Collapse or recovery: Pitt Island vegetation 1980-1993, with reference to Chatham Island

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Summary

Concern about the loss of native forests and wildlife from Pitt Island led to the establishment of a system of protected areas there in the late 1970s. Subsequent conservation management of those areas has aimed to halt and reverse that decline. The research reported on here has been designed to gain an understanding of the vegetation condition and trends and to assess whether the management was successful.

Vegetation plots and photopoints were established and first surveyed in 1980, were resurveyed and expanded in coverage in 1987, and were reassessed and further extended in 1993. They show very clearly that forest health and survival are profoundly dependent on conservation management - chiefly control of domestic stock and feral mammals - and that the effectiveness of the management is patchy.

Forest canopies are vulnerable to damage and death caused by storms, especially on exposed sites, and if unprotected, forests quickly collapse and disappear - within a few decades. By contrast, growing conditions on Pitt Island are such that with good browsing mammal control, natural regeneration is vigorous and diverse enough to repair any climatic damage. Forests can rapidly regenerate, even on sites that have been entirely deforested.

In the Glory and Canister Cove Blocks of Pitt Island Scenic Reserve, forest recovery is already well advanced in the portion that has had good browsing mammal control since 1980. The portion recently relieved of its feral sheep flock will follow the same recovery pathway. In the Rangiauria Block, forests, coastal scrub and spectacular herbfields will eventually be the result of recovery.

In the Waipaua Block of Pitt Island Scenic Reserve though, recovery is not so evident: browsing mammal numbers are still high enough to be having an unsustainable impact on most forests (including the nikau forests, peat domes and treelands. Better mammal control there will be required to allow recovery and to ensure quality habitat for wildlife.

This research has established a strong baseline for long term ecosystem monitoring, to which could now be coupled specific monitoring of wildlife and threatened plants.

The concept of partnership between DOC and Pitt Islanders in conservation management is supported for the island.

Parallels with the situation on Chatham Island are drawn.

The Scene

The Chatham Islands are biological jewels set in a great ocean. Because of their isolation they are very special, have a unique history and have distinctive conservation management needs. Just how those needs are handled will determine their future place on the conservation map of the world.

Before people arrived, the islands were cloaked in a mantle of dense forests, and were fringed near the shore with extraordinary herbfields. Seabirds occupied almost every nook and cranny. Centuries of human occupation have reduced this natural wealth to a shadow of what it was. It need not disappear altogether though, and has a remarkable ability to recover if nurtured.

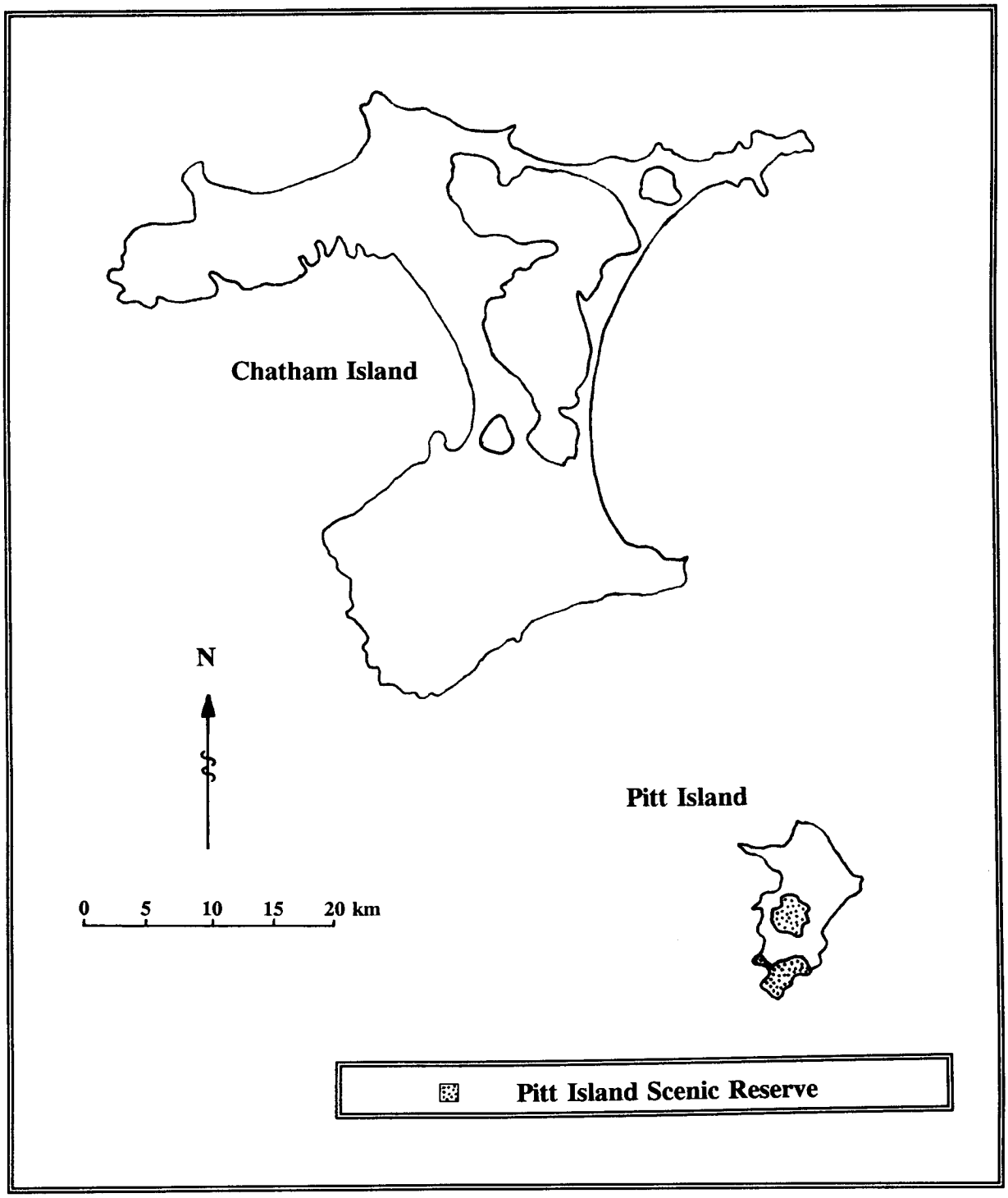
The facts of vegetation deterioration and recovery on the Chathams have long been recognised, but until recently there was no "hard data" to indicate the actual directions and pace of change. Protection work on Pitt Island in 1980 provided the opportunity to get that data. Geoff Walls was a member of a party that visited the island in February of that year, mapping the vegetation of what is now known as Pitt Island Scenic Reserve (Map 1) and setting up a series of vegetation plots to monitor forest changes in relation to animal control and the protection of a flock of feral sheep for their scientific interest.

In December 1987, we relocated those plots, measured them (expanding the technique to include other components of the vegetation than just the forest trees), established new plots to look at extra issues, finished the mapping and set up some photopoints. Our findings from the plot data comparisons were startling: all forests that still had substantial numbers of cattle, sheep and pigs were degrading so fast that they would be entirely gone in 20-80 years (depending on the site) unless protected; where forests were protected from those animals, regeneration was remarkably rapid (Walls 1988).

That work led to the Department of Conservation requesting that we establish such vegetation monitoring plots on Chatham Island. This we did in February-March 1990 (Walls and Scheele 1990).

This report is an account of our return visit to Pitt Island in February-March 1993 to follow up what was begun in 1980 and what we built on in 1987. It also includes an account of our associated work on Chatham Island whilst en route.

Conservation on Pitt Island has a colourful history, sparkling with opportunity and dogged by controversy. The issues are primarily human, to do with sovereignty, tradition, community development and the interplay between Crown agencies and island residents. We came into this arena as technical advisers with some trepidation, to discover that most obstacles were not as insurmountable as they appeared.



MAP 1: LOCATION OF PITT ISLAND SCENIC RESERVE, CHATHAM ISLANDS

The Expedition

We had allowed enough time to accommodate transport delays on the Chathams, but we hadn't bargained on fog closing Wellington airport. That cost us four days and meant we had to work all the daylight hours and some candlelit ones to achieve what we set out to do on Pitt Island. We put our time marooned in Wellington to good use though. In particular we discovered the collection of historical photographs of the Chathams in the National Library. They hold a wealth of information about the islands a century or so ago.

A couple of days at each end of the trip was earmarked for visits to our 1990 plot sites on Chatham, some botanical sleuthing on behalf of colleagues and discussions with people there. In between, for 10 all-too-short days, we were on Pitt Island, working in the various blocks of Pitt Island Scenic Reserve. Camped on the forest edge near where the Half Chain crosses Waipapaku (Second Water Creek), we had up to an hour and a half's walk each way to the eight vegetation plots we left in 1987. Each plot was remeasured, using nothing more technical than tapes, a clipboard and pencil. Two extra plots were established, to follow the progress of vegetation on the peat domes and of nikau forests. Photopoints were rephotographed. We visited other parts of Pitt Island Scenic Reserve to look at other issues of conservation management. We called on some of the Pitt Islanders to make ourselves known, discuss issues and make travel arrangements.

The plot measurement technique is described in Walls (1988) and Walls and Scheele (1990). In essence, each of the 25m x 25m plots was gridded into 5m x 5m squares, and within each of these the composition and abundance of the following were recorded:

- canopy species (trees and large tree ferns), whether alive or dead, with their locations mapped.

- upper understorey or subcanopy species (saplings, epicormic growths and tree ferns greater that 1.5m tall but too small to be called trees, also vines).

- lower understorey species (saplings, epicormic growths and tree ferns 0.3-1.5m tall, also vines).

- ground cover (plants less than 0.3m tall, including tree seedlings, grasses, herbs, sedges, ferns and creepers; leaf litter, rocks, logs, bare soil etc).

The presence and impact of sheep, cattle or pigs was also recorded, and anything else affecting vegetation processes was noted.

We encountered a fairly wide spectrum of weather. Warm clothing and waterproof gear were called upon, and shelter from the southerlies had to be constructed, but work was not much impeded. A comfortable camp, good provisions and generous help from Pitt Islanders ensured the success of the fieldwork.

With all the plots being a little inland, our base camp located in the centre of the island and none of our routes taking us to the coast, we spent virtually no time near the shore on this trip. Although this struck us as slightly weird at the time, what it meant was that we were, quite simply, close to the terrestrial heart of the island throughout the expedition.

What We Found

1 PITT ISLAND

1.1 The photopoints

In 1987 we set up three photopoints in what is now Pitt Island Scenic Reserve (Map 3). On this expedition, rough weather and lack of time prevented us getting to one point. The other two we photographed, but the film containing the shots of one of them has gone astray.

We are left then with photographic evidence of change from only one of the photopoints this expedition. This isn't a serious loss and can be readily enough compensated for subsequently because we have the 1987 baseline.

The photopoint for which we have a comparison between 1987 and 1993 is at the extreme northwest of the Glory Block of the reserve (Photopoint 2, Figure 1 in Appendix 2). From it has been photographed a panorama to the south and west. What has happened visually in the last five years is:

- The grassland - rank in 1987 - has become even more rank and now forms a dense cushion of grasses and herbs [including drifts of bidibidi (***Acaena anserinifolia***[1])] over most of the visible land.

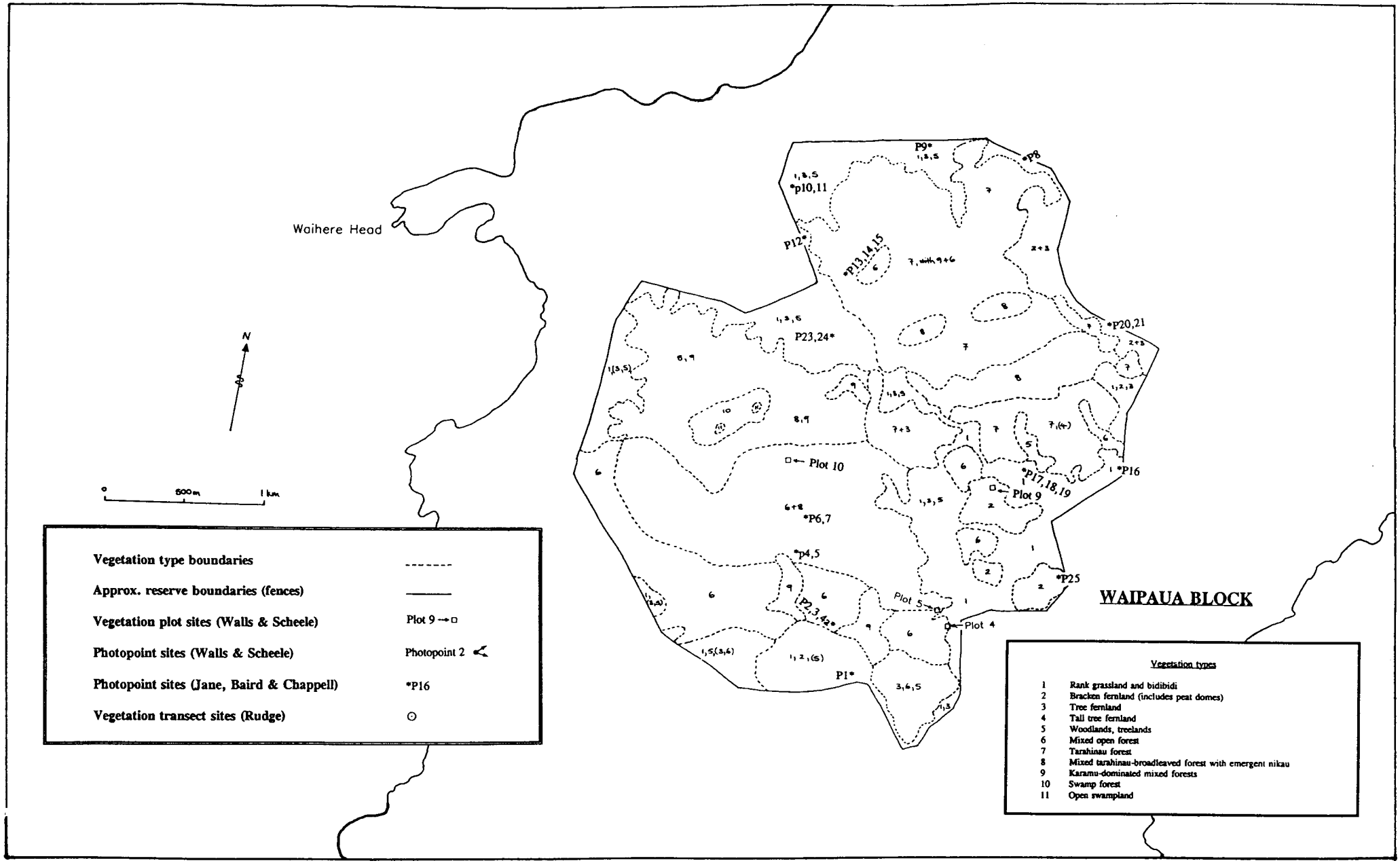
- Within the grassland, flax (*Phormium tenax*) has radically increased in abundance and clump size. There is probably around ten times as much flax now as there was in 1987.

- The numbers of live trees and shrubs (remnants of the former forest cover) scattered over the land have diminished substantially. No regeneration is yet evident.

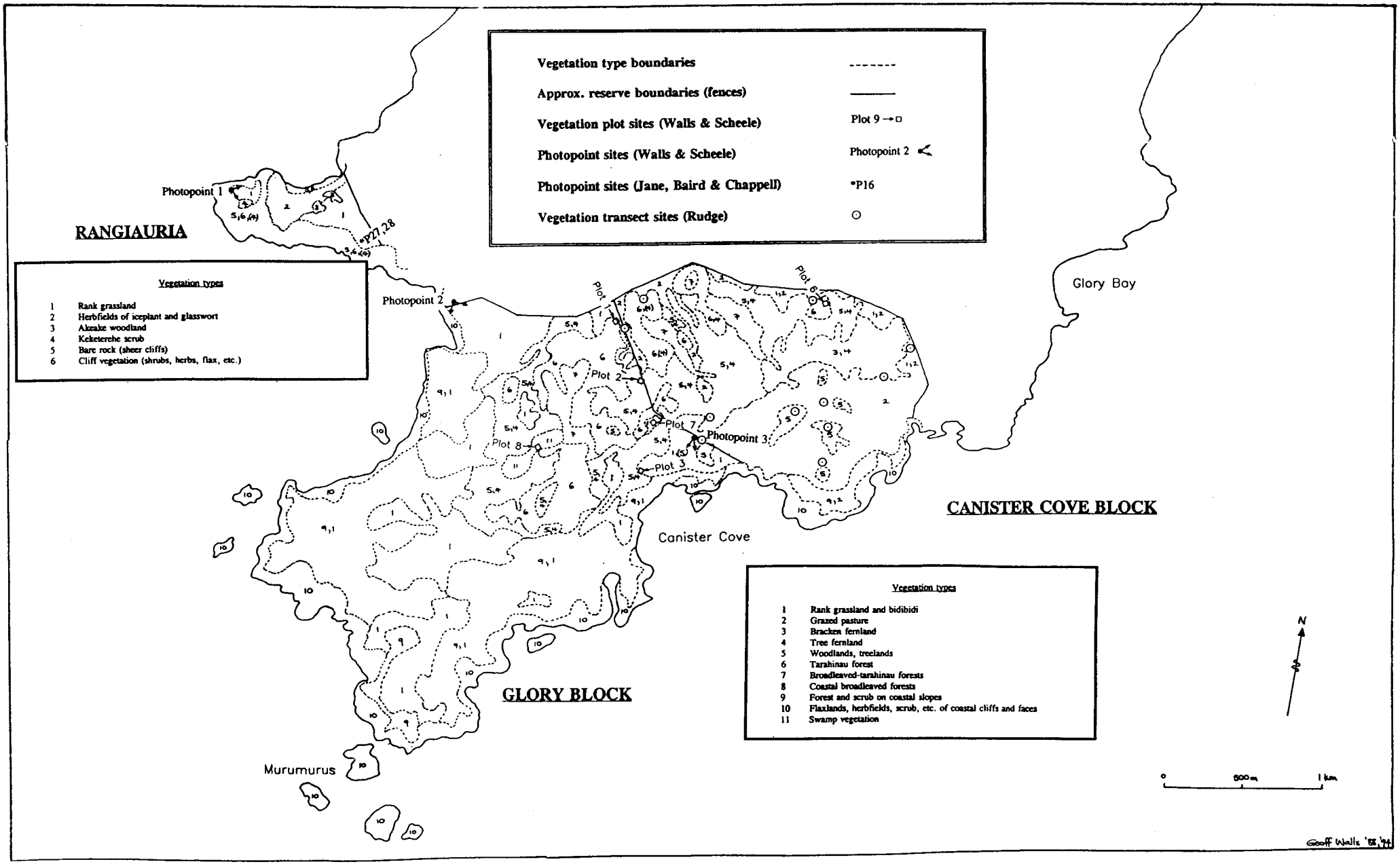
- Eroding scars - bare areas where the soil has gone following forest clearance - have begun to heal as they become reclothed in small plants.

Even a single photographic record then reveals a considerable amount of information at a site. What it shows is the beginning of the recovery of the stature and complexity of the vegetation cover - from the ground up - following removal of most of the grazing mammals. Remnant trees and shrubs stand-

[1] A glossary of plant names is at the end of this report (Appendix 1)



MAP 2: WAIPAUA BLOCK OF PITT ISLAND SCENIC RESERVE, SHOWING VEGETATION TYPES AND MONITORING SITES



MAP 3: RANGIAURIA, GLORY AND CANISTER COVE BLOCKS OF PITT ISLAND SCENIC RESERVE, SHOWING VEGETATION TYPES AND MONITORING SITES

ing out from the developing flaxlands are still dying through exposure to the elements but their spirits will, we are confident, live on in a new forest of trees and shrubs that will establish among the flax and eventually take over from it.

Both of the other two photopoints are expected to reveal similar changes and processes when next photographed. Photopoint 1, at the extreme west of the high ground on Rangiauria, was not visited this trip. At Photopoint 3, looking into Canister Cove from the north, the flax component of the vegetation has dramatically increased, and some loss of remnant trees was evident at the time of the visit.

1.2 The plots

All of the plots are located in Pitt Island Scenic Reserve (Maps 2 and 3). Some of the established plots were hard to find. This was because tree markers had been removed and pegs pulled out. However, good location maps and a bit of mathematical reconstruction allowed all to be accurately resurveyed. What follows is a narrative of the important changes revealed by comparisons of the data from 1980, 1987 and 1993 for each of the previously established plots, and descriptions of the two new ones. Some of the changes have been photographed, and are displayed in colour in Appendix 2 (Figures 2-19). Because of the massive amount of data from each plot, detail is presented graphically in a body at the end of the report (Appendix 3). Because in 1980 only trees were recorded, changes in other vegetation components could only be quantified for the 1987-1993 period.

Plot 1: Exposed forest edge, Glory Block

Situated near the northern boundary of the block, and just inside the fence dividing it from the Canister Cove Block, this plot is on an exposed ridge and spans a wind-shattered forest edge of tarahinau *(Dracophyllum arboreum),* karamu *(Coprosma chathamica),* matipo *(Myrsine chathamica)* and akeake *(Olearia traversii).* In 1980 the site was heavily grazed and browsed by sheep, cattle and pigs but was fenced to exclude sheep and cattle shortly afterwards. In 1987 only a few pigs were present. Now a few pigs and possibly some sheep pass through occasionally without having much impact.

In the canopy, the decline noted between 1980 and 1987 has continued, although at a lesser rate. Deaths have been mostly among karamu, matipo and wheki *(Dicksonia squarrosa),* and now nearly half of the canopy standing in 1980 has gone. The *proportion* of the trees that are dead has remained much the same over the time period.

The life expectancy of the existing canopy, if the trend continues, is between 40 and 50 years. Wind storms appear to be the main cause of decline.

In the subcanopy or upper understorey, a totally different picture is presented. There, plant numbers and density have radically increased, mostly of mahoe saplings. Between 1987 and 1993, overall numbers have increased by 61%. In 1980 there was virtually nothing in this tier. Now there is an average of 3500

saplings, tree ferns and epicormics per hectare (or .35/m²), quite sufficient to replace the canopy should it totally disappear.

The lower understorey reveals a different aspect still. There, a nett loss of 23% in numbers has taken place, most of the change because of mahoe *(Hymenanthera chathamica)* and hoho *(Pseudopanax chathamicus)* saplings growing up into the upper understorey. Meanwhile, many karamu have entered the lower understorey. At 800 per hectare, there are still plenty of saplings, tree ferns and epicormics in this tier. Blackberry (*Rubus fruticosus* agg.) has become much more abundant, especially in open areas, and there has been an increase in pohuehue *(Muehlenbeckia australis).*

On the ground, there has been a major increase in blackberry, water fern *(Histiopteris incisa)* and pennywort (*Hydrocotyle* spp.), and a slight decrease in rank grasses and bidibidi. Leaf litter has built up a lot, and with this many seedlings, especially of karamu, have appeared: there were none in 1980 or 1987.

This plot then demonstrates what can happen once the pressure from sheep and cattle is removed in exposed forest: canopy decline is not prevented, but regeneration of trees to replace the canopy is exuberant. Close by, regenerating tarahinau saplings form a dense thicket where in 1980 there was pasture and bracken *(Pteridium esculentum).*

Plot 2: Treeland (protected/unprotected), southern Pitt Island Scenic Reserve

Located in a flat valley head about 500m southwest of Plot 1, this plot straddles the dividing fence between the Glory Block and the Canister Cove Block. In 1980 the fence did not exist - it was built soon afterwards - and the site was a treeland of karamu, akeake, matipo, hoho, wheki and tarahinau, heavily grazed and browsed by sheep, cattle and pigs.

In 1987 and 1993 the Glory Block side of the fence was largely free of all except a few pigs and the occasional sheep, whereas feral sheep were abundant on the Canister Cove Block side - this reserve was set up specifically to protect those unusual animals. Subsequent to our visit, most of the sheep have been removed, signalling a change in direction of conservation management of southern Pitt Island Scenic Reserve. While this destroys the investigation of sheep impact on vegetation on this site, it will spell good news for forest recovery, as the data demonstrate. The plot will, from now on, simultaneously monitor forest recovery at two different stages: one begun in 1981, the other in 1993.

In the canopy, the trend of tree death has slowed latterly. In fact, the overall number of trees has dramatically increased since 1987, with numerous wheki and some gully fern *(Cyathea cunninghamii),* karamu and wheki-ponga *(Dicksonia fibrosa)* having grown up into the canopy. This is probably attributable to the relatively sheltered situation of this plot and relief from big animal browse (especially from cattle).

The trend in the subcanopy-upper understorey is similar to that in Plot 1. There has been a big increase in plant numbers (58% since 1987), coming from hoho, karamu and mahoe saplings. There are now 1300 stems per hectare in this tier, quite sufficient to replace the current canopy should it collapse. Significantly, all of these are in the part of the plot not accessible to sheep.

In the lower understorey, a slight increase in plant numbers (now at a density of 2000 per hectare) has taken place. There has been a major increase in karamu and a modest one in wheki-ponga, offset by losses of both wheki and hoho, which have grown up into the next tier. Blackberry and pohuehue have also increased. Except for tree ferns, there are no representatives of this tier in the area frequented by feral sheep.

On the ground a decrease in blackberry and pohuehue since 1987 has been recorded, with an increase in Pratia arenaria, pennywort, small rushes, mosses and leaf litter. Most spectacular has been the recruitment of tree seedlings: karamu, mahoe, hoho and matipo, mostly (but not all) in the area protected from sheep, and invariably in semi-shaded microsites.

Overall, Plot 2 indicates that the animal control begun when the fence was built is resulting in speedy forest recovery in all tiers in the Glory Block. By contrast, where there were still plenty of feral sheep at the time of our visit, there are very few plants to replace canopy trees or form an understorey. We are sure that, with the sheep removal, these forests will recover just as rapidly.

Plot 3: Coastal scarp broadleaved forest, Glory Block

Perched on the precipitous scarp of a stream that plunges into Canister Cove, this plot was initially chosen because it was free of cattle and represented coastal broadleaved forest of ngaio *(Myoporum laetum)*, mahoe, matipo, ribbonwood *(Plagianthus regius)*, hoho, akeake, karamu, tarahinau and tree ferns. Each survey has presented an interesting challenge of getting accurate measurements whilst scrambling around on a steep windswept coastal face.

The trend of dramatic canopy death and loss continues. There are now more dead trees than alive ones. Of the 41 trees alive in 1980, in an already shattered canopy, there were 27 in 1987 and only 15 in 1993. At this rate, all of that original canopy will have gone by the turn of the century or shortly thereafter. Storms are the prime destroyer in this exposed site.

In contrast, the trend in the subcanopy-upper understorey is healthy. The regeneration of tree species noted in 1987 has continued, with the numbers of saplings having nearly doubled since then. Most of these are hoho (the rapidly-growing progeny of a single large tree) and mahoe, with some karamu, matipo, akeake, tarahinau and ribbonwood. Thus as the old forest canopy crumbles, a new one is speedily re-forming.

In the lower understorey, there has been little overall change in composition since 1987: a slight decrease in numbers of hoho, wheki and ribbonwood

(either through growing up into the next tier or through death) matched by an increase in kawakawa *(Macropiper excelsum)* and flax.

On the ground, there has been a substantial increase in bidibidi and blackberry since 1987, and a smaller increase in pohuehue and ground ferns. Surprisingly, no tree seedlings were recorded during any of the surveys, suggesting that all recruitment took place between 1980 and 1987, the seedlings very rapidly growing to become saplings in that time.

Plot 3 demonstrates how rapid coastal forest loss can be in the Chathams, but that with protection from browsing animals even that loss is recoverable via natural regeneration.

Plot 4: Forest edge, Waipaua Block (Figure 2 in Appendix 2)

Spanning a forest edge on a gentle ridge, this plot was originally established in 1980 to follow changes after fencing of the Waipaua Block (the main body of Pitt Island Scenic Reserve in the centre of the island; also known as Frederick and Mary Hunt Memorial Reserve). Despite the fence and subsequent animal control operations, domestic and feral cattle, sheep and pigs have persisted on this site, though their numbers are much lower now than in 1980. Sheep are now the main users.

The canopy, mainly of karamu, matipo, hoho, and tree ferns, has continued to crumble rapidly. Losses have affected almost all species, with the greatest change being in the tree ferns (wheki, whekiponga and gully fern). Of the 127 live trees in the plot in 1980, 45% have died, and dead trees now make up 40% of the total number of trees in the canopy. At this rate, the entire existing canopy will have gone in about another two decades.

This state of affairs is confirmed in the subcanopy-understorey. There is only a single sapling, a ribbonwood: there are not even any tree ferns. This suggests that browsing animals have been having a big impact on this site for a long time.

However, in the lower understorey lies hope. Since 1987, the number of saplings has doubled to a density of .31/m² (3100 per hectare). Most are mahoe, wheki and wheki-ponga. Supplejack *(Ripogonum scandens)* and blackberry have increased somewhat too, suggesting that the impact of browsing animals has diminished.

On the ground, the story of optimism continues. Since 1987 there has been a significant increase in herbaceous vegetation, small ferns and seedlings of canopy trees (especially mahoe and hoho).

This plot demonstrates what happens to forest edges in the continued, though diminished, presence of browsing animals: a regeneration gap opens up and is only slowly filled, initially by a developing thicket of tree ferns that provides shelter for the establishment of seedlings and saplings of tree species. Only time will determine the outcome: whether the saplings will grow up to fill the canopy gaps before the current trees disappear, or whether they will

be exposed when the current canopy collapses and form a lower canopy that will gradually push upwards against the elements.

Plot 5: Sheltered woodland, Waipaua Block (Figure 3 in Appendix 2)

Plot 5 is only about 50m from Plot 4, but in the flat head of a small valley in open-canopied woodland of karamu, matipo, tarahihau and akeake trees, beneath which is an abundance of tree ferns. In 1980 the area was heavily used by domestic and feral animals, so was quite open beneath the trees and tree ferns. By 1987, blackberry thickets had become a feature of the site, growing up as animal numbers diminished, and by 1993 the blackberry was so rampant that we had to don protective gear and summon considerable reckless energy to re-measure the plot.

The trend of nett loss of canopy trees between 1980 and 1987 has, as in Plot 2, been reversed. Since 1987, 14 new trees - mainly karamu, mahoe, wheki and gully fern - have been recruited into the canopy, whilst 7 trees have died. The trend of regenerative recovery is very apparent in the subcanopy-upper understorey, where there has been a significant increase in the numbers of woody saplings and flourishing epicormic growths. Most of this change has been in mahoe, with a strong contribution too from karamu. Not yet big or numerous enough to replace the existing canopy, these saplings will nevertheless soon begin to plug canopy gaps.

There has been an embellishment of this regenerative recovery in the lower understorey, where the numbers of saplings and tree ferns have trebled since 1987 to .67/m² or 6700 per hectare. Most of this increase has been in mahoe, and to a lesser extent in karamu. The radical increase in blackberry already referred to is most apparent in this tier, as is an increase in supplejack and pohuehue.

Changes on the ground since 1987 have been a big increase in herbaceous plants, hook-grass *(Uncinia uncinata)* and tree seedlings (especially mahoe and hoho), with a simultaneous decrease in pasture species and, surprisingly, ground ferns. These changes have accompanied the buildup of a layer of tree fern litter and increased shading from blackberry in particular.

Plot 5 illustrates yet again the potential for forest recovery when browsing animals are sufficiently lowered in number, and the heightened speed of this process in sites sheltered from the brunt of storms. The blackberry is likely to be transitory, fading out when it becomes fully shaded: in the meantime it armours the site against browsing mammals and humans alike.

Plot 6: Sheep-occupied forest, Canister Cove Block

This is the only plot wholly within the area set aside around 1980 for the protection of a flock of the distinctive feral Pitt Island sheep (Saxon merinos). It is in a place relatively lightly used by the sheep, so reflects the best scenario of how forests survive in their presence. Feral pigs also used the site, though not intensively. Subsequent to our 1993 survey, the sheep have

been removed and the pigs have been hunted as part of a change in management for this part of the reserve. From now on, then, the plot will monitor recovery of the forest following relief from large mammal impact.

The trend of canopy death and loss recorded between 1980 and 1987 has continued since, but at a lower rate. It has been accompanied by significant recruitment, especially of tree ferns. As a result, the canopy is more or less holding its own, in terms of numbers of trees, against the elements. A partial explanation could lie in the site's semi-sheltered location, tucked just below a prominent ridge and flanked by two spurs.

In the subcanopy-upper understorey, the number of saplings has doubled since 1987, although it is still low (290 per hectare). Most increase has been in mahoe.

In the lower understorey, the continued impact of sheep is reflected in the lack of change since 1987 and the preponderance of tree ferns (mainly the less palatable wheki and wheki-ponga). Only where there are thickets of supplejack and blackberry are seedlings growing up into saplings.

On the ground, there has been a significant increase in herbaceous plants, and a large increase in the numbers of seedlings of all canopy tree species. However, these seedlings have been browsed off before they could reach more than a few centimetres in height.

On this site then, forest regeneration has been impeded, though not totally halted, by the feral sheep (and to a lesser extent pigs). The sheep probably used the forest more in winter, when pasture growth was low, and made most of their impact then.

Plot 7: Rank grassland. Glory Block (Figures 4 and 5 in Appendix 2)

Set on a flattish ridge above the coastal scarp that plunges into Canister Cove, this plot was established in 1987 to follow the process in pastureland "retired" from grazing around 1981.

In 1987, the plot had only two trees (large tarahinau) and a cover of rank grassland mainly composed of sweet vernal *(Anthoxanthum odoratum)* and Yorkshire fog *(Holcus lanatus),* with substantial amounts of bidibidi. In the north-western corner was a patch of blackberry.

The situation in 1993 initially looked similar, but some significant changes have occurred. The most impressive of these is that flax, absent from the plot in 1987, has made a major appearance. 19 clumps and bushes were counted, 9 of these being multi-fanned. Nearby bushes, waist high in 1987, are now over head height and much more extensive.

Pratia arenaria, a handsome creeping herb with star-like flowers and purple fruits, has substantially increased in abundance, and now threads its way through much of the rank pasture. The blackberry patch has expanded too, and at the current rate of spread has the potential to eventually cover the entire plot, taking between 40 and 65 years to do so.

There are, as yet, no tree seedlings in the plot, although some have appeared in similar rank pasture nearby. It is expected that in the long term forest will return to this site, so long as browsing animal numbers are kept low. Just how long the process will take, and how persistent the stages dominated by pasture grasses, herbs, flax and blackberry will be, isn't clear at this stage.

Plot 8: Swamp, Glory Block

In 1987 it was apparent that rapid change was happening in the swamp vegetation of the reserve following stock removal. Hence the establishment of this plot to find out just what the changes were and where they were leading.

Five years later, pigs were still using the area regularly, but there was no sign of other large feral animals. Six of the 16 trees (mostly tarahinau) in the plot have died, but there has been a profound increase in saplings and shrubs greater than 1.5m tall (from 600 per hectare in 1987 to 2000 per hectare in 1993) - also mostly tarahinau.

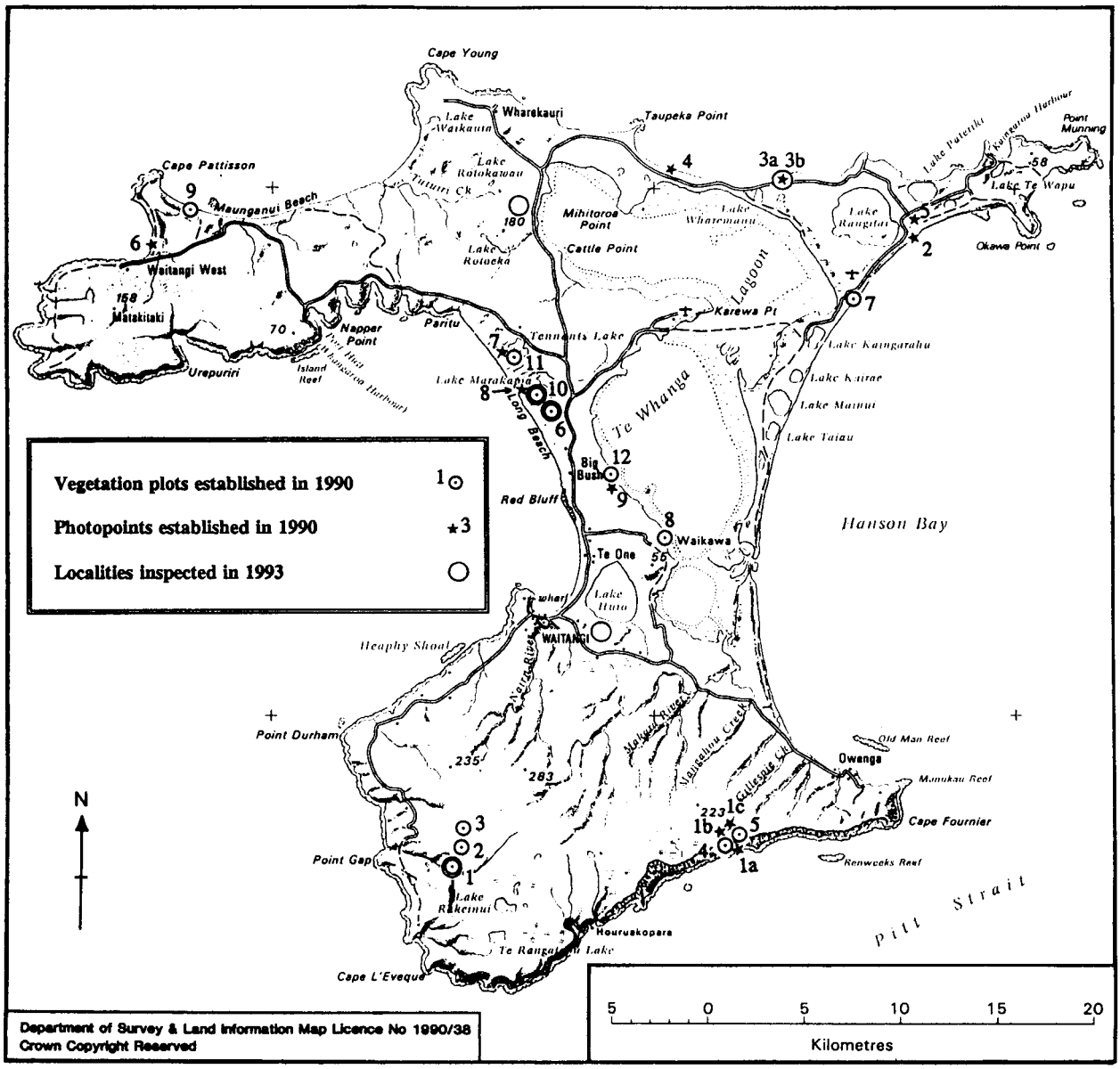
Just as dramatic has been the change in numbers of saplings and shrubs between 0.3 and 1.5m tall: from an estimated 900 per hectare in 1987 to around 13,000 per hectare in 1993, composed largely of tarahinau but also containing many keketerehe *(Olearia oporina* var.), karamu, *Coprosma propinqua* and wheki. Just outside the plot to the south-west, but still in the swamp, rautini *(Brachyglottis huntii)* is also regenerating prolifically. On the ground, flax has increased radically, as have the ferns kiokio *(Blechnum capense* agg.) and small kiokio (*B. procerum),* and there has been a significant increase in numbers of seedlings of tarahinau and keketerehe.

On the face of it, the swamp now appears damper and spongier than it did in 1987. It is certainly better clothed, and appears to be recovering as a living system, having suffered in the past from the effects of fires and large animals. It is too soon to say for sure where the vegetation is heading longterm, but there is no doubt it has been "caught" just in time, before the relics of the former swamp forest disappeared, along with the chance of their regeneration.

Plot 9: Peat dome. Waipaua Block (Figures 6 and '7 in Appendix 2)

In the east of the Waipaua Block are several fascinating raised domes, which have the appearance of geological structures. They are in fact living systems like the swamps, having been built up over thousands of years by the constant rain of leaf litter - probably mostly tarahinau needles - forming a deep forest carpet that was steadily converted into the peat beneath.

With forest removal, the supply of leaves has ceased, the litter carpet has gone and the surface peat has dried out. These effects, combined with fires and the browsing, trampling and rooting of pigs, sheep and cattle, have initiated the crumbling of the dome systems. Now they are steadily blowing and washing away. Without a forest cover they are dead systems and will disappear off the face of Pitt Island.



MAP 4: CHATHAM ISLAND, SHOWING LOCATIONS OF VEGETATION MONITORING SITES

But they can be revived, as our first survey shows.

On the advice of Amanda Baird (DOC, Canterbury), we looked for a good site for a permanent plot during this expedition. We chose the north-eastern edge of the northern-most peat dome, since it still had some tarahinau trees, remnants of the former dense tarahinau forest that would have covered all of these domes. The trees are very exposed to the elements, and their roots are progressively being unearthed, as animals trample around them and the peat dries, crumbles and disappears.

Throughout the plot is a low vegetation, mostly less than 1 m tall, of bracken, small kiokio, sedges, knobby clubrush *(Isolepis nodosa)* and blackberry, with some small wheki and patches of the umbrella fern *Gleichenia dicarpa.* Within this lies a potential forest: masses of small tarahinau seedlings, mostly less than 20cm tall, and a few seedlings of other trees [hoho, mahoe, karamu and hokataka *(Corokia macrocarpa)*]. There are at least 1500 of these tiny tarahinau, at varying densities (up to **20/m²** in places): an average of at least 20,000 per hectare, quite enough to regenerate a forest.

The problem at the moment is that regeneration is being prevented by browsing and trampling of sheep, and to a lesser extent by the impacts of pigs and cattle. The peat domes are criss-crossed by the tracks of these animals. There is no doubt that if their numbers were lowered substantially, the "mini-forests" of tarahinau, now thwarted in their attempts to grow, would rocket away to become at first dense thickets, then closed-canopy tarahinau forests.

With relief from browsing, the growth of blackberry and bidibidi would undoubtedly accelerate too, but the evidence from the small portions of the domes that receive little attention from big animals is that the tree species outstrip all other growth. This could be tested simply enough by erecting an exclosure and following the process inside and out, but it would take a few years to show conclusive results: years that the whole system could be recovering.

Plot 10: Nikau forest, Cabbage Tree, Waipaua Block (Figure 9 in Appendix 2)

Prior to and during our expedition, concern for the future of the nikau *(Rhopalostylis **sapida***[2]**)** forests that are a feature of central Pitt Island - and have their stronghold there - was expressed from several quarters. We therefore had as good a look at the forests as time allowed, and established a permanent plot to get to grips with and follow their progress.

We chose a site that we could be sure of finding again in 5 years time, that represented the forest with emergent nikau, rather than the woodlands where they are most plentiful, and that *should* show nikau regeneration because of plentiful seed source, shelter from cold winds and plentiful light. The plot was, accordingly, established just north of the summit of Cabbage Tree. This hill was named for its nikau, referring to the early use of the growing shoots for food.

[2] Although currently given the same species name as NZ mainland nikau, that in the Chathams is a distinct form found nowhere else on earth, and is listed as a threatened plant.

In the plot, like much of the forest in the vicinity, elegant nikau palms are emergent from a lower canopy of karamu, hoho, tarahinau and matipo. Beneath the canopy, sometimes contributing to it, is a dense tier of tree ferns (wheki, wheki-ponga, ponga *(Cyathea dealbata)* and gully fern). Beneath this again are entanglements of supplejack, thickets of shield fern *(Polystichum vestitum),* deep leaf litter and various tree seedlings.

Pigs and feral sheep are common enough to maintain an open understorey depleted of palatable plants and to prevent regeneration of forest trees, except where they establish out of reach on tree fern trunks. Although there are enough seedlings getting started on the forest floor to ensure plentiful regeneration, almost all are being browsed, trampled or rooted up before growing tall enough to be animal-proof. Nikau seedlings were found throughout the plot at a density of about one every 5 square metres (over 1800 per hectare), but none were taller than 35 cm and most were less than 20 cm tall. None will become palms unless pig and sheep numbers are substantially reduced.

In and near to the plot we encountered adult nikau snapped off (presumably by gales). The seed source for nikau is thereby diminishing year by year.

This picture was repeated wherever we looked at nikau forests on Pitt Island, although the plot is the only place we have a measure of it. Nikau is simply being prevented from regenerating, except for the odd plant on stream banks or in blackberry thickets out of reach of pigs and sheep. Pigs eat the fruit and root up seedlings, some of which they also consume. Sheep (and the occasional cattle) nibble off any seedlings they find.

If serious animal control is not carried out and maintained in the Waipaua Block of Pitt Island Scenic Reserve, we are sure nikau will progressively decline there (and if left long enough disappear altogether). The plot will simply record that decline, and will reinforce what has already been documented in the historical photographic record of Pitt Island (Figure 10 in Appendix 2, that shows nikau forests in the process of disappearing many decades ago).

The contrast with the situation in Nikau Bush Scenic Reserve (Chatham island), where good animal control has been put in place for not much more than a decade, is stunning (Figure 18 in Appendix 2). There nikau regeneration is prolific and will ensure that at least somewhere the Chatham Island nikau will persist. What Pitt Island Scenic Reserve offers that is much more significant is the potential to restore and maintain a whole living forest system: Nikau Bush Scenic Reserve is by comparison a pocket handkerchief, at best a museum showpiece.

2 CHATHAM ISLAND

2.1 Vegetation plots

We revisited three of the twelve vegetation plots we established in 1990 (Map 4, and Walls and Scheele 1990), because they were of particular focus for

DOC in terms of current management questions and were accessible in the time we had available.

Plot 1: Kopi forest, "Abyssinia", Tuku Nature Reserve (Figures 13 and 14 in Appendix 2)

This plot was established primarily because of the importance of the kopi *(Corynocarpus laevigatus)* in providing food for the very rare parea (Chatham Islands pigeon). In 1990, possums were abundant and evidently severely damaging the kopi canopy. Feral sheep, pigs and cattle browsing beneath the canopy ensured that there was virtually no understorey and almost no signs of regeneration.

Since then, pest control operations have reduced possums, sheep, pigs and cattle to low numbers. At the time of our 1993 visit, there were still signs of browsing and tracking, but there were also clear indications of a forest undergoing recovery.

In the canopy, there was no obvious tree death or radical wind damage, though a few branches had been brought down by the southwest storm of 31 January 1993. The kopi canopies looked decidedly healthier than in 1990, with much new leaf growth. Matipo trees were in full fruit, providing food for birds and seeds for the forest floor. Indeed, the biggest change has taken place on the ground. There has been profuse regeneration of ground ferns, herbs, tree ferns, supplejack and epicormic shoots at the bases of trees. Most spectacular has been the appearance of tree seedlings (mahoe, hoho, karamu, kawakawa, hokataka, matipo and kopi): virtually absent in 1990 but by 1993 throughout the whole plot at an average density of at least **5/m²** (50,000 per hectare).

The animal control programme is clearly of direct benefit to the health and recovery of the kopi forest. In turn, it is obvious that indigenous wildlife, notably parea, are far better provided for in terms of habitat quality. As forest recovery continues, so too should that of the wildlife dependent on it.

Even more spectacular has been the regeneration of tarahinau on the south side of the Tuku a Tamatea River where fenced to exclude domestic cattle and sheep (Figure 15 in Appendix 2). There, from a skeletal treeland and low fernland, a new tarahinau forest is rapidly rising. This too will hold value for Chatham Islands fauna.

Plot 6: Henga Scenic Reserve, southern forest edge

The lack of understory regeneration on this forest edge, despite rampant regeneration elsewhere in the forests of this reserve (fenced to exclude domestic stock around 1979), posed an obvious question: what was the cause?

In 1993 we found considerable recent storm damage: trees broken, trees defoliated, leaves wind-burnt. The understorey mahoe saplings were taller than in 1990, but with their growing tips wind-burnt. Mahoe seedlings had sub-

stantially grown up since 1993, but had been massively defoliated recently. Our conclusion was that regeneration at this forest edge was being impaired by a combination of two things: exposure to damaging winds, and browsing from stray stock (sheep and/or goats - we saw sheep in the immediate vicinity).

Plot 10: Henga Scenic Reserve, dunes

Formerly forested, these dunes now have a mosaic of shrub-grasslands, forest patches and treelands. The plot was established to study the interplay of the participants in this mosaic, particularly whether forests could regenerate and whether the exotic marram grass was problematic.

In 1993 we found much recent storm damage to trees, particularly akeake. In the exposed plot site there was no sign of regeneration of forest trees. However, mahoe was regenerating prolifically in more sheltered sites nearby. Marram grass *(Ammophila arenaria)* appeared not to have increased in dominance, if anything it seems to be being squeezed out by native shrubs, vines, herbs and rushes (*Styphelia parviflora, Pratia arenaria, Coprosma acerosa,* pohuehue and knobby clubrush).

We had the impression that weka were much more abundant in the Henga Scenic Reserve in 1993 than in 1990.

2.2 Cabbage trees (Figure 17 in Appendix 2)

Botanists visiting the Chatham Islands have considered the cabbage trees (ti kouka, *Cordyline australis*) to have been introduced from mainland New Zealand, but the question about their origin has never been seriously tackled. So in response to a request from Philip Simpson (Science and Research Division, DOC) we looked at what stands of cabbage trees we could find.

All the cabbage trees we saw were in woodlots, plantations, forest remnants and gardens. They were not widespread, and none were far from human habitation or in undisturbed forest. The largest stand by far was that on the south-western shores of Lake Huro at the mouth of Mangape Creek (grid reference: NZMS 260 Chatham Islands Sheet 1/473552). There, numerous cabbage trees are growing in a secondary open forest or woodland on flat, wet ground with akeake, mahoe, hoho and karamu. They are erect trees up to 15m tall, with stiff leaves. There are many saplings 5m or less tall, but few seedlings (presumably because of cattle and sheep browsing).

What we saw is consistent with cabbage trees having been introduced from New Zealand, probably not much more than a century ago, and although able to reproduce and become dominant in localised disturbed sites, not posing a competitive threat to Chatham Island forests. It would be worthwhile exploring written, photographic and oral history records to see whether they shed further light on the picture.

2.3 *Nikau Bush Scenic Reserve (Figure 18 in Appendix 2)*

Having examined the state and trend of the nikau forests and treelands on Pitt Island (as described in our Plot 10 report), we visited Nikau Bush Scenic Reserve for comparison. This reserve is the last remaining stronghold of nikau on Chatham Island (although a few plants occur elsewhere on the island). It was formerly so heavily browsed by domestic stock (sheep, cattle, goats and horses) that there was essentially no understorey beneath the trees, but for the last 13 years or so it has been fenced.

The result of the animal control is a revelation. Beneath the mixed canopy of nikau, kopi, karamu, matipo and hoho is a vigorous understorey of regenerating trees. Hoho saplings form thick stands in places, up to 5m tall. The other tree species are also well represented as saplings and seedlings, as is kawakawa. Nikau seedlings and saplings are abundant, forming dense thickets of different age classes, from tiny new seedlings to older plants 1.5m tall.

This is just what would be expected, with a plentiful seed source, relief from heavy browsing and a good environment for regeneration. This vigorous regeneration response is echoed in many nikau forests in New Zealand where good control of browsing animals has been achieved. We have seen examples in Hawke's Bay, East Coast, Bay of Plenty, Waikato, Taranaki and the Marlborough Sounds. It illustrates how the nikau forests of Pitt Island Scenic Reserve would respond if sufficiently protected from browsing pressure.

2.4 *Ocean Mail kopi (Figure 19 in Appendix 2)*

What is happening at Ocean Mail is an astonishing rescue from the brink of extinction, to rival, for an ecologist, that of the resurrection of the black robin. The awful "standing dead" kopi skeletons, relics of the former lush forests there, have revealed an enduring spark of life that would have been hard to credit three years ago. Since being fenced to exclude domestic stock in 1991, the apparently dead trees, and even cut stumps, have begun putting out fingers of delicate green leaves, mostly as epicormic shoots near the ground. Their root systems have remained alive, whilst their branch systems and trunks have died and crumbled. Until stock were controlled, new shoots were browsed off as they appeared, and would have eventually ceased to appear altogether.

It will be many years before a new kopi forest re-establishes at Ocean Mail, and continued control of animal and plant pests will be necessary. Scattering of kopi seed over the area - the immediate seed source has been destroyed and will take a decade or two to re-establish - would hasten the recovery process.

2.5 *Regeneration pathways and processes*

Each site we visited on Chatham Island where forests were regenerating told a local story. Each had a different canopy composition. Each had a different dominant regenerating species:
- mahoe in Henga Scenic Reserve;
- hoho in Nikau Bush Scenic Reserve;

- tarahinau at Tuku a Tamatea River;
- kawakawa at "Abyssinia";
- enclaves where karamu, kopi, nikau or matipo were locally dominant.

The dominant regenerating species did not necessarily tally with the canopy composition. What this illustrates is that the nature of regeneration is a product of:
- local conditions;
- seeds available;
- microclimate;
- type and numbers of browsers;
- history of the site.

It isn't easy to predict what forest structures will result from regeneration in the long term. The principles however are clear and consistent, despite the local variation. As soon as browsers are controlled to low enough levels, Chatham Island trees regenerate profusely by way of seedlings, saplings and epicormic growths.

Understories quickly re-establish beneath depleted canopies, new trees establish in open sites, and forests can re-form virtually anywhere where there were forests formerly. The pace and direction of regeneration depend on a number of factors, some of which are out of human control. The one that can be most readily managed, and that which makes the difference between collapse and recovery, is the number of browsing mammals on the site.

For Chatham Island then, as for Pitt island, continued mammal control will be a fact of life for restoration and maintenance of the unique vegetation communities, flora and fauna of these islands.

Conclusions and recommendations

1 PITT ISLAND

1.1 Forest canopy change

Forest canopy decline noted in 1980 and 1987 continues in most places, being fastest in exposed sites (forest edges and coastal scarps) and slowest in sheltered sites (gullies, hollows). Storm damage is the prime cause. Some recruitment into the canopy has occurred in places: mainly tree ferns in canopy gaps but also saplings of broadleaved trees and tarahinau. So far, recruitment has not kept pace with decline at any site.

1.2 Regeneration of forests and treelands

In forests and treelands where browsing mammal numbers have been relatively low since the early 1980s, there is abundant regeneration of canopy

tree species. Saplings and seedlings now form subcanopies, understories and ground cover even in places where there were no such tiers in 1980. These plants will strengthen or replace canopies as they crumble over the next few decades, and full multi-tiered forest structures should eventuate in the long term.

In contrast, where mammal numbers are still relatively high there is little regeneration and the long term result would be conversion of these forests into treelands followed by their eventual loss altogether (Figure 11 in Appendix 2). The major impediments to regeneration are domestic cattle and sheep and feral sheep and pigs.

1.3 Weeds

Blackberry and bidibidi have proliferated in many places following control or removal of domestic and feral browsing mammals. Although they make things unpleasant for humans, they are not threats to regeneration of forests or treelands. Both relinquish their dominance as forest vegetation establishes, grows through and overtops them.

Himalaya honeysuckle *(Leycesteria formosa)* and tutsan *(Hypericum androsaemum)* are present in the Waipaua Block of Pitt Island Scenic Reserve in modest amounts. Both have bird-borne fruits and may eventually displace native vegetation in semi-open sites if not controlled. Gorse *(Ulex europaeus)* is also established on Pitt Island, though not yet in the reserve. Although not likely to threaten native vegetation, it too should be monitored. All three weeds could be eradicated with relatively little effort now: the task is likely to grow much larger if left.

1.4 Retired pasture

Pasture becomes rank when retired from grazing, and its density is an initial impediment to forest regeneration. However, other vegetation - notably flax, blackberry, bidibidi and various native herbs - establishes and within a few years begins to break up the pasture. This process in turn provides opportunities and shelter for the establishment of forest tree seedlings and saplings. Long-term, this should lead to regeneration of forests on most sites formerly in pasture, without any other human intervention.

1.5 Treelands

The treelands are not natural. They are the product of progressive disintegration of the former forests on those sites, through a combination of wind damage, fires, tree cutting, natural death and, most significantly, browsing and grazing by introduced mammals. They can persist for decades, but the trees are very vulnerable to wind storms and climatic stress and crumble or topple at a greater rate than those in forests (Figures 8 and 16 in Appendix 2 show the damage a single gale can do). As anyone who has tried to grow trees in the open has found, side-shelter is highly important for their establishment, health and survival. Browsing and grazing prevents regeneration of trees, and where it persists those treelands on Pitt Island will disappear within 50 years. This process has been frequently noted in the Chathams, but has not been

quantified until now. Our plots show the very rapid rates of decline of the treelands, but also their ability to recover and regenerate to forests when relieved of browsing and grazing. At greatest risk currently are the treelands in the south end of the Waipaua Block of Pitt Island Scenic Reserve, and those outside it to the west and south.

1.6 Glory, Canister Cove and Rangiauria Blocks

Forest recovery is well on the way in all places where sheep and cattle have been removed for over a decade. That is, the animal control measures that have been taken are adequate to allow forest recovery. They will need to be maintained to ensure this. With sheep removal, the eastern portion will follow a similar recovery path to that of the western portion. At Rangiauria (Black Head), so long as the animal control remains good, a woody cover of trees and shrubs, probably dominated by akeake and keketerehe, will return to all but the rockiest of sites. Meanwhile it will become a stronghold for Chatham Islands giant herbs.

1.7 Waipaua Block

In some places animal control has been sufficient to allow forest recovery, though nowhere has it been as effective as in the southern block. Hence there will be a more faltering transition back to healthy forests there unless animal control efforts are stepped up.

In many places there are still too many animals to allow recovery - or even replacement - of the existing species in the canopy. The inevitable result then will be to lose forest quality, and in some sites the forest cover itself (Figure 12 in Appendix 2).

The recent decision to retain a flock of c.250 feral sheep in the Waipaua Block has radical implications for the long-term condition of the vegetation, and for conservation management. If the sheep are allowed to roam throughout the whole block, they will perpetuate the problems of forest regeneration impairment, especially in the places they frequent most. It is therefore recommended that they be confined to just part of the block, perhaps on the western side. If enough area was fenced and subdivided, the sheep could be periodically moved to allow pulses of regeneration in all places.

Pigs are likely to pose the major animal control problem in the Waipaua Block in future.

1.8 Nikau forests

The nikau forests are deteriorating in quality and not recovering. They will eventually disappear entirely if the current management regime is pursued. Management options to address this include:

a) More effective animal control over the whole area. This is our preferred option.

b) Subdivision of the block so that the limited level of animal control can be better targeted for the benefit of nikau. The block could be subdivided into, say, three sections. Animal control could be pursued vigor ously in each section in turn, with 20 years being a minimum period before control was relaxed (this regime would create a 60-year rotation of piecemeal sustained animal control). This should provide enough of a burst of canopy and subcanopy recruitment in each section to ensure forest recovery. This is not our preferred option, but a compromise that could have interim benefit.

c) Fencing of a core nikau area to exclude stock and allow more effective feral pig and sheep control. This option would not deal with the forest deterioration elsewhere.

1.9 Peat domes

These distinctive Pitt Island features are at risk of dying and disappearing altogether, such is the current impact of large mammals. However, they will rapidly recover through forest regeneration if animal numbers are reduced sufficiently: in most places there is a "mini forest" of tree seedlings poised to grow, if allowed. At the very minimum, one whole dome should be ring-fenced and accorded greater protection. It would be preferable, however, to do effective mammal control over the whole reserve block, so that all domes can recover.

1.10 Swamps

These too are distinctive living systems that will deteriorate or recover according to the numbers of sheep, cattle and pigs present. Plot 8 in the Glory Block demonstrates the rapid recovery potential, and the swamp there is well on the way to a return to health. The swamp in the Waipaua Block would benefit from more effective animal control. It has been suggested that vegetation recovery there would help restore and ensure the quality and reliability of water flow in Waipapaku (Second Water Creek).

1.11 Implications for wildlife

Protection of wildlife, particularly native birds, is popularly cited as the prime reason to do conservation on the Chatham Islands. Whilst it is clearly a strong motivating factor for DOC work on Pitt Island, the Department has a responsibility for indigenous ecosystems as a whole. The growing awareness of the functioning of ecosystems and the holistic concept of biodiversity conservation is helping put wildlife conservation within a context of nurturing whole landscapes.

Thus the health, diversity and resilience of the indigenous ecosystems is fundamental to the survival and wellbeing of indigenous wildlife on the island.

Because most of Pitt Island was formerly forested, most of its indigenous wildlife (including many invertebrates as yet unknown), depends for its survival on forest protection, either directly or indirectly: without forests they have nowhere to live and nothing to eat.

It can be assumed with confidence that nurturing forests on the island will benefit wildlife. Our vegetation monitoring shows that in some places forests are recovering, whilst in others they are still deteriorating. They also show that the full complement of forest types is not being adequately looked after.

The current management regime will lead to the loss of wildlife dependent on some kinds of habitats (eg. peat domes and nikau forests), and also to the loss of resources that may be needed seasonally by some animals (eg. nikau flowers and fruit). It will also lead to the loss of considerable areas of treelands that are serving as significant sources of food and shelter for birds and other native fauna, and which are the seed and shelter trees for forest regeneration on those sites. Better animal control in the Waipaua Block of Pitt Island Scenic Reserve would address most of these problems.

For wildlife, it is considered better to have a landscape mosaic of interconnected habitats than isolated chunks of habitat. From that point of view creation of connections between the southern blocks and the Waipaua Block of Pitt Island Scenic Reserve should be explored: both around the coasts and through the centre of the island.

If restoration of forest vegetation is done through planting or seed distribution, plants could be chosen that have particular value to wildlife, eg. ngaio, hoho, nikau and kopi for fruit-eating birds. In principle it is probably wise not to use exotic plants, in case they become weeds or act as hosts to exotic organisms that might disrupt natural systems.

1.12 Implications for plants

For the special plants of Pitt Island, the implications of management and change are similar to those for wildlife. Protection of as wide a range as possible of natural habitats in good condition will ensure the survival of rare endemic Chathams plants such as the forget-me-not *(Myosotidium hortensia),* rautini, Barker's koromiko *(Hebe barkeri), Astelia chathamica,* Cox's matipo *(Myrsine coxii)* and Dieffenbach's speargrass *(Aciphylla dieffenbachii).* Even species that are locally dominant on Pitt Island, such as nikau and keketerehe, are listed as threatened, and are in fact quite vulnerable in what should be their strongholds.

The prime management change required to ensure long term protection for flora on Pitt Island is better browsing mammal control in the Waipaua Block. The results of our 1993 survey reinforce this and reassert our 1987 conclusions and recommendations (Walls 1988), as well as those of Baird (1993), Given and Williams (1984) and Kelly (1983).

1.13 Monitoring

We have now established the basis for longer term ecosystem monitoring on Pitt Island. Our 5-yearly monitoring of vegetation condition and trend provides the foundation. If specific monitoring of wildlife and threatened plants were coupled to this foundation, it would provide the means to assess what is happening on the island and the effectiveness of management regimes. It would be able to directly guide management for the best and most cost-effective outcome for conservation.

Some wildlife monitoring has been started on Pitt Island (birds, skinks, invertebrates and feral mammals). However, it has not been set up with reference to the vegetation monitoring. We are certain that the value of this wildlife monitoring, and the ability to interpret its results, would be greatly enhanced by modifying it to make the connection, and we make suggestions below accordingly.

It is recommended that the following monitoring system, or something resembling it, be established:

- Continuation of 5-yearly monitoring of established vegetation plots: ours and those of Mike Rudge in the former sheep reserve (Rudge 1988).

- Monitoring of established photopoints, at least 5-yearly.

- Establishment of a few further vegetation monitoring plots and photopoints to complement those already in existence: eg. treelands in and adjacent to the Waipaua Block of Pitt Island Scenic Reserve; tarahinau - hoho forests in the Waipaua Block; pasture in the former sheep reserve (Canister Cove Block). This is being addressed.

- Establishment of a bird monitoring system, to be monitored at least every 2 years: eg. 5-minute bird counts near vegetation plot sites; parea display dive counts from strategic watch sites; sea bird burrow checks and counts. The two current bird count lines should be supplemented by a line in the heart of the Waipaua Block (eg. nikau forest) at the very least.

- Establishment of an invertebrate monitoring system, to be monitored at least 5-yearly: eg. pit trapping, malaise trapping and light trapping near a range of vegetation plot sites. The pitfall trapping begun in 1994 has given an indication of what is possible, but a wider range of sites, use of more than one sampling method and running trap lines simultaneously would give much better results.

- Establishment of a monitoring system for condition and trend of threatened plants in the Scenic Reserve, to be monitored at least 2-yearly.

- Establishment of a system to monitor phenological events such as fruiting of nikau and hoho.

- Establishment of a system to regularly assess introduced mammal numbers in a variety of sites.What has been started in 1994 goes a long way to addressing this.

1.14 Partnership

It became clear to us during our 1993 trip that killing animals and building good fences will not be enough to ensure conservation of the distinctive combination of native vegetation and fauna that makes Pitt Island special on earth. What is also required is a solid working partnership between the main groups of human participants, set up so that both people and nature benefit.

Because of the island's location, history, land tenure and social fabric, conservation can only be effective if it has the blessing of the islanders. The way forward requires sensitivity, respect, creativity and goodwill on both sides (DOC and Pitt Islanders), founded on an informed understanding of:

- the uniqueness of Pitt Island;
- the responsibilities of DOC under the Conservation Act, Atawhai Ruamano and the Conservation Management Strategy for the Chatham Islands;
- the needs and wishes of the islanders;
- the potential for partnership to the benefit of all.

A positive start has been made to help make conservation a sustainable way of life on Pitt Island, but in practice there is a long way to go. One model for achieving further progress in this regard would be to include the people of the island in most of the conservation management and monitoring work, with DOC having a largely advisory and guiding role. That work and nature tourism could provide both a significant income and a source of pride for the islanders. Such partnerships operate elsewhere in the world, both in island and mainland situations (eg. Shetland Islands, U.K.; Kakadu National Park, Australia). Pitt Island offers a similar such opportunity. The establishment of the Pitt Island Reserves Committee, which met for the first time in February 1994, addresses many of these issues.

2. CHATHAM ISLAND

All that applies to Pitt Island is also essentially true for Chatham. The scale and intensity are just a little different, and there are local variations. However, the themes and processes surrounding vegetation condition and trend and the implications for fauna and flora are the same: the basic conclusion being that with effective control of browsing mammals, native vegetation will recover and the wildlife dependent on it will benefit.

The partnership principle runs parallel too: with good understanding and co-operation between management agencies and local residents, both conservation and island community needs can flourish.

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Appendix 1: Glossary of Plant Names

COMMON NAME	BOTANICAL NAME
akeake	*Olearia traversii*
Barker's koromiko	*Hebe barkers*
bidibidi	*Acaena anserinifolia*
* blackberry	*Rubus fruticosus* agg.
bracken	*Pteridium esculentum*
‡cabbage tree	*Cordyline australis*
coprosma hybrid	*Coprosma propinqua x robusta*
Cox's matipo	*Myrsine coxii*
Dieffenbach's speargrass	*Aciphylla dieffenbachii*
flax	*Phormium tenax*
forget-me-not	*Myosotidium hortensia*
* gorse	*Ulex europaeus*
gully fern	*Cyathea cunninghamii*
*Himalaya honeysuckle	*Leycesteria formosa*
hoho	*Pseudopanax chathamicus*
hokataka	*Corokia macrocarpa*
hook-grass	*Uncinia uncinata*
karamu	*Coprosma chathamica*
kawakawa	*Macropiper excelsum*
keketerehe	*Olearia oporina* var. *(0. chathamica)*
kiokio	*Blechnum capense* agg.
knobby clubrush	*Isolepis nodosa*
kopi	*Corynocarpus laevigatus*
mahoe	*Hymenanthera chathamica*
mamaku	*Cyathea medullaris*
*marram grass	*Ammophila arenaria*
matipo	*Myrsine chathamica*
ngaio	*Myoporum laetum*
nikau	*Rhopalostylis sapida*
pennywort	*Hydrocotyle* spp.
pohuehue	*Muehlenbeckia australis*
ponga	*Cyathea dealbata*
rautini	*Brachyglottis huntii*
ribbonwood	*Plagianthus regius*
shield fern	*Polystichum vestitum*
small kiokio	*Blechnum procerum*
supple jack	*Ripogonum scandens*
*sweet vernal	*Anthoxanthum odoratum*
tarahinau	*Dracophyllum arboreum*
*tutsan	*Hypericum androsaemum*
water fern	*Histiopteris incisa*
wheki	*Dicksonia squarrosa*
wheki-ponga	*Dicksonia fibrosa*
*Yorkshire fog	*Holcus lanatus*

*exotic (introduced) plant
‡ NZ mainland plant

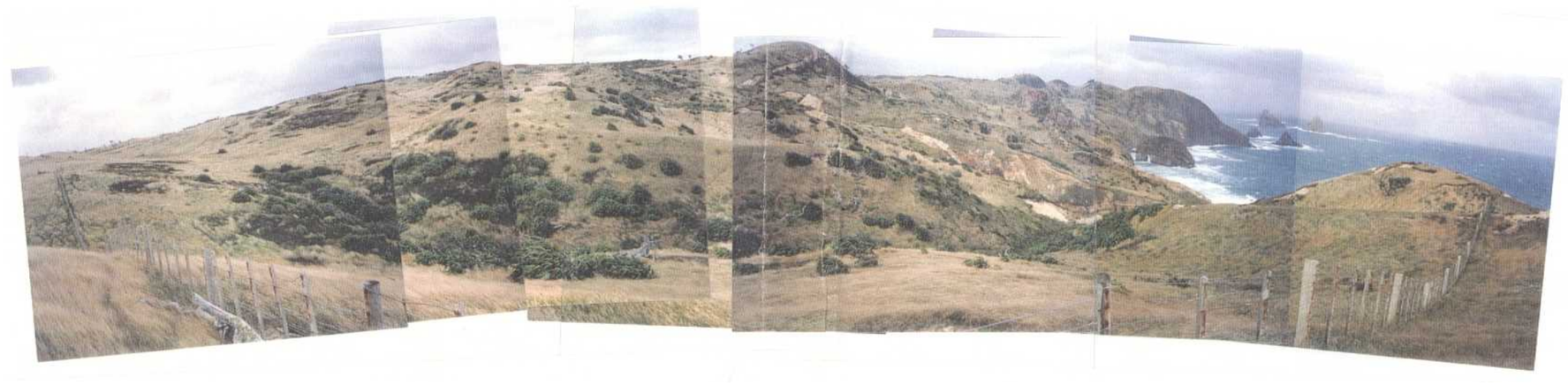
Appendix 2:
Colour Photographs of Photopoints, Plots and Vegetation, Pitt Island and Chatham Island

(FIGURES 1-19)

Figure 1: Photopoint 2, North-west Glory Block, Pitt Island Scenic Reserve

T'op panorama: December 1987 *Bottom panorama:* March 1993

Changes to note are the substantial increase in the amount of flax, the healing of erosion scars and the loss of remnant trees and shrubs (especially beyond the fence to the left). Domestic stock have been more or less excluded from the fenced area since about 1981 .



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