

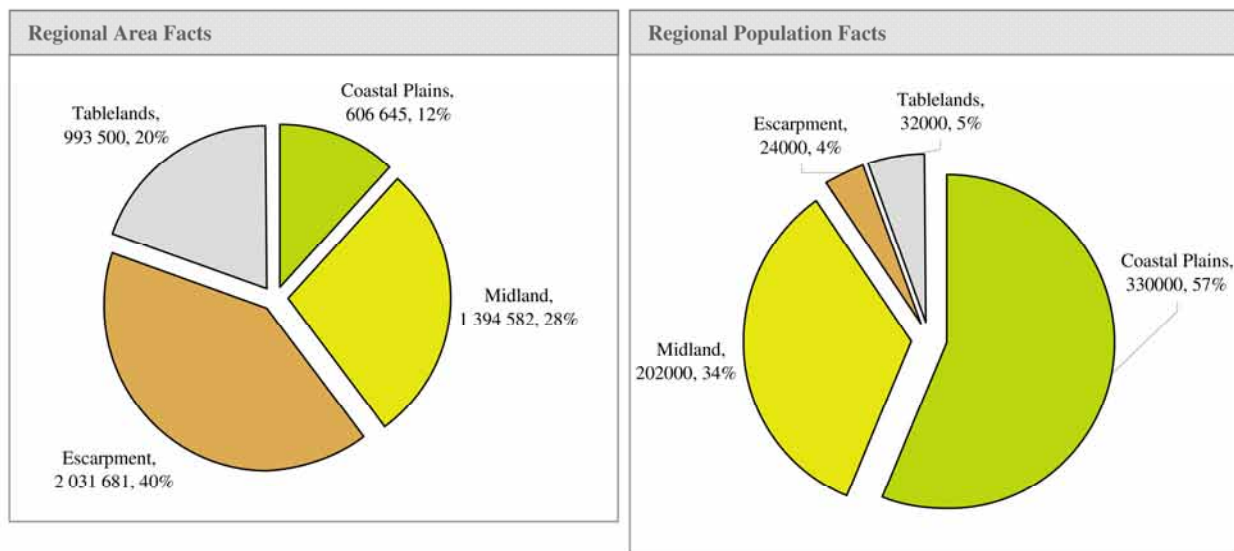
Appendix 9: Landscape descriptions

There are a number of figures in the main part of the Plan that relate to the information discussed in this appendix, including those listed in Table 1.

Table 1 List of relevant figures

Mapped area	Figure no.	Appendix no.
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* these figures are on the enclosed CD



The two pie charts highlight some of the main issues in relation to threats in the Northern Rivers Region. For example, although the coastal plains is the smallest landscape in area terms (covering 12% of the Region), it supports more than half the Region's population (57%). This high concentration of human population in the fragile coastal environment results in an array of threats impacting on this landscape. Conversely, the escarpment ranges landscape covers the largest area (40% of the Region) but supports the lowest number of people (4%) in the Region. Although there are some significant threats impacting the ranges, in comparison to the coastal plains the overall threat level is significantly lower.



1.1 Coastal plains

Landform

The coastal plains landscape covers 606 645 ha, or 12%, of the Northern Rivers Region. It includes floodplains and associated low hills between the ocean and the midland hills landscape. The western boundary corresponds approximately to the 25 m contour and the eastern boundary is the mean low water mark.

It is widest in the central north where it includes the extensive floodplains of the Richmond and Clarence rivers. From Woolgoolga to Stuarts Point it narrows considerably, except for the floodplain and valleys of the Bellinger, Kalang and Nambucca rivers. Further south it broadens over the Macleay and Hastings floodplains and narrows again near Laurieton. Slopes are predominantly flat to gentle (0-2°), however, there are areas of gentle to moderate slopes, such as the Blackall Range, Woodford Island Ridge and Coast Range. There are also prominent headlands such as Smokey Cape, Hat Head and Crescent Head.

Geology

The great majority of the coastal plains is unconsolidated sediments (75%), with sedimentary rocks the next most common substrate (13%), followed by metasediments (6%) and basic volcanics (2%).

Sedimentary rocks of the Triassic Clarence Moreton basin outcrop predominantly in the Richmond Valley forming low hills above the surrounding floodplain. The coastal headlands of the Macleay Valley are Permian sedimentary rocks with a small outcrop of Permian granite at Smokey Cape. Greywacke of the Carboniferous Neranleigh–Fernvale beds form the headlands at Byron Bay and nearby Broken Head. Greywacke from the Coramba beds outcrops along the coast north of Coffs Harbour and along the eastern Coast Range to near Sandon. Slate and chert metasediments outcrop south of Port Macquarie as part of the Silurian Watonga formation. The main Tertiary Lismore basalt outcrops are the Duranbah Plateau south of Kingscliff in the Tweed Valley, the ridges south of Brunswick Heads, and between Lennox Head and Ballina. Permian Serpentinite outcrops on the coast at Port Macquarie. In the far south, rhyolite from the Triassic Lorne basin forms the prominent Diamond Head.

Climate

The coastal plains landscape experiences a warm maritime climate with the majority of rain falling through summer to early autumn. Humidity is often high, especially in the warmer months. Thunderstorms often produce heavy falls of rain and occasionally hail and damaging winds. Tropical cyclones formed in far north Queensland

occasionally trail into northern NSW bringing heavy rains, strong winds and damaging seas. Annual rainfall varies throughout the coastal plains with the highest (1800 mm) received in the Tweed and Brunswick valleys. Most other coastal areas receive between 1400 and 1600 mm. Drier areas receiving around 900 and 1000 mm annually are located in the Richmond Valley around Casino, Kyogle and Whiporie, and the Clarence Valley around Grafton.

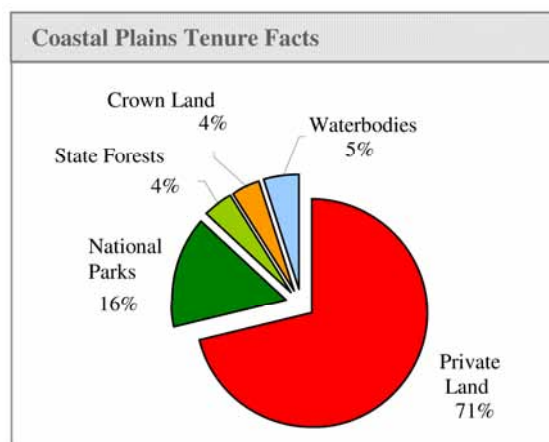
Sea breezes from the south-east during winter and spring, and from the north-east during summer and autumn, moderate temperatures along the coast. Summer days are warm to hot, with average maximum temperatures ranging along the coast from an average maximum of 26 °C in the south to 28 °C in the north. Inland average maximum temperatures reach over 30 °C around Casino and Kyogle. Winter temperatures are moderate, with frosts occasionally settling in the lower valleys and drainage depressions. Minimum annual temperatures range from 6 °C in the south to 10 °C in the north. Inland average minimum temperatures are cooler, reaching 4 °C in the Richmond Valley west

Coastal Plains Climate Facts	
Temperature	
Avg Max Temp:	26°C – 30°C
Avg Min Temp:	4°C – 10°C
Rainfall	
Annual rainfall:	900mm – 1800mm

of Casino, Kyogle and Whiporie. Fogs occur in many low-lying coastal areas when humidity is high and the temperatures drop to near dew point, and from time to time sea fogs blanket the coast.

Tenure

Over 70% of the coastal plains is private land. Nearly 25% is public land, including National Parks and Wildlife estate, Forests NSW estate and other Crown lands. Waterbodies cover 5% of the coastal plains. Around 3% of the plains are declared wilderness, and approximately 135 ha of Bundjalung National Park is part of the Gondwana Rainforests of Australia World Heritage Area. Some 0.3% of private land on the coastal plains is protected under a conversation agreement or covenant.



Landuse

Most private land in the coastal plains is zoned as either rural or agricultural (66%). Around 5% is zoned environmental protection, 6% is zoned urban purposes and another 0.6% is zoned rural residential. In addition to areas already zoned as urban and rural residential, a further 6223 ha have been identified for future urban growth and 4554 ha for future rural residential growth, as part of the Far North Coast and Mid North Regional Strategies.

Grazing is the predominant landuse, occurring on 33% of the coastal plains. 'Private forest' covers 12% of the coastal plains and, as of 2008, approximately 4920 ha was covered by 32 native forestry property vegetation plans approved under the *Native Vegetation Act 2003*. Intensive agriculture, primarily sugar cane cropping, is a major landuse covering over 8% of the coastal plains, with horticulture covering another 1.6%. Forests NSW estate covers 3.5% (with 1.5% excluded from logging) and plantations cover 0.7%. Other landuses include private plantations (1%), infrastructure (0.7%) and rural lifestyle (0.7%).

People and community

As of 2006, the coastal plains had a total population of over 330 000 people, and an average population density of nearly 55 people per square kilometre. Urban centres closer to the coast had higher population densities, while the inland areas around Kyogle and Casino had considerably lower densities.

The major urban centres on the coastal plains (and current population estimates) are: Tweed Heads (pop. 45 000), Port Macquarie (pop. 38 000), Lismore (pop. 27 500), Coffs Harbour (pop. 26 000), Grafton (pop. 17 500), Ballina (pop. 16 500). The following towns have populations over 1000 people: Bellingen, Bogangar, Brunswick Heads, Byron Bay, Casino, Coraki, Crescent Head, Evans Head, Iluka, Kingscliff, Kyogle, Lake Cathie, Laurieton, Lennox Head, Macksville, Maclean, Mullumbimby, Nambucca Heads, North Haven, Pottsville, Sawtell, South West Rocks, Urunga, Woolgoolga and Yamba. There are another 20 towns with populations between 200 and 1000.

The coastal plains landscape is expected to experience population increases over the next 30 years, estimated to be over 60% in the Tweed Heads, Coffs Harbour and Port Macquarie areas, 40% in the Byron, Ballina and Yamba areas, and 13% in the Nambucca and Kempsey areas.

Indigenous community

The coastal plains includes eastern parts of 17 local Aboriginal land councils, including Birpai (Wauchope), Birrigan Gargle (Yamba), Bogal (Coraki), Bunyah (Laurieton), Casino, Coffs Harbour, Grafton–Ngerrie, Gugin Gudduba (Kyogle), Jali (Ballina), Kempsey, Nambucca, Ngulingah (Nimbin), Purfleet/Taree, Stuart Island Tribal Elders Descendants (Nambucca Heads), Tweed Byron, Unkya (Eungai Creek), Yaegl (Maclean). The coastal plains landscape covers the eastern parts of the

Birpai (Hastings Valley), Dunghutti (Macleay Valley), Gumbainggir (Clarence Valley) and Bundjalung (Richmond–Tweed valleys) Indigenous language groups.

In the coastal plains landscape, six culturally significant Indigenous areas have been recognised under the *National Parks and Wildlife Act 1974*. An Aboriginal place has been declared at Ukerebagh Island near Tweed Heads. In addition, five Aboriginal areas have been reserved to protect Indigenous objects or places, including Dubai Nurahm Aboriginal Area (east of Wardell), Lennox Head Aboriginal Area, the Nambucca Aboriginal Area and the Tweed Heads and Clybucca historic sites. The Tweed Heads Historic Site contains a bora ring, cultural centre, museum and retail outlet. Clybucca Historic Site includes part of one of the largest estuarine Indigenous midden complexes recorded in temperate Australia, extending some 14 km and dated between 6000 to 9000 years old. It is situated north of Kempsey within the Dunghutti and Gumbainggir nations.

Community involvement

In the Northern Rivers Region over the recent years, there has been a large increase in the number of landholders involved in environmental programs such as Landcare, Commonwealth Natural Heritage Trust, NSW Environment Trust and Northern Rivers Catchment Management Authority (CMA) initiatives such as the Bush Recovery Program. Over 40 regional Landcare organisations coordinate more than 180 local Landcare groups, obtain funding and implement environmental works. Around 250 landholders have received funding for environmental works from the above programs over the last six years and 38 landowners have entered into some form of conservation agreement to protect biodiversity on their properties.

Broad vegetation

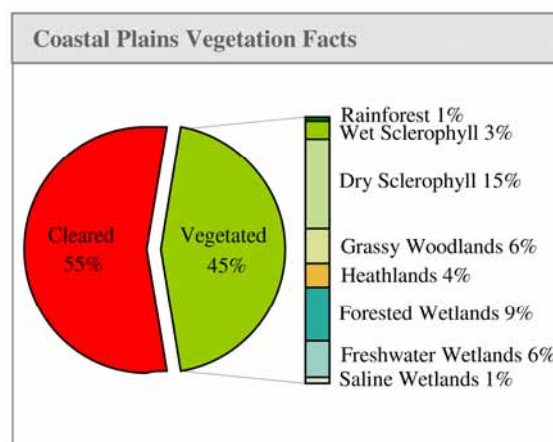
Just over 45% of the coastal plains is covered in native vegetation. Three-quarters of this vegetation is on Crown lands; one-quarter is on private lands. One-third of private land is covered in native vegetation. The vegetation formations in the coastal plains landscape are: dry sclerophyll forests (covering 15% of the landscape), forested wetlands (9%), freshwater wetlands (6%), grassy woodlands (6%), heathlands (4%), wet sclerophyll forests (3%), saline wetlands (1%), and rainforests (1%).

Remaining native vegetation on private land is generally highly fragmented and often degraded, especially on the floodplains of the major rivers.

Larger, contiguous remnants occur in the Bungawalbin Valley east to Bundjalung National Park, along the coast south of Yamba, along the Macleay Coast between Smokey Cape and Port Macquarie and south of Laurieton.

Many areas of vegetation on the coastal plains are part of important elevational corridors linking the midland hills and coastal plains landscapes. Such areas include around Cudgen Lake on the Tweed Coast, north of Brunswick Heads; the Bungawalbyn River valley; the Coast Range south-east of Grafton; Bongil Bongil National Park, south of Coffs Harbour; Yarrahapinni wetlands, north of Kempsey; Maria River and Limeburners Creek north of Port Macquarie; and between Port Macquarie and Laurieton.

Forest structure mapping was undertaken as part of the Comprehensive Regional Assessment for north-eastern NSW. It indicates that nearly 25% of the forest on the coastal plains is candidate old growth, 25% is disturbed old growth, 20% is disturbed mature forest, 10% is mature forest and 20% is young or recently disturbed forest. Of the area mapped as candidate old growth forest, nearly 20% occurs on private land, around 68% is on National Parks and Wildlife estate, 7% on Forests NSW estate and 5% on other Crown lands.





Heathlands, freshwater wetlands, estuarine wetlands and saline wetlands are important features of the coastal plains vegetation. The coastal plains contains over 35% of the Region's heathlands, nearly 70% of the Region's freshwater wetlands, and all the estuarine and saline wetlands. These communities have all been highly cleared, with an estimated 10% of estuarine and saline wetlands remaining and around 30% of freshwater wetlands and heathlands remaining. While over 60% of the remaining heathlands are reserved, only about 35% of freshwater wetlands and 26% of estuarine and saline wetlands are reserved. Many freshwater wetlands occur on private land and have been degraded by draining, filling and a long history of grazing and seasonal cropping.

Aquatic ecosystems

The coastal plains contain the lower reaches and estuaries of the Region's rivers. The eastern fringe of these rivers are considered to be in the poorest health (Turak et.al 2000).

Around 3000 km of the larger rivers and streams in the coastal plains have had their management priority assessed using the Riverstyles™ assessment. While this assessment does not provide a direct measure of stream condition, it does indicate how far different reaches of rivers are from an ideal condition. These assessments found that only 8% of the larger rivers and streams in the coastal plains are minimally disturbed and require only conservation management strategies. A further 2% require strategic management. Nearly 60% are regarded as having moderate recovery potential, 22% have low recovery potential and 9% have high recovery potential (Cohen & Brierley 1999; Cohen et al. 1998; Ferguson et al. 1999a, 1999b, 1999c, 1999d; Goldrick et al. 1999; Lampert et al. 1999a, 1999b).

Eighty barriers to fish passage (15% of the total number in the Region) have been identified in the coastal plains, including eight that are high priority for remediation (DPI 2006).

The estuaries of the Region are important habitat for a variety of waders, shorebirds, fish, crustaceans and other invertebrates. Coastal lakes are the most sensitive of all estuaries to human interventions. Sensitivity is greatest in coastal lakes that have limited exchange of fresh or saline water, including those that have entrances that are closed most of the time, or those that are an irregular shape. The coastal plains landscape contains 25 coastal lakes, including 22 assessed by the Healthy Rivers Commission in 2001. This assessment found that nine of the lakes were high conservation value, nine moderate value and four were low conservation value. Eleven lakes were considered to have an extremely high natural sensitivity, one very high and ten had high sensitivity. Only two lakes were considered pristine, ten slightly affected, six moderately affected and four severely affected (HRC 2002).

All of the Region's wetlands listed in the Directory of Important Wetlands are within the coastal plains landscape (Environment Australia 2001). In addition to these wetlands, there are many freshwater wetlands on the floodplains of the Region's rivers that, while having been mostly cleared, still function hydrologically as wetlands. Others have been drained or cleared and filled and no longer function as water storage bodies. Goodrick (1970) estimated that less than 40% of freshwater wetlands remained intact on the NSW coastal floodplains. Given the clearing and drainage works that have occurred since 1970, there are likely to be far less than 40% in an intact condition today (NSW Scientific Committee 2004a).

The coastal plains landscape supports habitat for the endangered Oxleyan Pygmy Perch which is restricted to north-east NSW and south-east Queensland. In NSW, it occurs from Corindi to Evans Head, with the area around Evans Head being one of the most important known habitats. Wallum heath freshwater bodies are its core habitat, but it also occurs in creeks that run out of these heathlands into intermediate eucalypt forest – heath community, littoral rainforest – melaleuca swamp, or saltrushes in estuarine creeks (DPI 2005).



Threatened species, populations and communities

Ecological communities

The coastal plains landscape supports 12 threatened ecological communities. One of these is listed as critically endangered on the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act):

- Littoral Rainforest and Coastal Vine Thickets of Eastern Australia.

Another 11 communities are listed as endangered under the NSW *Threatened Species Conservation Act 1995* (TSC Act):

- Byron Bay Dwarf Graminoid Clay Heath Community (endemic with a highly restricted distribution)
- Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
- Coastal Cypress Pine Forest in the New South Wales North Coast Bioregion (endemic)
- Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
- Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
- Lowland Rainforest in the New South Wales North Coast and Sydney Basin Bioregions
- Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion
- Sub-tropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion
- Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
- Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
- Themeda Grassland on Seacliffs and Coastal Headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions.

Ecological communities are important features of the coastal plains, with all remaining native vegetation on the floodplains being classified as an endangered ecological community. Refer to **Appendix 12** (on the enclosed CD) for more information on these communities.

Populations

Two fauna and two flora populations known to occur within the coastal plains are listed as endangered on the TSC Act, including:

- Emu population found around Yuraygir and Bundjalung National Parks and the Bungawalbin River Valley (endemic)
- Long-nosed Potoroo population at Cobaki Lakes and Tweed Heads West (endemic with a highly restricted distribution)
- Nambucca Glycine population found at Scotts Head (endemic with a highly restricted distribution)
- *Zieria smithii* population at Diggers Head north of Coffs Harbour (endemic with a highly restricted distribution).

Threatened species

A total of 116 threatened species (see box) have a strong association with the coastal plains, that is, have a majority of their habitat within this landscape. All species listed under the EPBC Act are also

listed under the TSC Act or *Fisheries Management Act 1994* (FM Act), however, some species may have a different status under these Acts.

Threatened species of particular significance to the coastal plains are those considered to have highly restricted distributions within this landscape, including: Black Grass-dart, Byron Bay Diuris, Floyd's Grass, Headland Zieria, Square-stemmed Olax, Swamp Mint-bush and Waterwheel Plant.

Other threatened species of particular significance are those with a disjunct distribution (i.e. with populations that are widely separated from each other), including: Native Justicia, Native Milkwort and Swamp Foxglove.

Appendix 13 (on the enclosed CD) provides a full list of threatened species, their threatened status, regional significance, distribution and habitats.

Coastal Plains Threatened Species Facts					
	EPBC Act	TSC Act	FM Act	Coastal Total	Region
No. of Threatened species	27	113	2	116	267
▪ Plants	11	36		36	145
▪ Invertebrates		4		4	5
▪ Fish	1		2	3	3
▪ Amphibians	2	3		3	15
▪ Birds	6	50		50	64
▪ Reptiles	4	5		5	8
▪ Mammals	3	15		15	31



1.2 Midland hills

Landform

The midland hills landscape covers around 1 394 582 ha or approximately one-third of the Northern Rivers Region. It includes the foothills and low ranges between the coastal plains and the escarpment ranges. The western boundary roughly corresponds to the 250 m contour, and the eastern boundary is the upper limit of the coastal floodplain. It is most extensive in the north where it encompasses much of the mid Tweed, Richmond and Clarence valleys, extending west to Bonalbo, Baryulgil and Nymboida. Around Coffs Harbour it narrows down to about 2 km wide.

The midland hills landscape includes geographic features such as the upper Tweed Valley, Burringbar Range, Alstonville Plateau, Mackellar Range, southern Richmond Range, Coast Range, the sandstone escarpments south of Grafton, Mount Yarrahapinni, Mungay Mountain, Cooperabung Range, Mount Cairncross, Broken Bago Range, North Brother and Middle Brother near Laurieton.

Elevations are generally between 25 and 200 m, but range up to around 500 m at locations such as the Mackellar Range, Mount Belmore and Mount Neville in the southern Richmond Range, and Mount Yarrahapinni, North and Middle Brothers. Slopes are predominantly flat to gentle (0-5°) with moderate to moderately steep slopes in the low ranges and precipitous slopes along cliff lines.

Geology

Sedimentary rocks predominant in the midland hills (66%), followed by basic volcanics (14%), meta-sediments (10%), unconsolidated sediments (5%), granite (3%) and acid volcanics (2%). Unconsolidated sediments which occur throughout the midland hills are scattered lenses associated with river valleys and drainage depressions.

In the central Tweed Valley, the Carboniferous Neranleigh–Fernvale metasediments dominate. Further south, from Ballina to Bangalow and west to Lismore and Kyogle, the Tertiary Lismore Basalts from the Mount Warning caldera form extensive flows. In the upper Tweed and throughout the south-western Richmond Valley and much of the Clarence Valley, sedimentary rocks of the Jurassic Clarence Moreton basin form distinctive sandstone escarpments. In this area there are also limited outcrops of the Walloon Coal measures which have been mined in the Nymboida area.

Along the Coffs Coast from Woolgoolga to Macksville, there are extensive areas of metasediments from the Carboniferous Coramba and Nambucca beds, as well as small areas of sedimentary Carboniferous Brooklana beds and granite outcrops of Permian Gleniffer Adamellite. South of Macksville, through the mid Macleay Valley, there are a variety of Carboniferous to Permian sedimentary rocks. On the southern side of the Macleay Valley there are outcrops of Permian limestone from Yessabah west to Willi Willi.

In the mid Hastings Valley there are extensive areas of sedimentary rocks including the Carboniferous sandstones of the Mingaletta, Pappinbarra and Hyndmans Creek Formations. As well, younger mudstones of the Permian Beechwood beds and sandstones of the Camden Haven group occur and form the distinctive ridge of the Broken Bago Range south of Wauchope. Triassic Rhyolites occur in the headwaters of the Camden Haven and Stewart Rivers west of Lorne and Triassic granite outcrops from the distinctive peaks of North and Middle Brothers near Laurieton.

Climate

The midland hills landscape experiences a warm temperate climate with the majority of rain falling through summer to early autumn. Thunderstorms often produce heavy falls of rain and occasionally hail. Annual rainfall varies markedly throughout the midland hills with the highest (2500 mm) received in

Midland Hills Climate Facts

Temperature

Avg Max Temp: 26°C – 30°C

Avg Min Temp: 2°C – 9°C

Rainfall

Annual rainfall: 900mm–2500mm

the ranges north and south of Murwillumbah and east of Dorrigo. Annual rainfall above 1500 mm occurs in the Tweed, Brunswick and eastern Richmond Valleys; from Woolgoolga to Urunga; and south of Wauchope in the Camden Haven area. Other areas receive 900 to 1500 mm each year, with drier areas located in the Richmond, Clarence and Macleay Valleys, and in rain shadow areas such as Bonalbo–Baryulgil.

Summer days are warm to hot, ranging from an average maximum of 26 °C in areas close to the south coast, to around 28 °C in the western valleys and far north, and over 30 °C between Bonalbo and Baryulgil. Winter temperatures are often cool, with frosts frequently settling in the lower valleys and drainage depressions. In the winter period the temperature ranges from an average minimum of 9 °C in the foothills of the Tweed, Brunswick and coastal Richmond valleys, to 2 °C around Tabulam, Baryulgil, Ramornie and Nymboida.

Tenure

Nearly three-quarters of the midland hills is private land. The remainder is Crown land including National Parks and Wildlife estate, Forests NSW estate and other Crown lands. 1.3% of the midland hills is declared wilderness, and approximately 500 ha is included in the Gondwana Rainforests of Australia World Heritage Area. Some 0.6% of private land is protected under a conversation agreement or covenant.

Landuse

Most private land is zoned as either rural or agricultural (72%). Around 2% is zoned environment protection, 1.2% is zoned urban purposes, and another 1% is zoned rural residential. In addition to areas presently zoned urban and rural residential, a further 7255 ha have been identified for future urban growth and 11 490 ha for future rural residential growth as part of the Far North Coast and Mid North Regional Strategies.

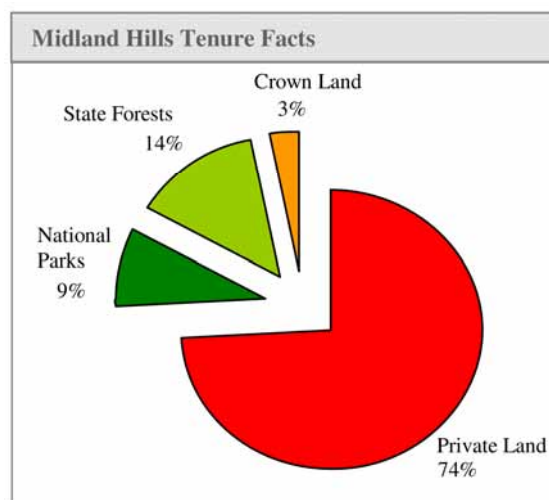
Grazing is the main landuse, occurring on 41% of the midland hills. 'Private forest' covers 22% of the midland hills and, as of 2008, approximately 42 200 ha was covered by 227 native forestry property vegetation plans approved under the *Native Vegetation Act 2003*. Timber plantations cover 1.7% of the midland hills. Other landuses include horticulture (1.4%), rural lifestyle (0.5%) and intensive agriculture (0.2%), and cover some 4920 ha.

People and community

As of 2006, the midland hills had a total population of nearly 202 000 people, and an average population density of 14 people per square kilometre. Many areas closer to the coast have higher than average population densities, while the areas from Bonalbo to Nymboida have lower densities.

The major urban centres on the midland hills (and current population estimates) are: Kempsey (pop. 8500), Murwillumbah (pop. 7600) and Wauchope (pop. 4800). Towns with populations greater than 1000 include: Alstonville–Wollongbar, Bangalow, Bilambil and Bowraville. There are another 20 towns that have populations between 200 and 1000.

The midland hills landscape is expected to experience low to moderate population growth over the next 30 years with areas around Lismore and Bellingen expecting 5% growth. Some areas, such as Kyogle, are expected to experience a slight decline over the next 30 years.



Indigenous community

The midland hills encompass 18 local Aboriginal land councils, including Baryulgil, Birpai (Wauchope), Bogal (Coraki), Bowraville, Bunyah (Laurieton), Casino, Coffs Harbour, Grafton–Ngerrie, Gugin Gudduba (Kyogle), Jali (Ballina), Jana Ngalee (North Baryulgil), Jubullum (Tabulam), Kempsey, Nambucca, Ngulingah (Nimbin), Tweed Byron, Unkya (Eungai Creek) and Yaegl (Macleay). The midland hills covers the central parts of the Birpai (Hastings Valley), Dunghutti (Macleay Valley), Gumbainggir (Clarence Valley) and Bundjalung (Richmond–Tweed valleys) Indigenous language groups.

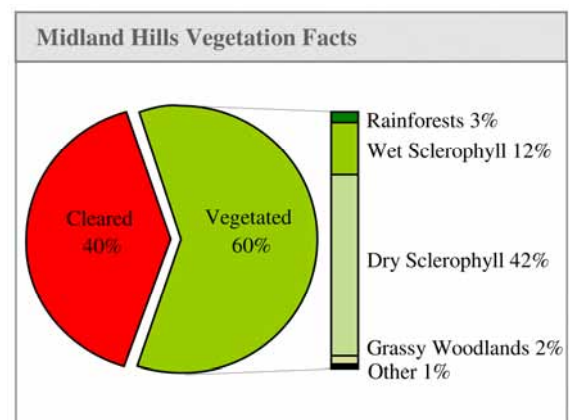
In the midland hills landscape, seven culturally significant Indigenous areas have been recognised under the *National Parks and Wildlife Act 1974*. Five Aboriginal places have been declared, including Casino Bora Ground, Jubullum Flat Camp at Tabulam, Mimiga Gaungan (St Marys Waterhole) west of Woolgoolga, Nymboida, and Parrots Nest (Goorumbil) south-west of Lismore. In addition, two Aboriginal areas have been reserved to protect Indigenous objects or places, including Jubullum Flat Camp and the Nunguu Mirral Aboriginal Area between Urunga and Nambucca Heads.

Community involvement

Over six regional Landcare organisations coordinate more than 150 local Landcare groups, obtain funding and implement environmental works. Around 1000 landholders have received funding for environmental works over the last six years, and 77 landowners have entered into some form of conservation agreement to protect biodiversity on their properties.

Broad vegetation

Nearly 60% of the midland hills landscape is covered in native vegetation. Nearly 40% of this vegetation is on Crown lands and the rest is on private land. Half of the private land in the midland hills is covered with some form of native vegetation. The vegetation formations in the midland hills are: dry sclerophyll forest (covering 40% of the landscape), wet sclerophyll forest (27%), rainforest (15%), grassy woodlands (2%). Areas of heath, freshwater wetland, forested wetland and rock cover 1% of the landscape.



The remaining native vegetation is generally contiguous except for areas in the north around Kyogle and Lismore where there has been extensive historical clearing.

Much of the remaining vegetation on the midland hills forms important corridors linking the escarpment ranges and coastal plains landscapes. Such areas include the foothills of the Macpherson Range north of Murwillumbah, Burringbar Range, Bungawalbyn River Valley, the Coast Range south-east of Grafton, Bongil Bongil National Park south of Coffs Harbour, Yarrahapinni Mountain, Maria and Wilsons rivers south of Kempsey, and the Queens Lake area south of Port Macquarie.

Forest structure mapping was undertaken as part of the Comprehensive Regional Assessment for north-eastern NSW. It indicates that nearly 20% of the forest in the midland hills is candidate old growth, 20% is disturbed old growth, 25% is disturbed mature, 10% mature, and 22% is young or recently disturbed. Of the area mapped as candidate old growth forest, over 40% occurs on private land, 35% is on National Parks and Wildlife estate, 17% is on Forests NSW estate, and 5% is on other Crown lands.



Aquatic ecosystems

The midland hills landscape contains the middle reaches of the larger rivers where the flows slow as the topography flattens. Many river beds have extensive gravel races and large still pools.

Around 3600 km of the larger rivers and streams in the midland hills have had their management priority assessed using the Riverstyles™ assessment. While this assessment does not provide a direct measure of stream condition, it does indicate how far differing reaches of rivers are from an ideal condition. These assessments found that only 14% of river reaches in the midland hills are minimally disturbed and require only conservation management strategies. A further 3% require strategic management. Nearly 50% are regarded as having moderate recovery potential, 17% have low recovery potential and 15% have high recovery potential (Cohen & Brierley 1999; Cohen et al. 1998; Ferguson et al. 1999a, 1999b, 1999c, 1999d; Goldrick et al. 1999; Lampert et al. 1999a, 1999b).

The midland hills landscape contains over half the Region's 520 barriers to fish passage, including 23 of the highest priority sites for remediation. The majority of these high priority sites are in the Tweed, Brunswick and Wilsons (eastern Richmond) catchments. Many of the riparian areas along rivers in the midland hills have been degraded as a result of agricultural activities and many have widespread weed infestations (e.g. Cat's Claw Creeper and Madeira Vine).

Threatened species, populations and communities

Ecological communities

Lowland Rainforest in NSW North Coast and Sydney Basin Bioregion is the only TSC Act threatened ecological community within the midland hills. Lowland rainforest includes subtropical rainforest and some related, structurally complex forms of dry rainforest. It is typically associated with a range of high nutrient geological substrates such as basalts and fine-grained sedimentary rocks up to 600 m altitude .

Populations

There are no midland hills fauna or flora populations listed as endangered under the EPBC Act, TSC Act or FM Act.

Threatened species

A total of 96 threatened species (see box) have a strong association with the midland hills, that is, have a majority of their habitat within this landscape. All species listed under the EPBC Act are also listed under the TSC Act or FM Act, however, some species may have a different status under these Acts.

Threatened species of particular significance to the midland hills are those considered to have highly restricted distributions within this landscape, including: *Ancistrachne maidenii*, *Banksia conferta* subsp. *conferta*, Banyabba Shiny-barked Gum, Chambigne Bertya, Glenugie Karaka, Narrow-leaf Melichrus, Noah's False Chickweed, Shannon Creek Boronia and Spiny Mint-bush.

Other threatened species of particular significance are those with a disjunct distribution (i.e. with populations that are widely separated from each other), including: Beadle's Grevillea, Native Justicia, Native Milkwort, Swamp Foxglove and Tangled Bedstraw.

Appendix 13 (on the enclosed CD) provides a full list of threatened species, their threatened status, regional significance, distribution and habitats.



Midland Hills Threatened Species Facts					
	EPBC Act	TSC Act	FM Act	Midland Total	Region
No of Threatened Spp	30	96		96	267
▪ Plants	22	51		51	145
▪ Invertebrates		1		1	5
▪ Fish					3
▪ Amphibians	1	2		2	15
▪ Reptiles		2		2	8
▪ Birds	4	22		22	64
▪ Mammals	3	18		18	31

1.3 Escarpment ranges

Landform

The escarpment ranges landscape covers around 2 031 681 ha, or approximately 40%, of the Northern Rivers Region. It stretches from the volcanic Macpherson and Nightcap ranges in the north, south to the Comboyne Plateau. The western boundary broadly corresponds to the New England Tablelands Region of the Interim Biogeographic Regionalisation for Australia. The eastern boundary roughly corresponds to the 250 m contour.

The escarpment ranges landscape includes geographic features such as Mount Warning, Border Ranges, Levers Plateau, Tooloom Range, Timbarra River gorge, Gibraltar Range, Mann River Valley, Guy Fawkes gorges, Dorrigo Plateau, Mount Killiecrankie, Macleay River gorges, Carrai Plateau, Werrikimbe and Bulga Tops.

Elevations range from around 250 m in the east to around 1500 m at Point Lookout in New England National Park. Slopes are predominantly moderately steep to very steep (16–45°) with small areas of precipitous slopes along the cliffs associated with gorges. Undulating slopes occur on the elevated plateaus and in the upper river valleys.

Geology

The geology of the escarpment ranges is complex and highly variable, including the oldest and youngest rocks of the Region. Sedimentary rocks are the most predominant (43%), followed by meta-sediments (28%), granites (13%), basic volcanics (10%) and acid volcanics (6%). The only major groups not present are the Quaternary sediments which are absent due to the landscape's steep slopes. The most recent rocks are the Tertiary basaltic plateaus at Acacia Plateau, Dorrigo and Comboyne. The oldest rocks are the granites, basalts and meta-sediments (including Serpentine) of the Cambrian Yarras formation west of Wauchope.

In the north, the Tertiary volcanic ranges associated with the Mount Warning and Focal Peak calderas include basaltic and rhyolitic flows and trachyte plugs and sills. Parts of the Jurassic Clarence–Moreton basin occur in the upper Clarence around Bonalbo and Woodenbong where the overlying volcanic flows have been eroded. West of Baryulgil to Bonalbo is the Permian Drake Volcanics that typically consist of andesite, rhyodacites and rhyolite. The Silurian Willowie Creek mudstones and limestones, south-west of Baryulgil, are considered some of the oldest rocks in the Region. Further west, approaching the boundary of the tablelands landscape, are granitic outcrops of the Triassic to Permian New England Batholith in the Gibraltar Range National Park, further north in the Ewingar area, and up through the upper Clarence and Cataract rivers.

The area to the west of Grafton and south to Dorrigo is characterised by the Carboniferous greywacke meta-sediments of the Coramba beds, mudstones of the Brooklana beds, siltstones of the Moombil beds, and the mixed sediments of the Dyamberin beds. The Demon Fault forms a clear geological unconformity running north–south from the western side of the Timbarra Plateau, south along the Timbarra River, across the Gwydir Highway west of Gibraltar Range and then along the Guy Fawkes River to Ebor. West of the fault lie the older meta-sediments of the Permian Sara and Coffs Harbour beds, as well as areas of the granitic New England Batholith.

To the south-east of the basalt plateaus around Dorrigo and Ebor are the phyllite, schists, shales and other meta-sediments of the Carboniferous Nambucca beds which extend from Bellingen to Taylors Arm and include the mountainous terrain west of Bowraville. Much of the upper Macleay River Valley and parts of the escarpment ranges landscape consist of a variety of Carboniferous to Permian sedimentary rocks, with areas of Permian granite on the Carrai Plateau and Carboniferous meta-sediments of the Girakool beds and Agnes greywacke in the gorges of the upper headwaters. On the southern side of the Macleay Valley there are outcrops of Permian limestone from Willi Willi to the Carrai Plateau.

In the upper Hastings Valley, there are extensive areas of some of the oldest sedimentary rocks, including Devonian Cowangara and Birdwood Formation sandstones and Rolland Road Formation siltstones, Silurian Myra beds of chert as well as younger Carboniferous sandstones of the Pappinbarra and Hyndmans Creek Formations. Triassic Glen Esk granite outcrops occur west of Rollands Plains in the upper Wilson River Valley. Permian conglomerates of the Manning group occur around Ellenborough Falls, west of the Tertiary basaltic Comboyne plateau.

Climate

The escarpment ranges landscape experiences a cool temperate climate with the majority of rain falling through summer to early autumn.

Thunderstorms and orographic rain often produce heavy falls of rain and occasionally hail in mountainous areas. Annual rainfall varies greatly, ranging from over 3000 mm on the Macpherson, Nightcap and Tweed ranges surrounding Mount Warning, to 700 mm in the rain shadows of the Macleay and Guy Fawkes River gorges. Other high elevation ranges such as the Border and Gibraltar ranges, Dorrigo Plateau, Mount Killiekrankie, Mount Werrikimbe and Comboyne plateau receive rainfall of around 2500 to 3000 mm per year.

Summer days are typically warm to hot, with maximum average temperatures ranging from 20 °C around Ebor to 30 °C in the gorges and around Woodenbong in the north. Winter average minimum temperatures are often cool, ranging from 0 °C in elevated central areas around Ebor and Gibraltar Range to 4–6 °C in the lower eastern regions in the far north. Frosts are relatively infrequent and localised due to the effects of vegetation and topography.

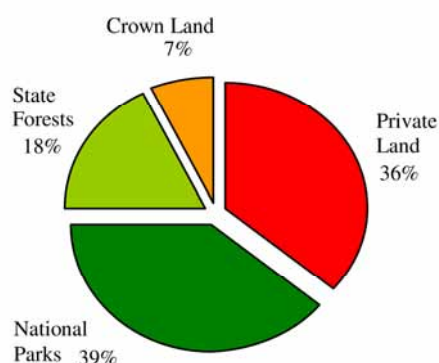
Escarpment Ranges Climate Facts

Temperature	
Avg Max Temp:	20°C – 30°C
Avg Min Temp:	0°C – 6°C
Rainfall	
Annual rainfall:	700mm–3000mm

Tenure

Compared to other landscapes, the escarpment ranges has the lowest proportion of private land (36%). A relatively high, 39%, of the landscape is in National Parks and Wildlife estate. Forest NSW estate accounts for 18% and other Crown lands, 7%. The escarpment ranges also includes a high proportion (20%) of declared wilderness and 12% of the landscape is within the Gondwana Rainforests of Australia World Heritage Area. Just 0.3% of the

Escarpment Ranges Tenure Facts





ranges is protected under a private land conversation agreement or covenant.

Landuse

Most private land is zoned rural or agricultural. Around 3% is zoned environmental protection and 1% as rural forestry. Aside from formal reserves and State forests, the predominant landuse is grazing (18%). Just over half of the Forest NSW estate is excluded from logging. 'Private forest' covers 16% of the ranges and, as of 2008, approximately 67 800 ha was covered by 350 native forestry property vegetation plans approved under the *Native Vegetation Act 2003*—the largest area of the landscapes. There are also small areas of private hardwood plantation (0.2%), rural lifestyle (0.2%) and rural residential (0.1%).

People and community

As of 2006, the escarpment ranges landscape had a population of nearly 24 000 people, and an average population density of one person per square kilometre (the lowest in the Region). These figures reflect the large areas of national park and State forest in the landscape, together with the rugged topography, difficult access and long distance from urban service centres.

Dorrigo is the main regional centre in the escarpment ranges and has a population of 1000. Other towns (and current population estimates) are: Comboyne (pop. 700), Woodenbong (pop. 320), Lowanna (pop. 300), Urbenville (pop. 220), Bellbrook (pop. 200), Drake (pop. 150) and Ebor (pop. 120). Only minor changes in population are expected over the next 30 years, although areas such as Dorriggo may experience growth as people move to the area for lifestyle reasons.

Indigenous community

The escarpment ranges landscape covers the outer components of many local Aboriginal land councils but includes major portions of Birpai (Port Macquarie), Bowraville, Dorriggo Plateau, Glen Innes, Grafton–Ngerrie, Jubullum (Tabulam) and Muli Muli (Woodenbong). The escarpment ranges cover the very eastern parts of the Nganyaywana (southern Tablelands) and Ngarabal (northern Tablelands) Indigenous language groups and the mid-western upland parts of the Biripi (Hastings Valley), Bundjalung (Richmond, Tweed and northern Clarence valleys), Dainggatti (Macleay Valley) and Gumbainggir (Bellinger and southern Clarence valleys) language groups.

In the escarpment ranges landscape, nine culturally significant Indigenous areas have been declared as Aboriginal places under the *National Parks and Wildlife Act 1974*. The places include: Tooloom Falls, Waratah Trig and Sugarloaf in the Gibraltar Range, and Carrai Waterholes, Long Gully and Burrell Bulai in the upper Macleay Valley.

Community involvement

Around 20 regional Landcare organisations coordinate 60 local Landcare groups, obtain funding and implement environmental works. Over 500 landholders have received funding for environmental works over the last six years and 57 landowners have entered into some form of conservation agreement to protect biodiversity on their properties.

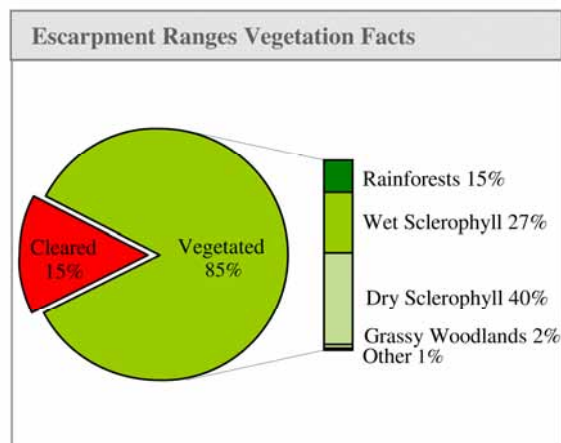
Broad vegetation

Over 85% of the escarpment ranges landscape is covered in native vegetation. Two-thirds of this is on Crown land. Around 70% of private land is vegetated. The vegetation formations in the escarpment ranges are: dry sclerophyll forest (covering 42% of the landscape), wet sclerophyll forest (12%), rainforest (3%) and grassy woodlands (2%). Areas of heath, freshwater wetland, forested wetland and rock cover 1% of the landscape.

Remaining vegetation is generally contiguous with only a small degree of fragmentation in the river valleys and areas adjacent to the tablelands. This contiguity is a key feature of the escarpment ranges, providing an important north–south vegetated corridor, as well as crucial links from the coastal valleys to the tablelands.

The escarpment ranges also support 85% of the Region's rainforests, half of its forests and woodlands and one-quarter of its heathlands.

Forest structure mapping was undertaken as part of the Comprehensive Regional Assessment for north-eastern NSW. It indicates that nearly three-quarters of the Region's candidate old growth forest occurs in the escarpment ranges. Some 43% of the forests on the escarpment ranges is old growth, 15% is disturbed old growth forest, 14% is mature and disturbed mature, and 10% is young or recently disturbed forest. Of the mapped candidate old growth forest, around 63% occurs on National Park and Wildlife estate, 13% on Forests NSW estate, 11% on other Crown lands and 12% on private land.



Aquatic ecosystems

The escarpment ranges contains the upper to middle reaches of the major rivers and the headwaters of many small tributaries. Waterfalls, gorges and cascades are a feature as the rivers drop up to 800 m from the tablelands to the midland hills and coastal plains.

Around 4800 km of the larger rivers and streams in the escarpment ranges have had their management priority assessed using the Riverstyles™ assessment. While this is not a direct measure of stream condition, it does indicate how far differing reaches of river are from an ideal condition. These assessments found that 54% of the larger rivers and streams in the escarpment ranges are minimally disturbed and require only conservation management strategies. A further 1% require strategic management. Around 23% are regraded as having moderate recovery potential, 13% have high recovery potential and 9% have low recovery potential (Cohen & Brierley 1999; Cohen et al. 1998; Ferguson et al. 1999a, 1999b, 1999c, 1999d; Goldrick et al. 1999; Lampert et al. 1999a, 1999b).

The escarpment ranges contains nearly 100 (20%) of the Region's barriers to fish passage, including 6 of the highest priority for remediation. There are small areas of wetlands on the flatter plateaus around Dorrigo and Carrai to the west of Kempsey as well as along some of the smaller streams in the upper headwaters around Tenterfield. Most of the riparian areas are in reasonable condition due to the steep topography and predominance of public land in this landscape.

The escarpment ranges landscape supports the habitat of the endangered Eastern Freshwater Cod. Since the late 1960s, only small numbers have been caught and only from tributaries of the Clarence River where some pristine habitat still exists (such as the Nymboida, Little Nymboida, Guy Fawkes, Boyd and Mann Rivers). The Cod is now considered extinct in the Richmond River system, and very rare or absent in the major northern tributaries of the Clarence River system (the Clarence, Rocky and Cataract Rivers). It is also no longer found in the Orara River, where they were once very common (DPI 2004).

Threatened species, populations and communities

Ecological communities

The escarpment ranges contains four threatened ecological communities, of which one is listed nationally as critically endangered on the EPBC Act:

- White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland.

Another three communities are listed as endangered under the TSC Act:

- Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps Bioregions
- White Gum Moist Forest in the NSW North Coast Bioregion
- Upland Wetlands of the Drainage Divide of the New England Tableland Bioregion.

Refer to **Appendix 12** (on the enclosed CD) for more information on these communities.

Neither cool temperate rainforests nor montane heathlands are listed as endangered, however, they are considered to be regionally significant ecological communities. Cool temperate rainforests reach their northern limit within the Region, and montane heathlands have a highly restricted distribution.

Populations

There are no escarpment ranges fauna or flora populations listed as endangered under the EPBC Act, TSC Act or FM Act.

Threatened species

A total of 98 threatened species have a strong association with the escarpment ranges, that is, having a majority of their habitat within this landscape. All species listed under the EPBC Act are also listed under the TSC Act or FM Act, however, some species may have a different status under these Acts.

Threatened species of particular significance to the escarpment ranges are those considered to have highly restricted distributions within this landscape, including: Acalypha, Barren Mountain Mallee, Bellinger River Emydura, Border Ranges Daisy, Brown Butterfly Orchid, Green Waxberry, *Hibbertia superans*, Mountain Angelica, Oval-leafed Pseudanthus, Pink Underwing Moth, Pygmy Bishop's Hat, Soft Grevillea and Stinky Lily.

Other threatened species of particular significance are those with a disjunct distribution (i.e. with populations that are widely separated from each other), including: Coolabah Bertya, Guthrie's Grevillea, Leafless Tongue Orchid, Pouched Frog, Veined Doubletail and Wollumbin Zieria

An additional three species—Eastern Quoll, Lesser Creeping Fern and Peppered Frog—have not been recorded for over 30 years and may be extinct.

Appendix 13 (on the enclosed CD) provides a full list of threatened species, their threatened status, regional significance, distribution and habitats.

Escarpment Ranges Threatened Species Facts					
	EPBC Act	TSC Act	FM Act	Escarpment Total	Region
No of Threatened Spp	40	97	1	98	267
▪ Plants	29	52		52	145
▪ Invertebrates	1	1		1	5
▪ Fish	1		1	1	3
▪ Amphibians	3	8		8	15
▪ Reptiles	1	2		2	8
▪ Birds		12		12	64
▪ Mammals	5	22		22	31



1.4 Tablelands

Landform

The tablelands landscape covers around 993 500 ha, about 20% of the Region. It includes the western New England Tableland, from Tenterfield in the north to Walcha in the south. The eastern boundary broadly corresponds to the New England Tablelands Region of the Interim Biogeographic Regionalisation for Australia. The tablelands landscape forms a narrow 20 km band north of Glen Innes and broadens to 75 km east of Armidale. It includes the prominent geographic features of Bald Rock, Timbarra Plateau, Mount Spirabo, Ben Lomond, Mount Duval, Cathedral Rocks and the extensive plain at Salisbury Waters north of Walcha.

Elevations range from around 900 m along the eastern fall to over 1500 m at Cathedral Rocks west of Ebor. Slopes are predominantly flat to undulating (0–10°) with small areas of steeper slopes along the eastern fall, elevated local ranges and incised river valleys.

Geology

The most predominant rocks on the tablelands are the granites (37%) and meta-sediments (34%). Other types are less extensive: basic volcanics (16%), sedimentary (7%), acid volcanics (4%), unconsolidated sediments (2%). Much of the tablelands, particularly the north, is characterised by the granite outcrops of the Triassic to Permian New England Batholith. Prominent examples include Bald Rock and Boonoo Boonoo north of Tenterfield, and Crown Mountain south-east of Glen Innes. In the south, granite outcrops occur at Cathedral Rocks west of Ebor, and along the escarpments of the upper Macleay River gorges. Older Carboniferous meta-sediments such as greywacke occur south-east of Armidale, north-west of Cathedral Rocks, east of Walcha, and between Uralla and Walcha.

Mineralisation has occurred in the contact zones between granite and older meta-sediments, with mineral deposits occurring at Hillgrove east of Armidale, Kingsgate south-east of Glen Innes and Liston north of Tenterfield. Overlaying the granite and meta-sediments in the south are the more recent Tertiary basalts, but these have largely been eroded and the only extensive areas are around Guyra, south and south-east of Walcha. These basalt flows have altered drainage patterns, forming small lakes and wetlands, particularly around Guyra. Smaller disjunct basalt outcrops also occur around Walcha, Armidale, Uralla and north-west of Cathedral Rocks.

Climate

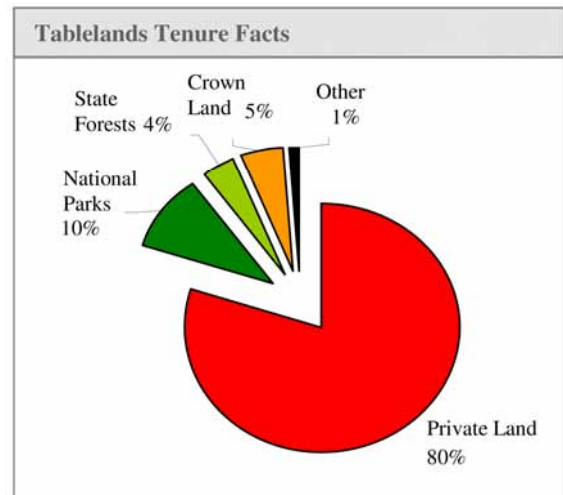
The tablelands landscape experiences a cool temperate climate with the majority of rain falling through the summer months to autumn. Thunderstorms often produce heavy falls of rain and occasionally hail. Snowfalls occur from June until November, with heavy falls every three to five years. Annual rainfall is typically 700 to 900 mm, increasing with proximity to the eastern escarpment.

Tablelands Climate Facts	
Temperature	
Avg Max Temp:	20°C – 26°C
Avg Min Temp:	-10°C – 10°C
Rainfall	
Annual rainfall:	700mm–900mm

Summer days are warm, ranging from an average maximum temperature of 20 °C in mountainous areas such as Cathedral Rocks, to 26 °C north of Tenterfield and around Uralla. Nights are cool. Humidity is typically low. In winter, severe frosts occur from June to September with minimum temperatures reaching as low as -10 °C with cold south-westerly winds restricting daytime temperatures to less than 10 °C. Average winter minimum temperatures are lowest (–1 °C) in the Walcha area.

Tenure

Tablelands landscape has the highest proportion of land in the Region under private ownership: 80%. Some 10% is National Parks and Wildlife estate, 4% is Forest NSW estate, and 5% is other Crown lands. Declared wilderness covers 4% of the tablelands and 2% is included in the Gondwana Rainforests of Australia World Heritage Area. Around 1% of private land is protected under a conversation agreement, covenant or Indigenous property agreement (the highest proportion in the Region).



Landuse

The vast majority of land in the tablelands is zoned rural, with small areas zoned urban and only 2% zoned environment protection. The predominant landuse is grazing (64% of the tablelands) and 0.5% is used for horticulture and other intensive agriculture. 'Private forests' cover 7% of the tablelands where private native forestry is not a major landuse activity—only seven property vegetation plans have been approved under the *Native Vegetation Act 2003*.

People and community

As of 2006, the tablelands landscape had a total population of just over 32 000 people, and an average population density of 3.5 people per square kilometre. Armidale is the main regional city and has a population of over 20 000. Armidale is also home to the University of New England which attracts around 4000 students. Other large town centres include Guyra (pop. 1800) and Walcha (pop. 1600). Towns that fall outside the Northern Rivers Region that are important town centres on the tablelands include: Glen Innes (pop. 5800), Tenterfield (pop. 3200) and Uralla (pop. 2300). Population growth of 10% is expected in the Armidale area over the next 30 years. Other areas are predicted to experience population declines ranging from 5% around Tenterfield, to nearly 20% around Glen Innes and Walcha.

Indigenous community

The tablelands landscape covers a major component of five local Aboriginal land councils including Amaroo (Walcha), Armidale, Guyra, Glen Innes, Moombahlene (Tenterfield) and the western portion of Muli Muli (Woodenbong). The tablelands covers the eastern parts of the Nganyaywana (southern Tablelands) and Ngarabal (northern Tablelands) Indigenous language groups and far western upland parts of the Bundjalung (Richmond, Tweed and northern Clarence valleys), Dainggatti (Macleay Valley) and Gumbainggir (Bellinger and southern Clarence valleys) language groups.

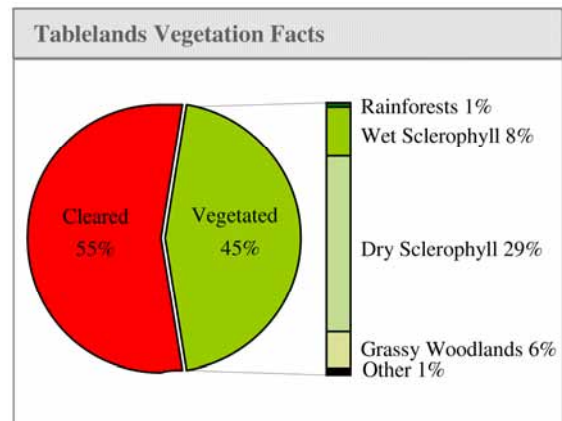
One culturally significant Indigenous area, Wellington Rock Aboriginal Place east of Tenterfield, has been recognised under the *National Parks and Wildlife Act 1974*.

Community involvement

Two regional Landcare organisations—Southern New England Landcare Coordinating Committee based in Armidale, and Granite Borders Landcare Committee Incorporated in Tenterfield—facilitate and coordinate over 45 local Landcare groups, obtain funding and implement environmental works. Over 90 landholders have received funding for environmental works over the last six years and another 15 landowners have entered into some form of conservation agreement to protect biodiversity on their properties.

Broad vegetation

Around 45% of the tablelands landscape is covered in native vegetation, the majority of which is on public land. Only 30% of private land is covered with native vegetation and much of this is degraded or fragmented. The vegetation formations in the tablelands landscape are: dry sclerophyll forest (covering 29% of the landscape), wet sclerophyll forest (8%), grassy woodlands (6%) and rainforest (1%). Areas of heath, freshwater wetland and rock cover 1% of the landscape.



Native vegetation west of the escarpment edge is generally degraded and fragmented, with many small remnants scattered across expanses of cleared land. Larger remnants occur in areas of rugged topography such as mountainous ranges, deep gorges and where there are poor soils or extensive areas of rocky outcrops. North of Glen Innes and Tenterfield there are important vegetation corridors that form links between the escarpment ranges and the western slopes and plains. The rocky outcrops typical of the granite areas north of Tenterfield, south-east of Glen Innes and east of Ebor support important vegetation communities and plants that are rare or have restricted distributions.

Forest structure mapping was undertaken as part of the Comprehensive Regional Assessment for north-eastern NSW. It indicates that 33% of the forest and woodland on the tablelands is candidate old growth forest (33%), 35% is disturbed old growth, 20% is mature or disturbed mature forest, and the remaining 10% is either young or recently disturbed forest. One-quarter of the candidate old growth forest is on private land, the majority is on National Parks and Wildlife estate (55%), Forests NSW estate (10%) and other Crown lands (10%).

Aquatic ecosystems

Around 1200 km of the larger rivers and streams in the escarpment ranges have had their management priority assessed using the Riverstyles™ assessment. While this is not a direct measure of stream condition, it does indicate how far differing reaches of river are from an ideal condition. These assessments found that only 14% of the larger rivers and streams in the tablelands are minimally disturbed and require only conservation management strategies. A further 3% require strategic management. Nearly 65% were regraded as having low recovery potential, 17% have moderate recovery potential and 3% have high recovery potential (Cohen & Brierley 1999; Cohen et al. 1998; Ferguson et al. 1999a, 1999b, 1999c, 1999d; Goldrick et al. 1999; Lampert et al. 1999a, 1999b).

The tablelands contains 75 barriers to fish passage, including three of the highest priority sites for remediation.

There are 37 mapped montane lagoons in the tablelands and these are part of the Upland Wetlands endangered ecological community. Many have been drained, dammed, cultivated or grazed and only two are within conservation reserves. One-third are considered to have intact hydrology and vegetation, and two-thirds are smaller than 10 ha (Bell et al. 2008).

There are two threatened ecological communities that comprise aquatic ecosystems on the tablelands: montane peatlands and swamps, and upland swamps.

Montane peatlands and swamps are associated with accumulated peaty or organic mineral sediments on poorly drained flats in the headwaters of streams. They occur on undulating tablelands and plateaus, generally in catchments with basic volcanic or fine-grained sedimentary substrates or, occasionally, granite (Scientific Committee 2004b). Montane peatlands and swamps typically have an open to very sparse layer of shrubs 1–5 m tall and a dense groundcover of sedges, grasses and



forbs (except where a dense cover of tall shrubs casts deep shade). Hummocks of sphagnum moss may occur amongst other components of the ground layer (Scientific Committee 2004b).

Upland swamps occur in shallow-temporary to near-permanent wetlands naturally restricted to the higher altitudes (> 900 m) associated with the Great Dividing Range (Scientific Committee 2002). Compared to montane peatlands and swamps, upland swamps have fewer woody plants, a greater component of aquatic herbs, are based on substrates with less peat and higher mineral content, and have shallow temporary to near-permanent standing water (Scientific Committee 2004b).

Upland wetlands are important habitat for a diverse vertebrate and invertebrate fauna. Waterbirds, frogs, turtles and eels are common, particularly when the wetlands are flooded. Some of these wetlands are sites of significance for migratory bird species covered by international agreements. Most of these wetlands are naturally temporary, however, some are practically permanent, and others are seasonal or intermittent (Boulton & Brock 1999, cited in Scientific Committee 2002). Together these wetting and drying patterns provide a mosaic of habitats in space and time across the landscape (Brock & Jarman 2000, cited in Scientific Committee 2002). Over 70% of upland wetlands have been lost through draining or damming since European settlement (Bell et al. 2000; Benson & Ashby 2000; Brock et al. 1999, cited in Scientific Committee 2002) and most of the remaining wetlands have been severely modified by changes in water regime (Bell et al. 2008).

Threatened species, populations and communities

Ecological communities

The tablelands landscape supports seven threatened ecological communities. Two of these are listed under the EPBC Act:

- Upland Wetlands of the New England Tablelands and the Monaro Plateau—endangered
- White Box – Yellow Box – Blakely’s Red Gum Grassy Woodland and Derived Native Grassland—critically endangered.

Another five communities are listed as endangered under the TSC Act:

- New England Peppermint Woodland on Basalts and Sediments in the New England Tableland Bioregion
- Ribbon Gum, Mountain Gum, Snow Gum Grassy Forest/Woodland of the New England Tableland Bioregion
- Montane Peatlands and Swamps
- Upland Wetlands of the Drainage Divide of the New England Tablelands
- White Box, Yellow Box, Blakely’s Red Gum Woodlands.

Refer to **Appendix 12** (on the enclosed CD) for more information on these communities.

Populations

The Tusked Frog *Adelotus brevis* in the Nandewar and New England Tablelands bioregions is the only population known to occur within the tablelands that is listed as endangered under the TSC Act.

Threatened species

A total of 51 threatened species (see box) have a strong association with the tablelands, that is, have a majority of their habitat within this landscape. All species listed under the EPBC Act are also listed under the TSC Act or FM Act, however, some species may have a different status under these Acts.

Threatened species of particular significance to the tablelands are those considered to have highly restricted distributions within this landscape, including: Bird Orchid, Montane Green Five-corners, Mountain Wax-flower, New England Gentian, Tenterfield Eyebright and Warra Broad-leaved Sally.

An additional two species—Yellow-spotted Bell Frog and Peppered Frog—have not been recorded for over 30 years and may be extinct. **Appendix 13** (on the enclosed CD) provides a full list of threatened species, their threatened status, regional significance, distribution and habitats.

Tablelands Threatened Species Facts					
	EPBC Act	TSC Act	FM Act	Midland Total	Region
No of Threatened Spp	23	51		51	267
▪ Plants	2	30		30	145
▪ Invertebrates					5
▪ Fish					3
▪ Amphibians	18	5		5	15
▪ Reptiles	1	1		1	8
▪ Birds	1	9		9	64
▪ Mammals	1	6		6	31



Acronyms

CMA	Catchment management authority
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
FM Act	<i>Fisheries Management Act 1994</i>
TSC Act	<i>Threatened Species Conservation Act 1995</i>

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