

## 6.2 *Stenotaphrum secundatum* - BUFFALO GRASS

### 6.2.1 History

Oliver (1910) recorded "buffalo grass meadow" communities on the Northern Terraces (Figure 20), the north rim of the crater and in one area on the east side of the Island. He noted the species had been on Raoul Island for 20 years (Oliver 1910, p. 148). Cheeseman (1888), twenty years earlier, makes no mention of this species. Presumably, the species was introduced by Bell who tried to establish pasture for sheep both in Denham Bay and on the Northern Terraces ('Morton 1964). Pasture species such as *Poa pratensis* probably did not do well in the warm climate of Raoul and species of more tropical origin may well have been sought as fodder. (Smith, 1887, reports that Bell planted 15 acres of *P. pratensis* and that it was growing well. However, the species has not persisted on Raoul.)

Sykes (1977a) documented buffalo grass from the same areas as Oliver but also noted large stands above Wilson and Lava Points and small areas above Coral Bay, Darcy Point, Boat Cove and in Denham Bay, indicating that the species has spread considerably since the days of settlement.

### 6.2.2 Ecology

Buffalo grass is a stoloniferous perennial grass (family Poaceae) which grows in dense and deep swards in the open. It is very tolerant of salt spray and does well by the coast. On ridges and slopes, this grass is up to 50 cm tall, but in hollows can be up to 1 m tall. The species flowers and sets seed freely on Raoul. Seeds are mostly dispersed over short distances by wind and over longer distances in mud attached to footwear or the fur and feathers of animals. Occasionally young plants are found along tracks through the forest, even in the wet forest.

Figure 20 Dense buffalo grass on the northern terraces, 1908. (Reproduced with permission from the W. B. Oliver Kermadec Expedition Album, Alexander Turnbull Library. Ref. no. C21463)



Stands of buffalo grass are exceedingly dense and usually exclude all other species. However, there are a few areas where other species have been able to establish into the sward. Near the Meteorological Station, in 1990, there was a fire which burnt a number of pohutukawa trees and some buffalo grass. In this area today are seedling pohutukawa which were able to establish at the same time as the buffalo grass was recovering from the fire. On slopes above the Woolshed large numbers of karaka seedlings are establishing in buffalo grass near adult karakas. Karaka seeds are the largest of any fruit produced on Raoul, and there are sufficient starch reserves in the seeds to enable seedlings to germinate and establish in the dense buffalo grass swards. In general, the commonest species seen amongst buffalo grass is the endemic grass *Imperata cheesemaniae*.

Buffalo grass is light-demanding and will gradually be reduced in extent as the forest expands. Oliver (1910) noted this species was being killed by the shadow of Kermadec pohutukawa trees.

The leaves of buffalo grass, although appearing to be blunt, have a strong tip which can irritate skin when wading through dense swards. Some people are more sensitive than others.

### 6.2.3 *Future work*

Hand pull seedlings where seen away from the major buffalo grass swards.

## 6.3 *Cirsium vulgare* - SCOTCH THISTLE

### 6.3.1 *History*

This plant arrived on Raoul island between 1967 and 1976 when it was first recorded by Sykes (1977a). Scotch thistle is a common contaminant in grass seed, hay, etc., and was introduced to Raoul in connection with the farming activity associated with the Meteorological Station.

Initially Scotch thistle was confined to the farm paddocks west of the Hostel but spread to the airstrip further west. In 1978, Sykes commented that he was disappointed to see so many seeding thistles in the old farm pastures. Five plants were found in Denham Bay in 1982 and pulled out before they seeded (Selby 1982a). Selby (1982a) recommended that Scotch thistle be put on the category A list to increase the amount of effort put in to its control. By 1984, this plant had extended its range to just beyond Ravine 8 (Sykes 1984). In 1990, Sykes felt that there were fewer Scotch thistles than on his previous trip. He also recorded this species on North Meyer for the first time (Sykes 1990). Scotch thistle is now widely dispersed along the Northern Terraces west of the airstrip towards and above Western Spring. Crawley (1990) noted that Scotch thistle was the main species to colonise much of the ground disturbed by archaeological diggings west of the Woolshed in 1990. Dispersal is predominantly west of the initial infestation.

### 6.3.2 *Ecology*

Scotch thistle is a prickly, biennial, herbaceous daisy (family Asteraceae) up to 100 cm tall. A rosette of leaves is formed in the first year of growth and in the

second, a flower-bearing stem is formed. The purple flowers are clustered at the end of the stem and the numerous, wind-dispersed seeds (fairies) are blown from the heads. Flowering and seeding probably takes place in most months (Sykes 1984).

This species requires relatively open conditions for germination and establishment and will not invade dense grass swards. However, it will spring up at track edges, on slips and barer ridges. It will also germinate in light gaps in the forest. On the New Zealand mainland Scotch thistle is one of the few biennial exotics which disperses a long way into the forest. The species is not a problem in forest as it does not disrupt regeneration and usually grows sparsely only in the lightest places. On open grassy slopes, it could be common but would seldom grow densely.

When this species was first observed on the Island, all plants were destroyed, but one or two had ripe seed (Sykes 1977b). Because control pressure was not consistently applied to this species, it has since expanded to the point where eradication is no longer feasible. On Raoul, given that forest is the natural cover for the entire Island, Scotch thistle is not a serious problem. It will in no way interfere with the regeneration to forest of the areas which are currently grass- or fern-covered. On the Meyers, this species could interfere with nesting seabirds.

#### 6.3.3 *Control methods*

To date plants have been grubbed out at the rosette stage or at flowering. Crawley (1990) reported that the thistles near the Woolshed were sprayed.

#### 6.3.4 *Future work*

Scotch thistle has spread too widely now for eradication to be feasible as the effort now required far outweighs the benefits to the natural forest cover. Plants should be grubbed out if remote from the main infestations. The Meyers should be checked regularly and plants destroyed only if scarce. If abundant, do not grub them out but chop them down, as more plants could germinate in disturbed ground.

### 6.4 *Bryophyllum pinnatum* - AIR PLANT

#### 6.4.1 *History*

Sorensen (1944) was the first to describe this plant from Raoul. He did not know its name but dubbed it the "lantern flower plant", and stated that it was a small plant reaching 2 ft 6 in. high and carrying numbers of small greenish purple "lanterns". At that time this species was plentiful and covered about an acre near the swamp in Denham Bay. Sykes (1977a) recorded air plant from the same location as well as a small area in the dune slack a short distance from the main site. Now the site in the dune slack has expanded considerably and densely growing air plant is the dominant species (Sykes & West in press). See plate 12G of Webb *et al.* (1988) for an illustration of this population. The original population by the swamp has also expanded. The increase in area occupied has been slow but steady, and is continuing.

#### 6.4.2 *Ecology*

Air plant is a succulent member of the crassula family (Crassulaceae) which grows up to 70 cm tall. The leaves are hairless and toothed with a dark margin. In high light the uppermost leaves on the stem often turn red, as do the "lanterns" which are the inflated calyx surrounding the flower and later the fruit. Any seed which is formed is unlikely to be fertile (Webb *et al.* 1988). Flower buds were recorded on plants near the swamp in August but flowering is generally from November to May (Webb *et al.* 1988).

Population expansion is by lateral vegetative spread. New populations could establish by carriage of vegetative material to other suitable sites. The common name of air plant relates to the ability of this species to grow in dry, almost soilless habitats - sites which are marginal for many other species. Air plant is unlikely to spread outside of Denham Bay but there is still plenty of available habitat within the bay. Although this species is light-demanding it does grow in shade beneath the canopy, but the stands are less dense (Sykes 1994).

#### 6.4.3 *Control methods*

Control of this species is not advocated at this stage (other species have much higher priority) but chemical control would be the only practicable method given the density of stems. Application of 2 % Roundup is suggested in the first instance.

#### 6.4.4 *Future work*

Mark the leading edges of the two infestations with pegs, and record the locations of any other infestations. Record the movement of the leading edges relative to the pegs annually.

### 6.5 *Tropaeolum majus* - GARDEN NASTURTIUM

#### 6.5.1 *History*

This species was not recorded by Cheeseman (1887), Oliver (1910), or Sorensen (1944), and was presumably introduced as a garden plant some time during this century (Sykes 1977a). It is mainly distributed along the north side of the Island, in sites disturbed by humans, e.g., Northern Terraces, the Orchard, Low Flat, Fishing Rock Road, and Moumoukai summit clearing. The species has not spread in extent since 1967.

#### 6.5.2 *Ecology*

Garden nasturtium is a scrambling, aromatic, herbaceous annual or short-lived perennial with rather succulent stems, from the family Tropaeolaceae. The leaves are nearly circular and c. 20 cm diam. Flowers are in red or orange tones. On Raoul, the species flowers almost continuously. Fruit are dry, segmented into three and contain one seed per segment.

Once established at a site, the species grows amongst other vegetation (Figure 21) and has not been observed outcompeting any other species. On



Figure 21 Garden nasturtium growing among *Cyperus ustulatus*, *Nephrolepis* aff. *cordifolia* and aroid lily on Moumoukai, October 1994.

Raoul, the species does not seem to climb up adjacent vegetation, as it often does on the mainland. Seeds are not dispersed very far as they simply drop off the plant.

#### 6.5.3 *Control methods*

The plants on Moumoukai were sprayed with Roundup in September 1988 (DoC file 21-220).

#### 6.5.4 *Future work*

There is no need to eradicate this species for ecological reasons because it is non-invasive, unlike some other members of the genus, e.g., *Tropaeolum speciosum*. The infestation on the summit of Moumoukai could be removed for aesthetic reasons, but it is a low priority.

## 6.6 *Trifolium campestre* - HOP TREFOIL

### 6.6.1 *History*

This species was first collected in 1980 from near the generator shed (Sykes 1984) and still grows in the vicinity although it is uncommon.

### 6.6.2 *Ecology*

Hop trefoil is an annual legume (family Fabaceae) with leaflets c. 4-15 mm long. The yellow flowers are clustered, 20-40 per head. Seed pods are c. 2 mm long and usually contain one seed c. 1 mm diam. Plants flower from November through to May. Like other herbaceous legumes, hop trefoil is light-demanding and grows in open sites. It is not a threat to forest regeneration and it is, therefore, not worth the effort to eradicate it.

### 6.6.3 *Future work*

No action required.

## 6.7 *Vicia sativa* - VETCH

### 6.7.1 *History*

This species was first collected in 1980 and recorded by Sykes (1984) from the immediate vicinity of Boat Cove Hut. Although all plants seen in 1980 were pulled out, they must have seeded because the species persists today (Sykes & West in press). In 1994, vetch was seen only on this area, growing at the turn-around area at the end of the road. Some, but not all, plants were pulled out.

### 6.7.2 *Ecology*

Vetch is an annual, scrambling leguminous herb (family Fabaceae) with pinnate leaves and grasping, branched tendrils. Leaflets are 5-40 mm long. The rosy purple flowers and seed pods were present in October. Seed pods are black and up to 60 mm long, containing 5-12 seeds. Seeds are dispersed by explosion of the seed pod, and unless carried in mud on vehicle tyres or footwear, expansion of the area occupied will be gradual.

The species is not a threat to forest regeneration, and in open habitats is not invasive, but grows amongst other vegetation.

### 6.7.3 *Future work*

Hand pull from the vicinity of Boat Cove Hut if the opportunity arises. Remove any plants remote from the current infestation site.

# 7. Category C weeds

PERSISTENT RELICS OF CULTIVATION OF HISTORIC SIGNIFICANCE OR PROVIDING EDIBLE FRUIT WHICH MAY BE PROTECTED.

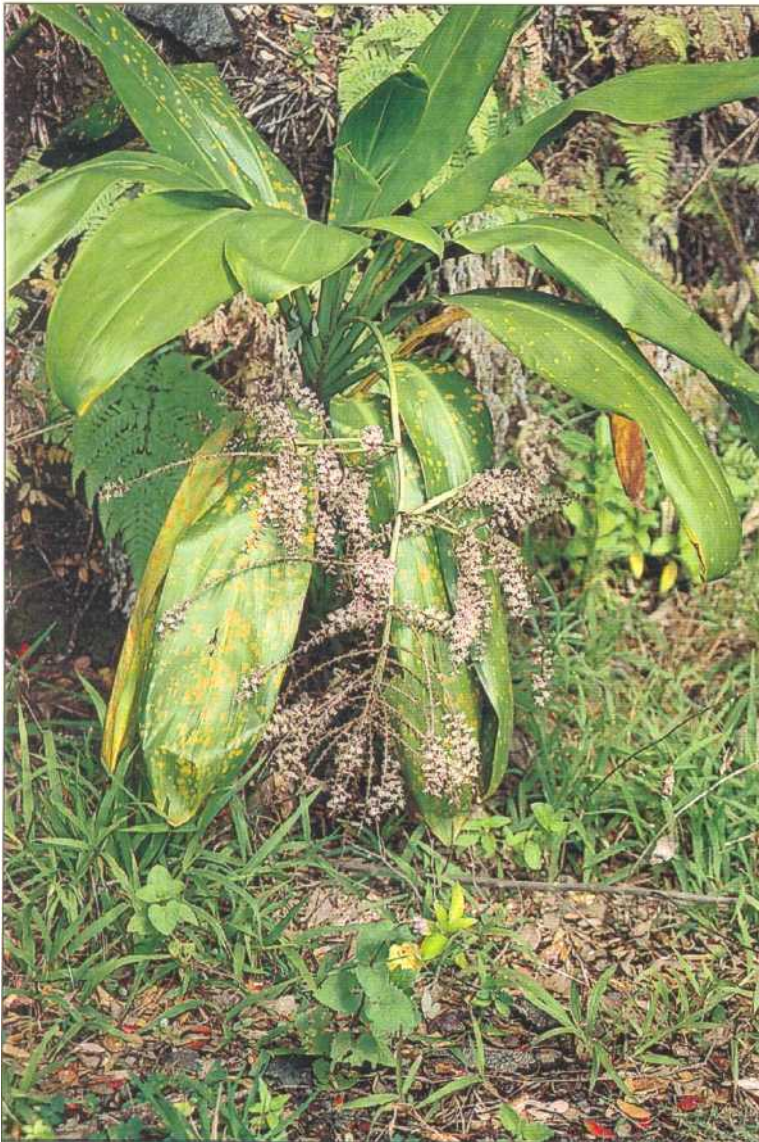
## 7.1 *Cordyline fruticosa* - TI

Previously *Cordyline terminalis*

### 7.1.1 History

It is most likely that this plant was brought to Raoul by Polynesian travellers (Sykes 1977a). Ti grows where there have been Polynesian or European settlements on Raoul, e.g., Low Flat, the Terraces, Denham Bay and Coral Bay. Since the departure of settlers, the range of this species has decreased, as the

Figure 22 A small ti plant flowering by the road edge near Low Flat, August 1993.



cultivation clearings have regenerated to forest. Davison (1938) stated that ti was not present in quantity and Sorensen (1944) recorded it from Coral Bay and from near the swamp in Denham Bay. In Denham Bay, Sorensen thought the ti was increasing. Today, ti is not uncommon, but is localised.

### 7.1.2 Ecology

Ti is a small, perennial, monocotyledonous shrub up to 3 m tall in the cabbage tree family (Asphodelaceae). The stems are slender and broad linear leaves are borne at the end of each stem (Figure 22). Leaves are up to 90 cm long and 15 cm wide. New stems sprout from the base of old ones, and cut stems will regrow from lateral buds. Clusters of mauve flowers are produced during winter and spring on Raoul. The species virtually never produces fruit on Raoul, although immature fruit were observed on one plant once (Sykes 1977a) and in 1978 six plants were observed fruiting (Dale 1979). Ripe fruit are red (Healy and Edgar 1980).

The species has declined on Raoul because it is light demanding and the old

cultivation sites are growing over. Today ti persists in light gaps on the Northern Terraces, at Low Flat and in Denham Bay and Coral Bay as well as growing along the road edge.

Dispersal of the species by seed is very unlikely given the lack of seed production on Raoul. Sykes (1977a), however, suggests that the plants on top of South Meyer probably resulted from bird dispersed seed. It is possible too, that people could have taken ti to the Meyers. For example, Hovell (1890) writes that he "crossed over to Meyer Islet ... and ... entered into occupation of it planting bananas, melons, pumpkins, etc...." Maybe ti was among the crops planted on the Meyers by early settlers such as Hovell. The most usual method of spread of ti is by vegetative fragments. This is particularly noticeable along the road edge where passing vehicles may break and carry stems before dropping them further down the road. These soon root and sprout new shoots.

Ti is fire tolerant, as exemplified by the fire near the Meteorological Station in 1990. Less than three years after the fire ti in the burnt area were sprouting from the base.

### 7.1.3 *Future work*

Leave alone.

## 7.2 *Aleurites moluccana* - CANDLENUT

### 7.2.1 *History*

Recorded by Cheeseman (1888) from the north and east side of the Island - not very common. Also by Oliver (1908) from Low Flat and Coral Bay and as recently planted at Denham Bay and on the Terraces. Both Cheeseman (1888) and Sykes (1977a) reason that candlenuts were introduced to Raoul by Polynesians. The main stand of candlenuts is at Coral Bay, a site used by Maori, but never disrupted by European settlement. Morton (1964) described the finding of candlenut fruit by the Bell girls. This was a great discovery for the Bell family, and it seems clear that they were not responsible for introducing the species to the Island. Elsewhere today, candlenut trees persist in the sites listed by Oliver (1908).

### 7.2.2 *Ecology*

Candlenut trees grow up to 15 m tall with trunks up to 80 cm d.b.h. and are in the euphorbia family (Euphorbiaceae). The leaves are relatively large (c. 10 x 8 cm) and are deltoid in shape. Flowers are insignificant and the time of flowering is not known. The fruit are large (c. 2 x 2 cm) and stone-like with a pronounced beak at one end. Cracking open the hard, stony fruit reveals a soft, oil-rich seed. This was threaded on string and lit to provide a light source by the Bells (Morton 1964). Fruiting times are not known, but fruit can be found at all times of year beneath the trees in Denham Bay and at Low Flat. Abundant seedling regeneration was noted beneath ring-barked trees in Denham Bay (Ombler 1977).



### 7.2.3 *Control methods*

Hand pull seedlings. In 1993 three seedlings were removed from beneath a candlenut on Low Flat.

### 7.2.4 *Future work*

Remove seedlings from beneath adult trees. The species will not disperse far because of the large size of the seed, especially given that most trees or groves are on flat land.

## 7.3 *Hibiscus tiliaceus* - SHORE HIBISCUS, FOU

### 7.3.1 *History*

Sykes (1977a) notes that Carver (1889-1893) sketched shore hibiscus or fou, as "bau shrub" in Bell's garden in Denham Bay in 1891 and Morton (1964) noted that this plant was used by the Bells for fibre. However, Sorensen (1944) was the first to positively record this species from Raoul Island. In the days of settlement this plant was cultivated for its fibre and was apparently, at that stage, not naturalised (Sykes 1977x). Presumably Bell took plants across to Low Flat from Denham Bay when he moved to the northern side of the Island.

In Denham Bay, Sorensen (1944) noted that there were several large patches of fou which had been planted and were growing well. He observed plenty of buds on the plants, but no open flowers, in August. Sykes (1977x) recorded shore hibiscus from Denham Bay and Low Flat. Currently, there are two extensive areas of this plant in Denham Bay, one by the hut (Figure 23) and the other further south and closer to the cliffs. In 1975 each of these patches was

Figure 23 The patch of fou, shore hibiscus, by Denham Hay hut shows up clearly with its yellow-green foliage, August 1993.

