# PLATEAU VEGETATION ON SUB-ANTARCTIC MACQUARIE ISLAND

by P.M. Selkirk

(with one text-figure, one plate and two tables)

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The plateau of sub-Antarctic Macquarie Island supports an open short herb, feldmark vegetation that is markedly affected by the prevailing strong westerly winds. This paper reports on a line transect survey carried out in 1980 which documents variation then apparent in species composition in this vegetation. Sixty-two species were recorded, with plant occurrences along 16 transects ranging from 16.7–99.5%. The cushion plant *Azorella macquariensis* Orchard was an important component of the plateau vegetation: it occurred at 14 of the 16 sites surveyed, with occurrences up to 50%. The dieback reported in *Azorella macquariensis* in 2008 was, by 2012, regarded as extensive and severe throughout its range. The data presented here well precede the first records of the dieback, and contribute to early descriptive data against which future developments in the plateau vegetation of Macquarie Island can be evaluated.
**Key Words: sub-Antarctic, Macquarie Island, feldmark, *Azorella macquariensis,* dieback.**

## INTRODUCTION

In a part of the world that is principally ocean, sub-Antarctic land is a rare resource. The few sub-Antarctic islands support extremely interesting vegetation, rare on the world scale. Macquarie Island, 158°55'E; 54°30'S, is no exception. Its flora is known to include 47 species of vascular plants of which four are endemic (*Flora of Australia* 1993, Clements & Jones 2007), 86 species of mosses (Seppelt 2004, Ochyra *et al.* 2008) and 51 species of liverworts (Selkirk *et al.* 1990). Its treeless vegetation ranges from tall tussock grasses on coastal slopes to an open, discontinuous short herb, tundra-like vegetation, known as feldmark, on the island's plateau above about 200 m (Carmichael 2007, Selkirk 2007, 2009). In the cool, cloudy, moist sub-Antarctic climate this distinctive vegetation is strongly affected by the extremely windy conditions, blowing predominantly from the west and northwest (Bureau of Meteorology 2012).

Macquarie Island's earliest human visitors were seafarers concerned with the seal fur and oil trades, but once its location became known in 1810, Macquarie Island and its vegetation became of interest to explorers and scientists. In 1894 Professor A. Hamilton of the University of Otago spent two weeks on the island, long enough to visit parts of the plateau. He wrote: "The tussocks and the *Stilbocarpa* become smaller as you ascend and, at about 300 feet, you gain a plateau so swept by the Antarctic gales that vegetation is reduced to compact, closely growing mosses, small *Uncinia*s, and the conspicuous cushion-like masses of *Azorella selago*… Round the tops of the hills the wind has cut out wonderful terraces, from a few inches to a foot or two in height, with completely bare rock much disintegrated by the weather on top" (Hamilton 1894, p. 564).

As part of a detailed and thorough study of Macquarie Island flora and vegetation, Taylor (1955a) mapped the vegetation of the whole island at a scale of 1 inch to the mile (approximately 1:63 000), using four categories: feldmark, bare ground, wet tussock, subglacial herbfield. He described species and growth forms of plants in the plateau vegetation he called "Feldmark Formation", comprising the *Azorella selago* alliance with three associations and the *Dicranoweisia antarctica* alliance with one association. He noted the effects of wind on growth form and species composition, observing that "…increasing wind exposure successively favours the various associations, *Azorella selago, Azorella selago-Rhacomitrium crispulum, Rhacomitrium crispulum,* and *Dicranoweisia antarctica* in that order" (Taylor 1955a, p. 83).

Botanical nomenclature and spelling have changed since Taylor's (1955a) study. The species of *Azorella* on Macquarie Island is now recognised as the endemic *A. macquariensis* (Orchard 1989); *Dicranoweisia antarctica* is now *Hymenoloma antarcticum* (Ochyra & Broughton 2004); *Rhacomitrium* has become *Racomitrium.* Taylor's references to *Dicranoweisia antarctica* in fact referred to *Ditrichum strictum* (Ashton & Gill 1965).

Taylor (1955b) described in detail the structure and vegetation of two forms of feldmark terraces that he designated "windward" and "leeward". Ashton & Gill (1965) proposed an alternative to Taylor's vegetation classification, considering the feldmark as a complex *Azorella-Ditrichum* alliance, comprising a number of associations that occur on particular sites. They described the floristic simplification that occurs in response to increased wind exposure on both windward and leeward slopes, and considered the associations recognised by Taylor as convenient points of reference in a continuous gradation.

Utilising aerial photography and satellite imagery that was then available, Selkirk & Adamson (1998a, b) took a structural approach in producing a map of the vegetation and drainage patterns on Macquarie Island. They included within their category "open short herb vegetation", Taylor's (1955a) Feldmark Formation, Ashton & Gill's (1965) *Azorella-Ditrichum* alliance, and Adamson *et al.*'s (1993) sparse vegetation on unfavourable soils.

The considerable variability of vegetation on Macquarie Island in relation to environmental factors (aspect, altitude, wind exposure, soil type) has been noted by authors since Hamilton (1894) drew attention to the diminution in stature of plants with increase in altitude and the influence of the strong winds. This paper reports results from a 1980 survey which documents variation then apparent in species

composition in the open short herb, feldmark vegetation on the plateau of Macquarie Island (table 1).

## METHODS

During January–March 1980, 16 line transects were studied at locations on the plateau of Macquarie Island: two sites on Windy Ridge, three sites to the north of Boot Hill, one site on the eastern lower slopes of Mt Law, two sites above the southwestern corner of the Green Gorge basin, two sites on the northern slopes of North Mountain, two sites on the western slopes of North Mountain, two sites on a ridge above the northern end of Sandy Bay, and two sites to the north of Prion Lake (fig. 1, pl. 1). As the study did not envisage revisiting the sites, precise locations of the transects were not recorded; map grid references were not noted and GPS technology was not then widely available.

Along a 20 m tape, fixed at each end, the species of first contact was recorded at 1 cm intervals (pl. 1A), hence there were 2000 species records per transect. From these data, percentage occurrences of species were calculated for each location (table 1). Identifications were made in the field with the aid of hand lenses. While most taxa could be identified to species level, some could only be determined to genus level and five (one species of moss, two species of liverwort and two species of lichen) were not able to be identified. Voucher specimens were not collected for later confirmation of identifications. At seven of the sites, observations of dead plants were recorded (tables 1, 2).

Although it is recognised that some taxonomic interpretations may change, the 1980 field identifications have been retained with names updated to accord with *Flora of Australia* (1993) for vascular plants, Seppelt (2004) and Ochyra & Broughton (2004) for mosses, McCarthy (2003) for liverworts, and Kantvilas & Seppelt (1992) for lichens.

## RESULTS

The observations recorded in table 1 confirm the extremely variable nature of the open short herb, feldmark vegetation that has been described on the Macquarie Island plateau (Taylor 1955a, Ashton & Gill 1965, Selkirk & Seppelt 1984, Selkirk *et al.* 1990). Total vegetation occurrences ranged from 16.7% at the Boot Hill 3 site to 99.5% at the southwest Green Gorge 2 site. The three Boot Hill sites were in the area of serpentinite and harzburgite soils which support extremely sparse feldmark-type vegetation (Adamson *et al.* 1993, Selkirk & Adamson 1998a, b). The southwest Green Gorge sites were terraced, site 2 with continuous vegetation (Selkirk *et al.* 1988, Selkirk 1998) (pl. 1A). In total, 62 species were recorded of which 17 species were angiosperms, one was fern, 18 were mosses, 12 were liverworts and 14 were lichens. At least for the mosses the species total is an understatement as the species of *Andreaea* (of which seven are now known from the island, Seppelt 2004) could not be distinguished in the field.

The five species with occurrences at the largest number of sites, the angiosperms *Azorella macquariensis, Agrostis magellanica* and *Luzula crinita,* and the mosses *Racomitrium crispulum* and *Ditrichum strictum* were described as dominant, co-dominant or frequent by Taylor (1955a) in his Floristic List for the Feldmark Formation. All appear also in Ashton & Gill's (1965, p. 239) list of "species present in *Azorella-Rhacomitrium* stripes, North Mountain".

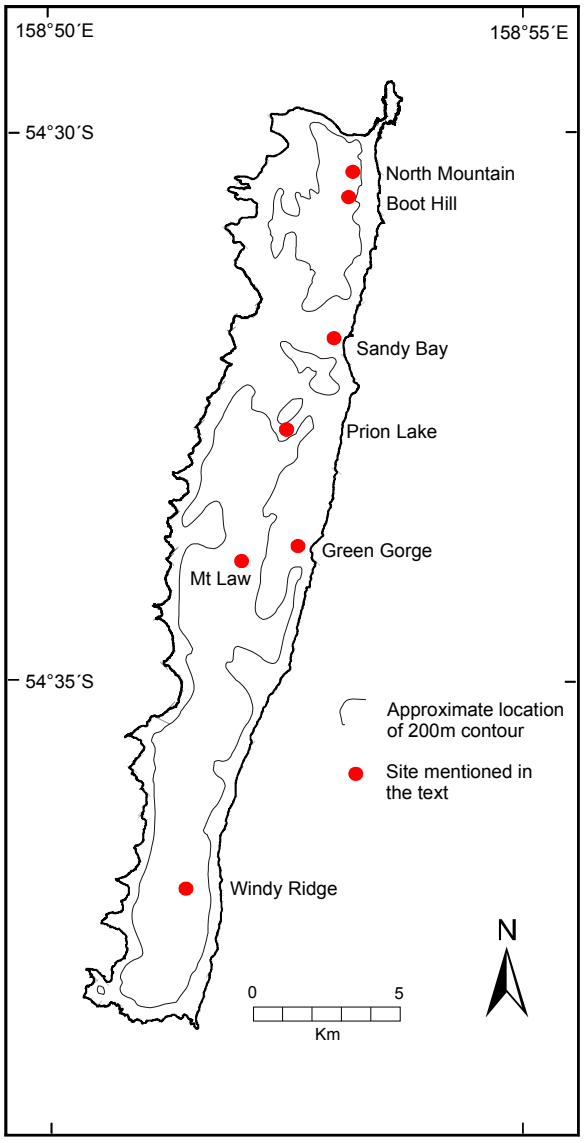


*FIG. 1 — Map showing location of Macquarie Island and study sites.*

In the present study (tables 1, 2), *A. macquariensis* occurred at 14 of the 16 sites; occurrences ranged from zero at the north Prion Lake sites to nearly 50% at the Mt Law site. In the transects from which dead *Azorella* was recorded, total *Azorella* occurrences were less than 10%; of this only 4% was dead at west North Mountain 2 while all was dead at Boot Hill 1.

*Agrostis magellanica* occurred at 14 of the 16 sites; occurrences ranged from zero at the Windy Ridge sites to 16.75% at the north North Mountain 1 site. In each of the seven transects from which dead plants were recorded, total *Agrostis* occurrences were less than 6%, and at only one, Sandy Bay Ridge 1, was there dead *Agrostis* (5.50% of total occurrences at the site).

*Luzula crinita* occurred at 14 of the 16 sites; occurrences ranged from zero at the Boot Hill sites to 10.22% at the Sandy Bay Ridge 2 site. In each of the seven transects from which dead plants were recorded, total *Luzula* occurrences were less than 6%, and at only one, the west North Mountain 1 site, was there dead *Luzula* (0.4% of total occurrences at the site).

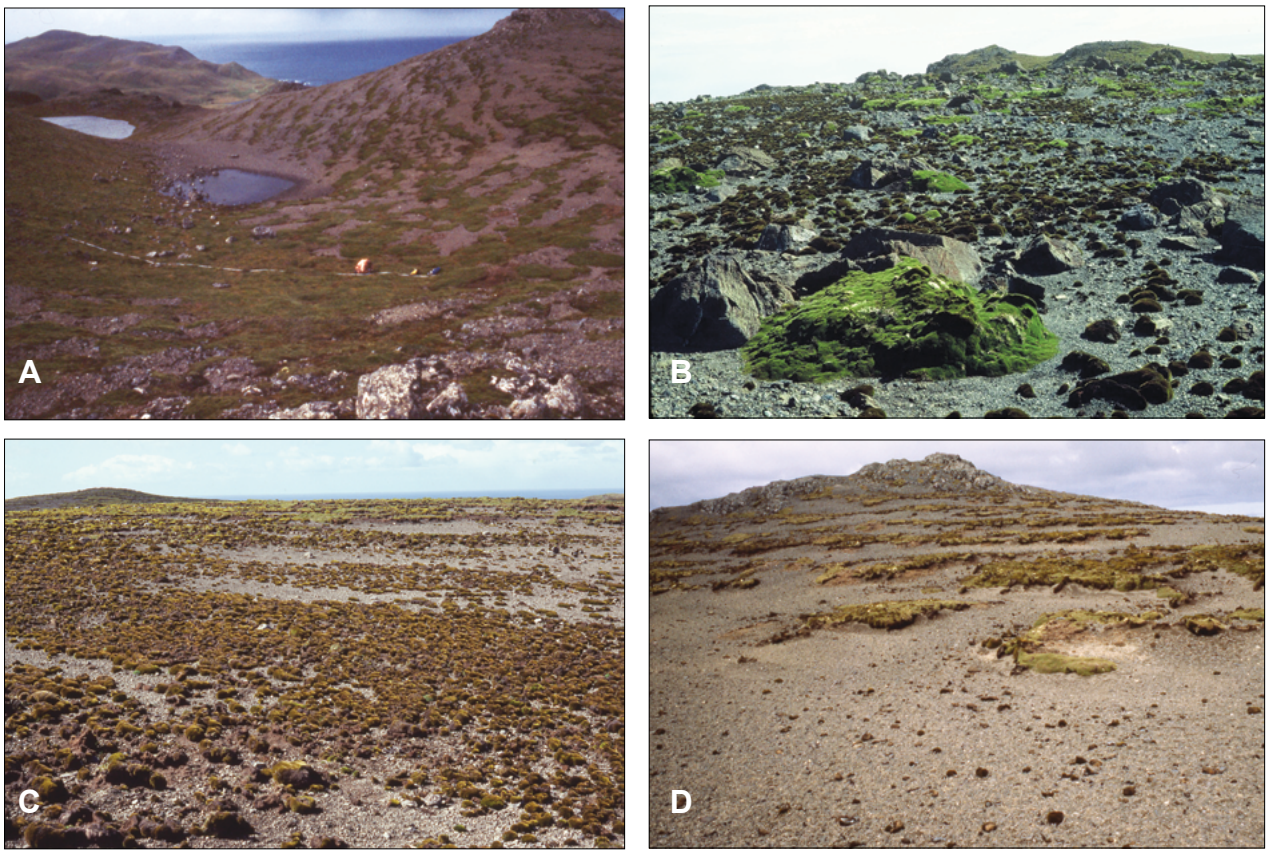


*PLATE 1*
*(A) Transect study in progress at continuous vegetation site southwest of Green Gorge, February 1980. (B) Vegetation between Boot Hill and North Mountain, March 1980. (C) Vegetation to the north of Prion Lake, February 1980. (D) Vegetation on western slopes of North Mountain, February 1980.*

*Racomitrium crispulum* occurred at each of the 16 sites; occurrences ranged from 0.05% at the Boot Hill 2 site to 20.45% at the Windy Ridge 1 site. At all seven transects from which dead plants were recorded, dead plants of *R. crispulum* were recorded, ranging from 3.26% of *R. crispulum* occurrences at west North Mountain 2 to 39.36% of *R. crispulum* occurrences at Windy Ridge 1.

*Ditrichum strictum* occurred at 12 of the 16 sites; occurrence ranged from zero at the Mt Law, southwest Green Gorge 1 and 2, and west North Mountain 2 sites to nearly 30% at the north Prion Lake 1 site. In the seven transects from which dead plants were recorded, total *D. strictum* occurrence was between 0 and nearly 30%; dead plants constituted between 0 and 23% of *D. strictum* occurrences (table 2).

## DISCUSSION

Although the open short herb, feldmark vegetation on the plateau of Macquarie Island is floristically quite variable it is clear that *Azorella macquariensis* is an extremely important component. In December 2008 dieback was reported in *A. macquariensis* from the northern end of the plateau. By 2012 the dieback was regarded as extensive and severe throughout its range, with the most advanced areas of dieback almost devoid of live cushions (Threatened Species Section 2012).

Factors responsible for this "recent catastrophic decline" of *A. macquariensis* are currently unknown, but are under investigation (Threatened Species Section 2012 p. 3). Climate change has been suggested as an influence in the species' declining health (Threatened Species Section 2012). The 1980 transect data presented here well precede the first records of dieback in *A. macquariensis* on the plateau of Macquarie Island in December 2008. The data also precede the period of drier conditions (Whinam & Copson 2006) and dry soil conditions on the island (Threatened Species Section 2012), and were collected about halfway through the 50-year period of warming that has been noted in the second half of the twentieth century (Adamson *et al.* 1988, Tweedie & Bergstrom 2000, Pendlebury & Barnes-Keoghan 2007).

The transect data show that there were dead plants of 14 species recorded in 1980 (table 2); the cause of the deaths is unknown. In contrast to the present situation with *A. macquariensis*, the dead plants generally constituted only modest proportions of the vegetation at any given site. For instance, dead plants constituting 100% of the total occurrences of *A. macquariensis* at the Boot Hill 1 site actually represented only 0.6% of total plant occurrences at that site. Similarly, the high value of dead plants making up 50% of *Racomitrium pruinosum* occurrences at the Windy Ridge 1 site is at a location where this species makes up only 0.2% of total plant occurrences.

In a line intercept study of a 300-foot (91.44-m) transect downslope to the west on North Mountain, Ashton & Gill (1965) reported similarly modest percentages of dead plants: *A. macquariensis* constituted 15.8% of occurrences of which

**TABLE 1**

**Plant species percentage occurrences along Macquarie Island feldmark transects in 1980. No entry means the species was not recorded at the site. Figures show occurrences of that species as a percentage of 2000 points of first contact along 20-metre line transects. For sites marked /d occurrences of dead plants are shown in format z/y; z is total percentage of points touching living or dead plants of that species, y is percentage of points touching dead plants of that species.**

| Species | Windy Ridge 1/d | Windy Ridge 2/d | Boot Hill 1/d | Boot Hill 2 | Boot Hill 3 | Mt Law | SW GG Terraces 1 |
|---|---|---|---|---|---|---|---|
| **VASCULAR PLANTS** | | | | | | | |
| *Acaena minor* (Hook.f.) Allan | | | | | | 0.40 | 0.05 |
| *Agrostis magellanica* Lam. | | | 0.85 | 1.00 | 0.10 | 1.55 | 0.90 |
| *Azorella macquariensis* Orchard | 7.65/0.84 | 7.85/1.20 | 0.60/0.60 | 9.40 | 6.35 | 49.85 | 14.00 |
| *Cardamine corymbosa* Hook.f. | | | | | | | |
| *Colobanthus apetalus* (Labill.) Druce | | | | 0.10 | | | |
| *Coprosma perpusilla* Colenso | | | | | | | |
| *Epilobium pedunculare* A.Cunn. | | | | | | | |
| *Epilobium brunnescens* (Cockayne) P.H.Raven & Engelhorn | | | | | | | |
| *Festuca contracta* Kirk | | | | | | | 0.05 |
| *Grammitis poeppigiana* (Mett.) Pic.-Serm. | 0.10 | 0.80/0.10 | | | | 2.05 | 0.20 |
| *Luzula crinita* Hook.f. | 0.30 | 0.25 | 0.70 | | | 0.75 | 1.30 |
| *Montia fontana* L. | | | | | | | |
| *Pleurophyllum hookeri* Buchan. | | | | | | 10.40 | |
| *Poa annua* L. | | | 0.05 | 0.05 | | | |
| *Ranunculus crassipes* Hook.f. | | | | | 0.05 | | 0.05 |
| *Stellaria parviflora* Banks & Sol. ex Hook.f. | | | | | | | |
| *Stilbocarpa polaris* (Hombr. & Jacquinot ex Hook.f.) A.Gray | | | | | | | |
| *Uncinia hookeri* Boott | | | | | | | 0.25 |
| **MOSSES** | | | | | | | |
| *Andreaea* spp. | 21.30/4.75 | 25.05/4.85 | | | | | 0.30 |
| *Bartramia ithyphylla* Brid. | | | | 0.10 | | | |
| *Breutelia pendula* (Smith) Mitt. | | | | | | | |
| *Conostomum pentastichum* (Brid.) Lindb. | 0.30 | 0.40 | | | 0.05 | | |
| *Dicranoloma billardierei* (Brid.) Paris | 0.45 | 0.15 | | | | 0.15 | 0.40 |
| *Ditrichum punctulatum* Mitten | | | | | | | 0.25 |
| *Ditrichum strictum* (Hook.f. & Wilson) Hampe | 11.30/1.25 | 17.50/3.95 | 25.40/4.50 | 10.85 | 9.75 | | |
| *Hymenoloma antarcticum* (Hook.f. & Wilson.) Ochyra | 0.10 | | | | | | |
| *Hypnum cupressiforme* Hedw. | | | | | | 0.05 | |
| *Leptostomum inclinans* R.Br. bis. | | | | 0.20 | | 0.05 | 0.10 |
| moss 1 | | | | | | | |

| SW GG cont Veg 2 | N North Mt 1 | N North Mt 2 | W North Mt 1/d | W North Mt 2/d | Sandy Bay Ridge 1/d | Sandy Bay Ridge 2 | N Prion Lake 1/d | N Prion Lake 2 |
|---|---|---|---|---|---|---|---|---|
| 3.70 | 1.75 | 2.55 | 1.65/0.20 | | 0.45 | 1.25 | 0.15 | |
| 9.05 | 16.75 | 15.75 | 2.70 | 5.25 | 2.70/0.15 | 9.20 | 0.90 | 0.30 |
| 41.33 | 9.50 | 6.05 | 8.20/1.75 | 5.80/0.25 | 0.35/0.05 | 0.45 | | |
| | 0.05 | 0.10 | 0.10 | | 0.35 | 0.40 | | |
| | | | 0.20 | | 0.05 | 0.15 | | |
| 0.05 | | | | | | | | |
| 0.45 | | | 0.35 | | | 0.55 | | |
| 0.10 | 0.70 | 0.35 | | | 0.05 | 1.85 | | |
| | 2.15 | 1.15 | 0.10 | | | | | |
| 0.20 | 0.85 | 0.60 | | 0.05 | | | | |
| 9.55 | 6.00 | 7.90 | 3.30/0.40 | 1.25 | 5.25 | 10.20 | 0.25 | 0.15 |
| | | | | | | 0.25 | | |
| 0.50 | 7.20 | 9.05 | | 0.15 | | | | |
| | | | | | | 0.10 | | |
| 2.65 | 0.40 | 0.50 | | | | | | |
| | | | | | | 0.25 | | |
| 0.05 | | | | | | | | |
| 1.55 | 0.65 | 0.50 | | | | | | |
| | 1.10 | 0.60 | 0.15 | 0.25 | 1.15 | 0.55 | 0.35 | 2.95 |
| 0.05 | | | | | | | | |
| 4.70 | 0.40 | 0.20 | | | 0.10 | 0.05 | | |
| | | | 0.05 | | 0.15 | | 0.20 | |
| 3.40 | 0.75 | 0.20 | | 0.05 | | 0.25 | 0.05 | |
| 0.25 | 0.45 | | | | 0.10 | 0.10 | | |
| | 0.80 | 1.85 | 0.90 | | 3.40 | 3.15 | 29.85/3.75 | 3.60 |
| 2.60 | | | | | | | | |
| 0.10 | 0.05 | | | | | | | |
| | | | | | | | 0.20 | |

**Table 1 cont.**

| Species | Windy Ridge 1/d | Windy Ridge 2/d | Boot Hill 1/d | Boot Hill 2 | Boot Hill 3 | Mt Law | SW GG Terraces 1 |
|---|---|---|---|---|---|---|---|
| *Notoligotrichum australe* (Hook.f. & Wilson) G.L.Sm. | 3.85/0.50 | 4.70/0.85 | | | | 0.70 | |
| *Polytrichastrum alpinum* (Hedw.) G.L.Sm. | | | | | | 0.20 | 0.70 |
| *Ptychomnion densifolium* (Brid.) A.Jaeger | | | | | | | |
| *Racomitrium crispulum* (Hook.f. & Wilson) Hook.f. & Wilson | 20.45/8.05 | 15.30/3.60 | 0.45/0.05 | 0.05 | 0.30 | 12.90 | 9.45 |
| *Racomitrium pruinosum* (Wilson) Müll.Hal. | 0.2/0.1 | 0.05 | | | | | 0.15 |
| *Rhacocarpus purpurascens* (Brid.) Paris | 2.00 | 1.15 | | | | 0.05 | 0.25 |
| *Sanionia uncinata* (Hedw.) Loeske | | | | | | | |
| *Thuidiopsis furfurosa* (Hook.f. & Wilson) M.Fleisch. | | | | | | | |
| **LIVERWORTS** | | | | | | | |
| *Chiloscyphus bispinosus* (Hook.f. & Taylor) J.J.Engel & R.M.Schust. | | | | 0.45 | | 1.00 | 0.40 |
| *Cryptochila* sp. | | | | | | 8.25 | 1.05 |
| hepatic 1 | 1.05/0.10 | 0.15 | | | | 0.10 | 0.05 |
| hepatic 2 | | | | | | | |
| *Jamesoniella colorata* (Lehm.) Spruce ex Schiffn. | 5.80/1.65 | 4.20/0.20 | | 0.70 | | | |
| *Lepidolaena* sp. | | | | | | 0.15 | |
| *Lepidozia* sp. | 1.60 | 0.35 | | | | | |
| *Metzgeria* sp. | | | | | | | |
| *Plagiochila retrospectans* Nees | | | | | | 0.05 | |
| *Riccardia aequicellularis* (Steph.) Hewson | | | | 0.45 | 0.10 | | |
| *Riccardia cochleata* (Hook.f. & Taylor) Kuntze | | | | | | | |
| *Riccardia* sp. | | | | | | | |
| **LICHENS** | | | | | | | |
| *Buellia* sp. [grey] | | | | 0.10 | | | 0.60 |
| *Cetraria* sp. | 0.10 | | | | | | |
| *Cladia aggregata* (Sw.) Nyl. | 0.60 | 0.55 | | | | 1.00 | 0.20 |
| *Cladonia* sp. | | | | | | | |
| *Hypogymnia* sp. | 0.80 | 0.25 | | | | 0.10 | |
| lichen 1 [grey] | | | | | | | |
| lichen 2 [white + red] | | | | | | | |
| *Peltigera* sp. | | | | | | | |
| *Pertusaria* sp. | 5.85 | 5.00 | | | | 0.20 | |
| *Pseudocyphellaria glabra* (J.D.Hook. and Taylor) Dodge | | | | | | | |
| *Stereocaulon* sp. | | | | | | | |
| *Stereocaulon argus* J.D. Hook. and Taylor | 0.40 | 1.80 | | | | 0.10 | |
| *Stereocaulon ramulosum* (Sw.) Räuschel | | | | | | | 0.20 |
| *Usnea* sp. | | | | | | 0.20 | |
| soil | | | | | | 9.55 | |
| stones | 15.80 | 14.50 | 71.95 | 76.55 | 83.30 | 0.20 | 69.10 |
| **TOTAL VEG** | 84.20/17.34 | 85.50/14.75 | 28.05/5.15 | 23.45 | 16.70 | 90.25 | 30.90 |

| SW GG cont Veg 2 | N North Mt 1 | N North Mt 2 | W North Mt 1/d | W North Mt 2/d | Sandy BBay Ridge 1/d | Sandy Bay Ridge 2 | N Prion Lake 1/d | N Prion Lake 2 |
|---|---|---|---|---|---|---|---|---|
| | | | | | 2.65/0.25 | 1.25 | 0.75 | |
| 10.25 | 1.80 | 2.25 | 2.50/0.30 | 0.90 | 0.70 | 1.75 | | |
| 0.15 | | | | | | | | |
| 2.55 | 7.75 | 7.95 | 14.35/2.00 | 9.20/0.30 | 17.00/1.20 | 17.55 | 2.25/0.60 | 0.25 |
| | 0.10 | | 0.05 | 0.05 | 0.15 | 0.65 | 0.10 | |
| 0.60 | 0.65 | 0.10 | | | | | | |
| | 2.05 | 3.00 | | | | | | |
| 0.35 | 0.05 | 0.05 | | | | | | |
| | | | | | | | | |
| 0.70 | 0.05 | 0.75 | | | | 0.50 | 0.45 | 0.05 |
| 3.05 | | | 1.30/0.05 | 1.00/0.10 | | | | |
| 0.65 | 0.15 | | | | | | | |
| | | | 0.05 | | | | 0.25 | |
| | 1.45 | 1.00 | | | 1.40 | 2.70 | 4.00/0.15 | 0.40 |
| | | | | | | | | |
| | 0.05 | | 0.05 | 0.05 | | | | |
| | | | 0.05 | | | | | |
| 0.10 | 0.05 | 0.15 | | | | | | |
| | | | | | | | | |
| 0.05 | | | | | | | | |
| | | | | | | | 0.80 | 0.15 |
| | | 2.00 | 0.30 | 0.40 | 0.50 | 0.10 | 0.20 | 2.25 |
| 0.60 | | | 1.10 | 0.25 | 0.10 | 0.20 | 0.05 | |
| 0.20 | | 0.05 | | | | 0.05 | | |
| 0.05 | | | | 0.10 | | 0.15 | | |
| | | | | | 0.45 | | | |
| | | | | | 0.10 | | | |
| | | | | | | 0.10 | | |
| | | 0.30 | | | 0.25 | | | |
| | | | 0.15 | | | | | |
| | | | | 0.15 | 0.90 | | | |
| | | | | | | 0.15 | | |
| | 0.10 | | 0.10 | | | | 0.10 | 0.45 |
| | 0.15 | 0.05 | | | 0.25 | 0.15 | | |
| 0.05 | 36.05 | 35.00 | 62.30 | 75.10 | 61.45 | 45.95 | 59.10 | 89.45 |
| 99.95 | 63.95 | 65.00 | 37.70/4.70 | 24.90/0.65 | 38.55/1.65 | 53.05 | 40.90/4.50 | 10.55 |

**TABLE 2**
**Percentage occurrences of dead plants along Macquarie Island feldmark transects in 1980. Figures show occurrences of dead plants as a percentage of that species' occurrences at the site. 0.00% means that live plants but no dead plants of that species were recorded at the site. No entry means the species was not recorded at the site.**

| Species | Windy Ridge 1/d | Windy Ridge 2/d | Boot Hill 1/d | W North Mt 1/d | W North Mt 2/d | Sandy Bay Ridge 1/d | N Prion Lake 1/d |
|---|---|---|---|---|---|---|---|
| **VASCULAR PLANTS** | | | | | | | |
| *Acaena minor* | | | | 12.12 | | 0.00 | 0.00 |
| *Agrostis magellanica* | | | 0.00 | 0.00 | 0.00 | 5.50 | 0.00 |
| *Azorella macquariensis* | 10.98 | 15.29 | 100.00 | 21.34 | 4.30 | 14.29 | |
| *Grammitis poeppigiana* | 0.00 | 12.50 | | | 0.00 | | |
| *Luzula crinita* | 0.00 | 0.00 | 0.00 | 12.12 | 0.00 | 0.00 | 0.00 |
| **MOSSES** | | | | | | | |
| *Andreaea* spp. | 22.30 | 19.36 | | 0.00 | 0.00 | 0.00 | 0.00 |
| *Ditrichum strictum* | 11.06 | 22.64 | 17.72 | 0.00 | | 0.00 | 12.56 |
| *Notoligotrichum australe* | 12.99 | 18.09 | | | | 9.43 | 0.00 |
| *Polytrichastrum alpinum* | | | | 12.00 | 0.00 | 0.00 | |
| *Racomitrium crispulum* | 39.36 | 23.52 | 11.11 | 13.94 | 3.26 | 7.06 | 26.67 |
| *Racomitrium pruinosum* | 50.00 | 0.00 | | 0.00 | 0.00 | 0.00 | 0.00 |
| **LIVERWORTS** | | | | | | | |
| *Cryptochila* sp. | | | | 3.85 | 10.00 | | |
| hepatic 1 | 9.52 | 0.00 | | | | | |
| *Jamesoniella colorata* | 28.45 | 4.76 | | | | 0.00 | 3.75 |
| **Total dead plants as % of total vegetation at site** | 20.57 | 17.26 | 18.36 | 12.47 | 2.61 | 4.28 | 11.06 |

11.4% were dead and *R. crispulum* constituted 21.9% of occurrences of which 7.8% were dead.

In Taylor's (1955a) tables of floristic lists 23 species of vascular plants, 11 species of mosses, liverworts as a group and lichens as a group were assigned to the categories "dominant, co-dominant, abundant, frequent, common, occasional, rare, very rare". Ashton & Gill (1965) list seven species of vascular plants, 11 species of mosses, four species of liverworts and 10 species of lichens from feldmark stripes on North Mountain. They also provided numerical data for percentage occurrences of seven species of vascular plants, four species of mosses, liverworts and other mosses as a group, and lichens as a group along 300 feet (91.44 m) of line transect on which total vegetation occurrence was 42.7%. The 1980 transect numerical data presented above provide information about a greater number of species than earlier studies. In combination with Taylor's categories and descriptions, and Ashton & Gill's descriptions, these 1980 data provide a picture of the pre-dieback composition of Macquarie Island plateau open short herb, feldmark vegetation. Against this picture future developments in the Macquarie Island plateau vegetation can be evaluated, in fulfilment of the recommendation to "monitor the impact on *A. macquariensis* over time and associated changes in the feldmark ecosystem" in the Listing Statement for *A. macquariensis* (Threatened Species Section 2012, p. 5).

Through such future monitoring answers will emerge to many questions of interest concerning future vegetation on Macquarie Island's plateau, including whether the same species will recolonise areas affected by *A. macquariensis* dieback (from the soil seed bank, or from living plants remaining in the few isolated unaffected areas on the island) when and if present environmental perturbations stabilise; whether a subset of the previous vegetation will expand and form a different floristic mix; whether species now present elsewhere on the island will extend their ranges on the plateau; and whether species not presently on the island, i.e., alien species, will become established on the plateau. It is fervently to be hoped that present and future research management strategies and recovery plan (Threatened Species Section 2012) will be successful in conserving *A. macquariensis* so that this species will continue to have a role in the interesting, rare plateau vegetation of Macquarie Island.

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