

together with very high summer temperatures — up to 38 °C in the shade at surface level. As a consequence, dryness of the air affect plants for at least twelve hours per day for four or five months of the year. No doubt plants rely to some extent on moisture supplied by internal condensation of water vapour just below the surface, as well as dew, which is frequently heavy. Soil nutrient levels are low, even on the old dunes, indicating unusually slow soil development.

Vegetation uniquely adapted to harsh conditions

In spite of all these limiting factors, it appears that a remarkably stable vegetation cover was able to evolve on these dunes, partially persisting to the present day, though adversely affected by fires in Maori times and since 1850 by grazing management which also included deliberate burning up until 1948. Existing native species include thirteen shrubs, ten herbs, and seven grasses and sedges. Ngaio, akeake, and kowhai are represented by a few old specimens, presumably relics of a formerly more abundant shrubby vegetation which probably included kanuka. Ake ake (*Dodonea viscosa*) and *Meuhlenbeckia astonii* are found here at the southern-most limit of their distribution. The prostrate broom (*Carmichaelia appressa*) is a species found only on Kaitorete Spit. It is probably a key component of the ecosystem because of its role as a soil building nitrogen-fixer. It is also very important in providing a favourable micro-environment for less hardy species. However, the prostrate broom is under constant browsing pressure from hares, rabbits, sheep and cattle, the

last causing major damage by tearing off large branches. It appears that most of these plants are old and there is no sign of regeneration in spite of abundant seed production.

All the native species are perennials, able to survive and even grow throughout the driest part of the year — in contrast to the introduced plants which are mostly winter annuals exploiting the period of least water shortage between May and October. Catsear, sorrel and Australian sheep's burr survive as perennials, but their leaves wither in the summer drought.

A whole range of adaptations to dry conditions can be observed among the native plants. Some, like *Clematis afoliata* and prostrate broom are leafless. Leaves when present are generally very small, narrow, covered in a thick cuticle, (i.e. pingao), or covered with woolly hairs as in scabweed (*Raoulia australis*) and woollyhead (*Craspedia lanata*). All the native species have extensive root systems, to enable them to absorb and store all available water. Low mounds of scabweeds only a few centimetres high may have roots seventy centimetres long; Prostrate brooms only twenty centimetres high may have roots over three metres long.

The vegetation of the Spit is unique and enough of the native vegetation remains today to provide some idea of its primitive state.

Threats from weeds, grazing and mining

Unfortunately the introduced marram grass (*Ammophila arenaria*) was planted about twenty years ago on eroding dunes about half way along the Spit, and more has



Prostrate broom in flower — Kaitorete Spit.

Photo S. Courtney



Prostrate broom *Carmichaelia appressa* is found only on the Kaitorete Spit. The plant in this photo has an unusual erect form.

Photo S. Courtney