CHAPTER 8

Regional Assessment for Oceania

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Regional Highlights

Key Facts

KEY REGIONAL DATA PRODUCED FOR THE GLOBAL PEATLANDS ASSESSMENT 2022[1]	
Total peatland area (hectares)	7,285,883 ha
Peatland cover over total region surface area (%)	0.9%
Degraded peatlands (%)	10.1%
Annual GHG emissions from peatlands (Megatons of carbon dioxide equivalent emissions per year)	27.6 Mt CO_2e / yr
Undegraded peatlands (%)	89.9%
Peatlands within protected areas (%)	25.7%
Top 5 Countries with largest peatland area (hectares)	1. Papua New Guinea (4,469,008 ha) 2. Australia (2,500,000 ha) 3. New Zealand (269,363 ha) 4. New Caledonia (20,000 ha) 5. Solomon Islands (10,000 ha)
ADDITIONAL DATA	
Total peatland carbon stock[2] (Megatons of carbon)	6,733 Mt C
Threatened peatland species[3] (VU = vulnerable; EN = endangered; CR = critically endangered)	Flora: 10 VU, 5 EN, 0 CR Fauna: 34 VU, 32 EN, 18 CR
Ramsar Wetlands of International Importance with peat[4]	18 sites (21.4% of total Ramsar sites in Oceania)

[1] Global Peatlands Assessment data retrieved from the Global Peatland Database compiled by the Greifswald Mire Centre.

[2] Joosten, H. (2009). The Global Peatland CO_2 Picture. Peatland status and drainage associated emissions in all countries of the World. Wetlands International, Ede, 10 p. + tables.

[3] Data extracted from the IUCN Red List of Threatened Species.

[4] Data extracted from the Ramsar Sites Information Service.

Peatlands cover an estimated 7.3 million hectares in Oceania and around 71 thousand hectares in the Sub-Antarctic Islands, representing approximately 1.5% of global peatlands. These estimates still have large uncertainty as comprehensive peatland mapping is only available in New Zealand, Papua New Guinea, and Australia. Oceania is a diverse region with continental, large-island and small island scales that supports a diverse group of peatland ecosystems. Peatlands often form part of IPLC's vision of interconnected lands, water and living things[1]. For example, in Australia, 39% of the peatlands are co-managed by Indigenous groups (mainly in Tasmania) and 8% are subject to special rights.

A suite of legislative and policy mechanisms has been implemented, mainly in Australia and New Zealand, with conservation and recovery plans. However, peatland degradation continues and a lack of information on the status and extent of degraded peatlands in the Oceania region hampers regional plans and action.

[1] Examples include the Wanganui River and Te Uruwera forests which now are given equal legal status as people (personhood) to Indigenous land owners https://www.laneneave.co.nz/news-events/legal-personhood-for-nature-has-legal-ramifications/

8.1. Biomes and Ecological Zones

Oceania is a diverse region and contains peatlands from the following FAO Global Ecological Zones (Table 8.1). Note that 800 m.a.s.l. is the altitudinal boundary between lowland and mountain system peatlands. Fig. 8.1 shows the distribution of Oceanian peatlands by Global Ecological Zone.

Table 8.1. Peat forming vegetation, ecosystem types, and location according to FAO Global Ecological Zones classification.

Ecological Zone	Country	Traditional, scientific and/or common name (example dominant plant genera)	Selected publications
Tropical lowland peatland	Australia, Pacific Islands, Papua New Guinea	**Swamp forest:** Palm-dominant (e.g., *Metroxylon* and *Pandanus*), Melaleuca; **Herbaceous wetlands:** Tall grass, sedge/rush/fern fen and mire, fern/moss bog	(Mueller-Dombois and Fosberg 1998; Bourke and Harwood 2009; Department of Agriculture Fisheries and Forestry [DAFF] 2010; Whinam *et al*. 2012; Ono *et al*. 2015; Beer 2018)
Tropical mountain peatland	Papua New Guinea	**Swamp forest:** *Pandanus*, Podocarpaceae (*Dacrydium*) Cupressaceae (*Papuacedrus*); **Herbaceous wetlands:** Tall grass, sedge/rush/fern fens and mires, grass/fern/moss bogs, blanket bog, bog heath, cushion bog	(Whinam *et al*. 2012; Hope 2015)
Subtropical lowland peatland	Australia New Zealand, Pacific Islands	**Swamp forest:** *Melaleuca, Pandanus;* Wet heathlands; **Herbaceous wetlands:** Sedge/rush/fern fens and mires	(Whinam *et al*. 2012; Moss *et al*. 2015)
Temperate lowland peatland	Australia, New Zealand	**Swamp forest:** Araucariaceae, Podocarpaceae (*Dacrycarpus, Lagarostrobus*), Cupressaceae (*Athrotaxis/ Libocedrus*) Myrtaceae *(Eucalyptus/Melaleuca); Laurelia, Banksia, Acacia*; Nothofagaceae **Wet heathland:** Ericaceae (*Dracophyllum*). Myrtaceae (*Leptospermum/Melaleuca/ Syzygium*) **Herbaceous wetlands:** Tall grass (*Phragmites/Typha*), sedge (*Gymnoschoenus/Bolboschoenus/Eleocharis/ Scirpus* etc.), rush (*Empodisma/Juncus* etc.), fern (*Gleichenia*) fens and mires, fern/moss bogs/moorland, blanket bog, bog heath, cushion bog, mound springs	(Wardle 1991; Pannell 1992; Grant *et al*. 1995; Bridle and Kirkpatrick 1997; Costin *et al*. 2000; Balmer *et al*. 2004; Harris and Kitchener 2005; Whinam and Hope 2005; Whinam *et al*. 2012; TASVEG 4.0 n.d.)
Temperate mountain peatland	Australia New Zealand	**Swamp forest:** Podocarpaceae (H*alocarpus/ Lepidothamnus/Manaoa*), Cupressaceae (*Athrotaxis/ Libocedrus*) Myrtaceae *(Eucalyptus/Leptospermum*), Nothofagaceae **Wet Heathlands:** Myrtaceae *(Baeckia/Melaleuca*), Ericaceae (*Dracophyllum/Richea)*, bolster heath **Herbaceous wetlands:** *Sphagnum* and other non-vascular plant bog, fen and mire; blanket bog, cushion bog	(Kirkpatrick 1984; Grant *et al*. 1995; Bridle and Kirkpatrick 1997; Whinam *et al*. 2001; Balmer *et al*. 2004; Keith 2004; Harris and Kitchener 2005; Whinam and Hope 2005; McDougall and Walsh 2007; Whinam *et al*. 2012; Grover and Baldock 2013; TASVEG 4.0 n.d.)
Polar lowland peatland	Antarctica Sub-Antarctic Islands	**Moss bank:** Non-vascular plant peat **Wet heathland:** *Metrosideros/Dracophyllum;* bog heath **Herbaceous wetland:** *Sphagnum* and other non-vascular plant bog, fen and mire; blanket bog, cushion bog	(Meurk *et al*. 1994; McGlone 2002; Dykes and Selkirk-Bell 2010; Royles and Griffiths 2015)

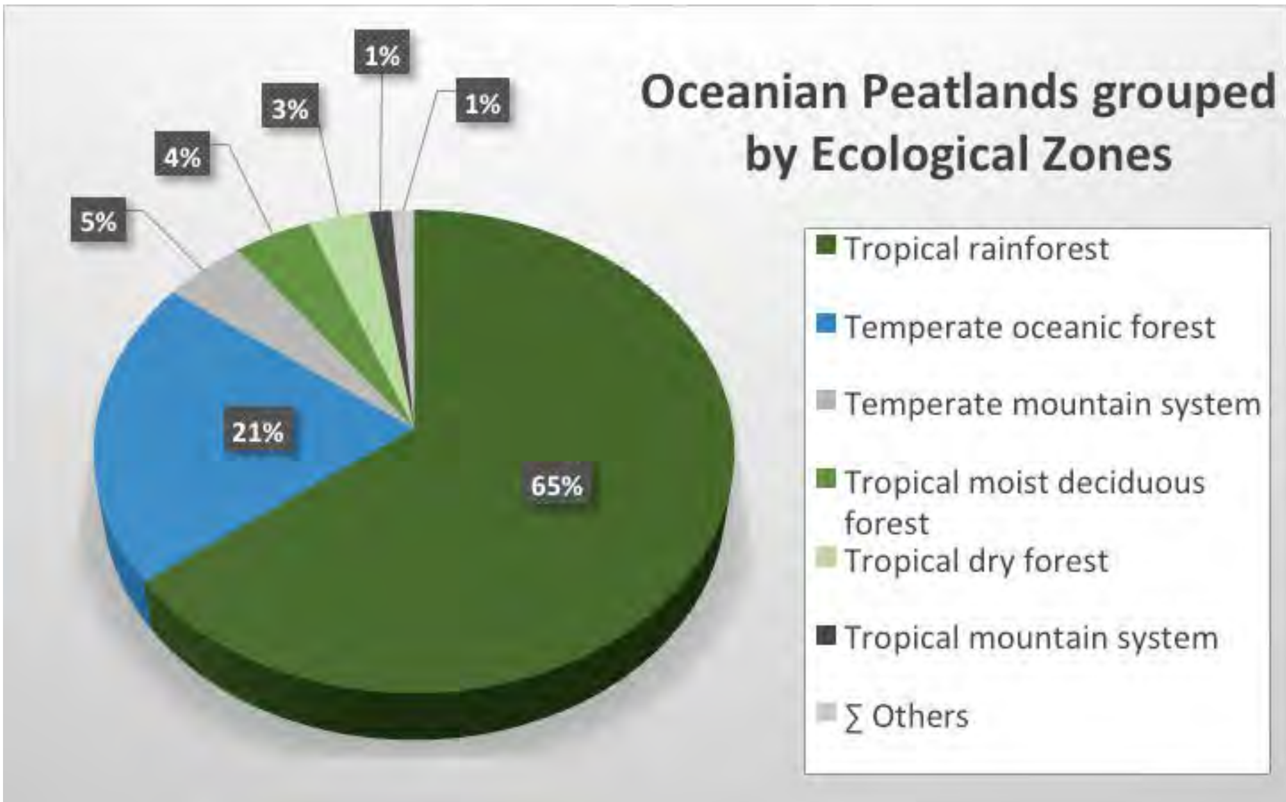

Figure 8.1. The distribution of Oceania's peatlands in aggregated FAO Global Ecological Zones.
Source: Global Peatlands Assessment data retrieved from the Global Peatland Database compiled by the Greifswald Mire Centre.

8.1.1. Australia and New Zealand

Peatlands in Australia occur from the wet tropics in the north, the arid in the centre and temperate zones in the south, the alpine regions in the south-east and the coastal plains in the southwest. Temperate montane peatlands are present under up to 10% of the snow-covered area in Australia (Hope 2012). The spatial extent of the peatlands is limited apart from in Tasmania which has extensive blanket bogs in the west of the island (Whinam and Hope 2005). The temperate-oceanic peatlands form globally rare mire systems (Grootjans *et al*. 2014). In particular, Restionaceae, Cyperaceae, Ericaceae and Myrtaceae plant families dominate the majority of Oceanian peatlands rather than *Sphagnum* mosses, with Australia and New Zealand containing some of the best-developed restiad-dominated bogs and fens in the world (Clarkson *et al*. 2017). Sedge and rush dominated coastal peatlands extend from subtropical Australia to Tasmania (including the Bass Strait Island) and South Australia, with similar communities situated in the coastal fringe of southwestern Australia, where rainfall is high enough to support peat development and can form relatively deep peat sequences (3 to 4 m in depth; Moss *et al*. 2015). One key peat-building genus found across temperate, sub-tropical and some coastal and sub-alpine locations in the region, is *Empodisma* (Clarkson *et al*. 2017). This genus consists of three species, *E. minus*, found in Australia and New Zealand; *E. robustum*, found in North Island New Zealand; and *E. gracillium*, found in far southwestern Australia. A unique characteristic of this genus is demonstrated by the fact that *E. minus* peatlands form the only known subtropical patterned fens in the world, which has been recognised as an Outstanding Universal Value for the World Heritage Listing of K'Gari (Fraser Island), as well as being a key component of Convention on Wetlands listed wetlands in the Great Sandy Strait Region of South East Queensland (Fig. 8.2) (Moss *et al*. 2016).

Another unique and important sedge-dominated peatland system is the buttongrass moorlands of western Tasmania (Fig. 8.3). These mires dominate large areas of western Tasmania and the critical peat forming species is *Gymnoschoenus sphaerocephalus* (Whinam and Hope 2005). Peat thickness is typically 30 cm for these communities (Bridle and Kirkpatrick 1997), although deeper sequences (>1 m) can occur in association with heath and *Sphagnum* communities in smaller areas of the buttongrass moorland landscape (Watson *et al*. 2022).

Figure 8.2. Wire rush peatland, K'Gari (Fraser Island). Photo: Patrick Moss.

Figure 8.3. Buttongrass moorland, Surrey Hills, Tasmania. Photo: Patrick Moss.

Paperbark (*Melaleuca*) forests can be important peat-forming ecosystems. These occur in temperate and tropical lowland areas across Oceania (e.g., Papua New Guinea). Within Australia, they occupy an area of about 750,000 hectares (Montreal Process Implementation Group for Australia [MPI] 2008; DAFF 2010). Paperbark forests generally occur in lacustrine and palustrine environments and are estimated to store between 158 to 286 tons of carbon per hectare in Australia (Tran *et al*. 2013).

In Australia, four peatland dominant communities, Alpine *Sphagnum* Bogs and Associated Fens, Temperate Highland Peat Swamps on Sandstone, Swamps of the Fleurieu Peninsula and Karst springs and associated alkaline fens of the Naracoorte Coastal Plain Bioregion, are nationally listed as Endangered Ecological Communities (EECs) (Threatened Species Scientific Committee [TSSC] 2003; TSSC 2005; TSSC 2009; TSSC 2020). The Alpine *Sphagnum* Bogs and Associated Fens ecological community is the only peatland dominant endangered community with a national recovery plan (Department of the Environment 2015). There are a number of listed EECs that have peatlands as a component with recovery plans (Fensham *et al*., 2010).

8.1.2. Pacific Islands Countries and Territories

The Pacific Island Countries and Territories can be categorised into four island types. These include mountainous islands (Papua New Guinea), volcanic islands (e.g., Fiji, Samoa), raised atolls (e.g., Tongatapu/Cook Islands) and low atolls (e.g., Tuvalu). Papua New Guinea holds Oceania's largest peatland area (4,469,008 hectares) and highest diversity of peatland types (Hope 2015). Tropical coastal and lowland, montane, subalpine and alpine peatlands can be found between sea level and 4,500 m at its highest peak (see Annex IV – Fig. IV.25. Distribution of Mountain Peatlands in Oceania by elevation). In the lowlands, a great diversity of herbaceous and arboreal tropical lowland peatlands and swamp types occur. In the montane zone, extensive peatlands formed on valley bottoms, behind levees of rivers or lake margins; they are dominated by montane swamp forests, tall grass fens, short grass fens, mixed sedge-grass fen and tall sedge fens. Whereas the montane peatlands are mostly groundwater-fed fens, sub-alpine peatland types are mainly rainwater fed bogs. Fig. 8.4 shows what peat accumulation over 40,000 years in a valley 2,000 meters above sea level looks like.

Figure 8.4. The result of 40,000 years of peat accumulation observed in an excavation at Pipikone, Ivane Valley, Central Province, Papua New Guinea (2000 m a.s.l.).
Photo: Matthew Prebble.

Within the tropics, raised atolls often hold peatlands dominated by *Acrostichum* and *Cyclosorus* ferns, palms, *Pandanus* or *Eleocharis/Scirpus/Schoenoplectus*, built up between concentric raised reefs and the volcanic island core (makatea) (Mueller-Dombois and Fosberg 1998). For example, on the small (800 hectares) tropical makatea island of Rimatara (French Polynesia), peatlands impacted by anthropogenic fire and agricultural activities make up around a third of the area and are built upon >15 m depth of pre-human settlement-aged peat composed of plant detritus and seabird guano (Prebble and Wilmshurst 2009). On tropical high islands, from the Solomon Islands to French Polynesia, coastal peatlands have mostly been highly modified for agricultural production since initial human colonization (Hope *et al* 2009; Whinam *et al*. 2012). Less degraded peatlands are found within the considerable number of volcanic calderas located across the Pacific Islands, which are either infilled with peat mires dominated by Cyperaceae sedges, *Scirpus* or *Schoenoplectus* rushes or are currently lakes but retain extensive floating peat-forming mats of sedges and rushes. Radiocarbon dating of peat from floating mats on Rapa Nui has revealed materials over 1,000 years old (Butler *et al*. 2004).

The least degraded peatlands with high biodiversity value include the tropical montane cloud forests of the larger high islands (Meyer 2011). The subsided volcanic caldera of Tagamaucia on Taveuni Island, Fiji (Wetland of International Importance) (Fig. 8.5), holds about 200 hectares of peatlands and floating mat vegetation (Hope *et al*. 2009). High rainfall and steep topography have helped this peatland avoid the threat of large-scale wildfires. Its steep slopes also make it unsuitable for agricultural production (Whinam *et al*. 2003).

Figure 8.5. Eleocharis dominant peatland at Tagamaucia, Taveuni, Fiji (800 m.a.s.l.). Photo: Matthew Prebble.

8.1.3. Antarctica and Sub-Antarctic Islands

Small, rare, slow accumulating Antarctic peatlands are known as moss peat banks. Two moss species, *Chorisodontium aciphyllum* and *Polytrichum strictum*, form occasional banks of peat that can be 2 meters deep and 6,000 years old on small islands to the north of the Antarctic Peninsula (Royles and Griffiths 2015). Further south, these moss peat banks are shallower and younger (0.3 m deep and 150 years old), (Royles *et al*. 2013). Permafrost occurs approximately at 0.3 m depth. The length of the growing season has increased with earlier snowmelt and later snowfall, but drought potentially limits growth in summer (Royles *et al*. 2013). Sub-Antarctic peatlands are quite different, with greater plant diversity and a predominance of vascular plants as the peat-forming species. Peatlands occur on most of the Sub-Antarctic Islands (Meurk *et al*. 1994; Smith 1994; McGlone 2002; McGlone *et al*. 2007; McGlone 2009; Dykes and Selkirk-Bell 2010). Peat stored in the peatlands of the Subantarctic Islands are formed from the leaf litter of small trees, shrubs, grassland, megaherbs or tundra vegetation (Van der Putten *et al*. 2009). On Campbell Island, peat covers nearly the entire 11,300 hectares land surface (McGlone *et al*. 2007). Numerous oligotrophic bogs hold peat down to 6 m in depth or more, accumulated since the Last Glacial Maximum (McGlone 2009).

8.2. Peatlands Distribution and Extent

Fig. 8.6 shows the geographic distribution of peatlands in Oceania as per the GPA data retrieved from the Global Peatland Database compiled by the Greifswald Mire Centre. Fig. 8.7 shows the proportionate distribution of peatlands by countries in the region, with 61% located in Papua New Guinea. The proportion of peatland areas on Sub-Antarctic Islands is shown in the Fig. 8.8.

The three areas of peatlands in Oceania that are well mapped are in Papua New Guinea, Tasmania and New Zealand, with Papua New Guinea containing the largest peatland area in the region. Peatlands in mainland Australia are not extensive. Because of their small extent, many peatlands do not appear on soil maps, and there is currently no accurate estimate of their extent in mainland Australia. According to the Australian Soil Classification (Isbell 2002), peats are considered Organosols with an estimate of about 150,000 hectares in mainland Australia. However, this number increases to around 481,672 hectares when including areas from a variety of mapping sources and scales. In Tasmania, a 'hybrid' Digital Soil Mapping (DSM) approach was used to predict peat areas using new and existing soil site data, intersected with a range of environmental spatial datasets (Minasny *et al*. 2019). This new digital map primarily provides decision support for fire management and suppression activities in these remote environments (Kidd *et al*. 2022). For the Tasmanian mapping, organic soils were defined based on their burn risk with > 12% SOC and depth > 5cm (Kidd *et al*. 2022). Thus, peat soils cover about 1.3 million hectares in Tasmania, with 90% in conservation/natural environment areas. A further 0.5 million hectares of rainforest area was modelled to have peat and organic soils (or surface litter accumulations), however these estimates are low in confidence owing to a lack of site data (Kidd *et al*. 2022).

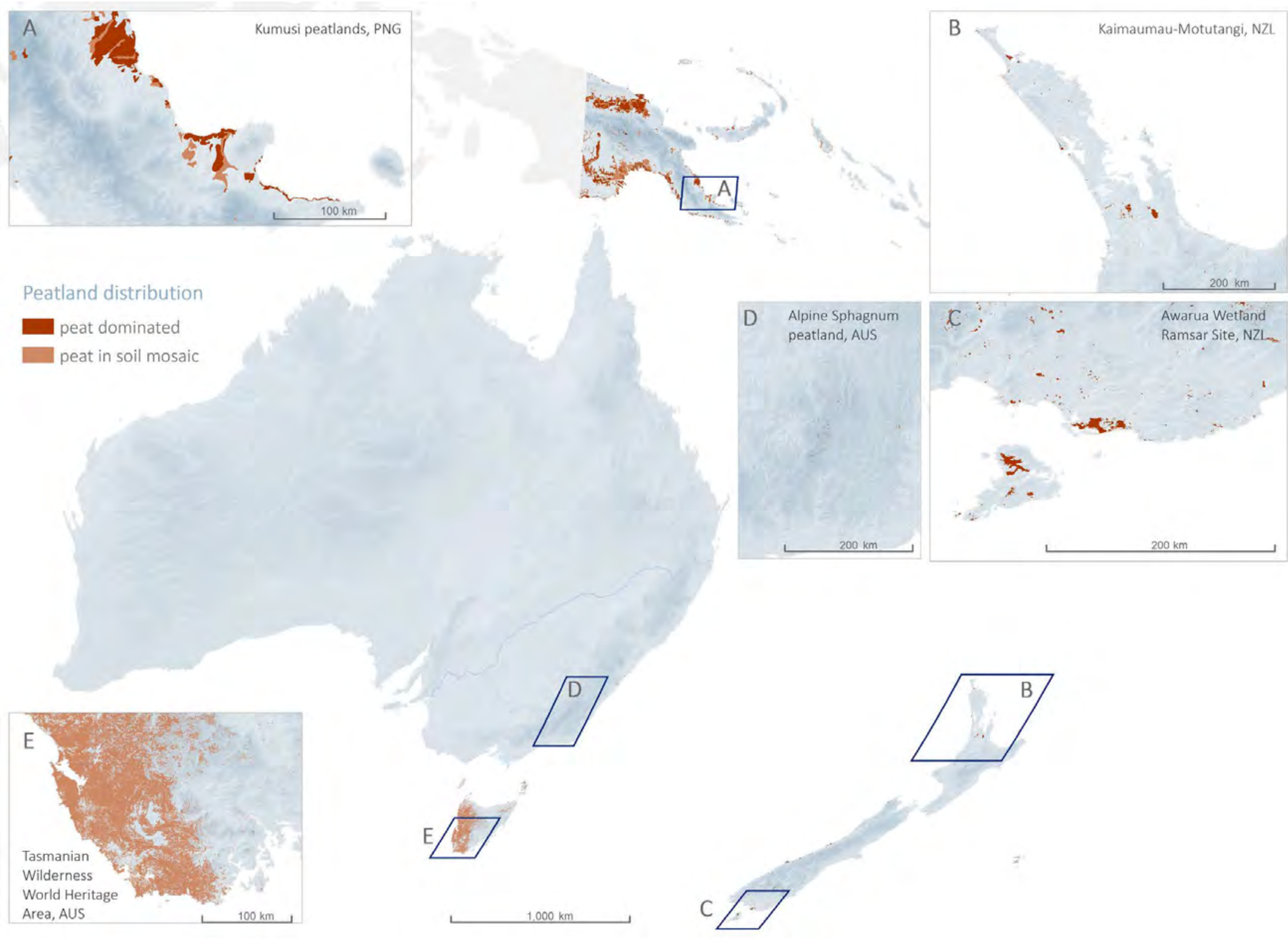

Figure 8.6. Peatland distribution in Oceania (partly incl. organic soils).

Source: Global Peatlands Assessment data retrieved from the Global Peatland Database compiled by the Greifswald Mire Centre. For more details on the methods and references used for this map, see Annex III. Production of the Global Peatland Map 2.0.

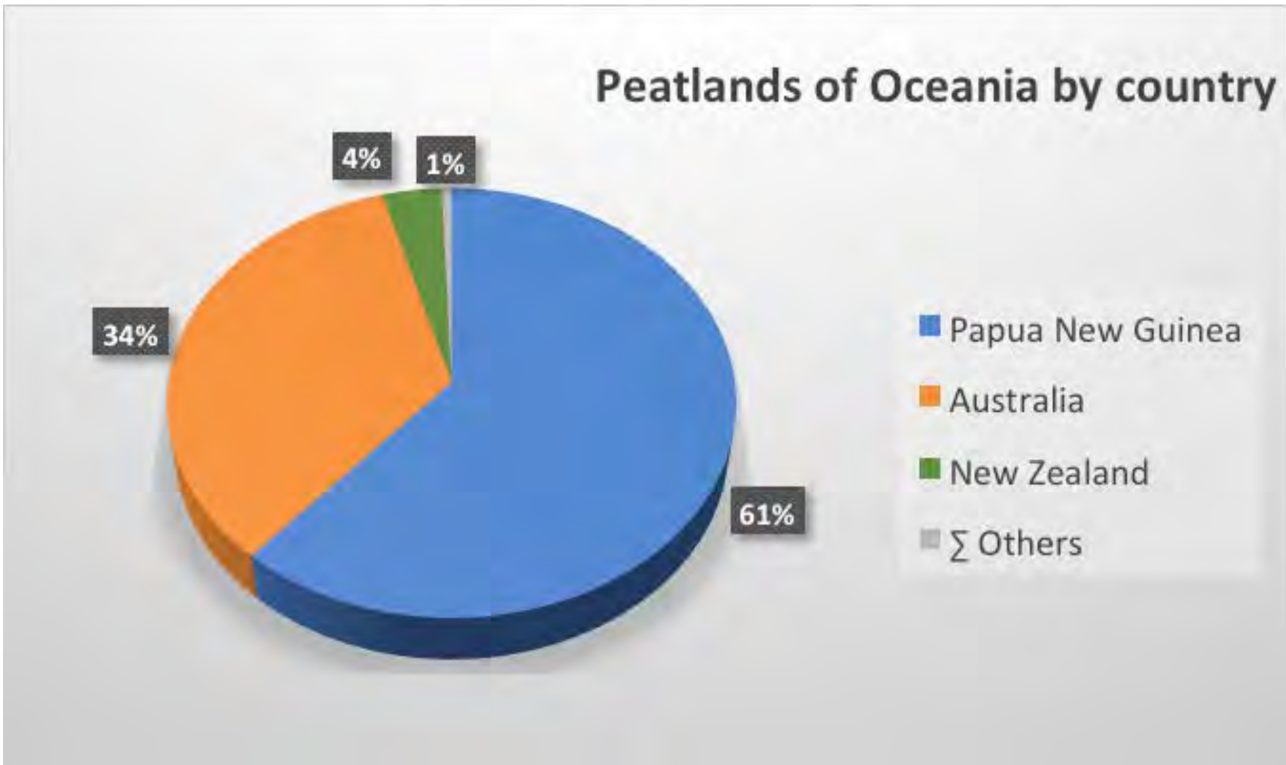

Figure 8.7. Proportion of Oceania's total peatland area per country.
Source: Global Peatlands Assessment data retrieved from the Global Peatland Database compiled by the Greifswald Mire Centre.

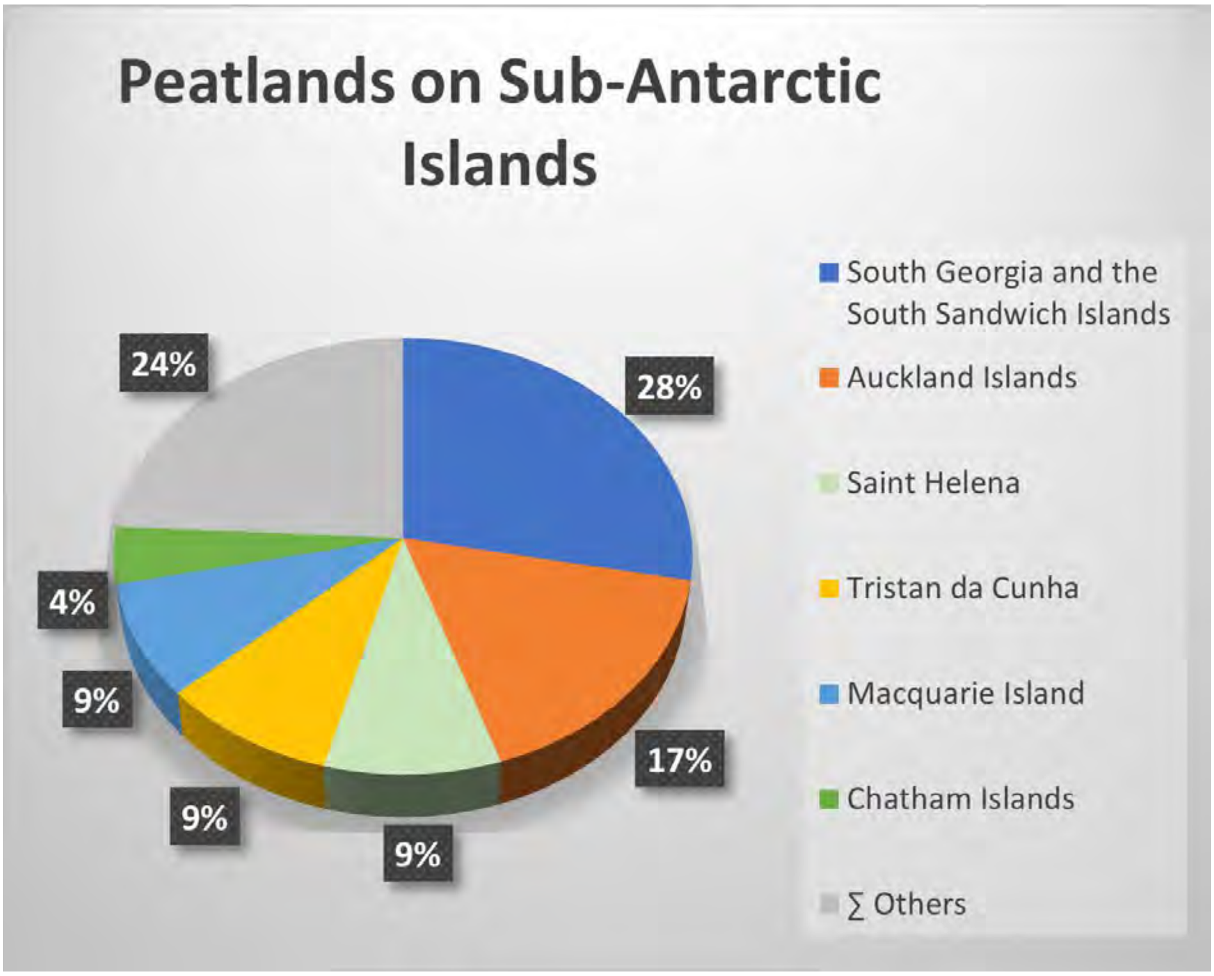

Figure 8.8. Proportion of peatland areas on Sub-Antarctic Islands.
Source: Global Peatlands Assessment data retrieved from the Global Peatland Database compiled by the Greifswald Mire Centre.

Analysis using the Australian Land Use Mapping (ALUM) indicates that the vast majority of peatland areas (around 81%) are classed as 'conservation or natural environments' (Table 8.2), and 70% having a tenure of 'nature conservation reserve' (Table 8.3). Despite being culturally significant to many Australian First Nations communities, only around 0.22% of Australian peatlands are formally classified as 'Indigenous Protected Areas (2022)'. Around 9% of Queensland's peatlands are Indigenous Protected Areas (Table 8.4), and 39% of the area (mainly in Tasmania) are co-managed by Indigenous groups.

Table 8.2. Australian Peatland Area by Land Use.

Landuse (ALUM)	Area (ha)
1 Conservation and natural environments	1,886,350
2 Production from relatively natural environments	159,146
3 Production from dryland agriculture and plantations	176,331
4 Production from irrigated agriculture and plantations	13,042
5 Intensive uses	16,838
5 Production from irrigated agriculture and plantations	0
6 Intensive uses	4
6 Water	62,8489
Not assigned	506
Grand Total	**2,315,066**

Table 8.3. Australian Peatland Area by Land Tenure.

Tenure	Area (ha)
Nature conservation reserve	1,625,548
Freehold	360,464
Multiple-use public forest	133,301
Other Crown purposes	130,568
Other Crown land	29,063
Pastoral term lease	15,971
Other perpetual lease	11,868
Other lease	3,153
Freeholding lease	2,476
Other term lease	2,214
No data/unresolved	262
Not assigned	168,980
Pastoral perpetual lease	9
Grand Total	**2,315,066**

Table 8.4. Australian Peatlands by Indigenous Protected Area (IPA).

Jurisdiction	IPA	Non-IPA	Area (ha)
Australian Capital Territory	0	5,480	5,480
New South Wales	20	57,249	57,269
Northern Territory	0	133	133
Other Territories	0	224	224
Queensland	4,560	45,176	49,736
South Australia	26	173,272	173,298
Tasmania	569	1,832,825	1,833,394
Victoria	0	64,056	64,056
Western Australia	0	131,475	131,475
Grand Total	**5,175**	**2,309,891**	**2,315,066**

In New Zealand, peatlands are covered in the national-scale soil maps at the 1:50,000 scale as part of the New Zealand Land Resources Inventory (NZLRI) (Dymond *et al*. 2021) and available as an online digital map. Peat soils cover 250,500 hectares, about 1% of New Zealand's mainland area. The Waikato region has the largest area of peatlands (43% of the total peatland area), with Southland (extreme south of the South Island) and Northland (extreme north of the North Island) being the two other regions with a substantial peatland cover. Most peat soils (169,000 hectares, or 67% of the peatland area) are under intensive agriculture, mainly high-producing grassland with around 8,200 hectares under irrigation (Dymond *et al*. 2021).

Various governmental and international researchers and agencies have conducted soil survey and mapping throughout several Pacific Islands. Some of the maps showing the extent of peats or peaty soils for some Pacific Islands are available at the Pacific Soils Portal (Pacific Soils Portal n.d.). The information on peatland distribution in the Pacific Island Countries is still sparse and requires a well-coordinated effort to centralise them. According to GPA mapping, there is about 44,000 hectares of peatland in the Pacific islands, however this estimate is highly uncertain due to the coarse scale of the maps.

Additional spatial inventory, mapping and modelling of Oceania peatlands will be necessary to appropriately assess and conserve these ecologically important environments. A recent inventory of existing mapped or modelled peatlands throughout Oceania and the sub-Antarctic and Antarctic areas show that global mapping areas are underestimating peatlands throughout the region.

- Many areas are too small to be represented on a global peatland map but are locally ecologically significant. For example, the Pacific Islands, and the arid mound springs in central Australia (Figs. 8.9 and 8.10).
- New Zealand degraded peatlands are not comprehensively mapped (as per many other Oceania countries). Further work is required to better identify these areas to prioritise rehabilitation activities.
- Peat-bank locations are known and described in Antarctica (e.g., particularly on the offshore islands e.g., Moe), but are also relatively unmapped. Mapping or spatial modelling of these areas will be important for future analysis of these fragile ecosystems with respect to climate change.

Figure 8.9. Bonatoa Bog freshwater peatlands, Viti Levu, Fiji Islands, encroached by urban development.
Source: Ash and Ash 1984.

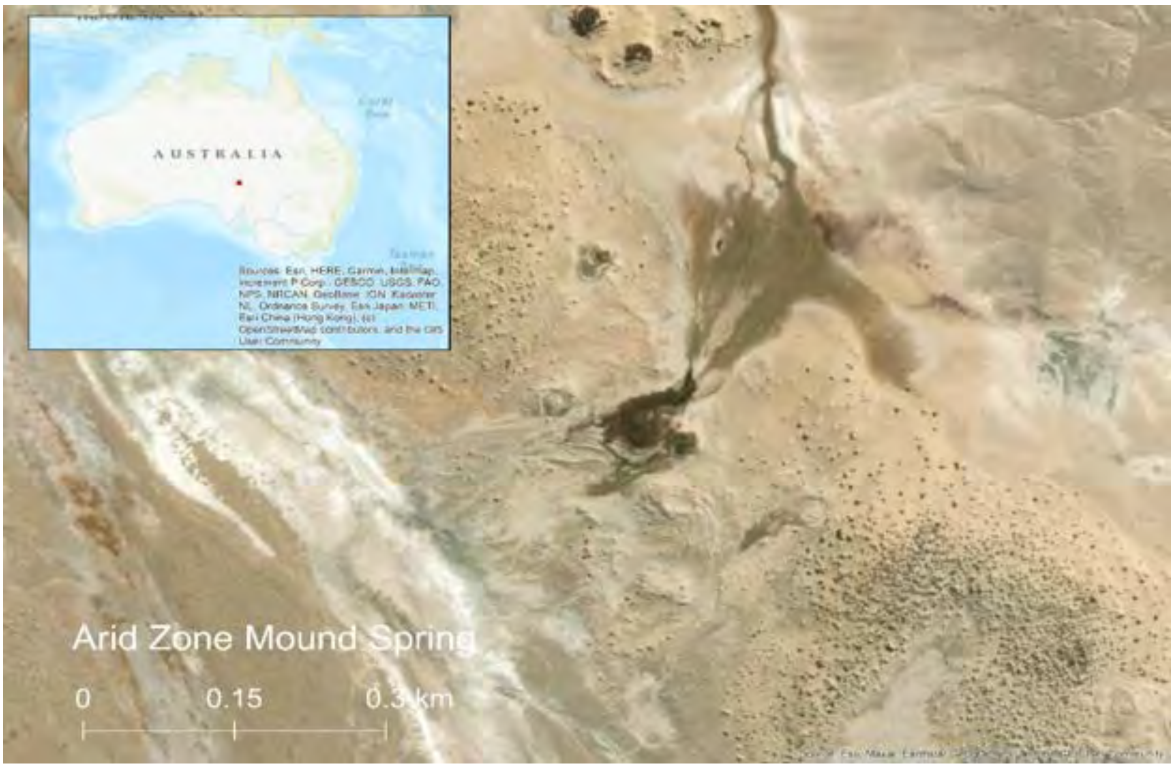

Figure 8.10. Arid Zone spring mound and associated peatland, McLachlan Springs, Lake Eyre South, Central Australia. These mounds form from wind-blown sands deposited around wet vegetation, which expands over time. The wetland vegetation deposits organic matter, resulting in gradual peat formation at the vent.
Source: Brake et al. 2019.

8.3 Biodiversity, Nature's Contributions to People and Hotspots of Value

8.3.1. Biodiversity

Peatlands in the region provide habitat for many unique plants and animals that are key to ecosystem services, as described in previous sections. However, extractive use of peat and conversion to agriculture coupled with climate change, threaten biodiversity housed in Oceania's peatlands. There are many threatened species, but there is a lack of monitoring and quantification of the state and trends of these species. Here we highlight some unique animals and plants.

The acid frogs of the Wallum wet heathlands of South East Queensland and northern New South Wales are a highly specialised group. They are well adapted to the low nutrient acidic soils and groundwater dependant wetlands. These include the extensive peatlands that occupy the sand masses of the region. The four key species, *Crinia tinnula, Litoria cooloolensis, L. freycineti* and *L. olongburrensis* are listed by the IUCN as Vulnerable to Endangered with the main pressures threatening them associated with land use intensification (Fairfax and Lindsay 2019; Filer *et al*. 2020).

The Sunset Frog (Fig. 8.11) is an endemic, monotypic genus of frog, wedded to wetlands with significant organic-rich sediments in the coolest and wettest part of southwestern Australia. *Spicospina flammocaerulea* represents an ancient lineage of frogs in the family Myobatrachidae dating from 33-36 million years ago (Roberts *et al*. 1997). The Sunset Frog is known from around 20-30 locations, is a short-range endemic and is vulnerable to climate change and land use impacts (Edwards and Roberts 2011).

In sub-alpine peatlands of Australia's high country, brightly coloured yellow-green striped Corroboree frogs are found (Fig. 8.12). There are two species. The Southern Corroboree Frog (*Pseudophryne corroboree*) found in the southern part of the snowy mountains and the Northern Corroboree Frog (*P. pengilleyi*) found in the northernmost part of Australia's alpine and subalpine area. Both species are listed as critically endangered, with populations declining since the 1980s due to chytrid fungus. This disease has caused numerous frog species' populations to decline or become extinct worldwide (Hunter *et al*. 2010).

The Wallum wet heathlands are also an important habitat for the vulnerable False Water-Rat (*Xeromys myoides*), two endangered fish species (*Nannoperca oxleyana* and *Pseudomugil mellis*) and the distinctive Ornate Rainbow Fish (*Rhadinocentrus ornatus*). All three species are adapted to the highly acidic waters of the patterned fen areas (Fairfax and Lindsay 2019). The heathland is also a habitat of three key bird species, including Lewin's Rail *(Lewinia pectoralis)*, Southern Emu-Wren *(Stipiturus malachurus*) and the Eastern Ground Parrot (*Pezoporus wallicus wallicus*) (Fairfax and Lindsay 2019).

Tasmania is a global hotspot for endemic burrowing crayfish (34 species in 3 genera) (Hansen and Richardson, 2006). Many of these species live in organic-rich soils. Their burrows provide a type of habitat, known as "pholoteros", for a community of invertebrate species (Brown *et al*. 1993). Two species of syncarid shrimps, *Allanaspides hickmani* and *Allanaspides helonomus,* are of particular scientific interest because they are very primitive among the higher crustaceans and have origins that reach back to the ancient supercontinent of Gondwana (Carle 1995; Driessen *et al*. 2014). In addition, Buttongrass moorlands of western Tasmania are the stronghold for the Eastern Ground Parrot *Pezoporus wallicus*, one of only five ground-dwelling parrots in the world (Driessen 2008).


Figure 8.11. Sunset Frog.
Photo: Rob Davis.


Figure 8.12. The Southern (left) and Northern (right) Corroboree Frog has striking brightly coloured stripes that are believed to be a signal to predators that they are toxic.
Photos: David Hunter.

Another unique ecosystem is created by cushion plants, a group of shrub species that can form vegetation associations known as Bolster Heaths (Kirkpatrick and Bridle 1999). Different species cooperate, growing together to form one solid canopy in an unusual mosaic pattern (Fig. 8.13). They have such tight canopies that it is impossible to see the branches underneath. This adaptation protects growing tips from the icy winds that blow from Antarctica. Increased wildfire frequency in Tasmania due to climate change poses a significant threat to these plant communities as most cushion plants grow very slowly, are severely damaged by fire and take a long time to recover (Gibson and Kirkpatrick 1992; Kirkpatrick *et al.* 2021).

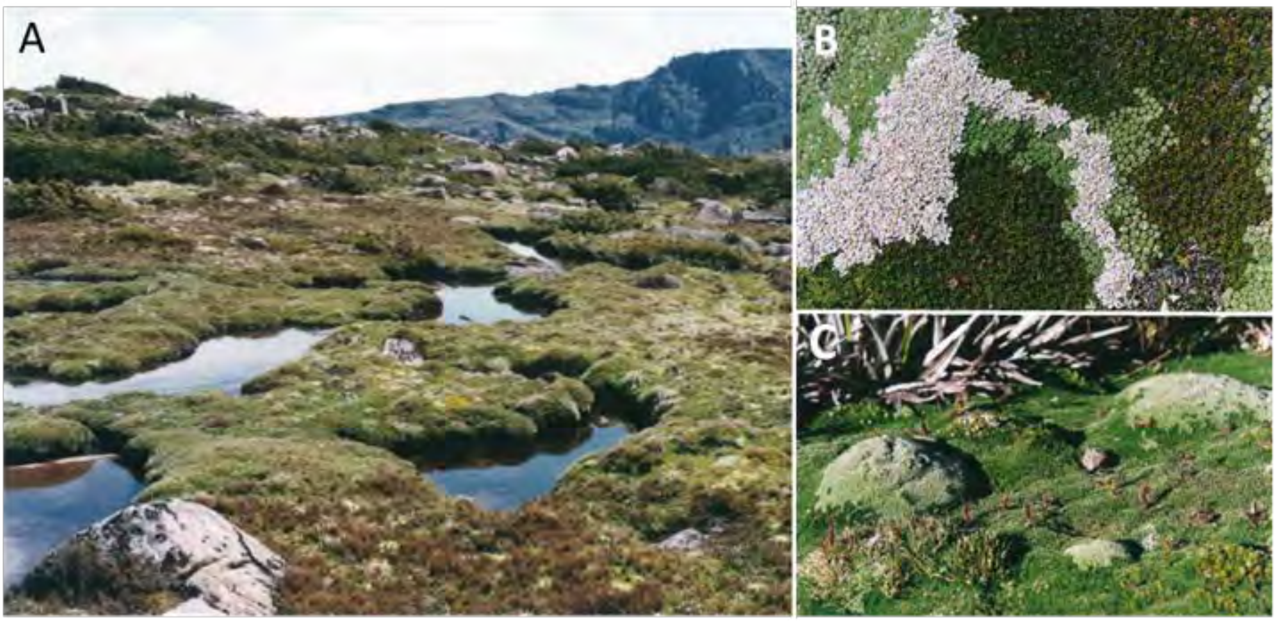

Figure 8.13. A: An example of cushion moorland dominated by cushion plants in Mt Field National Park in Tasmania, Australia. Cushion plant canopies grow so tightly that they can divert water flow to create pools as shown here. B: A mosaic pattern develops as the canopies of many different cushion plant species grow together. The canopies of different species (different coloured leaves) of cushion plants grow together to form a solid shield from the cold winds and protect the sensitive growing tips of the plants. C: The cushion plant canopy surface provides habitat for other plant species to grow including sundew species (red emerging leaves) and small grasses and rushes (bottom left corner).

Photos: Joslin Moore

8.3.2. Nature's Contributions to People

Indigenous First Nation perspectives on peatlands in Oceania are as diverse as the peoples within the region. Peatlands often form part of cultural origin traditions. They are frequently believed to be the dwelling places of important deities or ancestors and are often regarded as sacred. A common thread that runs across most indigenous societies of Oceania, prior to colonisation, is that peatlands were commonly used to preserve, through the burial processes that take place within them, treasured items that would normally rot away over time, like wooden items including canoes (Phillips *et al*. 2002).

The vital contributions provided by lowland peatlands in Australia and New Zealand as seasonally rich native food sources and gathering places to contemporary First Nations peoples are increasingly being recognised. Reengagement with traditional practices of food and other resource procurement in peatlands supports increased recognition of local identity and emphasises the aspirations of indigenous communities to take responsibility for the management of peatlands (Pyke *et al*. 2021). Furthermore, the most extensive peatlands found in Oceania provide the main substrate for staple crop production for rural communities across the intermontane basins and coastal and lowland river deltas of Papua New Guinea (Bourke and Harwood 2009), and in the valleys of many of the Pacific Islands high islands. The inherent sustainability of traditional food production (e.g., sago –*Metroxylon sagu* and taro –*Colocasia esculenta*) is increasingly being recognised. However, rampant development and increased dependence upon low-cost imported foods are undermining this food security. As women and girls in rural areas are often charged with taking care of domestic needs within the home, depleted natural resources mean that Indigenous women and girls often spend more time collecting water, biomass or other peatland products. It is therefore crucial to adopt gender-responsive approaches that specifically consider the needs and contributions of Indigenous women and girls who have the least adaptive capacities.

Aside from holding a rich biodiversity (section 8.4.1), peatlands of the Temperate Montane Zone provide support for people in the form of water regulation, electricity provisioning via significant hydroelectricity infrastructure and climate regulation through carbon storage and sequestration. They also provide material goods like fresh water and cultural amenities like recreation. Peatlands of the Temperate Coastal zone are used for agricultural food production (especially in New Zealand), peat extraction (small scale, confined to private land), flood mitigation and coastal recreational amenities like bird watching and water sports. While peatlands of Oceania demonstrably provide significant contributions to both the people of the region and to people globally, the current status of peatlands in Oceania and their ability to continue to provide these contributions has not been adequately surveyed.

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8.3.3. Hotspots of Value

Box 8.1. Case Study – Restoration of the Blue Mountains Swamps to Return their Benefits to People and Nature

The Blue Mountains Swamps are located in the headwaters of the World Heritage listed Blue Mountains Area. These swamps provide important contributions to people and to nature absorbing and filtering water thus regulating baseflows to watercourses, moderating peak flow events and purifying water. Besides these hydrological services, several nationally endangered animal species including the Blue Mountains Water Skink and Giant Dragonfly, and many threatened or regionally significant plants including *Carex klaphakei, Lepidosperma evansianum, Almalaea incurvata* and *Boronia deanei* have these swamps as their habitats (Hensen and Mahony 2010).

Part of the Blue Mountains Swamps have been impacted by urban development. One example was the impact promoted by the development of Katoomba, a township named from the First Nations Gundungurra and Darug people *kedumba*, meaning *shiny, falling waters*. Its development has caused several impacts in the surrounding swamps, namely a reduction of recharge to aquifers that support ground water dependent ecosystems; erosion and channelisation within swamps; delivery of nutrient-rich sediment; changes in floristic composition and increased vulnerability to weed invasion (Hensen and Mahony 2010).

In 2005, a restoration Program of these swamps was put in place by the Blue Mountains' City Council which has gradually brought these biodiverse peatlands back to their glory (Fig. 8.14). The 'Save our Swamps' project aims at enhancing the condition and extent of degraded swamps across the Blue Mountains and Lithgow local government areas. Focused on rehydrating desiccated swamp systems to restore their natural hydrological conditions, thereby allowing natural swamp regeneration to occur, while also tackling the drivers of degradation happening at the catchment level, the program allowed to return the swamps to a condition where they can provide the essential benefits to people and nature (Hensen and Mahony 2010).

In August 2020, the "Blue Mountains Upland Swamps" project has officially started aiming at developing a monitoring and adaptive management program and a decision support tool for assessing climate change impacts and adapting management of restoration action. In April 2021, the project started researching the ecological importance and water storage functions of these peatlands (Blue Mountains World Heritage Institute [BMWHI] n.d.). On the Blue Mountains World Heritage Institute's website, a video (BMWHI 2021) about "Why swamps matter?" illustrates how these peatlands have value for the region.

Figure 8.14. Katoomba peatland; urban greenspace hotspot of value. Restoration infrastructure installed in 2010 (left), sedges establishing in 2012 (middle) and successful hydrological and vegetative restoration in 2014 (right).
Photos: Shane Grundy.

A recent study has valued the carbon stock ensured by the "Temperate Highland Peat Swamps on Sandstone (THPSS)" where the Blue Mountains Swamps are included. Using the carbon abatement price of $16 Australian Dollars (~€10 Euros) per ton of CO_2e, the total value of THPSS is over $404 million Australian Dollars (~€263 million Euros) which makes a strong economic case for the restoration of these swamps (Cowley and Fryirs 2020).

Box 8.2. Papua New Guinea Spotlight Case - Kumusi Peatlands, Oro Province

The peatland complex of the Kumusi-Mambare coastal plain north of the provincial capital Popondetta is amongst the largest ombrotrophic coastal peatland complexes found in Papua New Guinea. It extends over approx. 80,000 hectares of the interfluvial areas between the Kumusi and Mambare rivers and holds a vegetation gradient from the edges to the central parts (Beer 2018). On shallow peat sometimes extensive *Metroxylon sagu* stands with mineral topsoils alternate with herbaceaous H*anguana anthelmintica – Mapania sumatranum*-formations on peat soils, which successively change to swamp savannah and low pole swamp forests with *Syzygium* sp., *Palaquium amboinense* and *Stemonurus ammui* further to the central peatland parts with indications of peat dome formation. Peat thickness reaches 10 meters and is surprisingly young, with layers at 8.5 m depth being only 2500 years old and carbon stock estimated at approximately 3,200 tons of carbon per hectare (Beer 2018). Limited human impacts on these peatlands might be due to their remote location and the land tenure system by the local communities in PNG (Beer 2018).

8.4. Status of Peatlands, Drivers of Change and Hotspots of Change

8.4.1. Status of Peatlands

Around 10% of the peatlands in the region are degraded, according to the GPA data retrieved from the Global Peatland Database compiled by the Greifswald Mire Centre. Fig. 8.15 shows the proportion of drained and undrained peatlands in countries of Oceania (partly including organic soils). More than 70% of New Zealand's peatlands have been drained for forestry, agriculture and peat extraction. For all other countries, the proportion of drained peatlands is less than 15%.

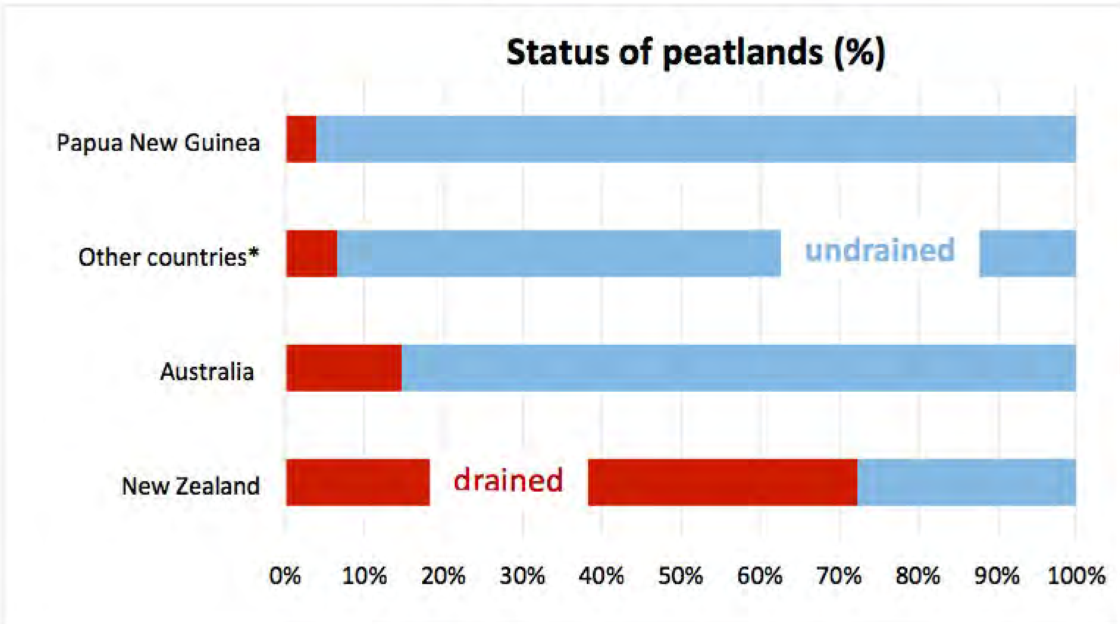

*Figure 8.15. Proportion of drained (red) and undrained (blue) peatlands in Oceania per country (partly including organic soils). Calculations are based on the drained area for forestry, agriculture and peat extraction. *Sum of Oceanian countries with less than 100,000 hectares of peatland area.*

Source: Global Peatlands Assessment data retrieved from the Global Peatland Database compiled by the Greifswald Mire Centre.

Although evidence is limited, it is likely that coastal tropical lowland peatlands of Papua New Guinea, particularly sago palm (*Metroxylon sagu*) peatlands, were heavily exploited for food and fibre by the earliest human societies (Barrau 1958). The earliest evidence for the use of peatlands in Oceania actually comes from the intermontane basins of Papua New Guinea as these areas were occupied by indigenous Papuan speaking communities at least 40,000 years ago. In the Ivane Valley (Central Province), karuka *Pandanus* nuts have been found within buried peat deposits along with stone tools. These assemblages have been radiocarbon dated to 45,000-30,000 years old (Summerhayes *et al*. 2006; Fig. 8.16). At Kuk Swamp in the Wahgi Valley (Western Highlands Province), a World Heritage Site, complex drainage ditch systems excavated within buried peat deposits containing evidence for Musaceae banana and aroids have been excavated and dated up to 7,000 years old (Golson *et al*. 1967; Denham *et al*. 2003). While intermontane peatlands were globally important independent centres of agricultural origin in the Holocene, the introduction of new dryland crops (e.g., I*pomoea batatas* and *Manihot esculenta*) has resulted in the abandonment of some peatlands in the last few centuries (Hope 2015). Current land use in peatlands in Papua New Guinea includes palm oil and rubber plantations (Bourke and Harwood 2009). Traditional forms of production continue to varying degrees in most tropical island nations, limited by the low-cost importation of intensively produced food products such as rice, or the conversion to cattle or copra production or other dryland crops (Wairiu *et al*. 2011).

Figure 8.16. Left: Metroxylon sagu grove, Embi Lakes, Oro Province, Papua New Guinea (50 m asl), and Right: The remains of a Metroxylon sagu trunk with the pith extracted for starch, Koil island, East Sepik Province Papua New Guinea (10 m asl). Photos: Matthew Prebble.

Kurnell in Sydney was extensive peatland and occupied by Indigenous Peoples (IP) for several thousand years. There was evidence of the use of fire to promote the growth of edible herbs, bulbs and bracken (Martin 1994). Before European colonisation, the peatlands of the small tropical and sub-tropical Pacific Islands and northern temperate New Zealand, were used by IPs for agricultural production of wetland crops such as taro (*Colocasia esculenta,* e.g., Prebble *et al*. 2019). IPs throughout Oceania have also used peatlands for the preservation of wood and fibre technologies including canoes identified during archaeological excavations (e.g., Phillips *et al*. 2002). A drastic change in the vegetation was observed following the arrival of humans. An increase in fires and deforestation led to higher erosion and sedimentation rates, which transformed valley peatlands into swamps with mineral topsoils (Prebble and Wilmshurst 2009). Hamilton/Kirikiriroa and Christchurch/Ōtautahi cities are built on extensive peatlands. Current uses of peatlands in New Zealand include horticulture (e.g., blueberry farms, Waikato, Southland), moss harvest (West Coast), apiculture (e.g., mānuka honey) and flood water storage (Waikato). Other notable factors that affect peatlands, particularly in Australia and New Zealand, include mining, forestry and the presence of invasive plants and animal species, such as horses, deer, pigs and willow.

Fig. 8.17 shows the annual GHG emissions from peatlands in Australia, Papua New Guinea and New Zealand, totalling close to 28 Mt CO_2e per year.

8.4.2. Drivers of Change

The key drivers of change in peatlands common across Oceania are agricultural conversion, altered hydrology, climate change and fire. Other notable drivers in specific areas are peat extraction, pollution, and invasive alien plant and animal species. In Antarctica, changes in seal and penguin populations associated with climate change are potential drivers of change in the moss peat banks (Amesbury *et al*. 2017).

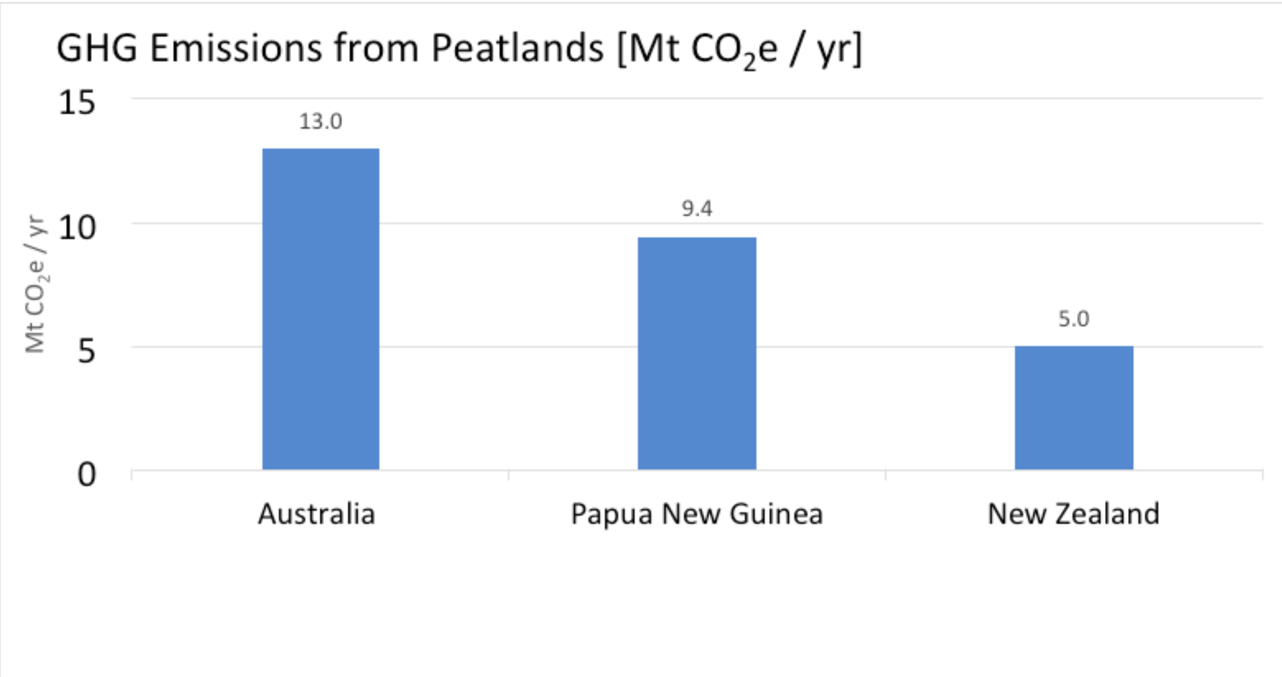

Figure 8.17. Oceanian countries emitting GHG from peatlands, with Australia representing 47%, PNG 34% and New Zealand 18%. C Calculations are based on the peatland drained area for forestry, agriculture and peat extraction and IPCC (2014) emission factors including CO_2, CH_4, N_2O, DOC, and emissions from ditches. Includes only net, on-site GHG emissions. Wildfire emissions are not included.

Source: Global Peatlands Assessment data retrieved from the Global Peatland Database compiled by the Greifswald Mire Centre.

Since European settlement in New Zealand, around 146,000 hectares of peatlands have been converted to agriculture, potentially contributing between 0.5 and 2 Mt CO_2 per year to New Zealand's greenhouse gas emissions (Ausseil *et al*. 2015). Due to the substantial loss of natural peatlands in New Zealand, the remaining peatland ecosystems support a relatively high number of threatened or at-risk species, many of which are endemic to New Zealand. Critically, the rare and threatened taxa include peat-forming species like the 'relict' *Sporadanthus ferrugineus*, which now only occurs within small pockets of the most intact restiad peatlands, and the 'at risk-declining' *Empodisma robustum*, which is under increasing threat from disturbance (Clarkson *et al*. 2021). Various other species adapted to peatlands are also at risk of ongoing population decline, such as the 'nationally critical' orchid *Corybas carsei,* 'nationally critical' Australasian bittern/matuku (*Botaurus poiciloptilus)* (O'Donnell and Robertson 2016) and several species of mudfish (e.g., *Neochanna heleios, N. diversus* and *N. apoda*) (Allibone *et al*. 2010) and Trichoptera invertebrates (Collier 1993).

The proportion of peatlands within protected areas, including bog, fen, gum land and swamp wetland types on peat soils, is relatively high for New Zealand (Robertson 2016). There are 79% of remaining bogs, 47% of fens and 83% of gumlands/pakihi occurring within protected areas. However, when considering the historical extent of peatlands, the percentage in protected areas decreases substantially (only 20% of bogs and 9% of fens are in protected areas based on the historical, pre-human extent (McGlone 2019). Further, the legal protection of peatlands is biased towards large systems, with very few small (<20 hectares) areas contained in reserves or conservation areas in New Zealand (Robertson 2016).

Over the past 10 years, there has been an increased focus on restoring peatlands in New Zealand. The national Arawai Kakariki wetland restoration programme, for example, is working in partnership with councils, local iwi (Māori tribe), the Department of Conservation and research organisations to restore vulnerable peatland ecosystems at Whangamarino Wetland (7,000 hectares raised bog-swamp complex, Wetland of International Importance), Awarua Wetland (20,000 hectares blanket bog, coastal lagoon complex, Wetland of International Importance) and Kaimaumau-Motutangi (3000 hectares gumland-dune complex). Various local restoration initiatives are also taking place throughout New Zealand. However, the overall scale of restoration is modest and there has been no national assessment on the effectiveness of these activities.

Changes in fire management have had a dramatic impact on peatland ecosystems across Australia. For instance, there has been an invasion of shrubs into buttongrass moorlands (Fig. 8.18) since a shift from indigenous fire management to European fire suppression practices over the last 150 to 200 years in Tasmania. This has also been documented in palaeoecological research in the Surrey Hills region (Fletcher *et al*. 2021). A similar disturbance has been observed in the subtropics of eastern Australia (K'Gari/Fraser Island) with the invasion of wire rush peatlands by paperbark forest between the late 1950s and mid-2010s (Stewart *et al*. 2020). Climate change poses ongoing threats to alpine and sub-alpine Australian peatlands, including droughts, increased fire frequency and intensity, and invasive species. Alpine peatlands are also subject to substantial legacy impacts associated with grazing and the development of hydroelectric schemes (MacPhee and Wilks 2013; Department of the Environment 2015; Australian Capital Territory Government 2017; Vernon 2017).

In Papua New Guinea (PNG), road construction and infrastructure expansion accelerate risks of increased deforestation, fire and GHG emissions from peatland drainage by granting easier access to the largest and most remote parts of the country (Alamgir *et al*. 2019).

Figure 8.18. Shrubs invading buttongrass moorland in Surrey Hills (Tasmania), after changes in fire management approaches since European settlement. Photo: Patrick Moss.

8.4.3. Hotspots of Change

8.4.3.1. Human-induced Fires in Papua New Guinea, New Zealand and Australia

Climate change and human-induced fires have led to catastrophic loss of habitat for indigenous species, loss of carbon via GHG emissions and vegetation disturbance. In Papua New Guinea, during the El Niño year of 1997, conflagrations enveloped huge areas of both the lowland and highlands, including vast areas of peatland (Hope 2015). Palaeoecological evidence shows that periods of intense El Niño Southern Oscillation (ENSO) and heightened human activity in the past have resulted in increased biomass and peatland burning (Haberle *et al*. 2001). Hotspots of fire on global peatlands during a strong El Niño (2015) and a moderate La Niña (2020) year can be seen in Chapter 4 Figure 4.11. In New Zealand, during the summer of 2021-22, fires due to prolonged dry conditions and human activities led to large-scale (more than 1000 hectares) fires at two of its largest peatlands, the Awarua Wetland of International Importance in Southland and Kaimaumau-Motutangi in Northland (Fig. 8.19). The wetland systems are also under pressure from drainage that lower water tables and enables fire-adapted invasive species (e.g., *Hakea* and *Acacia* species at Kaimaumau) to become more dominant. While the palaeoecological record (McGlone 2009) indicates peatlands in New Zealand have been subject to infrequent fires well before the arrival of humans, the increase in the frequency of fire due to human activities is a concern for vulnerable biodiversity, cultural values (e.g., taonga species) and carbon emissions.

Figure 8.19. Kaimaumau-Motutangi, a 3000 hectares peatland (gumland) in northern New Zealand that was affected by human-induced fire in 2021-22. More than 70% of the peatland was burnt.

Photo provided by the Coordinating Lead Authors.

Australia experienced the impact of climate change first hand on its peatlands following the catastrophic bushfires in 2019-2020 that burned 17 million hectares of land across the continent (Fig. 8.20). As a result, the Australian Government commissioned an independent ecological assessment to determine the sensitivity and exposure of vulnerable ecosystems to multiple fire-related threats (Keith *et al*. 2022). As part of the national assessment, Alpine *Sphagnum* Bogs and Associated Fens (in ACT, NSW and Victoria) and the Temperate Highland Peat Swamps on sandstone (Blue Mountains NSW) threatened ecological communities were identified as "at risk" post-fire. A suite of candidate management actions such as limiting feral animals and providing buffer areas were identified to respond to these impacts.

Figure 8.20. Peatland loss from wildfire, Musselroe Bay, Tasmania, 2017; Parks and Wildlife Service, Tasmania. Photo provided by the Coordinating Lead Authors.

8.5. Policy Context, Policy Options and Hotspots of Response

8.5.1. Policy Context

8.5.1.1. Australia

In Australia, the responsibility for peatland conservation and management is shared across the Commonwealth, State and local governments, catchment and conservation organisations and individual landholders. At the national level, the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) regulates development activities that may have a significant impact on matters of national environmental significance (MNES). This includes peatland systems that are listed as endangered ecological communities, designated Wetlands of International Importance, and listed as National Heritage or World Heritage sites.

National programs like the National Landcare program provide funding support for wetland conservation and rehabilitation projects and threatened ecosystem and species-focused research that can support peatlands management.

State and territory governments have important statutory responsibilities for the protection of peatlands (Australian Government n.d.). State legislation also provides the framework for local government's land use planning activities and development controls guiding peatlands restoration and management. Australia's ability to conserve and manage its peatlands outside of protected areas is hampered by the absence of a comprehensive national wetland inventory to inform decisions about the protection of peatlands. The vast majority of Australian alpine and sub-alpine peatlands are on publicly managed land and are now protected in National Parks or State Forests with restrictions on the activities that can be undertaken. The alpine and sub-alpine peatlands are nationally listed as an endangered ecological community under the Environment Protection and Biodiversity Conservation Act 1999.

8.5.1.2. New Zealand

The policy framework for the management of peatlands in New Zealand is similar to Australia, it comprises national (Department of Conservation) and regional organisations (e.g., councils) that have responsibility for managing and restoring relatively large areas of peatlands within public conservation land. However, the regulatory and cultural framework that guides peatland management is more specific to New Zealand.

The most significant recent advancement in environmental policy was the enactment of the National Policy Statement for Freshwater Management 2020 (New Zealand Government 2020) and the associated National Environmental Standards (NES-Freshwater). This contained a major policy shift to increase the regulatory protections for all wetlands (including peatlands). The overarching national policy was amended to, in effect, avoid peatland loss and promote restoration.

In addition, the cultural principle of *Te Mana o te Wai* was embedded in the legislation. This recognises the vital importance of water and states that, by protecting the health of water (including peatlands), the health and well-being of people and ecosystems are also protected. In essence, this requires local regional authorities to consider *Te Mana o te Wai*, through discussions with *tangata whenua* (local Māori) and communities. Therefore, cultural perspectives on natural resource management are critical in current and future peatland management.

The first New Zealand emissions reduction plan, Te hau māoroki ki anamata, was released in May 2022 (Ministry for the Environment 2022), specifically identifying peatlands' important function as Nature-based Solutions to climate change and the need to rewet degraded peatlands to help reduce emissions.

8.5.1.3. Papua New Guinea (PNG) and Pacific Countries

Efforts are underway in PNG to enhance information on peatlands and increase awareness towards improved climate policies, e.g., including peatland emissions in the Nationally Determined Contributions (NDCs).

In the Pacific Islands, seven countries are contracting parties to the Convention on Wetlands, with eleven Wetlands of International Importance designated at the national level, covering a total combined area of 807,580 hectares (Nanettew 2022). The State of Environment and Conservation in the Pacific Islands 2020 Regional Report revealed that coastal habitats in the region, which include wetlands, are essential but in decline.

In the Pacific islands, climate change poses the most serious threat, particularly rising sea levels on the low-lying atolls. Agricultural expansion is also presenting a challenge in the region effecting already degraded lowland peatlands. The South Pacific Community (SPC)'s strategic plan 2022-2023 broadly addressed key focus areas of Resilience and Climate Action and Natural Resources and Biodiversity, however, there is no explicit mention of peatlands (South Pacific Community [SPC] 2022).

8.5.1.4. Antarctica and sub-Antarctic Islands

Antarctica is subject to a series of legally binding international agreements collectively known as the Antarctic Treaty system. These aim to protect and conserve the environment, including more generically wetlands. The main agreement pertinent to peatlands is the Protocol on Environmental Protection to the Antarctic Treaty (Hughes *et al*. 2018).

8.5.2. Policy Options

Oceania is a diverse region, encompassing continental, large-island and small-island scales that supports a similarly diverse suite of peatland ecosystems. Loss and degradation of peatlands continue in Oceania, despite a range of legislative and policy mechanisms and management tools. A priority for the region is to increase efforts to put in place policy and management programmes to provide global goals for peatland conservation, restoration and sustainable management. For example, the Convention on Wetlands (Convention on Wetlands 2021) calls on governments, financing institutions and the private sector to ensure that drainage-based agriculture and forestry do not expand further into peatland areas, and to undertake large-scale peatland rewetting and restoration to achieve national and international climate change mitigation targets. The Convention further recommends mainstreaming a gender perspective in its implementation and this also applies to peatland-related activities. Improved national and regional policies and strategies are also urgently needed to prioritise efforts to protect and restore wetlands.

8.5.3. Hotspots of Response

8.5.3.1. Case Study – Local Advocacy and Science for Peatland Conservation, SW Australia

Southwestern Australia (SWA) is losing its extensive peatland ecosystems to climate change, fire, and damage from invasive species. A unique and slow-forming habitat harbouring endemic microbes, plants and animals, wetlands with organic soils are increasingly impacted by declining rainfall and groundwater.

These processes are drying soils, which enables severe and often irreparable damage to peatlands from fire. The Walpole-Nornalup National Parks Association (WNNPA) formally sought to recognise these threats. The WNNPA is a local community group established in 1987 to increase the understanding and awareness of positive interactions and engagement with the natural values of the lands and waters that make up the Walpole Wilderness Area. The group first nominated *Empodisma gracillimum*-based peatland communities of the high rainfall zones of southwestern Australia for listing as a Threatened Ecological Community, under the Australian Government's Environmental Protection and Biodiversity Conservation Act, in 2017, and then renominated it with additional information in 2019. The Ecological Community was then placed on the Finalised Priority Assessment List for the period commencing 1 October 2019 as "*Empodisma gracillimum* based peatlands of southwest Western Australia". Since then, consultant scientists have sought to define the ecological community accurately, and the Australian Government's Department of Agriculture, Water and Environment, has been working to gain Ministerial approval for the national government, with the goal of authorising recovery actions to prevent further decline.

8.6. Knowledge Gaps

Peatlands in Oceania are amongst the most threatened and least understood ecosystems. This is because they are rare and restricted in distribution due to their biogeography and, at the same time, unique because of the way they were formed. Knowledge of the peatlands of Oceania is best in New Zealand, followed by Tasmania and then mainland Australia. While there is a comprehensive peatland map of Papua New Guinea, knowledge of the peatlands there is still thin, especially in the tropical mountain systems. Likewise, peatland information on the Pacific Islands is limited. Polar lowland peatlands have been the focus of more research than their tropical counterparts.

Improving the knowledge of the distribution, values and benefits of peatlands in Oceania would assist in their conservation, restoration and sustainable management and ensure that they continue to provide services for planetary health. Oceania's peatlands provide important contributions to people and function as hotspots for biodiversity with numerous unique and endemic plants and animals found in them, many of which are threatened. Specifically, mapping efforts of Australia's lowland peatlands (temperate, sub-tropical and tropical) are very sparse and incomplete. Across the inhabited region, degraded peatlands are very poorly known, hampering restoration efforts. The peatlands are threatened by increasing human pressure on the land through conversion to agriculture, altered hydrology, climate change, fire and invasive alien plant and animal species. There is little information on carbon accumulation rates or greenhouse gas emissions from peatlands in the region with the exception of exemplar New Zealand sites (e.g., Goodrich *et al*. 2017). The risk of landscape scale bushfires across Oceania is increasing but there is still lack a comprehensive understanding of the relative carbon losses in burnt peatlands. Currently, there is no consistent regional monitoring of the state of peatlands or their biodiversity status. Most 'intact' peatlands in New Zealand and Australia are protected via regulations, but there is a large gap in protected areas elsewhere.

Knowledge of the peatlands of the Pacific Islands is scarce and a significant knowledge gap exists for the region. Support and resources to develop a unified and trusted Pacific Island soil information system, knowledge resource and monitoring program are crucial to assess these peatlands as a natural asset and carbon sink. Global collaboration is urgently required to address this inequity. Indeed, the threat that peatlands in Pacific Island countries will disappear before they are even documented is very real.