

# Vegetation monitoring in the subantarctic islands

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

This report was commissioned by Science and Research Division

ISSN 1171-9834

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Reference to material in this report should be cited thus:

Walls, G. 1998. Vegetation monitoring in the subantarctic islands. *Conservation Advisory Science Notes No. 174*. Department of Conservation, Wellington.

Keywords: subantarctic islands, Campbell Island, Auckland Islands, vegetation monitoring, flax

# Abstract

During November and December 1995 I worked on Campbell Island, learning the vegetation monitoring system from Colin Meurk (Manaaki Whenua-Landcare Research) on behalf of Department of Conservation. Transport there and back was with a consecutive pair of ecotours that went also to Auckland Islands and other islands. This is a report on the activities of the Campbell Island expedition and observations on the Auckland Islands. It has a focus on vegetation monitoring and historic flaxes. It has been culled from a larger, more holistic report written by Geoff Walls for the Southland Conservancy of DoC in February 1996. That report covered a wide spectrum of ecological, archeological, historic and conservation issues relating to Campbell Island, the Auckland Islands, Macquarie Island, and The Snares.

## 1. The expedition

### 1.1 THE PARTY

Colin Meurk, research botanist, Manaaki Whenua-Landcare Research, Lincoln, with over 25 years' subantarctic experience;

Vivienne Nicholls, Master's student, Massey University, interested in megaherb biology;

Geoff Walls, naturalist with more than a passing interest in island conservation, history and flax.

### 1.2 PURPOSE

The primary purpose was:

- to remeasure the vegetation monitoring plots on Campbell Island, and to facilitate a transfer of the vegetation monitoring knowledge and practice to the Department of Conservation.

Secondary purposes were:

- to investigate the potential for a study of megaherb ecophysiology;
- to collect various approved research samples - flaxes and chert for historical investigation, plant material for genetic analysis, samples of moss, peat and litter for pollen analysis.
- to consider the current and potential management of the subantarctic islands for conservation in a wider sense, particularly the roles and impacts of ecotourism and research (not included in this report, but a substantial part of the report furnished to DoC Southland Conservancy in February 1996).

### 1.3 ITINERARY

25-27 November 1995:	travel to Campbell Island from Bluff aboard "Akademik Shokalski", leg of an ecotour run by Zegrahm and Eco Expeditions/Southern Heritage Expeditions;
27 Nov-11 Dec:	Campbell Island;
11-13 December:	at sea between Campbell I and Macquarie I aboard "Akademik Shokalski";
13-15 December:	daytime visits to parts of Macquarie I as part of ecotour;
15-17 December:	at sea between Macquarie I and Auckland Is;
17-19 December:	Auckland Islands (Carnley Harbour, Enderby I, Port Ross);
19-21 December:	at sea between Auckland Is and Bluff, with a brief call at The Snares.

## 2. Vegetation resurvey, Campbell Island

### 2.1 BACKGROUND, RATIONALE

In 1970, the island was fenced in two, and feral sheep and cattle were removed from the northern portion. Colin Meurk set up plots on each side of the fence to determine the impact of the animals on the vegetation and to follow the recovery of vegetation in their absence.

In 1984, another fence was erected to confine the stock to the southwest corner of the island, and they were eradicated elsewhere. A further series of vegetation plots was established to follow this move.

In about 1990, the remaining stock were shot out, rendering the fences redundant. However, the vegetation plots have been remeasured every 5 years or so, and provide an excellent baseline for monitoring changes into the future. Manaaki Whenua will no longer fund such work and Department of Conservation is taking it over. This expedition was designed therefore to accomplish the 5-yearly monitoring and to "hand over the baton" to a DoC person.

### 2.2 TECHNIQUES

Colin has set up a variety of systems to monitor the vegetation. Their approximate locations are mapped in Figure 1.

- Quadrats along 1970 fenceline

These are pairs of 3 m x 3 m squares, one each side of the former fence at about 100 m intervals. Each quadrat is gridded with strings into 60 cm x 60 cm squares, to give a grid for accurate mapping of the plants and to give grid points for plant height measurements (Figure 3).

This technique is very labour-intensive, fairly specialised and yields a mountain of information that requires much detailed analysis. Open grassland vegetation is perhaps over-sampled, and dracophyllum forest is under-sampled.

- Transects along both fencelines

Along the 1970 fenceline, 2 m wide strip transects are done right from the western cliffs to the scrub above Tucker Cove, on each side of the fence. The transects are worked in 100 m lengths, and in each 5 m section all shrubs, *Chionochloa* tussocks and *Pleurophyllum* plants are counted and measured. This technique, too, is very labour-intensive (2 days' work for 2 people), data-heavy and samples only open vegetation.

In contrast, the 1984 fenceline transect is a neat, speedy affair (Figure 4). It samples only 10% of the line (every 10th post) using 2 m x 5 m strips each side of the fenceline and 1 m away from it to avoid the animal trafficking effect. For each strip, an Atkinson-style tier description is done, heights and widths of shrubs and *Pleurophyllum* plants are measured, and woody seedlings are counted. It is an excellent technique, evolved from the previous two, and perhaps should replace them in future.

- Remote quadrats

There are lone quadrats, either the 3 m x 3 m square variety or a skinny 50 cm x 5 m version, in several places: Mt Honey, Northeast Valley, Tucker Valley, Homestead Ridge (Figure 5), Northwest Bay, Garden Stream, Moubray Hill. There, the vegetation is recorded using the above methods.

- Photopoints

Photographs are taken at each quadrat or transect reference point, thereby giving a good visual coverage. In addition, Colin has tracked down the locations of several historic photos (e. g. Dougall 1888 and Morris 1894) and has rephotographed them. Most of these sites, as well as the quadrats, were plotted using a portable GPS (Global Positioning System), but this method was found to be no more accurate than a pencil point on a map.

## 2.3 FINDINGS

The data will take months of analysis, which only Colin can do, before what they have to tell can be revealed. So at this stage all that can be said is that:

- the stock ate most plant species, but preferred some such as the megaherbs (with the exception of *Bulbinella*), so changed the vegetation composition in favour of less palatable plants (Figure 5);

- all the most palatable plants, including the megaherbs and the tussock, *Chionochloa antarctica*, are making a radical comeback. No longer confined to inaccessible sites, they are beginning to provide a magical display over the whole island now the stock have gone;
- woody plants, especially *Dracophyllum* shrubs (*D. longifolium* and *D. scoparium*), have expanded their range upslope and have grown both in number and size in recent decades. This will see a contraction of grasslands and herbfields in future, but it is unlikely to go far enough to adversely affect any of the island's wildlife.

## 2.4 SUGGESTIONS FOR THE FUTURE

It is time now to review the vegetation monitoring programme for Campbell Island. I suggest the people to do that are Colin Meurk, Carol West, Brian Rance and me.

The monitoring system was set up to examine the situation relating to sheep and cattle. Now they've gone, that need has gone too. I think that a simplified sample of Colin's comprehensive system should be retained though, because it gives a baseline for long-term monitoring, and the monitoring interval of 5 years should also be retained. The experiment with feral sheep and cattle remains the largest of its kind in New Zealand, and there are now three phases of vegetation succession relating to fencing/destocking episodes. It would be of interest to follow these through, for the next 20 years at least.

It'll be necessary to get from Colin a location map of his quadrats, transects and photopoints, a description of his techniques, copies of his data and photos, and an analysis of the vegetation changes that have taken place.

Another thing I think necessary is to acquire the photopoint database from Rowley Taylor and Peter Wilson (Manaaki Whenua, Nelson), if this doesn't already reside with DoC. Their numbered photopoint tags on the island are weathering away and need replacing.

There is a raft of other vegetation issues needing investigation and surveillance, and to do them justice will require new approaches. These issues include:

- impact of visitors;
- impact of sea mammals;
- impact of seabirds (now and following rat and cat removal);
- impact of rats (and recovery after their removal);
- weeds - status, dynamics, effects of control;
- spread of woody vegetation;
- recovery of peat deflations and slips;
- relationships of plants and vegetation processes to those in other places.

### 3. Flaxes, Campbell Island and Auckland Islands

One of my trip missions was to examine the known plantations of flax (*Phormium*) on the islands, and to bring back propagation material to add to the National Flax Collection (maintained by Manaaki Whenua - Landcare Research). It was relatively easy to do this on Campbell, a severe chasing from a bull sealion at Camp Cove being the only hardship. At the Auckland Islands, it was necessary to do a bit of diplomatic footwork with the ecotour organisers. It was touch and go, but I was thrilled and grateful to be given the chance to do ethnobotanist impressions for a few frenzied minutes at each of the sites at Port Ross.

I am sure all of the six plantations are of harakeke (*Phormium tenax*), and there are at least two distinct entities, but it'll take some time to unravel their pedigrees; they'll need to be grown alongside one another and some historic research will need to be done. Meanwhile, they already tell an interesting story. Here's a brief description of each plantation. Their locations are mapped in Figures 1 and 2, and Figures 6-9 show most of the flaxes themselves.

#### 3.1 TUCKER COVE, CAMPBELL I.

This plantation is a large clump at the former farming homestead site, c.50 m from the old iron stove inland up a small stream. The clump is 3-4 m tall, and the leaf tips are very wind-frayed. Leaves are very erect, with dark red edges and bases. Their fibre is easy to extract, and is long, very strong and fairly coarse. There is no sign of any flowering or harvesting in recent years.

It is my opinion that this is a good general-purpose flax, associated in the past with the homestead, and probably grown from the plantation in Camp Cove subsequent to 1907. It does not appear in photos of the site taken then, but both it and the Camp Cove flax (below) are mentioned by Oliver and Sorensen in their Cape Expedition botanical report as present - though struggling - in the early 1940s.

#### 3.2 CAMP COVE, CAMPBELL I.

The flax here forms a protective hedge around the back and sides of the intriguing "Lady of the Heather's" sod hut remains. It is the oldest remaining plantation on the island (it appears in 1905 and 1907 photos) and to my knowledge the southern-most flax in the world! It is possible that the flax is as old as the hut (which was there in the 1860s, possibly as early as 1810) and may have been brought to the island by early sealers. We cannot be sure of its age, because although it was much smaller just after the turn of this century, it is likely to have been burnt and browsed then in those early years of farming.

There are many clumps of flax now, of varying ages, forming a mass covering an area of c. 20 m x 30 m. Sealions lie in it, charge through it, flatten and break it, but the flax nevertheless thrives. Its physical features appear to be identical to those of the Tucker Cove flax.

I found 3 old flower stalks, probably from the previous summer, but no new flower spikes. This flax has seeded in the recent past, as mentioned by Norm Judd (1993 report), who saw a small seedling nearby; it is still there and slightly larger now. The flax is likely to have seeded earlier, too, and has certainly spread vegetatively.

Norm expressed some concern about the weed potential of the plantation, and the effect of the flax on the sod hut. I consider the weed threat to be minimal, and think the flax is doing a good job of protecting the hut from the impact of sealions, weather and woody vegetation's probing roots. It raises an interesting challenge for conservation, though: how best to manage a living historical feature.

### **3.3 TUCKER VALLEY, CAMPBELL I.**

There is a clump of flax at the old derelict Tucker Camp, the site of the World War II coastwatch station that subsequently became the first meteorological station. This flax has features that appear identical to the other two. In a photo taken about 1957 (in Kerr's history of Campbell Island) there is no flax bush, but what appear to be small plants. I have since met the man who planted them: George Poppleton, who led three year-long expeditions to Campbell Island in 1955-60. George, who lives in Wellington and still dreams of the island, obtained his cuttings from the Camp Cove plantation. We have struck up a friendship and I was recently able to present him with a cutting from his own Tucker Camp plantation.

I am pretty sure, then, that all the Campbell Island flaxes are the same stock, the Camp Cove plantation being the original and the other two derived from it. Just where the Camp Cove flax was imported from I don't yet know, but it looks like a southern South Island flax - either from Southland or Otago. What's more, it looks to have similar origins to the next two flaxes to be described - both from Port Ross, Auckland Island. Furthermore, they all remind me of my memory of the planted flax at Sealers Bay on Whenua Hou (Codfish Island).

### **3.4 EREBUS COVE, PORT ROSS, AUCKLAND I.**

At the site of the inglorious Hardwicke settlement attempt (1849-52), some flaxes hang on. There are several clumps along about 200 m of shoreline, backed by rata forest, and a few seedlings on the old cobbled road just back from the shore. All are clearly foreign to the island and associated with the former human activity, but whether they were planted by sealers or the Hardwicke settlers is not obvious. The flax is very erect, has strong blades and has fine silky fibre that is fairly easy to extract. It would have been a useful flax in its day and was probably planted on ground cleared of forest. The plants there now have



probably self-sown from the original plantation. Some have flowered and set seed recently. In my opinion they pose no weed threat.

### **3.5 SEALERS CREEK, PORT ROSS, AUCKLAND I.**

There are 4-5 flax bushes at the mouth of Sealers Creek. They are indistinguishable from the Erebus Cove flax. This means that they could have been planted at the same time, or that one plantation is descended from the other. We may never know, but if Sealers Creek mouth was the site of a sealer's camp, it is most likely that the Port Ross flaxes came with sealers, were used and cultivated for a while, and have persisted - though only just - since.

### **3.6 RANUI COVE, AUCKLAND I.**

The flax in Ranui Cove is quite different from all the others. It is a tall plant with very broad leaves that droop and have a slight twist. Its fibre is easy to extract but is much softer than that of the other flaxes. There is a large plantation near the shore about 200 m east of the old coastwatch station, and a clump - undoubtedly grown from it - at the station itself. There is no sign of any flowering. I would bet that the flax was brought and cultivated during the Ngati Mutunga/Moriori settlement (1842-56). The settlers came from the Chatham Islands, but the flax is not a Chatham Islands flax; it is almost certain that its origins are with Ngati Mutunga, in which case it is probably a Taranaki flax. The planting of flax at this site is mentioned in Michael King's "Moriori" (1989).

Interestingly, Herries Beattie ("Our Southernmost Maoris", 1954) was told by a veteran Maori that, "The flax on the Aucklands has no whitau (fibre) in it and is brittle". That's a description that could apply to the flax native to the Chathams, but certainly not to the flaxes I found.

I took three cuttings from each of these six flax plantations. They are currently in the tender care of the Napier Field Centre nursery workers. When they have good root systems I intend to transfer them to the national reference collections at either Lincoln or Havelock North (Manaaki Whenua-Landcare Research), with one of each being returned to Southland for DoC custodianship and the other going either to the DoC collection in Napier or to the wonderful DoC collection in Golden Bay.

### **3.7 TANDY INLET, AUCKLAND I.**

To complete the picture of subantarctic flax, Nick Gales (Science & Research Division, DoC) sent me a cutting from the plantation in Tandy Inlet, Auckland Island. It looks like the Port Ross flaxes, though it's hard to be sure at this stage. Wynston Cooper and Carol West have contrived to also get me the Whenua Hou (Sealers Bay) flax.

## 4. Other studies

### 4.1 MEGAHERB STUDY, CAMPBELL ISLAND

Viv Nicholls quite sensibly took advantage of the presence of Colin and me to explore the idea of her proposed study on megaherb ecophysiology. I got involved in tracking down good study sites and devising sampling techniques. In return, Viv helped uncomplainingly on the vegetation monitoring, which in the end made the difference between completing the job and having to leave some of it.

As I understand it, the study revolves around looking at growth rates, causes of gigantism, reasons for having coloured flowers and impacts of browsers as a clue to evolution in their absence. Quite ambitious for a Master's study, so we tried to design something neat and manageable, with not too many species or study sites. Viv laid out sampling lines in five sites (western cliffs, Col Peak, Mt Lyall, Lyall-Col Saddle and Tucker Cove) and tagged individual plants on each (Figures 1, 10).

### 4.2 POLLEN RAIN AND PEAT SAMPLING, CAMPBELL ISLAND

Colin had the task of collecting samples for pollen analysis by Matt McGlone, Manaaki Whenua, Lincoln. As there was already more than enough core business to do in the time available, I took on the majority of this task. It involved taking pinches of moss and litter and little bits of peat from a whole range of sites from sea level to the tops. This will allow a picture of how the pollen from the existing vegetation travels and falls around the island to be built up, and will establish a baseline for interpretation of vegetation changes over time in the subantarctics.

Coupled with this went the sampling of a peat profile. We dug a cutting on the eastern flank of Homestead Ridge right down to bedrock. Colin took tiny peat samples at 5 cm depth intervals. Matt should be able to reconstruct the sequence of vegetation change right from the last glaciation from the samples. We restored the site to pretty near its pristine state.

### 4.3 PLANT MATERIAL COLLECTION, CAMPBELL ISLAND AND AUCKLAND ISLANDS

Leaves and flowers of buttercups and gentians were collected by Colin and Viv from both Campbell and the Aucklands (Figure 11). This was for genetic testing - in other words to find out if they were one or more species. Only little bits of plants were taken, so impact was negligible. I don't know who is analysing the genetics, or when the results will come out.

# 5. Other issues

## 5.1 AUCKLAND ISLANDS

### **The *Olearia lyallii* threat**

It seems to be that whether you are for or against *Olearia lyallii* remaining in Port Ross depends on whether you have a plant or an animal background.

I've read the arguments, seen the Port Ross situation and had a passing glance at the *Olearia's* ancestral home, The Snares (Figure 12). In my opinion it's a problem only if you have a concept of change being bad and of people of the past not rating in the present. If the *Olearia* threatened anything it'd be a different story. The *Olearia* can only persist long term in Port Ross - and even on Ewing Island - in the narrow fringe between rata forest and seaweed. It may expand in range and thicken in places over the next few decades, but in my view only in areas where the previous rata forest has been disturbed. In the end the rata will squeeze it back down to the shore. There it will in turn squeeze out some of the *Hebe elliptica* and other shoreline shrubs and grasses, but it'd take the development of a supermutant *Olearia lyallii* to threaten them.

Eradication is the only serious option other than letting things be. It'd be a huge job that would leave Ewing Island and bits of Port Ross looking hideous. Attempts to control it so far have been futile.

So I reckon we should rejoice in the historical accident that brought the *Olearia* to the Aucklands, and observe with interest. A very good monitoring system should be put in place. The plots and transects put in by Mike Rudge and John Campbell in 1972 and by Bill Lee and Paul Kennedy in 1982 should be remeasured, if this has not recently been done. A series of photopoints at a range of sites - both in areas of spread and in old thickets - should be established and revisited every 5 years. The distribution of the *Olearia* should be accurately mapped and updated at each 5-year inspection.

Only if the situation goes haywire should any management be contemplated: *Olearia lyalli* is just a weed of the mind.

### **Enderby Island forest recovery**

Now the rabbits and cattle have gone, the forest will come back. It'll be slow in places, surprisingly fast in others. There are already little rata plants in the cushion herbfields and in the wind-shorn scrub. The ferns in the existing forest look as though they're delighted to be able to spread their fronds again.

All this has implications for the future. Where it'll show most is in the centre of the island, especially on the moorlands and on the shattered edge of the existing forest (I was assured this was the result of burning, but it looked pretty much like a classic case of cattle and rabbits to me). It'll restrict the habitat for birds like banded dotterels, pipits and royal albatrosses; on the other hand it'll make it better for bellbirds, tits and yellow-eyed penguins. The *Bulbinella* and gentian

displays will shrink in size, though that may not seem so bad if the megaherbs (*Anisotome*, *Stilbocarpa*, *Pleurophyllum*) reappear. For tourists, it will mean a different sort of experience, and a tracking system will probably be necessary.

### **Visitor impact**

Enderby Island is the most visited, and probably most vulnerable, to visitor impact. It is also easiest to monitor. That's no reason to ignore the other islands though. One gravid rat getting ashore on Adams Island could wreak dreadful havoc, and the priceless relics of human history on Auckland Island could easily be damaged by a vandalistic treasure-seeker.

There are a few vegetation plots on Enderby, set up to look at recovery from browsing. People shuffle through them, oblivious, making their own impact. A series of plots and photopoints should be established in a range of sites on the island exposed to different degrees of visitor pressure. Places to concentrate on would be at Sandy Bay, on tracks, cushion bogs, coastal herbfields and megaherb sites. These should be complemented at frequented sites in Port Ross and Carnley Harbour, and a few comparative sites having no such pressure.

## **5.2 CAMPBELL ISLAND**

### **Visitor impact**

Currently, 600 visitors all up (conservation workers, researchers and ecotourists included) are permitted to visit New Zealand's subantarctic islands each year. It is an arbitrary number, based on a current best guess at what the fragile fauna and flora can stand without irreparable damage. The visitors certainly make impacts, but what isn't clear is whether these impacts are ecologically tolerable. A well directed monitoring system is required.

### **Impact on vegetation**

Where people go most, there is obvious damage: on the tracks, around the buildings, and at Lyall-Col Saddle. Monitoring this would be pretty straightforward, requiring fixed photopoints, transects and plots designed to gauge the impacts at those intensively used places and further afield. The megaherbs and low-altitude cushion bogs, being most vulnerable, require particular focus.

### **Impact on, and of, tracks**

A series of vegetation plots and photopoints is needed to monitor the condition of the tracks. A series of manipulations whereby sections of track are closed, re-routed and restored to use, and the effects noted, would answer questions of sustainability and best management. Jenny Scott has measured the impact of different use levels on the vegetation on Macquarie Island tracks. Her work could serve as a good model.

## **Introductions of pests**

One of the greatest threats posed by visitors is the potential introduction of animals such as rodents (see Figure 13), and plants that could become weeds. The practices already in place to prevent this, and the contingency plans should it occur, are good. In terms of monitoring, they should be regularly reviewed to ensure they are firmly in place. Surveillance in terms of what's around Beeman Base could perhaps be stepped up and made an annual focus.

## **Weeds**

Despite appearances, Campbell Island does have the odd weed. Nothing serious at this stage, but some vigilance is required. It would be easy enough to eradicate some, such as the rushes near Tucker Camp.

## **Fencelines (1970, 1984)**

The two fencelines set up to segregate parts of the island from sheep and cattle have been dismantled except for a few posts. My plea is to leave the remaining posts in the ground. They act as photopoints, vegetation plot locators and visual indications of the remarkable historical experiment that was carried out. If they are pulled out, it will be impossible to continue to track this work.

## **Rat and cat eradication**

This issue is about as important as anything that could be done for conservation in the subantarctic. The Norway rats and feral cats present are seldom seen, but are a serious impediment to ecological restoration. They have been there for well over a century, often building to plague proportions, and have made radical inroads into the fauna and flora. While they persist, the island's biodiversity will continue to erode. Having stood on the island and compared it with others in the subantarctic, I can imagine the return of the departed small seabirds and the Campbell Island teal, the revival of the larger invertebrate life, a resurgence in the vegetation currently browsed down or nipped in the bud (Figure 13), even a response in the intertidal zone. These things will surely happen once the rats and cats are gone.

## 6. Acknowledgements

Carol West, Lou Sanson and Andy Cox of Southland Conservancy DoC got me into this. My partner Sue Scheele not only urged me to take the opportunity but kept the weeds down and the animals fed at home. Our son Finn was equally enthusiastic even though he couldn't come too. My fellow inmates at Campbell Island were fun to be with and I learnt a lot from them.

Nick Gales (Science & Research Division, DoC, Wellington) made a radical detour to get me the Tandy Inlet flax, and Wynston Cooper and Carol West followed that with a flax from Whenua Hou (Codfish Island). The Tucker Valley flax has led me to the man who planted it in the 1950s, George Poppleton of Wellington. George has given me useful information and a living link with those who have gone before, immensely enriching my appreciation of the islands' human history.

Norm Judd (Auckland Regional Council) plied me with information sleuthed from the archives and helped carry my historical understanding yet further. So did my sister Kath Prickett (Auckland Museum).

To them, my travelling companions, others who helped and my workmates whom I left in the lurch for a month: thanks heaps!

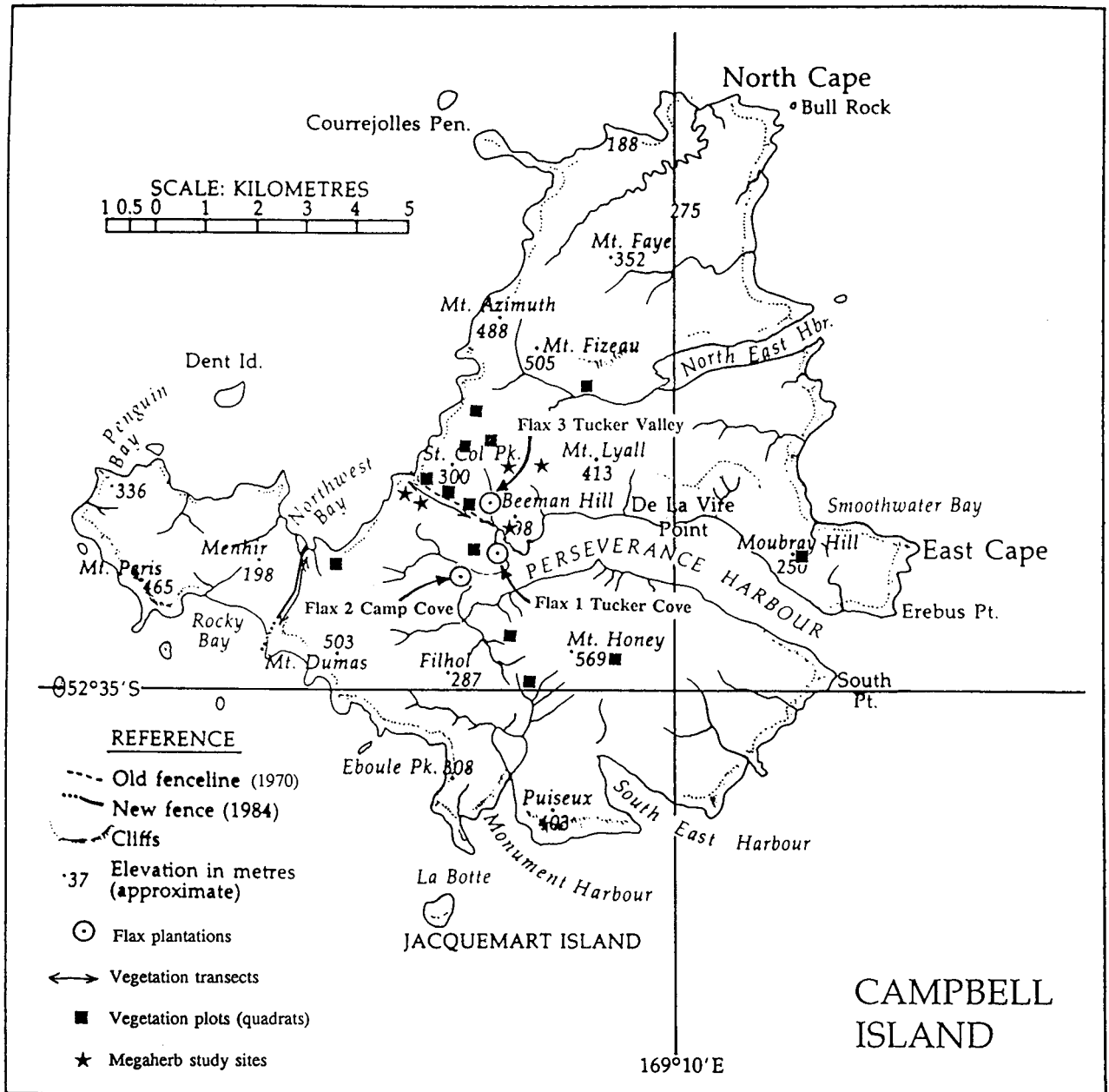


Figure 1. Campbell Island: locations of flax plantations, vegetation transects and plots, and megaherb study sites.





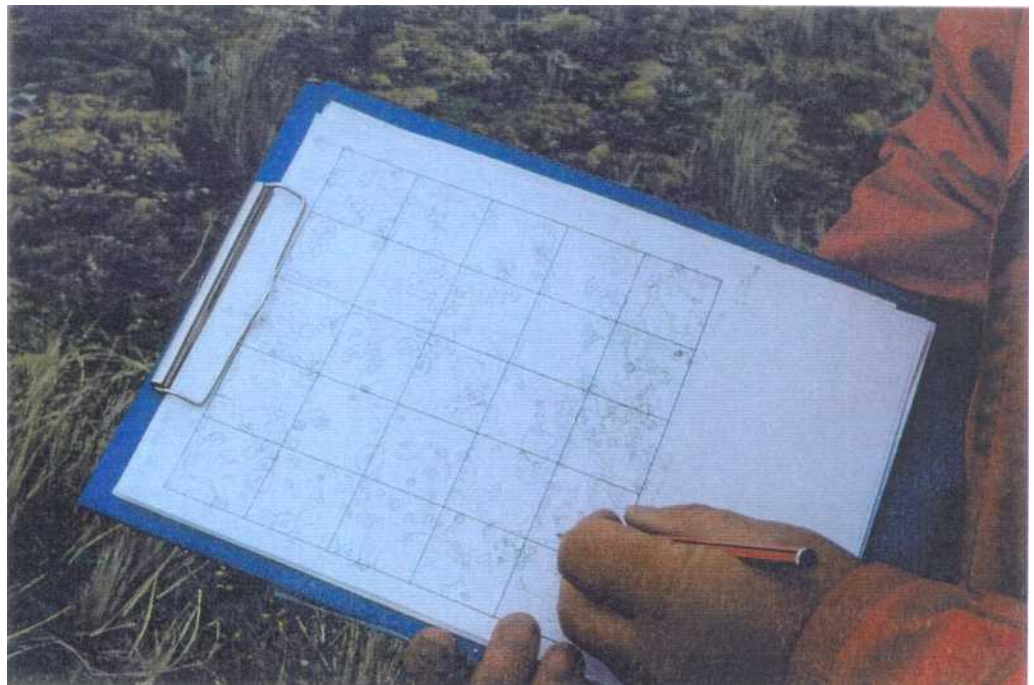


Figure 3. Above: Colin Meurk at work resurveying a permanent vegetation monitoring quadrat at the western cliffs end of the 1970 fenceline, Campbell Island.

Below: Mapping the plants within another quadrat at higher altitude on the same fenceline.