Winds of change: monitoring vegetation condition and trend in the Chatham Islands

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Published by
Department of Conservation
Head Office, PO Box 10-420,
Wellington, New Zealand

This report was commissioned by Canterbury Conservancy

ISSN 1171-9834

Reference to material in this report should be cited thus:

Walls, G., and Baird, A., 1995.
Winds of change : monitoring vegetation condition and trend in the Chatham Islands.
Conservation Advisory Science Notes No. 130, Department of Conservation, Wellington.

Keywords: Chatham Islands, Pitt Island, Chatham Island, vegetation, feral animals, fire, wind, monitoring, conservation, management

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Summary

Since 1980, a comprehensive system of permanent plots, transects and photopoints has been established on Pitt Island, to monitor vegetation condition and trend and to determine the processes of change. In early March 1995 we set up some new plots and photopoints to complement this system and to address some particular questions. The plots are four exclosure plots, with adjacent controls, to test whether forest conservation and recreational hunting goals are compatible.We suspect there are too many feral pigs and sheep present to allow forest recovery in the Waipaua Block of Pitt Island Scenic Reserve, and that at present levels of animals the forests and woodlands will be literally blown away. The exclosure plots will provide hard data and visual demonstration of the situation.

During the same expedition, the opportunity was taken to establish three permanent plots to monitor the recovery - or otherwise - of the large wetland reserve at Ocean Mail, northern Chatham Island, that was burnt in a fierce gale-driven fire in November 1994. Out of the ashes has arisen a wealth of tiny seedlings of the formerly dominant plants (bamboo rush, Chatham Islands aster and swamp heath). How they interact, and whether they will survive competition from invaders, the plots will be able to tell us.

This report describes the monitoring sites and the techniques used, also other activities and observations from the expedition.

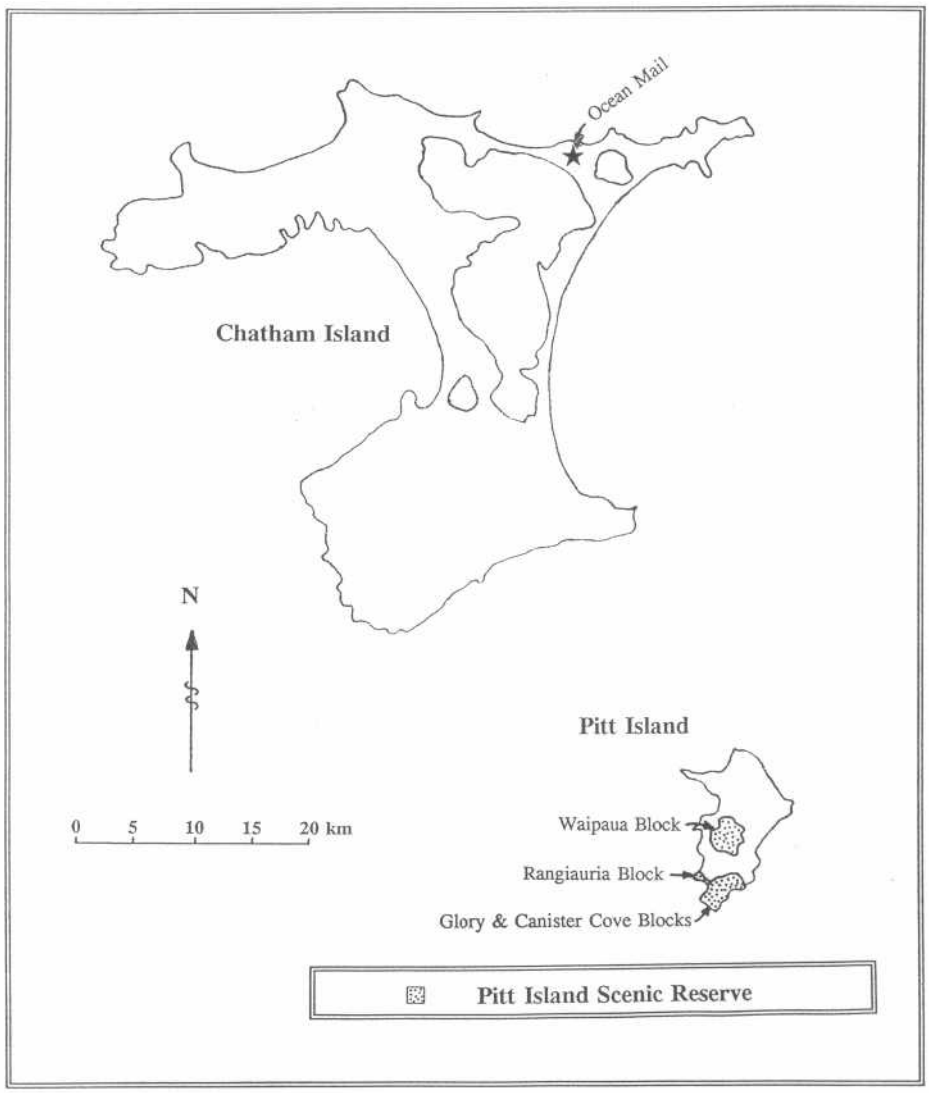
Introduction

This is a report on work done by us on the Chatham Islands in early March 1995. It was initiated by a suggestion from John Holloway (Director, Estate Protection Policy Division, Head Office of Department of Conservation). Operational costs were covered by the Department's Canterbury Conservancy and its Unprogrammed Science Advice and Services fund (administered by Science and Research Division).

The condition and trend of the vegetation of the Chathams has been of concern for many years (Ritchie 1970; Kelly 1971, 1978, 1983; Park 1980; Given and Williams 1984; Rudge 1988; Walls 1988; Walls and Scheele 1990, 1995; Baird 1993). Accordingly, some areas have been fenced to exclude domestic stock, and some control of feral possums, pigs, sheep and cattle has been carried out. However, questions still remain about the effectiveness of these protective measures, and the level of management required to strike a balance between restoration of ecosystems and habitats (mainly forests and wetlands) and provision of opportunities for recreation and tourism. On Pitt Island, the outstanding current question is: how many feral pigs and sheep are too many to prevent forest regeneration?

FIGURE 1

Map of the Chatham Islands, showing the locations of Pitt Island Scenic Reserve and Ocean Mail



To test the effectiveness of fencing and feral mammal control a system of 22 monitoring plots has already been established in the Chathams, in a wide range of sites: 12 on Chatham Island and 10 on Pitt Island (Walls 1988; Walls and Scheele 1990, 1995). Various photopoints have also been set up. All of these are being monitored 5-yearly.

In essence, the Chatham Islands have a windy climate. Their forests are naturally quite resilient to wind impact, and are able to repair any damage very quickly. However, once their structure is interfered with, and their processes of regeneration are disrupted, they are frighteningly vulnerable. Their canopies can then be devastated in a single storm, be knocked down progressively or disintegrate through exposure, and the recovery mechanism is absent. All tree species are highly palatable to exotic browsing mammals, or prone to being rooted out whilst young. Fences have to be of good quality and well maintained then, and feral animal control assiduous, if the forests are to remain.

Other vegetation - herbfields, wetland communities and dune communities - are also highly vulnerable to browsing. They are less at direct threat from wind than forests, though the massive burn in the wetland at Ocean Mail (northern Chatham Island, see Figure 1) in November 1994 showed how damaging gale-fanned fire can be.

John Holloway suggested establishing a series of exclosures in strategic parts of the Waipaua Block of Pitt Island Scenic Reserve (see Figure 1), and monitoring them to determine whether the feral pigs and sheep left there for hunting were at low enough numbers to allow forest regeneration. Accordingly, we identified four key sites and set up paired 20m x 20m monitoring plots at each. One of each pair of plots has since been ring fenced - by local islanders Kenneth and Judy Lanauze - to exclude large mammals. The other of the pair will provide the comparison (control).

So smoothly did this work go that we had time to do other things during the same trip: check established monitoring plots and photopoints, check sites for threatened plants, and establish new plots to monitor the recovery from fire of the Ocean Mail wetland.This report documents those activities.

Pitt Island

We established 20m x 20m quadrat plots in four sites in the Waipaua Block of Pitt Island Scenic Reserve - all on land between Waipaua Stream and Second Water Creek or Waipapaku (Figures 3 and 4). The numbering sequence carries on from the ten monitoring plots already established on the island (Walls 1988; Walls and Scheele 1995). At each site one plot was laid out in such a way that it could be encircled by an exclosure fence with minimal damage to the vegetation. Another plot was laid out close by, to provide a control, ie to monitor what will happen in the continued presence of large mammals. Each plot was laid out and measured according to the standard method (see Figure 2) developed and used in the past by the NZ Forest Service (Allen and McLennan 1983; Allen 1993).

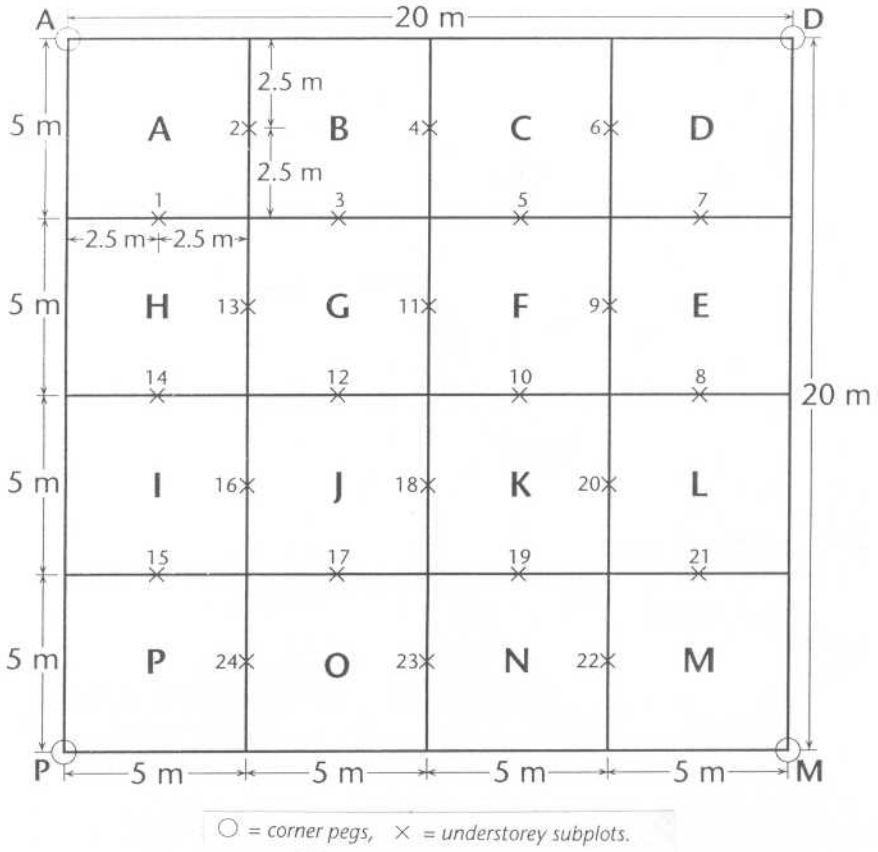


FIGURE 2

Diagrammatic representation of the 20m x 20m permanent plots, laid out with tapes and pegs (from Allen 1993).

All live trees were tagged and their diameters at breast height measured. Tree ferns and saplings were counted in standard height classes. Ground cover and tree seedlings were assessed via a series of fixed-point samples called understorey subplots (see Figure 2). Ecological site information was recorded on standard reconnaissance sheets.

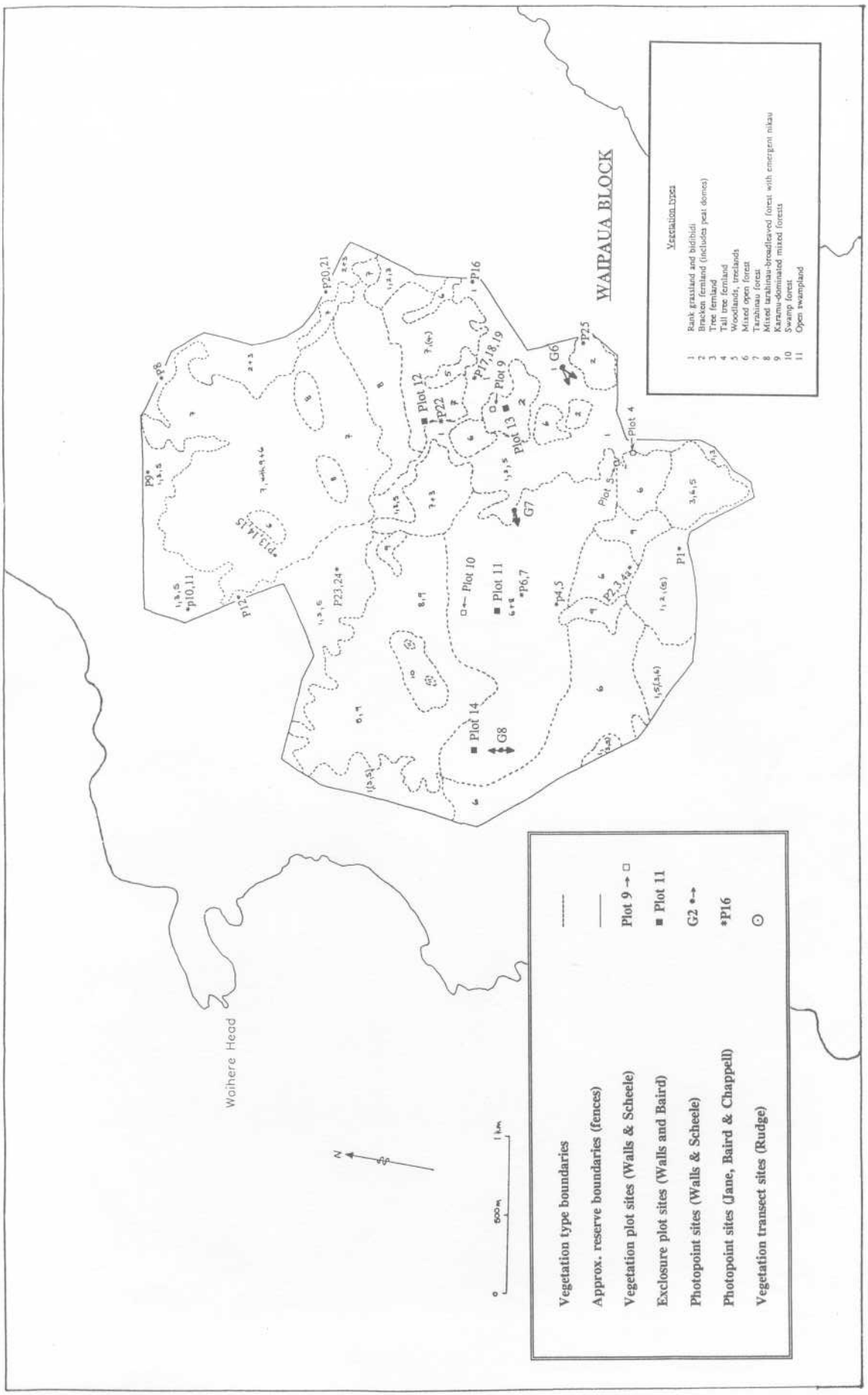


FIGURE 3
Waipaua Block of Pitt Island Reserve, showing vegetation types and monitoring sites

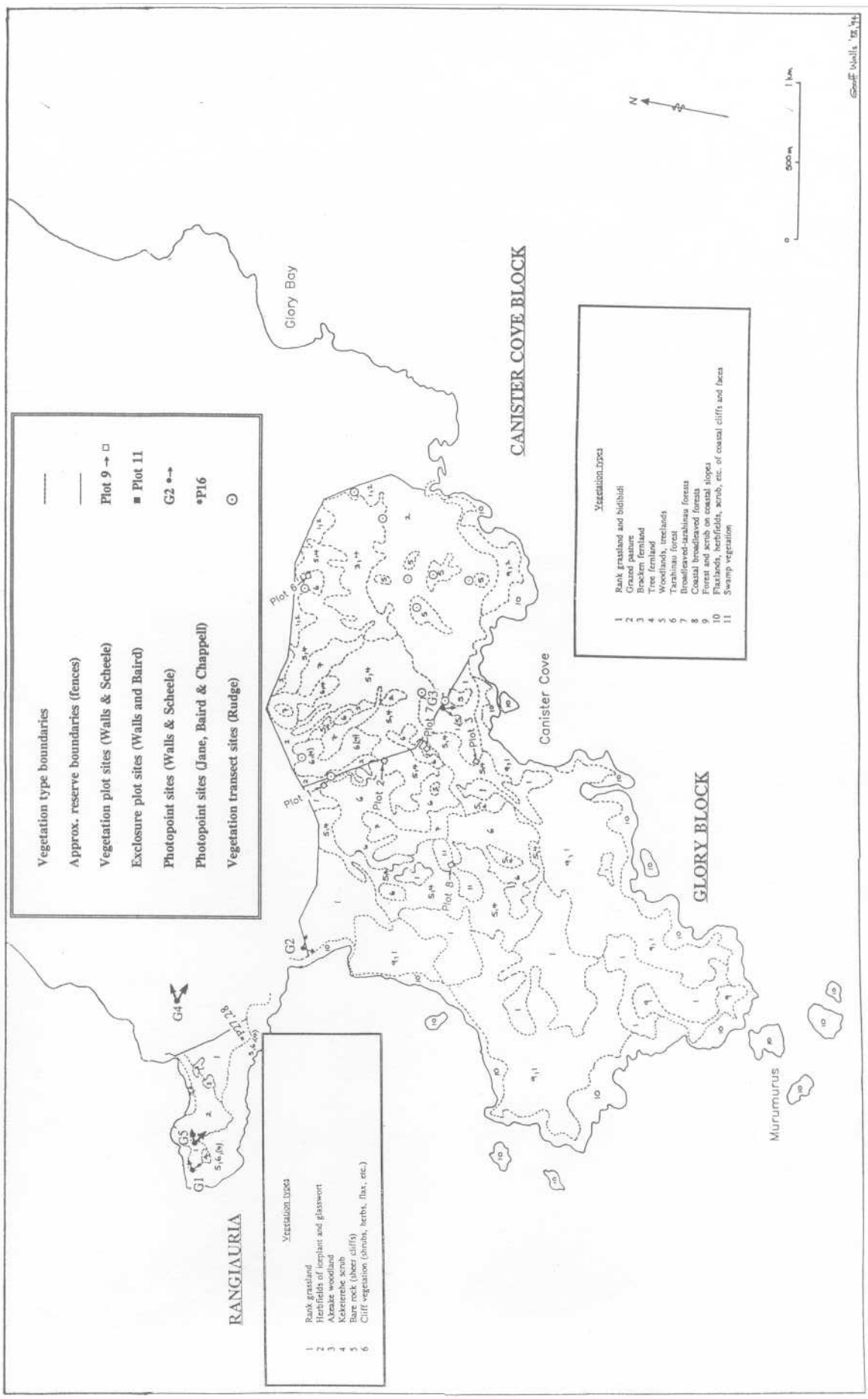


FIGURE 4

Rangiauria, Glory and Canister Cove blocks of Pitt Island Scenic Reserve, showing vegetation types and monitoring sites

PLOT 11 -WOODLAND IN BASIN SOUTH OF CABBAGE TREE

(grid reference. Chatham Islands Sheet 2/712169).

This site is in open-canopied woodland of broadleaved trees: akeake *(Olearia traversii),* karamu *(Coprosma chathamica),* matipo *(Myrsine chathamica),* hoho *(Pseudopanax chathamicus)* and ribbonwood *(Plagianthus regius).* Trees are exposed to the elements, because the protective under storey has been completely browsed out by domestic stock and feral animals (Figure 5). Beneath the trees is a dense sward of pasture grasses and herbs. Storms progressively damage or uproot trees, so the woodland gets more open year by year. At present there are enough feral sheep and pigs to prevent any regeneration.The only tree seedlings we found were so tiny they had not yet grown big enough to be browsed. Their sheer presence though is encouraging, and within the exclosure they should rapidly grow above the grasses and herbs and begin to re-form an understorey that will eventually contribute to a revitalised canopy. So too should epicormic growths from the trunks and roots of the existing trees.We expect the change within the exclosure to provide a graphic contrast with what's outside it within just a few years, so long as it is well constructed and maintained.

PLOT 12 - TARAHINAU FOREST FLANKING THE HALF CHAIN

(grid reference. Sheet 2/724177)

Tall tarahinau *(Dracophyllum arboreum)* trees dominate the forest on this site. Also present are trees of karamu, matipo, hoho and hokataka *(Corokia macrocarpa).* Tree ferns are common and include gully fern *(Cyathea cunninghamii),* mamaku *(C. medullaris),* ponga *(C. dealbata),* wheki *(Dicksonia squarrosa)* and wheki-ponga *(D. brosa).* There is a fairly dense understorey - mainly of tree ferns and supplejack *(Ripogonum scandens)* (Figure 6). Feral sheep, pig and cattle numbers have been lowered a lot in recent years, and this is resulting in some regeneration. However, there are still enough present to be keeping the forest floor quite open, and the exclosure will demonstrate whether the regeneration is sufficient to counter canopy losses.

These tarahinau forests are the ancient powerhouses of the peat soils on the Chathams. Without large animals, their rain of needle-like leaves should rebuild luxuriant carpets on the forest floor.

PLOT 13 - NORTHERN PEAT DOME

(grid reference. Sheet 2/725173)

This plot is close to Plot 9 that was established in 1993, and will provide an interesting comparison with it in terms of monitoring technique (Plots 1-10 are 25m x 25m plots, measured using a method that gains very similar information on vegetation composition but with less emphasis on volumetric structure and more on ecological processes -Walls 1995).

The peat-forming tarahinau forests have gone - blown away, burnt and browsed - remaining as an echo in a few gaunt trees (Figure 8). In 1993, feral sheep, cattle and pigs were numerous enough to prevent any regeneration, although a mass of tarahinau seedlings was present in the peat, poised to lead a regenerative charge. Now, with better animal control (particularly the reduction in cattle pressure), those seedlings have begun the comeback. Some are already knee high. We expect recovery within the exclosure to substantially outstrip that outside, and to contain plants such as rautini *(Brachyglottis huntii)* that are most sensitive to browse.

PLOT 14 - NIKAU WOODLAND EAST OF SUGARLOAF *(grid reference: Sheet 2/704169)*

This woodland, near the western edge of the Waipaua Block, is representative of woodlands fairly widespread in the area - that feature tall elegant nikau *(Rhopalostylis* "Chathams"). The woodlands have originated out of dense forests that have been progressively skeletonised by tree-cutting, fires and browsing, combined with the effects of a windy climate. Examples of such dense forests still remain to the north and east of Cabbage Tree, though their understories are heavily browsed. Plot 10 was established in 1993 to assess their condition and trend (Walls and Scheele 1995).

What remain in the woodlands now are scattered nikau that rattle in the wind above a lower open tier of matipo, hoho, karamu and akeake trees. Beneath the trees is nothing but a sward of pasture grasses and herbs, grazed by feral sheep and rooted by pigs (Figure 7).

The nikau in the Chatham Islands are now regarded as different from those on the New Zealand mainland, and are listed as nationally threatened (Molloy and Davis 1994).The Waipaua Block is their stronghold on earth, but the old palms are not being replaced as they fall because of browsing. Only in Nikau Bush Scenic Reserve, a pocket handkerchief reserve on Chatham Island, is there adequate regeneration of nikau, because of good fencing and animal control for over a decade. The long-term future of nikau on Pitt Island - once such a distinctive and ubiquitous feature of the island - looks bleak whilst large numbers of feral pigs and sheep persist. The only way adequate nikau regeneration will be assured is to keep these animals at very low levels, as we expect the exclosure and control to demonstrate. With the recently forged agreement - between the Department and the Pitt Island residents - to allow a recreational resource of feral pigs and sheep to remain in the Waipaua Block, internal fencing within the block may be essential to allow nikau recovery. One option is to exclude pigs and sheep from certain areas. Another is to subdivide the block and sequentially move the animals between sections 7 with a rotation period of at least 20 years, to allow pulses of regeneration over the whole block.

In addition to the plots, we set up a series of new photopoints to document changes on a larger scale. These are both within the Waipaua Block and elsewhere, and complement those already established (Budge 1988, Walls 1988, Baird 1993,Walls and Scheele 1995).Their locations are shown in Figures 3 and 4, and their numbering follows already established sequences:

- G4, looking eastwards from a knob just east of the Rangiauria Block of Pitt Island Scenic Reserve (grid reference: Sheet 2/697143) at the proposed corridor between the Waipaua and Canister Cove - Glory Blocks.

- G5, looking west at the Rangiauria Block from the high point at its eastern end (grid reference: Sheet 2/688138).

- G6, west of Hapua Hill,Waipaua Block (grid reference: Sheet 2/728169), to follow regeneration in the wetland between peat domes there.

- G7, from a small saddle further west (grid reference: Sheet 2/720169), looking west to Sugarloaf over an expanse of woodland.

- G8, from a prominent knoll 200m south of Plot 14 (grid reference: Sheet 2/705166), looking north at the woodland that contains Plot 14, and southwards at a large sheep camp amongst woodland and beyond to the proposed corridor between the Waipaua and Canister Cove - Glory Blocks.

The opportunity was taken to photograph some of the previously established photopoints (see Figure 10) and plot sites in passing. Populations of threatened plants were checked out too, and seed collected for restoration purposes:

- *Hebe barkeri* at Canister Cove;

- *Aciphylla dieffenbachii* at Rangiauria;

- *Aciphylla traversii* just north of Second Water Creek (Waipapaku) - this discovery represents a "first" for Pitt Island;

- *Astelia chathamica* at Rangiauria and North Head;

- *Cortaderia* "Chatham Islands" at North Head.

Chatham Island

The focus of our work on Chatham Island was on the reserve at Ocean Mail that was burnt in a severe fire in early November 1994. The fire burnt for two days, fanned by gale-force winds. About 700 ha of the c.800 ha reserve was burnt. More still would have been burnt but for some strategic back-burning by the fire-fighters.

Most of what was burnt was a large wetland vegetated in its centre by chest-high bamboo rush *(Sporadanthus traversii),* the purple-flowered Chatham Islands aster *(Olearia semidentata)* and swamp heath *(Dracophyllum paludosum).* These three plants are Chatham Islands endemics, and this wetland, before it burnt, was regarded as representative of a very special

Chathams vegetation type. It was fringed by more modified mixed vegetation containing flax *(Phormlum tenax),* swamp heath, bracken *(Pteridium esculentum),* jointed rush *(Leptocarpus similis)* and various shrubs and small trees. This too went up in flames.

We put in three 20m x 20m permanent plots to monitor what happens following the fire. The numbering system follows on from that established by Walls and Scheele (1990).

PLOT 13 - OCEAN MAIL
(grid reference: Sheet 1/591774)

This plot is on a broad peat terrace, near where it drops slightly into the core of the wetland. It was chosen because of the prolific population of speargrass *(Aciphylla traversii)* there, most of which have sprouted exuberantly from their charred bases since the fire (Figure 11). The pre-fire vegetation though was dominated by dense bracken, bamboo rush, aster and swamp heath.

Apart from the speargrass, only bracken and umbrella fern *(Gleichenia dicarpa)* have resprouted. The adult bamboo rush, aster and swamp heath have been killed stone dead. However, these three plants have reappeared as a mass of tiny seedlings that have greened up the whole ground surface as though they have been densely sown. It will be fascinating to see the interplay of these plants as time goes by.

PLOT 14 - OCEAN MAIL
(grid reference: Sheet 1/590772)

150 metres south of Plot 13, this plot is within the core of the wetland, that was previously a very dense community of bamboo rush and aster. This vegetation was totally obliterated by the fire, but like at Plot 13, there is now. a carpet of tiny seedlings of bamboo rush, aster and swamp heath turning the charred hummocks and hollows green (Figure 12). This plot will enable their progress to be followed.

PLOT 15 - OCEAN MAIL
(grid reference: Sheet 1/587778)

About 300 m north-west of Plot 13, this plot is on a peat plateau fringing the wetland. Before the fire it was clothed in head-high swamp heath, with aster, bamboo rush, umbrella fern and a few other tree, shrub, fern and rush species. Of these, only the umbrella fern and knobby clubrush *(Isolepis nodosa)* have resprouted from material surviving underground. But as in the other two plots, hummocks and hollows alike are densely dusted with masses of tiny seedlings of swamp heath and bamboo rush.There are seedlings too of aster, knobby clubrush, the grass *Poa chathamica* and other plants. The interplay of these as they regenerate will be interesting.

Elsewhere, flax, jointed rush and various shrubs (notably *Coprosma propinqua* and *Cyathodes robusta)* have sprouted from their bases even after being incinerated at the height of the fire (Figures 13 and 14). Bracken has rapidly sprung up from its rhizomes wherever it was formerly present. However, nowhere have bamboo rush, aster or swamp heath survived being burnt. It is hoped these three plants will regenerate via their seedlings - there must have been a huge seed mass banked up in the damp litter on the ground - to become dominant again. Should another fire burn the wetland though before they grow up to build another litter layer containing masses of seeds, or should cattle or sheep browse the young growth, they may be decimated and unable to bounce back. Fire prevention and animal control should therefore be key management considerations for the wetland.

Conclusions and recommendations

1. ADEQUACY OF COVERAGE OF VEGETATION MONITORING SITES

We believe that most issues concerning vegetation management - for ecosystem reasons, threatened fauna, threatened plants, recreation or restoration - are now covered on Pitt Island by the existing system of plots and photopoints. The newly established exclosure plots complement the other plots well, and will enable the impacts of animals and their control to be visually demonstrated. This should prove to be valuable in resolving many debates, particularly since the exclosures have been set up in partnership with Pitt Island residents. The only addition we can suggest that would give even better coverage is an additional exclosure in the nikau forests (as distinct from woodlands) to the north of Cabbage Tree.

Chatham Island is not so well covered, and we believe that four or five extra plots are needed in the wetlands, forests and coastal systems in the north. The southern tablelands are also not well covered, but with the current access situation such coverage does not look likely.

2. COMPARISON OF FIELD TECHNIQUES FOR VEGETATION MONITORING

There are now several monitoring techniques being applied to assess and follow vegetation change and response to management on both Pitt and Chatham:

- 25m x 25m permanent plots (Walls 1988;Walls and Scheele 1990, 1995)
- 20m x 20m permanent plots (this study)
- 30m x 4m permanent belt transects (Rudge 1988)
- photopoints (Baird 1993; Walls 1988; Walls and Scheele 1990, 1995)

- exclosures, measured by 20m x 20m permanent plots (this study)

They complement each other. The two permanent plot techniques systematically generate virtually identical information, but in slightly different ways. Their data analysis techniques are also a little different, but interpretation of their results should be no different. The belt transects generate different sorts of datasets, but they should not lead to substantially different interpretations of vegetation change or the reasons for it. The photopoints are not able to provide much quantitative data, but they are valuable for visually demonstrating changes over time, as Walls and Scheele (1995) have shown. The exclosure plots, so long as they are well set up and maintained, will provide a direct link between the visual and the measured, and will display the results of processes on the spot.

3. MONITORING INTERVALS (RETURN TIME)

We recommend a basic return time of 5 years for all the plots and photopoints. That means that the plots and photopoints on Chatham Island set up in 1990 are due for monitoring right now. Those on Pitt Island established by Mike Rudge (Budge 1988) have not been remeasured since late 1987, so are well overdue.

Some of the photopoints established by Graeme Jane, Rob Chappell and Amanda Baird on Pitt Island are also overdue for a revisit. The ten plots and three photopoints monitored regularly on Pitt Island since 1980 (Walls and Scheele 1995) are due for their next monitoring.

Some of the plots and photopoints should be revisited sooner than the 5-year interval though:

- the exclosures on Pitt Island should be inspected and photographed soon after they are built, and at yearly intervals at least. They should have their first remeasurement at two years (i.e. in 1997), their second at five years (i.e. in 2000), thence 5-yearly;

- the plots at Ocean Mail should be remeasured and photographed at yearly intervals if possible for the first five years, thence 5-yearly;

- photopoints at key management sites - such as the corridor between the Waipaua Block and the southern blocks of Pitt Island Scenic Reserve - should be revisited more often.

4. COLLABORATION AND CONTINUITY

For over 15 years now, this vegetation monitoring work has brought together expertise from quite a range of backgrounds, to systematically record changes, work out processes and advise conservation management. So far it has been done as a collaboration between various agencies, ecologists, botanists, islanders, wildlife specialists, volunteers and conservation managers. It has been

funded from a variety of sources. Our latest work carried on that tradition and is a good example of inter-conservancy co-operation within DOC.We feel all the efforts to date have been excellent value: they have provided good hard data and set up a useful monitoring baseline at very modest costs.

Continuity in this work has been provided only through the sustained efforts of one or two individuals. It has still to be properly picked up by an agency that can provide the required continuity. The Department is the obvious agency, having both the mandate and the need. We recommend that vegetation monitoring using this baseline be formally entered into the business planning system for Canterbury Conservancy, and budgeted for according to the programme we have outlined.

Acknowledgements

To Sue Scheele and Tony Anderson go our thanks for their generosity and unstinting support. We are grateful too for the help given by Alison Turner, Steve Harris and Steve Sawyer of Department of Conservation's Chatham Islands Field Centre. On Pitt Island, Bo and Ted Lanauze, Kenneth and Judy Lanauze and Ken and Eva Lanauze supported our work with kindness, interest, coffee and practical help - to them a big thank you. Thanks too to Dave Massam (Department of Conservation, Twizel) for help on Chatham Island, and to Jeanette Fifield (Department of Conservation, Napier) for cheerfully converting handwritten notes into typescript.

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