Studies of plant communities of the Antarctic Peninsula near Palmer Station

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Field operations started on 14 December 1983 and were concluded on 25 March 1984; Stan Scott and Miho Toi worked as field assistants during the entire time. Arthur Harbor operations were again supported from Palmer Station and the Antarctic Peninsula operations by R/V *Hero.* Two sites were visited with the French yacht *f'Murr* (homeport, Brest).

The following sites were sampled during the 1983–1984 summer: Anchorage and Horseshoe Islands; Goudier Island; Minot Point, Cape Claude, Metchnikoff Point, and Buls Bay on Brabant Island; Melchior Islands; Spigot Peak on Danco Coast; Keller Point, Point Thomas, Fildes Peninsula, Suffield Point, Demay Point, and Point Durant on King George Island, and Ardley Island, South Shetland Islands; Santos Peak, Leith Cove and Spring Point on Danco Coast: Quinton and Giard Points, Cape Monaco, Biscoe Point, point north of Biscoe Point, and several islands and points in Arthur Harbor area on Anvers Island; Dream Island; Gossler Islands; Joubin Islands; Argentine Islands; Almirante Brown Station (Argentina); and Bryde Island. Sampling of plant communities and their environment including some climatic variables and disturbance continued at each site; many plots were permanently marked or revisited.

Samples of vascular plants, mosses, and lichens from many additional localities along the Antarctic Peninsula were obtained from Sally and Jérôme Poncet, owners of the French yacht *Damien II* (homeport, La Rochelle) who discovered the new southernmost locality of the two native antarctic vascular plants *Deschampsia antarctica* Desv. and *Colobanthus quitensis* (Kunth) Bartl. on Terra Firma Islands at 62°42'S in Marguerite Bay on 16 February 1984. Both plants were growing vigorously and reproduced well there in 1984 so that they could probably occur farther south if suitable habitats were available (cf. Smith 1982). Altogether, twenty-four new localities of vascular plants (14 for *D. antarctica,* 2 for *C. quitensis,* and 8 for both species) were reported (Komarkova, S. Poncet, and J. Poncet in preparation) which brings the list of known vascular plant localities in the Antarctic Peninsula area to 116 (figure 1). *Damien II,* with six seasons of experience in the waters of the Antarctic Pensinula, proved very efficient at work requiring frequent landings in shallow waters near shore such as studies of plant or bird distributions; it is available for charter for research purposes.

The most complete environmental monitoring was carried out on the Stepping Stcne Island, Arthur Harbor area (64°S). Plant and soil temperatures, soil moisture, photosynthetically active radiation, wind speed, and precipitation were recorded by a Campbell Scientific model CR21 micrologger and air temperature and relative humidity were recorded by a hygrothermograph. Plant and soil temperature and soil moisture probes

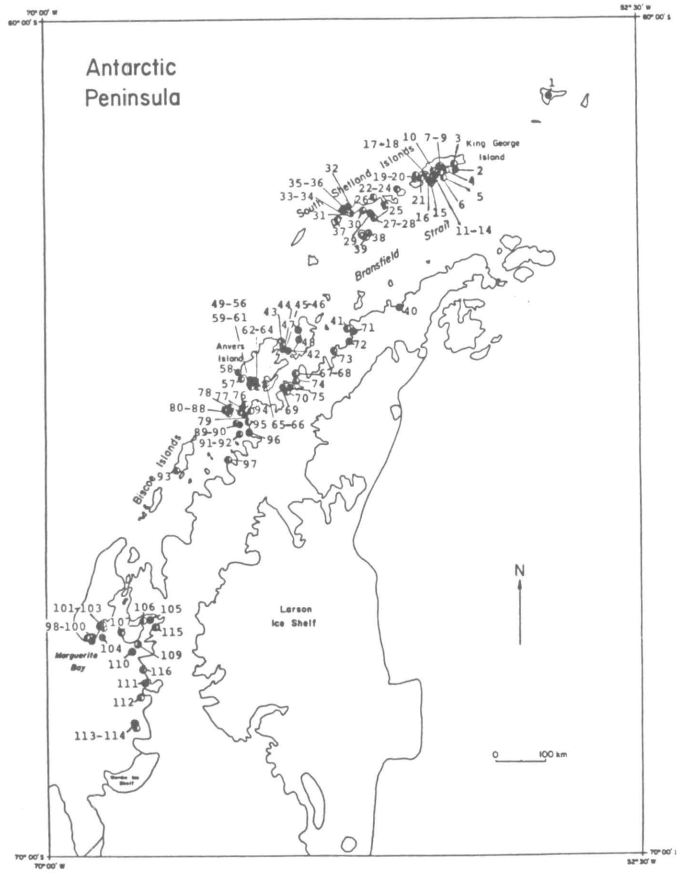

Figure 1. Localities of ***Deschampsia antarctica*** **Desv. and *Colobanthus quitensis* (Kunth) Bartl. in the Antarctic Peninsula area, including the localities listed by Greene and Holtom (1971). Full circle indicates the presence of both species, left half-full circle the presence of *D. antarctica,* and right half-full circle the presence of *C. quitensis.* The localities are grouped in the three least glaciated areas: South Shetland Islands, area between Cierva Point and Cape Garcia, and Marguerite Bay. *D. antarctica* alone occurs in 58 percent of localities and *C. quitensis* alone in 3 percent of localities; both species occur in 39 percent of localities. This reflects the considerably wider ecological range of *D. antarctica.* The distribution of vascular plants within ice-free areas may be determined, for example, by the radiation receipts of the habitat, geologic substrate, exposure to winds and storms, recent glacier movements, topography, altitude, and by the animal and human disturbance (Komarkova, S. Poncet, and J. Poncet in preparation).**

were located in adjacent *Deschampsia-* and *Colobanthus*-dominated communities where phenological changes and leaf and plant growth were observed at regular intervals. Two periods of soil drought developed at the *Deschampsia* site (figure 2). The first drought occurred during a period of intensive leaf growth, and was not associated with exceptional air relative humidity, vapor pressure deficit, or wind speed. Die-back of both *Deschampsia* and *Colobanthus* plants was observed, after both soil drought periods (figure 3). Greatest die-back occurred on north-facing rock ledges and other topographically high sites with shallow soil.

The die-back due to desiccation occurred also on Biscoe Point in the vicinity of Arthur Harbor, but not at Point Thomas, King George Island (62°S), at the ecological optimum of the two

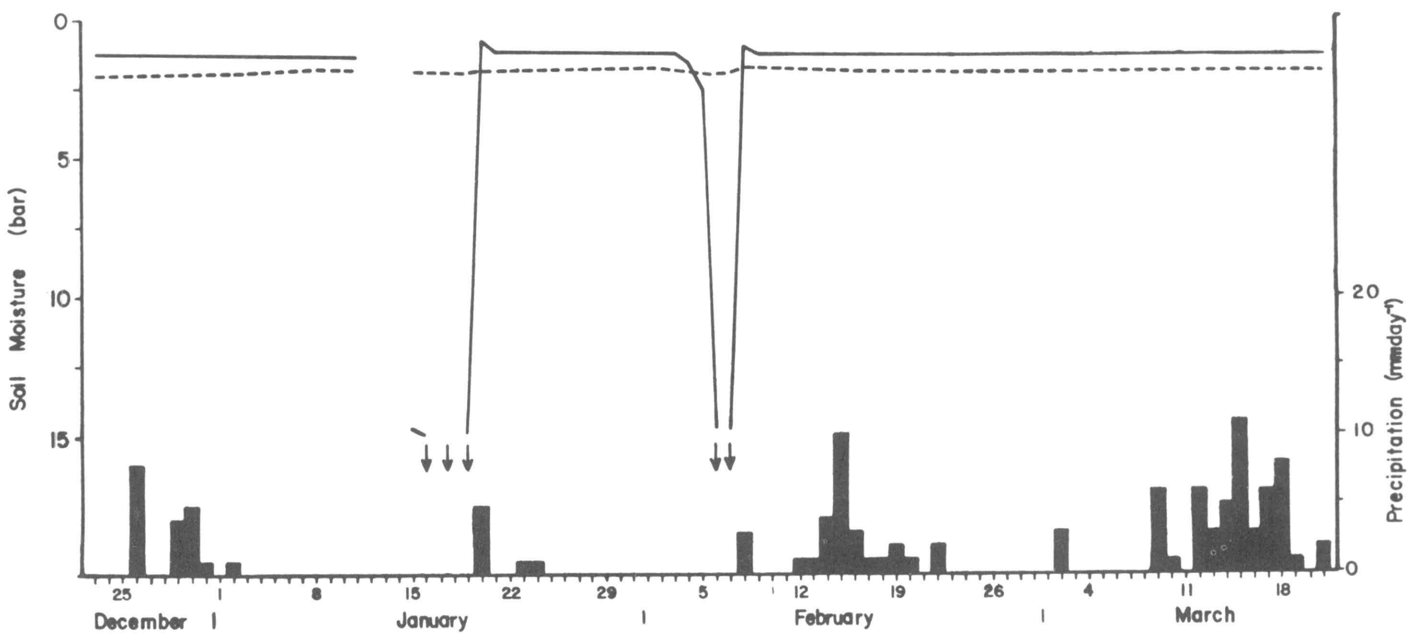

Figure 2. Daily maximum soil moisture at 1 centimeter below the surface in the root zone of *D. antarctica* (solid line and *C. quitensis* (dashed line). Soil moisture was measured with Delmhorst model 221 gypsum soil moisture blocks. Due to the nature of the polynomials used to convert the volt output into bars, the range of calculated values is limited to 0.1–15.0 bars even if some voltages indicated values in excess of 15.0 bars (arrows). Precipitation was measured by a Sierra-Misco model 2501 tipping bucket rain gauge recording the number of pulses indicating the times at which 1 millimeter of water was collected. Two periods of soil drought developed, in each case after 11 days of no precipitation, between 15 and 19 January and 6 and 7 February 1984 on the *Deschampsia* site. The soil drought was associated with die-back of the monitored *Deschampsia* tussock. The monitored *Colobanthus* cushion did not die-back during the drought while some nearby cushions did; apparently, very small differences in the distribution of moist soil layers and of roots decided whether the plants experienced soil drought or not.

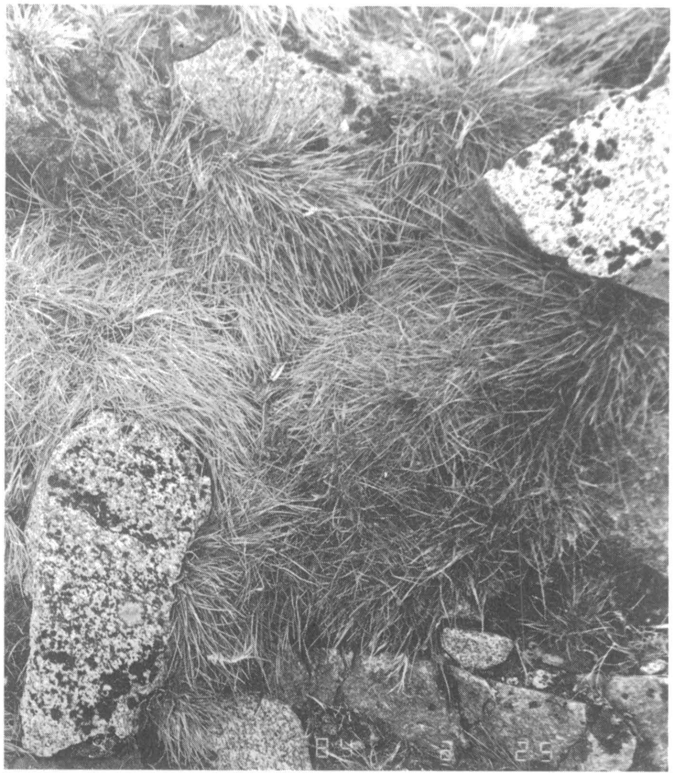

Figure 3. ***D. antarctica*** **tussock (left, 8 centimeters in diameter) which died back during the first period of soil drought on Stepping Stone Island between 16 and 19 January 1984. The light (rusty brown) color of the tussock on the left contrasts with the dark green color of the tussocks in a small depression on the right side of the photograph. The amount of current dead phytomass reached 50–90 percent in the rusty brown plants; inflorescences died only in plants with the highest current dead percentage. Only very few live leaves appeared at the time the photograph was taken (25 February 1984). The recovery of tussocks and cushions, which died back less, was faster; few tussocks and cushions did not recover at all in 1984.**

vascular plants in the Antarctic Peninsula area. During the soil droughts on Stepping Stone Island, the longest period with no precipitation lasted only 5 days on Point Thomas. Apparently, near their southern limits, vascular plants are not only stressed by lower mean annual temperature (−4°C in the Anvers Island area vs. −3°C in the South Shetland Islands; Reynolds 1981), but also by significantly greater environmental fluctuations of the more continental climate in the south. The recorded soil drought documents only one of several hypothesized events which may produce large patches of dead plants which occur in the southern stands; for example, plants may also be killed by freeze up or, in topographically low positions, by persisting snow or water logging (Komarkova, Scott, and Toi in preparation).

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