

Pherosphaera hookeriana

mount mawson pine

TASMANIAN THREATENED FLORA LISTING STATEMENT



Image by Richard Schahinger

Scientific name: *Pherosphaera hookeriana* W.Archer bis, *Hooker's J. Bot. Kew Gard. Misc. 2: 52 (1850)*

Common name: mount mawson pine

Group: vascular plant, Gymnospermae, family **Podocarpaceae**

Name History: *Microstrobos niphophilus*, drooping pine

Status: *Threatened Species Protection Act 1995: vulnerable*
Environment Protection and Biodiversity Conservation Act 1999: Not Listed

Distribution: Endemic status: **Endemic to Tasmania**
Tasmanian NRM Regions: **Cradle Coast, North & South**

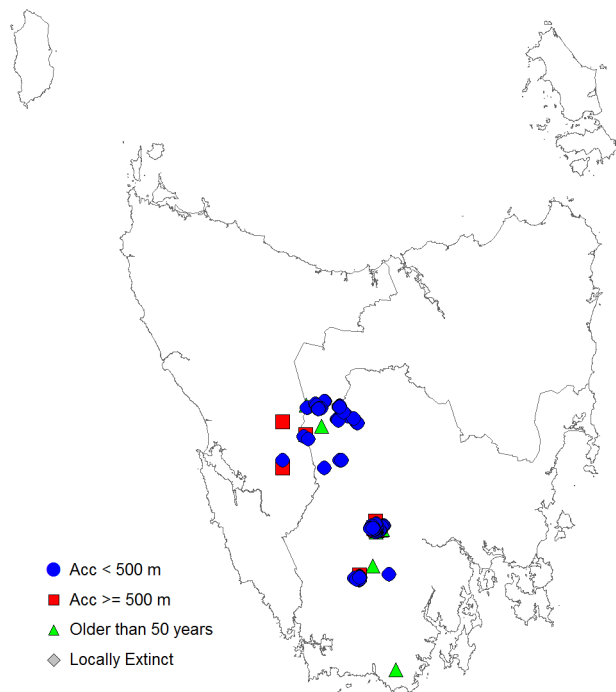


Figure 1. Distribution of *Pherosphaera hookeriana*, showing Natural Resource Management regions



Plate 1. *Pherosphaera hookeriana*: habit (image by Richard Schahinger)

SUMMARY: *Pherosphaera hookeriana* is a dwarf conifer endemic to Tasmania's west, southwest and central plateau at altitudes above 600 metres. The species occurs in woodland, heath and scrub, typically in boggy areas near water bodies, with most subpopulations on dolerite. About 30 sites are known, with a total population in the tens of thousands; almost all sites are in formal reserves within the Tasmanian Wilderness World Heritage Area. The species is highly sensitive to fire. An increase in severe fire events associated with a changing climate may lead to local extinctions and fragmentation of habitat. The species would benefit from active fire protection and surveys of potential habitat.

IDENTIFICATION AND ECOLOGY

Pherosphaera hookeriana is a small conifer of montane areas that can reach 5 metres in height, though may only attain 0.5 metres in exposed situations (Minchin 1983). The species' foliage is well suited to its high altitude habitat, with very small, imbricate leaves, and stomata which are restricted to the adaxial surface and protected by a marginal leaf frill (Hill and Brodribb 1999). Plants are usually dioecious, with the reproductive organs borne on specialised leaves which are arranged in cone-like structures; pollen is transferred to the ovules by wind, seed ripening by late April (Wood & Rudman 2015). It is unclear if the species has mast years or produces seed annually.

Recruitment from seed has been noted only rarely and appears to be restricted to moist, shady places. Seed appears to have a physiological dormancy which may result in a semi-persistent soil seed-bank with germination staggered over several years (the longevity of seed in the soil is unknown); preliminary trials indicate that seed requires warm stratification and then cold stratification to elicit germination, so the earliest recruitment would take place in the second spring/summer following dispersal (James Wood, pers. comm.). Seedlings superficially resemble small lycopods, with narrow, spreading leaves. Seed are not winged, so might be expected to drop within a few metres of the parent plant, with dispersal over longer distances by water a possibility for

plants at the edge of lakes and rivers (their buoyancy perhaps being enhanced by the tendency of cone scales to persist on the shed seed (Wood & Rudman 2015).

Pherosphaera hookeriana may form extensive clonal colonies via suckering (Fitzgerald 2011).

Ages of 250 to over 300 years have been estimated for plants with stem diameters of 3 to 6 cm on Mawson Plateau (Minchin 1983), with maximum ages in excess of 500 years likely. As for Tasmania's other alpine conifers, growth rates are likely to be extremely slow (Gibson et al 1995). The age to maturity is unknown, though fruiting plants were observed at Tarn Shelf in 2016 in areas that were burnt in 1966.

Pherosphaera hookeriana is highly sensitive to fire, recovery being dependent for the most part on seed from plants in unburnt areas and also the vegetative expansion of unburnt plants.

Pherosphaera hookeriana is one of five taxa in the Podocarpaceae family in Tasmania (de Salas & Baker 2016), four being endemic to Tasmania. It is one of only two species in the genus, *Pherosphaera fitzgeraldii* (syn. *Microstrobos fitzgeraldii*) being restricted to the Blue Mountains in New South Wales (Hill 1998).

Survey Techniques

Surveys may be undertaken at any time of year due to the species' distinctive foliage and habit.



Plate 2. *Pherosphaera hookeriana*: female 'cones' with ripening seed (image by Rob Wiltshire)

Description

Pherosphaera hookeriana is a densely-branched erect evergreen shrub or small tree to 5 m high (Plate 3). Its branches are often short and stiff. Its leaves are closely imbricate, fully appressed to the stem, and spirally arranged; individual leaves up to 1.5 mm long and 1 mm wide, thick, blunt, concave with a rounded keel. Male flowers in short, terminal globular cones, c. 1 to 5 mm in diameter, with 8 to 15 fertile scales, each with two pollen sacs on their under surface. Female flowers in cones on short, usually pendulous branches (hence the old common name of ‘drooping pine’); they are globular, 2 to 4 mm long, have 3 to 8 fertile scales, with a single ovule borne on the upper surface of each scale (Plate 2). Seed when ripe has a hard, glossy brown coat, and is about 1 mm in diameter.

[Description from Curtis & Morris (1975), Hill (1998)]



Plate 3. *Pherosphaera hookeriana*: tree form (image by Richard Schahinger)

Confusing species

Pherosphaera hookeriana may be confused with *Diselma archeri* (dwarf pine), another of Tasmania’s endemic dwarf conifers. *Diselma archeri* has opposite and decussate leaves, giving rise to branchlets that appear square in cross section. The foliage of *Pherosphaera hookeriana* differs from *Diselma archeri* in colour, the former being dark-green and the latter slightly yellow-green to grey to light brown (Plate 4). *Microcachrys tetragona* (strawberry pine) differs from *Pherosphaera hookeriana* in its prostrate habit and its opposite and decussate leaves.



Plate 4. *Diselma archeri* (foreground) and *Pherosphaera hookeriana* (right middle-ground) on the Mawson Plateau (image by Richard Schahinger)

DISTRIBUTION AND HABITAT

Pherosphaera hookeriana is endemic to Tasmania’s west, southwest and central plateau, confirmed records extending from the Walls of Jerusalem in the north to Mount La Perouse in the south (Figure 1). The species’ current distribution is a likely reflection of post-glacial expansion from refugia and subsequent fire events (Greg Jordan, pers. comm.; Kirkpatrick & Dickinson 1984).

Pherosphaera hookeriana has been recorded in the altitude range 600 to 1300 metres above sea level in a variety of habitats, including alpine and coniferous heath (Plate 5), eucalypt woodland, rainforest dominated by *Athrotaxis cupressoides* (pencil pine), the margins of streams and lakes, and *Sphagnum* bogs, the common element being high soil-moisture levels (Minchin 1983). Annual rainfall of known sites ranges from about 1500 to 2500 mm.



Plate 5. Coniferous heath dominated by *Pherosphaera hookeriana* (image by Richard Schahinger)

The species is known to occur in four vegetation communities listed as threatened on the Tasmanian *Nature Conservation Act 2002*: ‘Cushion moorland’, ‘*Athrotaxis cupressoides* open woodland’, ‘*Athrotaxis cupressoides* rainforest’ and ‘*Sphagnum* peatland’.

Associated species include *Astelia alpina*, *Athrotaxis cupressoides*, *Baekkea gunniana*, *Bauera rubioides*, *Bellendena montana*, *Carphe alpina*, *Diselma archeri*, *Epacris serpyllifolia*, *Gleichenia alpina*, *Leptospermum lanigerum*, *Microcachrys tetragona*, *Orites acicularis*, *Orites revoluta*, *Richea scoparia*, *Richea pandanifolia*, *Eucalyptus coccifera* and *Sphagnum cristatum*.

Most populations of *Pherosphaera hookeriana* occur on Jurassic dolerite, though there are exceptions: a stand on sedimentary deposits occurs in Artichoke Valley near Frenchmans Cap, the area supporting vegetation indicative of soils higher in nutrients than the surrounding Precambrian quartzites (Greg Jordan, pers. comm.).

POPULATION PARAMETERS

The *Pherosphaera hookeriana* population in Tasmania is believed to consist of at least 20,000 plants in more than 30 subpopulations (Table 1).

Subpopulations are defined as geographically or otherwise distinct groups in the population between which there is little demographic or genetic exchange. In the case of *Pherosphaera hookeriana* it has been assumed that a separation of at least one kilometre warrants classification as separate subpopulations, though it should be noted that the level of information across the species’ distribution varies enormously, and that the subpopulations cited in Table 1 may well change over time as new information comes to light. A number of the current subpopulations represent point records which have no supporting information as to the number of plants or the area of occupancy. Others, including several from Mount Field, represent multiple sites spanning perhaps 3 or 4 km in discrete catchments (Rudman & Schahinger 2016).

The linear range of the species is 180 km, and the extent of occurrence c. 6000 km². Reliable estimates for the area of occupancy are not available for all subpopulations, but within Mount Field National Park alone it is thought to exceed 300 hectares (Table 1).

Mount Field has long been recognised as the stronghold of *Pherosphaera hookeriana* in Tasmania, with areas of coniferous heath dominated or co-dominated by the species (Minchin 1983, Kirkpatrick 1997; Plates 1 & 4). Our understanding of the species’ extent at Mount Field has increased significantly in recent years, with surveys in early 2016 revealing the species’ presence in many hitherto unrecorded locations (Table 1; Rudman & Schahinger 2016). Observations in the past decade have also revealed sites in the Walls of Jerusalem, as well as the Mount Anne, Snowy Range, Frenchmans Cap and Nive River areas. In the latter area, current records suggest that the species is likely to be an occasional presence at the margins of rivers over an 18 km stretch, including the Little Nive Rivulet from Lake Ina to its junction with the Nive River, and further downstream to at least the Gowan Brae bridge. The likelihood of additional sites being uncovered is considered to be high, particularly in the Walls of Jerusalem National Park.

RESERVATION STATUS

Pherosphaera hookeriana is reserved in Cradle Mountain-Lake St Clair National Parks, Franklin-Gordon Wild Rivers National Park, Mount Field National Park and Southwest National Park. Almost all known subpopulations are within reserves, and all but two of the known subpopulations are within the Tasmanian Wilderness World Heritage Area (TWWHA), the exceptions being Butlers Gorge and Nive River (Gowan Brae) (Table 1).

CONSERVATION ASSESSMENT

Pherosphaera hookeriana was listed as rare on the original schedules of the Tasmanian *Threatened Species Protection Act 1995* under the name *Microstrobos niphophilus* and uplisted to vulnerable in 2001. The uplisting was deemed appropriate at the time due to the risk of fire to the species and the few known subpopulations.

Table 1. Population summary for *Pherosphaera hookeriana*

| | Subpopulation | Tenure | NRM region * | 1:25 000 mapsheet | Year last (& first) seen | Area of occupancy (ha) | Number. of mature plants |
|----|------------------------------------|---|--------------|--------------------|--------------------------|------------------------|--------------------------|
| 1a | Lake Fenton – Mount Field East | Mount Field National Park | South | Dobson | 2016 (1928) | 26 | < 2000 |
| 1b | Windy Moor to Davis River | Mount Field National Park | South | Dobson | 2016 | 120 | 1200 to 3600 |
| 1c | Upper Davis River near Mt Crooke | Mount Field National Park | South | Dobson | 2016 | 10 | 1000 to 3000 |
| 2 | Upper Broad River | Mount Field National Park | South | Dobson | 2016 | 22 | 1500 to 4500 |
| 3 | Lake Webster – Broad River Marshes | Mount Field National Park | South | Dobson & Ellendale | 2016 (1984) | 18 | 500 to 1500 |
| 4 | Lake Webster to Mt Lord | Mount Field National Park | South | Dobson & Ellendale | 2016 | 10 | 500 to 1500 |
| 5 | Lake Seal | Mount Field National Park | South | Dobson | 2008 | unknown | 10 to 50 |
| 6a | Wombat Moor (north) | Mount Field National Park | South | Dobson | 2015 (1944) | c. 15 | few 1000 |
| 6b | Wombat Moor (south) | Mount Field National Park | South | Dobson | 2015 | 1.2 | 50 to 100 |
| 7 | Eagle Tarn – Lake Dobson | Mount Field National Park | South | Dobson | 2016 (1940) | 2 | 400 to 600 |
| 8 | Mount Mawson – Tarn Shelf | Mount Field National Park | South | Dobson | 2014 (1924) | 100 | < 3000 |
| 9 | Clemes Tarn | Mount Field National Park | South | Dobson | 2013 (1984) | unknown | unknown |
| 10 | Newdegate Pass | Mount Field National Park | South | Dobson | 1977 | unknown | unknown |
| 11 | Lonely Tarns | Southwest National Park | South | Anne | 2015 (1988) | > 1 | > 500 |
| 12 | Mt Sarah Jane | Southwest National Park | South | Anne | 2013 | unknown | unknown |
| 13 | Lake Judd | Southwest National Park | South | Anne | 2014 | unknown | 100s |
| 14 | Eliza Plateau | Southwest National Park | South | Anne | 2014 | unknown | unknown |
| 15 | Jubilee Range | Southwest National Park | South | Skeleton | 1928 | unknown | unknown |
| 16 | Snowy Range | Southwest National Park | South | Nevada | 2016 (2015) | 1 to 2 | 100s |
| 17 | Artichoke Valley – Frenchmans Cap | Franklin-Gordon Wild Rivers National Park | Cradle Coast | Vera | 2007 | 0.01 | low numbers |
| 18 | Deception Range ^ | Franklin-Gordon Wild Rivers National Park | Cradle Coast | Vera | 1983 | unknown | unknown |
| 19 | Lake Richmond | Franklin-Gordon Wild Rivers National Park | South | Majors | 1982 | unknown | unknown |
| 20 | King William II | Franklin-Gordon Wild Rivers National Park | South | Majors | 1998 | c. 100 # | unknown |
| 21 | Australia Tarn | Franklin-Gordon Wild Rivers National Park | South | Rufus | 1999 | unknown | unknown |
| 22 | Cheyne Range | Franklin-Gordon Wild Rivers National Park | Cradle Coast | Collingwood | 1992 (1979) | unknown | unknown |

Listing Statement for *Pherosphaera hookeriana* (mount mawson pine)

| | Subpopulation | Tenure | NRM region * | 1:25 000 mapsheet | Year last (& first) seen | Area of occupancy (ha) | Number. of mature plants |
|----|--------------------------------------|--|---------------|-------------------|--------------------------|-------------------------|--------------------------|
| 23 | Derwent River (Butlers Gorge) | Hydro-Electric Corporation & Permanent Timber Production Zone Land | South | Tarraleah | 2013 (1986) | unknown | unknown |
| 24 | Orion Lakes – Lake Payana | Walls of Jerusalem National Park | North & South | Du Cane | 2011 | unknown | Several hundred |
| 25 | Junction Lake | Walls of Jerusalem National Park | North | Du Cane | 2007 | unknown | Several hundred |
| 26 | Lake Malbena & Nive River | Walls of Jerusalem National Park & Central Plateau Conservation Area | South | Olive | 2016 | unknown | 400 ±180 |
| 27 | Lake Linnhe | Central Plateau Conservation Area | South | Olive | 2016 | 0.02 | 300 ±100 |
| 28 | Lake Ina | Walls of Jerusalem National Park | South | Ina | 2016 (1992) | 4 | 500 to 1500 |
| 29 | Little Nive Rivulet | Tasmanian Land Conservancy ** | South | Ina | 2011 | over 400 m | 20 |
| 30 | Nive River (Skullbone Plains) | Tasmanian Land Conservancy ** | South | Ina | 2012 (2011) | over 1.2 km | 100 |
| 31 | Nive River (Gowan Brae) | Private land | South | Ina | 2015 (1985) | Several sites over 4 km | 100+ |
| 32 | Camp Hill region ^ | Cradle Mountain-Lake St Clair National Park | Cradle Coast | Goulds | 1983 | unknown | unknown |
| 33 | Du Cane Range – Mt Gould – Labyrinth | Cradle Mountain-Lake St Clair National Park | North | Du Cane | 1993 (1942) | unknown | unknown |
| 34 | Lake St Clair | Cradle Mountain-Lake St Clair National Park | South | Olympus | 1918 (1841) | unknown | unknown |
| 35 | Mount La Perouse | Southwest National Park | South | Precipitous | 1898 | unknown | unknown |

* NRM region = Natural Resource Management region; ^ = identification to be confirmed;

** covered by a conservation covenant under the Tasmanian *Nature Conservation Act 2002*;

Sib Corbett, pers. comm.: reported to occur extensively in several areas over a linear range of c. 5 km.

About fifteen new subpopulations have been discovered since the species was uplisted 2001 (Table 1), with a threefold increase in the number of plants and area of occupancy since the preparation of the species' listing statement in 2007/2008. A reassessment of the species' current conservation status is considered appropriate, though the species may still qualify for listing as vulnerable under criterion A2: 'a reduction of at least 20% projected to be met within the next ten years or the next three generations (to a maximum of 100 years), whichever is longer, based on (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat.'

THREATS, LIMITING FACTORS AND MANAGEMENT ISSUES

Fire: *Pherosphaera hookeriana* is a fire-sensitive species that has poor regenerative capacity through resprouting or seedling establishment after fire. Intense fire events may cause irreversible declines and fragmentation of subpopulations, as documented for occurrences at Tarn Shelf in the wake of an escaped forestry burn in 1966 (Kirkpatrick & Dickinson 1984, Kirkpatrick et al. 2010). Five years earlier fire burnt other areas at Mount Field known to support the species, including the southwestern margin of Mawson Plateau and the southernmost fringe of Wombat Moor

(Minchin 1983). Quantitative estimates of the plant losses associated with these two fires are not available, but given the areas involved are likely to have numbered in at least the hundreds.

Other suspected cases of fire affecting areas known to support the species are the Jubilee Range in early 1988 and Nive River in late 1989 (based on fire layers available on The List website at www.thelist.tas.gov.au), though there is no information as to the impact of either fire on the species. Fires in the 1930s impacted the known site in the Snowy Range; however, a small copse of closed low forest containing *Pherosphaera hookeriana* survived (Plate 3), with good recruitment evident in adjacent burned areas.

The likelihood of the entire *Pherosphaera hookeriana* population in Tasmania being eliminated by a single fire is considered to be negligible given the species' geographic extent and its range of habitats. However, the possibility of individual subpopulations being eliminated would appear to be on the increase, as evidenced by the Lake Mackenzie fire in early 2016 (partly within the Walls of Jerusalem National Park) which had a significant impact upon the fire-sensitive *Athrotaxis cupressoides*, killing plants in sites that previously would have been considered fire refugia (such as boulder fields and stream margins). Occurrences of *Pherosphaera hookeriana* at lower altitudes close to flammable vegetation types are considered to be at particular risk from fire over coming decades.

Poor recruitment: Anecdotal reports suggest the rate of seedling establishment is extremely low, while the species' seed dormancy mechanisms are yet to be fully understood. The possibility that many stands of this species are largely clonal, in combination with its dioecious breeding strategy, has the potential to limit viable seed set in some areas.

Grazing pressure: The montane conifer *Athrotaxis cupressoides* is known to be prone to grazing by native animals, leading to a lack of regeneration at sites such as Dixons Kingdom (Wood & Rudman 2015); there is currently no evidence to suggest that grazing is an issue for *Pherosphaera hookeriana*, but it is an area that warrants further investigation.

Climate change: The trend towards a warmer climate and greater seasonality in rainfall has the potential to adversely affect *Pherosphaera hookeriana*. However, the increase in occurrence of extreme events, such as drought, flood, heat and severe fire weather, are likely to constitute the most rapid and dramatic impacts on the species. Declines or local extinctions of the most susceptible subpopulations are highly likely to occur by the end of this century. Drier conditions may also have a deleterious impact on seedling recruitment.

MANAGEMENT STRATEGY

The main objective for the recovery of *Pherosphaera hookeriana* is to prevent the loss or degradation of known subpopulations and increase numbers through habitat management and surveys, as well as an improved understanding of recruitment requirements.

What has been done?

The distribution and habitat preferences of *Pherosphaera hookeriana* at Mount Field were investigated by Minchin (1983) as part of a broader vegetation study. The species was recorded in 26% of the 438 quadrats (5 m x 20 m) sampled systematically in an area of about 16 km². Minchin found a greater probability of occurrence as drainage became poorer and altitudes higher (mean of ~1250 m), but model fits were poor, suggesting non linear-responses to these factors (Minchin 1983). The species was also observed more frequently at the margins of creeks, possibly because these were naturally protected from fire.

The response of conifers, including *Diselma archeri* and *Pherosphaera hookeriana*, to a fire at Mount Field in 1966 was studied in 1980–81 using nine paired plots either side of fire boundaries (Kirkpatrick & Dickinson 1984), with repeat sampling of some of the plots in 1998 and 2010 (Kirkpatrick et al. 2010). All plots were in coniferous heath. The latter study concluded that these species had '... a very low resilience to a single fire of sufficient intensity to kill above ground vegetation'.

Targeted surveys for *Pherosphaera hookeriana* in the Mount Field region were conducted by DPIPWE personnel in February 2007; additional surveys were undertaken in early

2016 using remote imagery as an initial guide to potential new subpopulations, with the species found to be much more extensive than previously thought (Rudman & Schahinger 2016).

Pherosphaera hookeriana was flagged as a fire-sensitive species in the *Southern Region Strategic Fire Management Plan*, with protection from fire of known subpopulations at Mount Field cited as a priority (Fire Management Section 2011). The species has also been included in the Tasmanian Parks and Wildlife Service's Bushfire Risk Assessment Model (BRAM).

Long-term monitoring of *Pherosphaera hookeriana* was established at Tarn Shelf and Mawson Plateau in Mount Field National Park in 2011 as part of a project investigating the possible impact of climate change on Tasmania's endemic conifers (Fitzgerald 2011), with an additional site established on the Nive River (Tasmanian Land Conservancy 2014).

Seed was collected from four sites in 2015 for germination trials and long-term storage at the Tasmanian Seed Conservation Centre (Royal Tasmanian Botanical Gardens, Hobart). Collection sites included Lake Ina, Wombat Moor, Lonely Tarns and Nive River (Wood & Rudman 2015).

What is needed?

Recovery actions necessary to decrease the extinction risk to *Pherosphaera hookeriana* include:

- maintain and update the species' distribution mapping in the Bushfire Risk Assessment Model;
- collect abundance and area of occupancy data at previously unsurveyed subpopulations, and determine the veracity of sites that lack vouchered specimens;
- conduct extension surveys of potential habitat;
- continue implementation of the TWWHA conifer monitoring program;
- investigate the species' phenology, recruitment requirements (including browsing impacts), reproductive fitness, the ratio of male to female coning and seed production;
- assess the genetic diversity within and between subpopulations, with a focus on determining the level of clonality;
- collect seed from additional subpopulations to ensure a representative selection of the species' distribution is maintained at the Tasmanian Seed Conservation Centre;
- develop methods for rehabilitating subpopulations post-fire;
- prepare policy that sets out situations in which post-fire rehabilitation would be appropriate.

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Permit: It is an offence to collect, disturb, damage or destroy this species unless under permit.