



22(a)



22(b)

Figure 22(a), (b) Pā, site no. 9 (Q05/86) Moturua. (a) Where the platform was cleared of kākūka and false wattle about 1983, a dense sward of kikuyu is dominant. (b) Under kākūka canopy, the kikuyu has been unable to colonise; *Ehrharta stipoides* is dominant and some Mercury Bay weed is present.

the site features and ease of movement under the kākūka is better than in the kikuyu sward.

The rocky flanks are covered by pōhutukawa forest with an understorey of karamu. Thickets of young brush wattle grow in open areas and have seeded throughout the remaining kākūka. The open area supports a declining population of the uncommon native bindweed, *Calystegia marginata*. Within the kākūka, the ground cover is dominated by *Ehrharta stipoides* and *Dichondra repens* (Mercury Bay weed) and the grasses *Dichelachne crinitum* and *Rhytidosperma* sp. are prominent on the bush margin.

Management

The kikuyu grass and brush wattle detract from this excellent site; the former has conservation value (protecting the site) and should be subject to continuous review; the latter should be removed. The gallery forest created by tall kākūka and the ground cover of native grass should be encouraged to replace kikuyu, by the simple expedient of allowing the kākūka canopy to partially close over, much as we argued for in principle in the previous case studies report (Jones and Simpson, 1995).

3.7.4.2 Site 8, pits and terraces (Site record number unable to be traced)

This open site is situated on a knoll south-east of site 9 and provides excellent views of the northern half of the island, including numerous archaeological sites. The site itself was formerly a **kāinga** and has several **kūmara** storage pits. However, the entire surface is densely clothed in kikuyu grass and no surface relief is visible.

Management

The kikuyu grass protects the surface and facilitates unimpeded landscape views. The site is unsatisfying to the visitor because the pits and indications of settlement are cryptic. It would be desirable to maintain a native grassland sward (e.g., *Ehrharta stipoides*) here. However, this would not be possible given the competitive advantage of kikuyu in full sun. In the event of colonisation of **kānuka**, *E. stipoides* would re-establish and the surface features would be revealed. **Kānuka** or **mānuka** could be established by maintaining exposed soil and encouraging natural colonization, or assisting this process through planting.

3.7.4.3 Pā, site no. 3, Q05/87 GR 234634 (N12/49)

This site lies on the south-west point of Urupukapuka Bay, in the currently grazed portion of the island. The site has a simple transverse ditch and bank about 25 m long and with a height from base of ditch to top of bank of about 1.6 m. The enclosed area is about 80 m long by 10-20 m wide, with a slightly elevated platform immediately inside the ditch and bank dropping through terraces to the headland, and some lateral terracing at the head of the steep but passable slope to the south-west. The site has an interpretation sign.

Vegetation

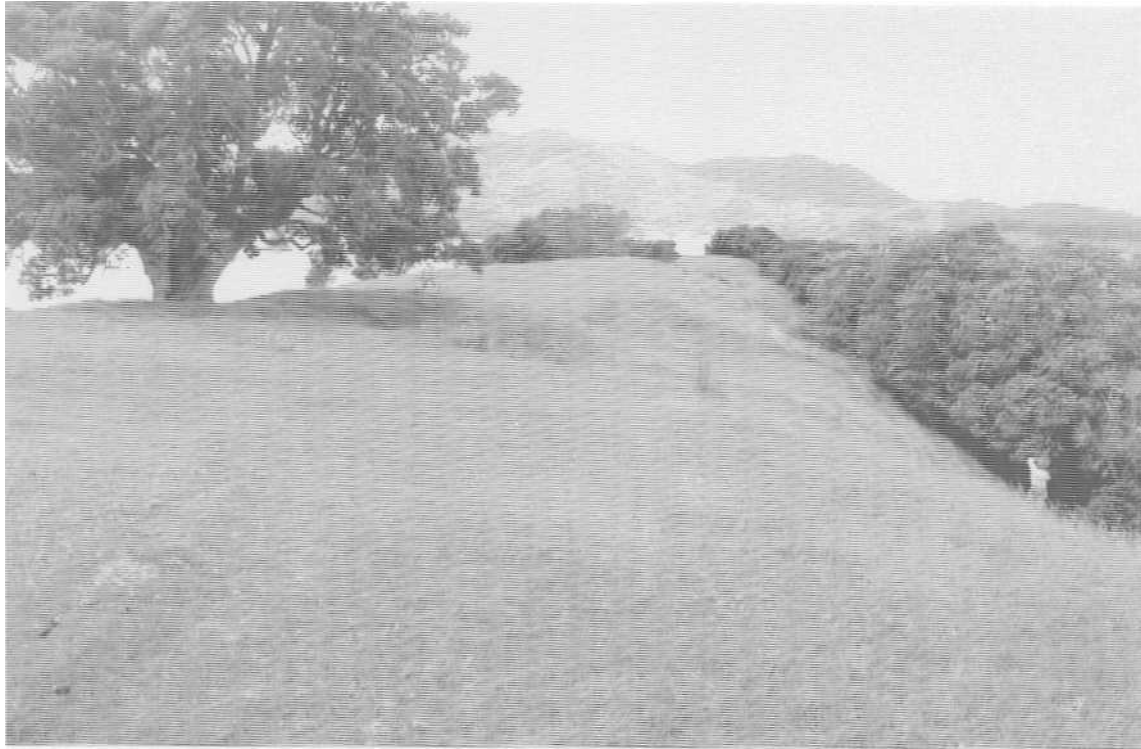
The steep slopes around the headland are covered by **pōhutukawa**, **kānuka**, **mānuka** and a few cabbage trees. Apart from a large **pōhutukawa** that has presumably grown up since the site was abandoned, the platform of the **pā** is covered in very short grazed grass: kikuyu, rye-grass and "danthonia" (*Rhynchospora* sp.), Figure 23(a). Stock have caused locally severe erosion at the edge of the platform and head of the slope, although where **kānuka** and **mānuka** protect the ground, active erosion has ceased. Erosion was previously occurring along the scarp of the **pā** ditch (perhaps aided by human tracking) but the scars are being grown over by kikuyu. Soil here is light grey in colour and possibly represents very infertile podzol formed under kauri. Nearby, in a location described as showing garden drains, a localised area of similar erosion is occurring. Podzolic soils, being infertile and dry, encourage "danthonia" rather than rye-grass; the former is insufficient to protect soil under a grazing regime. On such a soil kikuyu is advantageous.

Site condition and management

The site's management has long been unsatisfactory. We understand the area was for some time fenced to keep cattle out. Cattle are no longer run on the island and the fence has now been removed. Nevertheless, sheep have grazed the kikuyu sward on the point very closely, compared with other surfaces elsewhere, and are creating some erosion. Even at the end of a dry summer, there were viable plantlets evident in a generally sparse pattern of bare soil and eroded tag (flattened, dead grass stems). Generally, the point is subject to intense flocking by sheep, and some means, probably fencing, needs to be devised so that sheep can have occasional grazing, but be kept out of the area for much of the year, especially winter and summer.

The erosion arising from the apparent intensity of grazing is inappropriate for the particular site. The proneness to erosion may be exacerbated by the podzolic soil formed under previous kauri forest. Encouragement of low-growing **mānuka** (by securing manuka-brush containing seed over the eroded areas) may be one way to alleviate the problem. This should be done by pegging or criss-crossing the seed-rich brush on the eroded platform edges.

On the counter scarp of the ditch and bank, erosion is actively wearing away the relatively steep profile, Figure 23(b). This area would probably grow grass if it was fenced. It would also be possible to restore the profile here by adding turf and filling to the bank crest, perhaps using turfs taken from the base of the ditch. However, in general, control of sheep grazing and camping is the key priority for this site.



23(a)



23(b)

Figure 23(a), (b) Pā, site no. 3 (Q05/87), Moturua. (a) Pā platform is covered in a very closely grazed, reasonably stable sward of kikuyu, rye-grass and *Rhytidosperma*. Severe scarp erosion is occurring under the mānuka on the point furthest out. (b) Stock erosion on podsolised soils of ditch and bank. The grass cover is *Rhytidosperma* sp. (favouring hot, dry, low-fertility sites); it has re-colonised the erosion scar on the outer scarp (above centre).

4. CASE STUDIES: OTAGO AND CANTERBURY

Otago offered an opportunity to visit a range of sites in different ecological settings from those elsewhere in New Zealand, particularly mining sites in a dry environment. The Canterbury sites gave an opportunity to visit cave settings. On the coast, we were able to visit the southernmost examples of pa and also one of the earliest Moahunter settlements at Shag River. Fig. 24 shows sites and localities visited.

OTAGO

4.1 Kawarau Goldmining Centre, Otago Goldfields Park, F41/101-139, GR 045670 and vicinity (S133/451-490) (Fig. 25).

This site complex lies on the narrow alluvial terrace on the western side of the Kawarau River. The terrace is perched between 20-40 m above normal water flows in the river. Much of the lower parts of the terraces nearest the river have been downgraded by sluicing, leaving large areas of gravel gullies and stacked tailings. On the upper parts of the terrace, where it grades into the colluvium from the steep hill slopes above, the sluicing has been less intense. Here there are many mine shafts and adits, supply and head races and holding ponds for the miners' water, and also the main historic settled areas. There are also many informal huts and other shelters (many reconstructed) in the lower parts of the terrace amongst the tailings (Ritchie, 1983).

The historic complex is a key interpretative site for the Otago Goldfields Park. It contains a restaurant, tearooms and souvenir shop, a horse-riding concession, with the horses grazed on the grassed upper terraces, and a number of working demonstrations of mining techniques, principally sluicing with a hydraulic monitor and a stamping battery.

We were accompanied by the lessee and manager of the centre, Peter Egerton, and Mr Brian Ahern of the Queenstown Field Centre.

Vegetation (Fig. 26)

Broadly speaking there are four recognisable habitats: (1) the steep, rocky, hill-slope and catchments behind the park boundary; (2) rocky outcrops within the park boundary, adjacent to or surrounded by the river terrace; (3) the remnants of the colluvial and alluvial terrace between the hill and the river; and (4) the mined land along the length of the river (although generally leaving an unworked "Queen's Chain" immediately adjacent to the river) in which fine sediment has been sluiced from the alluvium and rounded river rocks have been stacked in heaps, walls or fences, and through which the visitor trail winds.

Although the mined area is the most critical from the point of view of stability and visitor interest, all four components contribute to the park landscape and interrelate functionally in determining management issues and opportunities within the park.