowing Tumut River. The southerly flowing Tooma River is also part of this Sub-Region.

**CHARACTERISTICS OF THE SOUTHERN ESCARPMENT WEST SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Acid/Intermediate Intrusives (61%); Acid/Intermediate Volcanics and Intrusives (16%;) Palaeozoic Sediments (20%); Basic Volcanics and Lavas (3%) |
| **Soils** | Shallow Loams (55%); Yellow and Red Texture Contrast Soils (29%); Massive Red and Yellow Earths (15%) |
| **Present-day Cover** | Dry Forests and woodlands (26%); Moist forests (36%); Cleared (24%); Exotic Forest (9%); Disturbed forest and woodland (3%) |
| **Conservation Areas** | Bimberi NP (597ha); Brindabella NP (11709ha); Kosciuszko NP (129393ha); Scabby Range NR (91ha); Wee Jasper NR (113ha)  TOTAL 19.3% (note that there may be a small amount of ACT reserves not included) |

**sthescwestsub3Ca Murray Province (147979ha)**

Located within the southern end of the Sub-Region, with the Murray River (Victorian border) as its southern boundary. Characterised by mountains with steep slopes and V-shaped valleys associated with the Murray River.

**CHARACTERISTICS OF THE MURRAY PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (27%); Acid/Intermediate Intrusives (73%) |
| **Soils** | Shallow Loams (22%); Yellow and Red Texture Contrast Soils (25%); Massive Red and Yellow Earths (53%) |
| **Present-day Cover** | Cleared (45%); Dry Forest and Woodland (40%); Moist Forests (13%); Water Bodies (2%) |
| **Conservation Areas** | Kosciuszko NP (18016ha) TOTAL 12.2% |

**3Cb Bogong Province (585498ha)**

A major part of this Sub-Region, the Bogong Province is characterised by very steep mountains and valleys associated with the Bago Range. The province is cut by the Tumut River and contains part of the Blowering and Talbingo Reservoirs.

**CHARACTERISTICS OF THE BOGONG PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (18%); Acid/Intermediate Intrusives (58%); Acid/Intermediate Volcanics (20%); Basic Volcanics and Lavas (4%) |
| **Soils** | Shallow Loams (62%); Yellow and Red Texture Contrast Soils (20%); Massive Red and Yellow Earths (7%); Deep Structured Red Clay Loams (1%) |
| **Present-day Cover** | Cleared (16%); Dry Forest and Woodland (24%); Moist Forests (44%); Water Bodies (1%); Disturbed Forests (15%) |
| **Conservation Areas** | Bimberi NR (597ha); Brindabella NP (11709ha); Kosciuszko NP (111377ha); Scabby Range NR (91ha); Wee Jasper NR (113ha) TOTAL 21.1% |

**3D EUCUMBENE HILLS SUB-REGION (7418 km2)**

A large Sub-Region, occupying 15% of the Region, Eucumbene Hills is located between the Canberra Hills Sub-Region and the Victorian border. The Sub-Region is to the east of the Australian Alps Region and includes Dalgety, Berridale, Bombala and Adaminaby. Unlike the adjoining Region, the defining landform is moderate hills (relief 90-180m), with some low hills (relief 30-90m) and moderately dissected plateaux. The Sub-Region is of relatively high altitude, with several mountain peaks above 1000m (Hudsons Peak, 1231m). Monaro Range runs through the Sub-Region.

Eucumbene Hills Sub-Region is a multicyclic erosional landscape of hills and hillocky areas with intervening areas of plains dissected by incised stream valleys. In the centre of the Sub-Region there is a broad basalt filled palaeoplain, that comprises a gently undulating surface cut by 60-100 m deep valleys.

There are several rivers within the Sub-Region. Snowy River forms Lake Eucumbene and Lake Jindabyne and flows south into Victoria. Delegate River and Bombala River flow west into the Snowy River. The Snowy Mountains Highway passes through the northern part of the Sub-Region.

**CHARACTERISTICS OF THE EUCUMBENE HILLS SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (43%); Acid/Intermediate Intrusives (37%); Basic Volcanics and Lavas (20%) |
| **Soils** | Yellow and Red Texture Contrast Soils (50%); Shallow Loams (23%); Deep Black Cracking Clays (25%); Massive Red and Yellow Earths (2%) |
| **Present-day Cover** | Cleared (68%); Disturbed forests and woodlands (5%); Dry forest and sub-alpine woodlands (16%); Moist forest (8%); Water bodies (2%) |
| **Conservation Areas** | Kosciuszko NP (62365ha); Scabby Range NR (78ha); Coolumbooka NR (194ha); Dandelong NR (665ha) TOTAL 8.5% |

**eucumhillsub3Da Eucumbene Province (538601ha)**

Characterised by a multicyclic erosional landscape of hills and hillocky areas with intervening areas of dissected plains, and incised stream valleys. Contains Lake Eucumbene and Lake Jindabyne, reservoirs associated with the Snowy River. Also contains Eucumbene, Bombala and Mowambe Rivers. Although of high altitude, it does not have as steep a relief as the nearby Australian Alps Region.

**CHARACTERISTICS OF THE EUCUMBENE PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (49%); Acid/Intermediate Intrusives (49%); Basic Volcanics and Lavas (1%); Acid/Intermediate Volcanics (1%) |
| **Soils** | Yellow and Red Texture Contrast Soils (59%); Shallow Loams (32%); Deep Black Cracking Clays (7%); Massive Red and Yellow Earths (2%) |
| **1750 Vegetation** | Cold, Dry Tableland Forest/Grass mosaic (*E.viminalis, E.pauciflora, E,rubida, E,dives*) 47%; Cold, Dry Tableland Forests (*E.dives, E.viminalis, E.pauciflora*) 15%; *E.pauciflora* Forests 10% |
| **Present-day Cover** | Cleared (51%); Disturbed forests and woodlands (8%); Dry forest and sub-alpine woodlands (23%); Moist forest (13%); Water bodies (4%); Scrub, heath, rocky complex (1%) |
| **Conservation Areas** | Kosciuszko NP (44353ha); Scabby Range NR (78ha); Coolumbooka NR (194ha); Dandelong NR (665ha) TOTAL 8.4% |

**3Db Monaro Province (203209ha)**

A relatively high altitude (Hudsons Peak, 1231m) landscape of moderate to high hills characterised as an undulating basalt-filled palaeoplain cut by 60-100m deep valleys.

**CHARACTERISTICS OF THE MONARO PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (29%); Acid/Intermediate Intrusives (8%); Basic Volcanics and Lavas (64%) |
| **Soils** | Yellow and Red Texture Contrast Soils (26%); Shallow Loams (1%); Deep Black Cracking Clays (73%) |
| **1750 Vegetation** | Cold, Dry Tableland Forest/Grass mosaic (*E.viminalis, E.pauciflora, E,rubida, E,dives*) 68%; Cold, Dry Tableland Forests (*E.dives, E.viminalis, E.pauciflora*) 14% |
| **Present-day Cover** | Cleared (90%); Disturbed forests and woodlands (2%); Dry forest and sub-alpine woodlands (7%); Water bodies (1%) |
| **Conservation Areas** | Kosciuszko NP (18012ha) TOTAL 8.9% |

**3E CANBERRA PLAINS SUB-REGION (4142 km2)**

This relatively small Sub-Region (8% of the Region) is in two areas. The main area is located between Crookwell and Tarago, to the east of Canberra. A smaller area is formed by Lake George. The defining landform for the Sub-Region is undulating plainsland, with a relief between 5m and 30m, and low hills (relief 30-90m). Lake George is classed as smooth plainsland (relief less than 5m). Lake Bathurst, near Tarago, is within the Sub-Region and Wollondilly River flows through the Sub-Region near Goulburn. The Sub-Region forms the upper catchment for the Lachlan River and Abercrombie River. The soil types are mainly moderately fertile, reflecting the extensive use of the Sub-Region for grazing (and the extent of clearing).

The Sub-Region is described as undulating to low hilly terrain with low swampy flats, with a hilly plateau forming the eastern part of Canberra Plains. There are four provinces in this Sub-Region.

**CHARACTERISTICS OF THE CANBERRA PLAINS SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (66%); Acid/Intermediate Intrusives (19%); Basic Volcanics and Lavas (9%); Acid/Intermediate Volcanics (6%) |
| **Soils** | Yellow and Red texture Contrast Soils (55%); Massive Red and Yellow Earths (18%); Deep Structured Red Clay Loams (13%); Shallow Loams (11%); Coarsely Cracking Grey Clays (3%) |
| **Present-day Cover** | Cleared (71%), Disturbed forests and woodlands (8%); Dry and moist forests and woodlands (13%); Water bodies (Lake George and Lake Bathurst, 8%) |
| **Conservation Areas** | Tarlo River NP (7708ha) TOTAL 1.9% |

**canberraplainsub3Ea Lake George Province (46088ha)**

Smooth plains and very gently sloping basins forming Lake George and the surrounding undulating plainsland.

**CHARACTERISTICS OF THE LAKE GEORGE PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (88%); Acid/Intermediate Intrusives (12%) |
| **Soils** | Yellow and Red texture Contrast Soils (45%); Massive Red and Yellow Earths (8%); Shallow Loams (21%); Coarsely Cracking Grey Clays (26%) |
| **1750 Vegetation** | Typical Dry Sclerophyll Forest (*E.mannifera, E.rossii, E.dives, E.macrorhyncha*) 72%; Savannah Woodlands (*E.bridgesiana, E.melliodora*) 27% |
| **Present-day Cover** | Cleared (53%), Disturbed forests and woodlands (5%); Dry forests (9%); Water bodies (33%) |
| **Conservation Areas** | None TOTAL 0% |

**3Eb Tarago Province (72112ha)**

Located at the southern end of the Sub-Region and containing Tarago and Lake Bathurst, this Province is characterised by undulating plainslands and tableland with broad shallow valleys and very gently sloping basins.

**CHARACTERISTICS OF THE TARAGO PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (71%); Acid/Intermediate Intrusives (16%); Acid/Intermediate Volcanics (13%) |
| **Soils** | Yellow and Red texture Contrast Soils (46%); Massive Red and Yellow Earths (48%); Shallow Loams (6%) |
| **1750 Vegetation** | Typical Dry Sclerophyll Forest (*E.mannifera, E.rossii, E.dives, E.macrorhyncha*) 70%; Savannah Woodlands (*E.bridgesiana, E.melliodora*) 29% |
| **Present-day Cover** | Cleared (66%), Disturbed forests and woodlands (13%); Dry forests (19%); Water bodies (2%) |
| **Conservation Areas** | None TOTAL 0% |

**3Ec Wollondilly Province (173109ha)**

Wollondilly is the largest Province in the Sub-Region and is located south, west and north of Goulburn. It is characterised by undulating plainslands and rolling low hills with broad shallow valleys and low swampy flats. Wollondilly River passes through this Province, and it is part of the upper catchment for the Abercrombie River.

**CHARACTERISTICS OF THE WOLLONDILLY PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (20%); Acid/Intermediate Intrusives (56%); Acid/Intermediate Volcanics (21%); Basic Volcanics and Lavas (3%) |
| **Soils** | Yellow and Red texture Contrast Soils (65%); Massive Red and Yellow Earths (14%); Shallow Loams (18%); Deep Structured Red Clay Loams (3%) |
| **1750 Vegetation** | Typical Dry Sclerophyll Forest (*E.mannifera, E.rossii, E.dives, E.macrorhyncha*) 60%; Savannah Woodlands (*E.bridgesiana, E.melliodora*) 20% |
| **Present-day Cover** | Cleared (53%), Disturbed forests and woodlands (14%); Dry forests (30%); Water bodies (1%); Other (2%) |
| **Conservation Areas** | Tarlo River NP (7708ha) TOTAL 4.4% |

**3Ed Crookwell Province (122877ha)**

Located in the northern end of the Sub-Region, Crookwell Province is characterised by undulating plainslands with low swampy flats, minor river flats and terraces. The upper catchments of the Crookwell, Wollondilly and Lachlan Rivers are within this Province.

**CHARACTERISTICS OF THE CROOKWELL PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (48%); Acid/Intermediate Intrusives (23%); Acid/Intermediate Volcanics (2%); Basic Volcanics and Lavas (27%) |
| **Soils** | Yellow and Red texture Contrast Soils (47%); Massive Red and Yellow Earths (11%); Shallow Loams (1%); Deep Structured Red Clay Loams (41%) |
| **Present-day Cover** | Dry Forest System (96%); Degraded Grassland (1%); Regrowth Forest and Remnant Bushland (3% |
| **Conservation Areas** | None TOTAL 0% |

**3F CANBERRA MOUNTAINS SUB-REGION (2687 km2)**

Canberra Mountains Sub-Region is a long narrow strip that occupies 5% of the Region. It is located between the Victorian border (near Craigie, east of Delegate) and Toggannoggera, south-west of Araluen. Cooma, Bombala and Nimmitabel are on the western edge of the Sub-Region.

The defining landform for the Sub-Region is steep mountains (relief greater than 360m), with deeply incised river valleys. The Sub-Region forms part of the “Great Escarpment”, which is considered to be a line of separation “between the coastlands and the broad plateaux and plainslands of the interior”[[21]](#footnote-21). Rivers flow westwards (Kybeyan River into the Numeralla River), eastwards (Bemboka River to the Bega River) and northwards (the northern part of the Sub-Region forms the upper catchment for the Shoalhaven River).

**CHARACTERISTICS OF THE CANBERRA MOUNTAINS SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Acid/Intermediate Intrusives (59%), Palaeozoic Sediments (38%); Basic Volcanic and Lavas (3%) |
| **Soils** | Shallow Loams (42%); Yellow and Red Texture Contrast Soils (42%); Stony Sandy Loams (11%); Deep Black Cracking Clays (5%) |
| **Present-day Cover** | Dry forest and woodland (55%); Moist forest and rainforest (4%); Cleared (17%); Disturbed Forests (18%); Exotic Forest (2%); Plateau Complex and heath (4%) |
| **Conservation Areas** | Badja Swamps NR (543ha); Coolumbooka NR (1329ha); Deua NP (4327ha); South East Forest NP (7016ha); Wadbilliga NP (11987ha); Dandelong NR (1295ha)TOTAL 9.9% |

**canberramtnsub**

**3Fa Minuma Province (93048ha)**

Located on the eastern side of the Sub-Region and characterised by sharp ridges and mountainous country with V-shaped valleys, ridge crests and low hilly tracts at the edge of the Great Escarpment. Contains the Minuma Range and is part of the upper catchment for the Shoalhaven River and the Bemboka River.

**CHARACTERISTICS OF THE MINUMA PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Acid/Intermediate Intrusives (70%), Palaeozoic Sediments (30%) |
| **Soils** | Shallow Loams (40%); Yellow and Red Texture Contrast Soils (26%); Stony Sandy Loams (30%); Deep Black Cracking Clays (4%) |
| **1750 Vegetation** | Tableland Moist Forest (*E.fastigata, E.viminalis, E.radiata*) 51%; Scarp Forests (*E.sieberi, E.fastigata, E.cypellocarpa*) 14%; *E.pauciflora* Forests 10% |
| **Present-day Cover** | Dry forest and woodland (55%); Moist forest and rainforest (8%); Cleared (6%); Disturbed Forests (22%); Plateau Complex and heath (9%) |
| **Conservation Areas** | Coolumbooka NR (4ha); Deua NP (3147ha); South East Forest NP (6674ha); Wadbilliga NP (11108ha) TOTAL 22.5% |

**3Fb Kybeyan Province (149014ha)**

Located on the western side of the Sub-Region, this Province is characterised by a steep-sided mountain range with narrow ridges and deeply incised narrow stream valleys (Kybeyan Range).

**CHARACTERISTICS OF THE KYBEYAN PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Acid/Intermediate Intrusives (92%), Palaeozoic Sediments (5%); Basic Volcanics and Lavas (3%) |
| **Soils** | Shallow Loams (50%); Yellow and Red Texture Contrast Soils (47%); Stony Sandy Loams (1%); Deep Black Cracking Clays (2%) |
| **1750 Vegetation** | Tableland Moist Forest (*E.fastigata, E.viminalis, E.radiata*) 23%; Cold, Dry Tableland Forests (*E.dives, E.viminalis, E.pauciflora*) 32%; *E.pauciflora* Forests 33% |
| **Present-day Cover** | Dry forest and woodland (63%); Moist forest (2%); Cleared (15%); Disturbed Forests (18%); Plateau Complex and heath (2%) |
| **Conservation Areas** | Badja Swamp NR (543ha); Deua NP (1180ha); Wadbilliga NP (879ha); Dandelong NR (1295ha) TOTAL 2.6% |

**3Fc Mila Province (26593ha)**

A relatively small province located at the southern end of the Sub-Region, near the Victorian border. It has a slightly lower relief than the other two provinces, with a landscape of steep hills, with some basalt valleys.

**CHARACTERISTICS OF THE MILA PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Acid/Intermediate Intrusives (11%), Palaeozoic Sediments (71%); Basic Volcanics and Lavas (18%) |
| **Soils** | Yellow and Red Texture Contrast Soils (69%); Stony Sandy Loams (4%); Deep Black Cracking Clays (27%) |
| **1750 Vegetation** | Tableland Moist Forest (*E.fastigata, E.viminalis, E.radiata*) 17%; Cold, Dry Tableland Forests (*E.dives, E.viminalis, E.pauciflora*) 68%; ScarpForests (*E.sieberi, E.fastigata, E.cypellocarpa*) 13% |
| **Present-day Cover** | Dry forest and woodland (8%); Moist forest (2%); Cleared (63%); Disturbed Forests (24%); Plateau Complex and heath (5%) |
| **Conservation Areas** | South East Forest NP (342ha); Coolumbooka NR (1325ha) TOTAL 6.3% |

**3G CANBERRA HILLS SUB-REGION (8865 km2)**

This is the one of the largest Sub-Regions, occupying 17% of the Region. The Sub-Region comprises a series of low to moderate hills, with a relief mainly between 30 and 90m, centred around Canberra. There are some areas of higher relief (90-180m) in the central and southern parts of the Sub-Region (Gundaroo, Canberra, Tarago, Queanbeyan). Lake George Range and several high hills are part of the Sub-Region e.g. Tidbinbilla Peak, Yarrow Peak (1080m), Mount Spring (886m), Mount Narrawa (811m). Lake George is not part of this Sub-Region, but forms part of the low relief Canberra Plains Sub-Region. Nearly all of the Australian Capital Territory is within this Sub-Region.

The Sub-Region can be considered to be undulating to rolling country with some hilly ridges and knolls with some broad valleys, plains or very gently sloping basins. In the south there are some steeper-sided hills with narrow ridges.

**CHARACTERISTICS OF THE CANBERRA HILLS SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (76%); Acid/Intermediate Intrusives (18%); Acid/Intermediate Volcanics (6%) |
| **Soils** | Massive Red and Yellow Earths (49%); Yellow and Red Texture Contrast Soils (30%); Shallow Loams (17%); Deep Structured Red Clay Loams (2%) |
| **Present-day Cover** | Cleared (71%); Disturbed Forests and Woodlands (8%); Dry Forests and Woodlands (17%); Moist Forests (2%); Exotic Forest (1%); Urban (1%) |
| **Conservation Areas** | Razorback NR (635ha); Abercrombie NP (16ha); Mundoonen NR (1385ha); Hattons Corner NR (4ha); Wee Jasper NR (519ha); Brindabella NP (307ha); Goorooyarroo NR (283ha); Queanbeyan NR (2ha); Tindery NR (13582ha) TOTAL 1.2% (ACT parks not included) |

**canberrahillsub3Ga Rift Valley Province (111516ha)**

Located between Brindabella Range and Tindery Mountains this Province is characterised by a hilly graben (rift valley), with a broad valley and undulating surface formed from the lower slopes of surrounding mountains.

**CHARACTERISTICS OF THE RIFT VALLEY PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (84%); Acid/Intermediate Intrusives (16%) |
| **Soils** | Massive Red and Yellow Earths (49%); Shallow Loams (51%) |
| **1750 Vegetation** | Savannah Woodlands (*E.bridgesiana, E.melliodora*), 46%; *E.pauciflora* Forests, 16%; Cold, Dry Tablelands Forest/Grass mosaic (*E.viminalis, E.pauciflora, E.rubida, E.dives*), 10%; Cold, Dry Tableland Forests (*E.dives, E.viminalis, E.pauciflora*), 18% |
| **Present-day Cover** | Cleared (35%); Disturbed Forests and Woodlands (7%); Dry Forests and Woodlands (49%); Moist Forests (8%); Water Bodies (1%) |
| **Conservation Areas** | Tindery NR (13582ha) TOTAL 12.2% |

**3Gb Canberra Province (588379ha)**

Covering a large proportion of the Sub-Region, the Canberra Province is characterised by stepped rolling low to moderate hills with plains and sloping basins. Contains urban Canberra and many small towns and farms.

**CHARACTERISTICS OF THE CANBERRA PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (82%); Acid/Intermediate Intrusives (16%); Acid/Intermediate Volcanics (2%) |
| **Soils** | Massive Red and Yellow Earths (53%); Shallow Loams (4%); Deep Structured Red Clay Loams (3%); Yellow and Red Texture Contrast Soils (40%) |
| **Present-day Cover** | Cleared (78%); Disturbed Forests and Woodlands (13%); Dry Forests and Woodlands (9%) |
| **Conservation Areas** | Mundoonen NR (1385ha); Goorooyaroo NR (283ha); Queanbeyan NR (2ha) TOTAL 0.3% |

**3Gc Binda Province (102868ha)**

A small province north of the Canberra Province, centred round Binda and Peelwood, in the Central tablelands. It is characterised by an undulating landscape of low to moderate relief, with rolling hills and swampy flats.

**CHARACTERISTICS OF THE BINDA PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (51%); Acid/Intermediate Intrusives (42%); Acid/Intermediate Volcanics (5%); Basic Volcanics and Lavas (3%) |
| **Soils** | Massive Red and Yellow Earths (12%); Shallow Loams (38%); Deep Structured Red Clay Loams (2%); Yellow and Red Texture Contrast Soils (48%) |
| **Present-day Cover** | Degraded Grassland (11%); Disturbed Forests and Woodlands (22%); Dry Forests and Woodlands (59%); Non-forest System (8%) |
| **Conservation Areas** | Razorback NR (635ha); Abercrombie River NP (16ha) TOTAL 0.6% |

**3Gd Yass Province (83573ha)**

Located in the western part of the Sub-Region, Yass province is characterised by undulating to rolling country with some hilly ridges and knolls dotted with tors. Contains Yass, Wee Jasper and Lake Burrunjuck.

**CHARACTERISTICS OF THE YASS PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (53%); Acid/Intermediate Intrusives (3%); Acid/Intermediate Volcanics (44%) |
| **Soils** | Massive Red and Yellow Earths (60%); Shallow Loams (39%); Deep Structured Red Clay Loams (1%) |
| **Present-day Cover** | Cleared (64%); Disturbed Forests and Woodlands (6%); Dry Forests and Woodlands (17%); Moist Forest (5%); Water Bodies (8%) |
| **Conservation Areas** | Hattons Corner NR (4ha); Wee Jasper NR (519ha); Brindabella NP (307ha) TOTAL 1.0% |

**3H BRAIDWOOD HILLS SUB-REGION (4305 km2)**

Braidwood Hills occupies 9% of the Region, and is located east of Canberra, in the Braidwood district. Its southern boundary is south of Araluen, and its northern boundary is near Goulburn. Bungonia, Nerriga and Mongarlowe are within the Sub-Region. The landforms within the Braidwood Hills Sub-Region are a mixture of low to moderate hills (relief 30 to 180m), with a rim of high hills (relief 180-360m) along the eastern edge. The high hills form part of the Budawang Range on the edge of the Great Escarpment. The Shoalhaven River runs south to north through the centre of the Sub-Region, and the Mongarlowe River runs east from the Sub-Region.

Braidwood Hills Sub-Region can be considered as a gently undulating tableland with broad shallow valleys and a low hilly to rugged hilly range, with gentle to moderately steep slopes. To the east, the landform becomes a dissected sandstone plateau and ridges, with flat to hilly crests and steep slopes.

**CHARACTERISTICS OF THE BRAIDWOOD HILLS SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (61%); Acid/Intermediate Intrusives (27%); Acid/Intermediate Vocanics (12%) |
| **Soils** | Massive Red and Yellow Earths (31%), Yellow and Red Texture Contrast Soils (37%); Shallow Loams (29%); Deep Structured Red Clay Loams (3%) |
| **Present-day Cover** | Cleared (48%); Disturbed Forests and Woodlands (12%); Dry forests and woodlands (32%); Moist forests (3%); Exotic Forest (2%); Rocky Outcrops, Water Bodies etc (3%) |
| **Conservation Areas** | Bungonia SRA (5343ha); Deua NP (8742ha); Morton NP (35314ha); Tindery NR (51ha); Budawang NP (3ha) TOTAL 11.5% |

**braidwoodhillsub3Ha Shoalhaven Valley Province (355185ha)**

Valley formed by Shoalhaven River, comprising low to moderate hills with gentle to moderate slopes, and broad shallow valleys (plainsland). Some dissected sandstone plateau in the north-east of the Province. Contains Goulburn and Braidwood.

**CHARACTERISTICS OF THE SHOALHAVEN VALLEY PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (61%); Acid/Intermediate Intrusives (27%); Acid/Intermediate Volcanics (2%) |
| **Soils** | Massive Red and Yellow Earths (34%); Shallow Loams (23%); Yellow and Red Texture Contrast Soils (41%); Deep Structured Red Clay Loams (2%) |
| **1750 Vegetation** | Transitional Tableland Forests (*Acacia mearnsii*) 27%; Scarp Forests (*E.sieberi, E.fastigata, E.cypellocarpa*) 14%; Typical Dry Sclerophyll Forest (*E.mannifera, E.rossii, E.dives, E.macrorhyncha*) 23% |
| **Present-day Cover** | Cleared (45%); Dry Forests and Woodlands (38%); Disturbed Forests and Woodlands (12%); Moist Forests (3%); Rock Outcrops, Heath, Plateau Complex (2%) |
| **Conservation Areas** | Bungonia SRA (3654ha); Deua NP (1719ha); Morton NP (9564ha); Tindery NR (51ha); Budawang NP (0.3ha) TOTAL 4.2% |

**3Hb Budawang Province (106638ha)**

A line of steep to very steep mountains along the eastern edge of the Sub-Region, formed from the Budawang Range. Landform mainly dissected sandstone plateau, terraced, ridges with flat to hilly crests and steep slopes, scarps, canyons and V-shaped valleys. Contains Araluen and Nerriga and the Mongarlowe River.

**CHARACTERISTICS OF THE BUDAWANG PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (73%); Acid/Intermediate Intrusives (21%); Acid/Intermediate Volcanics (6%) |
| **Soils** | Massive Red and Yellow Earths (19%); Shallow Loams (50%); Yellow and Red Texture Contrast Soils (27%); Deep Structured Red Clay Loams (1%); Stony Sandy Loams (3%) |
| **1750 Vegetation** | Scarp Forests (*E.sieberi, E.fastigata, E.cypellocarpa*) 31%; Transitional Tableland Forests (*Acacia mearnsii*) 31%; Shoalhaven Gorges (*A.floribunda, E.melliodora, Casuarina cunninghamiana*) 14% |
| **Present-day Cover** | Cleared (18%); Dry Forests and Woodlands (66%); Disturbed Forests and Woodlands (11%); Moist Forests (1%); Rock Outcrops, Heath, Plateau Complex (4%) |
| **Conservation Areas** | Bungonia SRA (1689ha); Deua NP (7023ha); Morton NP (25750ha); Budawang NP (3ha)TOTAL 32.3% |

**3I BATLOW HILLS SUB-REGION (823 km2)**

This small Sub-Region (occupies 2% of the Region) is located along the western edge of the Region, adjoining the Upper Slopes Sub-Region of the South Western Slopes Region of western NSW[[22]](#footnote-22). The Sub-Region is south of Batlow, west of Tumbarumba and east Holbrook i.e. within the south-western slopes of NSW.

The landform of the Sub-Region is dominated by moderate hills (relief 90-180m), with some undulating country with broad slopes and low narrow, often gravelly or stony, ridges. The Sub-Region passes into plains further to the west. The water courses mainly drain southwards directly into the Murray River, or to the east, draining into the Tooma River. Bago Range runs through the northern edge of the Sub-Region. The Sub-Region is also the Province.

**CHARACTERISTICS OF THE BATLOW HILLS SUB-REGION**

|  |  |
| --- | --- |
| Geology | Palaeozoic Sediment (63%); Acid/Intermediate Intrusives (37%) |
| **Soils** | Yellow and Red Texture Contrast Soils (49%); Massive Red and Yellow Earths (51%) |
| **Present-day Cover** | Cleared (45%); Exotic Forests (25%); Dry Forest and Woodlands (22%); Moist Forest (4%); Disturbed forest and woodland (4%) |
| **Conservation Areas** | None TOTAL 0% |

batlowhillsub**3J BATHURST HILLS SUB-REGION (10237 km2)**

The largest of the Sub-Regions (20% of the Region), Bathurst Hills is located in an area surrounding Bathurst, but not including Bathurst (which is in a valley – Bathurst Plains Sub-Region). The southern boundary of the Sub-Region is Peelwood, near Burraga, and the northern boundary is north of Ilford. The Sub-Region extends east to Lithgow, Hartley and Oberon, and west to Lyndhurst and Molong.

The defining landform is low to moderate hills (relief 30 to 180m). The area between Oberon and Burraga is classed as low hills, with higher hills in the Abercrombie River area (small areas of high mountains, relief 180-360m). Moderate hills (relief 90-180m) are found in the remainder of the Sub-Region i.e. Blayney, Orange, Lyndhurst in the west, Sofala and Ilford in the north, and Lithgow, Cullen Bullen in the east.

Bathurst Hills Sub-Region is mainly undulating to hilly ridge tops (plateau tracts) that may contain perched seasonally swampy basins and/or valleys. Rolling to steep hilly country in north, east and south with some steep scarps. There are some narrow undulating valleys (e.g. associated with Belubula and Abercrombie Rivers). The Macquarie Range is within the Sub-Region.

**CHARACTERISTICS OF THE BATHURST HILLS SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (60%); Basic Volcanics and Lavas (23%); Acid/Intermediate Intrusives (11%); Acid/Intermediate Volcanics (6%) |
| **Soils** | Massive Red and Yellow Earths (49%); Yellow and Red Texture Contrast Soils (27%); Shallow Loams (11%); Deep Structured Red Clays (10%) |
| **Present-day Cover** | Dry Forests and Woodlands, including white cypress pine (61%); Degraded grassland (7%); Exotic Forests (3%); Disturbed Forests (20%); Non-forest System (7%) |
| **Conservation Areas** | Abercrombie River NP (15953ha); Barton NR (526ha); Blue Mountains NP (1629ha); Copperhania NR (3324ha); Freemantle NR (367ha); Girralang NR (655ha); Gardens of Stone NP (7509ha); Hill End Historic Site (107ha); Mount Canobolas SRA (1608ha); Mullion Range SRA (1053ha); Razorback NR (1181ha); Winburndale NR (10999ha)  TOTAL 4.4% |

bathursthillsub**3Ja Winburndale Province (424019ha)**

Located in the northern part of the Sub-Region, Winburndale Province is characterised by rugged ranges incorporating a series of stepped undulating to hilly ridges with steep sided slopes and scarps above entrenched streams with very narrow floodplains (gorges). There are some basaltic knolls and ridges. Contains much of the mountainous country between Lithgow, Ilford and Orange.

**CHARACTERISTICS OF THE WINBURNDALE PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (75%); Basic Volcanics and Lavas (7%); Acid/Intermediate Intrusives (11%); Acid/Intermediate Volcanics (7%) |
| **Soils** | Massive Red and Yellow Earths (25%); Yellow and Red Texture Contrast Soils (54%); Shallow Loams (15%); Deep Structured Red Clays (3%); Stony Sandy Loams (3%) |
| **Present-day Cover** | Dry Forests and Woodlands, including white cypress pine (44%); Moist Forests (1%); Degraded grassland (11%); Exotic Forests (31%); Rocky Complex, Plateau Complex (13%) |
| **Conservation Areas** | Freemantle NR (367ha); Gardens of Stone NP (7509ha); Girralang NR (655ha); Hill End Historic Site (107ha); Mullion Range SRA (804ha); Winburndale NR (10999ha) TOTAL 4.8% |

**3Jb Macquarie Range Province (304407ha)**

This province is in the south-western part of the Sub-Region and is characterised by hilly to mountainous ranges and steep valleys, with basaltic tors and gravelly ridges, and rocky outcrops. Contains the upper catchments of the Abercrombie and Belubula Rivers (both flowing into Lachlan River).

**CHARACTERISTICS OF THE MACQUARIE RANGE PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Basic Volcanics and Lavas (49%); Palaeozoic Sediments (30%); Acid/Intermediate Intrusives (11%); Acid/Intermediate Volcanics (10%) |
| **Soils** | Massive Red and Yellow Earths (25%); Yellow and Red Texture Contrast Soils (25%); Shallow Loams (15%); Deep Structured Red Clays (29%); Shallow Black Self Mulching Clays (4%); Red Brown Earths (2%) |
| **Present-day Cover** | Dry Forests and Woodlands (70%); Disturbed Forests (21%); Rocky Complex and Non-forest System (6%); Degraded Grassland (3%) |
| **Conservation Areas** | Barton NR (526ha); Copperhania NR (3324ha); Razorback NR (1181ha); Abercrombie NP (3865ha); Mount Canobolas SRA (1608ha); Mullion Range SRA (249ha) TOTAL 3.5% |

**3Jc Black Springs Province (295276ha)**

A Province characterised by undulating low hills located south of Bathurst, containing Oberon, Black Springs and Burraga. Some basaltic tors and broad valleys.

**CHARACTERISTICS OF THE BLACK SPRINGS PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (80%); Basic Volcanics and Lavas (19%); Acid/Intermediate Intrusives (1%) |
| **Soils** | Massive Red and Yellow Earths (74%); Yellow and Red Texture Contrast Soils (5%); Shallow Loams (7%); Deep Structured Red Clays (11%); Deep Alluvial Loams (3%) |
| **Present-day Cover** | Dry Forests and Woodlands (75%); Degraded grassland (5%); Disturbed and Exotic Forests (18%); Non-forest System (2%) |
| **Conservation Areas** | Abercrombie River NP (12088ha); Blue Mountains NP (1629ha)  TOTAL 4.6% |

**3K BATHURST PLAINS SUB-REGION (1509 km2)**

This small Sub-Region (3% of the Region) is associated with the Macquarie River and its associated floodplains. The Sub-Region contains Bathurst Valley and the surrounding low hills. Its defining landform is undulating plainsland (relief 5-30m) and low hills (relief 30-90m). The surrounding low hills include Winburndale and Sunny Corner to the east. There are no Provinces in this Sub-Region.

**CHARACTERISTICS OF THE BATHURST PLAINS SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (31%); Acid/Intermediate Intrusives (69%) |
| **Soils** | Massive Red and Yellow Earths (46%); Yellow and Red Texture Contrast Soils (44%); Deep Alluvial Loams (8%); Shallow Loams (2%) |
| **Present-day Cover** | Dry Forests and Woodlands (73%); Disturbed Forests (17%); Degraded Grassland (2%); Non-forest System (7%); Urban (1%) |
| **Conservation Areas** | Winburndale NR (340ha); Wambool NR (197ha); Evans Crown NR (436ha) TOTAL 0.6% |

**bathurstplainsub**

**IBRA REGION 4: SYDNEY BASIN (35862 km2)**

The Sydney Basin IBRA Region is tersely described as “Mesozoic sandstones and shales; dissected plateaus (sic); forests, woodlands and heaths; skeletal soils, sands and podzolics”[[23]](#footnote-23). This does not fully describe the range of landforms, geology, soils and biological associations within this Region. The Sydney Basin Region encompasses the coastline from Ulladulla to north of Newcastle and includes three large embayments (Jervis Bay, Sydney Harbour and Broken Bay). The western boundary of the Region is near Molong, west of Orange, and much of the Blue Mountains, Hunter Range and Illawarra Escarpment are included in the Sydney Basin. Several large coastal rivers are within the Region e.g. Nepean-Hawkesbury River, Shoalhaven River, and the Hunter River is part of the Sydney Basin’s northern boundary.

The rock types are dominated by sediments (35% Palaeozoic and 62% Mesozoic), indicating the geological origins of the Region. The soil types are widely represented, with the low fertility Stony Sandy Loams dominating. According to Gretton and Salma[[24]](#footnote-24), 16.3% of the Region is native and voluntary pastures, 12,5% is improved pastures and croplands, and 65.3% is described as “Parks, timber and shrub lands”. The proportions of soil types and rock types in the Sydney Basin Region are given in Table 4, and the location of this Region, with the Sub-regions is given in the following map. There are 11 Sub-Regions and 18 Provinces in the Sydney Basin Region.

**TABLE 4: Soil Types and Rock Types in Sydney Basin Region**

**SOIL TYPES:**

Shallow Loams 8%

Yellow and Red Texture Contrast Soils 17%

Stony Sandy Loams 41%

Deep Structured Red Clay Loams 4%

Massive Red and Yellow Earths 9%

Deep Black Cracking Clays 1%

Deep Alluvial Loams 3%

Deep Friable Red and Brown Clays 2%

Massive Black and Grey Coastal Clays 1%

Red Brown Earths 4%

Siliceous Dune Sands 1%

Well Structured Red and Brown Earths 7%

**ROCK TYPES:**

Sandstone, siltstone, shale, chert, limestone (Palaeozoic Sediments) 35%

Sandstone, siltstone, mudstone (Mesozoic Sediments) 62%

Acid and intermediate volcanics and pyroclastics 1%

Basic volcanics and lavas (basalts) 1%

# sydneybasinKEY TO SUB-REGIONS AND PROVINCES OF THE SYDNEY BASIN IBRA REGION

|  |  |  |  |
| --- | --- | --- | --- |
|  | SUB-REGIONS |  | PROVINCES |
| Relief: 5-180m. Plains and low hills with some steeper hills adjoining Blue Mountains | **SOUTHERN HUNTER** | Dissected sandstone plateau and mountains, with basalt plateau and mountains in the north (Blue Mountains, Hunter and Liverpool) | **BROKE HILLS 4Aa** |
|  |  | Low hills and undulating plainslands associated with Lake Macquarie, Tuggerah Lake and Newcastle Bight (Hunter) | **NEWCASTLE COAST 4Ab** |
|  |  | Plainsland and low to moderate hills to the south and surrounding the Hunter River (Hunter) | **MUSWELLBROOK 4Ac** |
| Relief: 180-360m. High to very high mountains, dissected plateau and steep-sided valleys. Contains Illawarra Escarpment | **ILLAWARRA MOUNTAINS** | Dissected sandstone plateau with terraced ridges, flat to hilly crests and steep slopes, scarps and canyons (Ettrema) | **MORTON 4Ba** |

|  |  |  |  |
| --- | --- | --- | --- |
|  | SUB-REGIONS |  | PROVINCES |
|  | **ILLAWARRA MOUNTAINS** | Mixture of undulating plateau with low rises and broad valleys, with steep slopes and dissected valleys near the edge of the Great Escarpment. Eastern edge steep colluvial slopes below the escarpment (Moss Vale, Braidwood, Ettrema and Illawarra) | **MOSS VALE 4Bb** |
| Relief: 5-90m. Undulating plainsland with low hills | **ILLAWARRA COAST** | Coastal lowlands, coastal landscapes e.g. beach barrier systems, floodplains (South Coast) | **COASTAL PLAINS 4Ca** |
|  |  | Plainsland and low hills east of escarpment (South Coast, Illawarra) | **COASTAL HILLS 4Cb** |
| Relief: 180-360m. Steep mountains and dissected plateau | **GOULBURN RIVER MOUNTAINS** | Sandstone plateaux and ridges cut by steep-sided valleys associated with Goulburn River (Goulburn River) | **GOULBURN RIVER MOUNTAINS 4D** |

|  |  |  |  |
| --- | --- | --- | --- |
|  | SUB-REGIONS |  | PROVINCES |
| Relief: 30-90m. Low hills, low dissected plateau and ridges | **CUMBERLAND PLAINS** | Low hills and escarpments at the eastern edge of the Blue Mountains (Blue Mountains) | **SYDNEY HILLS 4Fa** |
|  |  | Gently rolling hilly country in a large basin extending to the coast at Sydney (Cumberland) | **SYDNEY PLAINS 4Fb** |
|  |  | Dissected low sandstone plateau forming the coast at the southern end of the sub-region (Blue Mountains) | **ROYAL 4Fc** |
| Relief: 90-180m. Dissected sandstone plateau, hills, ridges and river flats associated with Broken Bay | **BROKEN BAY** | Steep hilly country on the northern edge of Sydney basin (Blue Mountains) | **BROKEN BAY 4G** |
| Relief: 5-90m. Undulating country with low rises and valleys | **BRAIDWOOD PLAINS** | Gently undulating tableland with broad shallow valleys (Braidwood) | **BRAIDWOOD PLAINS 4H** |
| Relief: Greater than 360m. Steep mountains with deep gorges | **BLUE MOUNTAINS PEAKS** | Deeply dissected mountainous regions and sandstone plateaux (Blue Mountains) | **BLUE MOUNTAINS PEAKS 4I** |
|  | SUB-REGIONS |  | PROVINCES |
| Relief: 180-360m. Steep to very steep mountains and dissected sandstone plateau. Altitude rises above 1000m. | **BLUE MOUNTAINS** | Altitudes above 500m, steeply dissected plateau | **BLUE MOUNTAINS WEST 4Ja** |
|  |  | Altitudes below 500m, dissected plateau | **BLUE MOUNTAINS EAST 4Jb** |
| Relief: 180-360m. High mountains and high to very high dissected plateau and steep rugged ridges in the west of the region | **BATHURST MOUNTAINS** | Rugged ranges in a series of steeped undulating to hilly ridges with steep sided slopes above entrenched streams with very narrow flood-plains (Bathurst) | **BATHURST MOUNTAINS 4K** |

**4A SOUTHERN HUNTER SUB-REGION (5239 km2)**

Although within the Sydney Basin Region, this Sub-Region is closer to the North Coast Region, with characteristics related to the Hunter Valley. The Sub-Region forms the southern edge of the Hunter Valley, and, like its northern counterpart (Hunter North) is moderate to high hills sloping towards the Hunter River (Hunter Valley Sub-Region). This Sub-Region occupies 15% of the Region.

The eastern edge of the Southern Hunter Sub-Region is the coastline between Gosford to north of Newcastle (Nelson Bay). The western boundary is near Scone, and the New England Highway forms the northern boundary. The southern boundary is between Denman, Cessnock and Wyong. The Sub-Region includes such towns as Kurri Kurri, Cessnock, Morriset and Newcastle. Tuggerah Lake, Lake Munmorah and Lake Macquarie are also part of the Southern Hunter.

The defining landform is low (30-90m) to moderate (90-180m) hills, with undulating or irregular plainslands (relief 5-30m). The land is predominantly undulating plains and low hills, with steeper hills along the southern and western edges (adjoining Blue Mountains Sub-Region).

# CHARACTERISTICS OF THE SOUTHERN HUNTER SUB-REGION

|  |  |
| --- | --- |
| Geology | Palaeozoic Sediments (75%); Mesozoic Sediments (22%); Acid/Intermediate Volcanics (2%); Basic Volcanics and Lavas (1%) |
| **Soils** | Shallow Loams (37%); Yellow and Red Texture Contrast Soils (31%); Red Brown Earths (29%); Deep Alluvial Loams (13%); Deep Black Cracking Clays (6%); Siliceous Dune Sands (5%) |
| **Vegetation** | Influenced by sandstone (dry forests, woodlands, heath and shrublands), with the addition of coastal complexes in the Newcastle to Nelson Bay area. |
| **Present-day Cover** | Dry Forest and Woodland (16%); Moist Forest (1%); Coastal Complex (8%); Non-forest System (48%); Disturbed Forest (22%); Urban (4%) |
| **Conservation Areas** | Awabakal NR (182ha); Burning Mountain NR (15ha); Glenrock SRA (462ha); Hexham Swamp NR (903ha); Kooragang NR (1054ha); Manobalai NR (45ha); Moffits Swamp NR (70ha); Munmorah SRA (1258ha); Pulbah Island NR (18ha); Tingira Heights NR (18ha); Tomaree NP (1599ha); Wingen Maid NR (1040ha); Wyrrabalong NP (421ha); Yengo NP (204ha); Wollemi NP (231ha); Lower Hunter NP (2143ha); Towarri NP (1435ha); Watagans NP (1870ha); Tilligerry NR (116ha); Lake Macquarie SRA (619ha) TOTAL 3.1% |

sthnhuntersub

**4Aa Broke Hills Province (128519ha)**

This province is located along the southern edge of the Sub-Region and characterised by dissected sandstone plateau and mountains, with basalt plateau and mountains to the north-west. There are several peaks within the province (e.g. Mount Wambo (646m), Woodlands Mountain).

**CHARACTERISTICS OF THE BROKE HILLS PROVINCE**

|  |  |
| --- | --- |
| Geology | Palaeozoic Sediments (50%); Mesozoic Sediments (46%); Basic Volcanics and Lavas (4%) |
| **Soils** | Shallow Loams (13%); Yellow and Red Texture Contrast Soils (41%); Red Brown Earths (2%); Deep Alluvial Loams (5%); Deep Black Cracking Clays (18%); Massive Red and Yellow Earths (14%); Stony Sandy Loams (7%) |
| **Present-day Cover** | Dry Forest and Woodland (32%); Moist Forest (4%); Non-forest System (28%); Disturbed Forest (36%) |
| **Conservation Areas** | Burning Mountain NR (15ha); Manobalai NR (45ha); Wollemi NP (2445ha); Wingen Maid NR (1040ha); Yengo NP (201ha); Towarri NP (1435ha); Watagens NP (1870ha) TOTAL 5.5% |

**4Ab Newcastle Coast Province (117754ha)**

This province is associated with the coastal landform between Nelson Bay and The Entrance and contains Port Hunter, Lake Macquarie, Lake Munmorah and Tuggerah Lakes. The landform is characterised by plainsland and low hills, with alluvial flats and coastal features such as dunes, headlands, rock platforms, beaches etc. Newcastle City is within this Province.

**CHARACTERISTICS OF THE NEWCASTLE COAST PROVINCE**

|  |  |
| --- | --- |
| Geology | Palaeozoic Sediments (55%); Mesozoic Sediments (41%); Acid/Intermediate Volcanics (4%) |
| **Soils** | Shallow Loams (1%); Yellow and Red Texture Contrast Soils (60%); Deep Alluvial Loams (1%); Siliceous Dune Sands (23%); Massive Black and Grey Clay Loams (15%) |
| **Present-day Cover** | Dry Forest and Woodland (12%); Coastal Complex (27%); Non-forest System (27%); Disturbed Forest (25%); Urban (7%) |
| **Conservation Areas** | Awabakal NR (182ha); Glenrock SRA (462ha); Hexham Swamp NR (905ha); Kooragang NR (1054ha); Lake Macquarie SRA (619ha); Moffits Swamp NR (70ha); Munmorah SRA (1258ha); Pulbah Island NR (18ha); Tilligerry NR (116ha); Tingira Heights NR (18ha); Tomaree NP (1599ha); Wyrrabalong NP (421ha) TOTAL 5.7% |

**4Ac Muswellbrook Province (277620ha)**

Occupying a large proportion of the Sub-Region, the Muswellbrook Province is characterised by plainsland and low to moderate hills to the south of, and surrounding the Hunter River. The New England Highway approximates the northern border and the Province includes much of the Hunter Valley coal fields.

**CHARACTERISTICS OF THE MUSWELLBROOK PROVINCE**

|  |  |
| --- | --- |
| Geology | Palaeozoic Sediments (95%); Mesozoic Sediments (3%); Acid/Intermediate Volcanics (2%) |
| **Soils** | Yellow and Red Texture Contrast Soils (13%); Red Brown Earths (54%); Deep Alluvial Loams (22%); Deep Black Cracking Clays (3%); Massive Black and Grey Coastal Clays (2%); Massive Red and Yellow Earths (4%); Stony Sandy Soils (2%) |
| **Present-day Cover** | Dry Forest and Woodland (7%); Non-forest System (77%); Disturbed Forest (15%); Ephemeral Wetlands (1%) |
| **Conservation Areas** | Wollemi NP (231ha); Lower Hunter NP (2143ha); Towarri NP (0.4ha) TOTAL 0.8% |

**4B ILLAWARRA MOUNTAINS SUB-REGION (4204 km2)**

This Sub-Region is an extension of the Blue Mountains Sub-Region and occupies 12% of the Region. The northern boundary of the Sub-Region is at Bowral, and the southern boundary is west of Ulladulla, near Pigeon House. The Sub-Region forms part of the coastline between Wollongong and Kiama i.e. where steep hills are close to the ocean. The western boundary is near Marulan and Nerriga. The Shoalhaven River and Tallawa Dam are within the Sub-Region.

The defining landform for the Sub-Region is high (relief 180-360m) to very high (relief greater than 360m) mountains and dissected plateaux. The numerous water courses draining into Shoalhaven and Endrick Rivers form steep-sided valleys, of which Kangaroo Valley is at the eastern edge of the Sub-Region. The Illawarra Escarpment forms part of this Sub-Region.

The Illawarra Mountains can be described as dissected sandstone plateaux, with terraced ridges with flat to hilly crests and steep slopes. The landforms include steep escarpments, scarps, canyons, rock walls, pillars and slabs of sandstone.

**CHARACTERISTICS OF THE ILLAWARRA MOUNTAINS SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (74%); Mesozoic Sediments (20%); Basic Volcanics and Lavas (4%); Acid/Intermediate Volcanics (1%) |
| **Soils** | Deep Structured Red Clay Loams (23%); Shallow Loams (25%); Massive Red and Yellow Earths (18%); Well Structured Red and Brown Earths (20%); Yellow and Red Texture Contrast Soils (8%); Stony Sandy Loams (6%) |
| **Present-day Cover** | Dry Forests and Woodlands (41%); Plateau Complex (21%); Moist Forests and Rainforest (16%); Rocky Outcrops (12%); Cleared (8%); Disturbed Forests (1%); Water Bodies (1%) |
| **Conservation Areas** | Barren Grounds NR (1962ha); Budderoo NP (5953ha); Cecil Hoskins NR (48ha); Devils Glen NR (32ha); Morton NP (130411ha); Nattai NP (12225ha); Nattai SRA (50ha); Red Rocks NR (680ha); Robertson NR (5ha); Throsby Park Historic Site (75ha); Yerranderie SRA (52ha) TOTAL 36.5% |

**illawarramtnsub**

**4Ba Morton Province (234143ha)**

Located within the southern part of the Sub-Region, Morton province is characterised by dissected steep to very steep sandstone mountains and plateaux with ridges with flat to hilly crests and steep slopes, scarps, canyons, rock walls and pillars. It is cut by the easterly flowing Shoalhaven River and the westerly flowing Endrick River.

**CHARACTERISTICS OF THE MORTON PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (96%); Mesozoic Sediments (2%); Basic Volcanics and Lavas (1%); Acid/Intermediate Volcanics (1%) |
| **Soils** | Deep Structured Red Clay Loams (9%); Shallow Loams (33%); Massive Red and Yellow Earths (32%); Well Structured Red and Brown Earths (23%); Yellow and Red Texture Contrast Soils (3%) |
| **1750 Vegetation** | Plateau Heath Complex 32%; Shoalhaven Gorges (*A.floribunda, E.melliodora, Casuarina cunninghamiana*) 20%; *E.maculata* Forests 16%; Scarp Forests (*E.sieberi, E.fastigata, E.cypellocarpa*) 10% |
| **Present-day Cover** | Dry Forests and Woodlands (42%); Moist Forests and Rainforest (16%); Plateau Complex and Rocky Outcrops (33%); Cleared (7%); Disturbed Forests (1%); Water Bodies (1%) |
| **Conservation Areas** | Devils Glen NR (32ha); Morton NP (128640ha); Red Rocks NR (680ha) TOTAL 55.2% |

**4Bb Moss Vale Province (186233ha)**

Characterised by ridges and plateaux with steep slopes, steep gorges and steep, wide river valley tracts in the west of the Province (the rich grazing lands of Bowral and Moss Vale), and small outliers of basaltic plateau isolated by dissection. In the east are the steep colluvial slump slopes below the Illawarra Escarpment extending to the coast at Wollongong. The Province includes much of the Illawarra Escarpment, and the Macquarie Pass.

**CHARACTERISTICS OF THE MOSS VALE PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (47%); Mesozoic Sediments (45%); Basic Volcanics and Lavas (7%); Acid/Intermediate Volcanics (1%) |
| **Soils** | Deep Structured Red Clay Loams (49%); Shallow Loams (14%); Well Structured Red and Brown Earths (18%); Yellow and Red Texture Contrast Soils (17%); Stony Sandy Loams (2%) |
| **Present-day Cover** | Dry Forests and Woodlands (51%); Moist Forests and Rainforest (16%); Degraded Grassland (4%); Non-forest System (16%); Exotic Forests (12%); Water Bodies (1%) |
| **Conservation Areas** | Barren Grounds NR (1962ha); Budderoo NP (5953ha); Cecil Hoskins NR (48ha); Illawarra Escarpment SRA (1196ha); Macquarie Pass NP (901ha); Morton NP (1771ha); Nattai NP (12225ha); Nattai SRA (50ha); Robertson NR (5ha); Throsby Park Historic Site (75ha); Yerranderie SRA (52ha) TOTAL 13.0% |

**4C ILLAWARRA COAST SUB-REGION (1529 km2)**

Located along a relatively broad strip between Durras and Kiama, then a narrow broken strip along the coast to Wollongong, the Illawarra Coast Sub-Region occupies 4% of the Region. The Sub-Region north of Kiama is not continuous, as there are places where the Illawarra Mountains Sub-Region of steeper relief forms the coastline. The Sub-Region contains beach barrier systems with numerous lakes and beach dunes, as well as extensive alluvial floodplains associated with major coastal rivers (e.g. Shoalhaven River). As well, there are several large embayments, such as Jervis Bay and St Georges Basin in the Sub-Region.

Although its eastern margin is close to the coast, the western boundary extends as far inland as west of Nowra. There are numerous major towns within this Sub-Region, such as Ulladulla, Kiama, Gerringong, Wollongong, Bomaderry and Huskisson.

The defining landform for the Illawarra Coast is undulating or irregular plainsland (relief 5-30m), with low hills (relief 30-90m) in the southern part of the Sub-Region.

**CHARACTERISTICS OF THE ILLAWARRA COAST SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (95%); Acid/Intermediate Volcanics and Intrusives (5%) |
| **Soils** | Yellow and Red Texture Contrast Soils (50%); Deep Structured Red Clay Loams (17%); Well Structured Red and Brown Earths (16%); Massive Black and Grey Clays (7%); Massive Red and Yellow Earths (5%); Shallow Loams (1%); Stony Sandy Loams (2%) |
| **Vegetation** | Tall open eucalypt forests, rainforests (warm temperate and littoral), woodland and open forests, and coastal heaths and shrublands[[25]](#footnote-25) |
| **Present-day Cover** | Dry Forest and Woodlands (47%); Moist Forest and Rainforest (4%); Water Bodies (8%); Coastal Complex (6%); Disturbed Forests (5%); Cleared (30%) |
| **Conservation Areas** | Barren Grounds NR (112ha); Black Ash NR (96ha); Comerong Island NR (168ha); Conjola NP (1047ha); Cudmirrah NP (2194ha); Devils Glen NR (9ha); NSW Jervis Bay NP (3116ha); Murramarang Aboriginal Area (56ha); Murramarang NP (701ha); Rodway NR (85ha); Seven Mile Beach NP (883ha); Yalleyattah NR (19ha) TOTAL 6.3% |

**illawarracoastsub**

**4Ca Coastal Plains Province (27894ha)**

Scattered along the coast between Wollongong and Durras, this province is characterised by coastal lowlands, coastal landscapes e.g. beach barrier systems, estuarine systems, lakes, headlands, rock platforms and floodplains. Includes Jervis Bay and St Georges Basin.

**CHARACTERISTICS OF THE COASTAL PLAINS PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (98%); Acid/Intermediate Volcanics and Intrusives (2%) |
| **Soils** | Yellow and Red Texture Contrast Soils (64%); Deep Structured Red Clay Loams (25%); Well Structured Red and Brown Earths (6%); Massive Black and Grey Clays (3%); Siliceous Dune Sands (2%) |
| **1750 Vegetation** | Coastal *E.pilularis* Forests 71%; Coastal Heath Complex 22%; Anomalous Coastal Shoalhaven Valley (*Banksia integrifolia, B.serrata*) 13% |
| **Present-day Cover** | Dry Forest and Woodlands (40%); Moist Forest (5%); Water Bodies (7%); Coastal Complex, Plateau Complex (22%); Disturbed Forests, Urban (8%); Cleared (18%) |
| **Conservation Areas** | Comerong Island NR (23ha); Conjola NP (590ha); Cudmirrah NP (1548ha); NSW Jervis Bay NP (865ha); Murramarang Aboriginal Area (56ha); Murramarang NP (697ha); Narrawallee Ck NR (233ha); Seven Mile Beach NP (882ha) TOTAL 17.5% |

**4Cb Coastal Hills Province (122973ha)**

Plainsland and low hills beyond and at the coast between Kiama and Durras, including Nowra. Coastal lowlands at the lower foothills of the Budawang Range. Includes the lower reaches of the Shoalhaven River.

**CHARACTERISTICS OF THE COASTAL HILLS PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (94%); Acid/Intermediate Volcanics and Intrusives (6%) |
| **Soils** | Yellow and Red Texture Contrast Soils (63%); Well Structured Red and Brown Earths (23%); Massive Red and Yellow Earths (8%); Shallow Loams (2%); Stony Sandy Loams (4%) |
| **1750 Vegetation** | *E.maculata* Forests 41%; Coastal *E.pilularis* Forests 34% |
| **Present-day Cover** | Dry Forest and Woodlands (48%); Moist Forest (5%); Water Bodies (5%); Coastal Complex (4%); Disturbed Forests (6%); Cleared (32%) |
| **Conservation Areas** | Barren Grounds NR (112ha); Black Ash NR (96ha); Comerong Island NR (168ha); Conjola NP (457ha); Cudmirrah NP (646ha); Devils Glen NR (9ha); NSW Jervis Bay NP (2251ha); Morton NP (450ha); Murramarang NP (4ha); Narrawallee Creek NR (430ha); Rodway NR (85ha); Seven Mile Beach NP (1ha); Yalleyattah NR (19ha) TOTAL 3.8% |

**4D GOULBURN RIVER MOUNTAINS SUB-REGION (3080 km2)**

Located in the northern part of the Region, the Goulburn River Mountains Sub-Region covers the mountainous country associated with the Goulburn River between Muswellbrook and Wollar. The landscape is irregular plateaux and ridges broken by steep-sided valleys (gorges), or, where less resistant Permian rocks occur, wide valleys with undulating lowlands fringed by steep escarpments. The overall relief for this Sub-Region is 180-360m. There are no Provinces in this Sub-Region.

**CHARACTERISTICS OF THE GOULBURN RIVER MOUNTAINS SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Mesozoic Sediments (62%); Palaeozoic Sediments (37%); Basic Volcanics and Lavas (1%) |
| **Soils** | Stony Sandy Loams (60%); Massive Red and Yellow Earths (17%); Yellow and Red Texture Contrast Soils (16%); Shallow Black Self-Mulching Clays (5%); Deep Black Cracking Clays (2%) |
| **Present-day Cover** | Degraded Grasslands (2%); Dry Forests and Woodlands (42%); Non-forest Systems (31%); Disturbed Forests (25%) |
| **Conservation Areas** | Goulburn River NP (52399ha); Manobalai NR (3761ha); Munghorn Gap NR (1343ha); Wollemi NP (72037ha) TOTAL 42.1% |

goulburnrivmtnsub

**4E GOULBURN RIVER HILLS SUB-REGION (938 km2)**

Located to the west of Goulburn River Mountains Sub-Region, but characterised by low hills and plainsland (Relief 30-90m). Characterised by undulating hills with some low steep-sided palaeodrainage systems. Includes Ulan and Gulgong and the easterly flowing Goulburn River and the westerly flowing Talbragar River.

**CHARACTERISTICS OF THE GOULBURN RIVER HILLS SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Mesozoic Sediments (53%); Palaeozoic Sediments (41%); Acid/Intermediate Intrusives (6%) |
| **Soils** | Stony Sandy Loams (6%); Massive Red and Yellow Earths (63%); Yellow and Red Texture Contrast Soils (16%); Deep Black Cracking Clays (13%); Stony Sandy Loams (6%) |
| **Present-day Cover** | Degraded Grasslands (1%); Dry Forests and Woodlands (39%); Non-forest Systems (22%); Disturbed Forests (38%) |
| **Conservation Areas** | Goulburn River NP (16602ha); Munghorn Gap NR (4584ha) TOTAL 22.6% |

**goulburnrivhillsub**

**4F CUMBERLAND PLAIN SUB-REGION (3873 km2)**

The Cumberland Plain Sub-Region is located between the coast at Sydney and the foothills of the Blue Mountains as far as Blaxland. The southern limits of the Sub-Region are north of Wollongong and Camden, and the northern limits are at Palm Beach on the coast and Hornsby and Richmond further inland. The Sub-Region occupies 9% of the Region.

The defining landform for the Cumberland Plain are low hills, low dissected plateaux and low escarpment and ridges (relief 30-90m) i.e. the landform within the Sub-Region is not plainsland, but of a higher relief. To be accurate, the Sub-Region should be called Cumberland Hills, but the term “Plains” is part of an accepted terminology.

The Nepean-Hawkesbury River affects the northern part of the Sub-Region, with dissected plateaux and valleys in this area. Isolated portions of the Sub-Region form prominant hills in the north e.g.Terry Hills, Mt Coolah, Hornsby Plateau, and in the south-east e.g. Woranora Plateau. Warragamba Dam is within the Sub-Region.

The Sub-Region can be described as gently rolling; rounded hilly and steep hilly country in a large basin formed by the Blue Mountains and Illawarra Mountains Sub-Regions. The ridge and valley country has gently undulating ridge tops and steep side slopes, often with slumping in the south. There are some sleep slopes and broad valleys in centre and north of the Sub-Region.

# cumberlandplainsubCHARACTERISTICS OF THE CUMBERLAND PLAIN SUB-REGION

|  |  |
| --- | --- |
| Geology | Mesozoic Sediments (100%) |
| **Soils** | Stony Sandy Loams (38%); Yellow and Red Texture Contrast Soils (39%); Deep Friable Red and Brown Clays (15%); Deep Alluvial Loams (6%); Siliceous Dune Sands (2%) |
| **Vegetation** | Dry forests (e.g. Turpentine-Ironbark Forests) and Sydney Sandstone heaths, woodlands and forests, with some small patches of moister vegetation in sheltered valleys[[26]](#footnote-26) |
| **Present-day Cover** | Urban (24%); Disturbed Forests (22%); Dry forest and Woodland (27%); Moist Forest (7%); Non-forest systems (15%); Plateau Complex (2%); Water Bodies (1%) |
| **Conservation Areas** | Agnes Banks NR (109ha); Burragorang SRA (542ha); Castlereagh NR (456ha); Cattai NP (288ha); Dharawal SRA (4767ha); Garigal NP (2ha); Garawarra SRA (703ha); Georges River NP (350ha); Gulguer NR (354ha); Heathcote NP (2357ha); Illawarra Escarpment SRA (136ha); Ku-ring-gai Chase NP (2334ha); Lane Cove NP (591ha); Parr SRA (4128ha); Pitt Town NR (44ha); Royal NP (7267ha); Scheyville NP (933ha); Sydney Harbour NP (230ha); Towra Point NR (15ha); Wallumatta NR (5ha); Windsor Downs NR (364ha); Wollemi NP (9445ha); Rouse Hill Regional Park (43ha); Parramatta RP (87ha); Penrith Lakes RP (1ha); Leacock RP (34ha); Bents Basin SRA (48ha); Berowra Valley RP (2197ha); Western Sydney RP (578ha); Georges River SRA (2ha) TOTAL 11.0% |

**4Fa Sydney Hills Province (45410ha)**

At a similar relief (30-90m) to Sydney Plains (4Fb), but at a higher altitude, this Province represents the lower slopes of the Blue Mountains. Low hills formed from the edges of the sandstone plateau, with level to undulating ridges. Nepean River forms the eastern boundary and Kurrajong and Blaxland at along the western boundary. Contains Warragamba Dam.

**CHARACTERISTICS OF THE SYDNEY HILLS PROVINCE**

|  |  |
| --- | --- |
| Geology | Mesozoic Sediments (100%) |
| **Soils** | Stony Sandy Loams (99%); Deep Friable Red and Brown Clays (1%) |
| **Vegetation** | Sydney Sandstone Heaths, Woodlands and Forests; Cumberland Plain Woodlands; Blue Gum gullies below sandstone ridges[[27]](#footnote-27) |
| **Present-day Cover** | Disturbed Forests (16%); Dry forest and Woodland (69%); Moist Forest (4%); Non-forest systems (10%); Water Bodies (1%) |
| **Conservation Areas** | Blue Mountains NP (3278ha); Burragorang SRA (542ha); Wollemi NP (9445ha); Parr SRA (4128ha) TOTAL 38.3% |

**4Fb Sydney Plains Province (277311ha)**

Occupying the major part of the Sub-Region, this province extends from the Pacific Ocean to Nepean River (western boundary is Sydney Hills Province), and from Hornsby to Camden. The characteristic features are low undulating hills and ridges in a large basin. Ridge and valley country of gently undulating ridge tops and some steep sided slopes, often with slumping in the south. Forms part of the coastal landscape and includes Sydney Harbour and Botany Bay, with low undulating plains and steeper headlands.

**CHARACTERISTICS OF THE SYDNEY PLAINS PROVINCE**

|  |  |
| --- | --- |
| Geology | Mesozoic Sediments (100%) |
| **Soils** | Stony Sandy Loams (17%); Yellow and Red Texture Contrast Soils (52%); Deep Friable Red and Brown Clays (21%); Deep Alluvial Loams (8%); Siliceous Dune Sands (2%) |
| **Vegetation** | Sydney Sandstone Heaths, Woodland and Forests; Turpentine-Ironbark Forests; Estuarine Complex, Cumberland Plain Woodlands26 |
| **Present-day Cover** | Urban (24%); Disturbed Forests (45%); Dry forest and Woodland (14%); Moist Forest (1%); Coastal Complex (15%) |
| **Conservation Areas** | Agnes Banks NR (109ha); Blue Mountains NP (564ha); Castlereagh NR (456ha); Cattai NP (288ha); Garigal NP (2ha); Georges River NP (26ha); Gulguer NR (354ha); Ku-ring-gai Chase NP (2334ha); Lane Cove NP (591ha); Mulgoa NR (137ha); Pitt Town NR (44ha); Scheyville NP (933ha); Sydney Harbour NP (230ha); Wallumatta NR (5ha); Windsor Downs NR (364ha); Rouse Hill Regional Park (43ha); Parramatta RP (87ha); Penrith Lakes RP (1ha); Leacock RP (34ha); Berowra Valley RP (2197ha); Western Sydney RP (578ha); Bents Basin SRA (48ha) TOTAL 3.4% |

**4Fc Royal Province (67215ha)**

A small province in the southern end of the Sub-Region characterised by low hills and undulating dissected sandstone plateaux with ledges, cliffs and narrow sandy valleys. Covers the country from the southern shores of Botany Bay to north of Wollongong, including Port Hacking and Helensburgh.

**CHARACTERISTICS OF THE ROYAL PROVINCE**

|  |  |
| --- | --- |
| Geology | Mesozoic Sediments (100%) |
| **Soils** | Shallow Loams (3%); Stony Sandy Loams (85%); Yellow and Red Texture Contrast Soils (9%); Well Structured Red and Brown Earths (3%) |
| **Vegetation** | Sydney Sandstone heaths, woodlands and forests, with patches of open forest associated with Wianamatta Shale and moister gully vegetation |
| **Present-day Cover** | Urban (10%); Disturbed Forests (14%); Dry forest and Woodland (26%); Moist Forest (35%); Coastal Complex (12%); Water Bodies (3%) |
| **Conservation Areas** | Dharawal NR (368ha); Dharawal SRA (4767ha); Garawarra SRA (703ha); Georges River NP (324ha); Illawarra Escarpment SRA (136ha); Royal NP (7267ha); Georage River SRA (2ha); Heathcote NP (2357ha); Towra Point NR (15ha) TOTAL 22.2% |

**4G BROKEN BAY SUB-REGION (1351 km2)**

This Sub-Region is associated with the steep cliffs and hills surrounding Broken Bay, north of Sydney. Broken Bay is the outlet for the Hawkesbury River and the Sub-Region has many characteristics of the coast. Brisbane Waters form part of the Sub-Region, which extends west nearly to Wisemans Ferry. The Pacific Highway passes through the Sub-Region, crossing Hawksbury River at Brooklyn. Major towns in the Sub-Region include Gosford, Ourimbah and Woy Woy. The Sub-Region occupies 4% of the Region.

The defining landform is dissected plateau and hills of moderate relief (90-180m). The Sub-Region is described as a dissected sandstone plateau of moderate to strong relief with sandstone pillars and ledges, and level to undulating ridges, with some steep ridges, cliffs, canyons and narrow sandy valleys. There are also some minor river flats and terraces, and small alluvial plains and minor floodplain landforms. There are no provinces in this Sub-Region.

**CHARACTERISTICS OF THE BROKEN BAY SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Mesozoic Sediments (100%) |
| **Soils** | Stony Sandy Loams (66%); Deep Structural Red Clay Loams (14%); Deep Friable Red and Brown Clays (6%); Massive Red and Yellow Earths (6%); Shallow Loams (5%);Deep Alluvial Loams (2%); Well Structured Red and Brown Earths (1%) |
| **Vegetation** | Sydney Sandstone Heaths, Woodland and Forests; Estuarine Complex |
| **Present-day Cover** | Disturbed Forests (18%); Dry forest and Woodland (26%); Moist Forest and Rainforest (23%); Non-forest systems (18%); Plateau Complex (7%); Water Bodies (1%); Urban (7%) |
| **Conservation Areas** | Bouddi NP (82ha); Brisbane Water NP (10303ha); Cattai NP (145ha); Dalrymple-Hay NR (11ha); Dharug NP (1344ha); Garigal NP (2267ha); Howe Aboriginal Area (7ha); Marramarra NP (10948ha); Kur-ring-gai Chase NP (12676ha); Mooney Mooney Aboriginal Area (9ha); Muogamarra NR (2593ha); Pelican Island NR (51ha); Popran NP (638ha); Rileys Island NR (29ha); Wamberal Lagoon NR (135ha); Wyrrabalong NP (71ha); Berowra Valley RP (1392ha); Cockle Bay NR (23ha); Garawarra SRA (183ha); Wambina NR (50ha) TOTAL 31.8% |

**brokenbaysub4H BRAIDWOOD PLAINS SUB-REGION (319 km2)**

Braidwood Plains is a small narrow Sub-Region (1% of the Region) located south and west of the Blue Mountains Peaks Sub-Region. The northern boundary is near Oakdale, and the southern boundary is east of Bowral. The northern part of the Sub-Region is associated with Nattai River floodplains, whilst the southern part is associated with the undulating to hilly plateau complex at Moss Vale.

The Sub-Region is characterised by flat to undulating country with low rises, knolls and ridges, as well as swampy depressions and valleys. The relief is plainsland (5-30m) and low hills (30-90m). There are no provinces in this Sub-Region.

# CHARACTERISTICS OF THE BRAIDWOOD PLAINS SUB-REGION

|  |  |
| --- | --- |
| Geology | Palaeozoic Sediments (80%); Basic Volcanics and Lavas (12%); Acid/Intermediate Volcanics and Intrusives (8%). |
| **Soils** | Yellow and Red Textured Contrast Soils (60%); Shallow Loams (26%); Deep Structured Red Clay Loams (10%); Well Structured Red Clay Loams (4%) |
| **Vegetation** | Communities are mainly those associated with sandstone i.e dry forests and heaths, with some moister forests in the narrow valleys[[28]](#footnote-28) |
| **Present-day Cover** | Dry Forests and Woodlands (38%); Degraded Grassland (19%); Disturbed Forest (28%); Exotic Forest (2%); Non-forest System (13%) |
| **Conservation Areas** | Nattai NP (158ha); Morton NP (1093ha) TOTAL 3.9% |

**braidwoodplainsub4I BLUE MOUNTAINS PEAKS SUB-REGION (895 km2)**

Blue Mountains Peaks is a relatively small narrow Sub-Region (2.5% of the Region) that is located between Katoomba and Oakdale. It is characterised by mountains of very high relief (relief greater than 360m), and is dissected by the Nattai, Cox and Kowmung Rivers. It is basically a series of gorges formed by the three rivers and forms part of Lake Burragorang. There are steep cliff-lines, canyons, sandstone pillars, ledges, steep ridges, perched seasonally swampy basins, canyons and narrow sandy valleys (some inundated by Warragamba Dam).

# CHARACTERISTICS OF THE BLUE MOUNTAINS PEAKS SUB-REGION

|  |  |
| --- | --- |
| Geology | Palaeozoic Sediments (60%); Mesozoic Sediments (27%); Acid/Intermediate Volcanics and Intrusives (13%) |
| **Soils** | Shallow Loams (70%); Stony Sandy Loams (16%); Massive Red and Yellow Earths (6%); Yellow and Red Texture Contrast Soils (8%) |
| **Vegetation** | Sydney Sandstone Heaths, Woodlands and Forests; Cumberland Plain Woodlands; Shrub-Swamp & Sedge-Swamp; River-flat Forests with some moister forests in the narrow valleys26 |
| **Present-day Cover** | Dry Forest and Woodlands (72%); Moist Forest (9%); Disturbed Forest (7%); Rocky Complex (6%) |
| **Conservation Areas** | Blue Mountains NP (55142ha); Burragorang SRA (2573ha); Kanangra-Boyd NP (576ha); Nattai NP (1590ha); Nattai SRA (3256ha); Yarranderie SRA (3813ha) TOTAL 75% |

**bluemtnspeaksub4J BLUE MOUNTAINS SUB-REGION (13488 km2)**

The largest of the Sub-Regions, Blue Mountains occupies 20% of the Region. The Sub-Region includes land as far south as Bowral and north to Bylong. As well as including the main “Blue Mountains” area i.e. Katoomba to Blaxland, the Sub-Region also includes much of the Great Dividing Range in the Wollemi district, and part of the Southern Tablelands and Illawarra Escarpment near Wollongong.

The Blue Mountains Sub-Region is characterised by high mountains (relief 180-360m), as well as high (relief 180-360m) and very high (relief greater than 360m) dissected plateaux. There are several mountain peaks in the Sub-Region, particularly in the northern part, including Mount Monundilla (1108m), Mount Coricudgy (1257m), Mount Kindarun (746m), and Mount Victoria. The Sub-Region is dissected by many rivers, including the Capertree, Colo, Nattai and Nepean Rivers. There are several dams in the Sub-Region (Warragamba Dam, Avon Dam, Cordeaux Dam and Cataract Dam).

The Sub-Region can be described as dissected sandstone plateaux of moderate to high relief and altitude, with sandstone pillars, ledges, steep ridges, cliffs, perched seasonally swampy basins, canyons and narrow sandy valleys. There are also some level to undulating ridges, and irregularly benched slopes.

**CHARACTERISTICS OF THE BLUE MOUNTAINS SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Mesozoic Sediments (93%); Palaeozoic Sediments (7%) |
| **Soils** | Stony Sandy Loams (83%); Massive Red and Yellow Earths (7%); Shallow Loams (6%); Deep Friable Red and brown Clays (2%); Shallow Back Self-Mulching Clays (2%) |
| **Vegetation** | Sandstone Plateau Forest; Sydney Sandstone heath, woodland and forests; Cumberland Plains Woodland; River Flat Forests; Turpentine-Ironbark Forests; Wollemi Sandstone Woodland; Newnes Plateau Woodland; Talus Slope and Permian Valley Woodlands; Heath and Mallee; Shrub-Swamp and Sedge Swamp[[29]](#footnote-29). |
| **Present-day Cover** | Dry Forest and Woodlands (60%); Moist Forest (7%); Rocky Complex (5%); Non-forest Systems (10%); Disturbed Forest (12%); Urban (1%); Plateau Complex (3%) |

|  |  |
| --- | --- |
| **Conservation Areas** | Appletree Aboriginal Area (4ha); Bargo SRA (5280ha); Blue Mountains NP (120627ha); Brisbane Water NP (211ha); Burragorang SRA (14337ha); Dharawal SRA (982ha); Dharug NP (13866ha); Finchley Aboriginal Area (5ha); Gardens of Stone NP (7339ha); Illawarra Escarpment SRA (223ha); Macquarie Pass NP (162ha); Maroota Historic Site (32ha); Nattai SRA (42ha); Parr SRA (31512ha); Popran SRA (2970ha); Thirlmere Lakes NP (640ha); Wisemans Ferry Historic Site (20ha); Wollemi NP (409295ha); Yengo NP (163700ha); Yerranderie SRA (3172ha); Nattai NP (34004ha); Watagans NP (5889ha); William Howe Regional Park (44ha) TOTAL 60.4% |

bluemtnsub**4Ja Blue Mountains West Province (438084ha)**

Steep to very steep (relief 180m to above 360m) sandstone plateaux and mountains with an altitude generally above 500m. Dissected sandstone plateau with sandstone pillars, ledges, slabs, steep ridges, cliffs, canyons and narrow sandy valleys. Located in the west of the Sub-Region from Katoomba north to Bylong and west to include Newnes, Bilpin and Kandos. Includes eroded sandstone “pagodas” and the upper catchments of Cudgegong and Turon Rivers (flow westwards) and Capertree River (flows eastwards).

**CHARACTERISTICS OF THE BLUE MOUNTAINS WEST PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Mesozoic Sediments (84%); Palaeozoic Sediments (16%) |
| **Soils** | Stony Sandy Loams (78%); Massive Red and Yellow Earths (12%); Shallow Loams (4%); Deep Structured Red Clay Loams (1%); Shallow Back Self-Mulching Clays (2%); Yellow and Red Texture Contrast Soils (3%) |
| **Vegetation** | Sandstone Plateau Forest; Sydney Sandstone heath, woodland and forests; Cumberland Plains Woodland; River Flat Forests; Turpentine-Ironbark Forests; Wollemi Sandstone Woodland; Newnes Plateau Woodland; Talus Slope and Permian Valley Woodlands; Heath and Mallee; Shrub-Swamp and Sedge Swamp[[30]](#footnote-30). |
| **Present-day Cover** | Dry Forest and Woodlands (63%); Moist Forest (7%); Exotic Forests (7%); Non-forest Systems (23%); |
| **Conservation Areas** | Blue Mountains NP (73841ha); Gardens of Stone NP (7339ha); Wollemi NP (255539ha) TOTAL 76.9% |

**4Jb Blue Mountains East Province (910749ha)**

Predominantly steep (relief 180-360m) with some very steep (relief more than 360m) mountains and plateaux, generally below 500m altitude. Dissected sandstone plateaux with sandstone pillars, ledges, slabs, steep ridges, cliffs, canyons and narrow sandy valleys. Also includes the western “lip” of the Cumberland Basin at Camden. Located in the east of the Sub-Region between Bowral and Howes Valley, and including Blaxland, St Albans and Wollombi. Colo River, MacDonald River and Lake Burragorang are also in this Province.

**CHARACTERISTICS OF THE BLUE MOUNTAINS EAST PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Mesozoic Sediments (98%); Palaeozoic Sediments (2%) |
| **Soils** | Stony Sandy Loams (78%); Massive Red and Yellow Earths (3%); Shallow Loams (6%); Deep Friable Red and Brown Clays (2%); Shallow Black Self-Mulching Clays (1%); Deep Alluvial Loams (1%); Deep Friable Red and Brown Clays (2%); Red Brown Earths (1%); Yellow and Red texture Contrast Soils (8%) |
| **Vegetation** | Sandstone Plateau Forest; Sydney Sandstone heath, woodland and forests; Cumberland Plains Woodland; River Flat Forests; Turpentine-Ironbark Forests; Wollemi Sandstone Woodland; Newnes Plateau Woodland; Talus Slope and Permian Valley Woodlands; Heath and Mallee; Shrub-Swamp and Sedge Swamp[[31]](#footnote-31). |
| **Present-day Cover** | Dry Forest and Woodlands (59%); Moist Forest (7%); Rocky Complex (2%); Non-forest Systems (14%); Disturbed Forest (16%); Urban (1%); Plateau Complex (1%) |
| **Conservation Areas** | Appletree Aboriginal Area (4ha); Bargo SRA (5280ha); Blue Mountains NP (46786ha); Brisbane Water NP (211ha); Burragorang SRA (14337ha);  Dharawal SRA (982ha); Dharug NP (13866ha); Finchley Aboriginal Area (5ha); Illawarra Escarpment SRA (223ha); Macquarie Pass NP (162ha); Marramarra NP (383ha); Maroota Historic Site (32ha); Nattai SRA (42ha); Nattai NP (34004ha); Parr SRA (31513ha); Popran SRA (2970ha); Thirlmere Lakes NP (640ha); Wisemans Ferry Historic Site (20ha); Watagans NP (5889ha); William Howe RP (44ha); Wollemi NP (153755ha); Yengo NP (163700ha); Yerranderie SRA (3172ha).  TOTAL 52.5% |

**4K BATHURST MOUNTAINS SUB-REGION (933 km2)**

## This relatively small Sub-Region (3% of the Region) is located on the western side of the Great Dividing Range. Its southern boundary is near Ben Bullen, and its northern boundary is south of Gulgong. The Sub-Region includes Kandos and Glen Alice, and Rylstone is on the western boundary. Capertree River drains east through Bathurst Mountains, and Cudgegong River drains west into Windemere Dam.

The Bathurst Mountains Sub-Region is characterised by high mountains (relief 180-360m), high (relief 180-360m) and very high (relief greater than 360m) dissected plateaux. The Sub-Region is mainly dissected by Capertree River. The Sub-Region can be described as rugged ranges in a series of stepped undulating to hilly ridges with steep sided slopes. Steep slopes above entrenched steams with very narrow floodplains. Undulating to hilly ridge tops (plateaux tracts) have perched seasonally swampy basins and/or valleys.

**CHARACTERISTICS OF THE BATHURST MOUNTAINS SUB-REGION**

|  |  |
| --- | --- |
| Geology | Palaeozoic Sediments (99%); Mesozoic Sediments (1%) |
| **Soils** | Yellow and Red Texture Contrast Soils (60%); Massive Red and Yellow Earths (22%); Stony Sandy Loams (11%); Shallow Black Self-Mulching Clays (5%); Shallow Loams (2%) |
| **Vegetation** | Valley Woodlands on Permian sediments; Valley Woodlands on Devonian sediments and Woodland on talus slopes[[32]](#footnote-32) |
| **Present-day Cover** | Disturbed Forests and Woodlands (60%); Dry Forest and Woodland (20%); Degraded Grassland (10%); Non-forest System (5%); Plateau Complex (3%); Water Bodies (2%) |
| **Conservation Areas** | Wollemi NP (7376ha); Gardens of Stone NP (312ha) TOTAL 8.3% |

**bathurstmtnsubIBRA REGION 5: NORTH COAST (57311 km2)**

The North Coast Region is located between the Queensland border and Newcastle, and covers the coastline, coastal lowlands, and part of the Great Escarpment and the tablelands to the west. Although named “Coast”, this Region extends more than 120 km inland, and covers many of the catchments of eastward-flowing rivers, as well as the upper catchments of some westward-flowing rivers.

The bedrock geology is dominated by Palaeozoic and Mesozoic Sediments, and is shown in the main rock types including sandstone, siltstone, shale and chert. Many of the soils are moderately fertile (Well Structured Red and Brown Earths, Yellow and Red Texture Contrast Soils), with examples of soils associated with floodplains (e.g. alluvial loams, clays) and coastal dunes (siliceous sands). According to Gretton and Salma[[33]](#footnote-33), 31.8% of the Region is native and voluntary pastures, 10.6% is improved pastures and croplands, and 54.2% is described as “Parks, timber and shrub lands”. The proportions of soil types and rock types in the Sydney Basin Region are given in Table 5, and the location of this Region, with the Sub-regions is shown in the following map. There are 10 Sub-Regions and 18 Provinces in the North Coast Region.

**TABLE 5: Soil Types and Rock Types in North Coast Region**

**SOIL TYPES:**

Shallow Loams 14%

Yellow and Red Texture Contrast Soils 36%

Deep Structured Red Clay Loams 7%

Massive Red and Yellow Earths 1%

Deep Black Cracking Clays 1%

Deep Alluvial Loams 1%

Deep Friable Red and Brown Clays 1%

Massive Black and Grey Coastal Clays 4%

Siliceous Dune Sands 1%

Well Structured Red and Brown Earths 30%

**ROCK TYPES:**

Sandstone, siltstone, shale, chert, limestone (Palaeozoic Sediments) 61%

Sandstone, siltstone, mudstone (Mesozoic Sediments) 21%

Acid and intermediate volcanics and pyroclastics 10%

Basic volcanics and lavas (basalts) 8%

# northcoastKEY TO SUB-REGIONS AND PROVINCES OF THE NORTH COAST IBRA REGION

|  |  |  |  |
| --- | --- | --- | --- |
|  | SUB-REGIONS |  | PROVINCES |
| Relief: 30-180m. Low to moderate hills, with dissected plateau and some high mountains | **URBENVILLE HILLS** | Undulating to hilly coastal uplands with some areas of steep hilly to rugged terrain (Clarence) | RICHMOND 5Aa |
|  |  | Flat to undulating range crests flanked by hilly floodplains with some steep hilly to mountainous terrain (Urbenville and Lofty) | **BOONOO 5Ab** |
| Relief: 180-360m. High mountains and ridges and dissected basalt plateau | **RICHMOND MOUNTAINS** | Undulating to hilly dissected basalt plateau with some steep slopes and scarps (Lamington) | **KYOGLE 5Ba** |
|  |  | Undulating to hilly coastal uplands with areas of steep hilly to rugged terrain and steep valleys (Clarence) | **CASINO 5Bb** |
| Relief: 5-90m. Undulating to gently hilly lowlands and alluvial flats | **HUNTER VALLEY** | Associated with the coast at Port Stephens, smooth and undulating plainsland (Hunter) | **PORT STEPHENS 5Ca** |

|  |  |  |  |
| --- | --- | --- | --- |
|  | SUB-REGIONS |  | PROVINCES |
|  | **HUNTER VALLEY** | Gently hilly lowlands and alluvial flats on sedimentary rock associated with the Hunter River (Hunter) | **HUNTER RIVER 5Cb** |
| Relief: 90-360m. Moderate hills and high mountains to the north of Hunter River | **HUNTER NORTH** | Isolated steep range with a high undulating summit plateau on Tertiary basalt (Barrington) | **BARRINGTON RANGE 5Da** |
|  |  | Mountainous country derived from resistant sedimentary rocks, with a dissected plateau flank of steep hills, ridges and valleys to the north (Hunter and Wallabadah) | **HUNTER MOUNTAINS 5Db** |
| Relief: 180-360m. High and very high steep mountains and plateau dissected by valleys | **HASTINGS UPLANDS** | Plateau on Miocene Volcanics with steep valleys outcrops (Dorrigo) | **WERRIKIMBE 5Ea** |
|  |  | Plateau flank dissected into narrow strike ridges and valleys with outliers of basalt-capped rises, and steep hills at base of Great Escarpment (Gloucester and Hunter) | **OXLEY ESCARPMENT 5Eb** |

|  |  |  |  |
| --- | --- | --- | --- |
|  | SUB-REGIONS |  | PROVINCES |
| Relief: 5-90m. Floodplains and low hills associated with coastal rivers | **HASTINGS LOWLANDS** | Lowlands, low hills and barrier beaches along the coast between Forster and Coffs Harbour (Hastings) | **MID NORTH COAST 5Fa** |
|  |  | Low hills at the base of the Great Escarpment (Gloucester) | **GLOUCESTER 5Fb** |
| Relief: 180-360m. High steep mountains and deeply dissected terrain on edge of north-eastern escarpment | **CLARENCE UPLANDS** | Steep hilly to mountainous terrain; deeply dissected; some remnants of old gently undulating landscapes. Steep scarps and gorges associated with edge of Great Escarpment (Lofty) | **CLARENCE UPLANDS 5G** |
| Relief: 5-180m. Plainsland and low to moderate hills | **CLARENCE LOWLANDS** | Undulating to hilly coastal uplands with river floodplain and coastal landforms (Clarence) | **GRAFTON 5Ha** |
|  |  | Undulating to hilly basalt plateaux and plateau remnants (Lamington) | **BANGALOW 5Hb** |

|  |  |  |  |
| --- | --- | --- | --- |
|  | SUB-REGIONS |  | PROVINCES |
| Relief: 5-90m. Undulating and smooth plainsland with scattered linear dunes | **CLARENCE COAST** | River floodplains, coastal dunes, swamps and lakes and other coastal landforms (Clarence) | **CLARENCE COAST 5I** |
| Relief: 180-360m. High steep mountains and narrow valleys, with dissected basalt plateau | **BORDER RANGES** | Basalt plateaux and plateau remnants with steep slopes and scarps (Lamington) | **McPHERSON 5Ja** |
|  |  | Steep hilly country with narrow valleys part of remnants of large volcanic complex (Tweed) | **TWEED 5Jb** |

**5A URBENVILLE HILLS SUB-REGION (6071 km2)**

Urbenville Hills occupies 10% of the Region, and is located between the Queensland border and Whiporie, north of Grafton. The Sub-Region is traversed by two major highways (Bruxner and Lindsey Highways), but it is sparsely populated. There are several small towns in the Sub-Region (e.g. Urbenville, Tabulam, Woodenbong, Coaldale, Bonalbo).

The major features are the Richmond Range; upper catchment for the Clarence River, two highways and several small towns (see above); several mountain peaks e.g. Mt Marsh (502m), Mt Neville (552m), Edinburgh Castle.

The major landform is low (relief 30-90) to moderate (relief 90-180m) hills and dissected plateaux, with a small amount of high mountains (relief 180-360m) in the north of the Sub-Region. Undulating to hilly uplands with some areas of steep hilly to rugged terrain (dissected plateau). Intervening valleys and swampy areas in undulating areas. Flat to undulating range crests flanked by hilly to steep hilly narrow creek and river floodplains.

**CHARACTERISTICS OF THE URBENVILLE HILLS SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Mesozoic Sediments (69%); Palaeozoic Sediments (6%); Acid and intermediate volcanics and pyroclastics (16%); Basic Intrusives (2%); Basic volcanics and lavas (7%) |
| **Soils** | Deep Structured Red Clay Loams (1%); Well Structured Red and Brown Earths (36%); Yellow and Red Texture Contrast Soils (58%); Deep Black Cracking Clays (2%); Shallow Loams (4%) |
| **Vegetation** | Grassy, dry open forests with some development of moist open forest and dry rainforest thickets on protected or moister sites; Dry to moist open forest |
| **Present-day Cover** | Cleared (39%); Dry forests (24%); Disturbed forests and woodlands (17%); Exotic plantations (11%); Moist forest and rainforest (9%) |
| **Conservation Areas** | Border Ranges NP (754ha); Toolom NP (4376ha); Toonumbar NP (12316ha); Boonoo Boonoo NP (3811ha); Mt Neville NR (5796ha); Banyabba NR (10375ha); Captain Creek NR (2291ha); Koreelah NP (5070ha); Mt Clunie NP (1414ha); Mt Nothofagus NP (2166ha); North Obelisk NR (36ha); Richmond Range NP (15428ha); Yabbra NP (8862ha); Chapmans Peak NR (71ha); Hogarth Range NR (853ha); Mallangonee NP (1144ha); Mt Pikapene NP (2628ha) TOTAL 12.9% |

urbanvillehillsub**5Aa Richmond Province (319731ha)**

## Located in the southern half of the Sub-Region, Richmond Province is characterised by undulating to hilly coastal uplands with some areas of steep hilly to rugged terrain. Intervening valleys and swampy areas in undulating areas and steep-sided valleys in more rugged terrain. The Province is located between Whiporie and Bonalbo in the Richmond Range and there are several moderately high mountains (Mt Neville, 552m; Mt Marsh, 502m). The upper catchment for the Richmond River is within this province, whilst the Clarence River is part of the western boundary.

# CHARACTERISTICS OF THE RICHMOND PROVINCE

|  |  |
| --- | --- |
| **Geology** | Mesozoic Sediments (89%); Palaeozoic Sediments (3%); Acid and intermediate Intrusives (2%); Basic Intrusives (3%); Basic volcanics and lavas (3%) |
| **Soils** | Deep Structured Red Clay Loams 21%); Well Structured Red and Brown Earths (12%); Yellow and Red Texture Contrast Soils (78%); Deep Black Cracking Clays (1%); Shallow Loams (7%) |
| **1750 Vegetation** | Complex of grassy, dry open forest and moist open forest with a rainforest understorey (*Lophostemon confertus, E.Propinqua, Angophora subvelutina*) 13%; Grassy, dry sclerophyll forest (*E.henryi, E.siderophloia, E.tereticornis, E.maculata* )44%; Grassy, dry open forests merging with swamp forest and dry rainforest (*E.henryi, E.tereticornis, Lophostemon sauveolens*) 22%; Dry to moist open forest (*E.pilularis, Syncarpia glomulifera, A.woodsiana*) 15% |
| **Present-day Cover** | Cleared (44%); Dry forests (27%); Disturbed forests and woodlands (16%); Moist forest and rainforest (13%) |
| **Conservation Areas** | Toonumbar NP (4729ha); Mt Neville NR (5796ha); Banyabba NR (10375ha); Chapmans Peak NR (71ha); Fortis Creek NP (1217ha); Hogarth Range NR (853ha); Mallanganee NP (1144ha); Mt Pikapene NP (2628ha); Richmond Range NP (4225ha); Yabbra NP (3253ha)  TOTAL 10.7% |

5Ab Boonoo Province (287370ha)

Occupying the northern part of the Sub-Region, Boonoo Province is characterised by a hilly plateau with a rim of steep hills associated with the McPherson Ranges along the Queensland border. The plateau is described as flat to undulating range crests flanked by hilly narrow creek and river floodplains and composed of granite and Tertiary basalt. Richmond Range and the upper catchment of the Clarence river are part of this province.

**CHARACTERISTICS OF THE BOONOO PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Mesozoic Sediments (48%); Palaeozoic Sediments (9%); Acid/Intermediate volcanics (13%); Acid/Intermediate Intrusives (18%); Basic volcanics and lavas (12%) |
| **Soils** | Well Structured Red and Brown Earths (62%); Yellow and Red Texture Contrast Soils (35%); Deep Black Cracking Clays (3%) |
| **1750 Vegetation** | Grassy, dry open forest and moist forest with a rainforest understorey (*Lophostemon confertus, E.propinqua, A.subvelutina*) 39%; Grassy, dry open forests with some moist forest and dry rainforest thickets (*E.crebra, E.tereticornis, E.moluccana*) 31%; Grassy, cool dry open forest (*E.carnea, E.tereticornis, A.subvelutina*) 10% |
| **Present-day Cover** | Cleared (33%); Dry forests (20%); Disturbed forests and woodlands (16%); Moist forest and rainforest (30%); Rock (1%) |
| **Conservation Areas** | Border Ranges NP (754ha); Toolom NP (4376ha); Toonumbar NP (7587ha); Boonoo Boonoo NP (3811ha); Captains Creek NR (2291ha); Koreelah NP (5070ha); Mt Clunie NP (1414ha); Mt Nothofagus NP (2166ha); North Obelisk NR (36ha); Richmond Range NP (11203ha); Yabbra NP (5609ha) TOTAL 15.4% |

**5B** **RICHMOND MOUNTAINS SUB-REGION (2031 km2)**

Richmond Mountains adjoins the Border Ranges Sub-Region and occupies 3% of the Region. It is also within a high mountainous area, it is not as steep as the Border Ranges. This Sub-Region is within a relatively populous area, and contains several major towns (Lismore, Casino and Kyogle). This Sub-Region contains the upper catchment of Richmond River; as well as Bruxner Highway and the main northern rail.

The defining landforms are high mountainous ridges (relief 180-360m) formed from a dissected basalt plateau. The plateau surface is undulating to hilly with some steep slopes and scarps.

**CHARACTERISTICS OF THE RICHMOND MOUNTAINS SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Basic Volcanics and Lavas (67%); Mesozoic Sediments (33%) |
| **Soils** | Deep Friable Red and Brown Clays (4%); Deep Structured Red Clay Loams (48%); Well Structured Red and Brown Earths (3%); Yellow and Red Texture Contrast Soils (6%); Deep Black Cracking Clays (20%) |
| **Vegetation** | Moist open forest and subtropical or warm temperate rainforest; Subtropical rainforest on higher elevation basalt; Grassy, dry open forests |
| **Present-day Cover** | Cleared (70%); Moist forest and rainforest (17%); Disturbed forest (12%); Dry forest (1%) |
| **Conservation Areas** | Border Ranges NP (4494ha); Moore Park NR (13ha); Nightcap NP (1352ha); Wilson NR (27ha); Bungabbee NR (169ha); Mucklewee Mountain NR (354ha) TOTAL 3.2% |

**richmondmtnsub5Ba Kyogle Province (171785ha)**

This Province is part of the Northern Tablelands and includes Kyogle, Nimbin and Lismore. The Province is characterised by basaltic plateaux and plateau remnants of which the surface is hilly with steep slopes and scarps. The plateau edge has steep slopes that are often slumped, and small floodplains along the incised stream valleys.

**CHARACTERISTICS OF THE KYOGLE PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Basic Volcanics and Lavas (78%); Mesozoic Sediments (12%) |
| **Soils** | Deep Friable Red and Brown Clays (5%); Deep Structured Red Clay Loams (51%); Well Structured Red and Brown Earths (27%); Yellow and Red Texture Contrast Soils (2%); Deep Black Cracking Clays (15%) |
| **1750 Vegetation** | Moist open forest and subtropical or warm temperate rainforest (*Lophostemon confertus, E.grandis, Heritiera trifoliatum, Castanospermum australe*) 26%; Grassy, dry open forest and moist open forest with rainforest understorey (*L. confertus, E.propinqua, A.subvelutina*) 48%; Grassy, dry open forest merging with swamp forests (*E.henryi, E.tereticornis, L.sauveolens*) 11% |
| **Present-day Cover** | Cleared (65%); Moist forest and rainforest (30%); Disturbed forest (14%); Dry forest (1%) |
| **Conservation Areas** | Border Ranges NP (4494ha); Bungabbee NR (169ha); Moore Park NR (13ha); Mucklewee Mountain NR (354ha); Nightcap NP (1352ha); Wilson NR (27ha) TOTAL 3.7% |

# 5Bb Casino Province (31341ha)

A small province in the southern part of the Sub-Region, including Casino. The characteristic features are hilly uplands with some areas of steep hilly to rugged terrain. Intervening valleys and swampy areas and steep-sided valleys.

**CHARACTERISTICS OF THE CASINO PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Basic Volcanics and Lavas (96%); Mesozoic Sediments (4%) |
| **Soils** | Deep Structured Red Clay Loams (35%); Yellow and Red Texture Contrast Soils (25%); Deep Black Cracking Clays (40%) |
| **1750 Vegetation** | Grassy, dry open forest merging with swamp forests (*E.henryi, E.tereticornis, L.sauveolens*) 89%; Grassy, dry open forest and moist open forest with rainforest understorey (*L. confertus, E.propinqua, A.subvelutina*) 48% |
| **Present-day Cover** | Cleared (94%); Disturbed forest (6%) |
| **Conservation Areas** | None TOTAL 0% |

**5C HUNTER VALLEY SUB-REGION (2562 km2)**

The Hunter Valley is a long narrow Sub-Region associated with the lower reaches of the Hunter River. It occupies 4% of the Region, with its eastern boundary, the coastline north of Newcastle (Port Stephens, Nelson Bay), and its western boundary near Scone. Its major features are the Hunter Valley; the coastline at Port Stephens and Tea Gardens; towns such as Maitland, Singleton, Muswellbrook; and the Myall River.

The defining landforms are undulating or irregular plainsland (relief 5-30m) and low hills (relief 30-90m). An area of undulating to gently hilly lowlands, with large alluvial flats, developed on weak sedimentary rocks along the Hunter River.

**CHARACTERISTICS OF THE HUNTER VALLEY SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (81%); Acid/Intermediate Intrusives (19%) |
| **Soils** | Yellow and Red Texture Contrast Soils (53%); Shallow Loams (21%); Deep Alluvial Loams (6%); Massive Black and Grey Coastal Clays (6%); Siliceous Dune Sands (5%); Red Brown Earths (4%); Deep Black Cracking Clays (3%) |
| **Vegetation** | Dry open forest grading into moist forest; Low-lying, dry open forest on margins of swamp sclerophyll forest and low elevation, dry open forests |
| **Present-day Cover** | Coastal Complex (5%); Dry Open Forest (21%); Moist Forest (2%); Cleared (61%); Disturbed forests and woodlands (11%) |
| **Conservation Areas** | Myall Lakes NP (5184ha); Seaham Swamp NR (11ha); Moffats Swamp NR (73ha); Karuah NR (2401ha); Wallaroo NR (2220ha); Worimi NR (407ha) TOTAL 4.2% |

**huntervalleysub5Ca Port Stephens Province (43128ha)**

Coastal lowlands associated with Port Stephens and Nelson Bay, characterised by plainsland, dunes and beach barrier systems.

**CHARACTERISTICS OF THE PORT STEPHENS PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (84%); Acid/Intermediate Volcanics (16%) |
| **Soils** | Yellow and Red Texture Contrast Soils (71%); Siliceous Dune Sands (29%) |
| **1750 Vegetation** | Low elevation, dry open forests (*E.maculata, E.fibrosa, E.crebra, E.tereticornis*) 66%; Low lying, dry open forest on margins of swamp forest with heath (*E.piluparis, E.robusta, A.costata*) 27% |
| **Present-day Cover** | Coastal Complex (27%); Dry Open Forest (37%); Cleared (25%); Disturbed forests and woodlands (11%) |
| **Conservation Areas** | Myall Lakes NP (4931ha); Moffats Swamp NR (73ha); Karuah NR (343ha); Wallaroo NR (333ha); Worimi NR (407ha) TOTAL 14.1% |

**5Cb Hunter River Province (213116ha)**

Low hills and undulating plains associated with the lower reaches of the Hunter River, Myall River and Karuah River. Undulating to gently hilly lowlands developed on weak sedimentary rocks, with large alluvial flats along the Hunter River.

**CHARACTERISTICS OF THE HUNTER RIVER PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (69%); Acid/Intermediate Volcanics (31%) |
| **Soils** | Yellow and Red Texture Contrast Soils (12%); Shallow Loams (44%); Deep Alluvial Loams (13%); Massive Black and Grey Coastal Clays (14%); Shallow Black Self-mulching Clays (3%); Red Brown Earths (8%); Deep Black Cracking Clays (6%) |
| **1750 Vegetation** | Dry open forest (*E.pilularis, E.maculata, E.saligna*) 11%; Low elevation, dry open forests (*E.maculata, E.fibrosa, E.crebra, E.tereticornis*) 69%; Grassy, dry open forest with some dry rainforest (*E.melliodora, E.tereticornis, E.moluccana, E.laevopinea*) 13% |
| **Present-day Cover** | Coastal Complex (1%); Dry Open Forest (19%); Moist Forest (2%); Cleared (67%); Disturbed forests and woodlands (11%) |
| **Conservation Areas** | Myall Lakes NP (253ha); Seaham Swamp NR (11ha); Karuah NR (2058ha); Wallaroo NR (1887ha) TOTAL 2.0% |

**5D HUNTER NORTH SUB-REGION (8078 km2)**

Occupying 14% of the Region, Hunter North Sub-Region covers a series of high hills and muntain ranges to the north of the Hunter Valley Sub-Region.. The eastern boundary does not reach the coast, and Buladelah and Taree are at its eastern limits. The western limit of the Sub-Region is Murrurundi and Nundle, and the upper catchment for the Hunter River and many of the coastal rivers, including Manning River, is found in the Northern Hunter. Major features are Mount Royal Range, Barrington Tops and part of the Liverpool Range, and several coastal rivers e.g. Manning River, Myall River, Karuah River, Williams River; Dungog, Gloucester, Belltrees.

Defining landforms are high Mountains (relief 180-360m), with some hills of moderate relief (90-180m) in the eastern part, and some very high mountains (relief greater than 360m) in the western part of the Sub-Region. A tract of mountainous country developed on resistant sedimentary rocks, with a high summit plateau and dissected plateau flank. Flank composed of steep to very steep hills and ridges with narrow steep sided valleys. Plateau surface often capped by basalt.

**CHARACTERISTICS OF THE HUNTER NORTH SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (77%); Basic Volcanics and Lavas (11%); Acid/Intermediate Intrusives and Volcanics (12%) |
| **Soils** | Well Structured Red and Brown Earths (35%); Yellow and Red Texture Contrast Soils (26%); Shallow Loams (22%); Deep Structured Red Clay Loams (8%); Shallow Black Self Mulching Clays (7%) |
| **Vegetation** | Dry open forest at low elevation grading into high elevation moist open forest; Warm temperate rainforest complex, incorporating moist open forest ecotones; Predominantly moist open forest; Swampy open forest merging with dry to moist open forests; Grassy, dry to moist open forest; sub-alpine dry open forest and woodland grading into moist open forest and cool temperate rainforest |
| **Present-day Cover** | Moist forest (35%); Sub-alpine Woodland (13%); Disturbed forests and woodlands (18%); Cleared (47%) |
| **Conservation Areas** | Ben Halls Gap NP (1566ha); Wallabadah NR (499ha); Woko NP (1610ha); Camerons Gorge NR (1294ha); Barrington Tops NP (74168ha); Mt Royal Np (6968ha); Monkerai NR (866ha); Running Ck NR (909ha); Killarney NR (435ha); Mernot NR (320ha); Mankeycot NR (181); Monkerai NR (301ha); Nowendoc NP (2513ha); Tomalla NR (602ha); Wallaroo NR (564ha)  TOTAL 11.6% |

**hunternorthsub5Da Barrington Range Province (205539ha)**

An isolated steep range with a high summit undulating plateau on Tertiary basalt. Forms part of Mount Royal Range with several mountain peaks (Carey’s Peak, Mt Royal, Mt Patterson) and the upper catchment of several coastal rivers (e.g. Hunter River, Karuah River, Gloucester River).

**CHARACTERISTICS OF THE BARRINGTON RANGE PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (82%); Basic Volcanics and Lavas (5%); Acid/Intermediate Intrusives and Volcanics (13%) |
| **Soils** | Well Structured Red and Brown Earths (68%); Yellow and Red Texture Contrast Soils (8%); Shallow Loams (9%); Deep Structured Red Clay Loams (15%) |
| **1750 Vegetation** | Dry open forest (*E.pilularis, E.maculata, E.saligna*) 20%; Dry open forests on upper zone of foothills and moist open forest on escarpment (*E.saligna, E.eugenoides, A.subvelutina*) 16%; Moist open forest (*E.campanulata*) 19%; Grassy, dry open forest (*E.propinqua, E.tereticornis, E.siderophloia*) 10% |
| **Present-day Cover** | Moist forest (61%); Dry Forests (14%); Disturbed forests (6%); Cleared (18%) |
| **Conservation Areas** | Barrington Tops NP (66703ha); Monkerai NR (565ha); Mt Royal NP (6962ha); Running Ck NR (909ha) TOTAL 36.5% |

**5Db Hunter Mountains Province (602180ha)**

Steep to very steep mountains and high hills developed on weak sedimentary rocks and forming part of the Liverpool Range and Mount Royal Range. Also includes dissected basalt plateau flank composed of steep hills and ridges with narrow steep-sided valleys. Located west of Muswellbrook and Quirindi and including the Hunter River.

**CHARACTERISTICS OF THE HUNTER MOUNTAINS PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (76%); Basic Volcanics and Lavas (12%); Acid/Intermediate Intrusives (2%); Acid/Intermediate Volcanics (10%) |
| **Soils** | Well Structured Red and Brown Earths (23%); Yellow and Red Texture Contrast Soils (43%); Shallow Loams (27%); Deep Structured Red Clay Loams (6%); Shallow Black Self Mulching Clays (10%); Deep Black Cracking Clays (1%) |
| **1750 Vegetation** | Dry open forests (*E.maculata, E.fibrosa, E.crebra, E.tereticornis*) 16%; Grassy, dry open forest (*E.melliodora, E.tereticornis, E.moluccana, E.laevopinea*) 12%; Dry gully forests (*E.tereticornis, E.eugenoides, E.laevopinea, A.floribunda*) 26% |
| **Present-day Cover** | Moist forest (4%); Dry Forest (13%); Disturbed forests (23%); Cleared (60%) |
| **Conservation Areas** | Ben Halls Gap NP (1566ha); Wallabadah NR (499ha); Woko NP (1610ha); Camerons Gorge NR (1294ha); Barrington Tops NP (7465ha); Killarney NR (435ha); Mernot NR (320ha); Monkerai NR (301ha); Monkeycot NR (1181ha); Mt Royal NP (6ha); Nowendoc NP (2513ha); Tomalla NR (602ha); Wallaroo NR (564ha) TOTAL 3.0% |

**5E HASTINGS UPLANDS SUB-REGION (15289 km2)**

The largest Sub-Region in the Region (27%), Hastings Uplands has its eastern boundary near Taree, Kempsey and Coffs Harbour. The Sub-Region extends west to near Walcha and Guyra, and its southern boundary is near Yarrowitch and its northern boundary near Dorrigo. Although Hastings Uplands covers a large area, it is not highly populated, with most of the land used for grazing and forestry purposes. The major features are high mountains (e.g. Mount Banda Banda, 1263m; Major Point, 1538m; Mount Hyland, 1433m); major towns (Dorrigo, Wauchope); Upper catchments for many rivers, including the Macleay, Guy Fawkes, Nymboidea, Bellingen, and Hastings Rivers. Defining landforms are high (relief 180-360m) to very high mountain ridges (relief greater than 360m). Large plateau flank dissected into narrow strike ridges and valleys; with outliers of basalt-capped rises. Main plateau basalts derived from Miocene Volcanics.

**CHARACTERISTICS OF THE HASTINGS UPLANDS SUB-REGION**

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| --- | --- |
| **Geology** | Palaeozoic and Mesozoic Sediments (93%); Basic Volcanics and Lavas (3%); Acid/Intermediate Intrusives (4%) |
| **Soils** | Yellow and Red Texture Contrast Soils (32%); Well Structured Red and Brown Earths (39%); Shallow Loams (22%); Deep Structured Red Clay Loams (6%) |
| **Vegetation** | Complex of dry to moist open forests; Subtropical rainforest typical of basalt at higher elevation; Warm temperate rainforest complex, incorporating a moist open forest ecotones; Grassy, dry open forest and woodland (Class 25); Moist open forest |
| **Present-day Cover** | Moist forests and rainforest (47%); dry forests and woodlands (22%); Cleared 25%; Disturbed forest and woodland (5%) |

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| **Conservation Areas** | Baajin NR (1196ha); Bago Bluff NP (4016ha); Bagul Waajaarr NR (519ha); Barakee NP (3227ha); Barrington Tops NP (133ha); Bellinger River NP (2829ha); Bindarri NP (3485ha); Biriwal Bulga NP (4686ha); Bollanolla NR (651ha); Bongil Bongil NP (23ha); Boonanghi NR (3834ha); Boorganna NR (373ha); Bowraville NR (64ha); Bretti NR (2728ha); Bugan NR (1531ha); Camels Hump NR (514ha); Carrai NP (11432ha); Cascade NP (1197ha); Coocumbac Island NR (2ha); Coorabakh NP (243ha); Cottan-Bimbang NP (26804ha); Coxcomb NR (26ha); Cunnawarra NP (14912ha); Deer Vale NR (181ha); Dorrigo NP (11729ha); Dunggir NP (2435ha); Files Knob NR (546ha); Gads Sugarloaf NR (477ha); Ganay NR (356ha); Georges Ck NR (1263ha); Ghin-Doo-Ee NP (3654ha); Jaaningga NR (973ha); Jagun NR (97ha); Jasper NR (356ha); Jobs Mountain NR (702ha); Junuy Juluum NP (943ha); Juugawaarri NR (2149ha); Khatambuhl NR (695ha); Killabakh NR (2655ha); Koorebang NR (481ha); Kororo NR (12ha); Kumbatine NP (12497ha); Monkeycot NR (425ha); Mt Seaview NR (1765ha); Muldiva NR (10ha); Mummel Gulf NP (6023ha); Myall Lakes NP (175ha); New England NP (73103ha); Ngambaa NR (8881ha); Nungumirar Aboriginal Area (123ha); Nymboi-Binderay NP (17ha); Oxley Wild Rivers NP (100516ha); Pee Dee NR (435ha); Queens Lake NR (25ha); Skillion NR (125ha); Talawahl NR (127ha); Tapin Tops NP (10979ha); The Castles NR (2724ha); The Glen NR (2751ha); Ulidarra NP (184ha); Wallamba NR (837ha); Weelah NR (35ha); Werrikimbe NP (29500ha); Willi Willi Caves NR (8ha); Willi Willi NP (29210ha); Woko NP (6482ha); Yarravel NR (252ha); Yessabah NR (9ha); Yoorigan NP (28ha) TOTAL 26.3% |

**hastingsuplandsub5Ea Werrikimbe Province (261056ha)**

A relatively small province on the western edge of the Sub-Region, located east of Walcha, forming the upper catchment of the Macleay River. Characterised by a plateau on Miocene Volcanics (basalt) with the plateau edge forming steep to very steep ridges.

**CHARACTERISTICS OF THE WERRIKIMBE PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (84%); Basic Volcanics and Lavas (8%); Acid/Intermediate Intrusives (8%) |
| **Soils** | Yellow and Red Texture Contrast Soils (38%); Well Structured Red and Brown Earths (36%); Shallow Loams (10%); Deep Structured Red Clay Loams (16%) |
| **1750 Vegetation** | Moist open forest (*E.campanulata*) 10%; Complex of grassy, dry to moist open forests (*E.campanulata, E.caliginosa, E.laevopinea*) 10%; Grassy, dry open forest on steep exposed slopes (*E.biturbinata, E.eugenoides, E.tereticornis, E.melliodora*) 11%; Grassy, dry open forests (*E.melliodora, E.tereticornis, E.moluccana, E.laevopinea*) 17% |
| **Present-day Cover** | Moist forests and rainforest (25%); dry forests (47%); Cleared (23%); Disturbed forests (5%) |
| **Conservation Areas** | Deer Vale NR (181ha); Dorrigo NP (1980ha); Georges Creek NR (1263ha); Muldiva NR (10ha); New England NP (3198ha); Oxley Wild Rivers NP (96646ha); Werrikimbe NP (1787ha); Bagul Waajaarr NR (519ha); Bellinger River NP (51ha); Carrai NP (3887ha); Cascade NP (1197ha); Cunnawarra NP (5890ha); Junuy Juluum NP (943ha); Nymboi-Binderay NP 917ha); The Castles NR (86ha) TOTAL 45.1% |

**5Eb Oxley Escarpment Province (1267449ha)**

Occupying the major part of the Sub-Region, this province is characterised by steep to very steep mountains and ridges associated with a dissected plateau flank on the edge of the Great Escarpment. Flank dissected into narrow strike ridges and valleys with outliers of basalt. Contains many mountain peaks (e.g. Mt Banda Banda 1263m, Mt Boss, Kemps Pinnacle) and the upper catchments of the Hastings, Wilson and Macleay Rivers.

**CHARACTERISTICS OF THE OXLEY ESCARPMENT PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (93%); Mesozoic Sediments (2%); Basic Volcanics and Lavas (1%); Acid/Intermediate Intrusives (3%); Acid/Intermediate Volcanics (1%) |
| **Soils** | Yellow and Red Texture Contrast Soils (44%); Well Structured Red and Brown Earths (25%); Shallow Loams (22%); Deep Structured Red Clay Loams (7%); Deep Alluvial Loams (2%) |
| **1750 Vegetation** | Complex of grassy, dry open forest and moist open forest with rainforest understorey (*E.acmenoides, E.propinqua, E.amplifolia, Syncarpia glomulifera*) 13%; Dry and moist open forests (*E.propinqua, E.siderphloia, E.umbra, Syncarpia glomulifera*) 35% |
| **Present-day Cover** | Moist forests and rainforest (53%); Dry forests (15%); Cleared (26%); Disturbed forest (5%); Rock (1%) |

|  |  |
| --- | --- |
| **Conservation Areas** | Baajin NR (1196ha); Bago Bluff NP (4016ha); Barakee NP (3227ha); Barrington Tops NP (133ha); Bellinger River NP (2778ha); Bindarri NP (3485ha); Biriwal Bulga NP (4686ha); Bollanolla NR (651ha); Bongil Bongil NP (23ha); Boonanghi NR (3834ha); Boorganna NR (373ha); Bowraville NR (64ha); Bretti NR (2728ha); Bugan NR (1531ha); Camels Hump NR (514ha); Carrai NP (7545ha); Coocumbac Island NR (2ha); Coorabakh NP (243ha); Cottan-Bimbang NP (26804ha); Coxcomb NR (26ha); Cunnawarra NP (9022ha); Dorrigo NP (9749ha); Dunggir NP (2435ha); Files Knob NR (546ha); Gads Sugarloaf NR (477ha); Ganay NR (356ha); Ghin-Doo-Ee NP (3654ha); Jaaningga NR (973ha); Jagun NR (97ha); Jasper NR (356ha); Jobs Mountain NR (702ha); Juugawaarri NR (2149ha); Khatambuhl NR (695ha); Killabakh NR (2655ha); Koorebang NR (481ha); Kororo NR (12ha); Kumbatine NP (12497ha); Monkeycot NR (425ha); Mt Seaview NR (1765ha); Mummel Gulf NP (6023ha); Myall Lakes NP (175ha); New England NP (69905ha); Ngambaa NR (8881ha); Nungumirar Aboriginal Area (123ha); Oxley Wild Rivers NP (3870ha); Pee Dee NR (435ha); Queens Lake NR (25ha); Skillion NR (125ha); Talawahl NR (127ha); Tapin Tops NP (10979ha); The Castles NR 92638ha); The Glen NR (2751ha); Ulidarra NP (184ha); Wallamba NR (837ha); Weelah NR (35ha); Werrikimbe NP (27713ha); Willi Willi Caves NR (8ha); Willi Willi NP (29210ha); Woko NP (6482ha); Yarravel NR (252ha); yessabah NR (9ha); Yoorigan NP (28ha)TOTAL 22.4% |

**5F HASTINGS LOWLANDS SUB-REGION (5848 km2)**

A coastal Sub-Region extending from Buladelah to Coffs Harbour, and occupying 10% of the Region. This Sub-Region is relatively broad at its southern end (about 40km wide near Taree), but it narrows to the north where hilly Sub-Regions reach the coast. This part of the NSW coast is well developed, with many major towns (e.g. Port Macquarie, Coffs Harbour, Taree, Kempsey) and a high tourist use. Major features are the Pacific Highway; major towns, coastal lakes (e.g. Myall Lakes, Wallis Lakes, Lake Cathie, South West Rocks); coastal rivers (e.g. Myall, Manning, Hastings, Macleay and Bellinger Rivers)

Defining landforms are undulating or irregular plainsland (relief 5-30m), with some scattered linear dunes (relief 5-90m), and low hills (relief 30-90m) along the western part of the Sub-Region. Broad, flat floodplains associated with coastal rivers, together with coastal barriers and lagoons. Low hills to the west, as the Sub-Region approaches the foothills at the base of Great Escarpment.

**CHARACTERISTICS OF THE HASTINGS LOWLANDS SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic and Mesozoic Sediments (95%); Acid/Intermediate Intrusives and Volcanics (5%) |
| **Soils** | Yellow and Red Texture Contrast Soils (60%), Massive Black and Grey Coastal Clays (9%), Shallow Loams (6%), Siliceous Dune Sands (5%), Deep Structured Red Clay Loams (5%) |
| **Vegetation** | A complex of dry to moist open forests on low elevation coastal foothills; Swamp sclerophyll forest and low lying, dry to moist open forest on seasonally flooded or poorly drained soils; Swampy open forest merging with dry to moist open forests |
| **Present-day Cover** | Moist forest, including rainforest (23%); Dry forest and woodland (10%); Coastal complex (12%); Disturbed forest, woodland and coastal complex (7%); Cleared (47%) |

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| --- | --- |
| **Conservation Areas** | Arakoon SRA (78ha); Bandicoot Island NR (29ha); Bongil Bongil NP (833ha); Booti Booti NP (1442ha); Brimbin NR (22ha); Clybucca Historic Site (475ha); Coolongolook NR (202ha); Coocumbac Island NR (7ha); Cooperabung Ck NR (324ha); Coxcomb NR (47ha); Crowdy Bay NP (10150ha); Darawank NR (350ha); Dooragan NP (1070ha); Fishermans Bend NR (161ha); Goonook NR (931ha); Hat Head NP (7215ha); Jagun NR (1ha); Kattang NR (57ha); Khappinghat NR (3387ha); Kumbatine NP (534ha); Lake Innes NR (3368ha); Limeburners Creek NR (9182ha); Macquarie NR (12ha); Maria NP (2337ha); Mills Island NR (57ha); Moonee Beach NR (346ha); Myall Lakes NP (37347ha); Nambucca Aboriginal Area (2ha); Ngambaa NR (1676ha); Queens Lake NR (874ha); Rawdon Ck NR (557ha); Regatta Island NR (78ha); Sea Acres NR (62ha); Skillion NR (566ha); Talawahl NR (3028ha); Valla NR (30ha); Wallamba NP (324ha); Wallingat NP (6547ha); Yoorigan NP (1805ha) TOTAL 16.6% |

hastingslowlandsub**5Fa Mid North Coast Province (488923ha)**

Represents most of the coastline and coastal lowlands between Forster and Coffs Harbour and is characterised by undulating plainsland and low hills. Coastal lowland alluvial plains, broad flat floodplains of coastal rivers, coastal sand dunes, and a range of coastal landforms (beach barrier systems, estuarine complexes, headlands, rocky platforms etc). Also includes part of the foothills east of the escarpment.

# CHARACTERISTICS OF THE MID NORTH COAST PROVINCE

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (91%); Mesozoic Sediments (5%); Acid/Intermediate Intrusives (2%); Acid/Intermediate Volcanics (2%) |
| **Soils** | Yellow and Red Texture Contrast Soils (68%), Massive Black and Red Clays (11%), Shallow Loams (1%), Siliceous Dune Sands (6%), Deep Structured Red Clay Loams (6%); Deep Alluvial Loams (2%); Massive Red and Yellow Earths (3%); Well Structured Red and Brown Earths (3%) |
| **1750 Vegetation** | Dry and moist open forests (*E.propinqua, E.siderphloia, E.umbra, Syncarpia glomulifera*) 35%; Dry open forests at low elevation and moist higher elevation (*E.pilularis, E.maculata, E.saligna*) 10%; Grassy, dry sclerophyll forests (*E.propinqua, E.tereticornis, E.siderophloia*) 10%; Swampy open forest merging to dry to moist forests (*E.pilularis, E.resinifera*) 25% |
| **Present-day Cover** | Moist forest, including rainforest (32%); Dry forest (14%); Coastal complex (19%); Disturbed forest, woodland and coastal complex (10%); Cleared (25%) |

|  |  |
| --- | --- |
| **Conservation Areas** | Arakoon SRA (78ha); Bandicoot Island NR (29ha); Bongil Bongil NP (833ha); Booti Booti NP (1442ha); Brimbin NR (22ha); Clybucca Historic Site (475ha); Coolongolook NR (202ha); Coocumbac Island NR (7ha); Cooperabung Ck NR (324ha); Coxcomb NR (47ha); Crowdy Bay NP (10150ha); Darawank NR (350ha); Dooragan NP (1070ha); Fishermans Bend NR (161ha); Goonook NR (931ha); Hat Head NP (7215ha); Jagun NR (1ha); Kattang NR (57ha); Khappinghat NR (3387ha); Kumbatine NP (534ha); Lake Innes NR (3368ha); Limeburners Creek NR (9182ha); Macquarie NR (12ha); Maria NP (2337ha); Mills Island NR (57ha); Moonee Beach NR (346ha); Myall Lakes NP (28745ha); Nambucca Aboriginal Area (2ha); Ngambaa NR (1676ha); Queens Lake NR (874ha); Rawdon Ck NR (557ha); Regatta Island NR (78ha); Sea Acres NR (62ha); Skillion NR (566ha); Talawahl NR (3028ha); Valla NR (30ha); Wallamba NP (324ha); Wallingat NP (6547ha); Yoorigan NP (1805ha) TOTAL 18.1% |

5Fb Gloucester Province (93866ha)

A small province to the west of Buladelah and characterised by low basalt hills associated with the foothills of the Great Escarpment. Contains Stroud and Gloucester and Wards River.

**CHARACTERISTICS OF THE GLOUCESTER PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (87%); Acid/Intermediate Volcanics (13%) |
| **Soils** | Yellow and Red Texture Contrast Soils (71%), Shallow Loams (26%), Well Structured Red and Brown Earths (3%) |
| **1750 Vegetation** | Dry open forests at low elevation and moist higher elevation (*E.pilularis, E.maculata, E.saligna*) 49%; Grassy, dry sclerophyll forests (*E.propinqua, E.tereticornis, E.siderophloia*) 40% |
| **Present-day Cover** | Moist forest, including rainforest (33%); Dry forest (13%); Coastal complex (1%); Disturbed forest (7%); Cleared (46%) |
| **Conservation Areas** | Myall Lakes NP (8602ha) TOTAL 9.2% |

**5G CLARENCE UPLANDS SUB-REGION (8275 km2)**

The Clarence Uplands Sub-Region extends from the coast near Coffs Harbour inland to the Dividing Range near Drake. The Sub-Region occupies 14% of the Region. Most of the Sub-Region is sparsely populated, with grazing and forestry the main activities. The main part of the Clarence River catchment is within this Sub-Region. Major features are the Gwyder Highway and Pacific Highway; towns including Dalmorton, Drake, Glenreagh, Jackadgery and Cangai, and the Nymboida, Clarence, Boyd and Timbarra Rivers

Defining landforms are high steep mountains (relief 180-360m), with steep hilly to mountainous terrain; deeply dissected; some remnants of old gently undulating landscapes. Steep scarps; granite tors. Precipitous escarpments and gorges on the eastern edge of the New England Plateau, with some waterfalls where rivers leave the plateau. There are no provinces in this sub-region.

**CHARACTERISTICS OF THE CLARENCE UPLANDS SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (63%); Mesozoic Sediments (6%); Acid/Intermediate Intrusives (25%); Acid/Intermediate Volcanics (6%) |
| **Soils** | Shallow Loams (19%); Yellow and Red Texture Contrast Soils (26%); Deep Structured Red Clay Loams (3%); Well Structured Red and Brown Earths (52%) |
| **Vegetation** | Dry open forests where they grade into escarpment, moist open forests; Grassy, dry sclerophyll forest and woodland; Dry to moist open forest and woodland |
| **Present-day Cover** | Dry open forest (52%); Moist forest (23%); Cleared (18%); Disturbed forest and woodland (7%) |
| **Conservation Areas** | Barool NP (7010ha); Basket Swamp NP (121ha); Bindarri NP (1837ha); Burnt-Down Scrub NR (364ha); Byrnes Scrub NR (705ha); Cascade NP (2421ha); Chaelundi NP (10102ha); Coramba NR (9ha); Gibraltar Range NP (12415ha); Guy Fawkes River NP (46118ha); Hortons Ck NR (327ha); Koukandowie NR (250ha); Mann River NR (3258ha); Mt Hyland NR (2529ha); Nymboi-Binderay NP (16583ha); Nymboida NP (29675ha); Ramornie NP (3156ha); Sherwood NR (1451ha); Tallawudjah NR (510ha); Ulidarra NP (497ha); Washpool NP (40796ha) TOTAL 21.8% |

**clarenceuplandsub5H CLARENCE LOWLANDS SUB-REGION (5314 km2)**

Located west of the Clarence Coast Sub-Region, Clarence Lowlands occupies 9% of the Region. The Sub-Region extends from near Woolgoolga, north to Byron Bay, and west to Whiporie, as well as near Lismore and Casino. Clarence Lowlands only reaches the coast at Byron Bay. This Sub-Region is found within two major catchments i.e. Clarence and Richmond River basins. Major features include the Richmond Range, Pacific Highway, Clarence River, Richmond River, and several towns (e.g. Alstonville, Copmanhurst, Byron Bay, Coraki).

The defining landforms are smooth and undulating plainsland (relief 5-30m), with low to moderate hills (relief 30-180m) in the southern part of the Sub-Region. The northern part of the Sub-Region is a low dissected plateau of a relief between 30 and 90m. Undulating to hilly coastal uplands with some areas of steep hilly terrain. Intervening valleys and swampy areas in undulating areas.

**CHARACTERISTICS OF THE CLARENCE LOWLANDS SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Mesozoic and Palaeozoic Sediments (86%); Basic Volcanics and Lavas (14%) |
| **Soils** | Yellow and Red Texture Contrast Soils (58%); Shallow Loams (8%);  Deep Structured Red Clay Loams (14%); Deep Black Cracking Clays (5%); Deep Alluvial Loams (2%); Massive Black and Grey Coastal Clays (13%) |
| **Vegetation** | Swamp sclerophyll forest and low lying, dry to moist open forest on seasonally flooded or poorly drained soils; Grassy, dry sclerophyll forest merging with swamp sclerophyll forests; Swampy open forest merging with dry to moist open forests |
| **Present-day Cover** | Cleared (42%); Dry open forest (38%); Coastal complex (4%); Disturbed forest and woodland (14%); Moist Forest (2%) |
| **Conservation Areas** | Banyabba NR (4463ha); Bundjalung NP (4007ha); Bungawalbin NP (3726ha); Bungawalbin NR (464ha); Chambigne NR (799ha); Clarence Estuary NR (27ha); Flaggy Ck NR (72ha); Fortis Ck NP (6381ha); Koukandowie NR (1031ha); Sherwood NR (3294ha); Susan Island NR (24ha); Tabbimoble Swamp NR (991ha); Tallawudjah NR (737ha); Tuckean NR (1035ha); Tucki Tucki NR (5ha); Yuraygir NP (6363ha); Andrew Johnston Big Scrub NR (21ha); Boatharbour NR (27ha); Brunswick Heads NR (22ha); Cumbebin Swamp NR (40ha); Goonengerry NP (442ha); Davis Scrub NR (15ha); Hayters Hill NR (8ha); Mt Jerusalem NP (186ha); Nightcap NP (690ha); Snows Gully NR (34ha); Tyagarah NR (380ha); Victoria Park NR (17ha) TOTAL 6.6% |

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**5Ha Grafton Province (446427ha)**

This province curves north-west from the coast at Woolgoolga past Grafton and then east to Alstonville, along the foothills of Richmond Range. The landform is undulating to hilly coastal uplands with some areas of steep hilly to rugged terrain. Intervening valleys and swampy areas in undulating areas and steeper-sided valleys in the more rugged terrain. There are coastal features as well as more inland landscapes. Where the province is close to or along the coast between Woolgoolga and Maclean there are swamps and lakes, some dunes, and headlands, as well as river floodplains (Coldstream River, Orara River, Clarence River).

**CHARACTERISTICS OF THE GRAFTON PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Mesozoic Sediments (99%); Palaeozoic Sediments (1%) |
| **Soils** | Yellow and Red Texture Contrast Soils (68%); Shallow Loams (10%);  Deep Structured Red Clay Loams (1%); Deep Black Cracking Clays (5%); Deep Alluvial Loams (3%); Massive Black and Grey Coastal Clays (13%) |
| **1750 Vegetation** | Grassy, dry open forest (*E.henryi, E.siderophloa, E.tereticornis, E.maculata*) 27%; Grassy, dry open forest (*E.henryi, E.tereticornis, Lophostemon sauveolens*) 36%; Dry open forest (*E.pilularis, Syncarpia glomulifera, A.woodsiana*) 17%; Dry to moist open forests (*E.pilularis*) 14% |
| **Present-day Cover** | Cleared (37%); Dry open forest (45%); Coastal complex (5%); Disturbed forests (11%); Moist Forest (2%) |
| **Conservation Areas** | Banyabba NR (4463ha); Bundjalung NP (4007ha); Bungawalbin NP (3726ha); Bungawalbin NR (464ha); Chambigne NR (799ha); Clarence Estuary NR (27ha); Flaggy Ck NR (72ha); Fortis Ck NP (6381ha); Koukandowie NR (1031ha); Sherwood NR (3294ha); Susan Island NR (24ha); Tabbimoble Swamp NR (991ha); Tallawudjah NR (737ha); Tuckean NR (996ha); Tucki Tucki NR (1ha); Yuraygir NP (6363ha)  TOTAL 7.5% |

**5Hb Bangalow Province (84221ha)**

An area of smooth plainsland and low hills in the north of the Sub-Region, extending from near Ballina to Byron Bay. Characterised by low dissected basalt plateaux and plateau remnants and highly fertile soils. The plateau surface is undulating to hilly with some steep slopes, with small floodplains along incised stream valleys. Reaches the coast at Byron Bay as low hills.

**CHARACTERISTICS OF THE BANGALOW PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Mesozoic Sediments (6%); Palaeozoic Sediments (5%); Basic Volcanics and Lavas (89%) |
| **Soils** | Deep Structured Red Clay Loams (80%); Deep Black Cracking Clays (2%); Massive Black and Grey Coastal Clays (12%); Massive Red and Yellow Earths (3%); Well Structured Red and Brown Earths (3%) |
| **1750 Vegetation** | Moist open forest and sub-tropical or warm temperate rainforest 81%; Swamp sclerophyll forest 12% |
| **Present-day Cover** | Cleared (77%); Coastal complex (2%); Disturbed forests (14%); Moist Forest and rainforest (7%) |
| **Conservation Areas** | Andrew Johnston Big Scrub NR (21ha); Boatharbour NR (27ha); Brunswick Heads NR (22ha); Cumbebin Swamp NR (40ha); Goonengerry NP (442ha); Davis Scrub NR (15ha); Hayters Hill NR (8ha); Mt Jerusalem NP (186ha); Nightcap NP (690ha); Snows Gully NR (34ha); Tuckean NR (39ha); Tucki Tucki NR (4ha); Tyagarah NR (380ha); Victoria Park NR (17ha) TOTAL 2.3% |

**5I CLARENCE COAST SUB-REGION (2055 km2)**

A continuance of the Hastings Lowlands Sub-Region, the Clarence Coast Sub-Region extends along the coast from Woolgoolga to the Queensland border. There is a small break near Byron Bay, where the hilly Clarence Lowlands meets the coast. This Sub-Region is relatively narrow, with an extension inland along the Clarence River to Grafton. Like other coastal sub-regions, there are several major towns within the Clarence Coast Sub-Region (Ballina, Grafton, Maclean, Yamba, Brunswick Heads, Tweed Heads). Major features are coastal landscapes (estuaries, dunes); Pacific Highway; and coastal lakes (e.g. Lake Hiawatha, Wooloweyah Lagoon, The Broadwater)

Defining landforms are smooth plainslands (relief 5m), with scattered linear dunes (relief 5-90m). Undulating or irregular plainslands (relief 5-30m), with linear dunes (relief 5-90m). A small area of low to moderate hills (relief 30-180m) on the coast near Yamba. River floodplains and associated landforms; coastal dunes; swamps and lakes; beach sand dunes and rock platforms and other associated coastal landforms.

**CHARACTERISTICS OF THE CLARENCE COAST SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Mesozoic and Palaeozoic Sediments (99%); Basic Volcanics and Lavas (1%) |
| **Soils** | Yellow and Red Texture Contrast Soils (36%); Massive Black and Grey Coastal Clays (35%); Deep Alluvial Loams (9%); Deep Structured Red Clay Loams (6%); Shallow Loams (6%) |
| **Vegetation** | Swamp sclerophyll forest and low lying, dry to moist open forest on seasonally flooded or poorly drained soils. Also coastal heaths, shrublands and grasslands. |
| **Present-day Cover** | Cleared (51%), Coastal Complex (21%); Dry forest and woodland (19%), Disturbed forest and woodland (7%), Moist forest (2%) |
| **Conservation Areas** | Ballina NR (665ha); Billinudgel NR (268ha); Broadwater NP (4035ha); Broken Head NR (3ha); Brunswick Heads NR (144ha); Bundjalung NP (16743ha); Clarence Estuary NR (62ha); Cudgen NR (677ha); Fortis Ck NP (184ha); Iluka NR (53ha); Little Pimlico Island NR (6ha); Marshalls Ck NR (98ha); Mororo Ck NR (79ha); Munro Island NR (14ha); Richmond River NR (71ha); Stotts Island NR (13ha); Tabbimobile Swamp NR (83ha); Tweed Estuary NR (57ha); Tweed Heads Historic Site (8ha); Tyagarah NR( 52ha); Ukerebagh NR (120ha); Uralba NR(155ha); Waragai Ck NR (185ha); Woodford Island NR (373ha); Wooyung NR (65ha); Yuraygir NP (23684ha) TOTAL 23.2% |

clarencecoastsub**5J BORDER RANGES SUB-REGION (1788 km2)**

The Border Ranges Sub-Region is located along the Queensland border between Mt Lindsey and Chillingham, and occupies 3% of the Region. It is part of the Mount Warning Shield and extends into Queensland as part of the North Coast Region. The southern extent of the Sub-Region is Mullumbimby and Nimbin, and the eastern boundary is along the Pacific Highway, near Mooball and Condong. Major featuresa are mountains (Mount Warning, Mt Neville); McPherson Range; Bruxner Highway; towns including Lismore, Casino, Kyogle and Nimbin, and the upper catchment of Richmond River

Defining landforms are steep, high (relief 180-360m) to very high mountain ridges (relief greater that 360m). Hilly to steep hilly country with narrow valleys along the streams. A dissected basalt plateau resulting in several plateaux and plateau remnants. The plateau surface is undulating to hilly with some steep slopes and scarps.

**CHARACTERISTICS OF THE BORDER RANGES SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Basic Volcanics and Lavas (46%); Palaeozoic Sediments (34%); Mesozoic Sediments (14%); Acid/Intermediate Volcanics (6%) |
| **Soils** | Deep Friable Red and Brown Clays (15%); Massive Black and Grey Coastal Clays (5%); Deep Structured Red Clay Loams (1%); Massive Red and Yellow Earths (27%); Well Structured Red and Brown Earths (52%) |
| **Vegetation** | Moist open forest and subtropical or warm temperate rainforest; Complex of grassy, dry open forest and moist open forest with a rainforest understorey; Subtropical rainforest typical of high altitude basalt; Warm temperate rainforest complex, with moist open forest ecotones |
| **Present-day Cover** | Cleared (38%); Moist Forest and rainforest (50%); Disturbed forest (9%); Dry forest (1%); Coastal Complex (1%) |
| **Conservation Areas** | Billinudgel NR (456ha); Border Ranges NP (26380ha); Brunswich Heads NP (45ha); Couchy Ck NR (217ha); Hattons Bluff NR (18ha); Inner Pocket NR (234ha); Limpinwood NR (2746ha); Marshalls Ck NR (15ha); Mebbin NP (3804ha); Mooball NP (1163ha); Mt Jerusalem NP (4990ha); Mt Nullum NR (99ha); Snows Gully NR (1ha); Mt Warning NP (2531ha); Nightcap NP (4808ha); Numinbah NR (795ha); Stotts Island NR (140ha); Tweed Estuary NR (2ha) TOTAL 27.1% |

borderangesub**5Ja McPherson Province (81903ha)**

Between the Queensland border to just north of Nimbin, this province is characterised by dissected basalt plateaux and plateau remnants. The relief is very steep (over 360m) with steep slopes and scarps, and narrow incised valleys. There are numerous minor landslips on steep slopes composed of clay rich soils derived from weathered basalts and associated volcanics. The province is associated with McPherson Ranges.

**CHARACTERISTICS OF THE McPHERSON PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Basic Volcanics and Lavas (90%); Mesozoic Sediments (9%); Acid/Intermediate Volcanics (1%) |
| **Soils** | Deep Friable Red and Brown Clays (14%); Deep Structured Red Clay Loams (3%); Well Structured Red and Brown Earths (83%) |
| **1750 Vegetation** | Moist open forest and sub-tropical and warm temperate rainforest (*Lophostemon conferus, E.grandis, Heritiera trifoliatum, Castanospermum australe*) 51%; Grassy, dry open forest with rainforest understorey (*Lophostemon conferus, E.propinqua, A.subvelutina*) 18%; Subtropical rainforest (*Heritiera trifoliatum, Sloanea woollsii, Caldcluvia paniculosa*) 26% |
| **Present-day Cover** | Cleared (21%); Moist Forest and rainforest (71%); Disturbed forest (6%); Dry forest (2%) |
| **Conservation Areas** | Border Ranges NP (26380ha); Limpinwood NR (2746ha); Mebbin NP (3799ha); Mt Jerusalem NP (2368ha); Nightcap NP (4774ha); Numinbah NR (323ha); Snows Gully NR (1ha) TOTAL 49.3% |

**5Jb Tweed Province (96950ha)**

Between Clarence Coast and McPherson Provinces and the Queensland border, this province is characterised by steep to very steep mountains with narrow valleys associated with Mt Warning and the Border Ranges.

**CHARACTERISTICS OF THE TWEED PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Basic Volcanics and Lavas (10%); Palaeozoic Sediments (63%); Mesozoic Sediments (18%); Acid/Intermediate Volcanics (9%) |
| **Soils** | Deep Friable Red and Brown Clays (15%); Massive Black and Grey Coastal Clays (10%); Massive Red and Yellow Earths (50%); Well Structured Red and Brown Earths (25%) |
| **1750 Vegetation** | Moist open forest and sub-tropical and warm temperate rainforest (*Lophostemon conferus, E.grandis, Heritiera trifoliatum, Castanospermum australe*) 93% |
| **Present-day Cover** | Cleared (52%); Moist Forest and rainforest (34%); Disturbed forest (13%); Coastal Complex (1%) |
| **Conservation Areas** | Billinudgel NR (456ha); Brunswich Heads NP (45ha); Couchy Ck NR (217ha); Hattons Bluff NR (18ha); Inner Pocket NR (234ha); Marshalls Ck NR (15ha); Mebbin NP (5ha); Mooball NP (1163ha); Mt Jerusalem NP (2622ha); Mt Nullum NR (99ha); Mt Warning NP (2531ha); Nightcap NP (34ha); Numinbah NR (472ha); Stotts Island NR (140ha); Tweed Estuary NR (2ha) TOTAL 8.3% |

**IBRA REGION 6: NEW ENGLAND TABLELAND (27912 km2)**

This Region is described as “Elevated plateau of hills and plains on Palaeozoic sediments, granites and basalts; dominated by stringybark/peppermint/box species including *E. caliginosa, E. nova-anglica, E. melliodora* and *E. blakeyi*”. The New England Tableland is located in the north-western part of the study area and adjoins the Nandewar Region in the western NSW area.

The bedrock geology is dominated by Acid/Intermediate Intrusives (granitic rocks) and Palaeozoic Sediments (sandstone, siltstone, shale and chert). Most of the soils are of low fertility (Yellow and Red Texture Contrast Soils, Shallow Loams), with some soils of higher fertility (Deep Structured Red Clay Loams). 30% of the Region is native and voluntary pastures, 30.2% is improved pastures and croplands, and 38.6% is described as “Parks, timber and shrub lands”. The proportions of soil types and rock types in the New England Tableland Region are given in Table 6, and the location of this Region, and the Sub-regions, is given in the following map. There are seven Sub-Regions and 11 Provinces in the New England Tableland Region.

**TABLE 6: Soil Types and Rock Types in New England Tableland Region**

**SOIL TYPES:**

Shallow Loams 10%

Yellow and Red Texture Contrast Soils 48%

Deep Structured Red Clay Loams 16%

Deep Black Cracking Clays 4%

Deep Friable Red and Brown Clays 1%

Well Structured Red and Brown Earths 6%

Stony Sandy Loams 15%

**ROCK TYPES:**

Sandstone, siltstone, shale, chert, limestone (Palaeozoic Sediments) 35%

##### Acid and intermediate volcanics and pyroclastics 50%

Basic volcanics and lavas (basalts) 15%

# newenglandKEY TO SUB-REGIONS AND PROVINCES OF THE NEW ENGLAND TABLELAND IBRA REGION

|  |  |  |  |
| --- | --- | --- | --- |
|  | SUB-REGIONS |  | PROVINCES |
| Relief: 30-180m  Moderate Hills with  Undulating low plateau | **WESTERN HILLS** | Gently undulations tableland with rugged granitic areas with rock walls (Moonbi) | **NANDEWAR 6Aa** |
|  |  | Small remnant basalt plateau, with some granite tableland (Inverell) | **GWYDIR 6Ab** |
| Relief: 5-90m. Undulating plains with low hills | **WALCHA PLAINS** | Small remnant basalt area, with gently undulating tableland (Inverell and Tenterfield) | **GUYRA 6Ba** |
|  |  | Gently undulating to low hilly tableland with some scattered basaltic knolls and ridges (Walcha) | **ARMIDALE 6Bb** |
| Relief: 90-180m. Moderate hills and low hilly tableland | **WALCHA LOW HILLS** | Gently undulating to low hilly tableland (Walcha) | **WALCHA LOW HILLS 6C** |
| Relief: 180-360m. High steep mountains and deeply dissected terrain (eastern edge of north-eastern plateau) | **TENTERFIELD MOUNTAINS** | In the west, undulating granitic plateau with some tors and larger outcrops (Tenterfield), in the east deeply dissected hilly to mountainous terrain | **TENTERFIELD MOUNTAINS 6D** |

|  |  |  |  |
| --- | --- | --- | --- |
|  | SUB-REGIONS |  | PROVINCES |
| Relief: 90-180m. Moderate hills and undissected plateau, with some high mountains | **TENTERFIELD LOW HILLS** | Remnant basalt plateau, with isolated hills comprising Tertiary basalt flows (Inverell) | **BEN LOMAND 6Ea** |
|  |  | Undulating granitic plateau, with exposed granite domes and isolated basalt capped mesas and swamps and lakes | **EMMAVILLE 6Eb** |
| Relief: 180-360m. High to very high steep mountains and ridges and dissected plateau | **SOUTHERN MOUNTAINS** | Undulating tablelands with steeply dissected plateau flanks (Walcha and Wallabadah) | **APSLEY 6Fa** |
|  |  | Mainly undulating plateau on Miocene volcanics, with escarpment edge and deep gorges (Dorrigo and Macleay) | **ROUND MOUNTAIN 6Fb** |
| Relief: 30-360m. Moderate hills and ridges with some high mountains and low plateau | **NORTHERN HILLS** | Undulating undissected granitic plateaux, with isolated basalt capped mesas and exposed granite domes | **NORTHERN HILLS 6G** |

**6A WESTERN HILLS SUB-REGION (5374 km2)**

A large Sub-Region (occupies 19% of the Region) located along the western edge of the Region, between Inverell and Bendemeer. The Sub-Region forms part of the western slopes and all rivers are western flowing. The rivers include the Gwydir and Macdonald Rivers. The major features are the New England Highway; towns including Kingstown, Bendemeer, Bundarra and Inverell; Gwydir River (flows into Copeton Dam), Macdonald River (flows into Keepit Dam), Macintyre River and the Nandewar Range.

Defining landforms are moderate hills (relief 90-180m), with some areas of low plateau (relief 30-90m) at the northern end of the Sub-Region. Gently undulating to low hilly tableland, with some scattered basaltic knolls and ridges.

**CHARACTERISTICS OF THE WESTERN HILLS SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (17%); Acid/Intermediate Intrusives and Volcanics (79%); Basic Volcanics and Lavas (4%) |
| **Soils** | Yellow and Red Texture Contrast Soils (36%); Stony Sandy Loams (30%); Shallow Loams (21%); Deep Structured Red Clay Loams (3%); Deep Black Cracking Clays (9%) |
| **Vegetation** | Grassy open forests typical of the western slopes |
| **Present-day Cover** | Cleared (51%); Disturbed dry forests and woodlands (28%); Woodlands, including white cypress pine (14%); dry open forest (7%) |
| **Conservation Areas** | Ironbark NR (1502ha); Warrabah NP (2250ha); Watsons Creek NR (1385ha); Stony Batter Ck NR (562ha); Kings Plains NP (3ha); Single NP (2563ha); Stonewoman Aboriginal Area (2ha) TOTAL 1.5% |

**westernhillsub6Aa Nandewar Province (361510ha)**

Low to moderate hills and plateaux associated with Nandewar Range and Moonbi Range between Walcha Road and Inverell. Charaterised as a gently undulating plateau on granite with numerous granitic tors. Alluvial flats and minor floodplains with small lakes. Contains Copeton Dam, Gwydir River and the upper catchment of the MacDonald River.

**CHARACTERISTICS OF THE NANDEWAR PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (8%); Acid/Intermediate Intrusives (92%) |
| **Soils** | Yellow and Red Texture Contrast Soils (32%); Stony Sandy Loams (40%); Shallow Loams (21%); Deep Structured Red Clay Loams (1%); Deep Black Cracking Clays (6%) |
| **Present-day Cover** | Cleared (46%); Disturbed dry forests and woodlands (29%); Dry open forest (15%); Rock (10%) |
| **Conservation Areas** | Ironbark NR (1502ha); Warrabah NP (2250ha); Stony Batter Ck NR (562ha); Watsons Creek NR (1385ha) TOTAL 1.6% |

**6Ab Gwydir Province (174138ha)**

A smaller province on the eastern edge of the Sub-Region forming the upper catchment of the Gwydir River and containing the town of Tingha. The province is characterised by a gently undulating tableland of low to moderate hills with some scattered basaltic knolls and ridges, and remnant basalt plateaux.

**CHARACTERISTICS OF THE GWYDIR PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (34%); Acid/Intermediate Intrusives (21%); Acid/Intermediate Volcanics (33%); Basic Volcanics and Lavas (12%) |
| **Soils** | Yellow and Red Texture Contrast Soils (46%); Stony Sandy Loams (9%); Shallow Loams (21%); Deep Structured Red Clay Loams (9%); Deep Black Cracking Clays (15%) |
| **Present-day Cover** | Cleared (62%); Disturbed dry forests (24%); Dry open forest (14%) |
| **Conservation Areas** | Kings Plains NP (3ha); Single NP (2563ha); Stonewoman Aboriginal Area (2ha) TOTAL 1.5% |

**6B WALCHA PLAINS SUB-REGION (4730 km2)**

Walcha Plains is centred around Armidale, between Walcha and Guyra, and occupies 17% of the Region. Although located within the Tablelands, at a relatively high altitude, the landforms are rolling hills of low relief. The area is populous, and is extensively used for farming. Major features are the New England Highway; towns including Armidale and Guyra; and the upper catchments for easterly flowing Macleay River and the westerly flowing Gwydir River.

Defining landforms are undulating or irregular plainslands (relief 5-30m) and low hills (relief 30-90m). Gently undulating to low hilly granitic tableland, with some scattered basaltic knolls and ridges.

**CHARACTERISTICS OF THE WALCHA PLAINS SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (57%); Basic Volcanics and Lavas (12%); Acid/Intermediate Intrusives and Volcanics (31%) |
| **Soils** | Deep Structured Red Clay Loams (22%), Shallow Loams (5%), Well Structured Red and Brown Earths (2%), Yellow and Red Texture Contrast Soils (52%), Deep Black Cracking Clays (3%), Stony Sandy Loams (16%) |
| **Vegetation** | Grassy, dry open forest and woodland - typical New England Tablelands vegetation |
| **Present-day Cover** | Cleared (80%); Disturbed dry forests and woodlands (14%); Dry open forest (6%) |
| **Conservation Areas** | Booroolong NR (865ha); Duval NR (243ha); Guy Fawkes NP (111ha); Indawarra NP (938ha); Imbota NR (218ha); Mother of Ducks Lagoon NR (103ha); Mt Yarrowyck NR (170ha); Oxley Wild Rivers NP (1530ha); The Basin NR (2272ha); Yina NR (218ha) TOTAL 1.4% |

**walchaplainsub6Ba Guyra Province (95117ha)**

Located in the northern part of the Sub-Region and containing Guyra, this province is characterised by undulating plains and low hills, as part of a granitic tableland containing remnant basalt plateaux and mesas.

**CHARACTERISTICS OF THE GUYRA PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (44%); Basic Volcanics and Lavas (32%); Acid/Intermediate Intrusives (9%); Acid/Intermediate Volcanics (15%) |
| **Soils** | Deep Structured Red Clay Loams (43%); Shallow Loams (1%); Yellow and Red Texture Contrast Soils (53%); Deep Black Cracking Clays (3%) |
| **1750 Vegetation** | Grassy, dry open forest and woodland (*E.catiginosa, E.melliodora, E.blakelyi*) |
| **Present-day Cover** | Cleared (83%); Disturbed dry forests and woodlands (12%); Dry open forest (5%) |
| **Conservation Areas** | Guy Fawkes NP (111ha); Mother of Ducks Lagoon NR (103ha)  TOTAL 0.2% |

**6Bb Armidale Province (377978ha)**

Undulating plains and low hills in an area containing Armidale, Uralla and Yarrowick and the New England Highway. Characterised by a gently undulating tableland with some scattered basaltic knolls and ridges, as well as granitic tors.

**CHARACTERISTICS OF THE ARMIDALE PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (60%); Basic Volcanics and Lavas (7%); Acid/Intermediate Intrusives (30%); Acid/Intermediate Volcanics (3%) |
| **Soils** | Deep Structured Red Clay Loams (17%); Shallow Loams (6%); Yellow and Red Texture Contrast Soils (51%); Deep Black Cracking Clays (3%); Stony Sandy Loams (20%); Well Structured Red and Brown Earths (3%) |
| **1750 Vegetation** | Grassy, dry open forest and woodland (*E.catiginosa, E.melliodora, E.blakelyi*) |
| **Present-day Cover** | Cleared (80%); Disturbed dry forests (14%); Dry open forest (6%) |
| **Conservation Areas** | Booroolong NR (865ha); Duval NR (243ha); Imbota NR (218ha); Indwarra NP (938ha); Mt Yarrowyck NR (170ha); Oxley Wild Rivers NP (1530ha); The Basin NR (2272ha); Yina NR (100ha) TOTAL 1.7% |

**6C WALCHA LOW HILLS SUB-REGION (2927 km2)**

Located at the southern end of the Region, Walcha Low Hills is in the Walcha district on the eastern side of the New England Range. The Sub-Region occupies 10% of the Region and is primarily used for grazing and forestry. Major features are the New England Range; Oxley Highway; towns including Walcha and Woolbrook; and Apsley River and Macdonald River flowing west.

Defining landforms are moderate hills (relief 90-180m), and the sub-region is described as a gently undulating to low hilly tableland, with some scattered basaltic knolls and ridges. There are no provinces in this Sub-Region.

**CHARACTERISTICS OF THE WALCHA LOW HILLS SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (81%); Acid/Intermediate Intrusives (5%); Basic Volcanics and Lavas (14%) |
| **Soils** | Yellow and Red Texture Contrast Soils (52%); Stony Sandy Soils (7%); Shallow Loams (10%); Deep Structured Red Clay Loams (11%); Well Structured Red and Brown Loams (20%) |
| **1750 Vegetation** | Grassy, dry open forest and woodland (*E.catiginosa, E.melliodora, E.blakelyi*) 28%; Complex of dry open forest and woodland (*E.caloginosa*) 34%; Dry open forest and woodland subject to severe frost, with some moist forest (*E.dalrympleana, E.pauciflora, E.obliqua*) 18% |
| **Present-day Cover** | Cleared (79%); Dry open forests (11%); Disturbed dry and moist forests (9%); Moist forests (1%) |
| **Conservation Areas** | Oxley Wild Rivers NP (9845ha); Mummel Gulf NP (1630ha) TOTAL 3.9% |

**walchalowhillsub6D TENTERFIELD MOUNTAINS SUB-REGION (2862 km2)**

Another Sub-Region along the edge of the Great Escarpment, Tenterfield Mountains occupies 10% of the Region. The Sub-Region is located north of Guyra, east of Glen Innes and north of Deepwater. Major features are the Gwyder Highway, towns including Shannon Vale, Wards Mistake and Glen Elgin; and the upper catchment for Clarence River and Mann River.

Defining landforms are high mountains (relief 180-360m). Steep hilly to mountainous, deeply dissected terrain and steep scarps and granite tors. Precipitous escarpments and gorges on the eastern edge of the New England Plateau. Formed by the headwater tracts of the Clarence River system. Major waterfalls where rivers leave the plateau.

**CHARACTERISTICS OF THE TENTERFIELD MOUNTAINS SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (27%); Basic Volcanics and Lavas (1%); Acid/Intermediate Intrusives and Volcanics (72%) |
| **Soils** | Deep Structured Red Clay Loams (4%); Shallow Loams (12%); Well Structured Red and Brown Earths (9%); Yellow and Red Texture Contrast Soils (74%) |
| **1750 Vegetation** | Grassy, dry to moist open forests (*E.campanulata, E.caliginosa, E.laevopinea*) 13%; Cool, moist open forest and dry forest (*E.campanulata, E.brunnea*) 20%; High elevation dry to moist open forest subject to severe winter frost (*E.campanulata, E.cameronii*) 13%; Complex dry open forest and woodland (*E.caliginosa*); Dry open forest and woodland subject to severe winter frost, and minor development of moist open forest on sheltered aspects (*E.dalrympleana, E.pauciflora, E.obliqua*) 12% |
| **Present-day Cover** | Dry open forest (43%); Cleared (32%); Rock (10%); Disturbed forests and woodlands (9%) |
| **Conservation Areas** | Barool NP (4200ha); Butterleaf NP (2384ha); Capoompeta NP (2460ha); Demon NR (889ha); Gibraltar Range NP (12904ha); Guy Fawkes River NP (19559ha); Mann River NR (3429ha); Nymboidea NP (1944ha); Warra NP (2024ha); Washpool NP (14657ha) TOTAL 22.5% |

**tenterfieldmtnsub6E TENTERFIELD LOW HILLS SUB-REGION (5497 km2)**

This relatively large Sub-Region (occupies 20% of the Region) is located along the western edge of the Region, forming part of the western fall of the north-west slopes. The Sub-Region is located north of Guyra, west of Glen Innes, and east of Ashford and Inverell. The Severn River flows west through the Sub-Region into the Macintyre River. Major features are the Gwydir Highway, New England Highway; towns such as Glen Innes, Deepwater, Strathbogie, and Emmaville; Severn and Macintyre Rivers; and the Pindari Dam on the Severn River.

Defining land forms are moderate hills and some areas of plateau (relief 90-180m), with some high mountains (relief 180-360m) in the south-eastern parts. Undulating to hilly granitic plateau, with some basaltic tors and larger outcrops. The plateaux are relatively small and undissected with a steep break between plateaux and surrounding slopes.

**CHARACTERISTICS OF THE TENTERFIELD LOW HILLS SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (12%); Basic Volcanics and Lavas (36%); Acid/Intermediate Intrusives (22%); Acid/Intermediate Volcanics (30%) |
| **Soils** | Deep Structured Red Clay Loams (29%); Shallow Loams (1%); Yellow and Red Texture Contrast Soils (43%); Deep Black Cracking Clays (10%); Stony Sandy Loams (17%) |
| **Vegetation** | Dry open forest and woodland subject to severe winter frost, and minor development of moist open forest on sheltered aspects; Grassy, dry, open forest and woodland – typical New England Tablelands vegetation |
| **Present-day Cover** | Cleared (64%); Dry open forests (20%); Disturbed dry forests and woodlands (15%); Rock (1%) |
| **Conservation Areas** | Butterleaf NP (619ha); Kings Plains NP (5650ha); Little Llangothlin NR (254ha); Severn River NR (4362ha); Torrington SRA (5887ha) TOTAL 3.0% |

**tenterfieldlowhillsub6Ea Ben Lomand Province (218131ha)**

A Tertiary basaltic plateau characterised by low to moderate hills, with flat topped lava flows now occurring as small remnant plateaux. Part of the upper catchment of the MacIntyre River.

**CHARACTERISTICS OF THE BEN LOMAND PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Basic Volcanics and Lavas (80%); Acid/Intermediate Intrusives (10%); Acid/Intermediate Volcanics (10%) |
| **Soils** | Deep Structured Red Clay Loams (59%); Shallow Loams (2%); Yellow and Red Texture Contrast Soils (18%); Deep Black Cracking Clays (17%); Stony Sandy Loams (4%) |
| **Present-day Cover** | Cleared (80%); Dry open forests (6%); Disturbed dry forests and woodlands (14%) |
| **Conservation Areas** | Kings Plains NP (250ha); Little Llangothlin NR (254ha) TOTAL 0.2% |

**6Eb Emmaville Province (310701ha)**

An undulating granitic plateau of low hills with some tors and larger outcrops, isolated basalt-capped mesas and exposed granite domes. Swamps and lakes also present. Catchment for several rivers flowing north and west into the Dumaresq River (Deepwater, Beardy, Severn Rivers).

**CHARACTERISTICS OF THE EMMAVILLE PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (16%); Basic Volcanics and Lavas (9%); Acid/Intermediate Intrusives (30%); Acid/Intermediate Volcanics (45%) |
| **Soils** | Deep Structured Red Clay Loams (11%); Yellow and Red Texture Contrast Soils (58%); Deep Black Cracking Clays (5%); Stony Sandy Loams (26%) |
| **Present-day Cover** | Cleared (54%); Dry open forests (28%); Disturbed dry forests and woodlands (16%); Rock (2%) |
| **Conservation Areas** | Butterleaf NP (619ha); Kings Plains NP (5400ha); Severn River NR (4362ha); Torrington SRA (5887ha) TOTAL 5.2% |

**6F SOUTHERN MOUNTAINS SUB-REGION (3529 km2)**

Southern Mountains Sub-Region occupies 13% of the Region and comprises two main areas, with some small ‘outliers’. One area is located south of Walcha, in the Nundle district, and the second area is located east of Armidale, in the Wollomombi-Ebor district. Both are characterised by high to very high mountains along the eastern edge of the Sub-Region, and join the mountainous Hastings Uplands of the North Coast Region. Major features are Oxley Highway; mountain peaks (Round Mountain, Mt Sugarloaf), towns (Wollomombi, Ebor, Nundle), and the upper catchment of Manning River.

Defining landforms are high (relief 180-360m) and very high (relief greater than 360m) mountains and mountain ridges. Dissected plateau flank composed of steep to very steep hills and ridges with narrow steep sided valleys. Plateau surface capped by basalt, and basalt capped outliers detached from general elevation of Escarpment.

**CHARACTERISTICS OF THE SOUTHERN MOUNTAINS SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (60%); Basic Volcanics and Lavas (28%); Acid/Intermediate Intrusives (12%) |
| **Soils** | Deep Structured Red Clay Loams (34%): Shallow Loams (18%): Well Structured Red and Brown Earths (15%); Yellow and Red Texture Contrast Soils (32%); Shallow Black Self Mulching Clay (1%) |
| **Vegetation** | Complex of dry open forest and woodland, Grassy, dry open forest and woodland - typical New England Tablelands vegetation |
| **Present-day Cover** | Cleared (43%), Dry open forest (29%), Moist forest (12%), Rock (5%), Disturbed forest and woodland (11%) |
| **Conservation Areas** | Back River NR (735ha); Ben Halls Gap NP (900ha); Cathedral Rock NP (8929ha); Cottan-Bimbang NP (52ha); Cunnawarra NP (838ha); Guy Fawkes River NR (1718ha); Mummel Gulf NP (4568ha); New England NP (396ha); Ngulin NR (1254ha); Nowendoc NP (6307ha); Oxley Wild Rivers NP (5987ha); Serpentine NR (725ha); Tomalla NR (1ha); Tuggolo Ck NR (649ha); Werrikimbe NP (3784ha) TOTAL 10.9% |

**southernmtnsub6Fa Apsley Province (199364ha)**

Steep to very steep mountains on the eastern edge of the Great Dividing Range, located south of Walcha and north of Nundle. A dissected plateau flank composed of steep to very steep hills and ridges with narrow steep-sided valleys. Plateau surface capped by basalt with basalt-capped outliers detached from the general elevation of the Escarpment. Contains the upper catchment of the Barnard and Manning Rivers.

**CHARACTERISTICS OF THE APSLEY PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (64%); Basic Volcanics and Lavas (36%); |
| **Soils** | Deep Structured Red Clay Loams (48%): Shallow Loams (16%): Well Structured Red and Brown Earths (22%); Yellow and Red Texture Contrast Soils (13%); Shallow Black Self Mulching Clay (1%) |
| **Present-day Cover** | Cleared (40%), Dry open forest (30%), Moist forest (17%), Disturbed forests (19%); Exotic Plantation (3%) |
| **Conservation Areas** | Back River NR (735ha); Ben Halls Gap NP (900ha); Cottan-Bimbang NP (52ha); Mummel Gulf NP (4568ha); Ngulin NR (1254ha); Nowendoc NP (6307ha); Oxley Wild Rivers NP (756ha); Tomalla NR (1ha); Tuggolo Ck NR (649ha); Werrikimbe NP (3784ha) TOTAL 9.5% |

**6Fb Round Mountain Province**

Moderate hills and steep to very steep mountains on the eastern edge of the Great Dividing Range, located between Armidae and Ebor and containing Wollomombi. A dissected plateau flank composed of steep to very steep hills and ridges with narrow steep-sided valleys, with deep gorges associated with the Great Escarpment edge. Plateau surface capped by basalt with basalt-capped outliers detached from the general elevation of the Escarpment. Upper catchment of the Macleay and Clarence Rivers.

**CHARACTERISTICS OF THE ROUND MOUNTAIN PROVINCE**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (54%); Basic Volcanics and Lavas (17%); Acid/Intermediate Intrusives (28%) |
| **Soils** | Deep Structured Red Clay Loams (17%): Shallow Loams (21%): Well Structured Red and Brown Earths (4%); Yellow and Red Texture Contrast Soils (58%) |
| **1750 Vegetation** | Grassy, dry to moist open forests (*E.campanulata, E.caliginosa, E.laevopinea*) 14%; New England Tablelands forest and woodland (*E.caliginosa, E.melliodora, E.blakelyi*) 18%; High altitude dry to moist open forest (*E.campanulata, E.cameronii*) 12%; Dry open forest and woodland subject to severe frost (*E.dalrympleana, E.pauciflora, E.obliqua*) 22%; Sub-alpine dry open forest and woodland grading to moist forest and rainforest (*E.obliqua, E.pauciflora, E.dalrympleana, E.fastigata*) 12% |
| **Present-day Cover** | Cleared (48%), Dry open forest (26%), Moist forest (5%), Rock (11%), Disturbed forest and woodland (9%) |
| **Conservation Areas** | Cathedral Rock NP (8929ha); Cunnawarra NP (838ha); Guy Fawkes River NP (1529ha); Guy Fawkes River NR (1718ha); New England NP (396ha); Oxley Wild Rivers NP (5231ha); Serpentine NR (725ha) TOTAL 13.1% |

**6G NORTHERN HILLS SUB-REGION (2991 km2)**

Northern Hills is located in the north-western corner of the Region, with the Queensland border (and McPherson Range) forming the northern boundary. Northern Hills occupies 11% of the Region and lies east of Stanthorpe, west of Drake and surrounding Tenterfield. The New England Highway and Mount Lindsay Highway pass through the Sub-Region. Major features are the New England and Mount Lindsay Highways; towns including Tenterfield and Torrington; Mole River flowing west into the Dumaresq River; the Queensland border; and the McPherson Range.

Defining landforms are moderate hills, escarpment and ridges (relief 90-180m), with some high mountains (relief 180-360m) and low plateau (relief 30-90m) in the north. Undulating to hilly granitic plateau; with some tors and larger outcrops. There are no provinces in this Sub-Region.

**CHARACTERISTICS OF THE NORTHERN HILLS SUB-REGION**

|  |  |
| --- | --- |
| **Geology** | Palaeozoic Sediments (8%); Acid/Intermediate Intrusives and Volcanics (92%) |
| **Soils** | Well Structured Red and Brown Earths (4%); Yellow and Red Texture Contrast Soils (69%); Stony Sandy Soils (27%) |
| **Vegetation** | Complex of dry and moist open forest |
| **Present-day Cover** | Dry open forest (30%); Cleared (44%); Disturbed dry forests (14%); Moist forest (2%) |
| **Conservation Areas** | Bald Rock NP (7466ha); Basket Swamp NP (2698ha); Bluff River NR (1755ha); Boonoo Boonoo NP (586ha); Capoompeta NP (1440ha); Gibraltar NR (6ha); Maryland NP (891ha); Mt Mackenzie NR (141ha); Torrington SRA (23600ha); Washpool NP (3898ha) TOTAL 14.2% |

**northernhillsubCONSERVATION**

The percentage and area of land within conservation areas managed by the NSW National Parks and Wildlife Service was calculated from the Service Estate data-base supplied by this agency in 2001. The Estate layer was computed for each Sub-Region and Province and the area and % of each Sub-Region and Province occurring within the Service estate was calculated. The mean, standard deviation, 25 and 75% confidence intervals and range of each category was calculated using Sigma-Stat. Service Estate included the following categories: National Park, Nature Reserve, Regional Park, State Recreational Area, Aboriginal Area, and Historic Site. The values for the Estate were those available in January, 2001, and there will be a need to update the figures when digitized information about the newly gazetted areas becomes available (this will be discussed in the next Section).

Approximate proportions of IBRA Regions conserved are available in the Thackway and Cresswell report as Reservation Status (Table 14), but these also need upgrading.

The mean area conserved within the Sub-Regions of Eastern NSW is 476 900ha, with an overall proportion of 18.1% conserved within each Sub-Region. Details about these values appear in Table 7.

**TABLE 7: AREA CONSERVED WITHIN THE SUB-REGIONS IN EASTERN NSW**

Area (ha) % Conserved

Mean 77822 19.6

Number 49 49

Standard Deviation 136308 21.1

Minimum Value 0 0.0

Maximum Value 814356 94.9

25% Percentile 9282 4.3

75% Percentile 82330 25.8

The overall value of percentage conserved (19.6%) is misleading, as there are some Sub-Regions with a disproportionately high conservation rate e.g. Snowy Mountains Peak, 94.9% conserved. If the Sub-Regions are sorted in terms of the percentage conserved, then only 23 out of the 49 (47%) are conserved at a percentage above the proposed nationally agreed criteria for the establishment of a comprehensive, adequate and representative (CRA) reserve system for forests in Australia i.e. 15% conserved (JANIS Report, 1996).

Those Sub-Regions that are not adequately represented (i.e. less than 15% conserved) are listed in Table 8.

**TABLE 8: SUB-REGIONS OF EASTERN NSW NOT ADEQUATELY CONSERVED**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sub-Region Name** | **Sub-Region Number** | **Area (ha)** | **% Conserved** |
| Batlow Hills | 3I | 82320 | 0 |
| Bathurst Plains | 3K | 150900 | 0.6 |
| Western Hills | 6A | 537458 | 1.5 |
| Walcha Plains | 6B | 473000 | 1.4 |
| Canberra Plains | 3E | 414200 | 1.9 |
| Canberra Hills | 3G | 886500 | 1.2 |
| South Hunter | 4A | 523900 | 3.1 |
| Hunter Valley | 5C | 256200 | 4.2 |
| Richmond Hills | 5B | 203100 | 3.2 |
| Clarence Lowlands | 5H | 531400 | 6.6 |
| Tenterfield Low Hills | 6E | 549700 | 3.0 |
| Walcha Low Hills | 6C | 292700 | 3.9 |
| Urbenville Hills | 5A | 607100 | 12.9 |
| Braidwood Plains | 4H | 31900 | 3.9 |
| Bathurst Hills | 3J | 1023700 | 4.4 |
| Illawarra Coast | 4C | 152900 | 6.3 |
| Snowy Hills East | 2C | 63529 | 4.9 |
| Hunter North | 5D | 807800 | 11.6 |
| Eucumbene Hills | 3D | 741800 | 8.5 |
| Southern Mtns | 6F | 352900 | 10.9 |
| Canberra Mtns | 3F | 268700 | 9.9 |
| Bathurst Mtns | 4K | 93300 | 8.3 |
| South Coast | 2F | 73720 | 9.4 |
| Braidwood Hills | 3H | 430500 | 11.5 |
| Cumberland Plains | 4F | 387300 | 11.0 |
| Snowy Mtns East | 2D | 31684 | 11.2 |
| Northern Hills | 6G | 299100 | 14.2 |

There is a similar pattern with the Provinces. The mean area conserved within the Provinces of Eastern NSW is 41972ha, with an overall proportion of 19.0% conserved within each Province. Details about these values are given in Table 9.

**TABLE 9: AREA CONSERVED WITHIN THE PROVINCES IN EASTERN NSW**

Area (ha) % Conserved

Mean 41972 19.0

Number 75 75

Standard Deviation 81596 24.35

Minimum Value 0 0.0

Maximum Value 478020 95.2

25% Percentile 3033 2.4

75% Percentile 34436 23.5

Although the overall value for percentage conserved is 19% i.e. over the JANIS criteria, this is because of a few Provinces with extremely high conservation levels e.g. Mt Kosciusko, Yarrangobilly. If the Provinces are sorted in terms of the percentage conserved, then only 26 out of the 75 (35%) are conserved at a percentage above the proposed nationally agreed criteria i.e. 15%.

Those Provinces that are not adequately represented (i.e. less than 15% conserved) are listed in Table 10.

At the present level of analysis (see next section) there appears to be no relationship between the degree of conservation and the location of the Sub-Region or Province i.e. there is a similar proportion of areas from the southern, central and northern parts of the study area with conservation levels above 15%.

**TABLE 10: PROVINCES OF EASTERN NSW NOT ADEQUATELY CONSERVED**

|  |  |  |  |
| --- | --- | --- | --- |
| **Province Name** | **Province Number** | **Area (ha)** | **% Conserved** |
| Tumorrama | 3Aa | 31733 | 0.0 |
| Lake George | 3Ea | 46088 | 0.0 |
| Tarago | 3Eb | 72112 | 0.0 |
| Crookwell | 3Ed | 122877 | 0.0 |
| Casino | 5Bb | 31341 | 0.0 |
| Gwydir | 6Ab | 174138 | 1.5 |
| Hunter River | 5Cb | 213116 | 2.0 |
| Bega | 2Ab | 73235 | 0.1 |
| Muswellbrook | 4Ac | 277620 | 0.8 |
| Gloucester | 5Fb | 93866 | 9.2 |
| Guyra | 6Ba | 95117 | 0.2 |
| Ben Lomand | 6Ea | 218131 | 0.2 |
| Canberra | 3Gb | 588379 | 0.3 |
| Binda | 3Gc | 102868 | 0.6 |
| Bangalow | 5Hb | 84221 | 2.3 |
| Taralga | 3Ba | 70159 | 0.7 |
| Wollondilly | 3Ec | 173109 | 4.4 |
| Yass | 3Gd | 83573 | 1.0 |
| Armidale | 6Bb | 377978 | 1.7 |
| Hunter Mtns | 5Db | 602180 | 3.0 |
| Kybeyan | 3Fb | 149014 | 2.6 |
| Nandewar | 6Aa | 361510 | 1.6 |
| Grafton | 5Ha | 446427 | 7.5 |
| Mogo | 2Fb | 52475 | 1.8 |
| Sydney Plains | 4Fb | 277311 | 3.4 |
| Coastal Hills | 4Cb | 122973 | 3.8 |
| Apsley | 6Fa | 199364 | 9.5 |
| Kyogle | 5Ba | 171785 | 3.7 |
| Broke Hills | 4Aa | 128519 | 5.5 |
| Macquarie Range | 3Jb | 304407 | 3.5 |
| Tweed | 5Jb | 96950 | 8.3 |
| Richmond | 5Aa | 319731 | 10.7 |
| Mila | 3Fc | 26593 | 6.3 |
| Shoalhaven Valley | 3Ha | 355185 | 4.2 |
| Emmaville | 6Eb | 310701 | 5.2 |
| Winburndale | 3Ja | 424019 | 4.8 |
| Black Springs | 3Jc | 295276 | 4.6 |
| Newcastle Coast | 4Ab | 117754 | 5.7 |
| Bodalla | 2Gb | 193834 | 11.6 |
| Eucumbene | 3Da | 538601 | 8.4 |
| Monaro | 3Db | 203209 | 8.9 |
| Round Mtn | 6Fb | 147525 | 13.1 |
| Rock Flat | 2Da | 7594 | 10.8 |
| Bondi | 2Db | 24091 | 11.4 |
| Port Stephens | 5Ca | 43128 | 14.1 |
| Rift Valley | 3Ga | 111516 | 12.2 |
| Murray | 3Ca | 147979 | 12.2 |
| Moss Vale | 4Bb | 186233 | 13.0 |

**CONCLUSIONS**

OVERVIEW OF THE PROJECT

This project was established in 1995 as a three year study of the Regional Assessment of South, Central and North Coastal Lands. Funding was provided under the NSW Heritage Assistance Program (National Estate Grant), initially for the three years, but this was cut to two years. However, the project continued under the limited funding. The major aim of the project was to produce a description of Eastern NSW in terms of the biogeographic characteristics i.e. a bioregionalisation of the study area similar to that produced by Gethin Morgan for western NSW for the National Parks Association of NSW in 1992[[34]](#footnote-34). The role of the present exercise was to provide a system of classification of the eastern part of the State that complements the western study by Morgan. The information can then be used for planning and conservation purposes.

The Bioregional Ecosystems developed in Queensland provide an excellent example of how biogeographic regionalisation can be developed and put to use to provide a conservation framework for future land use planning[[35]](#footnote-35). The 13 Bioregions (IBRA regions) in Queensland are broken into 1085 Regional Ecosystems, of which 32% are considered threatened. Such an approach not only provides information about the natural attributes of each ecosystem, but also highlights those ecosystems where conservation management is a priority. The present project for eastern NSW parallels the approach for Queensland.

Initially, it was intended to use information from a study to be undertaken by the National Parks and Wildlife Service. This study was to establish bioregions for eastern NSW and it was planned to use this information to derive areas of conservation importance. However, it became clear during the early stages of the project that the study by NPWS would not eventuate, and that it would be necessary to develop the bioregions ourselves. This has been the thrust of the project over the last three years and this report provides the outcomes from the endeavor.

Part of the intention of the project was to develop a system of bioregionalisation using information available in an electronic format i.e. digitized data. During the 1990’s an increasing amount of information about the natural environment became available in an electronic format. As this method of data storage became more established, the technical problems became less difficult to overcome. Systems of storage and electronic formats were rationalised and it became possible to gain access to a wealth of data using a desk-top computer. This aspect of information technology was fully investigated and exploited, with the cooperation of many agencies and individuals.

Without detailing the many problems associated with negotiations with agencies, establishing licence agreements, undertaking data transfer, utilizing primitive computers and computer skills, and working with limited financial and other resources, it must be strongly stated that this project has been a success. Apart from producing a system of bioregionalisation for eastern NSW that complements the system used for western NSW, the project has shown that there is a large body of information about the natural environment that is available (usually under licence i.e. still not “freely” available) in an electronic format. With the geographic information systems now developed for use on personal computers, it is possible to analyse and manipulate the information to produce the system presented in this report.

IMPORTANCE OF THIS BIOREGIONALISATION SYSTEM

Apart from the advantages of having a consistent system of description of the biological and physical characteristics of New South Wales, it is important that bioregions be established for the State. At present, NSW is the only state or territory in Australia without a systematic approach to bioregionalisation. Such a system provides a basis for planning, including conservation planning, within the State. However, there are other important reasons for the development of a system of bioregions within NSW.

Large scale regionalisation is available for NSW through the IBRA system[[36]](#footnote-36). Some of these bioregions were based upon the regions developed by Gethin Morgan for western NSW, and the IBRA regions of eastern NSW were developed as a cooperative exercise between Environment Australia and the NSW Government. These regions are still considered as “interim” and may require revision. However, they are an established system that has been adopted by most agencies e.g. written into the NSW Threatened Species Conservation Act, used by the Industry Commission (see Footnote 12), and will probably continue to be used as a basis for overall bioregional planning in Australia.

However, there are problems with using such large regions when assessing conservation and other values of smaller areas. In Section 94 of the NSW Threatened Species Conservation Act, it states that assessment of significant effects upon threatened species must be on a regional basis. “Region” is considered to be the IBRA regions. Often, to assess the effects of a development in a relatively small area on the basis of the regional distribution of a particular species does not provide a true assessment of the impacts. If, for example, the importance of the presence of a threatened species in a development site at Campbelltown, in western Sydney, is assessed in terms of that species’ distribution and representation in conservation reserves in the Sydney Basin IBRA region (covering such disparate districts as the Cumberland Plain, Illawarra, Blue Mountains and Central Western Tablelands) then a false conclusion may be drawn. There is a need to be able to assess “regional” distribution on a finer basis than that presently available through the IBRA system. The series of Sub-Regions and Provinces presented here provide that opportunity.

In the case of a species found at Campbelltown, the area of the IBRA region to be used for assessment would be 3,586,200ha, whereas the area of the sub-region (Cumberland Plain) would be 387,300ha. The area of the province (Sydney Plains) that could be used for a ‘regional’ assessment would be 27,731ha. An added advantage of using the smaller area for an assessment is that each province (and sub-region) has been derived from a consistent set of biogeographic characteristics that assist in any comparative assessment.

With the boundaries of the Sub-Regions and Provinces available in a digitized format, it would be possible to manipulate any data provided for a larger area (e.g. IBRA regions, map sheets) to provide relevant information for the smaller areas and use that information in a more accurate assessment.

At the NPWS sponsored symposium, “National Parks Visions for the New Millennium”, it was repeatedly stated that there is a need for a bioregional approach to the planning of the national park system and to planning generally as we enter the new millennium. At present, NPWS are developing a bioregional approach to their on-going planning and needs. The Sub-Regions of eastern NSW developed in this project have been utilized by several individuals and departments within NPWS. Pressey and others have combined the Sub-Regions developed by Morgan and Terrey with those developed in this project to assess the representativeness of the terrestrial reserve system in NSW (Pressey *et al*, in press[[37]](#footnote-37)), and the New South Wales Preliminary Coastal Inventory developed by NPWS has also used the bioregions described in this report.

The system developed here provides an effective means of undertaking bioregional planning on a large-scale (using IBRA Regions and Sub-Regions) and smaller scale (using Provinces).

Apart from the use of the system for bioregional planning, there is a large body of information associated with each bioregion. At present, the following ‘layers’ of information are available for each Sub-Region and Province:

* Location within NSW (locations of towns and 1:10 million scale Australia base-map)
* Soil types
* Bedrock (geology)
* Relief Classes
* Regolith
* Modelled 1750 Vegetation
* Present-day Cover
* Service Estate

These layers are available as distributional maps that can be displayed, as polygons, within each Sub-Region and Province. As provided in this report, it is possible to derive an areal extent for each of these describers. Other characteristics are available and could be added to the GIS layers (see next section).

THE FUTURE

Although the project was undertaken over three years, time and resources were limited by the loss of one year’s funding. This has resulted in several aspects of the project having to be sidelined until further funding is available. The following is a description of some of these aspects.

It would be possible to determine areas within each Sub-Region and Province that could be conserved to bring the percentage conservation level up to the 15% recommended in the JANIS report. This could be done by merging the categories of undisturbed land within each Sub-Region and Province (derived from Present-day Cover data layer) and subtracting the land conserved (Service Estate) within this new category. The resultant area could be considered as “Key Conservation Areas” i.e. similar to that derived by Morgan and Terrey in their western NSW study. With some field investigation, it would be possible to assess and define such key areas. However, such an exercise will need to await further resources.

More detailed analysis of conservation needs and areas is required to ensure an adequate conservation system is currently being undertaken by agencies such as the NPWS, RACAC and Environment Australia. However, the approach taken in the present project to provide information about bioregions and to develop potential conservation areas may yield important results. An important aspect of the present study is that there are no boundaries to the analysis i.e. both Crown and private lands are given equal consideration. Other studies have concentrated on Crown land, State Forest land, or on a particular habitat group e.g. forests. In the present study, all habitats are incorporated into the analysis i.e. coastal lands, heaths, escarpments, grasslands etc are all part of the analysis.

With the variety of information now available in a form that can be used for detailed analysis, it is possible to investigate relationships between various parameters. It would be possible to investigate whether there is any relationship between broad soil fertility classes and degree of clearing and extent of conservation within each bioregion, between soil types and vegetation cover, between altitude and relief, and between altitude, relief and extent of conservation. Such an approach is being developed by Pressey *et al* (see footnote 37).

There are several other databases that are available, but not added to the bioregion layers of information. Environment Australia (ERIN) have provided, under licence, their Wild Rivers Database that contains seven factors identifying specific types and levels of disturbance of rivers, and five indices of impact. Unfortunately, there was insufficient time (and resources) to manipulate this database and incorporate into the bioregions. Another aspect not fully incorporated into the bioregional system was that of climate. It would be possible to categorize each bioregion into a climatic zone (perhaps using the system developed by Henry Nix, or by using Bioclim analysis). Again, this would take time and resources not available at present (and the possible purchase of relevant software and data).

Although some initial investigations were undertaken on the use of the 9 Second DEM (digital elevation model) database purchased from AUSLIG, this would again require further work to produce detailed maps of altitude to be incorporated into the bioregional database. Use of elevation data, combined with three dimensional analysis could produce 3D terrain maps showing relief and altitude, on which could be ‘draped’ various vector-derived maps of land cover, soils, geology etc.

There are other databases that can be purchased from the Land Information Centre (Surveyor-General’s Department NSW) e.g. State Forest boundaries, NSW rivers, NSW towns, that would be helpful in the use of the bioregional database. With the recent establishment of many National Parks and Nature Reserves, it will be necessary to upgrade the Service Estate database and recalculate the percentage conservation areas within each bioregion.

Finally, there will be a need to produce and promote this database. Initially, a well-produced book would help in the dissemination of information and an acceptance of the bioregional system. The publication could have a series of maps of defining characteristics for each Sub-Region and Province, as well as text describing each bioregion. A photograph of each bioregion could be added (most of these have been collected during the present project). It would also be possible to produce a CD with the digitized information and an imbedded reader (a similar product has been produced by CSIRO to show landcover change[[38]](#footnote-38)), and/or a CD with the relevant information, as Arc-View shape-files, to transfer into other systems.

It may be worth-while considering re-visiting the western NSW study and producing the Sub-Regions and Provinces developed by Morgan in a digitized format. It would then be possible to produce an entire NSW bioregional system in line with the rest of Australia.

Martin Denny

24th February, 2001

**APPENDIX 1: METHODOLOGY**

The bioregions were developed using two geographic information systems on a desktop Windows-based computer. Initially, the NPWS developed E-RMS software was used, but this was superseded by Arc-View 3.0, with the addition of the Spatial Analyst extension. The X-Tools extension from the Oregon Department of Forestry was also used. Most electronic data was supplied as shape files i.e. the Arc-View native format. It was possble to convert Arc-Info and Map Info export files using Arc-View, so most data could be used. Data generated on Genamap (used by the Department of Land and Water Conservation) could be exported as Map Info files and converted. Some data came as image files and could be converted into shape files, using the Spatial Analyst extension.

Conversions to and from different projections e.g. decimal degrees (latitude/longitude), ATM zones 55 and 56, Lamberts Coniform, were possible using the projector extension developed by Arc-View. It was necessary to use such conversions to ensure layers were in similar projections during analysis. Although the final mapping used decimal degrees as the projection, calculations of areas were based upon data projected into Tranverse Mercator (Australian Map Grid).

1. An electronic set of IBRA Regions for NSW was obtained from Environment Australia. Those regions within the Morgan and Terrey study area i.e. western NSW were removed to give a set of six regions that covered eastern NSW. These were merged to give a single polygon that represented the project area. The western boundary of this polygon was considered equivalent to the eastern boundary of the Morgan and Terrey project area.
2. Electronic datasets were obtained for various environmental parameters, under licence, from several agencies. The following datasets were used in this project:

* Geology of Australia – obtained initially from Bureau of Rural Resources (NRIC), then the Australian Geological Survey Organisation
* Relief of Australia - obtained initially from Bureau of Rural Resources (NRIC), then the Australian Geological Survey Organisation
* Regolith of Australia - obtained initially from Bureau of Rural Resources (NRIC), then a updated version from the Australian Geological Survey Organisation
* Soils of NSW – obtained from the NSW Department of Land and Water Conservation
* Topographic map of Australia – 1:2.5 million version commercially available from AUSLIG
* Service Estate – a dataset for January, 2001, was obtained from NPWS
* Eastern Bushland Database – three sets (southern, central and northern eastern NSW) from NPWS
* Modelled Forest Type Distribution – there were two datasets available, one for south-eastern NSW (developed by CSIRO, but supplied by NPWS) and another for north-eastern NSW (supplied by NPWS)

1. Each of these datasets were ‘clipped’ using the study area polygon to provide a dataset of each environmental parameter within the project area. A similar exercise was undertaken with the six IBRA regions with the polygons used to clip the datasets. Thus, for each IBRA region the following was available: geology, regolith, relief, soils, service estate (used as % conserved), current land cover (from Eastern Bushland Database) and modelled pre-1750’s vegetation for the southern and northern regions.
2. A new polygon theme was then created using the Union analysis tool (X-Tools extension). The new theme was created by overlaying two polygon themes. Thus the relief theme and the regolith theme were overlaid and a new theme that provided a series of unique combinations of the two original themes was created. This set of combinations could then be sorted in terms of relative size and those polygons with the larger areas used to create sub-regions and provinces. Polygons with the same relief class were placed into the same sub-region.
3. The sub-regions were further divided into provinces by determining which regolith categories were within each relief class. If it was difficult to determine the extent of the provinces, other parameters were used. Altitude, landscape features e.g. lakes, mountains, floodplains and geology were parameters also used to determine the boundaries of provinces.
4. Once the sub-regions and provinces were derived and named, it was then possible to clip the other datasets to derive other parameters within each bioregion. Thus geology, soils, present-day cover and, in the north and south, original vegetation communities.
5. As with most projects involving digitized data, there was some ‘massaging’ required. Some of the older datasets e.g. relief, regolith, showed incomplete or badly defined boundaries to some of the polygons when used at the detail needed for this project. These were corrected during the creation of the bioregions. Also, some of the datasets provided too much detail e.g. forest cover, and some classes needed to be merged.
6. The extent of conservation within each sub-region and province was derived from the service estate dataset, and the extent of clearing was derived from the Eastern Bushland Dataset by merging those classes describing cleared and disturbed communities (inlcuding exotic forests and urban areas). It was then possible to rank each sub-region in terms of conservation needs.

**APPENDIX 2: DESCRIPTION OF LAND COVER CATEGORIES (from NPWS Biodiversity Study Reports on vegetation systems)**

Rainforest system: Rainforest comprises at least 50% of the vegetation pattern, with the balance being mostly moist forest occurring along ridgelines and on more exposed aspects.

Moist forest system: Moist forest includes tall open forest and better developed open forest of the wet sclerophyll type and comprises at least 50% of the vegetation pattern. The balance of this system often consists of rainforest along valley bottoms and on sheltered aspects, with dry forest on ridgetops and exposed aspects.

Dry forest system: Dry forest comprises at least 50% of the vegetation pattern in this system, and frequently approaches 90%. The balance generally consists of woodland or moist forest with occasional patches of dry rainforest. Dry forest comprises open forest of the dry sclerophyll and grassy forest types.

Woodland system: Woodland comprises at least 50% of the vegetation pattern with the balance generally consisting of dry forest on sheltered aspects and some small areas of rainforest.

Coastal Complex system: Swamp forest, dry forest, woodland heath and sedgeland form a distinct complex that comprises at least 50% of the vegetation pattern in this system but generally exceeds 90%. The Coastal Complex is usually associated with alluvial and aeolian landforms of the coastal fringe.

Plateau Complex system: Dry forest, woodland, heath, sedgeland and outcropping rock form a distinct mosiac that comprises at least 50% of the vegetation pattern in this system but generally exceeds 80%. The Plateau Complex is usually associated with siliceous rock types such as quartz-sandstone and quartz rich granitic rocks.

Exotic forest system: Exotic forest comprises at least 50% of the vegetation pattern in this system but generally exceeds 90%. The system is predominantly pine plantation but includes small areas of native plantation and small areas colonised by exotics.

Disturbed-Remnant Vegetation system: This system consists of two classes of forest vegetation having the following attributes; i) small patches of forest vegetation surrounded by cleared land (each patch 5 to 50ha in area); and ii) areas of forest vegetation that have been severely disturbed with their cover distinctly fragmented and representing 30-70% of the original.

Non forest system: A system that takes in all land not mapped under the other vegetation systems. It is predominantly cleared land, with a forest cover less than 30%.

1. R. Thackway and I.D.Cresswell 1995 *An Interim Biogeographic Regionalisation for Australia: A Framework for Setting Priorities in the National Reserves System Cooperative Program. Version 4.0* Environment Australia, Canberra [↑](#footnote-ref-1)
2. Walker, P.J. 1991 *Land Systems of Western New South Wales* Soil Conservation Service of NSW Technical Report No.25 [↑](#footnote-ref-2)
3. G.Morgan and J.Terrey 1992 *Nature Conservation in Western New South Wales.* National Parks Association of NSW Inc, Sydney [↑](#footnote-ref-3)
4. “Soils: their properties and management” P.E.V.Charman and B.W.Murphy (eds) Sydney University Press, 1992 [↑](#footnote-ref-4)
5. P.Bridgewater 1987 The present Australian environment – terrestrial and freshwater. In G.R.Dyne (ed) “Fauna of Australia Volume 1A General Articles” A.G.P.S., Canberra [↑](#footnote-ref-5)
6. Nix, H. 1982 Environmental determinants of biogeography and evolution in Terra Australis. In W.R.Barker and P.J.M.Greenslade (eds) “Evolution of the Flora and Fauna of Arid Australia” Peacock Publications, Frewville, South Australia [↑](#footnote-ref-6)
7. “Climate” Atlas of Australian Resources AUSLIG [↑](#footnote-ref-7)
8. Areas given for each Region differ slightly from those given for IBRA Regions, due to differences in measuring polygon areas possibly because of different projections. [↑](#footnote-ref-8)
9. R. Thackway and I.D.Cresswell 1995 *An Interim Biogeographic Regionalisation for Australia: A Framework for Setting Priorities in the National Reserves System Cooperative Program. Version 4.0* Environment Australia, Canberra [↑](#footnote-ref-9)
10. Bracketed names denote the dominant regolith character within the Province. [↑](#footnote-ref-10)
11. R. Thackway and I.D.Cresswell 1995 *An Interim Biogeographic Regionalisation for Australia: A Framework for Setting Priorities in the National Reserves System Cooperative Program. Version 4.0* Environment Australia, Canberra [↑](#footnote-ref-11)
12. P. Gretton and U. Salma, 1996 *Land Degradation and the Australian Agricultural Industry.* Staff Information Paper, Industry Commission [↑](#footnote-ref-12)
13. see D.A.Keith and J.M.Saunders, 1990 Vegetation of the Eden region, south-eastern NSW, Australia *J.Vegetation Science 1:* 203-232; Braithwaite, L.W. et al 1984 CSIRO Div.Wildl. and Rangelands Res. Tech.Paper No.35; D.A. Keith and M.Bedward 1999 Native vegetation of the South East Forests region, Eden, NSW *Cunninghamia 6*: 1-218 [↑](#footnote-ref-13)
14. See M.P.Austin and K.D.Cocks (eds) 1978 *Land Use on the South Coast of NSW 4 volumes.* CSIRO Div. Land Use Research

    M.P.Austin and J.Sheafe 1976 *Vegetation survey data of the South Coast Study Area, NSW* CSIRO Tech.Mem. 76/15 CSIRO Div.Land Use Research [↑](#footnote-ref-14)
15. See M.P.Austin and K.D.Cocks (eds) 1978 *Land Use on the South Coast of NSW 4 volumes.* CSIRO Div. Land Use Research [↑](#footnote-ref-15)
16. See M.P.Austin and K.D.Cocks (eds) 1978 *Land Use on the South Coast of NSW 4 volumes.* CSIRO Div. Land Use Research

    M.P.Austin and J.Sheafe 1976 *Vegetation survey data of the South Coast Study Area, NSW* CSIRO Tech.Mem. 76/15 CSIRO Div.Land Use Research [↑](#footnote-ref-16)
17. The Budawang Committee 1982 *Pigeon House and Beyond: a guide to the Budawang Range and environs* [↑](#footnote-ref-17)
18. It is called Eastern Highlands in Victoria [↑](#footnote-ref-18)
19. R. Thackway and I.D.Cresswell 1995 *An Interim Biogeographic Regionalisation for Australia: A Framework for Setting Priorities in the National Reserves System Cooperative Program. Version 4.0* Environment Australia, Canberra [↑](#footnote-ref-19)
20. P. Gretton and U. Salma, 1996 *Land Degradation and the Australian Agricultural Industry.* Staff Information Paper, Industry Commission [↑](#footnote-ref-20)
21. J.N.Jennings and J.A.Mabbutt 1986 Physiographic Outlines and Regions in D.N.Jeans (ed) *Australia – A Geography Volume One The Natural Environment 2nd Edition.* Sydney University Press, Sydney [↑](#footnote-ref-21)
22. G.Morgan and J.Terrey 1992 *Nature Conservation in Western New South Wales.* National Parks Association of NSW Inc, Sydney [↑](#footnote-ref-22)
23. See Footnote 20 [↑](#footnote-ref-23)
24. See Footnote 19 [↑](#footnote-ref-24)
25. Details of vegetation in this Sub-Region can be obtained from numerous publications, such as P.A.Hazelton 1992 *Soil Landscapes of the Kiama 1:100 000 Sheet.* Dept Land and Water Conservation, Sydney [↑](#footnote-ref-25)
26. D.Benson and J.Howell 1990 *Taken for Granted The Bushland of Sydney and its Suburbs* Kangaroo Press and Royal Botanic Gardens; NPWS 2000 *The Native Vegetation of the Cumberland Plain, Western Sydney – Technical Report*, NSW NPWS Hurstville [↑](#footnote-ref-26)
27. D.Benson, J.Howell and L.McDougall 1996 “Mountain Devil to Mangrove. A Guide to Natural Vegetation in the Hawkesbury-Nepean Catchment” Royal Botanic Gardens, Sydney [↑](#footnote-ref-27)
28. Detailed vegetation descriptions are given in the 1:100 000 Burragorang map sheet vegetation survey (Royal Botanic Gardens) [↑](#footnote-ref-28)
29. See Footnote 27 for details of vegetation [↑](#footnote-ref-29)
30. See Footnote 27 for details of vegetation [↑](#footnote-ref-30)
31. See Footnote 27 for details of vegetation [↑](#footnote-ref-31)
32. The vegetation communities are described in D.Benson, J.Howell and L.McDonald 1996 *Mountain Devil to Mangrove. A Guide to Natural Vegetation in the Hawksbury-Nepean Catchment.* Royal Botanic Gardens, Sydney [↑](#footnote-ref-32)
33. See Footnote 19 [↑](#footnote-ref-33)
34. G.Morgan and J.Terrey 1992 *Nature Conservation in Western New South Wales.* National Parks Association of NSW Inc, Sydney [↑](#footnote-ref-34)
35. Sattler, P. and Williams, R. 1999 *The Conservation Status of Queensland’s Bioregional Ecosystems.* Environmental Protection Agency, Brisbane [↑](#footnote-ref-35)
36. R. Thackway and I.D.Cresswell 1995 *An Interim Biogeographic Regionalisation for Australia: A Framework for Setting Priorities in the National Reserves System Cooperative Program. Version 4.0* Environment Australia, Canberra [↑](#footnote-ref-36)
37. Pressey, R.L., Hager, T.C., Ryan, K.M., Schwarz, J., Wall, S., Ferrier, S. and Creaser, P.M. “Terrestrial reserves in New South Wales: gaps, biases, and priorities to minimize further loss of native vegetation” [↑](#footnote-ref-37)
38. AusWatch Data Sets for the Study of Landcover Change Satellite Imagery including Viewing Software by M.Wilson, R.Fisher, D.Graetz, S.Campbell and S.Wilson 1992 COSSA Publication No 031, Canberra) [↑](#footnote-ref-38)