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Biogeographic influences on the native plants of the New South Wales South Coast



Natural History in all its Branches

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ABSTRACT

Plant diversity on the New South Wales South Coast is shaped by a complex interaction of climatic gradients and its diverse geology, topography and landform. There is a rich mosaic of ecosystems, including rainforests, heathlands, and expansive eucalypt forests, supporting many rare or threatened plant species. This region is an ecological crossroads, where northern and southern climatic zones converge, creating range limits for many plant species. Plant diversity is also at a critical tipping point, increasingly affected by fire, land clearing, forestry, and urban expansion.

This paper examines the major biogeographic factors shaping plant diversity on the South Coast, highlighting key examples of rare plant communities, and assessing the impacts of the 2019–20 bushfires on regional vegetation.

The region was arguably hit hardest by the Black Summer bushfires, and its extensive eucalypt forests and rugged terrain make it particularly vulnerable to future fire events. Escalating development pressures and its transitional location, situated between northern and southern floral assemblages, as well as between tableland and coastal floras, could significantly increase its vulnerability to the ongoing effects of climate change. The environmental complexity and mounting pressures in this region underscore the urgent need for integrated, proactive efforts to preserve its distinctive botanical heritage.

INTRODUCTION

The boundaries of the New South Wales (NSW) South Coast are defined in various ways. For the purposes of this paper, the region is broadly defined according to the South Coast Botanical Subdivision, as outlined in the *Flora of New South Wales* (Figure 1) (Harden 2002). The area spans approximately 14 300 square kilometres, extending from the Shoalhaven River south to the NSW–Victorian border, and is bounded by the Pacific Ocean to the east and the Great Escarpment to the west. The region includes:

- Two major bioregions: the southern end of the Sydney Basin in the north and the predominating, South East Corner bioregion in the south (DCCEEW IBRA, 2025a)
- Four local government areas: Bega Valley, Eurobodalla Shire, most of Shoalhaven City Council, and a small part of the Queanbeyan-Palerang Regional Council
- Six major river catchments: the Towamba, Bega, Tuross, Moruya, Clyde, and most of the Shoalhaven, along with numerous smaller coastal catchments.

Climate and geology show a general north–south gradient, while topography rises sharply from the coastal plain to the Great Escarpment in the west. The terrain is often rugged, and the interplay of geology,

climate, and topography creates a mosaic of micro-environments that support diverse and highly localised plant communities. While coastal areas face various pressures, the 2019–20 bushfires had an unprecedented and wide-reaching impact in what was arguably the worst affected region in NSW.



Figure 1. Map of NSW South Coast showing regional boundary bioregions and main features.
Satellite image © Earthstar Geographics.

Geological Patterns

The NSW South Coast is a complex geological mosaic shaped by tectonic activity, erosion, sedimentation, and volcanic events over hundreds of millions of years (Figure 2). It largely lies within the Lachlan Orogen, an ancient system formed during the Palaeozoic Era mainly between the Ordovician and Devonian periods (~480 to ~360 million years ago) along the eastern margin of the ancient supercontinent Gondwana. A dominating geomorphological feature of the region is the Great Escarpment along its western edge, which separates the inland Southern Tablelands from the relatively narrow coastal zone.

The northern part of the region is characterised by Permian sedimentary rocks of the Sydney Basin, with Nowra Sandstone as the dominant unit. This resistant sandstone forms the region's distinctive steep cliffs and deeply dissected plateaux. Associated shales and siltstones, particularly the marine Wandrawandian Siltstone, contribute significantly to local variation in topography, soil characteristics, and vegetation distribution (Herbert & Helby 1980; Hesse 2010).

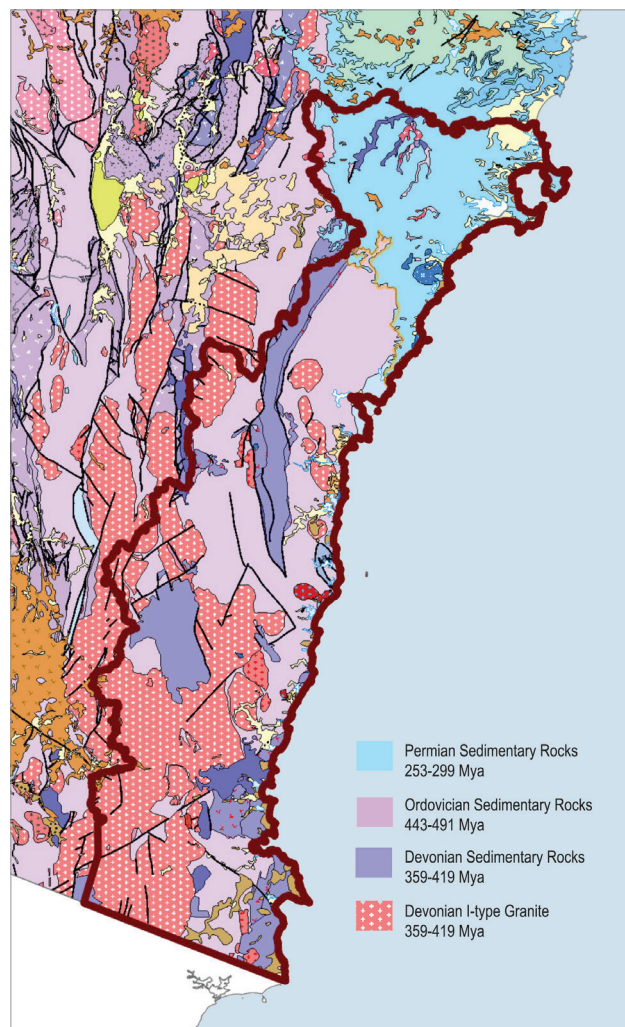


Figure 2. Geology of the NSW South Coast Region. Source: Geological Survey of NSW 2009, 1:1,500,000 Geology Map.

South of Ulladulla, the Sydney Basin narrows, and the geology becomes more structurally complex. This area represents a tectonic transition zone, where Permian sediments are faulted and folded against older basement rocks of the Lachlan Orogen. Further south around Moruya and Gulaga Mount Dromedary, the landscape is shaped by igneous rocks including granodiorite and monzonite, formed about 60 million years ago. Nearby, much older Devonian granites and metasediments from the eastern Lachlan Orogen add to the area's geological diversity.

The Great Escarpment, particularly in Budawang, Deua and Wadbilliga National Parks, reveals Ordovician to Devonian bedrock. These dissected uplands support vegetation communities adapted to shallow, acidic, nutrient-poor soils, especially dry sclerophyll forests and heathlands. In the far south, inland hills of the Bega Valley and Nadgee regions are underlain by large Devonian granite intrusions, which weather into sandy, nutrient-poor soils. These soils support dry sclerophyll vegetation, including heathlands and open forests, and are often associated with high plant diversity and endemism.

Although rare, more fertile soils derived from basalt, monzonite, or other igneous rocks occur in small, isolated patches, such as west of Milton, at Bingi Bingi Point, and around Tilba Tilba and Gulaga. These areas support wet sclerophyll forests and patches of subtropical to temperate rainforest, representing floristic refugia in a predominantly sclerophyllous landscape (Hesse 2010; Tozer et al. 2010a). Along the coast near Batemans Bay, Broulee, Narooma, and Tathra, the terrain is shaped by Quaternary dune systems,

marine terraces, and estuarine deposits. These recent sediments support coastal heathlands, swamp forests, and wetlands, which are often ecologically distinct from the inland ranges.

The diverse geology of the South Coast strongly shapes plant localisation and endemism, habitat specialisation, and fire response traits. It also influences microclimates and drainage patterns, all of which contribute to the region's rich ecological diversity.

Climate Gradients and Landscape Features

The region has a temperate climate with annual rainfall between 800 and 1200 mm, generally well-distributed with a slight summer maximum (Table 1). However, there are significant latitudinal and altitudinal variations in climate. The northern South Coast, near the Shoalhaven River, has warm temperate conditions with subtropical influences, while the southern reaches and some isolated high peaks approach a cool temperate climate. East–west gradients result in wetter and cooler conditions near the escarpment as altitude increases.

Site	Locality	Latitude (decimal °)	Elevation (m)	Climate - Annual Means		
				Rainfall (mm)	Max temp (°C)	Min temp (°C)
Nowra	Coastal - northern	34.88 °S	9	1020	21.3	11.3
Ulladulla	Coastal - northern	35.36° S	15	1214	20.7	13.4
Batemans Bay	Coastal - central	35.91 °S	7	889	21.6	10.0
Narooma	Coastal - central	36.21 °S	30	907	20.2	12.0
Bega	Coastal - southern	36.67 °S	50	675	21.9	8.9
Green Cape	Coastal - southern	37.26 °S	20	637	18.2	12.5
Nerriga ¹	Escarpment - northern	35.12 °S	630	755	19.1	6.5
Braidwood ¹	Escarpment - central	35.45 °S	642	723	19.0	5.5
Nalbaugh SF ²	Escarpment - southern	37.07 °S	675	1184	17.4	5.4

¹Tablelands location, slightly inland from the Escarpment

²Records ceased in 1977

Table 1: Climate Statistics for South Coast locations Source: Bureau of Meteorology (BoM), 2025

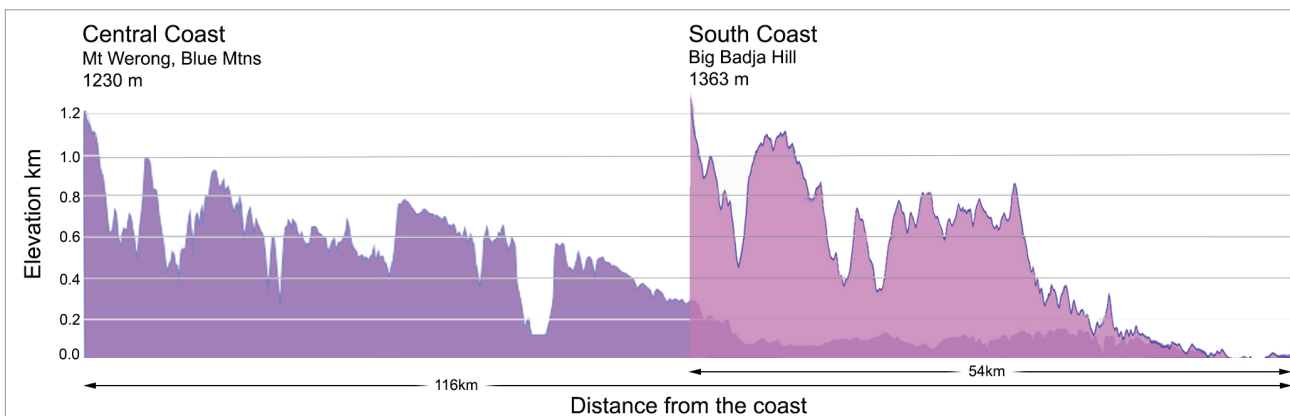


Figure 3. Elevation profile of the South Coast compared to the Central Coast. Source: NASA Shuttle Radar Topography Mission (SRTM).

Biogeographic influences on the native plants of the NSW South Coast

The landscape includes coastal dunes, estuarine systems, river valleys, lowland forests and upland escarpments, contributing to environmental heterogeneity and supporting high levels of plant diversity and endemism (DECCW 2010). In contrast to the broader and more gradual coastal plain of the Sydney Basin to the north, the South Coast features a markedly more abrupt and rugged transition (Figure 3). The coastal plain rises sharply to the Great Escarpment, resulting in dramatic topographic shifts. This is especially pronounced in the Deua–Wadbilliga wilderness, where a narrow coastal strip quickly gives way to steep and rugged hinterland terrain. Big Badja Hill, on the escarpment west of Narooma, is the highest point at 1,363 m above sea level (Figure 4).



Figure 4. Rugged wilderness in Wadbilliga National Park, looking north from Bumerry Ck Fire Trail Big Badja Hill, endangered tree *Eucalyptus stenostoma* (Jilliga Ash) in foreground. Oct 2024. Photo: S. Wawrzyczek.

These sharp topographic gradients, combined with underlying geological diversity and climatic variation, give rise to a complex patchwork of microenvironments. Steep slopes, shaded gullies, exposed ridgelines, and sheltered valleys each support distinct moisture regimes, soil types, and temperature ranges. As a result, plant communities are often highly localised, with many species restricted to narrow ecological niches. This environmental complexity contributes to the region's high floristic diversity and makes it particularly important for conservation (Keith 2004).



Figures 5a-e. Images of South Coast landscapes - **5a.** View south from Mount Bushwalker, Morton National Park, Sep 2024. Photo: P. Kaye.



5b. Ancient sedimentary rocks near Batemans Bay, Jul 2019. Photo: P. Warburton.



5c. Coastal cliffs reveal intense folding, Batemans Bay, Jul 2025. Photo: P. Kaye.



5d. Moruya River, looking west to the escarpment, May 2021. Photo: P. Warburton.



5e. View from the coastal township of Mystery Bay to Gulaga, May 2021. Photo: P. Warburton.

Flora and Vegetation

Vegetation Form	Area km ²	Percent of Total Area	Main Classes
Dry Sclerophyll Forests	4,949	34%	Southern Hinterland, Coastal Dune, South East, Southern Wattle, Sydney Coast, South Coast Sands
Wet Sclerophyll Forests	4,663	33%	South Coast, Southern Escarpment, Southern Lowland, Southern Tableland
Grassy Woodlands	841	6%	Coastal Valley
Rainforests	598	4%	Littoral, Warm Temperate, Cool Temperate, Dry
Total Forests	11,051	77%	
Heathlands	559	4%	Coastal Headland, Sydney Coastal, South Coast, Sydney Montane, Southern Montane
Wetlands	488	3%	Freshwater: Coastal Heath Swamps, Coastal Freshwater Lagoons, Coastal Floodplain, Riverine Forest Saline: Mangrove Swamps, Saltmarshes, Seagrass Meadows
Grasslands	29	<1%	Maritime, Temperate Montane
Total non-Forest	1,075	8%	
Total Native	12,126	85%	
Non-Native/Cleared	2,249	15%	

Table 2: Major Vegetation Formations of the NSW South Coast. Sources: State Vegetation Type Map (SVTM), NSW DCCEEW (2024); Jervis Bay Territory vegetation data from NSW OEH (2013) Biometric Compilation Map

The flora of the NSW South Coast has been shaped by the dynamic interplay of climate, geology, elevation, latitude and evolutionary history. A rich mosaic of vegetation types spans the landscape, ranging from heathlands and sclerophyll forests to temperate rainforests, wetlands, and riparian corridors (Table 2). These ecosystems reflect both long-term ecological persistence and ongoing environmental change, and offer important insights into speciation, resilience, and evolutionary processes.

At the floristic level, ancient Gondwanan lineages coexist with species that have evolved more recently in response to Australia's increasing aridity and fire frequency (Crisp & Cook 2013). Many species reach the northern or southern limits of their distribution, reflecting the region's transitional position between temperate and subtropical biogeographic zones.

Around 85% of the region remains covered by native vegetation, predominantly eucalypt-dominated forest (Table 2). Heathlands, wetlands and grasslands account for around 8% of the landscape, while the remaining 15% consists of land cleared for agricultural or residential development.

Eucalypt Forests and Woodlands

Wet and Dry Sclerophyll Forests occur in roughly equal proportions across the region. Dry Sclerophyll Forests occupy drier slopes and ridgelines and are particularly notable for spanning a broad altitudinal range, with distinct shifts in plant species composition occurring with increasing

elevation. In contrast, Wet Sclerophyll Forests are generally confined to higher elevations or steep gullies and sheltered slopes at lower altitudes. Lowland Wet Sclerophyll Forest, characterised by *Corymbia maculata* (Spotted Gum) with *Macrozamia communis* (Burrawang), is found at elevations below 300 m (Keith 2004) and is one of the most visually distinctive forest of the region (Figure 6).

Although they cover a relatively small proportion of the landscape, Grassy Woodlands are locally significant in coastal rain shadow valleys within the central and southern areas of the region. These woodlands occur on more fertile soils and have been heavily fragmented by land clearing, now surviving only as scattered remnants across the landscape.

With over 90 eucalypt species, the South Coast supports more than 10% of Australia's total eucalypt diversity. They range in form from towering mountain trees over 60 m tall to compact mallees just 1 m high, and occupy a wide variety of environments, from coastal headlands and alluvial flats to steep escarpments and rugged inland ranges. Individual species distributions are closely tied to factors such as rainfall, geology, soil fertility, and fire history.

There are a wide range of distribution patterns: some reach their northernmost or southernmost range limits here, others are confined to coastal lowlands or restricted to the mountainous areas of the escarpment and nearby tablelands. Some species occur broadly across the region. Several are endemic or have limited distributions, with seven currently listed as threatened.



Figure 6. ‘Old Blotchy’ in Murramarang NP near Batemans Bay, is considered to be the world’s largest Spotted Gum. Jan 2023. Photo: P. Kaye.

Rainforests

In wetter microclimates, particularly within escarpment gullies and sheltered slopes with fertile soils, small patches of Warm Temperate and Subtropical Rainforest persist. Batemans Bay marks the southern limit of Northern Warm Temperate Rainforest and its characteristic dominant species, *Ceratopetalum apetalum* (Coachwood). South of this point, the rainforest transitions to Southern Warm Temperate Rainforest, where the canopy is typically dominated by *Doryphora sassafras* (Sassafras) and/or *Acmena smithii* (Lilly Pilly).

Littoral Rainforest survives in sheltered coastal pockets, while Cool Temperate Rainforest dominated by *Eucryphia moorei* (Pinkwood) occurs at higher elevations along the escarpment and on isolated mountain peaks.

Heathlands and Wetlands

Coastal heath communities occur in a range of settings, typically on low-nutrient sandy soils or exposed rocky headlands near the sea. Heaths on sandy soils support the greater diversity of plant species and exhibit more complex structure (Keith 2004). These are mainly found north of Ulladulla and south of Bournda, and are large absent in the intervening areas. Headland heaths typically have a simpler species composition, and are usually dominated by a small number of hardy, salt- and wind-tolerant species.

Montane heaths occur on a variety of substrates, including sandstone plateaus in the northern part of the region, high wind-swept ridgelines along the escarpment, and rocky outcrops in Deua National Park and other isolated southern peaks. Each supports a distinct floral assemblage, often with many endemic species.

The region also supports a diversity of wetlands, both freshwater and saline. Freshwater wetlands include Coastal Heath Swamps, Coastal Lagoons and Forested Wetlands, which are scattered throughout the coastal zone. Saline wetlands include Mangrove Swamps, Salt Marshes and Seagrass Meadows. These important and sensitive habitats face competing demands for resources and have often been drained, cleared, or polluted.

Management and Conservation

Most native vegetation occurs within extensive protected areas or managed forest (Figure 7). Nearly half (46%) of the South Coast is under conservation management, including extensive national parks and nature reserves. A further 22% is designated as State Forest, permitting selective logging and multiple-use activities.

While overall endemism is lower than in some other Australian biodiversity hotspots, the South Coast harbours a relatively high number of localised endemic species, especially in areas with distinct geology or microclimates. These species and their habitats are under increasing pressure, presenting significant challenges for their conservation.

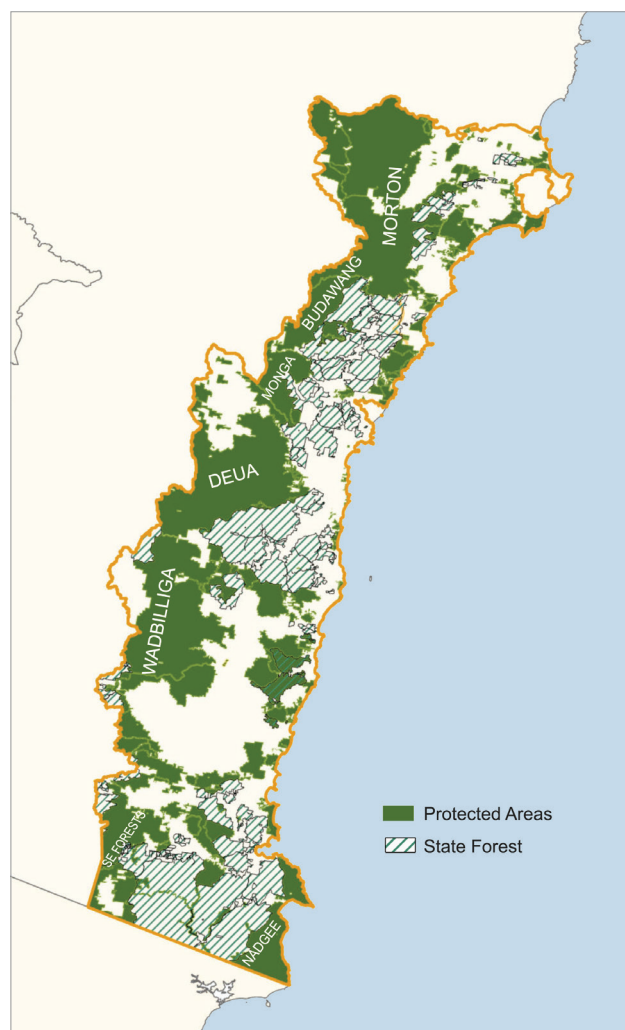


Figure 7. The region includes extensive protected areas adjoined by State Forest.

Sources: DCCEE CAPAD 2025b; NSW SFC 2025.

As of 2025, the region supports nearly 100 listed threatened plant taxa, including 14 critically endangered species, and more than 25 threatened ecological communities. Many of these species and communities occur in remote areas where active management and intervention are logistically challenging.

The combination of high native vegetation cover and complex biogeographic patterns underpins the region's significant biodiversity values. It also underscores the importance of integrated land-use planning and cross-tenure conservation strategies that maintain ecological function and promote long-term landscape resilience (Mackey et al. 2008).

Particular landscapes supporting isolated and distinct plant communities

Although the South Coast is perhaps best known for its coastal eucalypt forests dominated by *Corymbia maculata* (Spotted Gum), it also supports a remarkable variety of distinctive and often isolated plant communities. Many of these habitats act as important refuges for rare and endemic plant species. The following examples highlight the region's botanical richness, though they represent only a fraction of its diversity.

Balawan Mount Imlay Summit - an isolated botanical refuge

Balawan Mount Imlay is an isolated peak rising to 886 m in the far southeast. The lower slopes comprise Ordovician sedimentary rocks; the upper slopes and summit of the peak are of Devonian-age fine- to coarse-grained quartzose sediments (Herbert & Helby 1980). The summit flora is of remarkable biogeographic and conservation interest, hosting three endemic species, *Eucalyptus imlayensis* (Imlay Mallee), *Boronia imlayensis* (Imlay Boronia), and *Hibbertia circinata* (Connie's Guinea Flower), as well as several rare or disjunct taxa (Costermans 2009, McDougall et al. 2023). This flora shares closer affinities with Tasmanian vegetation than with the surrounding coastal vegetation of mainland NSW. *Eucalyptus imlayensis* is most closely related to Tasmanian species, while *Philotheca virgata* (Tasmanian Wax Flower) is otherwise restricted to Tasmania and a small part of Victoria. This rare plant community faces significant pressures. It was severely affected by the 2019–20 bushfires and continues to be threatened by feral deer and infection by *Phytophthora* species, raising serious concerns for its long-term persistence.

On the sheltered southern slopes of the mountain, notable pockets of Cool Temperate Rainforest occur, dominated by *Elaeocarpus holopetalus* (Black Olive Berry). Nearby, within Egan Peaks Nature Reserve, lies one of the southernmost stands of Cool Temperate Rainforest dominated by *Eucryphia moorei* (Pinkwood). The most southerly occurrence is in the Howe Range, East Gippsland, near the NSW–Victoria border.

Nadgee - a significant coastal ecosystem

Nadgee Nature Reserve near the Victorian border is the only declared coastal wilderness area in NSW. Diverse landscapes ranging from coastal heath, sclerophyll forest,

wet gully forest, and swamp ecosystems, support a high number of rare, endemic, and biogeographically significant plant species. Nadgee is one of the most botanically significant protected areas in south-eastern Australia (Keith 2004; Tozer et al. 2010a).

Notable endemic and regionally restricted species include *Eucalyptus cadens* (Nadgee Stringybark), a vulnerable eucalypt restricted to the reserve's coastal slopes, *Zieria parrisiae* (Parris' Zieria), an endangered shrub limited to rocky forest habitats in Nadgee and adjacent areas, *Prostanthera walteri* (Blotchy Mintbush), a rare mintbush occurring on moist forest edges, and *Pomaderris costata* (Veined Pomaderris) associated with sandstone or rocky heath habitats and considered rare in NSW.

Flora of rocky rhyolite outcrops

Rhyolite extrusions during the Palaeozoic formed steep, nutrient-poor outcrops composed of volcanic lava (Herbert and Helby 1980) support distinctive plant communities and habitats with narrow-range endemics; some are vulnerable to fire, weed invasion, and disturbance from recreational use NSW NPWS 2003. Noteworthy rhyolite outcrop sites include:

- **Pambula–Bega region**, supporting several threatened species including *Acacia constablei* (Narrabarba Wattle), *Acacia georgensis* (Bega Wattle), *Westringia davidii* (David's Westringia), *Leionema ralstonii* (Ralston's Leionema), *Genoplesium rhyoliticum* (Rhyolite Midge Orchid), and three species of *Zieria*: *Zieria buxijugum* (Box Range Zieria), *Zieria formosa* (Graceful Zieria), and *Zieria parrisiae* (Parris' Zieria).
- **Coondella Trig/Diamond Creek, Deua National Park**, hosting many rare species such as *Grevillea gilmourii* (a newly described species), *Pomaderris gilmourii* (Deua Pomaderris), *Grevillea rhyolitica* (Deua Grevillea) and *Leptospermum deuense* (Mountain Teatree).

Endemic flora of the Wadbilliga–Deua Wilderness

This extensive wilderness features a complex geological foundation of granitic, volcanic, and metamorphic rock types. These varied substrates, combined with steep topography create a mosaic of microhabitats that promote floristic differentiation and a high degree of endemism (Keith, 2004). Among the most significant endemic species are the critically endangered *Acacia blayana* (Blay's Wattle), *Eucalyptus paliformis* (Wadbilliga Ash), the endangered *Eucalyptus stenostoma* (Jilliga Ash), the rare *Eucalyptus olseni* (Woila Gum) and *Eucalyptus deuaensis* (Mongamulla Mallee). These species are confined to very restricted areas, reflecting narrow habitat tolerances and long-term isolation.

In addition, the area supports patches of cool temperate rainforest with *Eucryphia moorei* (Pinkwood) and unusual high-altitude populations of *Acmena smithii* (Lilly Pilly). The combination of rarity, endemism, and habitat diversity underpins the region's outstanding conservation significance and highlights the importance of protecting its fire-sensitive and climate-vulnerable ecosystems.

Gulaga Mount Dromedary – Shaped by an ancient volcano

Gulaga Mount Dromedary is the deeply eroded core of an ancient volcano that formed around 94 million years ago during the mid-Cretaceous period, and composed of igneous and extrusive rocks (Mount Dromedary Igneous Complex), primarily monzonite, basanite, and basic volcanic rocks. Currently around 800 m high, the mountain was once more than 2,000 m high and has gradually eroded away. Gulaga's distinctive geology, combined with its high rainfall, and elevation, create optimal conditions for diverse plant communities, supporting several rare and localised plant species. Warm Temperate Rainforest, dominated by *Doryphora sassafras* (Sassafras), grows on sheltered gullies and lower slopes, while Cool Temperate Rainforest with *Eucryphia moorei* (Pinkwood) is found near the summit. The ridges support Wet Sclerophyll Forests with tall *Eucalyptus fastigata* (Brown Barrel) and *Eucalyptus cypellocarpa* (Mountain Grey Gum). The vulnerable *Zieria tuberculata* (Warty Zieria) is restricted to Gulaga and Najanuka Little Dromedary Mountain, both part of the same ancient volcanic complex.

A very prominent landmark, Gulaga holds deep cultural significance for the Yuin people, who regard it as a sacred ancestral place of origin.

Flora of the Bendethera Karst Area

Situated within Deua National Park, the Bendethera Karst area is characterised by limestone geology. Moist forests and dry shrublands harbour rare species, including the endemic *Acacia covenyi* (Bendethera Wattle) confined to karst shrublands. This fire-responsive shrubland community appears to have benefited from the 2019–20 bushfires and may have declined or disappeared in the absence of such disturbance (Tozer et al. 2021).

Granite flora of the Araluen Valley

The Araluen Valley supports a distinctive assemblage of flora shaped by its sheltered topography, granitic soils, and relatively stable climate. Local faulting and erosion along Araluen Creek have generated diverse habitats that sustain unique microenvironments and locally endemic plant species. The valley's geology determines its floristic composition, with threatened species, such as *Eucalyptus kartzoffiana* (Araluen Gum) and *Zieria adenophora* (Araluen Zieria), showing strong associations with specific soil types derived from granitic intrusions (Hunter 2008; NSW OEH 2019).

Bangalay Sand Forest at Broulee

This coastal sand forest on Quaternary dunes and sandy flats is dominated by *Eucalyptus botryoides* (Bangalay) with a sub-canopy of *Banksia serrata* (Old Man Banksia) and *Banksia integrifolia* subsp. *integrifolia* (Coast Banksia), and a diverse heathy understorey (Keith 2004). The community forms part of the Coastal Sand Forests of the Sydney Basin and South East Corner Bioregions, listed as an Endangered Ecological Community (NSW Biodiversity Conservation Act 2016). Broulee supports a substantial

area of this important ecological community, which is considered largely intact, although some parts may not strictly meet the formal definition of the listed community (Miles, 2005). However, it remains under ongoing pressure from residential development and encroachment.

Monga Cool Temperate Rainforest

Located on the escarpment west of Batemans Bay, Monga National Park supports a distinctive assemblage of Gondwanan flora, including *Eucryphia moorei* (Pinkwood) and *Atherosperma moschatum* (Black Sassafras), uniquely co-dominating here (Mackey et al. 1999). The park lies at a biogeographic transition zone, where the near-southern limit of *Atherosperma moschatum* subsp. *moschatum* overlaps with the northernmost extent of *Atherosperma moschatum* subsp. *integrifolium*.

It is also one of the few regions where the endemic *Telopea mongaensis* (Braidwood Waratah) occurs alongside the more southern *Telopea oreades* (Victorian Waratah). There is both a meeting of northern and southern influences, and a high species mixing between the tableland and coastal floras (Tozer et al. 2010b).

Flora of the Budawang-Morton Wilderness Area

This region is characterised by deeply dissected sandstone plateaus of the Sydney Basin resting atop older Devonian sediments. This geological layering gives rise to dramatic escarpments, gorges, and distinctive rock formations, most notably within the Budawang Range (Gray & Sangster 1992). The interplay of geological substrates and varied topography supports endemic species, including rare or threatened plants, *Pultenaea baeuerlenii* (Budawangs Bush Pea), *Epacris gnidioides* (Budawangs Cliff Heath), *Plinthanthesis rodwayi* (Budawangs Wallaby Grass), and *Boronia subulifolia* (Awl-leaved Boronia).

At the north-eastern end of Morton National Park, the Ettrema Gorge to Yerriyong area lies within a floristic transition zone between coastal and tableland vegetation and is the habitat of the endemic *Eucalyptus sturgissiana* (Ettrema Mallee), a highly distinctive species, with no close relatives among other eucalypts. Also present is the locally endemic and endangered *Eucalyptus langleyi* (Nowra Mallee Ash).

Coastal Heathlands of the Ulladulla-Jervis Bay Region

At the southern end of the Sydney Basin, the Ulladulla–Jervis Bay region is shaped by Permian sandstones and marine siltstones such as the Wandrawandian Siltstone (de Jong 2022) (Figure 8). Around Jervis Bay, more recent Quaternary dune systems add another layer. These nutrient-poor, sandy and silty soils support species-rich heathlands, with many rare and localised plant species including *Grevillea macleayana* (Jervis Bay Grevillea), *Prasophyllum affine* (Jervis Bay Leek Orchid) and *Caladenia tessellata* (Thick-Lip Spider-Orchid). The local endemic *Dracophyllum oceanicum* (Jervis Bay Dracophyllum) grows on the edges of the coastal cliffs. This region marks the southernmost limit for *Telopea speciosissima* (Sydney Waratah), *Syzygium paniculatum* (Magenta Lilly Pilly) and *Melaleuca biconvexa* (Biconvex Paperbark).

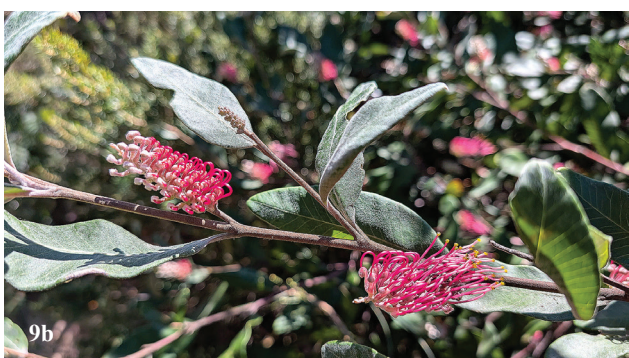


Figure 8. Coastal heathlands are just one of many unique plant communities on the South Coast. South Pacific Heathland Reserve, Ulladulla, Oct 2022. Photo: P. Kaye.

Figures 9a-e. Rare endemic plants from the South Coast.



9a. *Epacris gnidioides* (Budawang's Cliff Heath), Nibelung Pass, Oct 2024. Photo: S. Wawrzyczek.



9b. *Grevillea macleayana* (Jervis Bay Grevillea), Ulladulla, Sep 2022. Photo: P. Kaye.



9c. *Hibbertia circinata* (Connie's Guinea Flower), Mount Imlay, Mar 2022. Photo: D. Morrissey.



9d. *Leonema coxii* (Cox's Leionema), Monga National Park), Apr 2025. Photo: S. Wawrzyczek.



9e. *Telopea mongaensis* (Braidwood Waratah), Monga National Park, Sep 2022. Photo: P. Kaye.

Impact of the 2019–2020 Bushfires on NSW South Coast Flora

The 2019–2020 *Black Summer* bushfire season, had a profound impact on the South Coast flora, with 73% of native vegetation impacted, including rainforests, sclerophyll forests, woodlands, heathlands, and wetlands (Table 4).

While many of these ecosystems are fire-adapted, the scale, intensity, and frequency of these fires were ecologically unprecedented, leading to:

- Widespread canopy scorch and mortality in fire-sensitive communities such as Warm Temperate Rainforest, which typically burns infrequently.
- Loss of habitat for many narrow-range endemics and threatened species, and rare understorey herbs and shrubs.
- Delayed or failed regeneration in some fire-sensitive species and communities due to short fire intervals, drought stress, or seed bank depletion.
- Increased erosion, weed invasion, and habitat fragmentation in fire-affected landscapes, particularly on steep terrain.

- Post-fire colonisation by some opportunistic or fire-adapted species, leading to shifts in species composition and potential loss of ecological function in certain ecosystems.

The bushfires triggered an unprecedented conservation response, including rapid ecological assessments, seed collection and banking, targeted invasive species management, and the strategic prioritisation of species and ecological communities under both Commonwealth and NSW threatened species frameworks (DAWE, 2020, NSW DPIE 2021). Nonetheless, significant data deficiencies persist, as large portions of the affected landscape remain unsurveyed or lack systematic post-fire monitoring. It is also challenging to gain a clear overview of the activities being carried out, given the involvement of numerous organisations and funding sources, compounded by the fact that many of the reports that initially guided agencies are no longer publicly available.

As of 2020, fire was not listed as a threatening process under either Commonwealth or NSW legislation, despite having been included in earlier NSW legislation repealed in 2016. This significant gap was addressed with its re-listing under the *NSW Biodiversity Conservation Act 2016* in 2020, followed by its inclusion under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* in 2022.



Since then, several species have been newly listed as threatened or had their threatened status upgraded, largely as a result of the fire and subsequent ecological effects. Other nominated species were not listed due to a lack of information about their post-fire survival.

Extensive and Intense Bushfire

To assist in analysing the potential impact of the fire, the NSW government developed the Fire Extent and Severity Mapping (FESM) dataset, utilising Sentinel-2 satellite imagery and machine learning to assess the impact of fire. The dataset classifies fire-affected areas into the following severity categories, allowing consistent comparison of fire impacts across different landscapes (NSW DCCEEW FESM 2020):

- Unburnt: Areas that remained untouched by fire.
- Low Severity: Burnt understory with unburnt canopy (green)
- Moderate Severity: Partial canopy scorch (orange)
- High Severity: Complete canopy scorch with partial canopy consumption (red)
- Extreme Severity: Full canopy (black).

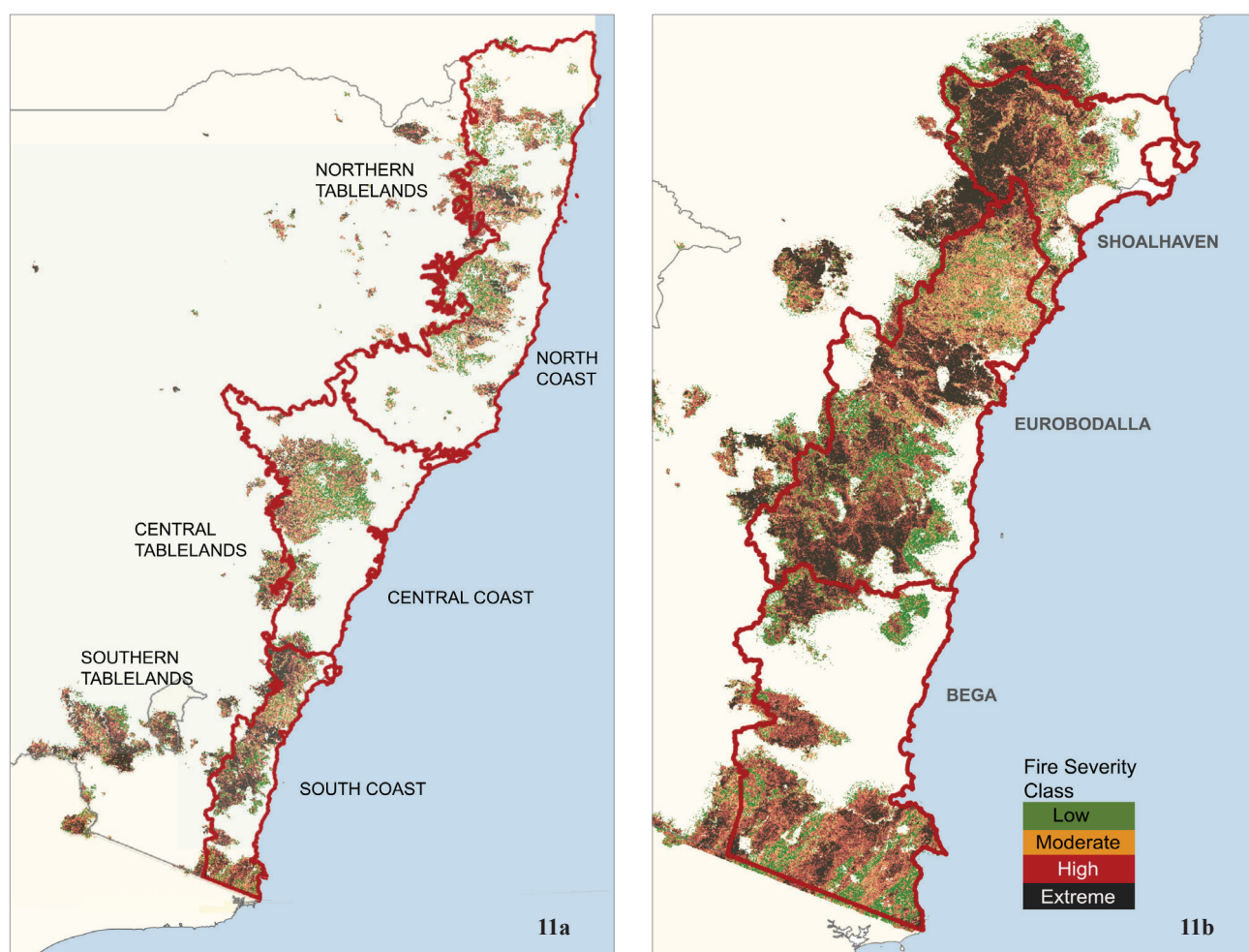
The FESM dataset was used to compare the impact of the 2019–20 fire season on the South Coast landscape to other NSW regions. Three South Coast sub-regions were analysed: Shoalhaven (north), Eurobodalla (central), and Bega (south), these areas being defined by catchments rather than local government (shire) boundaries, allowing a more ecologically meaningful comparison across the landscape.

The extent and intensity of burning were both greater across the South Coast than any other Botanical Sub-Division in NSW (Figure 11; Table 3).

- Across the South Coast region 64% of the landscape was burnt, compared with 26% on the North Coast.

The fire was also more intense, with more than 50% of the burnt areas classified as high to extreme severity (red and black on the map). In contrast, the majority of

Figures 10a-b. Forest burnt in the 2019–20 fire near Batemans Bay. (a) Burnt stand in January 2020; (b) resprouting observed in February 2020. Photos: P. Kaye.



Figures 11a-b. Maps showing the extent and severity of the 2019–20 fires in (a) New South Wales and (b) the South Coast region. Source: NSW DCCEEW FESM 2020.

burnt areas elsewhere in NSW fell into the low to moderate severity categories (green and orange areas in Figure 11).

Fire intensity varied across the region (Figure 11). The most severe fires occurred in the northern Shoalhaven, around Batemans Bay, and within the remote wilderness areas of Wadbilliga National Park (shown in black on Figure 11b). Much of the immediate coastal strip remained unburnt, except around Ulladulla, Batemans Bay and south of Eden.

The extent and intensity of the fire varied from north to south (Table 3):

- In the northern Shoalhaven-Jervis area, 60% of the

total area was burnt, with over 60% of the burnt area in the high-extreme category.

- In the central Eurobodalla area (the catchments of the Clyde, Moruya and Tuross Rivers) 76% of the area was burnt, with nearly 60% of the burnt area in the high to extreme categories.
- In the southern Bega area, 50% of the total area was burnt, lower in part due to a higher proportion of agricultural land. While fire severity was less intense than in Shoalhaven and Eurobodalla, it was still higher than most other parts of NSW.

Fire Severity	Total area in square kilometres					
	Bega	Eurobodalla	Shoalhaven	South Coast	North Coast	Other NSW
Unburnt	2,720	1,450	924	5,094	41,189	1,018,148
Low	612	869	279	1,760	4,156	6,064
Moderate	558	1,081	411	2,049	5,413	7,917
High	982	1,229	418	2,629	3,058	6,487
Extreme	643	1,424	733	2,800	1,934	5,748
Burnt Area	2,795	4,603	1,841	9,239	55,751	744,249
Total Area	5,515	6,053	2,765	14,333	14,563	26,217
% Burnt	51%	76%	67%	64%	26%	-

Table 3: 2019/20 Fire Extent and Severity in NSW Regions. Source: NSW DCCEEW FESM 2020

Extensive native vegetation burnt

Fire Severity Class	Total area in square kilometres						% Burnt
	Low	Moderate	High	Extreme	Total Burnt	Total Extent	
Dry Sclerophyll Forests	686	786	1,111	1,185	3,767	4,949	76%
Wet Sclerophyll Forests	754	859	1,045	869	3,527	4,663	76%
Grassy Woodlands	132	134	67	84	416	841	49%
Rainforests	101	147	99	104	451	598	74%
Total Forest & Woodland	1,672	1,926	2,321	2,241	8,161	11,051	74%
Heathlands	12	29	89	354	485	559	87%
Wetlands	41	60	56	66	223	488	46%
Grasslands	0	0	1	1	2	29	7%
Total Other	53	90	145	421	10	1,075	66%
Total Native Vegetation	1,725	2,016	2,466	2,663	8,871	12,126	73%

Table 4: Fire Extent and Severity for Vegetation Types. Sources: NSW DCCEEW FESM (2020); NSW DCCEEW SVTM (2024)

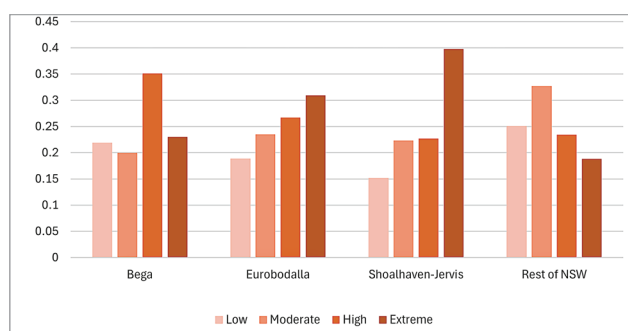


Figure 12. Fire severity profiles for sub-regions on the South Coast, and the rest of NSW. Source: NSW DCCEEW 2020.

Although 64% of the overall landscape was burnt during the 2019–20 fires, the impact on native vegetation was disproportionately higher, with 73% of native vegetation burnt to some degree (Table 4). All vegetation types were impacted, though the extent of burning varied considerably. Many plant communities on the South Coast are adapted to fire, and some even depend on it for regeneration. However, many are also sensitive to the cumulative effects of repeated fire, especially when combined with other disturbances and the potential pressures of climate change.

Heathlands were the most severely affected, with an estimated 89% of their extent burnt. In contrast, Grassy Woodlands and Wetlands experienced more moderate fire impacts, with around 50% of their area burnt, while Grasslands remained largely unburnt.

Sclerophyll forests—both dry and wet—were burnt across approximately 76% of their extent, with more than half of that area classified within the high to extreme severity categories. Several rare, range-restricted species were burnt across their entire known distributions. Notable examples include *Eucalyptus stenostoma* (Jilliga Ash), *Eucalyptus paliformis* (Wadbilliga Ash), and *Eucalyptus olsenii* (Woila Gum), all of which are confined to the rugged escarpment terrain of the Deua–Wadbilliga wilderness. These species are non-resprouting and depend on seed regeneration, making them particularly susceptible to intense or repeated fires.

Rainforests were also burnt across approximately 74% of their extent, though, with more than half of the burnt area within the low to moderate categories the severity was generally lower. Many rainforest species are fire-intolerant or weakly-tolerant. In the aftermath of fire, rainforest trees may be outcompeted by faster-growing, fire-adapted species such as eucalypts.

High Biodiversity Impact

In 2020, to assess species at greatest risk, priority ones were identified nationally by analysing current and projected distributions overlaid on maps of fire extent (Gallagher, 2020). The report identified 486 plant taxa as national priorities for immediate action – meaning they were likely to be severely impacted by the fire.

A staggering 22% of these (105 species) occur in the Eurobodalla region, from less than 5% of the total area burnt nationally (Table 5). Nearly half of the Eurobodalla priority species are endemic, primarily occurring in remote montane refugia within four National Parks—Morton, Monga, Deua, and Wadbilliga. On a per-area basis, the region supports approximately three times the number of priority species compared to the NSW average, and around ten times the national average.

In response, the Commonwealth Government identified 19 national investment priority species in the southeast forests, primarily rare endemics that had been burnt across 100% of their known range. Additionally, the NSW government listed a further 30 species deemed significantly impacted by the fires and subject to ongoing cumulative threats that could hinder post-fire recovery. This high number of significantly impacted species reflects

Region	Area Burnt		Priority Plant Species	
	Square kilometres	Percent of Total Area	Number	Percent of total
Eurobodalla	4,598	3%	106	22%
NSW	49,010	26%	391	56%
Australia	187,360	100%	486	100%

Table 5: Burnt Area and Number of Priority Species
Data Source: Fire Extent NSW FESM 2020. Priority species determined by Gallagher (2020).

both the extent and severity of the fire in the Eurobodalla region, and the number of rare species endemic to the south-east region.

Plant Survival since the Fire

Preliminary observations indicate a variety of ecological responses. For instance, the Bendethera shrublands appear to have responded positively to the high fire intensity, implying a historical pattern of intense fire events at the local scale (Tozer et al., 2021).

Likewise, *Telopea mungaensis* (Braidwood Waratah) showed strong post-fire survival, despite early concerns that the severity of the burn might have damaged its rootstock. The endemic eucalypts in the far north-eastern corner of the region, *Eucalyptus sturgissiana* (Ettrema Mallee) and *Eucalyptus langleyi* (Nowra Mallee Ash), were found to respond well following the 2020 fires (Mills 2021).

In contrast, other species have shown signs of stress and decline. Early assessments indicated approximately 50% survival of *Eucryphia moorei* (Pinkwood) in Monga National Park, but recent monitoring has documented further significant population decline (D. Keith pers. comm.) (Figure 13).

Similarly, current surveys of *Eucalyptus stenostoma* (Jilliga Ash) suggest that several known populations are now being outcompeted by dense post-fire regeneration of *Eucalyptus sieberi* (Silvertop Ash) (S. Wawrzyczek, pers. comm., March 2025). Although the highly range-restricted *Eucalyptus paliformis* (Wadbilliga Ash) has

shown good seedling regeneration, all adult plants were killed in the fire, and only a small number of seedlings had produced buds in 2024 (D. Nicolle, pers. comm., July 2025). The species remains at high risk of extinction should another fire occur within the next few years.

Since the 2019–20 fires, *Eucalyptus stenostoma* has been listed as Endangered under both Commonwealth and State legislation, while *Eucalyptus paliformis* was listed as Critically Endangered by the Commonwealth Government in March 2025 (Figures 14, 15). In June 2025, the Commonwealth proposed listing Cool Temperate Pinkwood Rainforests as an Endangered Ecological Community on the basis of escalating threats, especially from fire and climate change.

The long-term viability of numerous plant communities and individual species remains uncertain, particularly for rainforest refugia, lithic outcrops, karst systems, and montane endemics, habitats where small population sizes, limited dispersal capacity, and ecological isolation constrain natural recovery.



Figure 13. *Eucryphia moorei* (Pinkwood) regenerating stand in burnt area, Monga National Park, Jan 2025. R. Gray.



Figure 14. *Eucalyptus stenostoma* (Jilliga Ash) regenerating tree with fruit in Deua National Park, April 2025. Photo: S. Wawrzyczek.



Figure 15. *Eucalyptus paliformis* (Wadbilliga Ash) regenerating stand 12 in Wadbilliga National Park, Apr 2024. Photo: D. Nicolle.

Human Impact and Conservation

Since European colonization, the South Coast has experienced extensive habitat alteration due to clearing for agriculture, urban development, and logging. These pressures have fragmented native vegetation and introduced invasive species, significantly altering the biogeographic dynamics of the region. Conservation efforts now focus on preserving remaining native habitats, managing fire and invasive species and maintaining ecological connectivity.

Native forest logging remains a prominent land use in the South East Forests region, with approximately 22% of the landscape designated as State Forest. Over the past quarter century, public sentiment has shifted significantly, with increasing community opposition to native forest harvesting. Reflecting this trend, in 2022 Eurobodalla Shire Council, despite lacking jurisdiction over State Forest lands, formally endorsed a motion calling for an end to native forest logging within the shire.

Although the issue remains contentious, emerging research suggests that certain logging practices may elevate forest flammability by altering stand structure, reducing canopy cover, and increasing surface fuel loads (Lindenmayer & Zylstra 2023). Additionally, other studies highlight both direct declines in species abundance associated with logging and indirect impacts via heightened fire susceptibility and ecosystem destabilisation (Ward et al. 2024).

Conclusion

The flora of the NSW South Coast is a result of long-term biogeographic processes, intrinsically shaped by its geographical position between the Pacific coastline and the Great Dividing Range escarpment. Its characteristics are further influenced by significant microclimatic variability and a distinct evolutionary legacy, resulting in a high number of localised endemics. Despite its unique biodiversity, this region is often overlooked, due to its relative remoteness from major population centres.

The region was arguably hit hardest by the Black Summer bushfires, and its extensive eucalypt forests and rugged terrain make it particularly vulnerable to future fire events. Escalating development pressures and its transitional location, situated between northern and southern floral assemblages, as well as between tableland and coastal floras, could significantly increase its vulnerability to the ongoing effects of climate change.

Protecting the region's floristic diversity will require a landscape-scale approach that integrates biogeographic history with contemporary ecological management.

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