	Motuhaua	Hikunui	AK herbarium vouchers
*Parapholis incurva** †	lc		237245
*Paspalum dilatatum**	a		
Poa anceps	la		
*Polypogon fugax** †	lc		
*Sporobolus africanus**	c		
Zoysia pauciflora	l		
Vascular plant totals:	**33 + 36**	**11 + 3**	
Bryophytes			
Bryum clavatum	c		231712
Chiloscyphus semiteres	lc		231963
Didymodon australasiae	o		292210
*Lunularia cruciata**	lc		231964
Thuidium furfurosum	c		231711
Tortella flavovirens (= T. rubripes)	o		231710
Lichens			
Pannaria immixta	l		231767
Parmotrema ? reticulatum	c		231717
Ramalina australiensis	lc		231766
Ramalina celastri	lc		

Vascular flora of Rakitu (Arid Island): additions and comments

E K Cameron and P J Bellingham

Rakitu (Arid Island) is the only sizeable island on the eastern side of Great Barrier Island in the outer Hauraki Gulf and at 328ha (Taylor 1989) it is the third largest island of the Great Barrier Island group. During an Offshore Islands Research Group (OIRG) trip to Rakitu, 30 December 1980 – 8 January 1981, the vascular flora and vegetation was studied and herbarium specimens collected by EKC and Anthony Wright and in an annotated species list they recorded 321 taxa of wild plants with 75% being indigenous (Cameron & Wright 1982). At that time the island was privately owned by the Rope family, the central valley was mainly improved pasture with shrublands on the steeper slopes and tall forest in the protected side valleys – as it still is today.

In 1993 the Crown purchased the island from the Rope family and it is now managed as a Scenic Reserve by Department of Conservation (DOC) and the Ropes have a lease to farm the pastoral areas of the island until 2013. They still farm cattle and sheep, the last goats (c.20) were killed by DOC c.5 years ago (Bryce Rope pers. comm.). In the early 1980s there were around 300 cattle and 1000 sheep on the island, but since the early 1990s aerial topdressing was no longer financially viable and the farm stock was reduced to about 120 cattle and 600 sheep (Bryce Rope pers. comm.). Kikuyu grass (*Pennisetum clandestinum*) is still the dominant pasture species.

We were part of a group of five people on 26 February 2005 which landed on Rakitu for 2 hours and then again two days later we were ashore for 6 hours. The main purpose of the visit was to monitor two forest plots set up in the previous summer as part of a Marsden Fund project "Impacts of alien organisms on ecosystem function", but one of us (EKC) had the freedom to search for new plant records. EKC was also briefly ashore on 19 January 1994 guiding a trip from the *Te Aroha* when two plant specimens were collected which are also cited here. Apart from a DOC collection of *Colensoa physaloides* in 1998, these and the present specimens are the only herbarium specimens collected on the island that we are aware of since the OIRG survey in the summer of 1980-81.

Apart from measuring two existing 2004 forest plots and setting up two new plots there was only time during this present visit to investigate along the main stream (Abbott's Stream) up to the wetland at the head of the stream, and the lower sections of the two main valleys off to the northeast side (Reserve & Maori Creek valleys). Note – most place names are informal and follow those used by Cameron and Wright (1982: fig. 1). Because the original was printed too faintly the vegetation map of Cameron and Wright (1982: fig. 4) is reproduced here as Fig. 1. The comments below are mainly based on our visit to the island in February 2005, but also on the two specimens collected in January 1994, re-identifications of existing herbarium specimens, comments from Bryce Rope who holds the farm lease, and comments from DOC staff who have visited the island since 1993.

Summaries from four forest plots

Forest vegetation was measured in two valleys on the east side of the main gully that nearly bisects Rakitu: one presently grazed (Maori Creek valley) and the second from which stock have been excluded for c.30 years (Reserve Creek valley). Each valley was sampled with 2 subjectively-placed 10m × 10m plots under tall canopies; a taraire (*Beilschmiedia tarairi*) in a plot in ungrazed forest was 22 m tall. There was a very high basal area recorded in both valleys and low overall stem density (Table 1). Canopy composition was more diverse in the plots in the grazed valley but there were no understorey stems. There was a low density of understorey kawakawa (*Macropiper excelsum*) only in the ungrazed sites.

Species richness was lower in ungrazed forests (mean 20.5 species) than in grazed forests (mean 32 species; Table 2). The difference was due mostly to the number of dicot herbs in the grazed forest compared with the very low number in ungrazed forest. There were no exotic species in ungrazed forests and an average of 5 exotic species in plots in grazed forests, all of which were dicot herbs.

Table 1. Basal area (m^2 ha^{-1}; mean from two plots), stem density (number ha^{-1}; mean from two plots) and mean height (m; mean values from two plots if the species occurred in both plots) in grazed and ungrazed forests on Rakitu.

Species	Grazed			Ungrazed		
	Basal area	Stem density	Mean height	Basal area	Stem density	Mean height
Beilschmiedia tarairi	92.12	250	16.8	54.80	150	20.0
Pouteria costata	8.37	100	9.5			
Dysoxylum spectabile	4.52	250	6.9	17.33	700	8.1
Melicytus ramiflorus	3.21	50	11.0			
Beilschmiedia tawa	0.49	50	11.0			
Macropiper excelsum				0.02	50	2.0
Total	**108.72**	**700**		**72.15**	**900**	

Table 2. Species numbers per 100m2 (mean from two plots) in various life forms and by exotic and native status in grazed and ungrazed forests on Rakitu.

Life form		Grazed			Ungrazed		
		Exotic	Native	Total	Exotic	Native	Total
Fern			6.5	6.5		6.0	6.0
Dicot	Woody		12.5	12.5		11.0	11.0
	Herb	5.0	3.0	8.0		0.5	0.5
Monocot	Woody		0.5	0.5			
	Herb		4.5	4.5		3.0	3.0
Total		**5.0**	**27.0**	**32.0**	**0**	**20.5**	**20.5**

Additions to the flora of Rakitu from new observations and existing voucher specimens

AK = Auckland Museum herbarium

AKU = University of Auckland herbarium which was donated to the Auckland Museum (AK herbarium) in 2002 and has since been renumbered into the AK system

* = naturalised exotic species

** = planted exotic species

Ferns

Gleichenia microphylla – local, single young plant, grazed wetland just below the fenced off wetland, head of Abbott's Stream.

Dicots

Einadia trigonos – one of the existing voucher specimens of *E. triandra* (as *Rhagodia triandra*) has been re-determined as this species; AK 153192. Note – AKU 10799 (now AK 268526) is confirmed as *E. triandra*.

Epilobium nummulariifolium – local, in steep dry creek bed, open forest/shrubland margin, tributary of Abbott's Stream between Reserve and Maori Creek valleys; AK 290478.

Hypochoeris ?*glabra* × *H. radicata** – on floral characters (unfortunately lacking ripe achenes) plants at the head of the main valley in cattle pugged pasture below the fenced off wetland appeared to be intermediate between these two species. This hybrid doesn't appear to have been recorded in New Zealand before, but Stace (1995) records it as rarely occurring in Britain so may be overlooked. AK 290775.

*Galium divaricatum** – local, single patch amongst a clump of *Carex virgata* on the grazed margin of Abbott's Stream; AK 290476.

*Ludwigia palustris** – local, upper part of Abbott's Stream.

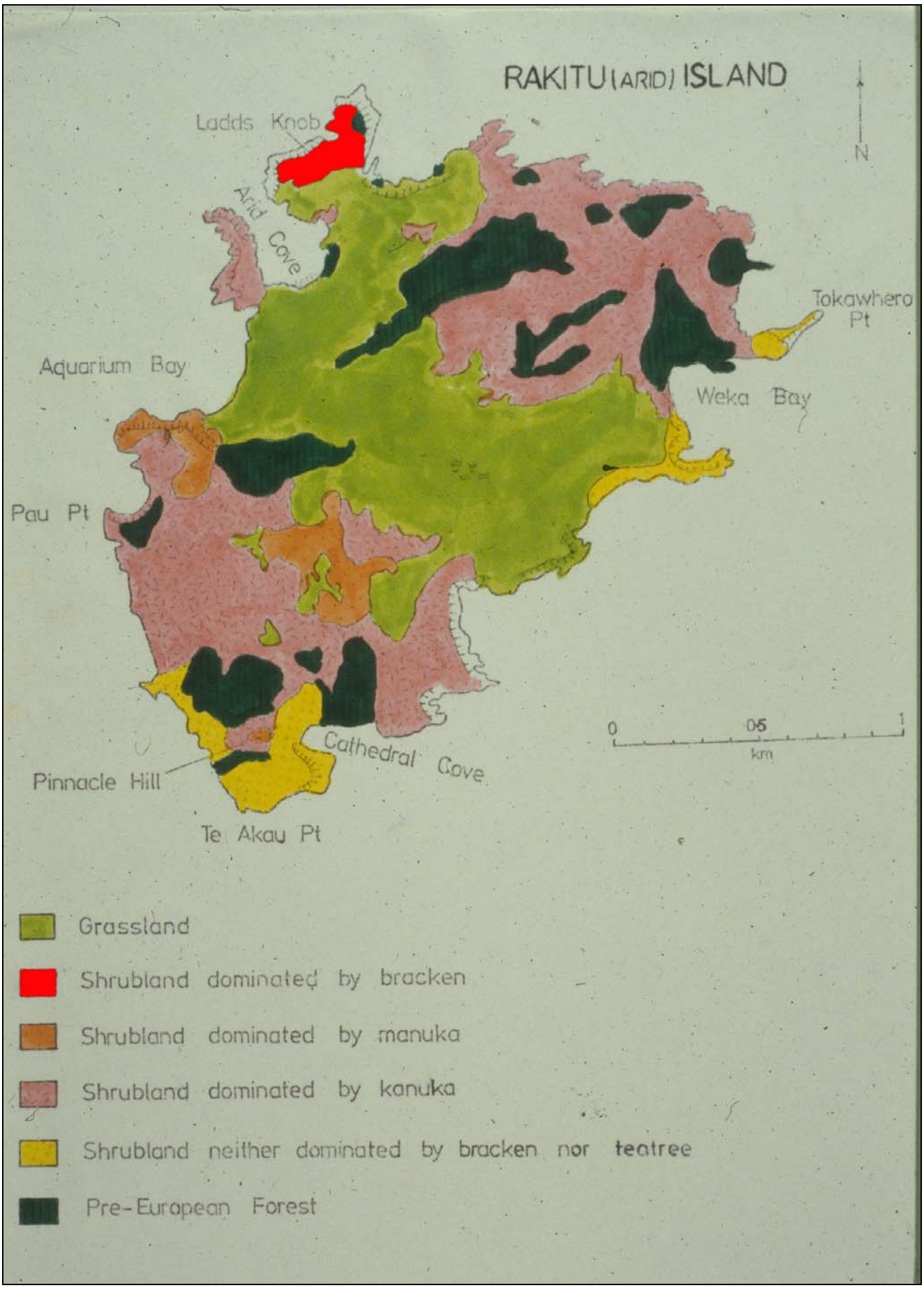

Fig. 1. Vegetation map for Rakitu (Arid Island) in 1981 (fig. 4 of Cameron & Wright 1982 - reproduced with improvements)

*Plantago major** – local, cattle-pugged margin of lower Reserve Creek, below fenced off area; AK 290482.

*Rumex pulcher** – local, upper part of Abbott's Stream; AK 292921.

Wahlenbergia littoricola subsp. *vernicosa* and *W. violacea* – previously recorded as *W. gracilis*, this genus was revised for New Zealand by Petterson (1997) who described several new species and no longer recognised *W. gracilis* s.str. for New Zealand. Two species are probably present on Rakitu: *W. littoricola* on the upper northern margin of Reserve Creek valley (AK 290486), and in Jan 1994 it was also present in the open near the southern highpoint (AK 218535); and from the comment "Both blue and white flowered forms are present" (Cameron & Wright 1982) *W. violacea* is suspected to be present as well, but requires confirmation. Note – the earlier collection (AKU 10854, *Cameron 143*) could not be located but it had white flowers and therefore is most likely to be *W. littoricola.*

Monocots

purple pampas grass (*Cortaderia jubata**) – local, a few plants amongst scrub and gorse on steep northeast side of Abbott's Stream between Reserve and Maori Creek valleys (other areas not investigated); AK 290479-80. Whether pampas grass (*C. selloana*), previously recorded by Cameron and Wright (1982), is still present on the island is unknown. Pampas grass (1 or 2 species?) is scattered across the island with a single large concentration on the coastal cliff tailings southwest of The Cove; it was sprayed by DOC for the first time in 2001 by helicopter (George Wilson pers. comm.).

Cyperus insularus × *C. ustulatus* – *C. ustulatus* was previously recorded as "frequent, back of beaches and open stream margins", but this species has recently been split into two species by Heenan and de Lange (2005). The specimen we collected from the margin of Abbott's Stream, where it was abundant, was considered to be intermediate of the two species; AK 290472 (det. Peter de Lange). There are no other collections of it from the island so it is unknown if one or both parents are also present.

*Echinochloa crus-galli** – locally common in swampy stream margin of Abbott's Stream just above the tributary from Reserve Creek; AK 290473.

*Glyceria declinata** – locally common with *Echinochloa crus-galli*; AK 290474.

*Juncus fockei** – locally common, along the grazed swampy margin of Abbott's Stream; AK 290475 & 290481.

Comments on some Rakitu species from existing voucher specimens or new observations

Ferns

Polystichum wawranum – this genus has recently been revised for New Zealand by Perrie et al. (2003) and the earlier voucher specimen of *P. richardii* has been re-determined as this species; AK 153563.

Dicots

bougainvillea (*Bougainvillea glabra* 'Magnifica'**) – with the magenta-purple flower bracts is a single large clump c.10m × 10m × 3-4m tall, originally planted c.20 years ago (Bryce Rope pers. comm.) in the lower Reserve Creek valley. It died-back after being sprayed with herbicide by DOC c.8 years ago, but has come away again. Although not wild and not setting seed, this clump has the potential to greatly expand and climb high into the adjacent native forest; AK 290483.

gorse (*Ulex europaeus**) – has increased markedly on the steep scrubby margins of the forest on the northeastern side of Abbott's Stream and the northeast headland (Ladd's Knob). Although the gorse was sprayed a couple of years ago by the Ropes, it has come away again.

hydrangea (*Hydrangea macrophylla**) – since December 1981 it has spread >0.5km further up the forested Reserve Creek valley from the only known locality of it on the island in the lower part of this valley. Occasional seedlings (AK 290485) were found under the tall forest by the stream and on the scrubby upper valley flanks >100m away from any adult plants. Flowering plants seen had blue normal-type flower heads; however, a flowering specimen collected in the same valley in January 1994 was the cultivar 'Lacecap' (AK 218543). There has been some minor control on this species over five years ago (Bryce Rope pers. comm.).

kawakawa (*Macropiper excelsum* subsp. *excelsum*) – this genus has been revised for New Zealand by Gardner (1997) and the earlier voucher specimen of *M. excelsum* has been re-determined as this taxon; AK 268517 (ex AKU 10788).

koru (*Colensoa physaloides*) – previously recorded (as *Pratia physaloides*) at two fairly inaccessible sites to stock in the southwest corner of the island - this is at its known geographical southern limit. A DOC follow-up survey on 27 February 2004 to map the koru site recorded c.200 plants at the lower site (Halema Jamieson pers. comm.). Stock appears to have eliminated the more accessible upper population near the local high point (see Cameron & Wright: fig. 1).

taraire (*Beilschmiedia tarairi*) – trees were up to 22m tall in Reserve Creek valley – which is twice the previous estimated height (cf. Cameron & Wright 1982).

*Geranium dissectum** – previously only recorded in Rockfall Bay, but also present on bank of Abbott's Stream above tributary of Reserve Creek.

Oxalis rubens – both previous vouchers of *O. perennans* have been re-determined as this species; AK 153314 & 268588 (ex AKU 10864).

Monocots

Aira caryophyllea subsp. *caryophyllea** – both previous voucher specimens of *A. multiculmis* (now *A. caryophyllea* subsp. *multiculmis*) have been re-determined as this species; AK 153304 & 268613 (ex AKU 10890). *Aira caryophyllea* subsp. *caryophyllea* was previously unrecorded for the island.

Drymoanthus adversus – previously recorded as frequent on kanuka; one plant during this visit was seen on taraire, lower Maori Creek valley.

Eleocharis acuta – previously only reported from the wetland at the head of the Abbott's Stream, but now also present on the swampy margin of Abbott's Stream near Reserve Creek tributary.

Poa seticulmis (now *Poa pusilla*) – should be deleted from the list because the specimen this record was based on (CHR 257012) has been re-determined as *Poa anceps*.

Schoenoplectus tabernaemontani – previously reported (as *Scirpus lacustris*) only from the wetland at the head of the Abbott's Stream where it and *Juncus pallidus* "scarcely grow tall enough to flower before being grazed almost to ground level". The fencing of this wetland has allowed the *S. tabernaemontani* to now become dense and tall. It is also locally present to 2m tall on the swampy margin of Abbott's Stream near Reserve Creek tributary; AK 290488.

Birds seen during the visit

Although not searched for these birds were noted during our visit: black-backed gull, brown teal (5 birds, creek mouth at The Cove), harrier, house sparrow, kingfisher, myna, New Zealand pigeon (common in broadleaf forest), North Island weka (introduced to the island in 1951), red-billed gull, spur-winged plover (2 birds), tui, welcome swallow and white-backed magpie. The magpie and spur-winged plover are additions to the annotated bird list compiled during the OIRG survey by Bellingham et al. (1982). In 1998 Phil Todd (Todd 1998) recorded two other additions: pukeko and white-faced heron.

Discussion

Flora

The record of *Cyperus insularus* × *C. ustulatus* is interesting because this suspected hybrid has also recently been collected amongst *C. insularis* on Aiguilles Island off the northern tip of Great Barrier Island (AK 290562). These two collections appear to be the first suggestion that *C. insularis* and *C. ustulatus* hybridise (cf. Heenan & de Lange 2005).

Eight new naturalised species, four native, and two suspected hybrids are added, and one native grass is deleted, bringing the new total recorded for the vascular flora of Rakitu to 332 taxa with 73% being indigenous. Only the suspected hybrids and the *Rumex pulcher* are new for the Great Barrier Ecological District and none of the additions are surprising. However, it is of concern that the purple pampas grass is now present, because for this species every flower sets seed without pollination ("by autonomous apomixis" Edgar & Connor 2000) giving it the potential to spread more quickly than its close relative, *C. selloana*. The other environmental weed we were concerned about was the hydrangea, because it is continuing to spread up the forested Reserve Creek valley. Gorse has certainly increased on the steep margins of pasture and forest; while a curse to the farm manager it may be a blessing to forest regeneration. A longer survey would add further species to the list; however, the areas searched in the limited time ashore were the key places where new plants introduced by humans or farm stock would most likely establish.

Farm management

Some of the fences to exclude stock from the bush areas have been improved since the OIRG visit, but stock still has access to some forest areas, e.g. Maori Creek valley, Cathedral Cove above the koru site. The wetland at the head of the Abbott's Stream is now fenced (c.150m × 50m) and has allowed the *Schoenoplectus tabernaemontani* to grow without being grazed. Its increased seed production coupled with the reduced stock numbers has allowed it to establish further down the valley. The establishment of the new fern, *Gleichenia microphylla*, recorded just below the fenced off wetland is also probably related to the fencing of the adjacent wetland.

Conservation issues

The few environmental weed species present on the island appear to be relatively local and should be eradicated before spreading further: especially purple pampas grass, pampas grass (if still present) and hydrangea. The single bougainvillea should also be eradicated. With the possible exception of purple pampas grass (seed blown across from Great Barrier Island?) all the new exotic species have probably all reached the island via stock introductions since the OIRG survey, or less likely, they were suppressed by the larger stock numbers and were missed during the intensive 10-day OIRG botanical survey.

DOC intends to eradicate the rats present on the island as soon as practically possible, but the presence of weka and farm stock on the island complicates this operation (George Wilson pers. comm.). Ship rats (*Rattus rattus*) are the only feral mammal confirmed to be present on the island (Hitchmough 1991); although there is an unconfirmed record of a suspected kiore (*R. exulans*) trapped 21 July 1998 by Phil Todd (Todd 1998). Some "island" plants currently present in low numbers are probably failing to regenerate because of the presence of ship rats, e.g. coastal mahoe

(*Melicytus novae-zelandiae*), large-leaved milk tree (*Streblus banksii*) and parapara (*Pisonia brunoniana*). Stock should be excluded from all the bush areas.

Acknowledgements

DOC staff (Halema Jamieson, Bec Stanley, George Wilson) and Bryce Rope for comments about the islands plants and present management; Rhys Gardner and Peter de Lange for commenting on some of the plant specimens; Russell Clague skipper of the *Ultimate Pursuit* for transport and accommodation; and the Marsden Fund for financial support.

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Vegetation and Flora of Claude Stream Valley and Hogs' Hill Bush, Whitford, southeast Auckland

E K Cameron

Introduction

On 21 May 2005, 45 people gathered at the end of Waikopua Road, 4.5km south of the Whitford Village on the Whitford-Maraetai Road, for the monthly Auckland Botanical Society (ABS) field trip. We visited the Claude Stream Valley forest (c.145ha) that is owned mainly by Manukau City Council (MCC), and also includes two private blocks (Graeme Currie and Barry and Una Grieve).

At the time of our visit the forest was threatened by proposals to expand the existing Whitford Quarry and associated Whitford Landfill (when quarrying is completed the void will be filled up with refuse) to the northeast and east into the western catchment of the Claude Stream Valley. The quarry is owned by MCC and since December 2004 managed by Fulton Hogan Ltd. After our visit Fulton Hogan announced a revised proposal; which would have less impact on the Claude Stream Valley, by focusing on expansion to the southeast and south (Hogs' Hill) rather than northeast and east as proposed at the time of our visit. A group of concerned local residents, the Whitford Residents' and Rate Payer's Association (WRRA), are challenging the proposed quarry and landfill expansions into the forest areas.

The trip was attended by: Chris Ashton, Tricia Aspin, Harry Beacham, Anthony Bellvé (WRRA and co-leader), Ewen Cameron (co-leader), Tim Carter, Leonie Clunie, Colleen Crampton, Brian Cumber, Geoff Davidson, Frances Duff, Josh Salter, Morag Fordham, Rhys Gardner, Richard Gillies, Anne Grace, Leslie Haines, Rosa Henderson, Ken Haydock, Marcel Horvath, Peter Hutton, Anthea Johnson, Lynden Johnson, Mike Johnson, Sandra Jones, Joan Kember, Helen Lyons, Jenny Lux, Elaine Marshall, Cara Nicholson, Douglas Nicholson, Ros Nicholson, Helen Preston-Jones, Mags Ramsay, Juliet Richmond, Clive Shirley, Catherine Tuck (WRRA), Bev Wade, Barrie Waterhouse (Whitford Quarry Community Committee (WQCC) & WRRA), Alison Wesley, Mike Wilcox, Tony Williams, Derek Williamson, Primrose Williamson and Maureen Young.

During the ABS field trip we visited the Claude Stream Valley area, including the eastern side of the quarry. During the earlier field trip reconnoitre (4 May 05) and again later, I also visited, in the company of Anthony Bellvé, Christine Maslowski and Barrie Waterhouse, the hill (Hogs' Hill) south of the quarry. Now with the revised proposal, Hogs' Hill bush is threatened directly by the quarry and landfill expansions. Hogs' Hill is contiguous with the Claude Stream Valley and is included in my account, of the four trips undertaken on: 6 November 2004, 4 and 21 May 2005 and 10 October 2005.

Vegetation Descriptions

Claude Stream Valley

The Claude Stream flows north into the Waikopua Estuary and out to Whitford Bay between Howick and Beachlands and then into the Tamaki Strait (see Fig. 1). The base rock, greywacke, is exposed along parts of the stream bed, especially where there are waterfalls. The valley is steep and dissected by the narrow Claude Stream and its four tributaries on the eastern side. Most of the bush was untracked and the