



TUSSAC GRASS IN THE FALKLANDS

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TUSSAC GRASS IN THE FALKLAND ISLANDS.

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SUMMARY

TUSSAC GRASS IN THE FALKLAND ISLANDS

SUMMARY

1. Introduction.

- 1.1 The tussac grass community constitutes a characteristic natural vegetation type, the most important single wildlife habitat in the islands, and a valuable resource for pasturage.
- 1.2 The survey arose from concern over the general decline of tussac in the Falklands. In January 1986, the Executive Council of FIG decided that a comprehensive survey of tussac should be undertaken as a basis for the development of guidelines or legislation for grazing management and for decisions upon the total protection of certain islands. Given that a thorough ground investigation would be exceedingly expensive, an alternative approach was adopted in the first instance using information already to hand. A photogrammetric desk survey, using interpretation of aerial photographs to produce a base-line map of tussac distribution in 1956 and assessing change by comparison with photographs taken in 1983, was undertaken by Cynthia and Martin Parry under the supervision of Robin Woods. At the same time, Mr Ian Strange collated his extensive on-site observations to produce a general overview of the status of tussac both in general and in relation to specific islands, and to identify sites of high conservation value. His report leads into a set of recommendations for further action.
- 1.3 These two reports, compiled during 1987, are complementary. Being produced independently, they emphasise different aspects of the same question and differ, for methodological reasons, in points of detail (see appendix 1) but come together to produce a clear overall picture from which conclusions may be drawn. Information on specific sites may be taken from the maps and reports but the results of these two parallel pieces of work are synthesised here to emphasise the salient points and provide a summary. Recommendations are also given; these do not replace those given by Mr Strange but present the general approach the Foundation would wish to espouse on the information contained in the reports.

2. Overall trends in tussac cover.

- 2.1.1 Tussac is in continuing decline in the Falklands. From an estimated original area of c.22,200 Ha. of which c.9,900 Ha. lay on the coasts of East and West Falkland, some 4-5000 Ha. of full tussac cover remains today. A mere 65 Ha. of that occurs on the two main islands. Important reductions in area have taken place in the past decade.
- 2.1.2 Tussac is susceptible to degradation from natural causes but can recover when left undisturbed. Such natural causes include wear and tear from seals and seabirds, and even occasional fire from lightning strike. Undisturbed tussac can also resist infection by 'rust' (*Puccinia* sp.).
- 2.2 Recovery from fire may nevertheless take many years and improved means of transport make tussac sites more accessible, increasing the risk of accidental burning. Out of 11 fires breaking out over the past 38 years, eight are attributable to human error (see Strange report). Fire is a major hazard, reducing the quality and quantity of tussac cover present at any given time and assuming an ever-increasing importance as the total tussac area decreases. Every effort must be made to reduce this risk. However, the main factor causing long-term decline of tussac is over-grazing.

3. Grazing and Tussac.

- 3.1.1 Grazing converts dense tussac into open cover. Continued uncontrolled grazing leads to elimination of the grass and to erosion. Notable recent examples of this process include Sedge Island, where tussac has been reduced from 330 Ha. in 1956 to 2 Ha. in 1986 following sheep stocking in the 1960's, and Staats, which had 60 Ha. of dense tussac in 1956 but now bears 2 Ha. following an increase in the introduced guanaco population.
- 3.1.2 Tussac can recover if grazing ceases. The process varies from island to island but Steeple Jason has shown a 40 Ha. increase in dense tussac since removal of sheep in 1968 and other islands have also shown increases in overall tussac cover.
- 3.1.3 Paddocks of tussac can, with careful management, support sustained seasonal grazing. The island farms on Sea Lion, Carcass and West Point are remarkable in this respect. It is also noteworthy that these farms can produce high yields of wool per acre. It is likely, though, that tussac cannot regenerate whilst subject to grazing pressure.

4. Conservation of tussac.

- 4.1.1 Sites carrying a mosaic of dense tussac and lower vegetation are as important as pure dense tussac stands for birds and probably more important for other groups, including native plants. It is the larger islands that will display the greatest ecological diversity and capacity to sustain viable populations of plants and animals. Small islands have a valuable role to play in tussac conservation but the premium is upon larger islands and not necessarily those covered in pure tussac.
- 4.1.2 A high proportion of tussac (26% in 1956) is on areas marked as Crown Land on the Ordnance Survey maps. Fifteen of the Crown Land islands are already government reserves. The remainder still include some important tussac sites.
- 4.1.3 Other highly important sites, both for tussac and by virtue of other ecological characteristics, are in private ownership. Eight are wildlife sanctuaries and over twenty are managed as private reserves. Others are not afforded any conservation status.
- 4.1.4 It is extremely probable that there are sites of high conservation value that are not yet known.

5. Recommendations.

- 5.1 Careful consideration must be given to the identification of potential causes of fire in tussac sites, and to taking all necessary action to reduce the possibility of its breaking out. These actions could include legislation, management practices applied to specific sites, and promotion of public awareness on the risks of fire. To err on the side of caution would be preferable to toleration of avoidable risks.
- 5.2 Tussac management can successfully be incorporated into sheep-farming practice although the more widespread trend is exploitative. There is a strong case for the elaboration of a code of practice for tussac management, backed by legislation where necessary. Given the continuing decline of tussac, the following steps should be taken without delay:
- 5.2.1 *Detailed examination of the economics and practice of tussac management in consultation with those individuals experienced in it, leading to the development and application of a code of practice.*

5.2.2 *Accepting that the foregoing recommendation will take time to implement and that close management of tussac may not be possible in all cases, to take immediate action to conserve tussac wherever feasible.*

5.3 The following recommendations relate to the conservation of tussac stands.

5.3.1 *Discontinue lease arrangements on Crown Land carrying tussac.*

5.3.2 *Take immediate action to secure pristine sites and other islands of high conservation value identified in this survey (see appendix 2) that are not already afforded conservation status. The manner in which these sites are secured for conservation will depend upon circumstances and may vary from site to site.*

5.3.3 *Develop a ground survey of sites as a follow-up to Mr Strange's field observations, to provide detailed, standardised information. It is recognised that extreme caution will be required in this undertaking to prevent disturbance and avoid increased fire risk but the work remains a fundamental requirement. Further refinements in the conservation programme may be made on the basis of the information obtained.*

5.3.4 *Review the legislation relating to reserves and legislation, to underpin reserve establishment and management.*

These recommendations should be regarded as one aspect of a broader based effort to secure protection of key conservation sites throughout the Falklands.

APPENDIX 1.

Methodological differences between the Woods and Strange tussac reports.

The main point of difference between the two reports lies in the calculation of areas. As a result, direct comparison of area cannot be made between the two documents; this requires explanation.

- i) The photogrammetric survey base-map covers all tussac on all islands throughout the Falklands in 1957. The on-site survey, although backed up by examination of aerial photographs, does not cover all the islands with tussac in the same way.
- ii) Definition of the boundaries of a tussac stand is subjective. Dense tussac does not present a problem; what is classed as 'scattered tussac' in the photogrammetric survey may, however, be considered a non-tussac community by Mr Strange.
- iii) The process of area calculation is subject to observer bias. Area measurements of identical stands of dense tussac are consistently greater in the photogrammetric survey than in the on-site survey.
- iv) There is potential for occasional misidentification of tussac in the aerial photographs. This could be corrected by direct inspection of the locality in the on-site survey but not in the photogrammetric work.
- v) Post-1983 and a limited number of pre-1983 changes in tussac cover are not accounted for in the photogrammetric survey.

The terms 'tussock' and 'tussac' are equally valid. The use of one or the other is a matter of personal preference.

Despite these differences, the two reports taken in conjunction provide a more balanced assessment of the situation than either one considered in isolation.

APPENDIX 2

Pristine tussac islands and other sites of high conservation value identified in the survey (source: Strange report) not afforded official status as a protected area.

a) Probable pristine sites:

- * Steeple/Grand Jason islet
- Gibraltar Rock
- ** North Island (N.B burnt, lightning strike, 1988).
- Cliff Island
- Cliff Knob Island
- Bold Island
- Double Creek islands
- Edgar Ridge Islet
- Calista Island
- Wedge Island
- Outer Island
- Double Island
- Keppel Islet
- Brandy Island
- Sea Lion Islet
- Sea Lion Easterly
- Little Motley Island
- Sandy Island
- Harbour Islands

b) Other sites of high conservation value:

- Split Island
- Third (Passage) Island
- Fourth (Passage) Island
- Penn Island
- * Seal Island
- Ten Shilling Bay islands
- Elephant Cays
- Perks Island
- Government Islet

* Crown Land.

** Managed as a private reserve, owned and/or leased by an organisation constituted to promote conservation. **N.B** : The owners of several other islands listed here are fully aware of the conservation value of their property and also treat them as private reserves.

TUSSAC GRASS SURVEY
Ian Stange

TUSSAC GRASS SURVEY

INTRODUCTION

Tussock grass is a unique plant, forming the Falkland Islands' most important terrestrial ecological niche. It is one of the Islands' most valuable natural assets as a nesting and feeding habitat and as shelter for man's stock. Even so, the Falkland Islands have an appalling record of spoliation of this extremely valuable plant, to the point where today only a small percentage of the original tussock remains. Much of this has resulted from ignorance of the plant itself, the part it plays in the general ecology of the Islands and, indeed, a lack of knowledge of the overall status of tussock in the archipelago.

In this survey paper, the first of what the author hopes will be a series of ongoing studies, information gathered over a number of years about tussock generally and about specific tussock islands is put together. The aim is to create a better understanding of this plant and the invaluable part it plays. It is also an inventory of the Falklands' remaining tussock communities with some details of their ecological value and status. Areas of tussock remaining on the islands are given, presenting what the author hopes will be a clear but rather alarming picture of the present status of tussock in the Islands today.

HISTORICAL

Early Description and Nomenclature

Tussock grass was first described by Johann Forster (1754-1794), when he accompanied his father Reinhold Forster on Captain Cook's second voyage 1772-1775. When Cook discovered South Georgia and made a landing at Possession Bay on the 17 January 1775 the two naturalists described the plants they found there. One of these, in Cook's words was "a coarse strong bladed grass which grows in tufts", today commonly referred to as Tussock Grass.

Forster named the grass *Dactylis glomerata*. Later names were to include *Dactylis caespitosa* (Forst. 1789), *Festuca flabellata*, (Lam. 1788), *Poa caespitosa* (Melvill 1903) and *Poa flabellata* (Lam.). In 1981 *Poa flabellata* was changed to *Parodiochloa flabellata*.

Common nomenclature was to vary considerably and when de Bougainville's expedition landed at the Falkland Islands in February 1764, Dom Pernetty, botanist to the expedition, referred to a "cornflag". Bougainville in his chronicles made a reference to Pernetty's description, writing: "All the sea coast and islands are covered with a plant which has been erroneously termed a Cornflag; it is, however, a species of grass, of the most beautiful green colour, and growing to a height of six feet". This description by de Bougainville leaves little doubt that he was referring to Tussock grass. Although de Bougainville may have believed Pernetty was also referring to Tussock grass, calling it a cornflag, it is probable that this botanist was in fact making reference to Sword Grass *Carex trifida*. The confusion between these two species is discussed later.

As early as 1774, the grass was referred to as Penguin grass, a reference no doubt to its use by Magellan penguins *Spheniscus magellanicus*. One of the earliest references to the term "tussock" appears in Fanning's writings in 1797. Describing a rookery of albatross and penquins at New Island he mentions the rookery being surrounded "with high bogs of tall grass called tussucks". Spellings and corruptions of the name were to follow. Lt James Grant of HMS The Lady Nelson, 1803, refers to the grass as "Fussack". Barnard (in 1812-1816) and other North American whalers and sealers called the grass "tushooks", although they clearly drew a distinction between the actual leaves and growing point of the plant and the fibrous base or tussock. M.d'Urville, visiting the Falkland Islands in 1822, mentions the grass being commonly called Tussack. Hooker, writing of the grass during his visit to the Islands in 1842 also used the name Tussack Grass "a name evidently given to it, from the immense tufts or tussacks formed by the plant". In later writings, Hooker appears to have changed the spelling to "tussock". one commonly accepted today.

In earlier times the name "Tussack" was also applied to the large species of *Carex*, Sword Grass *Carex trifida*. Pernetty in his reference to a "cornflag" was almost certainly referring to this form of sedge. Hooker wrote of the confusion between the two plants, pointing out that the name "Tussock Grass" is ...

"also applied to a similar species of *Carex*, which grows in a similar manner, a circumstance which gave rise to an important error: for specimens of the Tussack Sedge (*Carex trifida*), were put into the hands of the Botanist, that a description might be forwarded to the Colonial Office, and accordingly a description of the sedge, which, indeed, in its young state, is eaten by cattle, was transmitted instead of the grass".

This early confusion between the now rare Sword Grass *Carex trifida* and Tussock Grass *Poa flabellata* is interesting, in that it is a strong indication that the sedge, normally growing on the fringes of tussock grass stands, was before the introduction of stock a common plant, but being a peripheral species was grazed out first.

Early Distribution of Tussock

Before man settled the Falkland Islands in 1764, Tussock Grass *Poa flabellata* was far more widespread than it is today. Whether or not it existed in the whole littoral of the archipelago is the subject of some debate; few records exist giving details of the distribution of the grass around the Islands' coastlines, although a careful analysis of early accounts, along with present day surveys and knowledge of the plant, indicate with little doubt that although very extensive stands of tussock did exist in many areas of coast on the main islands, it did not extend over the entire littoral area of the archipelago.

One of the first references to the profusion of this grass comes from an account written in 1593 by Sir Richard Hawkins, when aboard his vessel the Dainty he was one of the first voyagers to sight the Falkland Islands. Hawkins did not land, but sailed along the northern extremity of the Islands, noting "a low, flat island of some two leagues long; we named it Faye Island, for it was all over as greene and smooth, as any meadow in the spring year". Today this island is known as Sedge Island and is completely devoid of its original cover of tussock grass. Hawkins' route took him across the northern entrance of the Falkland Sound and past the Eddystone Rock. Both these areas are described by Hawkins, although it is interesting that he makes no further references to any more large areas of tussock grass such as he viewed on 'Faye Island'.

In 1684 William Ambrose Cowley anchored off one of the outer Jason Islands. Cowley described the area, writing "The island seemed very pleasant to the eyes, with many woods, I may as well say the whole land was wood". Cowley was not to land, so confusing the tussock with trees not unlike palms, a mistake that many early voyagers were to make. It is not clear which of the Jason Islands Cowley was describing, but possibly Grand Jason Island. Today this island has little tussock, but there is evidence that at one time a very large proportion of the island was covered with this grass.

Probably the first botanist to describe the tussock in the Islands was Pernetty who accompanied deBougainville on his expedition to the Islands in 1764. Unfortunately the expedition was not to describe in detail how extensive the stands of tussock were, Bougainville making only a general observation that "All the sea coast and islands are covered". Bougainville was to introduce cattle, horses and possibly pigs to the Islands. He records an incident where tussock was deliberately set on fire. All were responsible for the destruction of this grass, especially in the immediate area of Port Louis. Less than forty years after Bougainville had commenced settlement, the botanist Gaudichaud visited the area of Port Louis. He recorded that tussock covered two thirds of the Isle of Penguins (Long Island) and other islets in French Bay (Berkeley Sound) but makes no reference to tussock being found on the main island in that area. An illustration showing French Bay at the time of the early French settlement does show tussock on the above mentioned islands and on some small areas of the coast of Berkeley Sound, but what is not clear is if the latter areas were to be destroyed in the period between settlement and Gaudichaud's visit, or were not significant enough for this botanist to record.

Lt. Clayton (1774) at Port Egmont on Saunders Island, described the tussock growing there as coarse species "rising to a height of six or seven, and sometimes ten feet". Clayton also gives an idea of the extent of the grass on that island, recording, "Many acres within the beach are overrun with these clumps". Again the suggestion is that parts of the island's coast were covered with stands of tussock, but not completely.

Captain Grey writing in 1836 gives an account of a journey he made round West Falkland. His descriptions of the landscape and the environment at that time are some of the more detailed. Describing a landing in Grave Cove at the NW tip of West Falkland, he wrote: "The walking was very bad, at first there was a great deal of tussock and then grass up to your middle". From Grey's descriptions, the area he walked can

be pinpointed today, although there is very little evidence that tussock existed there. From the same writings it is known that tussock existed, as it does today, on the small islets in Port Edgar and Lake Hammond, but not on the shores of these two areas. Grey wrote of the Swan Islands being covered in tussock grass, excepting the centre of the larger island. There are references to Port San Carlos, but no mention of the tussock grass, suggesting that this is one littoral that did not support the grass.

Parker Snow visiting San Carlos in 1885, although recording the existence of tussock grass on the small islets in Port San Carlos, makes no mention of this form of vegetation on the mainland coast of these waters.

Hooker, visiting the Islands in 1842 spoke of tussock grass as the "*gold and glory of the Falkland Islands*". Hooker was not to record in detail the distribution of tussock, but stated that "*All the smaller islands, which help to form the Falkland group, and some of them as large as Guernsey, are covered with it*". In another report Hooker wrote:

"Though not universal along the coast of these islands, the quantity is still prodigious, for it is always a gregarious grass, extending in patches sometimes for nearly a mile, but seldom seen, except within the influence of the sea air".

At the time of Hooker's visit Governor Moody was in office at Port Louis. Moody had a keen interest in tussock and reported at length to his superiors in London on how valuable a plant it was. Hooker was to quote from some of Moody's reports, which Hooker was to acknowledge "*the truth of which I can vouch, both from my own experience, and from his (Moody) having kindly given me ample means for judging of the correctness of his interesting and useful observations*". Extracts from these reports of Moody's give further indications of the distribution of the grass on the main island of East Falkland.

"During several long rides into the country I have always found the tussac flourishing most vigorously in the spots most exposed to the sea, and in a soil unfit for anything else to live in, viz the rankest peat bog, black or red. It is singular to observe the beaten footpaths of the wild cattle and horses, as marked as footpaths across the fields in England, extending for miles over wild moorland and always terminating in some point or peninsula covered with this favourite fodder".

In this one account of Moody's the indication is that tussock was largely confined to coastal peninsulas or points, which present day evidence tends to confirm. However, in another account, Moody infers otherwise: "*I may say that by far the greater part of the coasts of these islands are fringed with it in many places to the breadth of half a mile: all the smaller islands are covered with it*".

Moody's reference to a breadth of half a mile is probably a miscalculation unless he was describing those stands of the grass which covered the width of some peninsulas. Another possibility is the early confusion with Sword Grass *Carex trifida* and perhaps Cinnamon Grass *Hierochloa redolens*. Both these plants are associated with the fringes of tussock grass stands and from a distance might have been mistaken for tussock at a time when both were very much more common than they are today.

Today, with the advantages of aerial survey, it is possible to locate some of those areas where tussock stands existed. On the north coast of East Falkland, the now small remnants of petrel breeding grounds give an additional clue to the original sites of tussock stands. Eroded areas of a generally dry black peat, devoid of any vegetation, except patches of Sheeps Sorrel and scattered with small clusters of very small smooth peddles, mark other sites. The pebbles mark long abandoned Magellan penguin burrows, formed at one time beneath the cover of tussock. As the tussock was

destroyed, so the soft tussock peat eroded away, finally exposing the burrows, leaving only the heavier pebbles which the penguins bring to such sites, either in their excreta or as part of their courtship display.

In a very few localities on the coasts of the main islands of East Falkland and West Falkland, small areas of tussock remain. (See **Tussock Survey: Mainland Areas**). Today these areas are so small, that their value is now limited. They are however, further evidence of the distribution of this grass.

Even though there are few references to the exact locations of original stands of tussock, particularly on the mainlands, an analysis of the above reports and notes, combined with present day observations and some knowledge of the plant, does present us with a fairly good picture of the original distribution of stands. Main coasts, such as the north coast of East Falkland, as opposed to inland water coastlines, such as Salvador waters, would have supported the major stands of tussock. An area such as the north coast might then be divided into two supporting localities. One a fringe area composed largely of high standing coastline, predominantly rocky with generally thin soil layers, supporting sparse rather thin fringes of tussock grass, mainly on the cliff sides and immediate coastal edge. Some of these fringe growths remain today having escaped the grazing of cattle, horses and sheep because of their inaccessibility. The second area, supporting the larger, dense stands was on points, headlands, peninsulas, the fringes of some beaches and some lower coastlines. All are regions subjected to higher amounts of sea spray and nutrients in the form of animal and vegetable matter.

In order to try and establish a general picture of the original extent of tussock on the main island of East Falkland, an area of coastline, approximately 52 km in length, from Volunteer Point to the entrance of Port Salvador, was selected for survey. Using known criteria, evidence of old sites and the small areas of tussock that remain, estimates were drawn up. The probability is that this area of coast supported some 900 to 1000 Ha. of tussock, composed of pure stands, covering entirely some points and headlands or forming coastal belts 200m or more wide. This figure does not take into account fringe growths, which remain on some cliffs as individual tussocks, but including a small stand still in existence at Seal Bay House.

The area selected for this survey was probably one of the more prolific areas, with perhaps some 30 to 40% of that coastline fringed or supporting a belt of tussock. A similar cover probably existed from the entrance of Port Salvador to Cape Dolphin. However, on both the west and east sides of the Falkland Sound there is little evidence of original stands of tussock grass.

Decline of Tussock Grass by Natural Causes.

In considering the decline of tussock grass in the Falkland Islands, it is important to look first at natural causes, elements which were at work long before the Islands were settled by man. Although not complete, causing only a temporary decline, is the damage created by an increase in seal populations, particularly by Sea Lion *Otaria byronia* and in some instances by Fur Seal *Arctocephalus australis*. Present day evidence of this is very little, there being a general decline in the Islands' seal populations. A survey of tussock islands carried out in 1965, when some islands had very large populations of seal, found large areas of grass denuded of their growing points due to the continual passage of seal. On Beauchene Island, during this period, an area of tussock covering several hectares was found to be completely denuded due to the movement of seal. Today the area is marked by an exceptional growth of tussock. A similar situation is presented on Wreck Island.

Minor forms of destruction can occur through the actions of some bird species. On New Island a sudden increase in the population of King Cormorants on the Settlement Rookery, found large numbers of birds seeking nest material from a nearby tussock stand, with the result that an area of the grass was completely denuded and some individual tussock stools were killed. A similar situation was recorded on Beauchene Island. On this latter island, where some colony nesting species such as Rockhopper penguins and Black-browed albatross have their colonies partly confined by stands of tussock, increases in colony size effectively erode the perimeter edges of the tussock. However, as populations fluctuate, a decrease in a colony quickly reverses the situation with the tussock regaining ground.

Fire caused by lightening strikes was probably the one single element responsible for the greatest natural loss of tussock. Many islands still bear signs of having been burnt many years ago. Layers of red ash, in some cases a metre below present soil levels, suggest that such fires occurred before the arrival of man. In 1594 when Sir Richard Hawkins sailed along the northern part of the Islands in his vessel the Dainty, he recorded: "It was peopled. We saw many fires". Hawkins many indeed have witnessed the fires from a vagrant group of Yaghan canoe indians deposited on the Islands, but more probably he had viewed tussock fires caused by lightning. Lightning is still one of the causes of tussock grass fires and in the period 1949 to 1968 two tussocks islands were partly destroyed by fire from lightning strikes.

Depletion of Tussock Grass by Man.

In 1764 shortly after Bougainville's expedition landed in the Falkland Islands to establish the first settlement of the Islands, Bougainville was to record that some of his party set fire to an area of tussock grass on the island they were to name Penguin Island and that some two hundred penguins had perished. In a letter written by McBride to the Earl of Egmont dated April 1766, McBride makes an interesting reference to having discovered that the coastline on both sides of Carlisle Sound (Falkland Sound) had been burnt, "probably that French frigate, that Mr Byron met with in the streights of Megellan, may have touched there". McBride makes no mention of tussock grass in this account, but later references to the burning of tussock suggest that from the very early days of settlement, the coastal stands of tussock grass were probably considered a hindrance to landing parties and were deliberately fired to make passage inland easier. In 1803 Lt James Grant recording a visit to West Point Island wrote: "Some of our people, as I suspect, had wantonly set fire to the tussock, and there being a breeze the flames spread with great fury, so that our endeavors to extinguish it proved ineffectual. Although we had heavy rain for two days, yet I observed it was still burning". Grant was clearly concerned about the fire and noted how great the destruction this burning caused to wildlife. This was not a common sentiment among the early voyagers to the Islands and there are several accounts of tussock being fired. Even as late as 1882, from the Cruise of HMS Dwarf, visiting George Island on the 4 January 1882, an unknown writer records: *I set fire to the tussock and it caused a tremendous fire, which was burning like blazes when we left at 6pm for Port Stephens*".

Charles Barnard, an American whaler and sealer who made several journeys to the Falkland Islands in the early 1800's left some of the best accounts of tussock at the time. In his narrative dated 1812-1816 he wrote of the deliberate destruction of tussock, especially around the coastline of East Falkland. Noting heavy columns of smoke rising from the Speedwell group of islands, Barnard wrote of his belief that this was due to the actions of Spaniards from Buenos Aires:

"As I have often heard that the Spanish Government was in the habit of sending out every year a Guarda Costa, to examine their harbours and passes for foreign vessels, and if any were found, to order them off immediately: and so apprehensive were they that the subjects of a foreign power might form even a temporary settlement, for the

purpose of procuring seal skins and sea-elephant oil, that they often set fire to the tuchooks, and thus destroyed the harbours of the seal, to prevent them as much as possible from resorting to these islands".

This description by Barnard is interesting, accounting perhaps for some of the complete absence of any tussock stands on islands such as Barren, George and Speedwell, at the present time. On Sea Lion Island, which its name suggests was a main breeding ground for seal and where a considerable amount of tussock remains, there is much evidence of very early burning of the tussock stands. Quite possibly this was the result of what Barnard recorded.

Barnard relates another reason for the burning of tussock grass, "*I discovered a smoke rising from Beaver Island, which I knew was occasioned by some persons setting fire to the tushooks, that being the method here of making signals of distress, or when various parties are sealing on different islands, and wish to communicate or convey information to one another*". Of the resulting damage he wrote, "*If fire is kindled there, it will continue burning several days; and when it communicates to the bogs, or penetrates below the surface of the soil, which it most commonly does, it will burn several months, and make deep chasms or pits in the ground*". On Tea Island, Barnard recorded the finding of pits thirty to forty feet deep, but at the time of his discovery, about 1812-1813, these were thickly obscured by new tussock growth, indicating that this particular fire had occurred many years before Barnard's discovery.

In 1774 only ten years after Bougainville had established the first settlement in the Falkland Islands, whaling and sealing vessels were leaving French, British and North American ports for southern waters. The Falklands, and in particular areas around the SW of the archipelago, Beaver, New Island and Weddell Islands, became the self-styled homes of North American whalers and sealers. Although these expeditions took oil and skins from around the Islands, their main hunting was carried out further south and in the Pacific, the Falklands being largely exploited in another way. The harbours of islands like New Island and Beaver Island were secure winter anchorages and also places where they could replenish with wild game and the eggs of penguins and albatross. More important however was the discovery of tussock grass and its qualities as a grazing for pigs. It became the practice to bring such animals to the Falklands and release them on those islands with tussock stands. An analysis of the records of men like Barnard, leave little doubt that few islands in the area of Weddell Island were to escape stocking with pigs. In an account of whaling and sealing depredations by Governor Rennie in 1854, he reported on how pigs had been placed on Quaker Island. Unable to drive the pigs when time had come to take them off, the whalers had deliberately fired the tussock grass, a system also used to drive seals.

Where tussock was not destroyed by fire, the grazing by pigs, although slower, was equally disastrous. In a reference to pigs, Hooker wrote:

"After devouring the foliage, they eat down the stumps of the culms, greedily following them into the heart of the mass of roots from which they spring, for the sake of the white core just described; the rain water lodges in the cavity thus formed, and decay surely follows, that I have seen nearly half a mile of tussock -grass plants entirely destroyed by no other means."

Moody, writing in 1842, also made a reference to pigs, writing that: "*all animals, especially pigs, tear it up, to get at the sweet nutty flavoured roots*". At the time of Moody's arrival in the Islands, large herds of wild cattle and numbers of horses, roamed the main island of East Falkland. Moody wrote of the "avidity" with which all these animals fed upon the tussock stands and even noted how horses and cattle were a problem around the settlement of Port Louis, eating the dry tussock grass used in thatching some of the buildings.

In 1840 the first main attempt at sheep raising was made and by 1843 the number of imported sheep was slowly increasing. By 1859 there were some 8000 sheep in the Colony, all on the main island of East Falkland. Although it is probable that sheep were also having an effect on the remaining tussock stands, by this date tussock on East Falkland was diminishing. In a Government report dated 1847 the acreage of tussock grass in the area of Stanley was given as 1200 acres, at Port Louis, 6 acres and in Lafonia, at the southern end of East Falkland, 4000 acres. In 1848 Governor Rennie reported that "*tussock is largely to be found on the small offshore islands but is not that common on the mainlands*". In 1853 he reported that "*tussac now only grows in situations inaccessible to the wild cattle and horses*".

In a report from Bailey, Government Surveyor, dated February 1859, the decline of tussock is clearly recorded. "*On the 17th I proceeded to Elephant Creek, Foul Bay and examined the North-west corner of the island including Cape Dolphin, a very dry district formerly abounding in Tussac Grass of which now only the dead dry stools remain.*"

From these records it does appear that tussock on East Falkland had already been severely depleted by the grazing cattle, horses and pigs, before large numbers of sheep were introduced. The probability is that sheep were responsible for the final removal of tussock growing in more inaccessible regions, steep coastal slopes and cliffs. Sheep would also have grazed off young seedling tussocks, thus effectively stopping the original stands regenerating.

On the main island of West Falkland the depletion of tussock grass was different. Except for the possible destruction of vegetation by burning, the island was to remain free of stock until 1839. At this time some 66 cattle were introduced, but not until 1867 was West Falkland officially opened to settlers. By 1868, all available land on this island had been taken up for sheep farming. In the thirty years prior to this, cattle would have depleted some of the tussock, but there is little doubt that sheep were to be the main cause for the disappearance of tussock grass on the West Falkland.

With the leasing of the West Falkland mainland complete, attention was focussed on the larger offshore islands, with sheep farming spreading to places like Pebble Island, Saunders Island, Carcass Island, West Point Island, Weddell Island, Beaver Island, Keppel Island and New Island. Some of these islands had already lost large areas of their original tussock grass stands, from the actions of sealers and whalers, mainly through fire and the introduction of pigs, but sheep farming practices from the mid 1860's to the present day have been responsible for the loss of the largest proportion of tussock grass in the archipelago as a whole.

Present Day Decline of Tussock

The main factor responsible for the continuing decline in tussock still rests on the over-grazing. Share farming systems and the sub-division of larger farms have not assisted. In the case of the latter there is evidence that new sub-division owners are turning their attention to small offshore tussock islands, which prior to the break up of some larger estates were remote in both economical and logistic terms. At the present time however, forms of share farming are indirectly responsible for the loss of the largest acreage of tussock.

The survey found that the Great Island group, including North Swan Island, presented one of the most serious declines in tussock. New Island (North), Split Island (Beaver) have also lost considerable areas of tussock through leasing or share farming arrangements. Although privately owned, Sedge Island also presents a further example of serious overgrazing, it being estimated that this island has lost over 500 acres in less than ten years.

It has been suggested that the fungal disease "Rust" is responsible for the decline of much of the tussock grass in the Falkland Islands. Areas of tussock with the disease on New Island were looked at by a United States expert on rust diseases, Dr M. D. Simmons, who later identified the fungus as Yellow or Stripe Rust *Puccinia striiformis*. Dr Simmons made the point that although the fungus can reduce the vigour of plants already suffering from overgrazing or some other malady, rust is not capable of killing plants and normal vigorous tussock communities are not affected seriously. The survey's findings bore this out and although evidence of rust was found on a small number of untouched tussock islands there was no evidence that plants were impaired by the fungus.

Fire remains a serious hazard to any tussock community. There is evidence that some islands have been burnt as a result of lightning strikes (See **Tussock Island Survey, List of Islands**), but by far the largest majority are caused by man. Records show that between 1949 and 1987 some eleven tussock islands have been burnt. Two of these were caused by lightning and one from unknown causes. A total of eight however have been due to human error, with all occurring in the last five years. Military activities have been shown to be responsible for some of these fires, although no tussock islands were burnt during the conflict of 1982. An important factor of these more recent fires has been the increased ability for a larger number of persons to gain access to tussock islands. The military had that ability and although now much reduced, this may well be offset by increases in tourism operations, the movement of small boats about the archipelago, such as visiting yachts, scientific expeditions and even vessels employed in the various activities associated with the present fisheries. All these factions have proved to have the ability and inclination and therefore present a potential hazard to the few remaining tussock islands.

Estimates of Original Tussock Cover.

East Falkland Island.

Estimates are based on analysis of early records and the survey of selected areas of coastline. Using known criteria, evidence of original communities (see: **Early Distribution of Tussock**), it was possible to build up a general picture of the tussock's original distribution at the time of the first settlement in 1764. Although it is often generally stated that tussock grew round the entire coastlines of East and West Falkland, evidence gathered by the author suggests that this was not so. Little evidence of tussock was for example, found on the west coast of Lafonia between Grantham Sound, south to Port King. The almost landlocked coast of Port Salvador was probably almost devoid of any tussock communities. However, on the north and north-east coasts of East Falkland, tussock was probably prolific. Some 52 km of coastline lying between Volunteer Point and Cape Frehel at the entrance to Port Salvador was estimated to have supported some 2470 acres (1000 Ha.). Using the survey of this section as a base line, the very similar coastline between Cape Dolphin and Port Salvador was estimated to have carried the same, 2470 acres (1000 Ha.), while the west coast of Cape Dolphin, Foul Bay and Middle Bay areas was estimated to have supported some 741 acres (300 Ha.).

The area north of Choiseul Sound to Port Harriet, just south of Stanley, appears to have been less prolific with tussock confined largely to coastal points. The total area of tussock for this region is estimated at some 2964 acres (1200 Ha.).

According to a Government report dated 1847 the area of Stanley at this time was estimated at 1200 acres of tussock. The area "County of Lafonia", south of Darwin, 4000 acres and the "Township of Anson", Port Louis, 6 acres. What percentage these figures are representative of the original communities is not known. By this date fairly large herds of cattle and some horses roamed much of East Falkland, resulting in the

decline of some tussock, but it is probable that only in the immediate region of Port Louis had tussock been severely depleted by this date.

Allowing for a reduction of tussock in the area of Port Louis of some 200 acres (80 ha), the total estimated figure for the whole of East Falkland is just over 14000 acres (5668 ha).

West Falkland Island.

This island was to remain free of stock for some 75 years after East Falkland had been stocked and was not to be settled by sheep farmers for a further 30 years. (See Depletion of Tussock by Man). The life of those original tussock communities on West Falkland therefore extended into an era when it is probable that more records were maintained, yet very few accounts mention the grass on this island, suggesting that tussock was less evident. The present survey tended to endorse this. Tussock was found growing at some three sites on West Falkland (See, Tussock Survey, Mainland Areas). Two of these sites, Cape Meredith and Cape Orford, were almost certainly more extensive than they are today. Records exist of tussock communities at Queen Point, Hope Harbour, Penguin Point, Kitts Creek, Fox Bay, White Rock Bay, Port Albermarle and Spring Point. Communities may also have existed on sites at Port North, Pond Bay, Mare Rincon, South Harbour, Lucas Bay and Carcass Bay.

The area of tussock surviving today on West Falkland is greater than on East Falkland. However, the evidence is that original stands were proportionately much lower on this island with an estimated acreage of some 10,500 acres, (4251 ha).

Offshore Islands

In 1867 West Falkland was officially opened to settlers for sheep farming; by 1868 all available land on this island had been secured by tenants. Although some of the larger offshore islands had also been taken up by this date, the leasing of West Falkland for sheep farming undoubtedly added impetus to the taking up of land. The interest spread to any island large enough to support even a few hundred sheep and within a very short space of time many medium sized islands were stocked.

In proportion to the main islands of East Falkland and West Falkland, the majority of these offshore islands held a much greater percentage of tussock. Table "A" lists 47 Offshore islands known to have supported large areas of tussock. All these islands are stocked or are recorded as having been stocked for continuous periods of more than 15 years. The estimated total area of tussock that originally existed on these islands is some 20,900 acres (8462 ha). The total estimated area remaining today on these islands is 1916 acres (776 ha), indicating a loss of some 18,984 acres.

ECOLOGY

The Plant

Hooker wrote of the plant: "*The similarity between the tussock-grass and a small palm tree is due to the curious mode of growth of the former. Each plant forms a hillock of matted roots, rising straight out of the ground, and a few feet or more apart from the roots of the surrounding tussock plants. The hillocks are often six feet high, and four or five feet in diameter, and they throw out from the summit the copious grassy foliage, with blades full six feet in length, drooping on all sides, those of the opposite plants meeting, so as to over-arch the spaces between. Thus a tussock-bog (for so a tract of land covered with this grass is called) becomes often a labyrinth.*"

Hooker's description is fairly typical of the general form of tussock grass found in the islands, although there are considerable variations in the form of growth, depending both on rainfall and nutrients available to individual plants and probably more important a combination of these two factors. In general, those stands of tussock grass growing on the islands in the SW of the archipelago, New Island, North Island, Saddle Island, Channel Islands, etc, do not present the vigorous and luxuriant growth more typically found on the eastern side of East Falkland and to the SE. Rainfall is noticeably lower in the SW of the Islands, thus affecting growth and in turn the build up of ground humus or peat needed to retain moisture.

Variations in form and growth were recorded in the NW of the archipelago. On the outer Jason Islands, Steeple Jason Island and Grand Jason Island, the tussock did not exhibit the same vigorous growth of plants on those islands to the east of the group, namely Gibraltar Rock, The Twins and Elephant Jason Island. No records exist to show annual rainfall within the group but the indication is that the outer islands have a much dryer climate than those islands to the east. West Point Island has a recorded annual rainfall of 431mm (average for period of ten years). Within this general situation however, mini climatical conditions can develop affecting the growth of tussock in specific areas.

Such a situation exists on Steeple Jason Island. On the SW side of the island's central ridge where elevations rise to over 900 feet (295 m) a vigorous growth of tussock grass has established along much of the ridge length. The very steep nature of the island's SW side creates a predominant updraft which carries both sea spray and moisture laden air to the top of the ridge. At other times when the lower elevations may be subjected to dry conditions, the island's ridge may often be shrouded in low cloud, creating a cloud forest effect.

Variations in tussock growth caused by other factors may also exist in a particular climatic area. For example, on South Fur Island, a low lying island at the east end of the Jason Island chain, much of the island tussock grew as a dense but low lying mat over a solid blanket of root fibres with little or no pedestal formation. Both living and dead leaf lay predominately in one direction, apparently influenced by the prevailing winds. South Fur Island was found to be unique, in that the entire island is composed of igneous rock, initially identified as a form of dolerite. Much of the island's "blanket-like" tussock appeared to be growing over a base of dolerite boulders, probably accounting for its rather unusual growth form.

Tussock growth may also be greatly modified by the actions of animal and bird life. On a number of islands the passage of seals through stands of tussock was found to have worn the sides of the tussock pedestals and consolidated the ground beneath the individual plants to such an extent, that the effective height of tussocks was greatly increased. In other situations, particularly where small areas of tussock have been

periodically exposed to large numbers of seal, eg. Wreck Island and Port Egmont Cays, the height and formation of pedestals may be reduced by the movement of seal over the tops of the tussocks, the plants tending to form a greater amount of vigorous leaf growth during periods of decline in the seal populations.

On some islands the burrowing actions of species such as Thin-billed Prion and Diving Petrels within stands of tussock grass were found to influence the form of growth. In areas of intense activity by these birds, plants lacked the fibrous base of pedestal, tillers producing a mass of vigorous leaf growth from a loose matrix of fibrous root debris and peaty soil. In such situations it was difficult to identify individual plants and travelling over areas of the grass resulted in one sinking up to half a metre into the loose peaty ground. In such stands, dense populations of birds forming nest burrows between and in the base of the plants have kept the ground cultivated by their burrowing actions. The result of this appears to restrict the formation of a pedestal and instead encourage the plant to produce tillers which root and spread out into what is effectively a mulch formed from the loosened soil about the plants.

On the steep south side of South Jason Island, tussock was found to be growing in a similar form, but with no evidence of ground burrowing petrels. This was to be the only site recorded on the present survey, where this form of growth had apparently been influenced by other factors. In January 1960 this island caught fire (see **Survey: South Jason Island**). Whether this form of growth was present and influenced by a large petrel population prior to the fire is not known, but the indications are that the tussock's present growth form is probably a re-established phase after burning, coupled to the generally unstable soils which exist on the steep slopes of this island.

On the few islands in the Falklands that remain ungrazed and intact and where tussock grows under optimum conditions of a higher than average rainfall for the islands (25-28 in -640 to 718 mm) plus high fertility, the grass can grow to exceptional dimensions. On Easterly Sea Lion Island, plants were commonly 3m high, including the fibrous pedestal. On Beauchene Island, plants in some areas had an estimated average height of 3m with pedestal dimensions of 2m, some of the largest plants measuring 4m in height. In larger plants the growing point or crown produced dense canopies with tillers commonly 2m in length. Canopies from adjoining plants would often overlap producing a shaded "tunnel-like" environment between the individual pedestals, (see **Tussock Environment**). The crown of larger plants may be made up of several hundred living tillers, these remaining green for over a year. On dying the leaves remain attached curving and deflexed to form a dense skirt of dead leaf round the pedestal. In the same manner that the skirt of the tussock develops, so the pedestal builds up from the old culms and roots of tillers to form a dense fibrous-like matrix.

The dense fibrous nature of the pedestal forms the tussock's own medium into which the roots of the crown grow. In young plants with relatively low pedestals the living roots may penetrate the original soil layers, but as the pedestal develops height so the growing point with its newly forming roots are elevated above the sub-strata. In older tussocks the growing point is therefore isolated from the ground, the plant's roots drawing moisture from the pedestal itself, the latter in turn drawing some of its water by capillary action from the sub-strata.

Seedling plants, growing under optimum conditions, develop a mass of leaf relatively quickly, plants reaching a height of 1.5m in eight to ten years, but with little or no pedestal formation. The development of the latter is very slow, plants with pedestals of a metre high probably exceeding an age of 200 plus years. A radiocarbon date from a pedestal 75cm high on Beauchene Island gave an age of 290 + - 40 years BP (Lewis Smith, Prince 85). In 1949 fire swept through the tussock on Elephant Jason Island. Much of the damage appears to have been superficial, leaving areas of large tussocks

black and scorched, but capable of re-growth. Some of these tussocks still retain their blackened pedestals denoting development prior to 1949, with subsequent pedestal build-up unscarred. By comparing the relative heights of the two, it was possible to obtain an estimate of the development rate and thus an indication of the considerable age of some larger tussock plants.

In the Falkland Islands tussock forms inflorescences in late summer (January-February) these remaining ensheathed during the winter. Development probably depends on weather conditions prevailing during the mid-winter months of June and July, plus the condition and form of a particular stand of tussock, but plants commonly develop inflorescences with anthesis in mid August, with seedheads being ripe in September-October. The plant is thus able to drop seed during the optimum growing period of October through January-February. The early development of the flower in relation to the winter grazing of tussock is discussed under **Survey results: Discussion**.

The Tussock Ecosystem.

Tussock thrives in a maritime environment where it may be subjected to considerable amounts of sea spray and a moisture-laden atmosphere with a high salt content. Whether the plant benefits nutritionally in a direct manner from this salt-laden air is not clear, but its tolerance to such an environment plays an important part in reducing competition from other plants. In old, well established tussock communities, where large plants produce a dense canopy, often excluding light from the ground, the ground flora is almost non-existent, thus a tussock grass community may be considered as monospecific. The area between the individual pedestals being covered instead with dead leaf litter from the tussock skirts. New communities developing from seedlings must, on the other hand, rely on their ability to tolerate salt which many would-be competitive plants are unable to do. However, other factors play an important part in the development of a tussock community.

Unfortunately very few examples exist in the Islands where tussock is establishing as a new community, as distinct from old stands being allowed to regenerate. Small establishing communities exist on Beauchene Island but probably the best example is on Steeple Jason Island. The site of this new community is typically coastal and therefore subjected to a moist, salt-laden atmosphere. But equally important, the area is occupied by a large and well-established Gentoo penguin colony. Here the colonisation limits of the new tussock community are clearly restricted to those Guano enriched areas on the old breeding sites of the penguins.

In this particular situation plants receive nutrients directly from Guano enriched soils of old nest sites, from the excrement of birds passing through the stands and some seepage derived from nesting sites used annually. A number of variations exist in these direct methods of nutrient supply. Ground burrowing species of bird such as petrels, shearwaters and Magellan penguins which nest in tussock stands, deposit nutrients in the form of excrement at the base, or in the pedestals of plants. In some localized situations, seal supply nutrients in the form of faeces and urine.

On some sites, notably Beauchene Island, Steeple Jason Island, Grand Jason Island and New Island, where large seabird colonies are annexed to, but not always integrated with tussock communities, the stands receive amounts of volatilized nitrogen from these colonies. This is particularly evident when the Guano-rich ground of a colony, dampened by precipitation or sea spray, is warmed by the sun. In such conditions, volatilized nitrogenous compounds rise as visible vapour. In this form nutrients may be dispersed over considerable areas, explaining the vigorous growth of tussock on some higher elevations (see **The Plant - Steeple Jason**).

The extent to which this dispersal of volatilized nutrients and sea spray carries inland is probably a major factor in determining the width of coastal tussock communities. Although there are exceptions, tussock stands are generally restricted to a coastal belt which rarely exceeds some 300 m in width. Outside this limit the tussock plants noticeably diminish both in size and vigour. At this point the monospecific tussock community tends to be taken over by those peripheral species such as Wild Celery *Apium australe* and Sword Grass *Carex trifida*. Outside the generally narrow peripheral zone the ground flora may then be taken over either by a dwarf shrub association, grassland or a mixture of these two depending on soil layers, altitude and the area's particular climatical conditions. Generally this coastal limitation of tussock results in most of those offshore islands having a distance between two opposite coastlines of some 800 m or more, developing a central plain composed of other flora, while smaller islands are generally covered with a pure stand of tussock. However, there are variations to this general pattern and these are noted under the survey of individual islands.

An analysis of surface tussock peat by different investigations at a number of sites has shown that in general this form of peat has high concentrations of total and available N and P in contrast to the generally low fertility of other peat soils found in the Falkland Islands. Clearly the rather specialised environment in which tussock grows, its inter-relationship with bird and animal life, in particular species which depend on a marine environment, are all factors important to established tussock communities.

However, the supporting structure from the early development stages of a community, the following and continuing high build-up of a tussock stand and the biomass of most tussock islands has to be principally the result of the original ground layers having very high concentrations of important chemical elements laid down by seabirds and mammals, as noted on the site used by Gentoos penguins on Steeple Jason Island.

The Tussock Habitat and Environment.

Tussock presents the Falkland Islands' most important terrestrial habitat for wildlife, especially the avifauna of the Island and it is evident that a number of species have declined greatly in numbers since the introduction of stock and subsequent grazing out of large areas of this habitat.

The tussock grass environment, more especially where stands are composed of large plants in densely formed communities, offer an ideal nesting habitat for a variety of species. Tussock communities are rich in invertebrate fauna presenting a feeding niche, while the panicles of the plants are an important source of feed for seed eating species.

Of the 62 or so regular breeding species of bird found in the Falklands, 46 species use tussock as either a nesting or feeding habitat. Of the three species of seal found breeding in the Islands, two commonly use the tussock environment as a shelter for breeding or as a hauling up ground.

One of the most important factors of the habitat is the insulation qualities of the tussock. The thatch-like form of the skirt offers insulation to both the underlying pedestal and also the area between the tussock plants. The generally dense nature and deflexed form of the skirt also forms as a waterproof mat to the interior, while at the same time assisting the retention of moisture in the fibrous pedestal. The surface ground debris of loosely compacted leaf matter can also form a base insulation. On the upper surfaces, where the plant's growing point produces a dense canopy of leaf, wind is deflected, effectively producing an area of still air between the pedestals below. Thus the whole "forest" produces an exceptional and very favourable thermal environment, where

ground and air temperatures are typically higher than those registered externally. Such an environment in islands where other forms of vegetative cover are not prolific has an exceptionally high value, not only as a nesting and feeding habitat but as an important shelter zone.

Its continuing existence may be critical to the survival of some species. For example, studies on the Striated Caracara, ("The Ecology of the Striated Caracara *Phalacrocorax australis*"; Strange, in preparation), indicate that at certain times of the year when food supplies are low, the species relies on the unique thermal qualities of tussock to conserve and help compensate heat and energy losses at such times of low food intake.

Besides a tussock community's exceptional thermal qualities, the forest-like form of a stand with its dense upper canopy reduces evaporation of the underlying peaty ground layers, thus in an environment subjected to fairly continuous and drying winds, where evaporation levels are high, tussock is capable of maintaining optimum moisture levels in the sub-strata.

In many localities, the loss of tussock cover has resulted in a drying out of the soil layers resulting in serious soil erosion. To what extent the original tussock cover might have affected an overall retention of moisture in the Falklands' ground layers generally remains hypothetical. However there is evidence which suggests that as a result of this vegetative cover being severely reduced on some islands, original water tables have dropped and that such areas are effectively drying out. The author believes that the possibility should not be ruled out that the effect might be similar if not the same as deforestation and could be adversely affecting the Islands.

THE SURVEY

Introduction

In the List of Islands, references to sheet numbers are taken from the Directorate of Overseas Survey Maps 1:50,000 series DOS 453 published in 1961. Distances given in metres and kilometres are taken from the same series. The maps have also been used as a source for the names of islands. Where islands are not given on the DOS maps, references will be given for example "Island (unnamed) in channel between Steeple and Grand Jason Islands". Where only one island is named in a group, eg Cross Island, Port Stephens, the name will be used to identify the group as a whole. Where unnamed islands are located close to a mainland area, that area's name is used for the purpose of identification in this survey only.

Areas of islands and estimates of tussock communities are given both in hectares and acres. As this survey is to be submitted as a separate report, but in parallel with a desk study using area calculations from "A Survey of the number, size and distribution of Islands in the Falkland archipelago", Woods 1985, sizes of islands are taken from this source. Calculations for this survey were found to correspond fairly well with Woods' figures.

Islands surveyed are listed in groups, following the DOS sheet numbers 1-29. Sheets are not necessarily listed in numerical order, but placed in groups according to geographical location, ie Jason Island Group NW Falklands. Weddell Island, Queen Charlotte Bay Area, etc.

Existing Government, Private and Wildlife Reserves under the Falkland Islands Foundation (FIF) have been classified either "A" or "B" according to their ecological values. (At the time of the Survey these are proposals by the author, as there is as yet no appropriate legislation to cover these classifications).

Areas with the classification "A" are defined as "**Specially Protected Areas**" ie an area with a unique complex of species, an area which is the type locality as only known habitat of any native plant or invertebrate species, and an area which should be kept inviolate so that in future it may be used for purposes of comparison with localities that have been disturbed by man.

Areas defined "B" are "**Sites of Special Value**" ie representative examples of major ecological systems, and areas with important collections of species. Access to such areas would be controlled, with entry being allowed only for compelling scientific and comparative study purposes which cannot be served elsewhere, so long as these did not jeopardise the natural ecological system in such areas.

It is proposed that a third category, classification "C", might be established for areas of "**Special Interest**". Such areas would be open for tourists on a controlled basis.

Where known, ownership of a particular island is given together with the island's present conservation status, if any, as at March 1987. With the present trend in sub-division of large estates, ownership of some islands is likely to change.

Survey Methods

The main objective of this survey was to establish by on-site inspection which offshore islands support tussock grass communities, which are presently not grazed, the form, condition and amount of tussock on such islands and their potential ecological value.

Details of offshore tussock islands have been collected over a number of years, either by aerial survey using photography and visual observations, or where logistically possible, by ground surveys. Aerial surveying has the main advantage of being possible to cover a fairly large area of ground relatively quickly, an important factor where there is a requirement to establish the overall condition of tussock in different areas at a given period of the year. This method was also preferable where repeated reviews were necessary of certain islands, especially those stocked with sheep or cattle. However, the results of aerial survey can be misleading with a danger of incorrect interpretation unless this method can be combined with a thorough knowledge of the ground being overflown. With this in mind, ground surveys have been a priority.

Although much of the background knowledge used in the present survey, which started in 1984, has been gathered over a number of years prior to this date, there was a need to re-survey some islands. Many islands, for example the large number in that area between Golding Island and the West Falkland mainland, were generally considered to have a low ecological value and for the purpose of this survey were not worth ground surveying. A similar view was taken of those many islands in Choiseul Sound, although some located at the eastern entrance were landed on. Islands believed to be in pristine condition and of ecological interest were priority for ground survey, with second priority being given to islands representative of different climatical and geological areas of the archipelago.

Within these priorities, some fifty offshore tussock islands were landed on and ground surveyed. A number were visited several times at different periods of the year. Time spent on each island varied very greatly from some hours on small Cays such as the Port Egmont Cays, East Cay and Wreck Islands, to several days or weeks on larger islands.

Islands ground surveyed were checked for signs of past burning, sealing, penguin oiling activities and other forms of spoliation. Where evidence of past stocking with cattle, pigs or sheep was found, efforts have been made to establish dates and other details of such stocking.

The avifauna of each island was noted and an assessment made of the size of some colony nesting species. Some of the main population species are noted in the report. A note of those islands holding colonies of seal are given. Where islands were found to support other plant associations or exceptional forms these are included.

SURVEY RESULTS

In this survey of offshore island tussock grass communities presently unstocked with cattle, horses or sheep, a total of 272 islands, islets and stacks are listed as holding some form of tussock grass community. The total estimated area for this tussock is 9388 acres (3801 Ha.).

Of the 272 listed areas, 40 are designated Government Wildlife Reserves or Sanctuaries, private wildlife reserves or reserves managed by organisations such as the Falkland Island Foundation. The total acreage of tussock on these is 4566 acres (1849 Ha.), 49% of the total given above.

The Jason Island group, embraced by West Cay at the western extremity and Gibraltar Rock to the east, has a total tussock area of 2312 acres (936 Ha.), equal to 24% of the total tussock on the 272 islands listed.

The survey found that only 27 islands and islets, with a tussock community of 5 acres or more, bore no evidence of having been stocked and might therefore be considered as "areas of special value" having ecologically perfect tussock communities, (See: Table "B"). Of the 27 listed, 15 are protected by reserve status or, for reasons of accessibility, are unlikely to be violated. However, the author believes that no less than six of the 27 areas are under possible threat of stocking.

Out of the total of 272 islands, 130 are very small islets or stacks supporting as little as 0.5 acres of tussock. The total estimated acreage for these smaller areas was 1504 acres (609 Ha.). Some 100 islands and islets listed were found to bear evidence of some form of spolioation, either having been burnt or stocked at some point in the past.

The total estimated area of tussock remaining on East Falkland was found to be no more than 40 acres (16 Ha.). On West Falkland some 120 acres (49 Ha.) was estimated. Only three island farms at present practice tussock management, ie using the grass on a farm of rotational basis with other pastures during winter. The total area under such management was estimated at 725 acres (294 Ha.). Due to the uncertain and rather fluctuating status of some tussock grass used for stock (e.g. North Swan Island), they have not been included in the present survey.

The total estimated area of tussock remaining in the Falkland Islands is given as 10,272 acres (4159 Ha.). The estimated, probable area of tussock which originally grew in the archipelago prior to settlement, is 54,788 acres (22181 Ha.).

DISCUSSION

The tussock island survey presents an inventory of those islands, islets and stacks holding tussock grass communities considered by the author to be in pristine, or near perfect condition, together with those areas of tussock at present unstocked. The total of 272 islands listed in this category is a comparatively small number for the total of islands in the archipelago, although various figures are quoted. Woods, 1978, in his analysis of the DOS 1:50,000 maps gives a total figure of 778 islands. However, although this author could be technically correct in his evaluation of the maps by including every area that is shown as islands on the DOS maps, are land bridged, others may change depending on tides. A large number of rocks and reefs are listed and this author also includes islands in freshwater ponds. For the purpose of this survey, therefore, "islands" are defined as areas in a marine environment having some form of field layer supporting forms of vegetation. The total for such islands is some 420.

Of considerable significance was the survey's findings that of the 272 islands at present holding tussock, only 27 bear no evidence of spolioation and are considered to be ecologically sound. Even so, six of these areas could be under immediate threat of stocking. The author believes these findings alone demonstrate the enormous impact and vulnerability of tussock islands generally to the farming industry. Table "A" amplifies this, showing that 47 islands with an estimated original total of 20,900 acres of tussock in the mid 1800's has been reduced to a present day figure of 1916 acres, a reduction of 91%.

At the present time only three farms effectively practice management of original tussock communities (See: Island Farms). The total tussock area for these is an estimated 725 acres, 3.5% of the original estimated acreage in Table "A", a figure illustrating the general lack of tussock management or disregard for the long term conservation and use of tussock. Alternatively, as the author believes, the management of some tussock communities, especially on smaller islands with a complete cover of grass, is simply not a practical possibility. Therefore such islands were used for the short term; once eaten out they were abandoned.

In many cases sheep have been landed on offshore islands and then because of logistic problems (difficulty of landing, etc) the animals have been left unattended for long periods. Few medium sized tussock islands have been fenced, with the result that while sheep remained, there was no management of the tussock. Even today, examples of such practices continue.

What is particularly alarming is the survey's findings that more recent losses from overgrazing have not been a gradual and widespread reduction over the Falkland Islands as a whole, but as a result of more intensive stocking in certain areas by a very few operators. This situation remains, with the frightening realisation that it only requires one or two operators with the means and inclination, which there are, to reduce by a substantial amount the Islands' already small and dwindling tussock communities.

Looking at the general ecology of tussock, the inter-relationship between the grass and wildlife is clearly very important. There is evidence that new tussock grass communities can only successfully establish and thrive in those areas where a very high level of nutrients has been built up from the excrement of seabird colonies and seals. A tussock community's ability to establish and thrive in a coastal environment where the plant is subjected to high levels of moist, salt laden air is also shown to be extremely important. In such conditions competition from other plants is minimal and the tussock forms a unique monospecific community, which under optimum conditions (See: Ecology, The Plant) forms very dense stands of plants with large dimensions and of vigorous growth. Such communities develop a very favourable thermal environment, creating the most important nesting and feeding habitat for a large percentage of the Falklands' bird species.

This environment may also be an essential factor for the plant's optimum development. Under normal conditions of growth, tussock flowers in August, with seed panicles being produced in the early spring. The plant also remains green throughout the winter. It is therefore probable that the plant does not have a period of dormancy, but continues to grow as a result to the thermal environment it creates for itself.. However, when this environment is broken down, there are indications that the plant's growth can be checked. These points can be related to the management and stocking of tussock. Even under optimum conditions of tussock management, annual winter grazing could reduce the plant's ability to produce a normal quantity of seed panicles, either due to checked growth, or simply by the plant's flowering stems being grazed off. Tussock is entirely dependent on seed for its natural reproduction. Under ideal

conditions, the development of seedling tussocks is slow. Young plants are also vulnerable to the grazing of sheep, thus a tussock stand's ability to spread and replace those very old plants that die is greatly reduced.

Very large tussock plants, with pedestals of more than 1.5 m high, are probably less vulnerable to grazing sheep. Plants of this size have been shown to be of a very considerable age, presenting the possibility that some tussock communities that have survived annual grazing since the late 1800's were of a large size when first subjected to stocking and that this may have been a very important factor in their continued survival. Certainly the indication today is that even with optimum management, such areas are not spreading or developing a sufficient number of maturing plants to replace old tussocks that must eventually die. For the longer term future conservation and use of such areas, it may therefore be advisable to change management to allow young plants to develop, perhaps even by resting areas for some years at a time.

Following a considerable amount of speculation that the fungal disease "rust" is responsible for the decline in tussock, the survey reports on its own findings. Although evidence of "rust" identified as Yellow or Stripe Rust *Puccinia striiformis* was found on a number of ungrazed tussock island communities, the effect on these areas was found to be negligible. Only in areas subjected to excessive grazing was evidence found of a plant's growth being further impaired by this fungal disease. (See: Present Day Decline of Tussock).

Before the settlement of the Falkland Islands and subsequent introduction of stock, tussock was far more widespread than it is today. A careful analysis of records and descriptions of the Islands in earlier times does show that extensive stands or communities of tussock grass grew on most offshore islands and on the coasts of East Falkland and West Falkland, but in the case of the latter two main islands, did not extend round the entire littoral. An estimate of the total area on East Falkland gives a figure of some 14,000 acres (5668 Ha.). West Falkland was found to be proportionately lower with a total of some 10,500 acres (4251 Ha.). With the addition of 20,900 acres, (8462 Ha.) estimated for stands originally growing on those offshore islands settled in the mid 1800's, plus the present survey's estimate of 9388 acres, (3801 Ha.) for those smaller islands with surviving stands of tussock, the estimated total for the archipelago at the time of early settlement is 54,788 acres (22,181 Ha.).

The total estimated amount of tussock growing in the Falkland Islands today is no more than 10,500 acres (4251 Ha.): a loss of some 81%. In 1965 the author carried out a similar survey, at that time estimating the total area of tussock for the Islands at some 12,000 acres. Both surveys are subject to error, but do support the author's findings that even in recent times the Islands' tussock communities have declined at a very high rate.

As early as 1842, when it was probable that the Falkland Islands still held a very large percentage of its original tussock cover, Governor Moody in a despatch dated that year, wrote:

"There is another indigenous grass of inestimable value and which deserves the particular attention of every person connected with grazing and sheep farming, even in England, but more especially Scotland and Ireland; I allude to what is here called tussac."

"Enclosing and improving tracts of tussac grass on the coasts for winter fodder. This is very advisable and ought to be commenced as early as possible. The value of this fodder is only to be conceived by those who have witnessed the fondness which cattle show for it and have tested the beef so fed."

Regrettably, although the value of tussock was widely known and acknowledged in the Islands, Moody's advice was to be ignored and Hooker's statement that *"the splendid tussock grass is the gold and glory of the Falkland Islands"* may well turn to was *"the gold and glory"*, unless measures are taken immediately to arrest its decline.

RECOMMENDATIONS

1. The Survey's findings are that tussock grass has declined in the Islands at an alarming rate since the introduction of stock, with indications that there is every possibility this decline will continue unless preventative measures are taken immediately.
2. The decline can be attributed to three factors: 1. Overgrazing. 2. Fire caused by human error. 3. Loss by natural causes, ie lightning strikes.
3. Overgrazing remains the most serious and ultimately the most difficult to control. A considerable proportion of the remaining tussock stands are situated on islands owned by private companies or individuals. A large number of these, including six tussock islands listed under Table "B" (Tussock Islands with no Evidence of Spoliation) are the property of the Falkland Islands Company Ltd. The Managing Director of this company has already been approached by the author on the question of diminishing tussock stocks and the matter is to be followed up. It is recommended however, that a copy of this survey report be released to the FIC for its immediate information.
4. The survey found that in a number of cases, ownership of some islands appeared to be in doubt. It is therefore recommended that a list of those islands held by the Crown, should in the first instance be drawn up.
5. In the case of those tussock islands owned by the Crown it is recommended that initially in order to arrest the further decline of tussock stocks, a "holding" policy be adopted, ie the further leasing and granting of tussock islands owned by the Crown be discontinued.
6. It is recommended that a review of present ordinances governing the control and establishment of wildlife reserves and sanctuaries be carried out. Many aspects of the present ordinances are both out of date and inadequate to meet present development in the islands.
7. In the case of tussock islands and their conservation, the survey identifies three different classes of islands. It is therefore recommended that a review of the Ordinances should take into account these different classes. For example the survey identifies a very small number of islands of exceptional value. Such islands are invaluable as "yardsticks", examples of ecologically perfect ecosystems. Such areas should be given "Specially Protected Area" status, and declared inviolate. Some islands were identified as being of special scientific value, "Sites of Special Value", while a third class might be given "Sites of Special Interest" status as areas suitable for tourism.
8. At present there is no satisfactory control over access to many tussock islands listed as wildlife reserves. Nor is there a satisfactory policy regarding access to some of the more vulnerable and "special" areas such as Beauchene Island. As an interim measure until present ordinances can be reviewed, it is strongly recommended that reserves owned by the Crown and listed in Table "B" be closed areas.

9. What control the Falkland Islands Government established in the past regarding access to Wildlife Reserves and Sanctuaries under the Crown, has traditionally been the responsibility of the Agricultural Department. At other times, responsibility has rested with the Government Secretary, or with Government's adviser on conservation and wildlife. As a whole range of environmental factors are inter-related with the Falklands tussock islands and their ultimate protection, there would be merit in placing greater responsibility for tussock island reserves, not so much on the Agricultural Department, but more on some department or body having a greater involvement in wildlife and conservation matters. Such a department or body would also take on the responsibility of monitoring existing tussock communities using the present survey as a baseline.
10. It is recommended that there should be a closer liaison with the British Forces in the Falklands (BFFI) on the question of access to tussock islands. The author acting as advisor-consultant to the MOD on conservation and wildlife matters, has through the nature of this work been in a position to liaise closely with BFFI on this matter and thus avert problems. However, with the recent move of BFFI to MPA, liaison is not now possible at the same level. In normal circumstances there is virtually no requirement for forces personnel to visit tussock islands. However, there are times when, for example, military survey teams require to work in such areas. There is also a probability that the EOD (Bomb Disposal Unit) will also have to continue work on some specific places such as South Jason Island. Even though notes have been lodged with BFFI on the special requirements needed for personnel visiting and especially camping on tussock islands, the turn-round in BFFI is such that information of this kind is not always passed on. It is therefore recommended that Government should also lodge standing instructions with BFFI, that special permission and instructions must be sought prior to such visits.
11. A similar situation appears to exist with visiting yachts, tourist vessels and Fishery Patrol Vessels. All present a potential hazard to tussock islands. It is therefore recommended that a system be adopted whereby all such vessels are issued suitable instructions.
12. Today, tussock is unfortunately playing a diminishing role in the Islands' sheep and cattle industries. The author believes much of this rests on the fact that having been largely grazed out in earlier times, many present day farmers either do not have experience or knowledge of tussock grass and its potential, or are not prepared to re-establish tussock due to the relatively high costs involved in carrying this out. At a time when agriculture in other parts of the world is placing more importance and emphasis on research into the use of indigenous or native plants, it is suggested that the Falkland Islands might look more closely at the potential of tussock. It is therefore recommended that "tussock reserves" should be established for the purpose of ensuring that plant and seed stocks are conserved for possible research, such areas of tussock to be identified and held separately to wildlife reserves.
13. It is also recommended that the re-establishment of tussock grass or methods employed to conserve tussock could be included in, or identified as an important development for both the Islands' environment and the farming industry and could be included in grant schemes.

TABLE 'A'
Estimated Original Tussock Area In Stocked Offshore Islands

Grand Jason Island	300 Ha	(135) acre
Steeple Jason Island	625	(300)
Sedge Island	500	(5)
* Carcass Island	200	(200)
* West Point Island	120	(120)
Saunders Island	2,050	(25)
Keppel Island	894	
Pebble Islet	350	(35)
Pebble Island	1,500	
Hummock Island	80	
Rabbit Island	50	
New Island	580	(148)
Beaver Island	1,190	
Weddell Island	2,500	
Governor Island	250	(123)
Staats Island	300	(5)
Barclay Island	150	(54)
Fox Is. (Weddell)	80	(66)
Quaker Island	200	(150)
Dyke Island	277	
Fox Island	128	
Split Island (Beaver)	148	(20)
Peat Tyssen	44	
George Island	593	
Barren Island	284	
Speedwell Island	1,059	
Ruggles Island	494	
Great Island	500	
Tickle Island	124	
Wolfe Island	148	
East Wolfe Is.	86	
Sandbar Is.	153	
North Tyssen	120	(50)
West Tyssen	148	
Sandy Is.	148	
Swan Island	338	
North Swan Is.	124	(50)
West Swan	370	
* Sea Lion Island	505	(405)
Bleaker Island	511	
Motley Island	250	(25)
Lively Island	1,299	
Triste Is.	185	
North East Is.	309	
Philimore Is.	371	
Middle Is.	185	
Long Is.	80	
	-----	-----
	20,900	(1,916)
	=====	=====

Total Islands: 47

NOTE: Figures in brackets represent present estimated acreages tussock grass remaining.

*: denotes islands managing tussock as part of grazing programme.

TABLE "B"
Tussock Islands With No Evidence of Spoilation

Steeple/Grand Jason Islet	52 acres
Flat Jason Island	802
North Fur Island	148
Gibraltar Rock	49
Cliff Island	44
* North Island	150
Cliff Knob Island	5
Bold Island	18
Double Creek Island (3)	40
Outer Island	40
Double Island	18
Sea Dog Island	67
* Bird Island	220
Edgar Ridge Islet	5
Calista Island	150
Wedge Island	40
Keppel Islet	18
Centre Island	5
Little Motley Island	12
Sandy Island	71
Harbour Islands	35
Brandy Island	85
Sea Lion Islet	15
* Sea Lion Easterly	180
* Beauchene Island	292

	2,561 acres
	=====

* Proposed areas of special value.

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I J Strange
 Falkland Islands

July 1988

TUSSAC ISLAND SURVEY
List of Islands

TUSSOCK ISLAND SURVEY: LIST OF ISLANDS

JASON ISLAND GROUP. NW Falklands (DOS 1:50.000 Sheets 1 & 2)

Jason West Cay

Furthest island west of the group lying 12 kms west of Steeple Jason Island. Low lying island composed almost entirely of exposed and fairly deeply layered rock lying on a WNW by ESE axis. Westerly spurs of the island appear to be composed of the more severe terrain while a narrow central strip east of centre has been built up of finer rock debris and guano accumulations. The island has no tussock stand, growth being restricted to a few low growing plants.

Important breeding site for Fur Seal *Arctocephalus australis*. Colonies cover the three westerly spurs of the island. Island also holds small colony of Giant Petrels and is site for small colony of Gentoo Penguins.

- Government Wildlife Reserve.
- Classification B.

Area: 22 Ha (54 acres). **No tussock stand**, few individual plants.

Jason East Cay.

Island lying 4 kms to west of Steeple Jason Island. Largely composed of exposed ridges which are very difficult to traverse on foot. A small area of very thin Tussock grows in the centre of the widest point of the island.

Not recorded as a breeding ground for Fur Seal but is important winter hauling up ground for this species.

- Government Wildlife Reserve.
- Classification B.

Area: 20 Ha. (49 acres). **Tussock area: 1 Ha. (2.47 acres)**

Steeple Jason Island.

Large island 8 kms in length with an average width of just over 1 km. At a point at the centre of the island's long axis, a narrow waist almost divides the island into two parts, these being known as Steeple Jason West and Steeple Jason East. Both the east and west sections of the island have impressive hill ranges aligned with their long axis, the highest elevation, on the eastern section, rising to 952 feet. Both hill ranges are steep sided with summits composed of "knife" edge ridges. On the SW aspect of the island the terrain, which is quite severe, slopes up from the coastline to the summits of the hills. These slopes cover some 3 kms of the island's length, only being broken at the

central waist and at the west end of the island. On the NE aspect of the island a flat plateau borders the entire coastline extending some 500 metres inland before starting to rise to form the island's backbone of hills. On the NE aspect the plateau forms an important site for large colonies of Gentoo Penguins, small scattered groups of Southern Giant Petrel, Falkland Skua and at the west end of this plateau extensive colonies of Black-browed Albatross and Rockhopper Penguins, which then extend in broken colonies along the SW slopes of the island. Interspersed with these two main breeding species are colonies of King Cormorant.

Steeple Jason Island holds the largest population of Black-browed Albatross and Rockhopper Penguins in the archipelago. It is also one of the more important sites for breeding pairs of Striated Caracara (*Phalacrocorax australis*).

The main stands of tussock grass along the SW aspect of the island, growing approximately from the 100 foot contour to the highest points of the island. A stand also grows across the west end of the island behind a coastal colony of Black-browed Albatross and Rockhopper Penguins. The plateau on the NE side of the island is generally composed of grassland except for an area of tussock situated about half way along the west section of the island. Scattered patches exist in the region of the central waist.

Steeple Jason was probably first stocked with cattle and possibly some sheep when the island was leased by Jason Hansen in September 1872. Between 1927 and 1968 the island was stocked continuously with some 700 sheep. Due to economic and logistic reasons of operating the island, the sheep were cleared from the island in 1968. In 1968 very little of the original tussock remained, however by 1970 denuded tussock stools at the west end were already showing signs of new growth and there was evidence of regeneration by seed especially in the area of the main Gentoo colonies on the NE plateau below the peak of Steeple Jason West. An area very severely eroded to the east of the narrow waist showed little recovery although a small number of new plants were visible. In 1986 this latter area still showed severe erosion with only a small percentage of the ground being covered with tussock. The most impressive re-vegetation has been in the region of the above mentioned Gentoo colonies where stands of tussock over one metre and a half have established from the seedlings noted in 1970. New tussock has also re-established on the higher slopes of the SW side of the island.

- Private land: Owner, R Hill Esq. Run as a wildlife reserve.
- Classification B.

Area: 790 Ha. (1952 acres). **Tussock area 120-150 Ha. (296-370 acres).**
Note: Due to broken nature of the stands and their position on very steep terrain this figure can only be taken as approximate.

Grand Jason Island.

Considering the proximity of this island to the former and the many similarities in its geological alignment, this island has not retained the impressive peaks of the former.

Generally the terrain is far more severe especially on the SW aspects where a large amount of rock debris, now strewn over the slopes, appears to have originated from what must have been peaks identical to those of Steeple Jason. On the SW coast the island holds some large colonies of Black-browed Albatross and Rockhopper Penguins, although the total population would not reach that of Steeple Jason. On the NE side of the island, a plateau extends along the coastal edge, a distance of some 8kms. A number of Gentoo Penguin colonies are sited on this plateau.

Like its sister island, Grand Jason has a history of stocking going back to the 1870's. There are records of goats and cattle being placed on the island and since 1927 Dean Bros stocked the island with 1200 sheep. These were destroyed in 1968. Clear evidence of burning exists at the SE corner of the island.

Considerable erosion exists still on the island, large areas at the east, west and north-west points are denuded and have changed little since 1968. On the SW side a narrow belt of tussock grass has re-established but not to the extent that it has on Steeple Jason. Much of the ground on the SW slopes is unstable and although covered in parts with a dense growth of *Penna marina*, Sorrel and *Empetrum rubrum*, the ground has yet to recover from a long period of overgrazing. In the NW-facing Sand Bay, a few small stands of Sword Grass *Carex trifida* were found. This area of the island is not so dry, with one or two good water sources. It is quite possible therefore that this now uncommon sedge formed some extensive communities in this region of the island. The dry north facing slopes were found to support large numbers of *Calceolaria fothersgillii* and *Viola maculata*.

- Private land. Owner, R Hill Esq. Retained as a wildlife reserve.
- Classification B.

Area: 1380 Ha. (3408 acres). **Tussock stands: 50-60 Ha. (123-148 acres).**
Note: Area very difficult to calculate owing to sparse formations over steep terrain.

Island (Unnamed) in channel between Steeple and Grand Jason Is.

Low lying island completely covered with dense stand of tussock grass except for very small area on northern shore. As both Grand and Steeple Jason Islands support small colonies of Thin-billed Prion, Falkland Diving Petrels and Wilsons Petrel, there is a possibility that this untouched island is also a breeding site for these species.

Property: Crown Land. Not listed as a reserve.

Area: 22 Ha. (54 acres). **Tussock area 21 Ha. (52 acres).**

The Fridays.

Two small islands lying some 5 kms from the NW corner of Flat Jason Island. Both islands are low lying with extended shore lines composed of incised strike ridges. Main areas of both islands are covered with tussock grass with a small elevated area

on both being covered with exposed peaty ground, this area on the smaller island being the site of a small Southern Giant Petrel colony.

- Crown Land: Reserve.
- Classification B

Area: Total 21 Ha. (52 acres). **Tussock area 10 Ha. (25 acres).**

Flat Jason Island.

A low lying tussock island made up of a slightly inclined plateau; the island is some 6kms along its long axis, running NW by SE. The average width of the island is some 600 metres, a point about centre of its length being pinched in to form a narrow waist. At this point the island is also rather low-lying with the indication that in exceptionally bad sea conditions the sea may run over this waist. The north-east facing coast is made up of mainly boulder beach, intersected with numerous rocky outcrops. This coast is, for much of its length, low lying. At the northern point the coast line increases height with rocky formations forming small bluffs. At this point two small fairly sheltered coves are aligned with each other, one open to the east, the other to the NW. The east cove had signs of being used, probably as an early sealers encampment. Both coves showed signs of being hauling up grounds for Elephant Seal and Sea Lion. The extreme NW point of the island is made up of a mass of exposed rocky foreshore, much of this being highly polished. This area had all the signs of having been a Fur Seal colony. Six male Fur Seal were found verifying the possible use of this area, but there are no records of breeding.

The SW coast is the more formidable, much of its length composed of steep-sided mini stacks and bluffs, in parts giving the appearance of a small "Giants Causeway", the naturally stepped formations allowing the shoreline to be scaled in parts.

Flat Jason is not completely covered with tussock grass, there being on the SE section of the island an area of grassland of about 20 hectares, the dominant vegetation is Mountain Blue Grass *Poa alopecurus*. On the more exposed SW coastal aspects a small area of *Poa robusta* was found. *Tillaea moschata* was common in rocky areas close to the sea. On the NE aspects tussock was found growing to heights in excess of 2 to 3 m and dense. On the SE coastal areas tussock grew less than one metre high, forming a dense mat of foliage with little or no stool formation. A small amount of Sword Grass *Carex trifida* grew in patches on the NE side of the island.

There are no records of stocking the island. Due to the difficult access it is doubtful if the island has ever been used for stock and there is no evidence of earlier burning.

No large seabird colonies exist on the island, although the island has a population of Falkland Diving Petrels of unknown size. Tussock Birds and Cobb's Wren were numerous suggesting the island is free of rodents. The island also has a good population of Striated Caracara.

- Crown Land: Wildlife Reserve.
- Classification A.

Area: 375 Ha. (926 acres). **Tussock stand area: 325 Ha. (802 acres).**

Seal Rocks.

Group of rocky islands lying midway between Flat Jason Island and North Fur Island. Islands extend in a line over a distance of over 2.5 km. One main island extends over 1.5 km. The average width of the chain is about 100 m.

Whole area is made up of incised strike ridges almost completely devoid of tussock grass. The main island is now an important breeding site for Fur Seal, while the two smaller rocky islets are hauling up grounds for the same species. The island is the site of a large King Cormorant colony. The very small amount of tussock is sparse and very low growing.

- Crown Land: Reserve.

Area: Total 22 Ha. (54 acres). **Tussock area: 1 Ha. (2.47 acres).**

North Fur Island.

In general a very difficult island to traverse with the coastline being made up of high standing incised strike ridges lying at an estimated angle of some 65 degrees. Numerous narrow fissures break up the coastline making access difficult. A rocky spur forms the NW point of the island, its alignment with the nearby Seal Rocks suggesting that the two are joined by an underwater ridge.

Except for this spur, some exposed rocks at the NE corner and a number of exposed peat areas on the coastal perimeter, the island is covered with fairly dense tussock grass less than 2m in height. Other vegetation was limited to *Tillaea moschata* and a few plants of Goosefoot *Chenopodium macrospermum*. A small amount of Nodding *Scirpus Isolepis cernua* was also recorded.

Cobb's Wren and Tussock Birds were numerous suggesting the absence of rodents. No evidence of burning was found. There are no records of stocking.

The island's name suggests that at one time it was used by Fur Seal. Previous surveys have not revealed this species; however in January 1985 a small colony estimated at between 200 and 300 animals was found breeding on the NW spur. One Elephant Seal was also recorded although it is doubtful if animals frequent the island's coast. The absence of a large population of Striated Caracara is an indication that the site has only recently been used by Fur Seal.

- Crown Land: Wildlife Reserve.

- Classification A.

Area: 75 Ha. (185 acres). Tussock area: 60 Ha. (148 acres).

Elephant Jason Island.

May be so named for when a plan of the island is viewed from the north, the general shape resembles an elephant with outstretched trunk. Also, the west facing coast of the island is cut to resemble the feet and legs of this animal. The island is not favoured by Elephant Seal.

The north, north-eastern and part of the south-east coastline is bordered by a fairly flat plateau giving way to rising ground towards the south and south-western areas, the more severe terrain being on the west facing slopes below the island's highest point. To the south of the island main peak a narrow peninsula curves to the west forming the "trunk" of the island. Continuing the "trunk" but broken away from the main island area a number of rocky islets, are not named but often referred to as the Elephant Jason Rocks. Like North Fur Island, the west coast is severe, steeply inclined rock formations cutting deeply into the island and in many areas forming narrow caverns of an unknown depth. On the "trunk" of the island the steeply inclined rock strata forms on the north facing side an almost undercut coast, while on the south very steep, rather smooth rock faces run into seemingly deep water. On the north, north-east and south-east aspects the coastline is generally low lying with gently sloping rock slab, or boulder beaches. There are no sand or shingle type beaches.

A stand of coastal tussock varying in width runs round the island. At the south end the stands extend to the higher elevations, but do not cover completely this section. At the north end the tussock gives way to a grass and heath area. The form of tussock growth varies greatly from area to area on the island. On the north, north-east and south-east aspects the grass is deep, forming stools, the total height of stands being over 2m.

To the south the grass is dense but with little stool formation and rarely attaining a height of over one metre. Elephant Jason suffered fire damage in November 1949 and continued burning for two years. Except that the fire started on the NE point there is little information on the fire itself. Evidence of the fire can still be seen today at the southern end where the original tussock bases, although now covered with new growth, are black with a charcoal-like dust. Petrel burrows, identified as Prion and Diving Petrel, are scorched and in some cases the remains of the occupying birds are still to be found in the original nest chambers. The indication is that in this area of the island the fire swept through quickly, superficially burning and scorching. There is no evidence of underground burning and specimens of very large Balsam Bog in that area remain intact. On the NW coast there are signs of very severe burning, many areas remaining devoid of vegetation, the soil layers that remain appearing unstable and lacking humus. The result is that this area is very dry and subject to erosion. On the east and north-east corners the stands of tussock appear to have recovered, although there is no evidence of their original size.

One unusual feature recorded on this area was the generally soft springy nature of the ground between the tussock stools. The ground lacked compaction, it being very easy to lift the leaf debris.

The central grass and heath land contains a mixture of plants, the dominant vegetation being the two forms of blue grass, Mountain Blue Grass *Poa alopecurus* and *Agropyron magellanicus*; *Trisetum spicatum*, fairly common; Native Fescue *Festuca magellanica*; Native Woodrush *Luzula alopecurus*; Sword Grass *Carex trifida* and Cinnamon Grass *Hierochloe redolens*. Small patches of Yorkshire Fog were also found, probably introduced in the late 1960's, when the island was leased for sheep raising.

Other plants included Wild Strawberry *Rubus geoides*, Scurvy Grass *Oxalis enneaphylla*, *Bolax gummifera*, *Acaena ascendans*, *Calceolaria fothergillii* and pure stands of fern *Blechnum magellanicum*. In the centre of the island, a saddle at approximately 300 feet forms a "feldmark", the dominant vegetation is composed of *Bolax gummifera*, *Valeriana sedifolia* and lichens.

Except for unknown sized colonies of petrels, (Diving Petrels have been confirmed as breeding on the island), the only other colony nesting species so far recorded are too small mixed colonies of Black-browed Albatross and Rockhopper Penguins. Cobb's Wren, Black-throated Finch, and Snipe were the most numerous species recorded. Tussock Birds were also seen in fairly large numbers but not as prolific as expected. Red-breasted MeadowLark, Siskin and Grass Wrens were also recorded.

Elephant Seal and Seal Lion breed on the island but in small numbers. Since the late 1800's there have been records of Fur Seal inhabiting the outer Elephant Jason Rock. Several surveys carried out by the author since the mid 1960's have shown this site to be the largest in the islands. Since the 1983 breeding season the site has been deserted except for a very small number. In February 1987 some 20 non-breeding animals were recorded. The reason for the sudden disappearance of this large apparently well established colony will be the subject of a separate report.

Elephant Jason has a short history of stocking. Sheep and possibly cattle were placed on the island for use by a Government Seal Fishery Guard. The guard operated between 1921 and 1926, their purpose being to protect the Fur Seal colony from poaching. Later in 1967 a few hundred sheep were placed on the island following an agreement by Government to lease the island to a private individual for this purpose. The lease was given up and the sheep removed in 1971 when it was found impractical to work the island.

No evidence of rodents was found on the island.

- Crown Land: Under the 1964 Ordinance the island was designated a Sanctuary.
- Classification B.

Area 260 Ha (642 acres). Tussock grass area 100 Ha. (247 acres).

South Jason Island.

South Jason lies 3 km south of Elephant Jason, its long axis, over 7 km, running almost due east and west and at right angles to the main Jason Island chain. At its widest point, centre of its length, the island is a kilometre wide with a central ridge reaching an elevation of 945 feet. When viewed from east or west the island has the appearance of a steep-sided triangle. Only at the east and west points of the island does the terrain level out to form small plateaux. In general the terrain of the island is severe to very severe. Even on the relatively flat area at the west end the ground is difficult to traverse.

Mountain Blue grass *Poa alopecurus*, which predominates, forms into small dense tussocks, the ground between being broken by small fissures. Much of this ground is soft, often with standing water. In one small area of standing water the aquatic herb *Callitriche antarctica* was found growing. Native Woodrush, Wild Celery, *Senecio littoralis* (Yellow Daisy) *Tilaea moschata* and *Penna marina* are all fairly common plants. In contrast to Elephant Jason, Balsam Bog was not found to be so common.

Much of the western side of the island and extending to the ridge line is made up of very dry rather thin grassland. Soil layers are exceptionally thin, evident by the underlying rock layers which break through much of the surface. Large areas are covered by small pieces of rock debris which have rolled down the very steep gradients from the higher central ridge.

In contrast, the east facing slopes of the island are largely tussock grass covered. At the west end the tussock forms a dense cover to the ground and although only about one metre deep is very difficult to penetrate, the severe gradients adding to the difficulty of moving over this side of the island. Approximately half way down the length of the eastern side, the tussock becomes interspersed with *Blechnum* fern, this rather unusual association covering an area from the coast to the island's central ridge and extending along the slope for a distance of some 2 km. At the east end of the island the vegetation is again fairly dense tussock composed of plants of a more conventional form and growing to a height of some 2 m.

In January 1960 South Jason caught fire, caused, it is believed, by a survey party. The fire burnt for some 4 to 5 months, but according to R.B. Napier, West Point Island (pers. comm.) the fire passed over the island very quickly although the actual extent of the fire was never recorded in detail. At the west point of the island, evidence of the fire remains in the form of charred tussock stools although the general growth has recovered. On the point the tussock varies in height from plants under a metre, to plants of over two metres. Density of growth also varies greatly.

On the west point several large pits of varying depth and width were found amongst the tussock stands. In one or two cases the only indication of these holes was a narrow fissure about half a metre wide and almost covered by dense tussock leaf. Local information (R.B. Napier) records that the pits were known to exist prior to the 1960 fire. The presence of scorched and blackened tussock stools in the area of these pits is further evidence that these must have been the result of a much earlier burning.

The only colony nesting species found were Black-browed Albatross which form a small colony on the east facing slope of the island. Striated Caracara, are fairly numerous. Species frequently recorded were Snipe, Cobbs Wren, Thrush, Pied and Black Oystercatcher. The presence of Tussock Birds, Grass Wrens and Red-breasted Meadowlark suggests that the island is free of rodents.

At the extreme western tip of the island a rocky peninsula is the site of a Fur Seal colony.

- Crown Land: Wildlife Reserve.
- Classification B.

Area: 375 Ha. (926 acres). **Tussock area: 185 Ha. (457 acres).**

The Twins

Two small low-lying islands 3 km due west of the North West Point of Carcass Island. Smaller of the two islands is completely covered with a fairly dense stand of Tussock Grass. The larger island is covered except for an extended sand beach on the NE side of the island. At this point the sand continues above high water mark and into the tussock fringe.

The island is commonly used by breeding groups of Elephant Seal. Movement by these seal through the tussock has effectively cleared much of the stand of leaf debris, the result being that passage through the tussock is relatively easy. Consolidation of the ground litter has also in effect given extra height to the individual tussock stools, many plants being some 3 m in height.

The larger of the two islands has a large Elephant Seal wallow which by its appearance not infrequently traps numbers of seal. The presence of this wallow could be an indication that at some time in the past the island was burnt with a resulting ash pit being, at first, filled with water and later attracting moulting seal.

- Private Land: A wildlife reserve owned by the Society for the Promotion of Nature Conservation (SPNC), on lease to Falkland Islands Foundation (FIF).

Area: Total 23 Ha. (57 acres). **Tussock grass area: 15 Ha. (37 acres).**

South Fur Island.

Small island lying 5 km south of South Jason Island. Just over 1 km in length and at its widest point 300 m wide, its long axis runs on a line NW by SE in keeping with the majority of the other Jason Island group excepting South Jason Island which runs at right angles. Except for one small area the island is generally low lying, maximum elevation being just over 50 feet.

The geological makeup of the island probably presents one of the more interesting features, being formed from a volcanic dyke. Subject to a more thorough examination,

the rock is believed to be dolerite. On the higher SW facing coast the island is composed of huge upstanding boulders, these diminishing in size across the island, forming on the NE coast beaches of storm boulders and shingle. At one point where the island is about 100 m wide, the evidence is that some of these boulder beaches may be formed from the actions of heavy seas washing over the island from the SW side.

Soil layers on the island are generally very thin. As a result the tussock, although forming a dense mat in parts, is very short, often less than 0.5 m in height. In some of the more exposed areas this very short tussock lies almost horizontal to the ground. On the SW side of the island *Poa robusta* was common, forming dense and often very deep mats of vegetation. Other plants recorded were *Tillaea moschata*, Wild Celery *Apium australe*, Goosefoot *Chenopodium macrosperrum*, *Galium antarcticum* and Sand Spurry *Spergularia media*.

Two small breeding groups of Sea Lion and a breeding group of Elephant Seal were found on the island. Some 16 species of bird were recorded, including a number of adult pairs of Striated Caracara. Cobbs Wren, Tyrants, Thrushes and Tussock Birds were fairly common. There was no evidence of rodents on the island.

- Crown Land: Wildlife Reserve.
- Classification B.

Area: 25 Ha. (62 acres). Tussock area: 12 Ha. (30 acres).

Gibraltar Rock (The Slipper).

Small island lying some 2 km from Cape Terrible, West Point Island. When viewed in profile, island resembles a steeply angled wedge, the top of the wedge forming the island's SW coast. The SW coast is composed largely of almost sheer cliff with a maximum elevation of over 300 feet. In parts these cliffs are undercut, at one point where the SW coast forms an indentation, a large fissure or cave appearing to go well beneath the west corner of the island. On the NE side of the island, much of the coast is made up of inclined slabs of rock, at one point forming a natural causeway across to a small rocky islet lying to the NE of the main island.

Much of the island's NE facing surface is covered with a dense growth of tussock grass. Only on the SE corner does this growth extend over onto parts of the SW coastline where the cliffs give way to some steep slopes. A small amount of tussock grows on the offlying islet.

Offlying islet is breeding site for Sea Lion with no indication of the main island being used.

The island is known to have a population of Striated Caracara and from the evidence of large numbers of burrows on the SE point is probably an important site for Prions and possibly Diving Petrels. Large numbers of Rock Cormorant breed on the SW cliff face.

- Private Property: Sanctuary status. Access difficult. Island probably ecologically perfect.

- Classification A.

Area: 20 Ha. (49 acres). Tussock area 20 Ha. (49 acres).

Split Island

So named after a fault or fissure which effectively isolates approximately one third of the island from the main eastern portion. In section the island is wedge shaped with a very severe SW coastline. The SW side forms the high point of the wedge, rising to a height of over 500 feet. On the NE coast fairly steep inclined rock slabs form the thin end of the wedge. Although the 1:50,000 map indicates three streams and a pond only surface water courses were located. Two of these were dry, the third stream marked on the map being the fissure which splits the island. The pond appears to be shallow and fed by surface water. No springs were found although it is possible from the geological nature of the island that some water sources may exist on the lower NE coast. The general terrain is severe, passage over the island not being improved by the form of plant life.

Soil layers are generally thin, especially above the 200 ft contour. The lower elevations, along the NE side of the island, exhibit deeper soils probably as a result of a build up from soil and vegetable debris from the higher slopes. As a result of these different soil layers the vegetation changes from fieldmark type of small cushion-forming plants such as Balsam on the higher SW slopes, through a thick mat of vegetation dominated by Mountain Blue Grass *Poa alopecurus* on the central slopes, to a belt of Tussock grass interspersed by impenetrable areas of Native Boxwood *Hebe elliptica* covering a larger portion of the lower elevations. However, tussock and boxwood is not entirely confined to these areas. That section of the island to the west of the fissure is almost entirely covered by a pure stand of tussock grass with a mixture of tussock and boxwood growing in small amounts in some areas at the very highest points of the island.

The tussock stands on the island were not found to be exceptionally dense, with plants averaging some 2m in height. The exceptional growth was that of the Native Boxwood, many individual shrubs being over 3m high and 3-4m in diameter. The island holds the largest stands of this shrub recorded in the Falklands.

On the central grassland dominated by *Poa alopecurus*, the broader leaved form of Blue Grass *Agropyron magellanicum*, Native Sheep Fescue *Festuca magellanicum* and *Trisetum spicatum* were found in smaller amounts. Scattered communities of *Primula farinosa* were also found in the same areas. Specimens of Falkland Rock Cress *Arabis maclovianus* were also found on the central grassland. Other plants recorded as fairly common were Scurvy Grass *Oxalis enneaphylla*, Vanilla Daisy *Leuceria suaveolens*, Christmas Bush *Baccharis magellanica*, fern *Blechnun penna-marina*, Diddle dee *Empetrum rubrum* and fern *Blechnum magellanicum*.

Patagonian Fox *Dusicyon griseus griseus* was introduced to Split Island in the 1930's. The present population is not known although well marked tracks, numerous faeces and fairly common sightings of these animals suggest a sound and probably stable population.

Bird life was not prolific, probably due to predation by foxes, although surprisingly, Pipits were common and Grass Wrens, Thrushes, Tyrants and Black-throated finches were recorded. Only one Tussock Bird was seen.

Sea Lion were present on the NE coast but in very small numbers.

- Private Land: R. Gibbons. The practical difficulties of working such a severe island, the presence of foxes and its generally thin soil layers, make the island unsuitable and not worth considering for farming. The island is noteworthy for its vegetation and in particular for the large stands of Native Boxwood.

The island should be viewed as a potentially valuable conservation area.

Area: 220 Ha. (543 acres). **Tussock grass area: 100-120 Ha. (247-296 acres).**

Cliff Island.

Island made up of fairly steeply dipping layers of quartzite with the dip surface falling to the NNE. Coastline generally severe with the SW side undercut in parts. Surface of island undulating with two domed areas rising to a maximum elevation of just over 100 feet. Island supports a dense cover of medium height tussock which in most of the perimeter areas extends to the cliff edges. The general appearance of the tussock community as a whole is similar to that noted on Split Island, the plants indicating a rather dry environment.

Island has small groups of Rock Cormorants nesting on coastal cliffs. No other colony nesting species were noted. Island is breeding ground for Sea Lion.

No evidence of early burning was found. Island has no history of stocking.

- Property: Crown Land. It is recommended that the island be viewed as a potential conservation area.

Area: 20 Ha. (49 acres). **Tussock area: 18 Ha. (44 acres).**

Bense Island and Little Bense.

Both islands lie in entrance to Port North and about 1 kilometre off Pickthorne Point on West Falkland. Although shown on the DOS 1:50,000 map as two separate islands, it is possible to cross from one to the other at low tide.

Bense Island has a history of stocking going back to pre-1900, the island being used for cattle, horses and sheep. Sheep have also been placed on Little Bense (pers. comm. S. Miller) the animals being driven over from Bense at low tide. Both islands have a rabbit and rat population.

A very thick stand of tussock surrounds the coastline of Little Bense Island with a small area of grassland in the centre. The island has a number of small coastal stands of Native Boxwood *Hebe elliptica*. Main island has a thin coastal belt of sparse tussock growth with a large proportion in the centre being grassland.

- Private Land: Roy Cove Sub-division.

Area: Bense Island 110 Ha. (272 acres). **Tussock area 40 Ha. (99 acres).**
Area: Little Bense Island 30 Ha. (74 acres). **Tussock area 25 Ha. (62 acres).**

Beechams Island.

Very small islet in Port Pattison, Carcass Island.
Tussock covered. Not stocked. No evidence of rodents.

- Private Property: Carcass Island.

Area: 1 Ha. (2.47 acres). **Tussock grass area: 1 Ha. (2.47 acres).**

Needles Rocks.

To SE of Needles Point, Carcass Island. Larger rock islet has small stand of tussock grass.

- Private Property: Carcass Island.

Area: Main rocky islet only 2.5 Ha. (6 acres). **Tussock area: 1 Ha (2.47 acres).**

NW Falkland Islands.

(DOS map sheet 4)

Low Island.

Situated NW of entrance to Byron Sound. Small island with coastal belt of tussock grass and central grassland area. To the west of the main island a boulder strewn beach extends out at low tide to join up with a small rocky islet which is used as a breeding site for Sea Lion.

Island stocked with cattle so tussock cover varies. Tussock fairly dense, medium height (under 2m). Central grassland composed mainly of *Poa alopecurus* and

Sheep's Sorrel *Rumex acetosella*.

Central grass plain breeding ground for Falkland Skua. Tussock areas hold large population of Magellan penguins.

- Private Land: West Point estate. Sanctuary Status.

Area: 75 Ha. (185 acres). **Tussock area 50 Ha. (123 acres).**

Note: area does fluctuate depending on degree of stocking.

Button Island.

Very Small islet lying approx 1 kilometre SE off Low Island.
Tussock covered.

Area: 1 Ha. (2.47 acres). **Tussock area: 1 Ha. (2.47 acres).**

Dunbar Island.

Island situated at entrance to Byron Sound Island nearly 3.5 km in length and 1 km wide at its widest point. Coastline mainly of steeply inclined rock rising out of deep water.

Centre of island grassland and heath with large percentage of *Empetrum rubrum* and Sheep's Sorrel. Small areas of Cinnamon Grass *Hierochloa redolens*. Island originally had very dense coastal belt of tussock grass, much reduced by stocking with sheep. In 1969 sheep were removed and the area left to re-establish. Large areas of the coastal tussock have now regrown but island still retains areas of denuded tussock stools and exposed peaty ground.

- Private Land: West Point estate. Wildlife Sanctuary.

Area: 225 Ha. (556 acres). **Tussock grass area: 45 Ha. (111 acres).**

Wreck Islands.

Group of three rocky islets 7.5 km east of Sedge Island. Islets low lying, narrow with an average width of about 50 metres. Overall length of the group 2 km, lying almost due east and west. Islands formed from a series of steep incised strike ridges aligned with their long axis, this formation being particularly evident on the centre islet. Islet to east composed largely of rock debris with a small area of low but vigorous tussock grass. West islet also composed largely of rock debris, but with a larger area of fairly dense tussock grass.

During a seal survey carried out on this island in 1965, tussock was found to be very sparse with large areas worn away by the movement of seal. Few seal were recorded

when a landing was made in 1982, probably accounting for the increase in tussock cover.

Bird life not prolific except for a large colony of King Cormorants on the centre islet. West end islet probable nesting site for small number of Southern Giant Petrel.

- Property: Sedge Island estate.

Remote nature, difficulty of landing and small size offer these islets a measure of protection.

- Classification B.

Area: 15 Ha (37 acres). **Tussock area: 4 Ha (11 acres).**

Port Egmont Cays.

Small group of rocky islets lying some 10.5 km north of Keppel Island. Islets form part of a shallow reef about 2.75 km in length and running in a gentle curve from east to north-west. Islets composed of rock layers which dip gently to the SW, their exposed vertical edges forming a series of shallow ridges aligned with the islet's long axis. Islets generally low lying, one to west largely covered with rock debris with little sparse tussock cover. Islet to east, tussock covered.

West islet breeding site for King Cormorants, small group of breeding Sea Lion on east islet.

- Crown Property: No conservation status.

Area: Total 7 Ha. (17 acres). **Tussock area: 2 Ha. (5 acres).**

Sedge Island.

Island 4 km in length with average width less than 1 km. Island lies almost due east and west. Island built up of quartzite layers which dip slightly to the south. North coast severe, forming a scarp in parts stepped from exposed rock layers. Some areas of this coastline being broken away to form very severe boulder beaches. Southern coastline less severe with gradually shelving rock for much of its length, occasionally broken by gently inclined sand and boulder beaches.

Island rather flat except for a slightly raised area topped with an exposed rock ridge which runs for just over 1 km east and west and about centre of the island.

Sedge Island has a history of stocking going back to before 1927 when cattle were originally placed on the island. Foxes were then introduced just prior to 1939 as part of a commercial project of fur raising. In the mid 1960's the island was stocked for the first time with sheep, the remaining cattle being killed off. By the early 1970's the remaining fox population was destroyed. In 1986, following severe overgrazing, sheep were removed.

A survey carried out in 1965 estimated the island's tussock cover as 60% with some areas to the west end of the island showing over grazing of the tussock. In 1985 a thorough ground survey found nothing left of this original cover except for a few individual tussock plants growing in inaccessible places on the north coast cliffs where sheep had been unable to graze. Elsewhere on the island the only evidence of the original tussock stands were old tussock stools in various degrees of erosion. Between the stools, dunes of peat dust had started to accumulate, the only vegetation being an occasional patch of Sheeps Sorrel and one or two tussock grass seedlings growing on the top of some higher tussock stools where sheep were unable to reach.

In the centre of the island and covering about 40% of the land area, a grass and heathland formation had also been severely overgrazed leaving large areas completely denuded of any form of vegetation. Elsewhere, Sheep's Sorrel remained the dominant vegetation, with small areas of *Empetrum rubrum*, *Blechnum penna-marina* and some grasses. In a small enclosed area, one specimen of Sword Grass *Carex trifida* was found growing - a remnant of what was probably a common species to the island and probably the origin of the island's name.

Bird life was not prolific, although Tussock Birds were very evident about the old settlement. Dotterel, Two-banded Plover and White-rumped Sandpiper were also evident on the island's central areas. A total of 24 different species were recorded but all in very small numbers. There was no evidence of any ground burrowing petrels remaining on the island.

Island is important breeding ground for Sea Elephant and small number of Sea Lion, although the latter have diminished very considerably since a survey made in 1965. At the NW point of the island, Fur Seal have been recorded hauling up in mid-winter on occasions. This point exhibits all the signs of having been used as a breeding site by this species some time in the past.

In the estimates for 1843 (Governor Moody) a figure of #130 is given for the lease of sealing grounds which includes Sedge Island Cay, an earlier name for Sedge Island. In the previous year, 1842, the rental of Sedge Island Cay went to one Augustean Aroba for the purpose of sealing.

Note: Sedge Island has been included in this survey, offering as it does, a good site for monitoring the re-establishment of tussock following a period of overgrazing.

- Property: Private. No conservation status.

Area: 330 Ha. (815 acres). **Tussock area: Estimated 2Ha (5 acres) on cliff edges.**

Burnt Island Islet.

Small islet lying 100 metres off Burnt Island at eastern end of Byron Sound. Very low lying islet almost completely covered with medium growth of tussock. Spur to north of the islet often used as breeding site for South American Tern.

Area: 4 Ha. (10 acres). **Tussock grass area: 3 Ha. (8 acres).**

Skip Rock.

Very small islet to south of Burnt Island islet. Has medium cover of tussock grass.

Area: 1 Ha. (2.47 acres). **Tussock grass area: 0.5 Ha (1 acre).**

Bluff Island.

Lies off Foot Point, Hill Cove. Very small high standing islet situated on a sand bar. Has very sparse cover of tussock grass.

- Property: Hill Cove estate.

Area: 1 Ha. (2.47 acres). **Tussock grass area: 0.5 Ha (1 acre).**

Hill Cove Islet.

Unnamed islet lying at entrance to Hill Cove Harbour. Fairly high standing islet covered with fairly dense cover of tussock grass. Known breeding site for Magellan Penguins.

- Property: Estate Hill Cove. With proposed sub division of the Hill Cove estate, it might be prudent for FIG to make some recommendations for the use of this small islet to ensure that it does not get grazed out.

Area: 2 Ha. (5 acres). **Tussock grass area: 2 Ha. (5 acres).**

Horse Island.

Small islet SW entrance to Port Edgar. Low flat island which at December 86 had sparse covering of very brown dead looking tussock grass.

- Property: Estate Saunders Island.

Area: 5 Ha. (12 acres). **Tussock grass area: 2 Ha (5 acres).**

Calf Island.

Small islet 1 km south of Horse Island. Low lying island much of which is composed of exposed reef. At December 1986 island had sparse covering of very dead looking tussock grass. No evidence of stock but had all the appearances of having been stocked.

- Property: Estate Saunders Island.

Area: 5 Ha. (12 acres). **Tussock grass area: 2 Ha. (5 acres).**

Passage Island Group: King George Bay.

DOS Sheet 9

First Island.

Lies 1 km NW of Dunnose Head. Island some 8 km in length and varying in width from a maximum of nearly 2 km at its southern end, to 50 m at one point on the northern end.

Island made up of a slightly tilted plateau with the higher elevations forming on the west coast, descending across the width of the island to its east and south - east coastlines. General coastline, formidable to severe, with the western aspects having cliffs rising to 100-150 feet, in parts indented with narrow fissures. East side of the island has much lower coastline, less than 50 feet but composed of steep cliff.

Large percentage of island's surface area composed of heath and grass formations with very narrow coastal fringe of tussock grass being largely confined to the steep and inaccessible cliff areas of the east coast. There is no evidence that the island supported any stands of tussock further inland. Soil layers generally thin with many parts of the island having areas of exposed base rock.

First stocked by the John Hamilton Estate in the early 1940's. In the mid 1940's sheep were removed and the island left until the early 1950's when it was re-stocked again with sheep. This latter stocking was to continue until 1967. At the time of preparing this report (April 1987) ownership of the island was about to change, with the possibility of it being re-stocked with sheep.

Colony nesting species known to breed on the island are Rockhopper Penguin and King Cormorant.

Not known to be a breeding site for any species of Seal.

Island is reported as having a population of rats but species not known. (Pers. comm. R Ferguson).

- Property: J Hamilton Estate as at February 1987.

Area: 750 Ha. (1852 acres). **Tussock grass area: Estimated 12 Ha (30 acres);** difficult to calculate due to irregular formation on cliff sides.

Second Island.

Positioned 3 km to NW of First Island but with its long axis almost due east and west and therefore almost at right angles to the main axis of First Island. Island forms an almost flat plateau raised about 100 feet above sea level. On this plateau a number of smaller areas rise to 150 feet, one rising to form a small hill with an elevation of 248 feet. Island is just over 6 km in length and 1.5 km at its widest point.

Much of the island's main south and north facing coastline are severe with steep sided cliffs, deeply fissured or indented to form a series of small bluffs and promontories.

The two larger ponds shown on the DOS map 1:50,000 are shallow with rock or clay base and supporting no obvious forms of life. In contrast a small pond lying close to the perimeter of one of these larger ponds was found to have a very rich perimeter growth of Cinnamon Grass *Hierochloe redolens*, *Juncus sp*, *Celery* and *Acaena ovalifolia*. The pond and its immediate area were also rich in bird life with large numbers of Yellow billed Teal. Snipe were also recorded.

Except for this small area in the immediate vicinity of this pond the island was found to be extremely dry, the vegetation appearing to suffer from a lack of moisture. Vegetation was thin with the heath and grass formations being composed largely of Christmas Bush *Baccharis magellanica*, *Empetrum rubrum*, *Blechnum penna-marina*, *Oxalis* and Mountain Blue Grass *Poa alopecurus*, the latter being the dominant form of grass. Large areas of the island were covered with very thin soil layers, bedrock and rock debris breaking through the surface in many places.

Tussock grass is largely confined to the steep slopes and cliff sides of the north facing coastline, the only areas where stands form being in a small area at the extreme eastern tip of the island and surrounding a shallow bay which forms the islands main anchorage and landing area. In this latter area the tussock is over 2 m in height, but not dense. Much of the perimeter of this stand shows signs of past overgrazing with areas covered with dead tussock stools and small dunes of peat dust. There was no evidence that tussock had at one time formed a coastal belt anywhere else on the island. No signs of past burning were found.

The only colony nesting species recorded on the island were Rockhopper Penguins, with a small colony on the south coast, and colony of Dominican Gull. Evidence was found of Thin-billed Prion and Diving Petrels breeding on the north coast, but probably in small numbers. Striated Caracara breed on the island, but population small. Thrush, Grass Wren, Black-throated Finch and Tyrant were recorded. The island had a noticeably low population of Upland Geese and Ruddy-headed Geese. No seal were found breeding.

The island is believed to be free of rodents.

History of stocking similar to that of First Island, except the remaining sheep from the 1950's stocking were not removed until 1978-79.

- Property: John Hamilton Estate as at February 1987.

- Island has no conservation status, although recommendations have been made that its value as a sheep holding is extremely doubtful and that the island might better serve as a form of wildlife reserve with national park status. Such a status would however depend on future ownership and the practical aspects of getting to and onto the island.

Area: 650 Ha. (1605 acres). **Tussock grass area: 35 Ha. (86 acres).**

Round Island.

Small island off the eastern tip of Second Island and lying in Whale Passage. Coast severe with steep sided cliffs. Top of the island has dense cover of tussock grass.

Area: 5 Ha. (12 acres). **Tussock grass area: 5 Ha. (12 acres).**

Third Island.

Lies 1 km due west of Second Island. In comparison with latter, island is fairly low lying, the highest elevation being on the NE corner where the ground rises just over 100 feet to form a small hillock. In general the coastline is less severe than that of Second or First Islands, much of the NW, N and E facing coasts, composed of low dipping strata. On the S coast the shoreline is more formidable being made up of small broken cliffs and boulder beach. Facing NE a broad sweeping sand beach curves out to form one side of a narrow spur which protrudes from the main island out to the east.

Island is covered with fairly dense tussock of medium height (2 metres) except for a small area of grassland situated centre of the southern end and a small area on the spur. This latter area is predominantly hard sandy ground supporting a mixture of Sea Cabbage *Senecio candicans*, Wild Celery *Apium australe*, *Tillaea moschata*, *Spergularia media*, *Gunnera magellanica*, *Carex trifida*, Sheep's Sorrel, two species of grass yet to be identified and tussock grass, the latter forming quite large plants but widely spaced over much of the spur.

On the spur and nesting in small groups between the tussock stools is a small colony of Southern Giant Petrel. Tussock Bird and Cobbs Wren were common. The island was also found to have a fairly high density of Striated Caracara. Most species associated with a coastal environment, Kelp Geese, Night Heron, Pied and Black Oystercatcher and Steamer Duck were all common.

Two small colonies of Sea Lion, one breeding, were located on the spur and sand beach.

Island was stocked with a small number of cattle for a short period in the 1960's.

- Property: John Hamilton Estate at February 1987.
- Island has no conservation status but is highly recommended for Reserve status.
- Subject to further surveys could possibly be given 'A' classification.

Area: 80 Ha. (198 acres). **Tussock grass area: 70 Ha. (173 acres).**

Fourth Island.

Lies 800 m WNW of Third Island. Island generally low lying with only one or two higher areas, reaching just over 100 feet, being situated on its south coast. Island's north coast largely made up of gently tilted rock slabs which slope to the north. On the SW and S coast this dipped formation being broken away to create small cliffs which are shelved and in parts undercut.

Island is covered with a fairly dense stand of tussock grass of medium height (2 metres) except for a narrow coastal strip of exposed rock clay ground along the southern edge.

Stocked with cattle in the early 1960's. In a survey made in 1965 it was noted that the island had been eaten out. Following this overgrazing, the cattle were destroyed in 1969. The present survey found very little evidence of this earlier grazing except that tussock stools in the centre of the island had less dead leaf debris and therefore the overall appearance of this area was that the tussock was not so dense.

Colony nesting species recorded were, King Cormorants, Rock Cormorants and Gentoo Penguins. Small population of Striated Caracara. No seal colonies were found.

- Property: John Hamilton Estate as at February 1987.
- Island has no conservation status but would be a valuable addition to Third Island if the latter were to receive reserve status. Due to the very close proximity of these two islands it is probable that their ecology is linked, certainly in the case of the Striated Caracara population. (See 'Ecology of the Striated Caracara *Phalacrocorax australis* in the Falkland Islands', I J Strange. - In preparation).

Area: 150 Ha. (370 acres). **Tussock grass area: 135 Ha. (333 acres).**

King George Bay Area. West Falkland

DOS 1:50,000 Sheet 10

The Crouching Lions. Rabbit Island Rocks.

Group of small rocky islets lying midway between Rabbit Island and Hummock Island. Generally high standing islets with severe coastlines. Main islets including isolated one by Hummock Island have some tussock growth. Larger of the Crouching Lions, breeding site for Sea Lion.

Area: 11 Ha. (27 acres). **Tussock grass area: 5 Ha. (12 acres).**

Middle Island.

Dome shaped island rising to a height of 414 feet. Much of the island covered with a heath and Blechnum formation with a tussock grass fringe on the coastline. Suffered a lightning strike in 1967-68 and part of the island was burnt out. Was stocked with sheep for a short period prior to 1930.

- Property: Hill Cove Estate. Was given Sanctuary status in 1966.

Area: 155 Ha. (383 acres). **Tussock area: 16 Ha. (39 acres).**

Note: With present proposed sub-division of the Hill Cove Estate this island has not been featured in any sub-division plan, the recommendation of the present manager being that the island retain its conservation status.

Gid's Island.

Island 2.5 kms SE of Middle Island. Small dome shaped island with coastal belt of tussock and central area of heath formation. Has been stocked with sheep but not on a permanent basis. Island was given Sanctuary status.

- Property: Hill Cove Estate. This island has not been featured in plans for a sub-division of the Hill Cove Estate, the recommendations being that it should retain its Sanctuary status.

Area: 30 Ha. (74 acres). **Tussock area: 16 Ha. (40 acres).**

Green Island.

Small tussock covered islet off Town Point, West Falkland.

Island very low lying with an area across the centre which may be tidal at very high water. Latter requires confirmation.

Area: 4 Ha. (10 acres). **Tussock area: 3.5 Ha. (9 acres).**

Christmas Harbour Islands.

Tide Island

Half Tide Island

Celery Island. Islet is site for colony of Night Herons.

Christmas Island

All very small islets situated in Christmas Harbour, Chartres, West Falkland. Islets low lying with extended reef-like shore lines. Area used as breeding sites for Dominican Gull and South American Tern. Islets all have a cover of rather low tussock growth.

- Property: Hill Cove Estate.

Area: 4 Ha. (10 acres). **Tussock area: 3 Ha. (8 acres)**

Turkey Island.

Small rocky island at the entrance to Crooked Inlet. Island has sparse cover of tussock growing on cliff edges.

Has been recorded as important nesting area for Turkey Vulture, but present status not known as island was fired.

- Property: Roy Cove subdivision.

Area: 6 Ha (15 acres). **Tussock area: 0.5 Ha. (1.5 acres).**

Seal Island

Very small islet lying short distance off Crooked Inlet West Paddock. Islet had cover of medium height tussock grass. Since commencement of survey island was burnt in summer period 1986. Had been noted as important breeding site for Turkey Vultures. As at March 1987 showed no sign of re-growth.

Area: 1 Ha. (2.47 acres). **Tussock area: 0.5 Ha. (1.5 acres).**

South West Falkland Islands: New Island, Beaver Island and Weddell Group.

(DOS 1:50.000 Sheet 16)

North Island.

Positioned some 2.5 km NE of North Bluff and New Island North. North Island is 1.75 kms in length, running almost due north and south, with an average width of just under 0.5 km. Has very severe west facing coastline with almost sheer cliffs which rise to a height of some 200 feet. Base of cliffs slightly shelved and in parts undercut. At one point on this west coast, the island is quite deeply indented, one side of this forming a spur, at the point of which is a narrow cone shaped bluff. From this west coast the island tilts slightly to the east, the surface forming a relatively flat plateau which on reaching the east coast drops away at an angle of about 45 degrees in a series of narrow shelves to sea level. In parts the surface plateau overhangs this east coast, while at the base of this coastline the rock layers are often undercut, the combination forming a natural barrier to the island's surface plateau.

Tussock grass covers a large portion of the island's surface plateau extending down the steep eastern coast and in parts, on the west cliffs, although in the case of the latter

growth is sparse and generally poor. In parts of the centre of the plateau and extending in some areas to the western cliff edges the vegetation is a combination of Balsam Bog *Bolax gummifera*, Mountain Blue Grass *Poa alopecurus*, Native Woodrush, Celery and small amounts of *Empetrum rubrum*. In these areas the Balsam formed the dominant vegetation with huge cushions over two metres in diameter and over a metre high, many of the individual cushions growing so close together that areas were covered with a dense mat of this plant. On the perimeter of these areas, both tussock and Balsam presented a mixed formation, although tussock growth in these situations would form little or no stool.

Tussock growth varied but generally was only medium height, fairly dense but extending the form of growth more typical of the drier regions of the islands.

Soil layers were found to be thin. This was particularly evident on the eastern side island where many of the island's large Black-browed Albatross colonies were situated on large areas of exposed rock slab which lay between tussock grass. In these regions, the level between base rock and the floor of the tussock stands was 0.5 m.

Island has extensive colonies of Black-browed Albatross and Rockhopper Penguins. Tussock Bird, Black-throated Finch, Falkland Thrush, Striated Caracara were commonly recorded.

Fur Seal have been recorded as breeding on the South end of the island, but this survey found no signs of this species.

Due to its very severe coast, access is difficult. In fact it is probable that the island has remained inviolate throughout the period of man's settlement of the Falklands. North Island therefore presents one of the very few ecologically perfect sites remaining in the archipelago and the only one in the SW corner of the Islands with this distinction. It is highly recommended that it remain as an inviolate site.

- Property: Originally New Island Preservation Co., subsequently passed to the Royal Society for the Promotion of Nature Conservation (RSPNC). Reserve status under RSPNC, leased to Falkland Island Foundation.

Area: 75 Ha. (185 acres). **Tussock area: 61 Ha. (150 acres).**

Note: Tussock area difficult to calculate due to nature of terrain and mixed tussock/balsam formation.

Saddle Island.

Island situated about midway between North Island, North Bluff and New Island North.

When viewed from the south, profile saddle-shaped, the higher points of the saddle being formed its east and west facing coasts which rise to over 250ft. Coastline on

west, east and northern aspects severe with steep cliffs. In parts base of cliffs shelved and undercut. On the southern corner a small sand and boulder beach gives access to the island. Large portion tussock covered, except for an area of exposed rock slab which extends from the sand beach and along a section of the SW coast. Two shallow depressions almost centre of the island form ponds, although these are normally dry in the summer period.

Island has a small colony of breeding Sea Lion, but no record of Fur Seal.

Has a number of colonies of Rock Cormorant but no other colony nesting species. Thin-billed Prions are present, but the population status is not known. Has a breeding population of Striated Caracara.

Has been stocked in the past with cattle, but there are no records of pigs or goats having been placed on it. No evidence was found of the island having been fired in the past.

- Property: Originally New Island Preservation Co., then passed to the RSPNC. Status: Wildlife Reserve under RSPNC. leased to Falkland Islands Foundation. Classification B.

Area: 35 Ha. (86 acres). **Tussock area: 31 Ha. (76 acres)**

Ship Island.

Small island situated in Ship Harbour, New Island. Island low and flat with coast of slightly shelved rock. Surface hard and dry, composed mainly of clay subsoil with little peat. Evidence suggests island was probably covered with tussock which was subsequently burnt. Main vegetation composed of Sheeps Sorrel, Mayweed, Celery and a little *Empetrum*. Island also has a substantial colony of Native Pansy *Viola maculata*.

Until 1972 island was used as a ram holding, but following serious de-vegetation of the area these were removed. Since the removal of stock, a small area of tussock has re-established.

Island is nesting site for Dominican Gull, Dolphin Gull and Terns. The area also has a large population of Skua.

A small number of non breeding Sea Lion use the island as a hauling up ground.

- Property: Originally New Island Preservation Co., then passed to RSPNC. Status: Wildlife Reserve under RSPNC.

Area: 9 Ha. (22 acres). **Tussock area: 0.5 acre, sparse.**

Cliff Knob Island.

Small high standing island with dome shaped top. Lies approximately 400 metres off Sabina Point, New Island North.

Coastline severe with cliffs formed of horizontally layered rock. Top of island covered with dense stand of tussock grass of medium height.

Island has no record of having been stocked. Probably remains untouched due to difficulty of access.

Known to have population of Thin-billed Prion, probably Diving Petrels. Tussock Birds common.

- Property: RSPNC. Originally New Island Preservation Co.
Status: Wildlife Reserve under RSPNC.

Area: 2 Ha. (5 acres). Tussock area: 2 Ha. (5 acres)

Beef Island.

Small island lying at entrance to South Harbour, New Island South. General form of island dome shaped and rising to over 150 feet. NW and SW aspects gradually sloping away to a coastline of low rock shelves. On the SE side the tussock covered slopes fall away more steeply, the shoreline being made up of almost sheer rock face. At the NE end an area of heath and grass extends from the inside perimeter of the coastal stand of tussock to the top of the island. This heath and grass formation covers about 1/8 of the island, the remainder being covered with a fairly dense cover of tussock of low to medium height.

Has history of stocking, being used for cattle and small number of sheep. Has not been stocked since 1972.

Sea Lion are commonly recorded but are not known to breed.

Island is important breeding site for Falkland Skua, Rock Cormorant, Thin-billed Prion and Night Heron. Tussock Bird, Cobbs Wren, Falkland Thrush and Black-throated Finch and common and recorded as breeding.

- Property: RSPNC. Formerly New Island Preservation Co.
Status: Wildlife Reserve under RSPNC.

Area: 10 Ha. (25 acres). Tussock area: 8 Ha. (20 acres).

Coffin Island.

Lies 1 km off the south end of New Island. Top of island dome shaped with coastal edge falling away to form steep sided cliffs, which on the east and south west sides, rise to between 100 and 150 ft above sea level. On the NW side the cliffs drop in height, the domed top surface dropping in a shallow valley to a point a few metres above the high tide line and forming the islands only access from the sea.

Domed surface largely composed of grass and heath formation gradually giving way to feldmark on the higher elevations. Soil layers rather thin with areas of exposed rock debris. Tussock grass forms a rather sparse and not very vigorous growth on the steep coastal edges.

Island has history of stocking and carried sheep until 1972. It is not known if it was used in earlier times for pigs. There is no evidence of the island having been burnt.

Holds breeding group of Sea Lion.

Has no colony nesting species except Rock Cormorants and on occasions Dominican Gull. Tussock Bird, Skua, Upland Geese and Kelp Geese are common breeding species.

- Property: RSPNC. Formerly owned by New Island Preservation Co.
Status: Wildlife Reserve under RSPNC.

Area: 45 Ha (111 acres). Tussock area: 8 Ha. (20 acres).

Landsend Bluff.

Two large bluffs lying off the NW point of New Island South. Main bluff has very slightly inclined cliffs with a flat plateau-like top. Smaller of the two formations deeply fissured and presenting a more pinnacle shape. Both bluffs having elevations of over 300 feet.

Smaller of the two bluffs has top surface composed largely of rock debris with very sparse growth of tussock. Main bluff has plateau covered with approximately 60% tussock of low to medium height and medium density and 40% grassland-heath formation, mainly composed of *Poa robusta*. On the NE facing cliffs of the main bluff, tussock extends to within 10 metres of the high water mark.

Base of the bluffs important hauling up grounds for Fur Seal.

SW facing cliffs breeding site for large numbers of Black-browed Albatross.

- Property: RSPNC. Formerly New Island Preservation Co.
Wildlife Reserve under RSPNC
Classification B.

Area: 7 Ha. (17 acres). Tussock area: 8 Ha. (20 acres). Note this takes into account area of cliff.

New Island.

In general form, the island is shaped like an inverted "L", one section running almost due north and south, the short section of the "L" aligned west to east. The combined length of the island is 13 km, with an approximate average width of 0.75 km.

In section it is generally wedge-shaped, the west and north facing coastlines forming steep and in parts undercut cliff faces. Much of this coastline rises to some 300 ft, with a maximum elevation of 743 ft. On the south and east coasts, which form the inside edge of the inverted "L", the coastal elevations are generally low lying. In contrast to the west and north sides of the island, the east and south sides are more sheltered. Much of this coastline is made up of low rocky shores with a number of sand beaches.

New Island has a history of human depredations which probably go back to the late 1700's. At about this time the island was so named by whalers from the New England sea ports of North America, who used the island as a base for their exploits about the Falklands and further south. New Island's large seabird colonies were exploited by the whalers. There is evidence to show that when the island was first discovered, large areas of its eastern coasts were covered with tussock grass. This was also to be exploited when pigs, rabbits and goats were placed on the island as a readily available supply of fresh meat. Weddell, visiting the island in 1822, recorded that he found tussock grass burning on the north end. There is also evidence that much of the original tussock grass which grew in the vicinity of the present settlement was also destroyed by burning.

Exactly when New Island was first stocked with cattle and sheep is not clear, but by 1867 it had been established as a farm, continuing as such until 1971/2. From this time and under new ownership, attention was turned to the severe overgrazing problems and to the island's value as a very important wildlife area. The sheep farming operation was cut back and a new concept of operating the island as a reserve, financed by wildlife tourism, was established. In 1972 the New Island Preservation Company Ltd, was formed. This was dissolved in 1977 and the island divided into two separate sections: New Island North and New Island South. New Island South continued to operate as a reserve with interests in wildlife tourism and research, retaining a minimal interest in stock.

In 1978-79 sheep were removed from a large area of New Island South, the policy being to allow that section to re-establish its original vegetation to correct erosion and encourage more bird life for the ultimate benefit of research and specialised wildlife tourism.

New Island holds what is probably the most important breeding ground in the archipelago for the Thin-billed Prion. The island also holds extensive colonies of Gentoo Penguin, King Cormorant, Black-browed Albatross and Rockhopper Penguin. The island is one of the eight breeding sites for Falkland Islands Fur Seal *Arctocephalus australis*.

Two areas of tussock grass exist on New Island South: one surrounding the "Settlement Rookery" and composed of medium to low tussock of medium density; the

second area lying between Cliff Peak and Grand Cliff. This area is inferior to the former.

- Private wildlife reserve.
Classification B

Total area of New Island 2363 Ha. (5837 acres)
New Island **South** 1150 Ha. (2841 acres). **Tussock area: 60 Ha. (148 acres).**

Seal Rocks.

Group of two islets plus rocks lying in Grey Channel 1.5 kms off Strong Tide Point, New Island South. SE islet high standing with a maximum elevation of over 150 feet, top surface dome shaped with a dense cover of short to medium height tussock grass. In parts this tussock grows down the islands very steep cliff sides.

NW islet lower lying, contrasting with the former in that it is composed largely of horizontally bedded sandstones and rock debris. Islet is also fissured in parts, giving the islets coastline a very broken appearance. Has a little tussock cover, but very sparse and dry looking.

The two rocks shown on the DOS 1:50,000 are high standing points, forming in effect extensions of the two islets.

Although the name of these islets suggests that they may at one time have been used by seal, surveys made at different times since 1965 have not recorded seal on them.

- Property: Crown Land.

Area: 10 Ha. (25 acres). **Tussock area: 5 Ha. (12.5 acres).**

Long Point Islet.

Unnamed islet off Long Point, Beaver Island. Small fairly high standing islet with coastline of steep and fissured cliffs. Top of islet tussock covered. Dense but only low to medium height.

Area: 2 Ha. (5 acres). **Tussock cover: 1.5 Ha. (4 acres).**

Channel Rock.

Very steep sided islet lying some 300 metres north of Channel Islands off Beaver Island. The name "rock" rather misleading as its top plateau-like surface is covered with a dense growth of tussock grass.

- Area: 2 Ha. (5 acres). **Tussock area: 1.5 Ha. (4 acres).**

Channel Islands.

Two islands lying 1 km off the north end of Beaver Island. Both islands have steep coastal edges of horizontally layered rock, in parts shelved and overhanging. Top surfaces of both islands have pronounced domes. Soil layers generally thin with many parts showing exposed rocky areas. "Y" shaped island to south has two main areas of tussock grass, one stand covering the southern point, the other covering part of the NW point. Island to north has one stand of tussock grass covering area on southern point. Tussock generally sparse, low to medium height and having appearance of a growth typical of thin soil layers and dry conditions. A thin belt of tussock also grows on steep north coast cliffs, but very sparse. Central areas of both islands covered with heath formation. Channel Island south has approximately 40% of its surface area covered with tussock grass. Channel Island north, approximately 30%.

Islands have no record of having been stocked. Due to the difficulties of landing on these two islands it is possible that they have remained inviolate since before the introduction of stock to this area of the Falkland Islands.

- Property: J Hamilton Estate.
- Area: 28 and 25 Ha. (69 and 62 acres). **Tussock area: 20 and 24 acres. Total 18 Ha. (44 acres).**

Beaver Harbour Islands.

Group of 19 islands and islets lying between Beaver Island and Weddell Island. Majority of these islands have been stocked with cattle or sheep up until relatively recent times. There is also documented evidence of some islands having been stocked with pigs, probably as early as the late 1700's. A number appear to have been burnt about the same period. (see Historical). As at April 1987, all islands in the group were owned by the Estate John Hamilton, although at the time of this report, ownership was about to change.

Cucumber Island.

Small islet with complete cover of tussock grass medium to low height, dense.

Area: 3 Ha. (7 acres). **Tussock area: 2.5 Ha. (6 acres).**

Rookery Island.

Very sparse cover of tussock showing signs of overgrazing. Estimated 10% cover. April 1984. Island was stocked with cattle until 1983.

Area: 25 Ha. (62 acres). **Tussock area: 2.5 ha. (6 acres).**

Rat Island.

Very small low lying islet in the entrance of Fish Creek. Island has a very sparse cover of tussock. No record of recent stocking but was probably used in early times for pigs.

Area: 1 Ha. (2.47 acres). **Tussock area: 0.5 Ha. (1 acre).**

Green Island.

Lies to north side of Governor Channel. At time of the 1985 survey island was noted as having very good cover of dense tussock grass of medium height. Island presently appears to be stocked with cattle and in denuded state. Very large hole at the southern end suggests that the island was burnt in earlier times.

Area: 25 Ha, (62 acres). **Tussock area: 24 Ha. (60 acres).**

Chain Island.

Lies to west of Green Island. Very low islet partly made up of storm boulder beaches. Tussock covered. Recorded as having been stocked with cattle in the past.

Area: 10 Ha. (25 acres). **Tussock area: 6 Ha. (15 acres).**

Governor Island.

Lies to north of Governor Channel off east coast of beaver Island. Has very sparse growth of tussock with appearance of having been grazed. Island was stocked with sheep in the 1950's and remained until 1977-78. Island displays evidence of past burning.

Area: 220 Ha. (543 acres). **Tussock area: 50 Ha. (123 acres).**

Little Coffin Island.

Small island at eastern approach to Governor Channel. Island dome shaped. SE end has cover of fairly dense, medium height tussock grass. Remainder of island covered with heath formation. Small islet off the SE end of the island has 100% cover of dense tussock grass.

Like most islands in this group, has been used in the past for cattle and sheep. May possibly have been used in the days of the early American whalers as a holding for pigs. Shows no obvious signs of past burning.

- Property: J Hamilton Estate.

Area: 23 Ha. (57 acres). **Tussock area: 10 Ha. (25 acres).**

Stick In The Mud Islet.

Small unnamed islet in the Stick In The Mud Passage between Governor Island and Weddell Island. Fairly low lying islet with a broken rocky foreshore. Southern point of the islet has extended rocky foreshore which is used as a breeding site for Sea Lion. Island has medium to low height tussock of medium density but noticeably vigorous in its appearance. One of the few islands in the group with no history of stocking.

- Property: J Hamilton Estate.

Area: 3 Ha. (7 acres). **Tussock area: 2 Ha. (5.5 acres).**

Skull Bay Island.

Situated in Tea Island Passage between Tea Island and Weddell Island. Northern tip of the island low lying, S and SW aspects have higher standing coastal edge of rock. SW edge of island made up of exposed rock shelf with the remainder covered with a dense very green looking tussock of medium height. One of the few islands in this group which has no recent history of stocking.

- Property: J Hamilton Estate.

Area: 5 Ha. (12 acres). **Tussock area: 4 Ha. (9 acres).**

Tea Island.

Lies 1 Km off Weddell Point, Weddell Island. Island formed in two sections, main section 3 Km in length by 1 Km wide, the island's long axis lying SW by NE. Centre of this section rises to a height of over 650 feet. Smaller section of the island composed of a fairly low lying spur which is joined to the main part by a narrow and low lying peninsula composed of boulders. The general appearance of this peninsula suggests that it was formed from a storm boulder beach and at one time the two sections were separate islands. Smaller section of island has low lying coast round NE end, rising at SW end in steep and in parts undercut cliffs some 50 feet high. Larger section of the island similar with S and SW coast very severe with sea cliffs rising to 300 feet.

Much of the surface cover of the main section heath and grass formation with very sparse tussock forming a narrow belt on the NW coast and along the SE side. Smaller section of the island has slightly better stand of tussock, covering larger portion of

surface. This section has some fairly large stands of Native Box *Hebe elliptica* along its SE coast.

Has history of stocking having been used for breeding ewes in 1962 and for a period in the mid 1970's. There are records of the island being used for pigs by early American whalers. It is also recorded as having been burnt at some period prior to 1812. (See Historical).

Island was at one time the site of a Fur Seal colony. Area has not been used by this species in living memory.

- Property: J Hamilton Estate.

Area: 310 Ha. (766 acres). **Tussock area: 70 Ha. (173 acres).**

Staats Island.

Large island lying between Tea Island and SE point of Beaver Island, 5 kms in length with an average width of just over 1 km. Island's long axis lies SW and NE. Terrain generally severe with island formed from a series of domed peaks which rise to over 450 feet. At the SW end, top of island forms a small plateau with a coastline of formidable cliffs, which break away to form a number of impressive bluffs. Much of the NW facing coastline continues with steep sided cliffs towards the NE end of the island. SE coastline steep sided but generally accessible.

Much of the surface covered with grass and heath formations, a large area being covered with *Empetrum rubrum*, *Blechnum penna-marina* association. On the higher elevations at the SW end of the island, the vegetation is dominated by pure stands of *Poa robusta*. At the NE corner of the island, the coastline supported a dense stand of Native Box *Hebe elliptica*. Overgrazing by the island Guanaco population, which has increased in recent years, has all but grazed this out. Overgrazing by Guanaco has also severely depleted the tussock grass which formed a narrow belt along parts of the SE facing coastline. At 1985 the only tussock remaining was restricted to a small bluff on the SW corner of the main island.

Since the early 1930's the island has been stocked with Guanaco *Lama guanicoe* introduced from South America by John Hamilton. It also holds a population of Patagonian Fox *Dusicyon griseus griseus*, (introduced).

- Property: J Hamilton Estate. Island has no conservation status, but except for occasional culling of the Guanaco herds, has remained a form of reserve for these creatures. Because of the fox population and practical difficulties of working the island as a viable sheep holding, there is a strong argument for retaining it as a form of reserve. It is recommended that any new owner be encouraged to view the property as a potential visiting area for wildlife tourists. However, there is a serious need to reduce the Guanaco population by culling out the all-male herds, in order to reduce overgrazing.

Area: 500 Ha. (1235 acres). **Tussock area: 2 Ha. (5 acres).**

Letterbox Island.

Small islet 1 km off Quaker Hill, Weddell Island. Islet has very good cover of medium height, dense tussock grass. Has no record of stocking.

Area: 2 Ha. (5 acres). **Tussock area: 2 Ha. (4.5 acres).**

Gull Island.

Lies 1 km north of Letterbox Island and some 200m off Quaker Hill Camp on Weddell Island. Has small area of tussock on the northern and southern tips, but generally very sparse and only of low to medium height. Since commencement of survey, island has been stocked with two beef cattle.

Area: 25 Ha. (62 acres). **Tussock area: 8.5 Ha. (21 acres).**

Penn Island.

Lies some 4 km NE of Beaver Island and at entrance to Friend Passage. Island with coastal edge varying from sand beaches and low shelving rock on its east and south-west aspects to low cliff on the north-east and west sides. Parts of its interior fairly low lying with some higher ground in the coastal areas. Soil layers thin with some areas showing exposed rock. Higher elevations and some central areas covered with heath and grass formations with *Empetrum rubrum*, dominant. Tussock rather thin of low to medium height. Tends to show characteristics of stands growing in low rainfall areas and on generally thin soil layers. Forms coastal stand on the SE point and covering small peninsula that runs to the south from this point. Forms a rather thin stand inland from east facing sand beach and round NE facing point. Thin coastal belt runs round north and west sides.

Island is important breeding site for colony of Southern Giant Petrel.

Has been stocked with sheep at intervals between the 1950's and 1976 when the remaining few sheep were taken off. Island is believed to have a population of rats, but this requires confirmation.

- Property: J Hamilton Estate. No conservation status. The presence of such a large colony of Giant Petrels on this island (estimated 850-1000 pairs Dec. 1986), one of the largest single colonies in the Falklands, makes the island an important and potential reserve.

Area: 80 Ha. (198 acres). **Tussock area: 27 Ha. (66 acres).**

Low Island.

Lies 1 km SE of Penn Island and about 1 km NW of Weddell Island. As name suggests, is generally low lying island with maximum elevation just over 50 feet. Coastline of low dipping rock slabs and rock debris. Like most of the other islands in the group, has very thin soil layers with generally poor vegetative cover. Climax vegetation *Empetrum rubrum* associations. Tussock restricted to three small areas on the SW, NE and part of W coast. All these stands were rather sparse, composed of low to medium height tussock.

Was stocked with cattle in the early 1940's but removed in 1949. Not recorded as having been stocked since this date.

- Property: J Hamilton Estate.

Area: 75 Ha. (185 acres). **Tussock area: 24 Ha. (60 acres).**

Barclay Island.

Lies 1 km to NE side of Friend Passage and Low Island. West side of the island composed of low but steep sided cliffs, sloping off to a low coastline on the NE facing side. Large area of surface covered with heath formation. Tussock area on SE facing coast rather thin and low to medium height.

Was stocked with beef cattle for a period in the 1970's.

- Property: J Hamilton Estate.

Area: 110 Ha. (272 acres). **Tussock area: 22 Ha. (54 acres).**

Fox Island.

Situated 0.5 km NE of Barclay Island. Low dome shaped island with coastal edge composed of low cliffs. NE side fairly deeply indented. Centre heath and grassland with large percentage of Balsam Bog. Sparse cover of tussock grass on coastal edges, at the NW, eastern tip and SW end. Overall appearance very dry with thin soil layers.

Was stocked with breeding ewes from the 1950's until 1977.

- Property: J Hamilton Estate.

Area: 80 Ha. (198 acres). **Tussock area: 27 Ha. (66 acres).**

- **Quaker Island.**

Lies 0.5 km off NW tip of Weddell Island and some 200m SE of Fox Island. Except for a point at the SW end which rises to a height of 250ft, is generally low lying. Coastline also low lying with beaches of slightly tilted rock slab. At the SW point an area of low rocky shelves forms a natural causeway to a small islet. Large part of the island covered with a heath and grass formation with a large percentage of *Empetrum rubrum*. NE point has fairly thick cover of low to medium height tussock grass, with a smaller area to the SW. Small attached islet has approximately 20% cover of tussock. Large area of black peaty ground, once covered with tussock, lies on the eastern coast of the island.

Was stocked with breeding ewes from the 1950's until 1977.

- Property: J Hamilton Estate.

Area: 195 Ha. (482 acres). **Tussock area: 61 Ha. (150 acres).**

Hill Island

Small dome shaped island lying close to Quaker Island. Earlier surveys gave nil cover of tussock. Recent re-check shows a recovery of some tussock estimated at 10% of area. Island was stocked with sheep for a number of years. Sheep finally removed in 1977-78.

- Property: J Hamilton Estate.

Area: 50 Ha. (123 acres). **Tussock area: 5 Ha. (12 acres).**

Pitt Island.

Low lying island 0.5 km to NW of Porpoise Creek, Weddell Island. Has two areas of very sparse tussock grass, one situated at the SW end, the other on the west coast. Remainder covered with heath formation.

Was stocked with breeding ewes in the 1950's, these being removed in 1977.

- Property: J Hamilton Estate.

Area: 45 Ha. (111 acres). **Tussock area: 22 Ha. (55 acres).**

Cliff Island.

Lies about 1 km off SW coast of Weddell Island. High standing rocky island which is deeply cut by a channel at the site of an eroded igneous dyke. NE point of island which is almost severed from main part is completely covered with low to medium height tussock grass. Remaining section generally rocky with small area of tussock.

Area: 3 Ha. (7 acres). **Tussock area: 1 Ha. (2.5 acres).**

Weddell Island and Queen Charlotte Bay

DOS Sheet No. 17

Bald Island.

Small island at entrance to Bald Roads, Weddell Island. Island fairly high standing with a domed top surface. Coastline severe with steep cut cliffs. Covered with a dense stand of medium height tussock. Probably one of the few islands in this area which is ecologically intact. No record of stocking.

- Property: J Hamilton Estate.

Area: 8 Ha. (20 acres). **Tussock area: 7 Ha. (18 acres).**

Useless Island.

Small islet in Chatham Harbour, Weddell Island. Very low lying with complete cover of low to medium height tussock grass. There is no record of the island having been stocked.

Area: 3 Ha. (7 acres). **Tussock area: 2.5 Ha. (6 acres).**

Carthorse Island.

Situated in Chatham Harbour, Weddell Island. Small island with a tidal reef dividing the island into two sections. Fairly long and narrow lying SW by NE. The NE section of the island has narrow tussock fringe of rather sparse growth. A small amount of tussock grows at the SW end and on part of its NW facing coastline.

Area: 33 Ha. (81 acres). **Tussock area: 15 Ha. (37 acres).**

Harbour Islands.

Two low lying islands situated 0.5 km off east coast of Weddell Island. Islands connected by low lying tidal reef. Both sections covered with fairly dense growth of tussock.

Area: 16 Ha. (40 acres). **Tussock area: 12 Ha. (30 acres).**

Circum Island.

Small plateau-like island lying 0.5 km off Circum Point, Weddell Island. Has dense cover of rich looking tussock grass except for a narrow coastal perimeter of fine grassland. This reverse order in the positioning of grassland and tussock stand is very unusual and has only been recorded on this island. Shows evidence of early burning on coastal edge.

- Property: J Hamilton Estate.

Area: 24 Ha. (59 acres). Tussock area: 16 Ha. (40 acres).

Stop Island.

Lies about 100 m off SE coast of Weddell Island in Smylie Channel. Fairly low lying island with cover of rather sparse tussock growth. At low water the island is effectively connected to the main island of Weddell by a land bridge allowing sheep to cross over.

Area: 22 Ha. (54 acres). Tussock area: 16 Ha. (40 acres).

Double Creek Islands.

Three small islands lying in Port Richards 0.5 km off Double Creek, West Falkland. Low lying islands with gently inclined rock foreshores. All three islands have dense cover of medium height tussock grass with no evidence of having been stocked.

Sea Lion inhabit the two larger islands.

Area: 18 Ha. (44 acres). Tussock area: 16 Ha. (40 acres).

Outer Island.

Low lying island at eastern end of Queen Charlotte Bay and lying some 2 kms SW of Fox Island. Covered with fairly dense tussock grass except for small areas at the SE end. Island has been recorded in past as a breeding site for large number of Sea Lion. Recent surveys recorded no seal. No record of having been stocked and therefore might be potential addition to list of conservation areas.

Area: 20 Ha. (49 acres). Tussock area: 16 Ha. (40 acres).

Double Island.

Lies to east of Outer Island. Very low lying island with extended reef-like foreshore. Tussock covering large portion of the higher areas. Both Outer Island and Double Island have evidence of ground burrowing petrels, but require through ground survey to verify species.

Area: 9 Ha. (22 acres). Tussock area: 7 Ha. (18 acres).

Harpoon Island.

Island situated 1.5 km north of Outer and Double Islands. Low lying with extended rocky foreshores. Small raised portion of island covered with fairly dense tussock grass.

Area: 3 Ha. (7 acres). Tussock area: 2.5 Ha. (6 acres).

Green Island.

Lies at entrance to Philome! Road, Dunnose Head. Small island with low but steep sided foreshore. Covered with dense growth of medium height tussock grass. Has no history of stocking.

Area: 17 Ha. (42 acres). Tussock area: 17 Ha. (42 acres).

Note: Outer, Double, Harpoon, Green Island and the Double Creek Islands all appear to be examples of untouched tussock islands in an area where there are few such examples remaining. It is recommended that they be considered for reserve status.

Spring Point Island.

Lies to east of Fox Island and some 200m off Main Point, West Falkland. Low lying island with rocky foreshore. Has coastal belt of very sparse tussock grass.

Area: 14 Ha. (35 acres). Tussock area: 4Ha. (11 acres).

South West. West Falkland.

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Seal Island.

Small low lying islet at east end of Philomel Pass and some 200 m off Main Point, West Falkland. Covered with a dense growth of tussock grass. Holds large colony of Black-crowned Night Herons. Island also breeding site for number of Sea Lion.

Area: 1.5 Ha. (4 acres). **Tussock area: 1.4 Ha. (3.5 acres).**

Bullock Island.

Sister island to Seal Island, lies further out into Philomel Pass. Low lying island with fairly dense cover of medium height tussock grass. Is known breeding ground for Magellan Penguins and Rock Cormorants.

- Property: Crown land.

Area: 8 Ha. (18 acres). **Tussock area: 6 Ha. (15 acres).**

Horse Island.

Small low lying islet on NE side of entrance to Philomel Pass and approximately 100 m off Dunnose Head. Has cover of tussock grass.

Area: 3 Ha. (7 acres). **Tussock area: 2.5 Ha. (6 acres).**

Port Philomel Islet.

Very small islet unnamed and lying 2 km SE of Round Point, Dunnose Head. Islet low lying and covered with tussock grass.

Area: 1Ha. (2.47 acres). **Tussock area: 0.75 Ha. (2 acres).**

Rees Harbour Islets.

Two small islets lying in this harbour and one islet to NE close to northern point of Half Tide Island all have cover of tussock grass. All islets unnamed.

Area: Total for the four: 9 Ha. (22 acres). **Tussock area: 6 Ha. (15 acres).**

Lake Hammond Islets.

Larger islet in Lake Hammond has sparse cover of tussock and one islet lying at entrance to Leicester Creek.

Area: 4 Ha. (10 acres). **Tussock area: 2 Ha. (5 acres).**

Flat Island.

Small tussock covered islet lying off Fox Bay Settlement. Tussock fairly dense of low to medium height.

Area: 1 Ha. (2.47 acres). **Tussock area: 0.75 Ha. (2 acres).**

Fox Bay Island.

Unnamed island in the inner harbour of Fox Bay to north of Flat Island. Covered with fairly dense, low to medium height tussock grass.

Area: 3 Ha. (7 acres). **Tussock area: 2.5 Ha. (6 acres).**

Knob Island.

Situated in outer harbour of Fox Bay. Fairly high standing rocky islet with steep sides. Top of Islet covered with tussock grass.

Area: 1 Ha. (2.47 acres). **Tussock area: 0.5 Ha. (1.5 acres).**

South West Falkland. Port Stephens Area.

DOS Sheet 23.

Sea Dog Island.

Lies 1 km NW of Cape Orford, West Falkland. Forms a tilted plateau which rises from low lying beaches on the east side to steep and deeply fissured cliffs which form the west and south west aspects. Maximum elevation of the west and SW cliffs do not exceed 100 feet, yet they present some of the most formidable looking in this area of the archipelago. Large proportion of east and north shores composed of boulder beach except for a point on the NE corner composed of gently inclined rock slabs and low lying cliff. At the extreme west corner of the island a small bluff stands almost severed from the main island.

Large percentage of the island's surface is covered with a dense growth of tussock grass, but only of low to medium height. This tussock has all the characteristics of stands forming in areas of low rainfall or where soil layers are thin. It also lacks the vigour and colour associated with grass which is receiving large amounts of nutrient

from sea bird colonies. On the west and south west coastal edges the surface is broken by areas of exposed rock slab and rocky debris. Along this edge the tussock is extremely thin and short, giving way in many areas to stands of *Poa robusta* and patches of *Tillaea moschata*.

In the early 1800's Sea Dog Island was a recognised haunt of Fur Seal. Several aerial surveys carried out of the island since 1965 have found no Fur Seal and only very few Sea Lion. This recent ground survey carried out during the breeding season of Fur Seal confirmed that no seal of this species are present, although the probable original site was located.

The island has no record of stocking and there was no evidence of early burning. Due to difficulties of landing it is possible that the island has remained intact except for occasional visits by early sealers.

No colony nesting birds were found on the island or obvious signs of ground burrowing petrels.

- Property: Crown Land. Was given Reserve status under the 1964 Reserves Ordinance. Classification B.

Area: 30 Ha. (74 acres). Tussock area: 27 Ha. (67 acres).

Tussac Island.

Total of three islands in South Harbour off Cape Orford. Two of the group very small islets situated 0.5 km east of an area known as West Island. This latter area forms the NE tip of Cape Orford. At one time this area of land had probably been an island, subsequently to be joined to Cape Orford by a storm beach of sand.

Two smaller islets low lying; larger island rising gently to over 100 feet above sea level. Latter island formed into two almost separate islands but joined by a narrow isthmus. The two smaller islets have cover of tussock grass of medium height and density. Section of larger island lying to east has also cover of tussock. Section to west about 50% cover of tussock with remaining area of heath and grass formations.

Islands appear to be stocked on occasions as tussock area varies. NE point of larger island recorded as being used by Southern Giant Petrels. Recent surveys found no nesting birds.

- Property: Port Stephens FIC.

Area: Total 96 Ha. (237 acres). Tussock area: 57 Ha. (140 acres).

Bird Island.

Lies 4.5 km SW off Stephens Peak, West Falkland. Island formed from three promontories, one facing north, one to the west and one to the east, the centre of the

island from which these radiate forming the lowest elevation and marked by a very shallow pond. The west promontory forms a tilted plateau, rising from the centre of the island to very steep and in parts undercut cliffs which make up the west, south west and north west coasts of this section of the island. The northern promontory has a fairly low lying coastline on its north facing aspects, rising on the east coast to give the surface a domed appearance with the apex of the dome being broken into a series of upstanding towers, the edges of these formations often sheer. The eastern promontory, in complete contrast to the rest of the island, is formed from two high peaks, one rising to over 400 feet and one over 300 feet. Both peaks drop steeply away to the coastal edge, the last 100 feet forming sheer cliff faces on the southern aspects and formidable but stepped cliffs on the north east. A large part of the entire island's coastline is deeply cut with the western promontory having fissures which almost sever this area from the remaining part of the island. Taking a section through the island, the whole is made up of a series of sedimentary layers slightly dipping to the east.

Much of the north promontory and centre of the island is covered with a very dense cover of tussock grass which varies in height from medium to high (2m to 3m +). Towards the west promontory and especially on the higher elevations at the tip of this promontory, the tussock remains dense but of low to medium height. On this point the tussock is broken by areas of *Poa alopecurus* (Mountain Blue Grass), Wild Celery *Apium australe* and *Agropyron magellanicum*. On the immediate coastal edge, especially on the west tip and along the north-west facing coastline, large areas are composed of bedrock, often quite thickly covered with lichen *Ramalina sp.* On the east promontory the tussock, although dense, is generally very short, forming little or no stool, with plants growing out of a soft and often very loose peaty layer.

On the northern promontory a low lying area was found to have an interesting formation of tussock, Sword Grass (*Carex trifida*), Celery, *Poa alopecurus* and Nodding Scirpus (*Isolepsis cernua*). In one specific coastal area, where the tussock had been worn by the passage of seals and the ground covered with thick layers of guano, the area was dominated by an almost pure stand of Wild Celery of enormous proportions.

Tillaea moschata was commonly found growing in the coastal areas.

Fur Seal *Arctocephalus australis* were located at two positions on the island, one of these composed of a breeding group. One of the few colonies on the islands which has shown an increase since surveys carried out in 1965 and 1968. Sea Lion were present on the island, but in very small numbers.

Colony nesting birds recorded were, Black-browed Albatross, Rockhopper Penguin, King Cormorant and Dolphin Gull. Island has large population of Thin-billed Prion, Wilson's Petrel and Falkland Diving Petrel.

Island has no history of stocking but is recorded as having been used by early sealers not only for the taking of Fur Seal, but eggs of Albatross and Penguins. Shortly after 1868 JM Dean took out a lease of the island for sealing. The taking of Fur Seal from this site continued until the early years of the 1900's.

The island shows no signs of having been burnt.

- Property: Crown Land. Status: Wildlife Reserve. Classification A.

Area: 120 Ha. (296 acres). **Tussock area: 89 Ha. (220 acres).**

Ten Shilling Bay Islands.

Two islands lying 0.5 km off Ten Shilling Bay peninsula and just outside the entrance to Port Stephens. Larger of the two islands forms a slightly tilted plateau, its south facing coastline forming the higher elevation, reaching over 200 feet and dropping off with steep cliffs. Much of this coast is shelved and in parts undercut. Smaller of the islands, lower lying but forming similar dipped plateau. Part of this latter island has area of low lying rock slab, crossing the island from south to north, the indication being that during exceptionally high seas, the island is probably separated into two parts.

Both islands covered with fairly dense tussock grass of medium height.

Island had quite large group of breeding Sea Lion.

No colony nesting species recorded. Bird life not prolific. Island is not recorded as having any rodents, but needs checking.

Area: Total 72 Ha. (30 & 42) (178 acres). **Tussock area: Total for the two islands 49 Ha. (120 acres).**

Castle Rock.

Small high standing islet or rock some 1.5 km west of Ten Shilling Bay islands. Has very sparse growth of tussock grass on top surface of point on the extreme west end.

Area: 2 Ha. (5 acres). **Tussock area probably less than one acre.**

Stephens Bluff.

Bluff lying off SW coast of the larger of the Ten Shilling Bay Islands. Bluff stands some 200 feet above sea level with very sheer cliff sides. Top of bluff a small plateau with sparse cover of tussock grass.

Area: 2 Ha. (5 acres). **Tussock area: 1.5 Ha. (4 acres).**

Cross Island.

Island situated in entrance to Port Stephens. Island about 1.75 kms in length and some 300 to 400 metres wide. Island fairly low lying with coastal edges composed of slightly tilted rock shelves. Has rather poor tussock fringe, low to medium height,

estimated as covering some 50 % of the island's surface.

Breeding site for numbers of Rock Shag.

Area: 65 Ha. (161 acres). **Tussock area: 32 Ha. (80 acres).**

Cross Island Islets.

Group of some five unnamed islets which lie in area to south of Cross Island and Kitts Creek area. All these islets have cover of tussock grass, fairly dense but short.

Area: Total 7 Ha. (17 acres). **Tussock area: 6 Ha. (15 acres).**

Knoll Island.

Lies in Port Stephens. Island is stocked on occasions. Has rather sparse perimeter of tussock grass.

Area: 105 Ha. (259 acres). **Tussock area: 20 Ha. (50 acres).**

Knob Island.

Small islet NW of Knoll Island. Has cover of fairly dense tussock grass. Islet to SW also covered with tussock.

Area: Total for Knob and islet 4 Ha. (10 acres). **Tussock area: 3.5 Ha. (9 acres).**

Cape Meredith.

Two unnamed high standing islets of bluffs off Cape Meredith have sparse cover of tussock grass.

Area: Total 1 Ha. (2.47 acres). **Tussock area: 1 Ha. (2.47 acres).**

Eagle Rocks.

High standing islet or bluff standing off Eagle Rocks camp ENE of Cape Meredith. Coastline made up of shelved rock layers, in parts deeply undercut. Top surface slightly domed and covered with fairly dense but low tussock grass. Usually appears dry and not very vigorous.

Area: 1 Ha. (2.47 acres). **Tussock area: 0.75 Ha (2 acres).**

Port Albemarle & Arch Islands Group.

Clump Island.

Small islet lying close to the Natural Arch Island. Island almost wedge shaped and formed from steeply dipping rock layers. NE facing slope of islet largely covered with fairly dense but low to medium height tussock grass. Indication is that soil layers are very thin with many individual tussocks, barely holding on the steep rock slopes.

- Property: Crown Land. Status Wildlife Reserve.

Area: 3 Ha. (7 acres). Tussock area: 2 Ha. (5 acres).

Pyramid Rock.

High standing rocky islet with very irregular shaped cliff sides, the whole islet roughly pyramid in shape. Has a very small amount of tussock growing on NE slopes. Probably less than 0.5 acres. Islet lying some 60 metres to the south, also high standing with steep rocky sides, has small fairly flat top on which tussock grows. Tussock generally low growing and not very dense.

- Property: Crown Land. Included in with Arch Island group as a wildlife reserve.

Area: 1 Ha. (2.47 acres). Tussock area: 1 acre.

Tussac Island.

Low lying island some 3 kms west of Arch Island East. Has fairly dense cover of medium height tussock grass.

- Property: Crown Land. Status: Wildlife Reserve.

Area: 9 Ha. (22 acres). Tussock area: 20 Ha. (50 acres).

Natural Arch Island.

Island nearly 2.5 kms in length with an average width of some 400 m. Island's long axis lies almost west and east. South side of the island very severe with steeply inclined cliffs, in parts undercut. At west end the cliffs are undercut from one side of the island to the other, thus forming a natural tunnel or arch, through which the sea passes.

Larger portion of the island is covered with tussock grass, fairly dense growth but low to medium height. Tussock has the characteristics of stands growing on rather thin soil layers and in dryer conditions. At the west end of the island, immediately over the "arch" the tussock gives way to a small area of grassland composed mainly of *Poa alopecurus*. A little further to the east, a further area of grassland is also largely

covered with Mountain Blue Grass (*Poa alopecurus*), some Wild Celery and small very short areas of *Poa robusta* (Spikey Grass). All these areas are very dry in appearance.

At the northern point of the west end there is clear evidence that the island was burnt in earlier times. Layers of red ash show on this point indicating very severe burning.

Large formations of shelving rock in the immediate vicinity of the island's arch were looked at for evidence of rodents as on the neighbouring island of Arch Island East.

- Property: Crown Land: Wildlife Reserve. Classification C.

Area: 88 Ha. (217 acres). Tussock area: 77 Ha. (190 acres).

Peat Island.

Small low lying tussock island positioned off Albemarle Rincon. Island locally known as Jacks Island. Has dense cover of medium height tussock grass. Recorded as one of the last islands to have feral pigs. Was also used for sheep by the Albemarle Sealing Company in the 1940's.

- Property: Crown Land. Status: Wildlife Reserve.

Area: 30 Ha. (74 acres). Tussock area: 28 Ha. (70 acres).

Arch Island.

Largest of the group in Port Albemarle lying some 3 kms SE of Albemarle Rincon. Island formed from three main promontories, one to the north-west, a smaller promontory to the south-west and one to the north-east which extends out as a narrow and very steep sided spur. The SE aspects of the SW and NE promontories forming the island's highest elevations and more formidable coastline. On this coast, the cliffs are made up from rock strata formed on an almost vertical plane. On the N and NW facing sides of the island, the coast is steep but lower.

Island has large percentage of its surface covered with tussock grass. Grass fairly dense but low to medium height. Has similar characteristics to stands on the Natural Arch, rather dry looking and not showing the vigorous and green appearance of other stands. About centre of the island a grass and heath area is formed largely of Mountain Blue Grass *Poa alopecurus* and Native Woodrush *Luzula alopecurus*, with *Deschampsia antarctica*, *Blechnum penna-marina*, *Emetrum rubrum*, *Gunnera magellanica*, *Baccharis*, *Blechnum magellanica* and *Senecio littoralis*. Other plants recorded included *Acaena pumila* and *Acaena ovalifolia*, *Oxalis* and Celery.

Island has a history of stocking. In 1948 it was leased for the purpose of sheep and cattle raising. The operation was only run for some two seasons, but some stock was left on the island. It is not clear when this was eventually removed. The island was also the scene of some penguin oiling in the mid 1800's when Rockhopper Penguins were exploited. The island has a high population of Black Rat *Rattus rattus*. There is

evidence of burning on the island with the remains of ash pits on the NW area.

Island hold a small population of Sea Lion.

Colony nesting species recorded are Rockhopper Penguin, King Cormorant and Rock Cormorant. The only passerine species noted were Tyrants.

- Property: Crown Land. Status: Wildlife Reserve.
Note: Although the value of the island as a reserve is lowered due to the presence of rats, the area is botanically interesting. As the island is not large, consideration might be given to a programme of rat extermination. However, very careful consideration would have to be given to the method employed as the island does hold a population of Red-backed Buzzard, Crested Caracara and Striated Caracara.

Area: 200 Ha. (494 acres). **Tussock area: 162 Ha. (400 acres).**

Arch Island East Islets.

Two small unnamed islets lying some 300 metres to the west of Arch Island East. Both low lying and covered with dense and medium height tussock grass. Larger of the two has sand beach extending along its east shore. Area used by breeding groups of Sea Lion. Islets have no history of stocking, although it is likely that the larger of the two would have been used by early sealers for pigs.

- Property: Crown Land. Status: Wildlife Reserve.

Area: Total 19 Ha. (47 acres). **Tussock area: 16 Ha. (40 acres)**

Albemarle Rock.

High standing rocky islet lying 3 km east of Arch Island East. Islet formed from almost vertically dipping strata which in parts are deeply fissured. Islet extends into a series of sharply peaked rocks. Main part of the formation is covered with fairly dense tussock grass, but generally short. In parts the tussock extends down the steep sides of the islet.

- Property: Crown Land. Status: Wildlife Reserve.

Area: Total 6 Ha. (15 acres). **Tussock area: 6 Ha. (15 acres).**

Islet South of Edgar Ridge.

Unnamed islet lying 1 km due south of the southern point of Port Edgar Ridge. Islet has plateau-like surface with a coastline composed of almost sheer cliff face. Coastline is deeply indented in parts. Some areas of the coast, especially at southern point of the island, extend out as a mass of reef-like rocks. Plateau's very slightly

domed surface covered with a dense cover of medium height tussock grass. Island displays no evidence of having been burnt. Due to the very severe form of this island's coast it is possible that the island remains inviolate.

Area: 2.5 Ha. (6 acres). **Tussock area: 2 Ha. (5 acres).**

Whale Island Islets.

Very small low lying islet with two other islets situated close by, positioned in south part of Port Edgar. All three islets have cover of fairly dense, low to medium height tussock grass.

Area: Total 3 Ha. (7 acres). **Tussock area: 2.5 Ha. (6 acres).**

Falkland Sound Area. Southern End. Elephant Cays Group.

DOS Sheet 25

Elephant Cay North.

Larger of the Cays group. Fairly low lying island with two ponds and centre of island small area of grassland. Coast rocky extending out with reef. North-east point sandy and important breeding site for Southern Giant Petrel. Island has very thick medium to high tussock on perimeter.

Important site for Sea Lion.

Area: 80 Ha. (198 acres). **Tussock area: 36 Ha. (90 acres).**

Elephant Cay West.

Lies 0.5 km to west of Elephant Cay North. Is second largest island in this group. Generally low lying island with coast of low lying reef which extends out according to the state of tide. Island is surrounded with a particularly thick belt of *Macrocystis*. NW point of the island bare peaty ground, remainder covered with a dense and high (2 m +) tussock grass.

Sea Lion breeding site.

Area: 33 Ha. (82 acres). **Tussock area: 28 Ha. (70 acres).**

Golden Knob.

Very small islet some 2 km SSE of Elephant Cay North. Islet forms a high spot on tidal reef, the islet having extended coastline of sand with a centre area of tussock grass. Area has perimeter of very dense *Macrocystis* offshore. Island very important breeding ground for Southern Giant Petrel.

Area: 1.5 Ha. (4 acres). **Tussock area: 1 Ha. (2 acres).**
Area of islet effectively larger than 1.5 Ha. if sand bar taken into account.

Elephant Cay SW.

Low lying island just SW of Golden Knob Islet. Coastline of low lying reef. Island has generally poor cover of tussock grass, may have been denuded by seal movement during survey in 1985.

Area: 20 Ha. (49 acres). **Tussock area: 14 Ha. (35 acres).**

Elephant Cay SE.

Lies 0.5 km SE of above islet. Low lying island with gently tilted beaches which extend out to low lying reefs. Like most islands in the group, is surrounded by thick belt of *Macrocystis*.

Island covered with fairly dense tussock. Very small islet to NE also has cover of tussock.

Area: 13 Ha. (32 acres). **Tussock area: 12 Ha. (30 acres).**

Note: Although all the Elephant Cay group of islands, excepting perhaps the Golden Knob Islet, have been stocked with cattle at times, their value as wildlife areas is high. They are especially important as breeding ground for Giant Petrels. All these islets are owned by the Falkland Islands Company and are at present included with a number of other islands in a share farming agreement with a lessee. It is recommended that the FIC should be approached on the possibility of putting these islets aside as wildlife reserves.

Stinker Island.

Small low lying island 3 km to the east of Elephant Cay North. Island covered with tussock except for small area in centre. Last survey in 1985 recorded two cattle on this island, so present state not known.

Area: 10 Ha. (25 acres). **Tussock area in 1985: 6 Ha. (15 acres).**

Mikes Island.

Small tussock island 1 km south of Ruggles Island. Had approximately 90% tussock grass cover at time of 1985 survey, but island recorded as having cattle upon it.

Area: 6 Ha. (15 acres). **Tussock area: 4 Ha. (10 acres).**

Calista Island.

Lies 8 km NW of Ruggles Island approximately midway between East and West Falkland in the Falkland Sound. Fairly low lying island with coast mainly made up of low lying rock slab. Surface covered with dense, medium to high tussock of a rich quality. Island has no record of stocking in recent times.

Area: 72 Ha. (178 acres). **Tussock area: 61 Ha. (150 acres).**

Wedge Island.

Positioned about 2 km NE of Calista Island. Area covered with dense, medium to high tussock of a vigorous form. Important breeding area for Sea Lion along with small offshore rocky reef. Unnamed islet to NE also covered with very dense tussock grass.

Area: Including unnamed islet 17 Ha. (42 acres). **Tussock area: 16 Ha. (40 acres).**

Clump Island.

Very small islet lying 3 km NW of Ruggles Island. Is covered with dense growth of tussock grass.

Area: 1.5 Ha. (4 acres). **Tussock area: 1.5 Ha. (4 acres).**

Cay Wolfe.

Small low lying island 300 metres off SW tip of Wolfe Island. Is covered with tussock grass.

Area: 6 Ha. (15 acres). **Tussock area: 5 Ha. (12 acres).**

Flat Wolfe Island.

Low lying islet to north of Wolfe Harbour, Wolfe Island. Recorded in the 1985 survey as having complete cover of tussock grass.

Area: 4.5 Ha. (11 acres). **Tussock area: 3.5 Ha. (9 acres).**

Note: Cay Wolfe, Clump Island and Flat Wolfe all lie close to Wolfe Island which is listed in the Great Island share farming agreement. It is not clear if these small islets are owned by the FIC or excluded from the Great Island property for other reasons.

West Island.

Small island lies 2 km off Coast Ridge, West Falkland. Island covered with very dense cover of tussock grass. No record of it being used for stock, probably remains untouched due to its small size and fairly severe coastline.

Area: 4 Ha. (10 acres). **Tussock area: 3 Ha. (8 acres).**

Tyssen Island Group.

DOS Sheet 19

High Tyssen Island.

Lies on the SW edge of the Tyssen Island Group and is the smallest island out of the seven islands. Low flat island with cover of good dense tussock grass of medium height. Most recent survey carried out March 1987.

Remaining islands in the group are stocked or have been stocked recently. Survey made in October 1981 gave tussock cover as 50% for Sandbar Island, Flat Tyssen, Sandy Island and North Tyssen. At March 1987 all were recorded as being in very denuded state. The SE end of Sandbar Island was burnt in 1983. Peat Tyssen was recorded as having cattle upon it at March 1987. All the islands in the Tyssen group are owned by the FIC and are included in the Great Island share farming agreement. West Tyssen has population of rabbits resulting in very bad erosion. Survey of North Tyssen, the largest of the group, in July 1983, gave tussock cover of 10% and of fairly good quality.

Area: High Tyssen: 8 Ha. (20 acres). **Tussock area: 7 Ha. (18 acres).**

Port King Islet.

Small low lying islet 0.75 km off coast of East Falkland and lying in Port King. Islet is unnamed. Has good cover of dense, medium height tussock grass. Last survey March 1987.

Area: 4 Ha. (10 acres). **Tussock area: 3.5 Ha. (9 acres).**

Hill Gap Island.

Lies off north end of Coast Ridge, West Falkland. Very narrow island 2 km in length and in parts only 50 m wide, extending to about 300 m. Island very low lying its long axis following the line of the Coast Ridge coastline. Has very sparse, low, generally poor looking tussock on perimeter only.

Smaller islet (unnamed) to NE and almost joined to Hill Gap Island has complete cover of tussock grass, but very thin growth. A third very small unnamed islet in entrance to Hill Gap also covered with tussock. Rather thin, short.

- Property: Crown Land, leased to Port Howard.

Area: Hill Gap Island 38 Ha. (94 acres). **Tussock Area: 5 Ha. (12 acres).**
Islet to NE: 11 Ha. **Tussock area: 10 Ha. (25 acres).**
Islet in entrance to Hill Gap: **Tussock area: 0.75 Ha. (2 acres).**

Perks Island.

Very small islet lying between West Falkland mainland at Hill Gap and West Swan Island. Islet has complete cover of tussock. Island and nearby unnamed islet and reef, site for large colonies of South American Tern and Brown hooded Gull.

Area: 1 Ha. (2.47 acres). **Tussock area: 0.75 Ha. (2 acres).**

Narrows Island.

Long narrow island some 2 km in length and 50 m to some 200 m wide, lying just south of entrance to Port Howard. Island has small amount of tussock situated at one end. Rather thin low growing grass. Colony nesting species recorded are Dominican Gull.

- Property: Port Howard Estate.

Area: 25 Ha. (62 acres). **Tussock area: 0.75 Ha. (2 acres).**

High Cliff Island Group, Main Passage, Falkland Sound.

DOS Sheet 20

High Cliff Island.

Lies 2.5 km off Shag Rookery Point, East Falkland. Only named island of a group of six islets and islands. All are covered with a fairly dense, medium height tussock grass. Have no recent record of stocking. Islands are listed, as three, in the Great Island share farming agreement.

- Property: FIC.

Area: Total of group: 19 Ha. (47 acres). Tussock area: 15 Ha. (38 acres).

Falkland Sound: North (Grantham Sound).

DOS Sheet 12

Praltos Island.

Lies some 300 metres off Praltos Point, Lafonia, East Falkland. Small narrow island, fairly low lying composed of horizontally bedded sandstone. Island has covering of tussock, low to medium height and rather thin.

Area: 6 Ha. (15 acres). Tussock area: 5 Ha. (12 acres).

Rookery Island.

Small island lying north of entrance to Grantham Sound and 1.5 km from Wreck Point. Island has fairly dense cover of tussock grass of medium height. Probable that it has not been stocked. Small islet to NE of this island, low lying rocky with no tussock.

- Property: R. Gibbons Esq. with lease agreement to the Falkland Islands Foundation. Status: Wildlife Reserve.

Area: 2.5 Ha. (6 acres). Tussock area: 2 Ha. (5 acres).

South West Horse Island.

Small island lying some 200 metres off Wreck Point camp on East Falkland. Island has a history of stocking, being used as a traditional winter holding ground for horses. At November 1985 it had a cover of medium to low tussock, medium density. It is not clear if the present owners will use the island for stock.

- Property: Wreck Point Estate. G. Dixon Esq.

Area: 3 Ha. (7 acres). Tussock area: 2 Ha. (5 acres).

Inner North West Island.

Lies 0.5 km off Wreck Point. East Falkland. Island approximately 1.5 km in length with an average width of some 500 m. It forms a fairly low lying plateau of horizontally bedded very dark, almost black, sandstone. Coastline raised above high water mark approximately 3 to 4 m. Beaches generally composed of flat low lying rock with some areas of shingle which at low water extend some 50 m out from the island's coastline.

Has a history of stocking, probably with horses, cattle and sheep. The island is populated with rats although it is not known which species. There is evidence of earlier burning although there are no records indicating when this might have occurred. A very small section of the island suffered a second burning, probably in 1982 when a missile landed in tussock at the northern point. In mid 1983 the whole island was burnt out, causing considerable damage to the lower peat layers where the fire went underground. A survey carried out in February 1987 found the island to be recovering slowly with the original tussock stools having considerable re-growth.

- Property: R. Gibbons Esq. with lease agreement to the Falkland Islands Foundation. Status: Wildlife Reserve.

Area: 35 Ha. (86 acres). Tussock area: At present the island has an estimate unburnt area on the coastal edges of some 2 Ha. (5 acres).

Islet to S of Inner North West Island has complete cover of untouched tussock grass. Tussock area: 1 Ha. (3 acres).

Outer North West Island.

Positioned 0.5 km west of the Inner North West Island. Generally low lying island forming a plateau of horizontally bedded dark coloured sandstone. (Tillite of black slate, perhaps an extension of the tillite and black slate beds which cross East Falkland). Surface plateau raised some 5 metres above high water mark. Beaches of generally low lying flat rock strata and shingle. At low water the flat rocky foreshore is exposed to a distance of some 50 m from the coastline. Island is about 1.5 km in length with a width varying between 0.5 and 0.75 km.

Slightly south of the centre of the island is a small area of heath and grassland covering an estimated 8 to 10 acres (3.5 to 4 Ha.). The remaining area being tussock grass, at the present time suffering the effects of a fire which broke out during the third week in October 1986. A survey of the fire damage is contained in a separate report dated 4 March 1987. Prior to the fire the island's tussock was fairly dense and of medium height except on the perimeter of the central heath and grassland area, where tussock became sparse and of low height. The central area, which suffered minimal damage from the fire, is composed of Christmas Bush *Baccharis magellanica*, Small Fern *Blechnum penna-marina*, Almond Flower *Enargea marinata* (a rather unusual situation for this plant), Diddle-dee *Empetrum rubrum*, which was uncommon, Tea Berry *Myrteola nummularia*, Native Strawberry *Rubus geoides*, and *Senecio littoralis*. The most common form of grass was *Poa alopecurus*, with a form of Hair Grass *Deschampsia* sp. Patches of Sword Grass *Carex trifida* were found on the perimeter of the central grassland area, with some very exceptional stands of this species growing just above high water mark on the south shore of the island.

Bird and animal life was not found to be very prolific. A colony of Sea Lion were recorded on the SE shore. Small numbers of Magellan Penguin, Steamer Duck, Crested Duck, Night Heron, Kelp Geese, Black Oystercatcher, and Ground Tyrants were noted.

Except for the Tyrants, no other passerine birds were recorded. There was no evidence of ground burrowing petrels, although a number of the larger tussock stools had signs of burrows.

The survey carried out in March 1987 found that the island's tussock grass had been burnt superficially, the fire apparently passing over the island very quickly. No evidence of underground burning was found, with very little indication of individual tussock stools suffering more than burning off of the dead leaf skirt and green leaf. Some four months after the fire, 95% of the original tussock stools were showing signs of new growth.

The island has no record of having been stocked, but does hold a population of rats. The effect of the fire on these rodents is not known.

- Property: R. Gibbons Esq. with lease agreement to the Falkland Islands Foundation. Status: Wildlife Reserve.

Area: 65 Ha. (161 acres). **Tussock area: Estimated less than 10 acres of tussock untouched by fire. Possible recovery area 57 Ha. (140 acres).**

Cat Island.

Small island lying some 5 km NNE of North West Islands and 1.5 km off the coast of Wreck Point North, East Falkland. Island generally low lying with low coastline. Is covered with fairly dense tussock of medium height.

Island is not known to have been stocked.

- Property: Falkland Islands Foundation.

Area: 3 Ha. (7 acres). **Tussock area: 2 Ha. (5 acres).**

North Falkland Sound.

DOS Sheet 6

Fanning Island.

Island forms southern edge of Fanning Harbour in the entrance to Port San Carlos. Long narrow island some 2.5 km in length and varying in width from about 50 m to some 200 m. Island fairly low lying with low coastline. Has narrow coastal belt of tussock. Grass rather short and thin having been used as a traditional winter feeding area for horses. Present stocking is not clear.

- Property: Estate Port San Carlos.

Area: 33 Ha. (82 acres). **Tussock area: 18 Ha. (45 acres).**

Rabbit Island.

Small islet 0.5 km SE of Fanning Island. Low lying islet with complete cover of tussock grass. Island is not known to have been stocked in recent years.

- Property: Estate Port San Carlos.

Area: 2.5 Ha. (6 acres). **Tussock area: 2 Ha. (5 acres).**

Jersey Harbour Islands, White Rock Bay.

Group of three small islands lying in entrance to Jersey Harbour in White Rock Bay, West Falkland. Islands fairly low lying with rocky coastlines, low but moderate to severe. All islands have cover of tussock grass, the larger two islands having a dense cover of medium height. Smaller islands not so dense.

- Property: Port Howard.

Area: Total 8.5 Ha. (21 acres). **Tussock area: 7 Ha. (18 acres).**

West Falklands: North: Pebble Island, Golding Island Area. DOS Sheet 5

Government Islet.

Island positioned some 2 km NW of Pebble Islet and 7.5 km NNE of Keppel Island. Island a little over 2 km in length by 1 km at widest point. Generally low lying with a coastline made up of boulder beaches and layered rock.

Has a dense cover of medium height tussock grass. Stand generally very rich and vigorous looking, being the best example, and largest area of comparatively untouched tussock now remaining in this area. Island has one record of having been stocked with a small number of cattle for a short period. There is no evidence that the island has been burnt in the past.

Holds breeding groups of Sea Lion, although numbers have declined since the 1965 census.

- Property: Pebble Island Estate. No conservation status. It is recommended that the owners of this island be approached with the suggestion that this island might be given some form of conservation status.

Area: 110 Ha. (272 acres). **Tussock area: 101 Ha. (250 acres).**

Keppel Islet.

Small islet lying in Keppel Sound, 4.5 km NE of Keppel Island and 2 km SW of Pebble Islet. Island fairly low lying with coast of layered rock and boulder beaches. Has

complete cover of dense tussock grass of medium height and showing vigorous growth. Island has no history of stocking but may have been used for beef cattle on occasions.

This island is one of three examples of near perfect tussock stands at present remaining in the Pebble Island, Keppel Island area. The same recommendation is made for this island as for Government Islet.

- Property: Pebble Island Estate.

Area: 8 Ha. (20 acres). **Tussock area: 7 Ha. (18 acres).**

White Island.

Small island lying 2 km N of Marble Mountain Camp, Pebble Island. Island formed from a series of incised strike ridges which rise some 10 to 15 m above high water mark. Coast severe with surface of the island very rocky but supporting a small area of rather thin medium to low tussock grass.

Site for a large breeding colony of King Cormorants.

Area: 5 Ha. (12 acres). **Tussock area: 2 Ha. (5 acres).**

Golding Island Group.

This group embraces over fifty islands and islets which are broadly situated in an area surrounding Golding Island and embraced by Pebble Island to the north, Keppel Island to the west and the West Falkland mainland to the south and south east. The islands are owned by various estates.

All the islands in this area are typically low lying, formed from horizontally bedded sandstones with shorelines that extend in many areas to form low lying reefs. In some cases, reefs from neighbouring island or islets join at low water, forming in effect one island.

Generally, all the islands are covered with heath and grass formations, tussock being restricted to a very small number of islets. Where tussock does exist it is typically thin, of low height and having the characteristics of grass growing in rather dry and nutrient deficient conditions. Except for colonies of Dominican Gull, Dolphin Gull and South American Tern which use some of the smaller islets, the area is not prolific in other colony nesting species.

Due to their close proximity to each other and relatively easy access from islands such as Pebble, Saunders, Keppel and Golding, the majority of the islands in this group have been used for stock. Probably less than ten islets, with surface areas of less than 5 Ha. each, now hold tussock growth which has not been grazed.

At May 1986, the following islets in the group held small amounts of ungrazed tussock grass.

- Barton Island. Area: 7 Ha. **Tussock area: 6 Ha. (15 acres).**
- Calf Island. Area: 2 Ha. **Tussock area: 2 Ha. (5 acres).**
- Dockyard Islands (Smaller islet at entrance): 2 Ha. **Tussock area: 2 Ha. (5 acres).**
- December Island. Small unnamed islet to SW. Area: 2 Ha. **Tussock area: 3 acres.**
- Diddle Dee Island. Small unnamed islet to east has very thin cover of tussock. Area: 2 Ha. **Tussock area: 0.5 acre.**
- Half Tide Island. Area: 4 Ha. **Tussock area: 8 acres.**
- Monday Island. Small unnamed islet to SW of this island and islet due west of Monday Island have complete cover of tussock grass. Total two islets 5 Ha. **Tussock area: 10 acres.**
- October Island. Small unnamed islet NW. Area: 1 Ha. **Tussock area: 2 acres.**
- Karina Kirsten Island. Has complete cover of tussock. Area: 2 Ha. **Tussock area: 4 acres.**
- River Island Knob. Lies due north of River Island. Area: 4 Ha. **Tussock area: 8 acres.**
- Tussac Island. Small unnamed islet to east. Area: 1.5 Ha. **Tussock area: 3 acres.**

Total 12 islets listed above: **Total tussock acreage: 24 Ha. (63.5 acres).**

- Property: Ownership of many not clear. Port Howard own River Island Knob, Top Island (2).

North of East Falkland

DOS Sheets 7.8.14 & 15.

Big Shag Island.

Island lies in entrance to Port Salvador just over 0.5 km off the East Falkland coast. Except for small area in centre of the island, area is covered with fairly dense medium height tussock grass. Has been stocked with small number of cattle on occasions.

- Property: Salvador Estate.

Area: 18 Ha. (44 acres). **Tussock area: 16 Ha. (38 acres).**

Little Shag Island.

Lies some 200 metres NNW of Big Shag Island. Very small islet with complete cover of tussock grass of medium height and density. Island has been stocked with small number of cattle.

- Property: Salvador Estate.

Area: 2 Ha. (5 acres). **Tussock area: 2 Ha. (5 acres).**

Centre Island.

Lies some 3 km south of Shag Islands in channel leading to Port Salvador. Island has coastal belt of tussock grass. Has been stocked but not in the last three to four years.

Ear Island and Rat Island lying in the same area also have some tussock growth, but very poor and therefore not considered for inclusion in this survey.

- Property: Salvador Estate.

Area: 25 Ha. (62 acres). **Tussock area: 12 Ha. (30 acres).**

Seal Bay Islet.

Very small unnamed islet lying 0.5 km off East Falkland coast and 3 km east of Seal Bay. High standing islet with steep rocky coastline. Top surface covered with medium height tussock.

Probably remains inviolate due to its formidable coastline.

Area: 1 Ha. (2.47 acres). **Tussock area: 0.75 Ha. (2 acres).**

Port Louis Harbour Area

DOS Sheet 14

Peat Island.

Small islet lying 1 km north of Long Island. Very low lying islet with complete cover of fairly dense tussock of medium height. No evidence of stocking at time of the 1985 survey. Tussock cut for winter feeding.

- Property: Port Louis Estate.

Area: 1 Ha. (2.47 acres). **Tussock area: 0.75 Ha. (2 acres).**

Celery Island.

Small low lying islet situated 1.5 km SW of Peat Island and 0.5 km NW of Long Island. Has complete cover of medium height fairly dense tussock grass. No evidence of stocking at time of the 1985 survey. No record of stocking.

- Property: Green Patch Estate.

Area: 1 Ha. (2.47 acres). **Tussock area: 0.5 Ha. (1.5 acres).**

Duperrey Islet (Unnamed in Duperrey Harbour).

Very small islet situated in Duperrey Harbour, Long Island House. Islet has cover of medium to low tussock, but not dense. No record of stocking, but has been used in the past as a source of winter fodder by cutting.

- Property: Long Island Estate.

Area: 1 Ha. (2.47 acres). **Tussock area: 0.5 Ha. (1.5 acres).**

Cochon Island.

Small island lying about 1 km off the south shore of Berkeley Sound and at the SE approaches of the Sound. When viewed from the NE, profile of the island resembles two pigs back to back, hence its name.

NE side of the island formed from steeply dipping rock strata forming almost perpendicular cliffs which rise to form a fairly narrow ridge along the backbone of the island. The NW end of this ridge rises to over 100 ft, forming the island's highest elevation. A less inclined scarp forms the SW side. A small area of fairly flat but broken rocky ground is situated on the island's central ridge towards the eastern end.

A fairly dense, but rather low formation to tussock grass grows along the backbone and in parts down the SW side but, due to the rocky nature of the island, soil layers are generally thin preventing the firm establishment of a very vigorous grass. Wild Celery *Apium australe* and *Tillaea moschata* are the only other forms of vegetation commonly recorded on the island.

Colony nesting species recorded are Rockhopper Penguin, King Cormorant, Rock Cormorant. Also has small colonies of Sooty Shearwater, Wilson's Petrel and Falkland Diving Petrel.

There are no records of the island having been stocked. The island is rodent free and there is no evidence that it has been burnt.

- Property: Crown Land. Status: Wildlife Reserve, established 23 October 1964.

Area: 8 Ha. (20 acres). **Tussock area: 5 Ha. (12 acres).**

Kidney Island.

Island situated 0.5 km off the SE coast of Berkeley Sound and Kidney Cove, East Falkland. Island irregular in shape but with its long axis lying almost due west and east. At the east end a deeply cut bay is formed by extended promontories on the north and south coasts. At the west end, the island is cut obliquely to give a coastline with a SW facing aspect. This coast curves slightly to form a small and narrow sand and boulder beach although a larger proportion of the SW and W sides of the island are composed of rock and boulder strewn shoreline. Much of the north facing coast is composed of steeply dipping rock which rises out of deep water forming small but fairly severe cliff some 12 to 15 m high. The highest elevation is some 18 to 20 m.

Except for a small area about centre of the island, the surface is covered with a dense growth of medium height tussock grass. The stand is fairly typical of grass growing in a nutrient rich area with a higher than average rainfall. In those areas where tussock is not dominant the vegetation is a fairly complex formation of plants. Wild Celery *Apium australe*, fern *Blechnum penna-marina*, Native Woodrush *Luzula alopecurus*, *Pratia repens*, *Senecio littoralis*, Wild Strawberry *Rubus geoides* and a number of small stands of Sword Grass *Carex trifida*, are some of the plants recorded in these areas.

Colony nesting species recorded on the island are Rockhopper Penguin, King Cormorant, Rock Cormorant, South American Tern and Dolphin Gull. The island is particularly noteworthy for its large population of Sooty Shearwaters and other species of ground burrowing Petrel. The island is the only known breeding site in the Falkland Islands of a small population of Greater Shearwater.

Sea Lion frequent the island, but the area is not commonly used for breeding.

- Property: Crown Land. Wildlife Reserve established 23 October 1964.

Classification B.

Kidney Island is an exceptionally fine example of an offshore tussock island and although lying close to Port Stanley has remained virtually untouched. For many years the island's tussock stand was cut and sold in Stanley as winter feed for cattle and its Rockhopper Penguin colony was subjected to annual egg collecting. There are however no records of the island being stocked; it has remained rodent free and there is no evidence that the area has been burnt at any time.

Kidney Island is also exceptional in the variety and density of bird life. It is especially valuable for its collection of Ground burrowing Petrels.

Area: 32 Ha. (79 acres). **Tussock area: 28 Ha. (70 acres).**

Dutchmans Island.

Very small islet lying some 75 m off the NE coast of East Falkland approximately half way between Cape Carysfort and MacBride Head. Islet fairly high standing with rocky

coastal edge. Top of islet covered with tussock grass of low to medium height, rather thin.

Islet supported a very small colony of Sooty Shearwaters. Present status not known.

Area: 1 Ha. (2.47 acres). **Tussock area: 0.5 Ha. (1.5 acres).**

Tussac Islands (Top and Bottom Islands).

Situated on the south side of entrance into Port William and 0.75 km off north side of Cape Pembroke peninsula. Both fairly high standing with fairly severe rocky coastlines. Islands have complete cover of tussock grass. Both islands suffered burning due to military activities in the period 1982-3. In both cases burning was superficial and although the stands were completely burnt over, there was no evidence of fire going underground and destroying the peat layers. At February 1987 both islands were showing a complete cover of re-growth.

Both islands have been stocked with cattle and have population of rats.

The outer island has a small number of Sea Lion. Occasional breeding has been recorded.

- Property: Crown Land. No conservation status.

Area: Total 20 Ha. (49 acres). **Tussock area: 18 Ha. (45 acres).**

Kelly Rock (Port William).

Very small rocky islet situated in Port William 0.5 km west of the Tussac Islands. Islet has part of its surface covered with rather sparse, low growing tussock grass.

- Property: Crown Land.

Area: 0.5 Ha. **Tussock area: 1 acre.**

Seal Point Islet (Port Harriet).

Small islet lying at Seal Point. Islet forms part of a rocky reef which extends out from Seal Point for a distance of about 1 km. Centre area of the islet is raised to form a small tussock covered dome. Tussock of low to medium height, fairly dense.

Area is breeding site for small group of Sea Lion. Also used as a hauling up ground for Sea Elephant.

Area: 1 Ha. (2.47 acres). **Tussock area: 0.5 Ha. (1.5 acres).**

North East Point Islet.

Small islet 0.5 km east of North East Point, Port Fitzroy and 0.75 west of East Island. Shoreline low lying reef, with the centre of the islet raised with a fairly dense cover of tussock grass of medium height.

Island has no record of having been stocked. No evidence of burning or of rodents.

Area: 1 Ha. (2.47 acres). **Tussock area: 0.5 Ha. (1.5 acres).**

South East Point Islet.

Unnamed islet 1 km south of North East Point Islet and 1 km to east of South East Point, Port Fitzroy. Island similar in form to the above with a low lying shoreline of reef. Raised section of islet covered with fairly dense tussock of medium height.

Island has no record of having been stocked. No evidence of rodents.

Area: 2 Ha. (5 acres). **Tussock area: 1.5 Ha. (4 acres).**

Outer Knob Island.

Lies at entrance to Port Pleasant and 2 km to NE of Pleasant Point. Fairly low lying island with shoreline on south side extending out into low-lying reef. Raised area of the island tussock covered with grass of medium height and medium density. No record of stocking although its proximity to Fitzroy Settlement offers that possibility.

Area: 4 Ha. (10 acres). **Tussock area: 3 Ha. (7 acres).**

Whale Point Islets (Kelp Islands).

Four small islets lying off Whale Point and collectively known as Kelp Islands probably due to the very dense beds of *Macrocystis* which lie to the east of them. All have rocky reef-like shorelines with areas supporting tussock being raised a few metres above the high water mark. Tussock medium height and density, with centres of the islands slightly domed suggesting fairly deep accumulations of peat.

Although small all these islands are fairly important sites for Sea Lion.

Islands show no evidence of having been stocked or fired.

Area: Total for the four islets 10 Ha. (25 acres). **Tussock area: 7 Ha. (18 acres).**

Direction Island.

Small fairly high-standing islet situated 1.5 km off Bertha's Beach. Islet has a very rocky shoreline of low lying reef, with centre area being raised some 5 m above the high tide line. Top surface covered with medium height tussock, but not dense. Has small population of Sea Lion. Islet has high population of birds, with indications of a small population of ground burrowing petrels such as shearwaters.

Area: 1 Ha. (2.47 acres). **Tussock area: 0.5 Ha. (1.5 acres).**

Fox Point Islet.

Small islet, unnamed, lying about 1 km east of Fox Point, East Cove. Islet fairly low lying, slightly dome shaped. Shoreline composed of low lying reef, boulder and shingle which slopes gently up to the tussock grass line. Tussock of medium height and fairly dense. Island has no record of having been stocked. In surveys carried out in mid 1960's area was very important breeding ground for Sea Lion. Recent surveys have revealed only a small group.

Area: 1 Ha. (2.47 acres). **Tussock area: 0.75 Ha. (2 acres).**

East Falkland: Choiseul Sound.**Centre Island.**

Small island lying in centre of entrance to Choiseul Sound. Island circular in shape, fairly high standing with low reef-like shoreline. At low tide reef exposes very dense beds of *Lessonia* and *Durvillea antarctica*.

Tussock covered area of the island is slightly domed, the whole being raised above the shoreline some 2 or 3 metres on a series of horizontally bedded rock layers. Tussock fairly dense of medium height. With the tussock area being effectively isolated from the shoreline by the island's low but almost sheer rocky coastal edge, it is likely that the island has not been subjected to stocking. No evidence of burning was found.

Supports fairly large colony of Rock Shags. No evidence of ground burrowing Petrels.

Area: 3 Ha. (7 acres). **Tussock area: 2.5 Ha. (5 acres).**

Kidney Islands.

Group of two small islands lying west of the northern point of Lively Island (Kelp Bay). Low lying islands with cover of medium height fairly dense tussock grass.

Area: Total 6 Ha. (15 acres). **Tussock area: 5 Ha. (12 acres).**

Green Island.

Low lying island 2 km west of Middle Island and lying in entrance to Choiseul Sound. Island has complete cover of medium height, fairly dense tussock grass. Two smaller islets 0.5 km north of Green Island also have cover of tussock.

At time of survey in 1985 island did not appear to have been grazed. Two smaller islets probably untouched due to their size. A large majority of the islands in the Lively Island group are grazed, therefore Green Island being subjected to grazing is a probability.

Area: Green Island 7 Ha. (17 acres), plus 1.5 Ha. for two islets. **Tussock area: 6 Ha. (15 acres).**

Middle Island Islets.

Two small unnamed islets lying approximately 500 m due east of Middle Island. Islets are not shown on the DOS maps 1:50,000. Islets have low coastal edges surrounded by rocky shoreline. Both islets have cover of medium height tussock.

Area: Subject to confirmation but estimated total 6 Ha. (15 acres). **Tussock area: 4 Ha. (10 acres).**

Islet east of Big Samual Island.

Small fairly high standing islet lying 1 km east of Big Samual Island. Islet similar in form of Centre Island having fairly sheer but low coastal edge surrounded by low lying rocky shoreline. Islets top surface covered with medium height tussock grass but not very dense. No record of the islet having been stocked.

Area: 1 Ha. (2.47 acres). **Tussock area: 1 acre.**

Islands in Choiseul Sound.

The majority of the 30 or so islands and islets in the Sound and at the entrance to Darwin Harbour all show some evidence of being stocked or having been stocked in recent times. In general these very low lying islands do not have good stands of tussock grass and are not considered to be important wildlife areas.

South East of East Falkland

DOS Sheet 26, 27, 28 and 29

Sal Point Islet.

Small unnamed islet lying 0.5 km off Sal Point, Lively Island. Fairly low lying island with extended reef-like foreshores. Centre section of the islet covered with fairly dense

low to medium height tussock grass. Island is site of Sea Lion colony. No evidence of stocking.

Area: 3 Ha. (7 acres). **Tussock area: 2.5 Ha. (5 acres).**

Little Motley Island.

Island lies 0.5 km off south point of Motley island. Fairly high standing island, slightly dome shaped with coastal edge of low rocky cliffs and lower shore of flat rock. North points lopes down to a shingle and reef beach. Approximately 50% of island's surface is covered with fairly dense tussock grass of medium height. Island is breeding site for colony of King Cormorants. Parts of the island's elevated surfaces indicate the presence of ground burrowing petrels. Should be ground surveyed to confirm or otherwise. Is not known to have been stocked. Has small colony of Sea Lion.

Area: 10 Ha. (25 acres). **Tussock area: 5 Ha. (12 acres).**

Outer Triste Islands.

Two fairly low lying islands positioned 3 km SW of Motley Point, East Falkland, and 0.5 km south of Triste Island. Both islands covered with medium height and density tussock grass. Both islands surrounded by thick bed of *Macrocystis*. At time of survey in 1985, islands had no visible signs of having been stocked.

Inner island, largest of the three, holds colony of Sea Lion. A very small islet, unnamed, lies 1 km to the West of the larger of the above Triste Islands. Island covered with dense tussock.

Area: Total for three areas 28 Ha. (69 acres). **Tussock area: 24 Ha. (60 acres).**

Sandy Bay Island.

Island lies 1.5 km off the east coast of Bleaker Island. Fairly high standing island with elevation in the centre of the island reaching over 50 ft, (16 to 18 m). Coastline generally rocky with series of low lying reef on the east and north-east side with small area of sand. Island has small grass and heath formation at southern end with remainder of the island's surface being covered with medium height tussock.

Island has large colony of Rock Shags at the southern tip. West coast has evidence of ground burrowing petrels, possibly shearwaters or White-chinned Petrels. Requires ground survey to confirm or otherwise.

Has no record of having been stocked and possibly presents one of the better remaining tussock islands in this area.

Area: 32 Ha. (79 acres). **Tussock area: 29 Ha. (71 acres).**

Ghost Island.

Small island lying in Sandy Bay off the east coast of Bleaker Island. Island has covering of good tussock of medium height and density. No evidence of stocking.

Area: 3 Ha. (7 acres). **Tussock area: 2 Ha. (5 acres).**

Turn Island Islets.

Lies 200-300 m off Low Bay Rincon, East Falkland, between Adventure Sound and Low Bay. Low lying island covered with dense growth of medium height tussock grass. Very small unnamed islet lying 250 m off the SW point of Turn Island also has complete cover of tussock grass.

Some 2 km to the NW of Turn Island and 1 km off the west coast of Low Bay Rincon a further three small islets are all covered with tussock grass. Note. The DOS 1:50,000 map shows only one islet in this position.

Area: Turn Island 27 Ha. (67 acres). **Tussock area: 25 acres.** Islet off Turn Island plus three unnamed islets: 4 Ha. (10 acres). **Tussock area: 9 acres. Total for group: 14 Ha. (34 acres).**

Little Island.

Small narrow island situated in Adventure Sound and some 4 km to SW of Low Bay Rincon. Island low lying and covered with fairly dense medium height tussock grass.

Area: 3 Ha. (7 acres). **Tussock area: 2 Ha. (5.5 acres).**

Sisters Islands.

Group of four small islets lying in Adventure Sound on a line NW by SE. Islands all fairly low lying with dense cover of tussock grass of medium height. Islets used by small numbers of Sea Lion but breeding not recorded.

Area: Total 6 Ha. (15 acres). **Tussock area: 5 Ha. (12 acres).**

Halt Island.

Island lying at entrance to Bleaker Island settlement harbour and some 2 km from the settlement. At time of a survey made in 1985 this island plus others in the harbour all had a good cover of tussock. Their proximity to Bleaker Island settlement does however raise a question as to whether or not the islands are at times stocked with cattle.

Area: 13 Ha. (32 acres). **Tussock area: 10 Ha. (25 acres).**

First, Second and Third Islands.

Three small islets situated in the Bleaker Island harbour. At time of the 1985 survey all three islets were covered with tussock grass. Their very close proximity to the Bleaker Island settlement does however raise the question of whether or not these are used at times for cattle.

Area: 8 Ha. (20 acres). **Tussock area: 5 Ha. (12 acres).**

Shell Island.

Island lying 1 km off Shell Point, Low Bay Rincon on the east side of Adventure Sound. Has coastal perimeter of medium height tussock grass.

Area: 18 Ha. (44 acres). **Tussock area: 8 Ha. (20 acres).**

Button Island.

Positioned centre of Adventure Sound 3 km to the west of Shell Island and 1.5 km east of Great Island. Very small islet with complete cover of medium height and dense tussock.

Area: 1 Ha. (2.47 acres). **Tussock area: 0.75 Ha. (2 acres).**

Great Island.

Lies to west side of Adventure Sound and north side of Fox Harbour, 0.5 km off Horn Hill Rincon. Perimeter of the island has belt of tussock. Not stocked at time of 1985 survey but condition and position of the island are indications that the area is stocked at times.

Area: 70 Ha. (173 acres). **Tussock area: 14 Ha. (34 acres).**

Trap Island.

Also known as North Island. Island positioned at north end of Adventure Sound and 1 km east of Sound Rincon. Has coastal perimeter covered with tussock grass.

Area: 23 Ha. (57 acres). **Tussock area: 5 Ha. (12 acres).**

Kelp Island.

Small islet with two other smaller unnamed islets lying in line off Large Island Point on Black Rincon, SW side of Adventure Sound. All these islets have a complete cover of tussock grass.

Area: 5 Ha. (12 acres). **Tussock area: 4 Ha. (9 acres).**

Harbour Islands.

Two islands lying close to Fanny Islands, SE side of Bay of Harbours and some 2 km off east coast of Devils Point and Fanny Rincon. Islands composed of horizontally bedded sandstone. Coastline in parts raised some 4 to 5 metres above a shoreline of low lying tidal reef. In these areas the layers of dark coloured sandstone form almost vertical walls of rock which are deeply eroded and cut along the horizontal layers of sandstone. In other areas of the coast the beaches are composed of a mixture of shingle, loose stone and rock.

Centre of both islands slightly dome shaped with dense, medium height tussock grass which extends down to a point just above high water mark. On the northern point of the largest island an area of shingle and small rock is covered with a dense mat of Wild *Celery Apium australe*.

Both islands considered to be fine examples of untouched tussock and representative of islands in that area.

Area: 10 Ha. and 5 Ha. (25 & 12 acres). **Tussock area: Total for both islands: 14 Ha. (35 acres).**

Bay of Harbours Unnamed islets.

The following is a list of small islets unnamed, lying in the Bay of Harbours and which have a cover of tussock grass.

Devils Point. Rocky islet with centre covered with medium height tussock.

Island Point. Small reef-like islet with 30% cover of tussock.

Two unnamed islets off Long Rincon, both have complete cover of tussock grass.

Small islet lying between Long Rincon and Low Moffit Harbour camp has complete cover of tussock grass.

Due to their small size it is doubtful if any of the above listed islets have been stocked.

Total area: 4.5 Ha. (11 acres). **Tussock area: 3 Ha. (8 acres).**

Driftwood Island.

Island lies 1 km off Driftwood Point, east side of entrance to Bay of Harbours. Much of the island is composed of low lying reef. Area at SW end raised and with cover of tussock grass.

Area: 4 Ha. (10 acres). **Tussock area: 1.5 Ha. (4 acres).**

South East, East Falkland: Bull Point, Barren Island and George Island Group. DOS Sheet 28

Bull Island.

Very small islet lying some 200 metres off SE coast of Black Rincon. Covered with tussock.

Area: 1.5 Ha. (4 acres). **Tussock area: 1 Ha. (2.47 acres).**

Kelp Lagoon Islands.

Two unnamed islands, one situated at entrance to Kelp Lagoon, Bull Point. Second island situated just outside the Lagoon and 0.5 km west of Tussac Point, Bull Point. Fairly low lying islands with low shorelines extending out to form low lying reefs. Both have centre areas covered with dense, medium height tussock grass. Hold small colonies of Sea Lion.

A third very small islet lies to the south of Tussac Point. This also has dense cover of tussock.

Area: Total 16 Ha. for three islands (40 acres). **Tussock area: 14 Ha. (34 acres).**

Lion Creek Island.

Small island lying off west coast of Lion Creek camp. Tussock generally poor and on perimeter of island only. No evidence of stocking at time of 1985 survey.

Larger unnamed island 0.75 km west of Lion Creek Island has good cover of dense, medium height tussock.

Area: Lion Creek Island 9 Ha. Unnamed island 11 Ha. (22 acres & 27 acres). **Total tussock area: 13 Ha. (32 acres).**

Blind Island.

Fairly low lying island to NW of Eagle Passage and 0.5 km off North West Arm camp. Island very irregular shape with three narrow peninsulas. East and north peninsulas have very thick cover of tussock, remaining tussock rather sparse and restricted to narrow coastal belt. At time of survey in 1985 no evidence of stock, although indications are that island has been stocked.

Area: 130 Ha. (321 acres). **Tussock area: 51 Ha. (125 acres).**

Emily Island.

Small island lying 0.5 km off the north coast of Barren Island. Island fairly low-lying, slightly dome shaped. Has almost complete cover of dense, medium height tussock grass.

Area: 9 Ha. (22 acres). **Tussock area: 8 Ha. (20 acres).**

Tiny Island.

Small low lying islet 250 m off north coast of Barren Island and 400 m SE of Emily Island. Islet has cover of good tussock, medium height and density. Island holds small number of Sea Lion.

Area: 6 Ha. (15 acres). **Tussock area: 5.5 Ha. (14 acres).**

Knob Islands.

Two very small islets lying some 250 m off the SE coast of the north end of George Island. Both islets have poor cover of thin low growing tussock grass.

Area: Total 2 Ha. (5 acres). **Tussock area: 1.5 Ha. (3 acres).**

Mid Island.

Small island lying midway between North West Arm, East Falkland, and Speedwell Island. Island low lying with complete cover of fairly dense, medium height tussock grass. Has large King Cormorant colony. No evidence of having been stocked.

Area: 7 Ha. (17 acres). **Tussock area: 6 Ha. (16 acres).**

Ladrillo Island.

Small low lying island 250 m off Ladrillo camp, East Falkland. Island has cover of good tussock, medium height. No evidence of stocking.

Island has small group of Sea Lion. North east corner site of South American Tern colony.

Area: 3 Ha. (7 acres). **Tussock area: 3 Ha. (7 acres).**

Halfway Cove Island.

Unnamed island lying in Halfway Cove 200 m off east coast of Speedwell Island. Has coastal perimeter of tussock, medium height and density. Is probably stocked at times.

Area: 6 Ha. (15 acres). **Tussock area: 3 Ha. (8 acres).**

Brandy Island.

Island lying some 2 km east of Sea Lion Island. Island forms a fairly flat plateau with a maximum elevation of just over 50 feet (16 m). Plateau slopes off on coastal perimeter to a shoreline composed of low flat areas of rock, much of which is tidal, beaches of rock and boulders and steep banks of horizontally bedded sandstones.

Island covered with a dense cover of medium to tall tussock grass. Has no record of stocking with no evidence of burning.

Unnamed island lying some 400 m to east of Brandy Island: similar in form to Brandy and having dense cover of medium to high tussock.

- Property: R. McGill Esq.

Area: Brandy Island 25 Ha. Unnamed island 13 Ha. (62 & 32 acres). **Tussock area: Total 34 Ha. (85 acres).**

Unnamed Island off Sea Lion Island.

Small narrow island, fairly low lying with shoreline composed largely of loose stone and a small sand beach on the NW side. Island has a dense cover of medium to high tussock grass.

- Property: R. McGill Esq.

Area: 7 Ha. (17 acres). **Tussock area: 6 Ha. (15 acres).**

Sea Lion Easterly.

Second largest island in the Sea Lion Island group. Island lies 8.5 km east of Sea Lion Island and some 5 km east of Brandy Island. Geologically, the island is made up of a series of horizontally bedded layers of dark grey sandstones, the whole forming a fairly low lying plateau. On the SW facing coastline the island has been gradually eroded away, leaving extensive areas of low lying shoreline of flat rock, most of which is tidal. Behind the tidal area, the coast on the SW side is raised some 5 m, with banks of thinly layered sandstone, often deeply cut and eroded. Much of the remaining coastline is composed of fairly steeply angled beaches of broken rock and boulders.

Island has a coastal belt of very dense, medium to high tussock grass, with a central plain of finer grasses and other plants. Much of this central plain was found to be quite boggy with these areas broken and cut by an intricate maze of small fissures, some 20 cms deep and varying greatly in width, from some 10 cms to 30 cms or more. In the bottom of these fissures the ground was composed of a soft wet peat. In these areas plant life was dominated by *Pratia repens*, forming dense mats with exceptionally

large leaves and flowers. Nodding Scirpus *Isolepis cernua*, with *Ranunculus bitermatus* was also very evident, commonly forming an undercover to the ground on which Mountain Blue Grass *Poa alopecurus*, *Senecio littoralis*, Marsh Daisy *Aster vahlii*, Native Woodrush *Luzula alopecurus* and Wild Celery were all common. On the inside perimeter of the tussock stands, Sword Grass *Carex trifida* grew in large clumps, often over a metre high.

Island is breeding ground for Elephant Seal and small number of Sea Lion.

Established as important breeding ground for Falkland Diving Petrels.

Sea Lion Easterly represents one of the finest examples of an untouched tussock island remaining in the archipelago. Its central plain is of exceptional value, presenting one of the very few remaining areas of a plant formation which before the introduction of stock must have been typical of islands situated in the SE corner of the archipelago.

- Property: R. McGill Esq.

Area: 85 Ha. (210 acres). **Tussock area: 73 Ha. (180 acres).**

Beauchene Island.

Most remote island in the Falkland archipelago lying at latitude 52°54'S, longitude 59°09'W, some 51 km south of Sea Lion Islands, the nearest land to Beauchene Island. Island is just over 3 km in length and at its widest point 900 m. Topographically, the island has little similarity with the Sea Lion Island group, being more of a form seen in those islands SE of West Falkland.

It is formed from gently dipping layers of grey-white quartzite in contrast to the horizontally bedded dark grey sandstones of the former islands.

Island's long axis aligned almost due north-south direction. The northern two-thirds of the island is relatively broad, consisting of a gently tilting plateau, rising some 30 to 40m in sheer and in parts undercut cliffs, before ascending with steep slopes to a maximum elevation of some 80 m on the east side. From these higher elevations the plateau then tilts to the west, where the coastline varies from broken cliff up to about 15m high to boulder beaches and areas of shelving rock platforms in the south-west of this area. Most of this section of the island is covered with a dense, medium to high stand of tussock grass.

To the south and composing about one third of the island's length, the island is comparatively narrow. The tussock stand extends into this narrow area, some one third of this section's length, but much of this part of the island is made up of a mixture of gently sloping rock platforms, huge, generally flat slabs of rock and smaller slabs and boulders. About midway along this section, the island forms a fairly narrow and low lying waist, the indication being that in exceptional sea conditions the island is breached across its width at this point. At the extreme southern end, elevations increase to about 70 m, the coastline at this point being made up of vertical and deeply

fissured cliffs. A major fault crosses this point almost severing the area into two sections.

Beauchene Island is breeding ground for small number of Sea Lion. Elephant Seal are recorded on the island, but breeding unconfirmed. At one time area was important breeding ground for Fur Seal, but the species has not been recorded from the island since the early 1900's.

Island holds the Falklands' largest single colony of Black-browed Albatross and Rockhopper Penguins, is a very important breeding ground for the Striated Caracara and the only site in the Islands known to hold a large number of Fairy Prion. It also has a large population of both Diving Petrels and Wilson's Storm Petrel.

Under the Wild Animal and Bird Protection Ordinance 1964, the island was given Sanctuary Status on 30 December 1964. As Crown Property the island was also closed as an area of special value.

Beauchene Island is a particularly valuable area for its population of Striated Caracara, the only site in the archipelago where this rare raptor lives in complete isolation from the influence of man.

- Classification: A, with recommendation that its status be changed to Reserve with "Specially Protected Area" status.

Area: 170 Ha. (420 acres). **Tussock area: 118 Ha. (292 acres).**

TUSSOCK SURVEY MAINLAND AREAS.

For comparative purposes, mainland areas holding the remains of original tussock communities are listed below. Details are also given of tussock remaining on some island farms, where the grass forms part of the farms' grazing system.

East Falkland.

Individual and small groups of tussock plants may still be found growing in inaccessible areas of coastline, especially along the N and NE coasts of this mainland. Today however, the only sizable stand that remains and may be described as a near original community, is an area of some 10 acres (4 Ha.) at Seal Bay. A larger but inferior stand exists on Seal Point and is estimated to cover some 20 acres (8 Ha.). The remnants of other stands exist at Cape Dolphin, mainly individual plants located on the coast, a small area of generally poor growth at Mengeary Point and a small re-establishing community at Tussac Point, Hadassa Bay. The total area covered by these communities is estimated at no more than 40 acres (16 Ha.).

West Falkland.

The largest remaining tussock community on this island is in the area of Port Stephens where a fairly vigorous form grows on the steep coastal cliffs from Cape Meredith to Big Cape, a distance of some 4 km. Sparse stands also exist at the entrance to Kitts Creek and at Cape Orford.

The only remaining stand recorded at the northern extremity of West Falkland is an estimated 8 acres (3 Ha.) on Penguin Point near Tamar Pass.

The total area for West Falkland is estimated at some 120 acres, (49 Ha.).

Island Farms.

On a few island farms tussock still features in stock management, being used as an annual winter feed for both sheep and cattle. The following island farms still retain some original stands, although acreages given may include "plantations", areas of tussock planted by hand.

Sea Lion Island: 164 Ha. (405 acres)

Carcass Island: 81 Ha. (200 acres)

West Point Island: 49 Ha. (120 acres)

Total area managed for stock: 294 Ha. (725 acres).

TUSSAC DISTRIBUTION SURVEY
Robin Woods

FALKLAND ISLANDS: TUSSAC DISTRIBUTION SURVEY

Source: aerial photographs, 1956 (Huntings 26/FI) & 1979/1983 (RAF PX8/87).
Surveyed by: C J Parry, M L Parry, R W Woods, 1987. Base Map: DOS 1:50,000 (DOS 453)

BACKGROUND TO THE SURVEY

On 31st January 1986, David Taylor, Chief Executive of the Falkland Islands Government wrote to Simon Lyster, then Secretary of the Falkland Islands Foundation. Concern had been officially recorded by Executive Council at the continuing damage being done to tussac grass, which was an important wildlife habitat and source of feed for livestock in the colony. Exco felt that conservation efforts could, in effect, only apply to the offshore islands because there was so little remaining on the main islands of East and West Falkland.

In the short term, Exco felt that guidelines on limitation of grazing could be considered only for those islands where a change of ownership or usage was proposed. In the light of R W Woods' (1985) count of 778 islands in the group, Exco foresaw difficulties in providing information on so many islands.

Members felt that positive steps should be taken and that for long term planning, a full-scale, definitive survey should be made. David Taylor remarked on the Foundation's interest in such a survey and commented that he felt it was only on the basis of a comprehensive survey that the Foundation could know which islands were worthy of conservation. He asked whether the Foundation were interested and suggested that it might be worth making a sample survey of the 272 islands identified by Woods as being over 5 hectares.

R W Woods received the letter of 31 January via Simon Lyster in early February and responded on 11 February 1986. Through knowledge of the 1956 aerial survey and possession of a few prints, it was suggested that a photogrammetric survey of the Huntings photographs could provide a complete picture of tussac distribution in 1956. It was felt that three categories of tussac could be identified.

1. dense mature
2. open mature
3. poor open tussac

Measurements of tussac area could be obtained by the same gridding method used in the survey of the number, size and distribution of islands in the Falkland archipelago (Woods 1985). Historical data from farmers on grazing regimes would be useful in understanding the present state of tussac on some islands and prints from the 1983 RAF aerial photography would allow a comparison of tussac distribution over a 27-year period.

Computer classification of islands or coastal strips in the three categories was suggested, to be followed by the communication of results to FI Government. Follow-up field work to ascertain tussac condition, grazing history, plant and bird species and the presence of introduced predators was felt to be necessary in order that FIG could be sufficiently informed to make decisions on control and conservation measures.

Various factors delayed progress until August 1986, when Simon Lyster informed FIG of the generous offer made by a Foundation member, Robert Gibbons, to share equally with FIG, the estimated cost of this photogrammetric study and of Ian Strange's complementary report based on knowledge gained in the islands. Further negotiations between David Taylor and Simon Lyster made it clear that FIG were not willing to fund field work after the photogrammetric study. The original proposal envisaged such field work as a logical sequel to the map work in order to check the state of tussac on the ground. Finally, in October 1986, Exco/SFC agreed to support the original proposal for photogrammetric work and Mr Strange's report on a shared financial basis.

Through Alan Woods, an approach was made to Dr Martin Parry of Birmingham University. He was interested in the project and agreed to set up an interpretation key from a sample box of 1956 prints to be used in stereoscopy by Cynthia Parry, an experienced photogrammetician.

Approaches were made to Overseas Surveys Directorate at Southampton by phone and letter from R W Woods and Simon Lyster in early November 1986. Four sheets of the 1:50,000 maps were purchased by the Foundation for use as the base map in producing overlays of tussac distribution. On 23 November 1986, R W Woods visited the Parrys with Alan Woods. An outline plan of work and approximate costings were agreed and R W. offered to supply several photographs of tussac in various conditions for consultation during photogrammetry. Preliminary examination of photographs showed that only three categories could be discerned:

1. dense tussac
2. scattered tussac
3. no tussac

On 27 November, a meeting between Simon Lyster, Robert Gibbons, Roger Wilson (the incoming Secretary of the Foundation), Martin Parry and Robin Woods took place in London. The project was discussed and it was agreed to go ahead as planned and to approach the Ministry of Defence in order to obtain copies of their 1983 aerial photographs from RAF Brampton.

In early January 1987, RW asked OSD to supply all aerial photos to cover West Falkland but because they were stored in flight-lines, OSD asked for about ten flight-lines as an initial batch. The remaining 1:50,000 maps were ordered. A group of flight-lines was identified by Martin Parry and these were requested from OSD on 13 January 1987 with ten boxes of prints. Concurrent negotiations between Simon Lyster, RW and MOD produced conflicting information about the supply of 1983 RAF prints at cost or no cost. Unfortunately, MOD later insisted that the Foundation had to pay for prints. This decision meant that only photographs of selected areas could be examined, at a cost of £5.60 for each print, plus postage and packing.

On 5 February, Cynthia Parry was about halfway through the ten boxes of prints. Martin Parry stated that mapping from photographs would have to be finished by mid-March. It was agreed to wait until all 1956 photos had been examined before ordering 1983 photos. On 6 February, RW Spoke with Roger Wilson who had

recently returned from the Falklands. The delay in requesting 1983 prints was agreed and the possibility of obtaining them free was discussed. Roger Wilson had agreed with Ian Strange that there would be an exchange of final drafts of the two reports before presentation to F I Government.

The second batch of 1956 prints was ordered on 10 February 1987 and it arrived at Birmingham on 25 February after some confusion with OSD about returning the first batch. The final batch was received in early March and map work was completed by 13 March. RW visited the Parrys on 15 March, examined outline map transparencies, agreed that inked outline maps would be copied and sent to RW and selected twelve areas for which 1983 cover was desirable. These areas were described by letter to Roger Wilson on 16 March. By 30 March he had requested them from MOD (JARIC, RAF Brampton). On 7 April, finished copies of 1956 outline maps were received by RW with a list of areas where interpretation was uncertain through poor photographs of uneven sloping ground.

RW's work on the maps, calculating areas and tabulating tussac amounts was carried out between 25 April and 7 May. Samples of island maps were drawn and copies sent to Roger Wilson and Robert Gibbons on 9 May.

Negotiations between Roger Wilson and JARIC continued through April and into early May. On 1 June the first batch of 1983 RAF prints was received and sent to the Parrys. On 22 June, JARIC had identified the second set of target areas and awaited payment before printing them. Cynthia Parry was unable to work on the first batch of 1983 prints until late July and the second batch was not received by Roger Wilson until 27 July. They were sent to RW for onward transmission to the Parrys on 14 August when they returned from holiday. Cynthia Parry finally finished work on the 1983 prints on 23 September 1987.

RW and Martin Parry discussed ways of presenting changes between 1956 and 1983 and it was agreed that distinctive shading for 1983 changes should be shown on this second set of transparent overlays. This work was completed, copies made and two sets of overlays received by RW on 18 October 1987.

Summary of time elapsed.

	Start of phase	End of phase	Time elapsed
Approach to OSD	3.11.86	25.2.87. Last rec'd	3 mos. 3 weeks
Approach to MOD	Jan. 87	early May 87	4 mos. negotiation
Request 1983 cover	16.3.87	27.7.87 last rec'd	4 mos. 1 week
1956 stereoscopy	Nov. 86	mid-March 87	4 mos.
1983 stereoscopy	early June 87	late Sept. 87	3 mos. 2 weeks
Anal. 1956 maps	25.4.87	7.5.87	2 weeks
Anal. 1983 maps	18.10.87	19.11.87	2 weeks

METHODS USED

A complete set of Huntings Aerosurvey aerial photographs at a scale of 1:25,000 was obtained from TISS, Overseas Surveys Directorate, Ordnance Survey, Southampton. Four batches were sent direct to Martin Parry at Birmingham. Stereoscopy was carried out by Cynthia Parry who also drew complete outline maps from 28 of the 29 1:50,000 map sheets of the Falklands. Sheet 13 was omitted because it contained no coastline. Areas of dense (over 70% cover), scattered (under 30% cover) and no tussac were outlined on each map. Notes were made on areas unclassified due to near vertical cliffs obscuring cover, too poor photographic cover through glare, blurred prints or poor contrast due to rocky terrain with many shadows and areas where indications of tussac were noted.

Robin Woods estimated percentage cover of tussac where indicated or measured it using a grid. A list was produced in map sheet order showing island area (from the 1985 analysis), percentages of dense and scattered tussac on islands completely covered and on islands partially covered. From this list tables were made; of islands covered with dense tussac in size categories from the 1985 paper, of islands covered with dense and scattered tussac and of tussac on larger farmed islands. Other tables made were of tussac on Crown land and tussac on East and West Falkland. A summary table showed the total of tussac recorded on the maps in hectares and the percentages on completely covered islands, larger farmed islands and coasts of East and West Falkland.

Cynthia Parry used stereoscopy on pairs of RAF air photographs. Most were taken between October and December 1983, but those of the Northwest Islands in Falkland South were dated March 1979. The altitude also varied; most were from 13,700 feet, several from 13,200 feet and a few from 5,000, 6,000, 12,500 or 13,200 feet. Cover was somewhat incomplete on the Cape Meredith and Bleaker Island prints, thus preventing stereoscopic viewing. Sea Lion Easterly, Brandy and Rum Islands in the Sea Lion group were represented by single prints, but these were from 5,000 feet allowing easy recognition of tussac. Transparent film overlays of all islands covered by 1983 prints were drawn on separate sheets for each map sheet. Only areas or islands represented by prints were drawn on these sheets. Tussac seen to be present was outlined in six categories of shading, three showing increase since 1956 and three showing decrease of tussac cover (see attached Key).

Robin Woods measured by grid and tabulated the areas of dense and scattered tussac in 1983 and calculated the areas lost or gained. Data were analysed in three categories, using information from Ian Strange's paper concerning period of grazing by livestock and dates when livestock were removed from some islands. The categories used were:

1. Islands continuously stocked between 1956 and 1983
2. Islands where livestock was removed before 1983
3. Islands that had not been grazed.

RESULTS: ANALYSIS OF 1956 MATERIAL

Table 1.

Number of Islands with complete DENSE tussac cover in 1956

Area in Ha.	<1	1-5	5-10	10-20	20-40	40-70	70-100	100-250	TOTAL
	55	137	36	25	20	1	2	1	277

Table 1 shows that 277 islands were found to be completely covered by dense tussac in the summer of 1956/57. Almost half (49.5%) were between 1 ha. and 5 ha. in area (2.5 to 12 acres). 45 islands between 10 and 40 ha. (25 to 99 acres) were completely covered by dense tussac. The largest in the group was Fourth Passage Island (150 ha.). Calista (72 ha.), Sea Lion Easterly (85 ha.) and the eastern Ten Shilling Bay Island (42 ha.) were the next three largest islands identified as completely covered by dense tussac.

Table 2.

Number of islands covered by DENSE and SCATTERED tussac in 1956

Area in Ha.	<1	1-5	5-10	10-20	20-40	40-70	70-100	100-250	250-500	TOTAL
	1	5	7	5	10	5	3	1	2	39

Table 2 shows that only 39 islands carried a complete cover of mixed dense and scattered tussac. The two largest, in the category 250-500 ha., were South Jason (375 ha.) and Sedge Island (330 ha.). The next four largest were Government Islet (110 ha.), North Fur (75 ha.), Third Passage Island (80 ha.) and North Island (75 ha.).

Table 3.

Total number of islands completely covered by tussac in 1956

Area in Ha.	<1	1-5	5-10	10-20	20-40	40-70	70-100	100-250	250-500	TOTAL
	56	142	43	30	30	6	5	2	2	316

Almost two-thirds (62.6%) of islands completely covered by tussac were of 5 ha. (12 acres) or less in area. One third (32.6%) were between 5 and 40 ha. (12 to 99 acres).

Table 4.

Total tussac area (Hectares) on uninhabited islands in 1956

Completely tussac covered			Islands partially covered by tussac			
100% Dense	100% D. and S.	Total	Dense	Scattered	Total	Grand Total
1771	1730	3501	3612	901	4513	8014

Table 4 shows that 4513 ha. (11147 acres) or 56% of the tussac on uninhabited islands was on those only partially covered. On these partly covered islands, the amount of dense tussac (3612 ha.) was more than double the quantity found on islands covered by dense growth (1771 ha.). Field work in 1983 (Woods 1984) showed that more passerine bird species inhabited a mosaic of dense tussac and low vegetation than were found in continuous mature tussac. These partly covered islands are probably of at least equal importance for birds as those islands completely covered. Table 4 does not include the larger islands having some tussac, which are tabulated separately in Table 6.

Table 5.

Total tussac (Hectares) on East and West Falkland in 1956

East Dense	East Scattered	West Dense	West Scattered	Grand Total
35	197	588	333	
	232		921	1153

Table 5 illustrates the scarcity of tussac on coasts of East and West Falkland in 1956. 80% of this tussac was on West Falkland and it is noteworthy that 676 ha. (1169 acres) was on Crown Land stretching northwards towards Port Stephens from Cape Meredith. This coastal region of 11½ kilometres (7 miles) carried 59% of all tussac on East and West Falkland. It extended up steep slopes to the summit of Meredith Hill (726 feet or 221 metres) and occurred to at least 1300 yards (1200 metres) inland. On the 1956 aerial photographs, this Cape Meredith tussac was very noticeable as the only substantial remnant of coastal tussac on the two main islands.

The Cape Meredith camp, Bull Point south of the Bay of Harbours and 65 offshore islands, all marked as Crown Land on the 1:50,000 (DOS 453) maps of 1961 and 1962, held a total of 2851 ha. (7041 acres) of tussac in 1956, about 26% of the tussac growing in the archipelago. 42 of these islands were completely covered by tussac; they ranged in size from <1 ha. to 375 ha. (South Jason) and 17 were between 8 and 110 ha. (20 to 272 acres). Kidney Island (32 ha. or 80 acres) and Cochon Island (8 ha.) in this group, are well known to be important breeding sites for many bird species. It is likely that many of these 17 islands are equally important.

Table 6

Tussac area (Hectares) on larger islands in 1956

	Dense	Scattered	Total Hectares	Island area
Carcass	95	2	97	1894
West Point	111	29	140	1255
Saunders	18	6	24	8500
Keppel	3	0	3	3626
Pebble	0	29	29	10336
Weddell	130	27	157	21850
Beaver	163	69	232	4856
New	58.5	48	106.5	2363
Lively	5	0	5	5585
Speedwell	0	0	0	5150
Bleaker	13	8	21	2070
George	213	2	215	2400
Barren	259	3	262	1150
Sea Lion	189.5	128	317.5	905
Total	1258	351	1609	71940

The total of 1609 ha. (3974 acres) of tussac covered ground on the fourteen inhabited islands in Table 6 was only 2.2% of their total land area of 71940 ha. (17769 acres). George and Barren Islands were included in this group because it was known that they had been stocked for some years to 1956; since then their grazing regime has possibly changed. Further information is needed from the Falkland Islands Company.

There was considerable variation in proportion of tussac. On Carcass, Sea Lion and West Point, three smaller independently farmed islands under 2000 ha. (5000 acres), tussac proportion varied from 5% on Carcass and 11% on West Point to 35% on Sea Lion Island. All these islands have practised seasonal controlled grazing of tussac paddocks for many years and were shown by Theophilus (1972) to produce nearly four times more wool per acre than the Falkland average. Their wool output in 1970-71 is in the same order as their proportion of tussac in 1956; Carcass 5.07 lbs/acre, West Point 5.92 lbs/acre and Sea Lion 7.59 lbs/acre.

Table 7

Total tussac cover in 1956 (Hectares)

Smaller Islands	Larger Islands	East and West Falklands	Grand Total
8014	1609	1153	10776

Smaller islands in Table 7 are less than 500 ha. (1235 acres) while the fourteen Larger Islands, between 905 ha. (2235 acres) and 21850 ha. (53970 acres), have all been farmed and most of them settled for a century or more. The 316 smaller islands held almost five times as much tussac as the larger islands.

RESULTS: ANALYSIS OF 1983 MATERIAL

Interpretation of aerial photographs.

The aerial photographs obtained for comparison with the 1956 material were selected on criteria from the 1956 prints and previous knowledge. These included continuous management and use of tussac paddocks for many years (eg Carcass and West Point Islands), presence of substantial tussac fringes in 1956 (George and Barren Islands), use of uninhabited islands without grazing controls (eg the Tyssen Islands group and Sedge Island) and the presence of large tussac areas in 1956 on a main island coast (Cape Meredith camp).

Several difficulties were encountered in stereoscopy of these 1983 prints. On Staats, Great (Falkland Sound), George and Barren Islands and Sea Lion Easterly, areas of apparently dense tussac were not equally interpreted. Cynthia Parry found that the texture and depth of tussac differed from the usually clearly pronounced tussac areas. Tussac showed darker in tone than usual but on close inspection it appeared that there was still dense tussac, though it was possibly very low or dying out. Only one print of Sea Lion Easterly was supplied by the RAF, thus preventing stereoscopic viewing. The centre of the island appeared to lack tussac on the photograph. Aerial viewing from a few hundred feet on 6 November 1983 and pictures taken then by R.W showed that the dense tussac thinned out towards the centre; the December 1983 RAF picture from 5,000 feet showed a whitish fringe to the dense tussac area where it joined the centre of the island, possibly the effect of large dead tussac plants.

The 1983 photographic cover supplied for the Cape Meredith camp ceased about 1.6 Kilometres (1 mile) north of the Cape. This meant that no information was available for the Lighthouse camp. Cynthia Parry noted that at the southern end of Middle Plantation camp it seemed that the formerly dense tussac had disappeared.

On Bleaker Island the two pairs of stereo photographs did not overlap at the central neck, which was the area of most interest on the 1956 prints. Photographic quality was below standard, with blurring noted at the edge. Therefore, it was not possible to make an accurate comparison.

The RAF prints of Inner Northwest Island were taken in March 1979 from 6,000 feet. This island has carried livestock in the past, according to Ian Strange and has also suffered burning on at least three occasions, possibly before 1979. Cynthia Parry noticed that the easternmost part apparently had a central patch of 'scattered' tussac. The texture and shading differed from the outer edge of the island, possibly due to dense, low tussac with patches of tall tussac. Because this island was partly burnt in 1982 and completely burnt over in 1983, it would be difficult if not impossible to check this interpretation.

1983 Photographic cover

The 1983 prints obtained were sufficient to allow comparison between 1956 and 1983 tussac cover on 49 islands. Previous knowledge and historical records from Sally Poncet of the yacht *Damien II*, Roddy Napier of West Point Island, Kitty and Cecil Bertrand formerly of Carcass Island and from Ian Strange's report on tussac, allowed these islands to be placed in one of three categories as follows;

1. 22 islands stocked continuously between 1956 and 1983; total area 17,765 hectares.
2. 16 islands where stock was removed and grazing ceased before 1983; total area 5090 hectares.
3. 11 islands that have remained unstocked by grazing animals; total area 1200 hectares.

Tables 8, 9 and 10 show comparisons between 1956 and 1983 cover of DENSE, SCATTERED and TOTAL tussac respectively for the islands in the above three categories.

Table 8

Change over 27 years in DENSE tussac cover

Number	Category	1956	1983	Hectares Change	Percentage Change
22	1. Stocked 1956-1983	1698.75	991	-707.75	-41.7
16	2. Stock removed pre-1983	993	954	-39.0	-3.9
11	3. Unstocked Islands	875.7	872	-3.7	-0.4

Table 8 shows a considerable loss of dense tussac on continuously stocked islands. The 41.7% decrease for these islands is equivalent to an annual loss of 1.5%. In contrast, islands where stock had been removed at various dates between 1949 and 1978/79 showed overall a very slight loss of dense tussac. A noticeable increase in dense tussac was shown on Steeple Jason (+40 ha.) from which all sheep were removed in 1968. Unstocked islands showed a negligible decrease in dense tussac.

Table 9

Change over 27 years in SCATTERED tussac cover

Number	Category	1956	1983	Hectares Change	Percentage Change
22	1. Stocked 1956-1983	484.05	954.5	+470.45	+97.2
16	2. Stock removed pre-1983	423.5	516	+92.5	+21.8
11	3. Unstocked islands	250.3	257	+6.7	+2.7

The large increase in scattered tussac on stocked islands is due to the decrease in dense tussac on the same areas; formerly dense cover had become open, probably through continual grazing. Scattered tussac increased on the islands from which stock had been removed. This is a real increase due to colonisation rather than replacement of dense by scattered tussac. Unstocked islands showed a negligible increase in scattered tussac.

Table 10

Change over 27 years in TOTAL tussac cover

Number	Category	1956	1983	Hectares Change	Percentage Change
22	1. Stocked 1956-1983	2182.8	1945.5	-237.3	-10.9
16	2. Stock removed pre-1983	1416.5	1470	+53.5	+3.8
11	3. Unstocked islands	1126	1129	+3.0	+0.3

The overall decrease in tussac cover in the 27-year period on stocked islands (-10.9%) is equivalent to an annual loss of 0.4%. Islands from which stock had been removed showed a slight overall increase in tussac cover. There is considerable variation from 75-79 ha. increase on Grand and Steeple Jason to a loss of 17 ha. on Tea Island. Those islands northwest of Weddell Island from which sheep were removed between 1976 and 1979 (4 to 7 years before the 1983 photography) showed negligible changes in total tussac cover, as measured in this examination of aerial photographs. Unstocked islands showed minimal changes in total tussac cover.

The effects of burning on tussac are spectacular at the time of occurrence. It appears however, from the limited aerial photographic material available that tussac which remains ungrazed is capable of recovery after burning. South Jason Island is a good example. It was burnt over superficially in 1960 but has remained unstocked. The 1956 air photographs showed that it was covered in tussac, half dense and half scattered, four years before the fire. In 1983, 23 years after the fire, the tussac cover appears exactly the same as in 1956. Kidney Island (32 ha. or 80 acres) in the southern end of Berkeley Sound was almost completely covered in tussac in 1956; in 1958 personal observations were made of large tussac pedestals showing charring to 2 metres (6 feet) above ground. Local information indicated that there had been a fire in the 1940s, at least 15 years earlier. In 1983, personal observations suggested that there was no change in total tussac cover and possibly that established tussac was taller than in 1958.

Summary and Conclusions

Tables 1, 2 and 3 show that there were 316 islands completely covered by tussac in 1956. They carried 3501 ha. (8647 acres) of tussac. Partially covered islands (Table 4) carried an additional 4513 ha. (11147 acres), making a total of 8014 ha. (19794 acres) on islands completely covered by tussac.

Tussac was almost absent from coasts of East and West Falkland, with the notable exception of the Cape Meredith Crown land camps which held 676 ha. (1169 acres) in 1956.

The larger farmed islands held only 1609 ha. (3974 acres) in 1956. Total tussac cover in 1956 was calculated as 10776 ha. (26619). The small size of the 1983 sample did not allow any overall comparison between total tussac in 1956 and 1983. When this sample was compared with the same islands in the 1956 survey, it was shown that continual grazing by livestock had a deleterious effect on total tussac cover.

Aerial photography has limitations for vegetation surveys, as described in the background notes and descriptions of the 1983 material. Nevertheless, it was possible to measure nearly all the cover of tussac grass in the Falklands in 1956. This photogrammetric study of aerial photographs has provided a baseline against which to judge the effects of time and grazing on this very valuable source of food for livestock and breeding habitat for the majority of Falkland birds.

Reference

THEOPHILUS, T.W.D, 1972. The economics of wool production in the Falkland Islands. Foreign & Commonwealth Office, Overseas Development Administration.

TUSSAC DISTRIBUTION SURVEY

List of islands selected for ecological survey

This list was produced from the photogrammetric survey of the 1956 aerial photographs. It includes 174 islands, about a quarter of those in the Falkland archipelago. Criteria used for selection were:

1. Islands of 5 ha. or more
2. Islands completely covered in Dense or Dense and Scattered tussac
3. Islands with 50% tussac cover or more
4. Islands in the group northwest of Weddell Island that are not included in the above three categories.

Islands are listed by sheets of the 1:50,000 maps, DOS 453 and collected into groups according to geographical area, with suggested centres for island surveys by seaborne parties.

Abbreviations:

A = Area

D = Dense (over 70% tussac cover)

S = Scattered (under 30% tussac cover)

N = No tussac cover

Tussac area measurements from islands sampled on 1983 aerial photographs are given in the second set of 'D', 'S' and 'N' columns, where available.

GROUP 1

Sheets 1, 2 & 3; Centres: West Point or Carcass Islands

Total: 16 (10-100% tussac, 6->50% & <100 tussac)

Sheet	Name of Island	Hectares 1956				1983		
		A	D	S	N	D	S	N
1	Islet SE/Steeple Jason I.	22	19	3	-	21	1	-
2	The Fridays (N)	13	11	-	2			
	The Fridays (S)	8	7	-	1			
	Flat Jason	375	356	11	8	355	20	-
	North Fur	75	71	4	-			
	Elephant Jason	260	143	13	104	143	13	104
	South Jason	375	188	187	-	188	187	-
	The Twins (N)	8	8	-	-			
	The Twins (S)	15	15	-	-			
	Islet W/South Jason I.	5	5	-	-			
3	South Fur	25	25	-	-			
	Gibraltar Rock	20	20	-	-			
	Cliff	20	20	-	-			
	Little Bense	40	30	10	-			
	Bense	110	66	-	44			
	Split	220	108	46	66	108	46	66

GROUP 2

Sheets 4 & 5; Centres: Saunders or Keppel Islands
Total: 20 (17-100% tussac, 3->50% & <100% tussac)

Sheet	Name of Island	Hectares 1956						
		A	D	S	N	D	S	N
4	Sedge	330	264	66	-	169	96	65
	Wreck (E)	5	5	-	-	-	-	-
	Low	75	67	-	8	-	-	-
	Penguin	25	15	-	10	-	-	-
	Horse (near Saundersl.)	5	5	-	-	-	-	-
5	Calf (S of Horse I.)	5	5	-	-	-	-	-
	Christmas	45	-	45	-	-	-	-
	Islet N/Shallow Bay	7	7	-	-	-	-	-
	Tuesday	10	-	6	4	6	-	4
	Monday	25	1	24	-	-	25	-
	Islet W/Passage I.	14	14	-	-	-	-	-
	Big Channel	35	28	-	7	8	20	7
	Barton	7	7	-	-	7	-	-
	Top	15	15	-	-	-	-	-
	Rabbit	30	9	21	-	-	-	-
	Kent I. Knob	5	5	-	-	-	-	-
	Bullock	20	2	18	-	-	-	-
	Dockyard I. (SW)	7	2	5	-	-	-	-
Keppel Islet	8	8	-	-	-	-	-	
Government Islet	110	105	5	-	-	-	-	

GROUP 3

Sheets 6, 11 & 12; Centres: Port San Carlos or Port Howard
Total: 7 (6-100% tussac; 1->50% & 100% tussac)

Sheet	Name of Island	Hectares 1956							1983	
		A	D	S	N	D	S	N		
6	Jersey Harbour (NE)	6	6	-	-	-	-	-	-	-
	Fanning	33	23	10	-	-	-	-	-	-
11	North Swan	105	63	-	42	-	-	-	-	-
12	Outer Northwest	65	62	3	-	*62	3	-	-	-
	Inner Northwest	35	35	-	-	*32	-	-	-	3
	Praltos	6	-	6	-	-	-	-	-	-
	Cantera	7	3.5	3.5	-	-	-	-	-	-

* Inner & Outer Northwest Islands photographed in March 1979

GROUP 4

Sheets 8 & 14; Centre: Salvador
Total: 7 (6-100% tussac; 1->50% & <100% tussac)

Sheet	Name of Island	Hectares 1956			
		A	D	S	N
8	Big Shag	18	18	-	-
	Centre	25	25	-	-
	Ear	30	30	-	-
	Bob's	40	20	20	-
14	Ram	5	5	-	-
	Pony	11	11	-	-
	Hog	30	27	-	3

GROUP 5

Sheets 9, 10, 16, 17, 18; Centres: Beaver or Weddell

Total: 36 (22-100% tussac; 9->50% & <100% tussac; 5 additional in Weddell 1 group)

Sheet	Name of Island	Hectares 1956				1983		
		A	D	S	N	D	S	N
9	Fourth Passage	150	150	-	-	150	-	-
	Third Passage	80	76	4	-	76	4	-
	Round	5	5	-	-	5	-	-
10	Middle	155	60	25	70			
	Gid's	30	25	5	-			
16	Beef	10	7	-	3	7	3	-
	Saddle	35	35	-	-			
	North	75	73	2	-			
	Rookery	25	18	1	6			
	Stinker	5	5	-	-			
	Green (SE/Beaver Isle)	25	25	-	-			
	Chain (S)	10	10	-	-			
	Gull	25	13	5	7			
	Penn	155	48	22	85	42	18.5	94.5
	Low	75	38	7	30			
	Barclay	110	39	5	66	36	1.5	72.5
	Fox	80	28	4	48	19	13	48
	Hill	50	2	2	46	2.5	2.5	45
	Quaker	195	107	10	78	86	31	78
	Pitt	45	32	2	11			
	Little Coffin	23	9	-	14			
	Staats	500	60	14	426	27	47	426
Tea	310	139	47	124	104.5	64.5	141	
17	Skull Bay	5	4	1	-			
	Bald	8	8	-	-			
	Carthorse (N)	8	8	-	-			
	Harbour (S)	12	7	5	-			
	Circum	24	24	-	-			
	Stop	22	22	-	-			
	Double Creek (SW)	7	7	-	-			
	Double Creek (NE)	10	10	-	-			
	Outer	20	20	-	-			
	Double	9	9	-	-			
18	Green (in Philomel Road)	17	17	-	-			
	Spring Point	14	14	-	-			
	Bullock	8	8	-	-			

GROUP 6

Sheets 15, 21 % 22; Centres: Stanley, Fitzroy, Goose Green.

Total: 20 (13-100% tussac; 6->50% % <100% tussac; 1 - uncertain)

Sheet	Name of Island	Hectares 1956				
		A	D	S	N	
15	Cochon	8	8	-	-	
	Kidney	32	32	-	-	
	Tussac (E)	8	8	-	-	
	Tussac (W)	12	12	-	-	
	21	Arrow (W)	30	12	?	?
		Rory's	7	4	-	3
		Whig (N)	9	9	-	-
		Whig (S)	12	1	5	6
		Becher (main)	12	8	4	-
		Gull	33	8	25	-
		Big Samuel	50	13	37	-
		Little Samuel	25	13	-	12
		Islet WSW/Little Samuel	6	-	4	2
Hammond		30	30	-	-	
Green	7	7	-	-		
22	Middle	150	39	93	18	
	Irene	5	5	-	-	
	Islet in Kelp Lagoon	5	2.5	2.5	-	
	East	140	84	-	56	
	Tussac	15	3	12	-	

GROUP 7

Sheets 23 & 24; Centres: Beaver Island or Port Stephens.

Total: 13 (6-100% tussac; 7->50% & <100% tussac)

Sheet	Name of Island	Hectares 1956				
		A	D	S	N	
23	Sea Dog	30	25	5	-	
	Tussac (main)	90	63	9	18	
	Bird	120	114	-	6	
	Knoll	105	26	37	42	
	Ten Shilling Bay (W)	30	18	-	12	
	Ten Shilling Bay (E)	42	42	-	-	
	Cross	65	58	7	-	
	Tussac (N/Arch Islands)	18	18	-	-	
	24	Natural Arch	88	66	18	4
		Islet W/Big Arch I.	18	18	-	-
Big Arch		200	160	-	40	
Peat		30	25	-	5	
	Albemarle Rock	6	6	-	-	

GROUP 8

Sheets 19, 20 & 25; Centre: Great Island.

Total: 24 (19-100% tussac; 5->50% & <100% tussac)

Sheet	Name of Island	Hectares 1956				1983			
		A	D	S	N	D	S	N	
19	Islet N/Hill Gap I.	11	11	-	-				
	Hill Gap	38	34	-	4				
	Sandy	45	44	-	1	26	18	1	
	Flat Tyssen	13	9	-	4	9	-	4	
	West Tyssen	130	19	85	26	-	104	26	
	High Tyssen	8	8	-	-				
	Peat Tyssen	18	16	2	-	10	8	-	
	Islet SE/Swan I.	12	12	-	-				
	Islet S/High Cliff I.	9	9	-	-				
20	High Cliff	5	5	-	-				
	Wedge	12	12	-	-				
25	Calista	72	72	-	-				
	Islet NE/Wedge I.	5	5	-	-				
	Cay Wolfe	6	6	-	-				
	East Wolfe	35	33	2	-				
	Mike's	6	6	-	-				
	Stinker	10	10	-	-				
	Elephant Cays (N)	80	72	-	8				
	Elephant Cays (S)	33	33	-	-				
	Elephant Cays (SW)	20	20	-	-				
	Elephant Cays (SE)	13	13	-	-				
	Islet in Halfway Cove	6	3	3	-				
Mid	7	7	-	-					
Flores Harbour	28	28	-	-					

GROUP 9

Sheets 26, 27, 28 & 29; Centres: Speedwell, North Arm or Bleaker Island

Total: 31 (21-100% tussac, 10->50% & <100% tussac)

Sheet	Name of Island	Hectares 1956				1983			
		A	D	S	N	D	S	N	
26	Cattle Point	45	18	16	11				
	Saturday	7	2.5	2	2.5				
	Shell	27	15	6	6				
	Urchin	14	14	-	-				
	Adventure	18	15	3	-				
	Fanny	100	54	26	20				
	Harbour (E)	10	10	-	-				
	Harbour (W)	5	5	-	-				
	Turn	27	27	-	-				
	North Point	20	20	-	-				
27	Sandy Bay	32	30	2	-				
	Halt	13	13	-	-				
	Triste	155	90	-	65				
	Outer Triste (N)	18	18	-	-				
	Outer Triste (S)	9	9	-	-				
	Little Motley	10	10	-	-				
	Seal	27	27	-	-				
	Pyramid	8	4	4	-				
	Islet SW/Northwest I.	12	12	-	-				
	Annie	45	25	18	2				
28	Blind	130	74	4	52				
	Lion Creek	9	7	-	2				
	Islet W/Lion Creek I.	11	11	-	-				
	Islet W/Tussac Point	9	8	-	1				
	Kelp Lagoon	6	6	-	-				
	Emily	9	9	-	-				
	Tiny	6	6	-	-				
	Beauchêne	170	102	-	68				
	Brandy	25	25	-	-	25	-	-	
	Rum	13	13	-	-	13	-	-	
29	Sea Lion Easterly	85	85	-	-	80	-	5	

APPENDIX ONE

TUSSAC DISTRIBUTION SURVEY

List of islands and regions covered by RAF aerial photographs with dates of photography and altitude where known.

Sheet	Island/Region
1	Grand Jason, Steeple Jason, Islet 4: NE/Grand Jason, Islet 3: SE/Steeple Jason (probably Nov. '83)
2	Flat Jason, Elephant Jason, South Jason (probably Nov. '83)
3	West Point (Nov. '83, 13,700 ft), Split (Nov. '83, 13,200 ft), Carcass (Dec. '83, 13,200 ft)
4	Sedge (Dec. '83, 13,200 ft)
5	Islet 13: W/Monday, Islet 14: WNW/Tuesday, Islet 15: W/Passage, Islet 20: NE/Monday, Islet 21: E/Box. Tuesday, Monday, Dry, Barton, Big Channel, Box, Passage (Dec. '83, 13,700 ft)
9	First Passage, Round, Second & Third Passage (Dec. '83, 13,200 ft); Third & Fourth Passage (Dec. '83, 5,000 ft)
12	Outer Northwest, Inner Northwest (March '79, 6,000 ft)
16	Penn, Barclay, Low, Fox, Hill, Quaker, Staats, Tea, Beaver, New, Beef, Coffin (Nov. '83, 13,700 ft)
17	Loop Ridge, Weddell I. (Nov. '83, 13,700 ft)
19	North, West, Flat & Peat Tyssen Is. Sandy, Sandbar (Nov. '83, 12,500 ft); Great (Oct. '83, 12,500 ft)
23	Cape Meredith camp; Three Crowns to Middle Plantation, but excluding southern point (Lighthouse camp), Cross I. (Jan. '84, 13,700 ft)
27	Bleaker (Nov. '83, 12,500 ft). Two pairs did not meet in centre.
28	Barren (Nov. '83, 12,700 ft), George (Nov. '83, 12,700 ft & Dec. '83, 13,700 ft)
29	Sea Lion main (Dec. '83, 12,700 ft), Brandy, Rum & Sea Lion Easterly (Dec. '83, 5,000 ft). Only single print for Sea Lion Easterly.

APPENDIX TWO

Data used to produce Tables 8, 9 & 10 (pages 10-11)

Category 1: Islands stocked continuously or intermittently 1956-1983

Island	Stocking History	Area Ha.	1956			1983		
			D	S	Σ	D	S	Σ
West Point	Sheep 1880s-1983; few cattle	1255	111	29	140	72	42	114
Carcass Tuesday	Sheep 1873-1983; ?	1894	95	2	97	72	98	170
Monday	? Stocked continuously	10	-	6	6	6	-	6
Dry	? Stocked continuously	25	1.25	23.75	25	-	25	25
Big Channel	? Stocked continuously	90	-	4.5	4.5	-	4.5	4.5
Box	? Stocked continuously	35	28	-	28	8	20	28
Inner Northwest	? Stocked in past	90	22.5	-	22.5	-	-	-
Staats New	Burnt 1982 & 1983; Guanaco & Fox 1930s-1983	35	35	-	35	32	-	32
North Tyssen	Stocked in past	500	60.5	13.5	74	27	47	74
Flat	? Stocked in past	2363	50.5	48	406.5	53	38	91
Sandy West	Stocked in past	250	37.5	-	37.5	19.5	30	49.5
Peat	Cattle	13	9	-	9	9	-	9
Sandbar	Sheep; SE end burnt in 1983	45	44	-	44	26	18	44
Great	Sheep	130	19.5	84.5	104	-	104	104
Barren	? Stocked after 1965	18	16.2	1.8	18	10	8	18
George	Sheep	126	35.3	205	37.8	18	15	33
Sedge	Cattle 1920s-60s; Foxes c1938-1970s; Sheep mid 1960s-1983	1245	37	-	37	32.5	2	34.5
Beaver	Sheep; few cattle	1150	259	3.5	262.5	128.5	134	262.5
Sea Lion	Sheep; few cattle	2400	213	2	215	119	110	229
Totals		330	264	66	330	169	96	265
		4856	163	69	232	0	35	35
		905	189.5	128	317.5	189.5	128	317.5
			1698.75		21.82.8	954.5		1945.5
				484.05		991		

The stocking history of some islands in the above table is uncertain. The group southeast of Keppel I. (Tuesday to Box Is. inclusive) is least known. They may have carried stock continuously or been used intermittently for cattle. This sample of 22 islands covers a wide range, varying in area from 10 to 4856 ha. **Barren and George Islands** are particularly interesting as two of the largest islands retaining a significant tussac fringe. Knowledge of their grazing and settlement history would be valuable when considering the management of tussac. This information could be obtained from the Falkland Islands Company in London and from past or present Camp Managers for East Falkland, based at Darwin.

APPENDIX TWO

Category 2: Islands from which stock were removed before 1983

Island	Period of Stocking	Area Ha.	1956			1983		
			D	S	Σ	D	S	Σ
Low (W/Weddel)	1940s- 49 Cattle	75	37.5	7.5	45	37.5	7.5	45
Third Passage	1960s Cattle	80	76	4	80	76	4	80
First Passage	1950s-67 Sheep	750	90	210	300	68	156	224
Grand Jason	1927-68; 1200 sheep	1380	-	-	-	6	73	79
Steeple Jason	1927-68; 700 sheep	790	79	79	158	129	104	233
Fourth Passage	1960-69; cattle, "heavy"	150	150	-	150	150	-	150
Beef Coffin	Cattle & few sheep to 1972	10	7	-	7	7	3	10
Tea Barclay	Sheep 1962; mid 1970s	310	139	47	186	104.5	64.5	169
Elephant Jason	Cattle "1970s"	110	38.5	5.5	44	36	1.5	37.5
Penn Quaker	"Few hundred sheep" 1967-1971	260	143	13	156	143	13	156
Fox Hill	Sheep 1950s-1976	155	48	21.5	69.5	42	18.5	60.5
Second Passage	Sheep 1950s-1977	195	107	10	117	86	31	117
	Sheep 1950s-1977	80	28	4	32	19	13	32
	Sheep - 1977/78	50	2.5	2.5	5	2.5	2.5	5
	Sheep, early 1950s-78/79	650	45.5	19.5	65	45.5	21.5	67
Totals			993	423.5	1416.5	954	516	1470

Category 3: Unstocked islands

Island	Area Ha.	1956			1983		
		D	S	Σ	D	S	Σ
Islet 3: SE/Steeple Jason	22	18.7	3.3	22	21	1	22
Flat Jason 375	356	356	11	367	355	20	375
*South Jason	375	188	187	375	188	187	375
Split (S/West Point I.)	220	108	46	154	108	46	154
Barton	7	7	-	7	7	-	7
Round (E/Second Passage I.)	5	5	-	5	5	-	5
Outer Northwest	65	62	3	65	62	3	65
High Tyssen	8	8	-	8	8	-	8
Brandy 25	25	25	-	25	25	-	25
Rum (E/Brandy I.)	13	13	-	13	13	-	13
Sea Lion Easterly	85	85	-	85	80	-	80
Totals		875.7	250.3	1126	872	257	1129

* Note that South Jason tussac was burnt over in 1960

KEY TO CHANGES 1956 to 1983



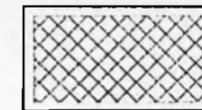
None to Scattered



None to Dense



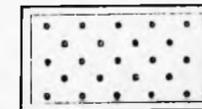
Scattered to Dense



Dense to Scattered



Scattered to none



Dense to None

D to Up
D to Up

Dense to Uncertain

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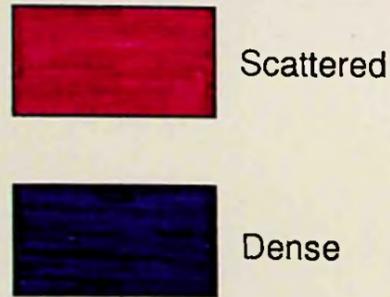
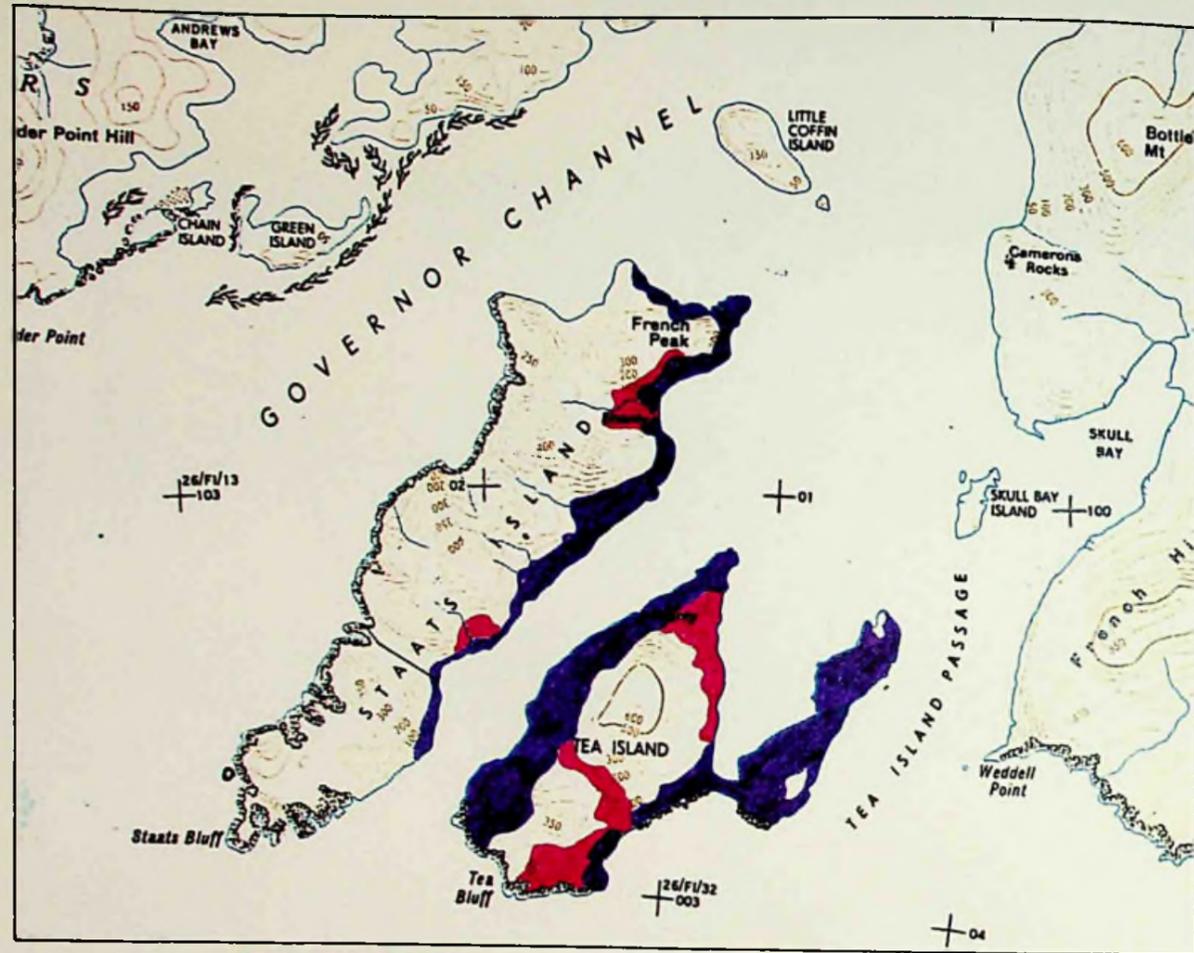
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Note: Areas drawn only where 1983 airphotos have been studied.

EXAMPLES

Patterns of change in tussac cover

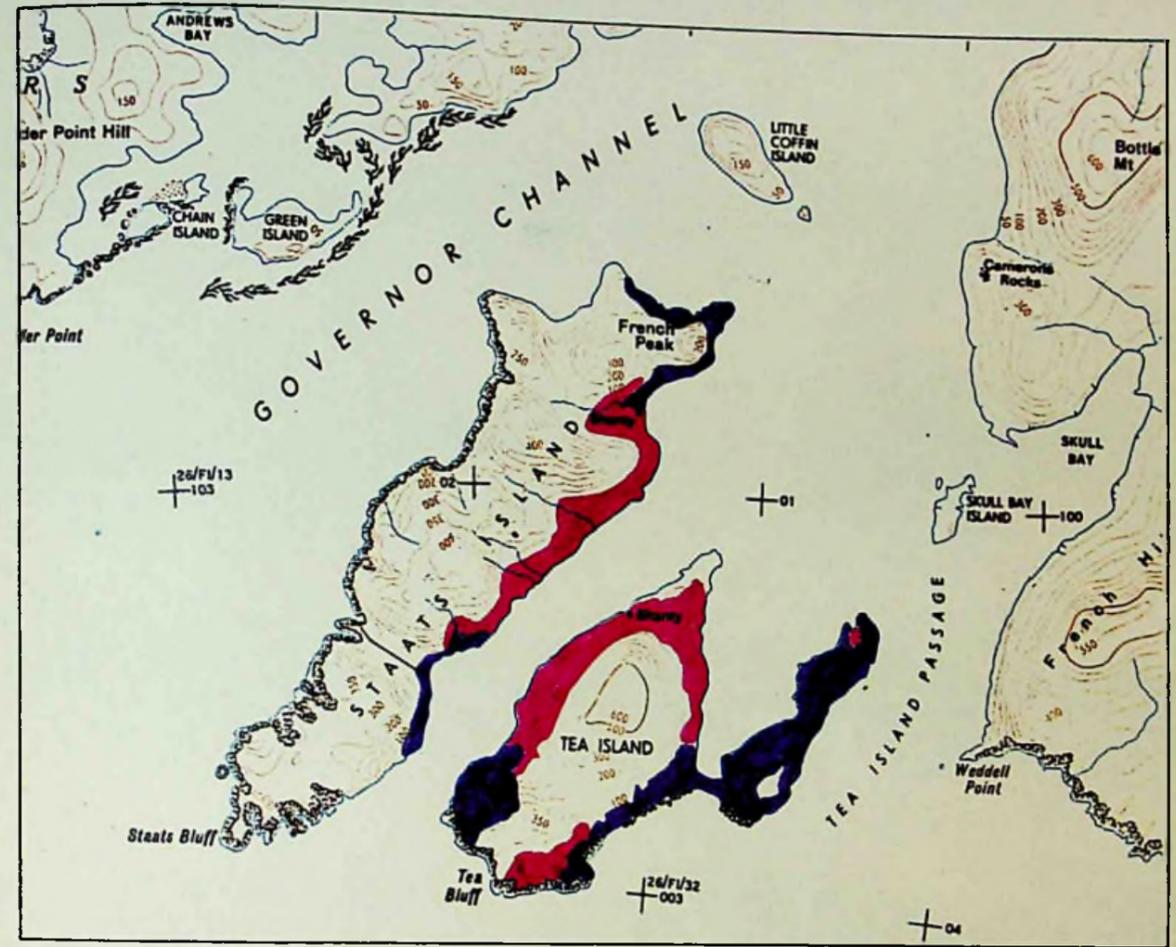
1956



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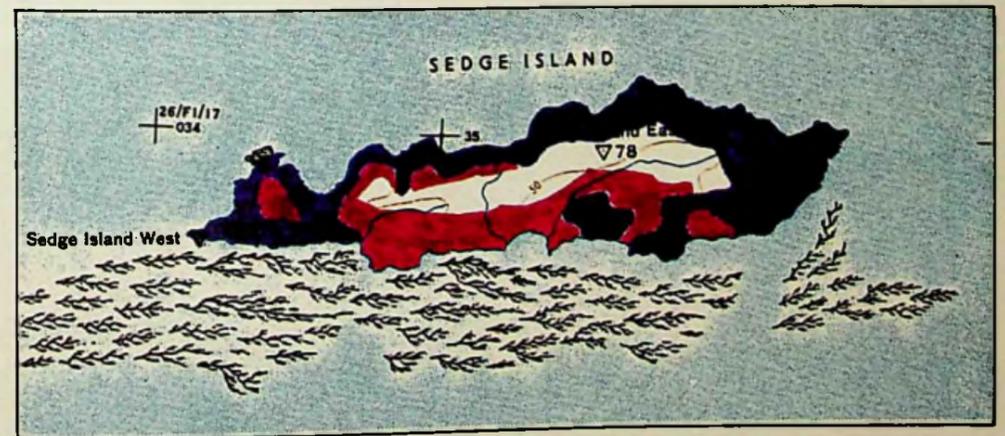
Note: Areas drawn only where 1983 airphotos have been studied.

1983



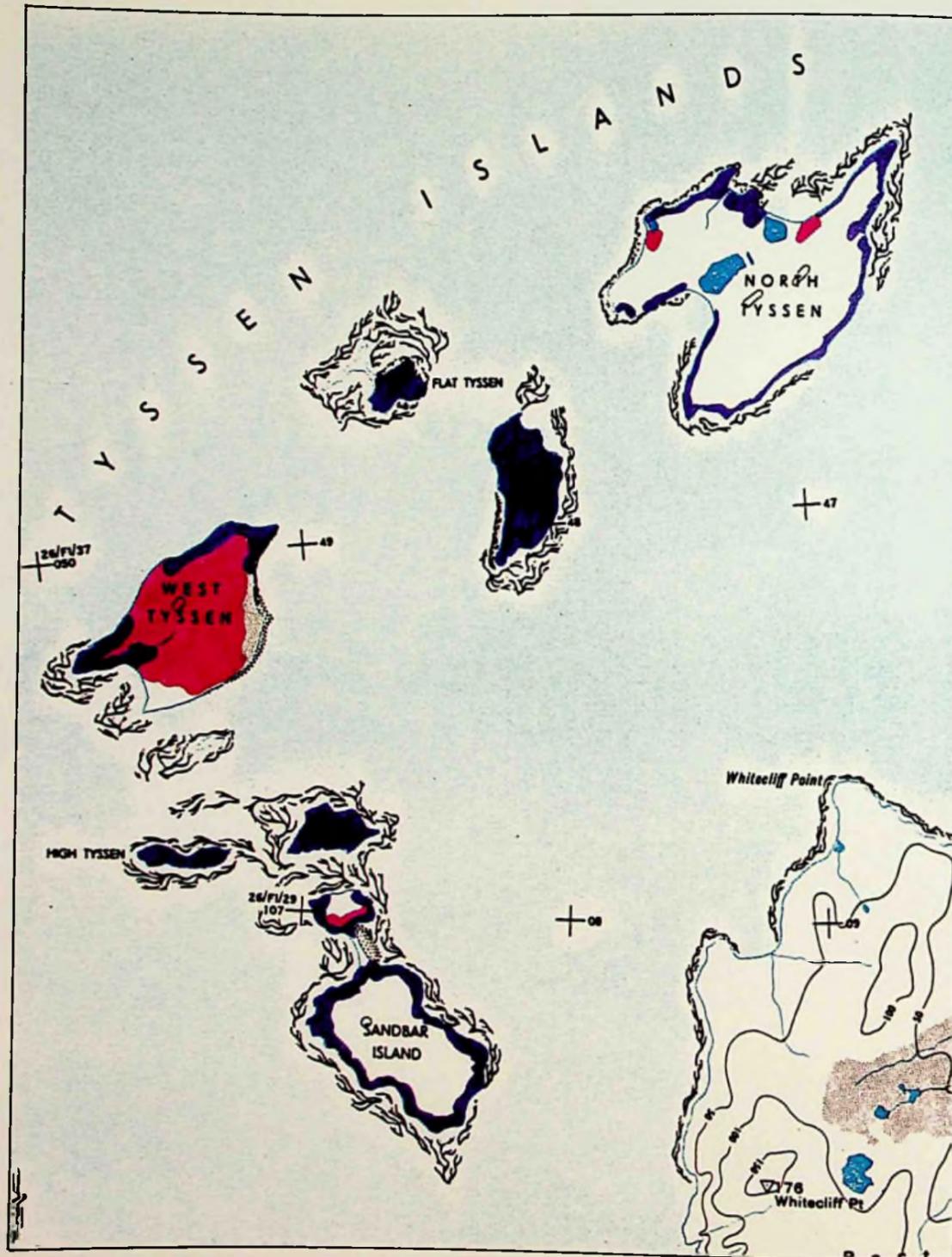
States Island. Introduced Guanaco have caused reduction and loss of tussac through overgrazing. Since 1983 grazing pressure has been maintained and by 1985 the only remaining tussac was found on a small bluff off the south-west coast of the island. Much of the tussac mapped from the 1983 photograph may consist of grazed-off stools.

Tea Island. Tussac cover has decreased through stocking with sheep in 1962 and the mid-1970s.



Sedge Island. Comparison between 1956 and 1983 shows the disastrous effects of severe overgrazing following introduction of sheep in the mid-1960s. The remaining tussac mapped from 1983 photographs probably consists largely of old stools because the only living tussac cover found on a ground survey in 1985 was of individual plants in inaccessible places on the north coast. Sheep were removed from Sedge in 1986.

1956



Scattered

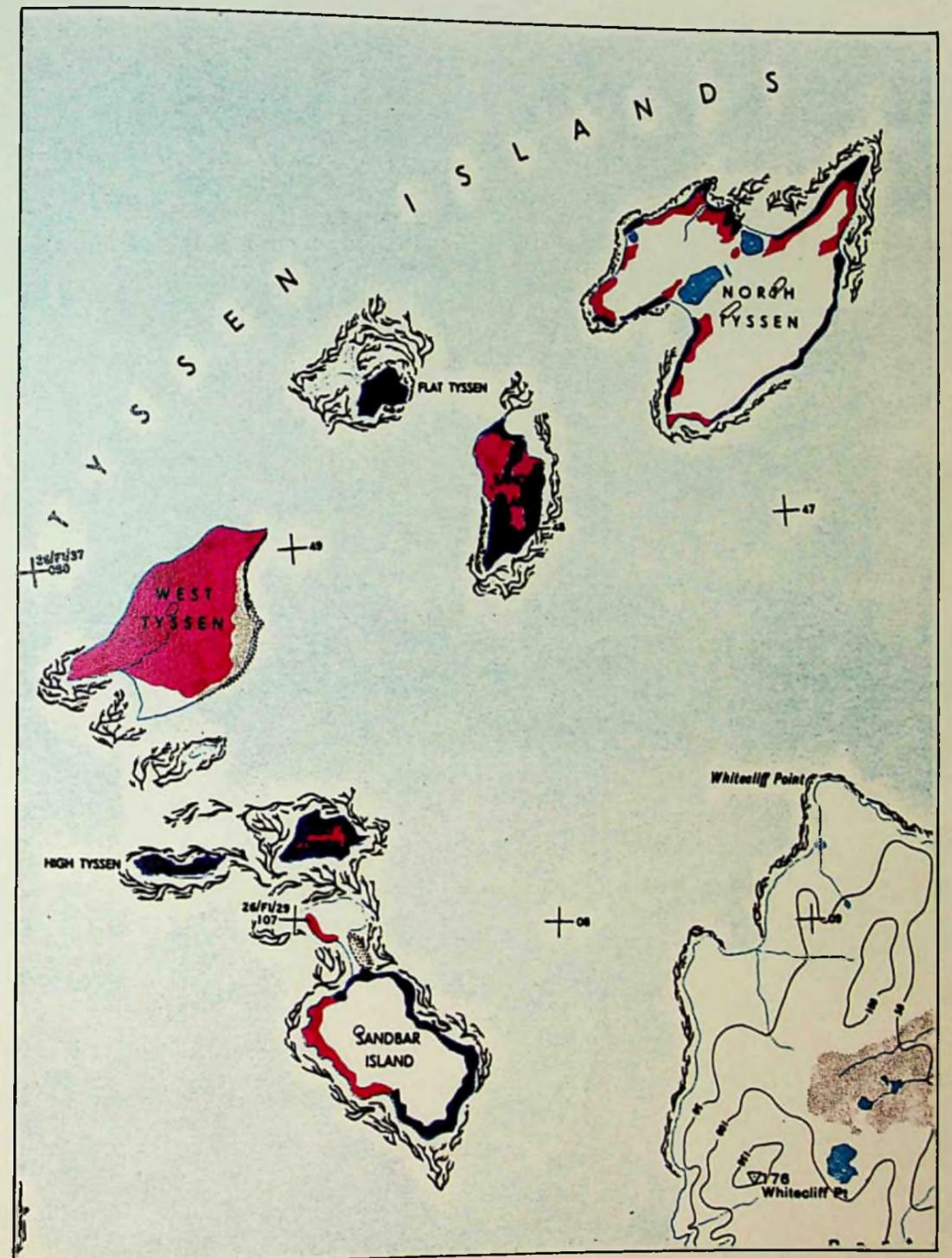
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Dense

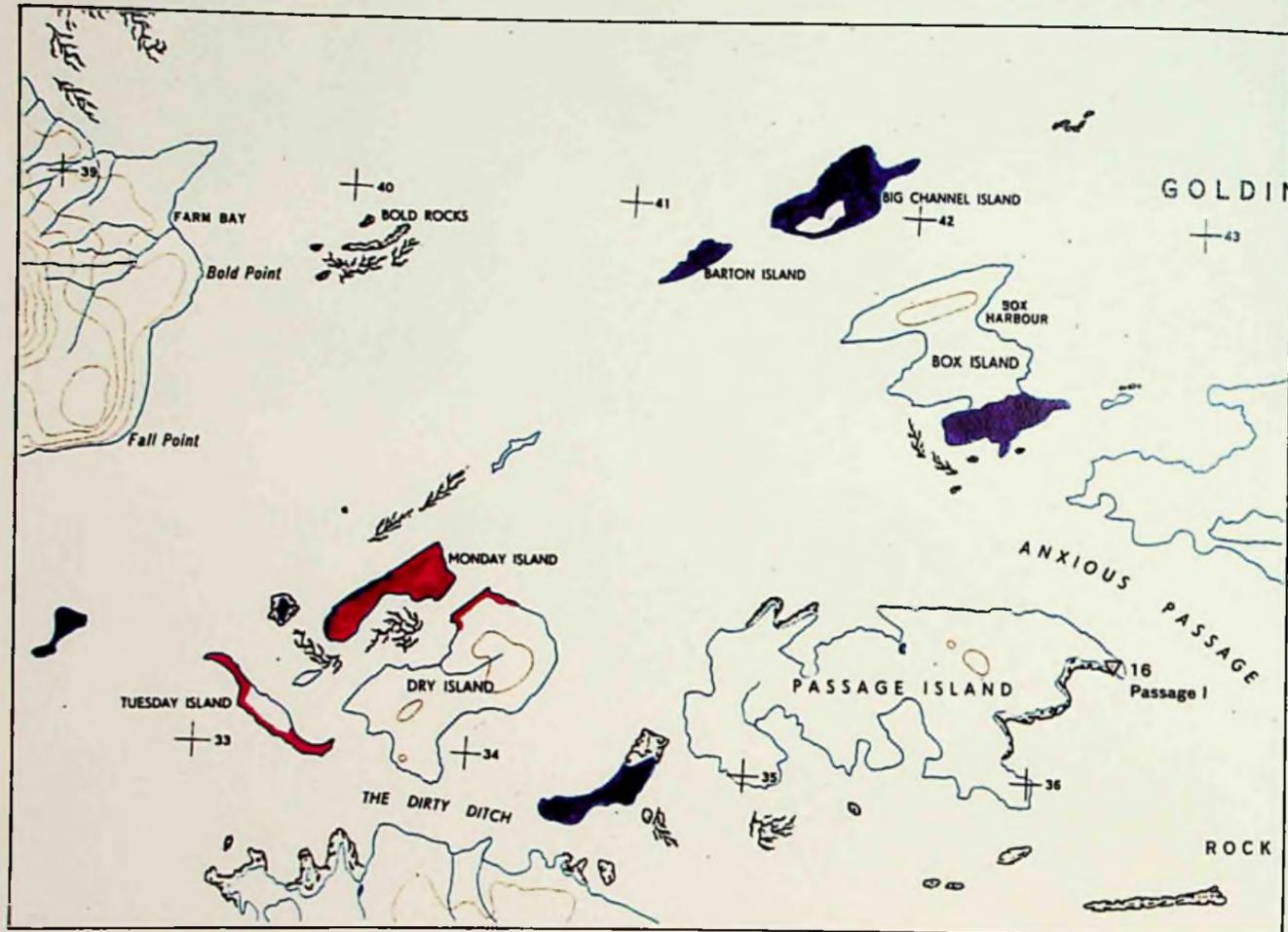
Note: Areas drawn only where 1983 airphotos have been studied.

1983

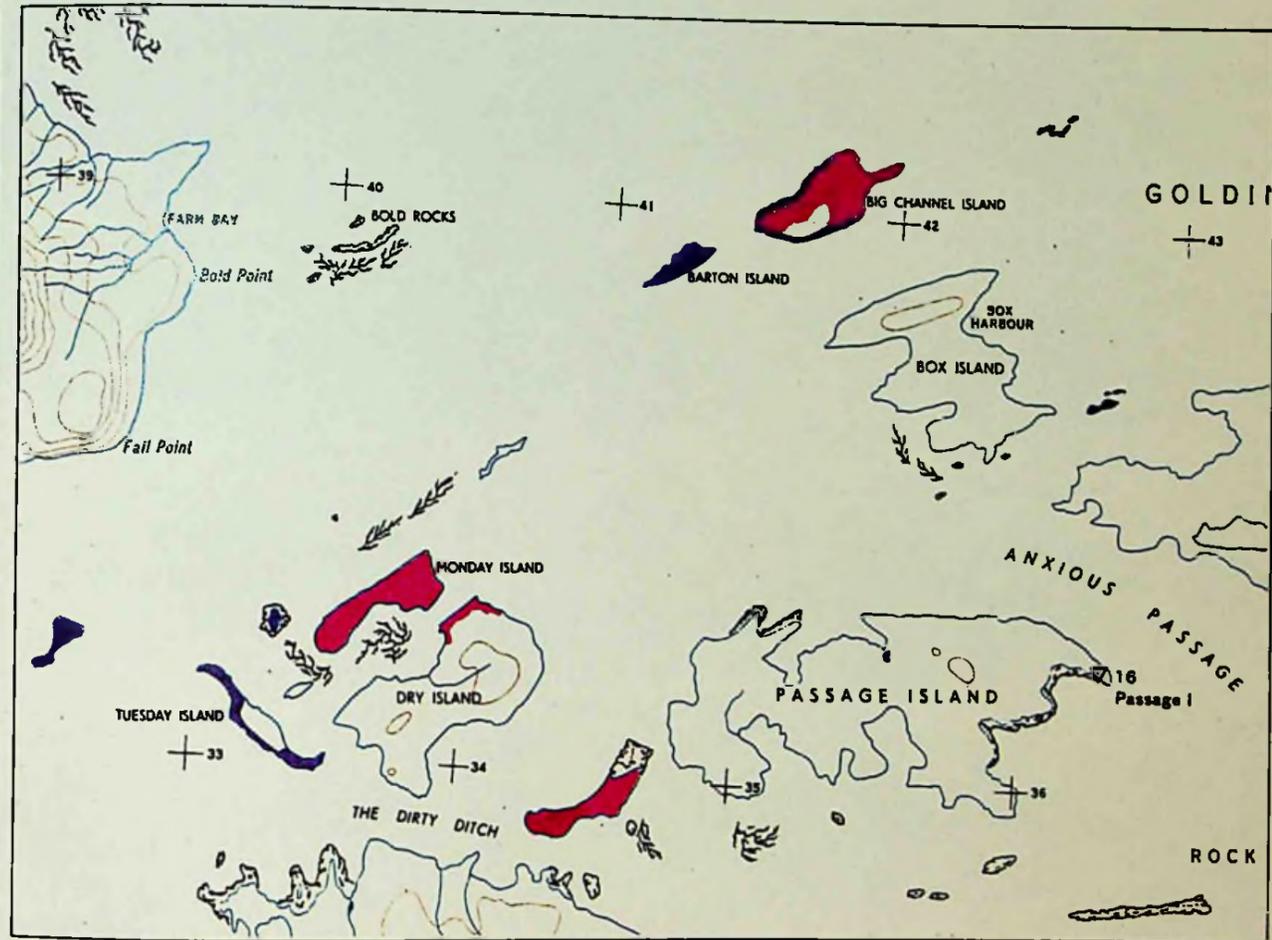


Tyssen Islands. With the exception of High Tyssen, the islands display a general decline in tussac cover due to grazing. The decline continued post-1983, the islands being recorded as very denuded in 1987. The situation on West Tyssen is exacerbated by the presence of rabbits. It should be noted, however, that North Tyssen shows a net increase in cover since 1957 and still bears a good stand of the grass.

1956



1983



Scattered



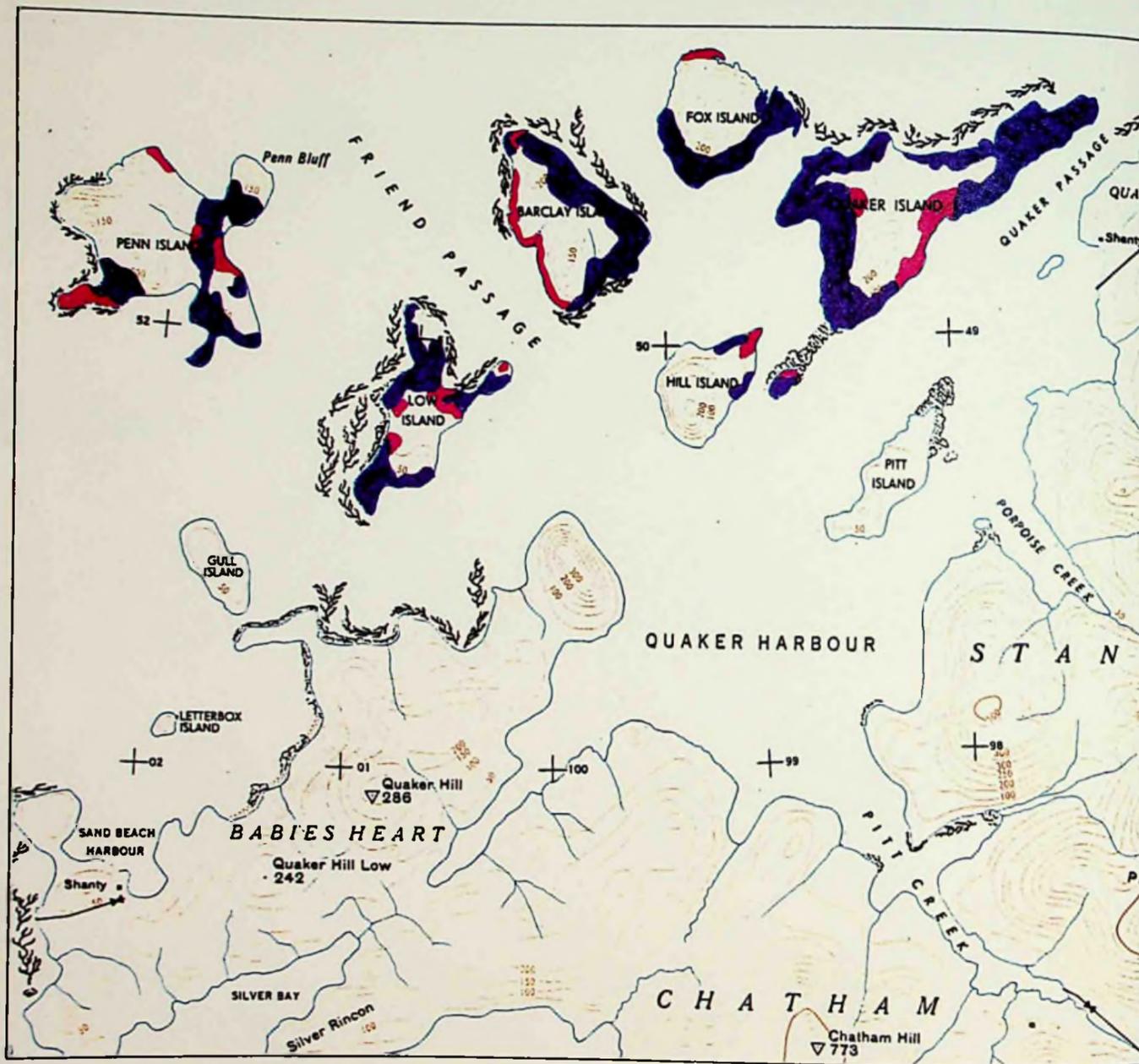
Dense

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Note: Areas drawn only where 1983 airphotos have been studied.

Islands South-East of Keppel. The smaller islands in the group are ungrazed and have retained full tussac cover. 'Tuesday Island' shows re-establishment of tussac in the absence of grazing; it has since been restocked and grazed off again. The other islands show a general opening up and loss of tussac cover. **N.B.** The island names on the map do not conform with those in general use. 'Tuesday Island' is the islet to the west of the one named, which remains densely covered in tussac growth.

1956



Scattered

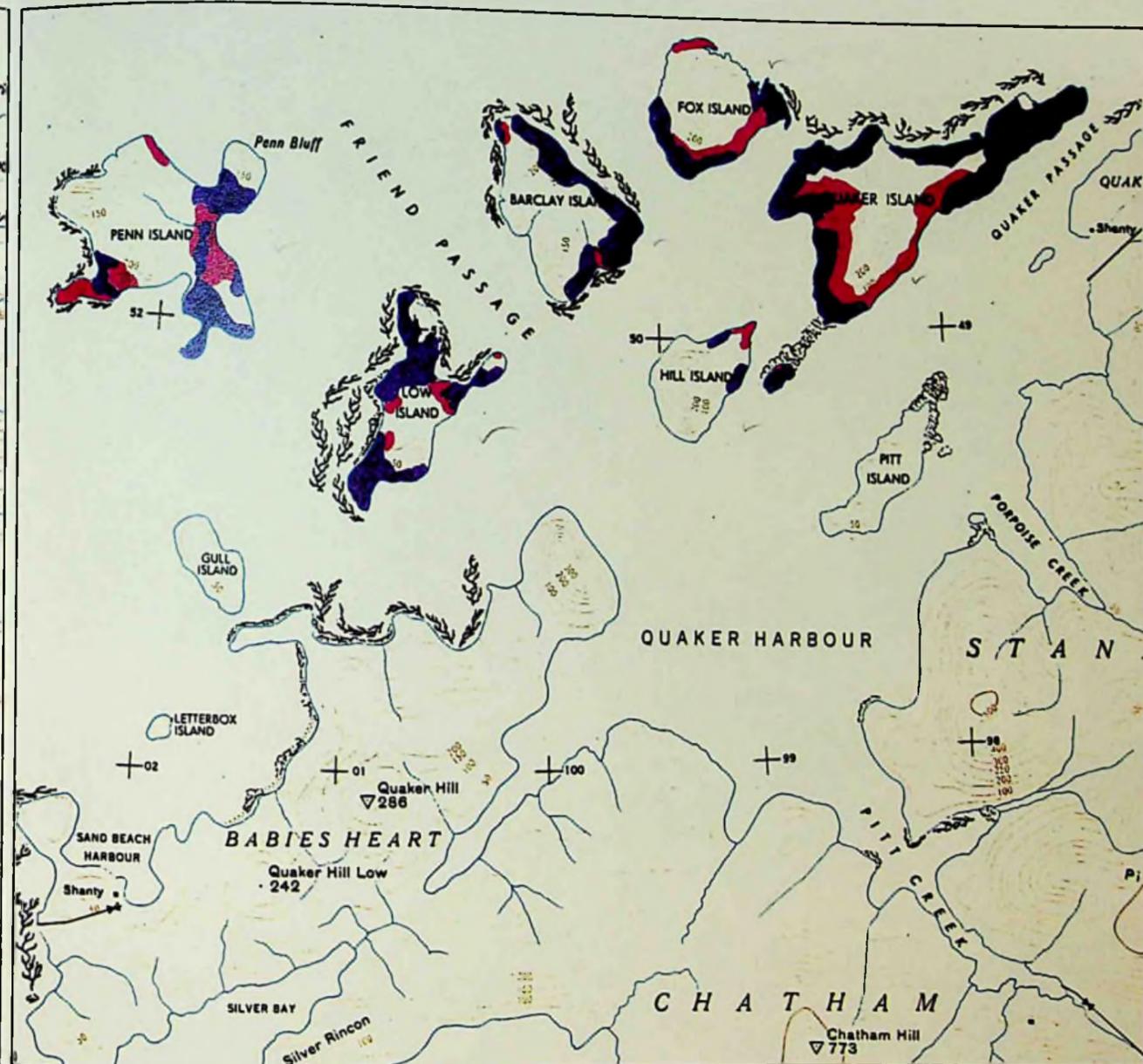


Dense

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Note: Areas drawn only where 1983 airphotos have been studied.

1983



Islands North-West of Weddell. Penn has been intermittently stocked and shows areas of overall tussac loss and re-colonisation. Low has been unstocked since 1949 and the pattern of cover found in 1957 remained unaltered in 1983. Fox and Quaker show an overall loss of cover, following sheep stocking from the 1950s to 1977. Some recovery of tussac cover may be taking place in the absence of sheep, but insufficient to reach the 1956 condition. Hill, on the other hand, was completely denuded of tussac after 1956 and has since recovered completely, so that no overall change has been mapped. Loss of cover on Barclay is due to cattle grazing.

1956



1983

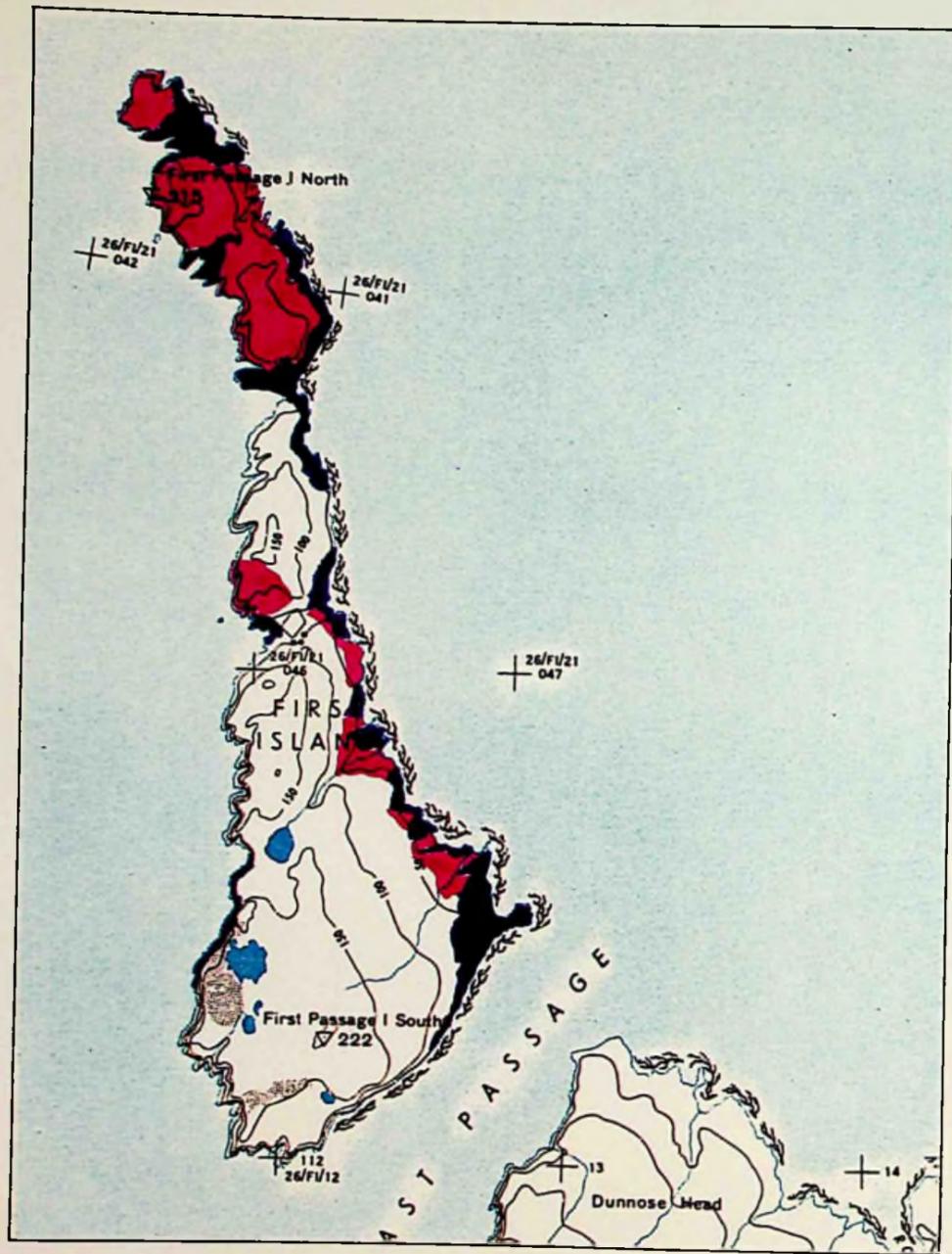


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Note: Areas drawn only where 1983 airphotos have been studied.

New Island. There has been a reduction in the tussac area through grazing pressure, except where protected by fences. Re-establishment is, however, taking place on Bold Point. Beef and Coffin Island show regrowth following removal of stock in 1972. Landsend Bluff, Saddle and North Island are all ungrazed and unchanged. North Island has since been burnt over following a lightning strike in 1988.

1956



Scattered

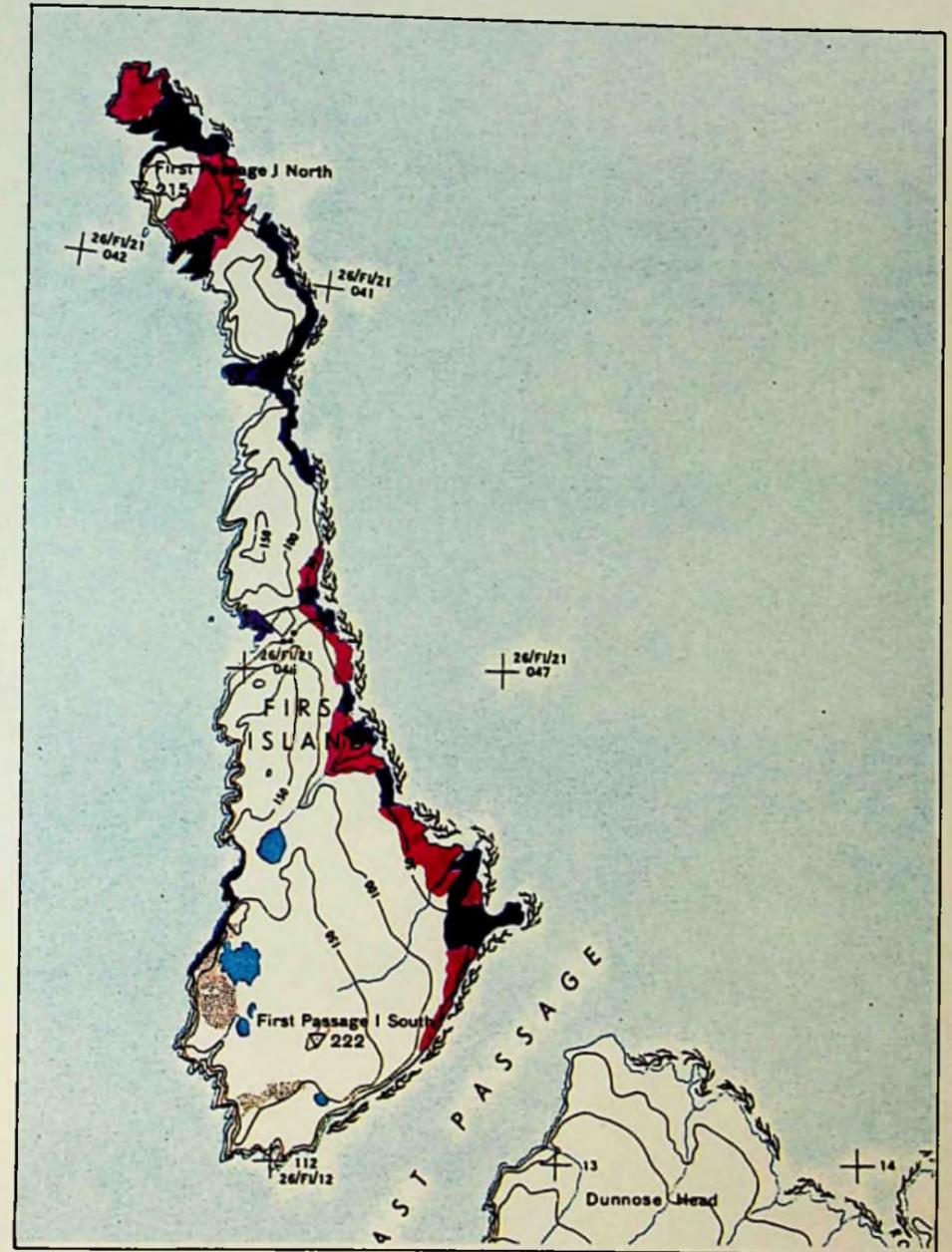


Dense

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Note: Areas drawn only where 1983 airphotos have been studied.

1983

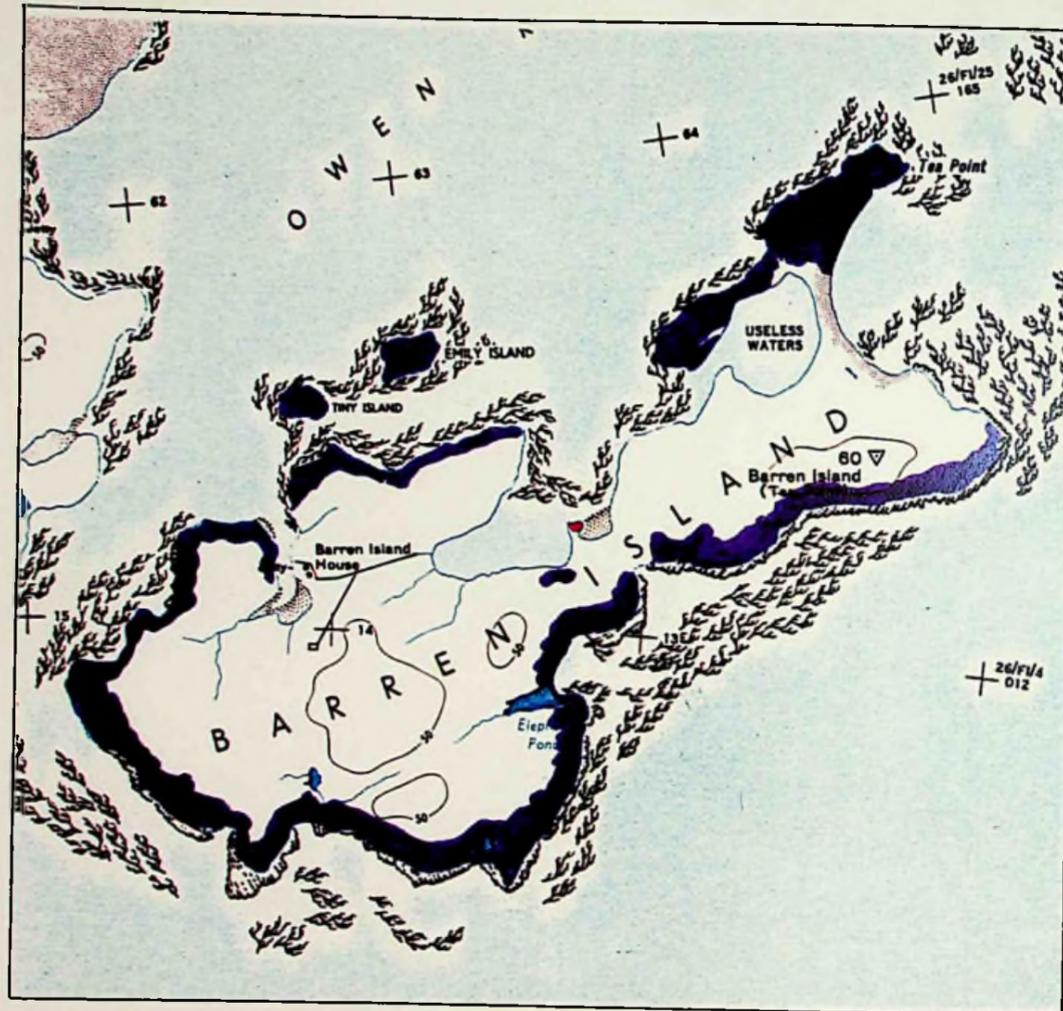


Passage Islands.

First (Passage) Island. Tussac cover has been reduced through sheep grazing in the 1940s and from the early 1950s to about 1967. The tussac has not increased to the 1957 amount since the removal to stock in 1967.

Third and Fourth (Passage) Islands. Both islands show complete recuperation of tussac cover following cattle grazing. Third Island was stocked briefly during the 1960s. Fourth Island was grazed out by 1969 but has since recovered completely, giving no net change in cover. (Not illustrated).

1956



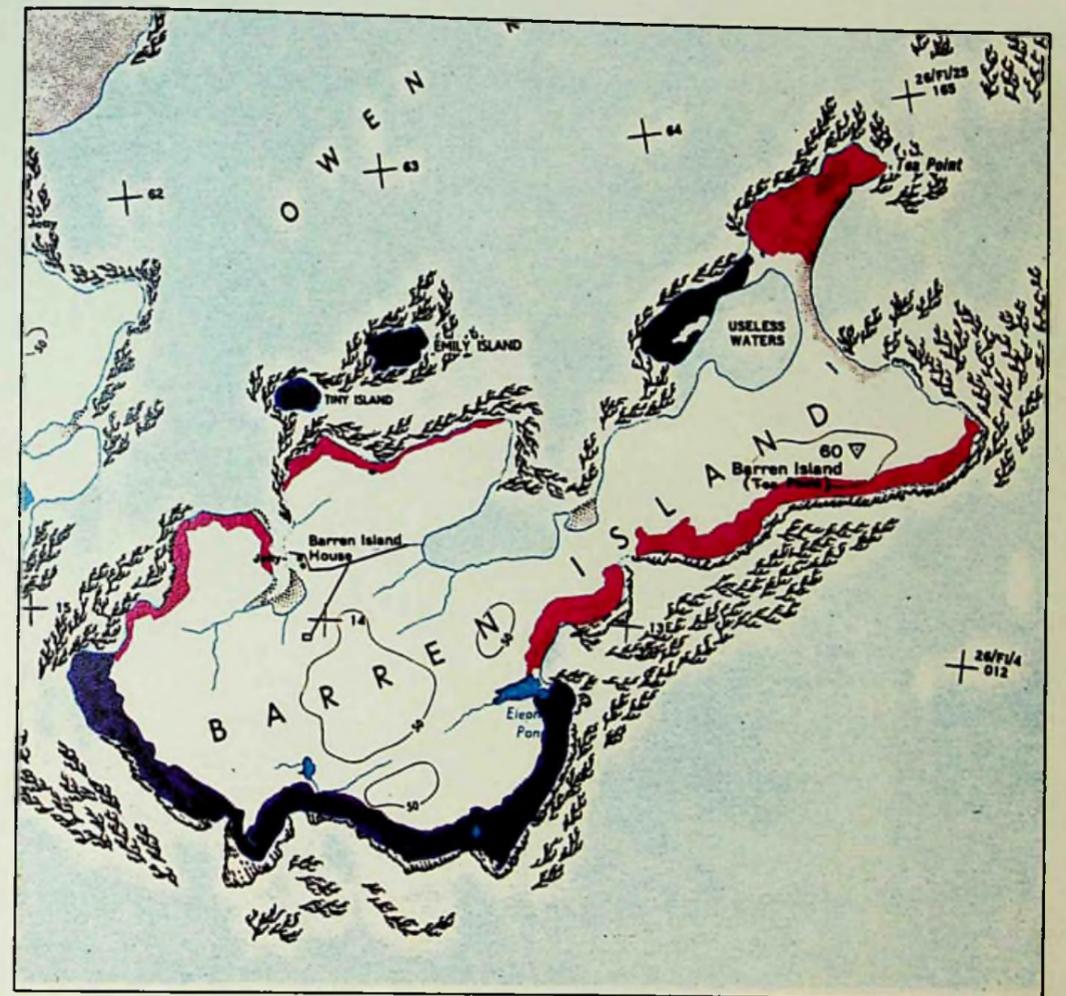
 Scattered

 Dense

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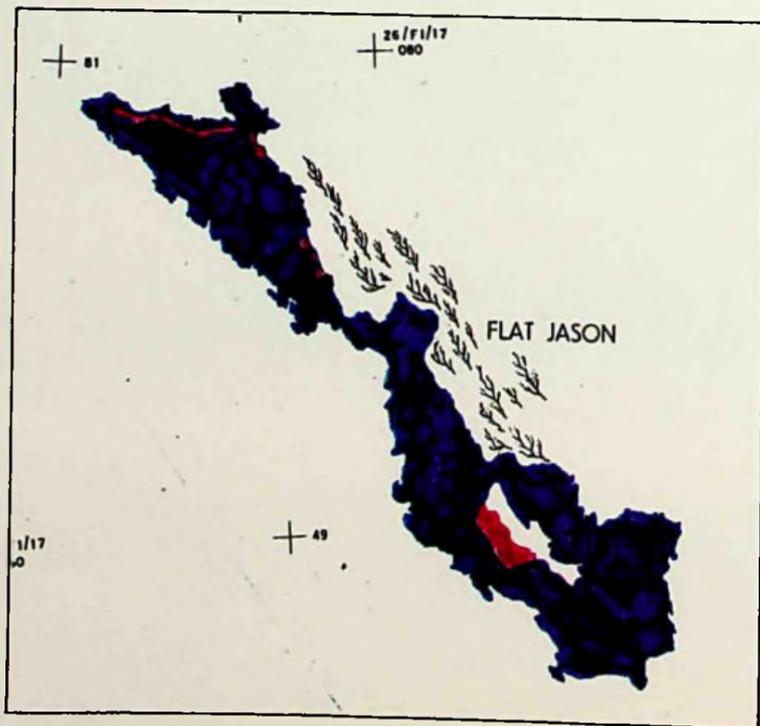
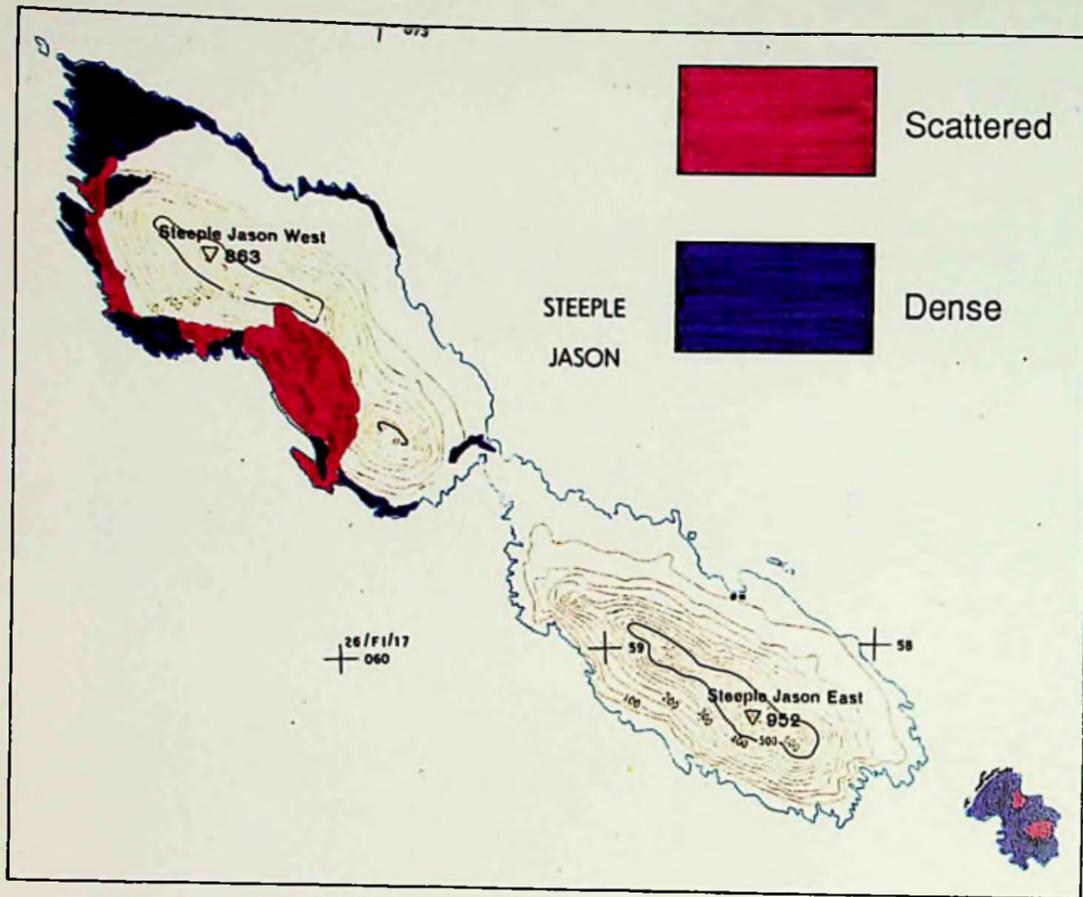
Note: Areas drawn only where 1983 airphotos have been studied.

1983



Barren Island. Both Barren Island and adjacent George Island retain significant fringes of tussac, despite a reduction in cover since 1956. Their grazing history is not known, but it is exceptional for a tussac fringe to remain on islands of this size.

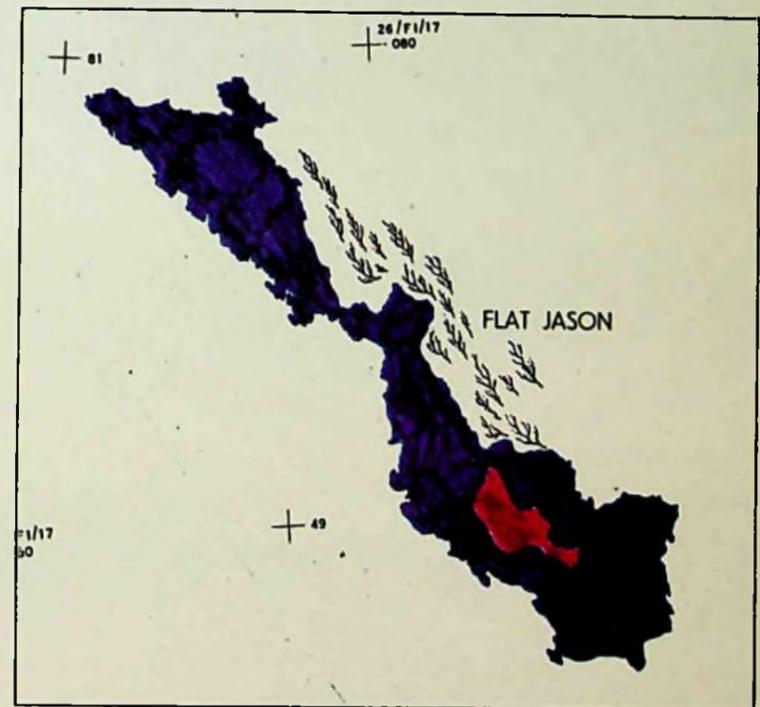
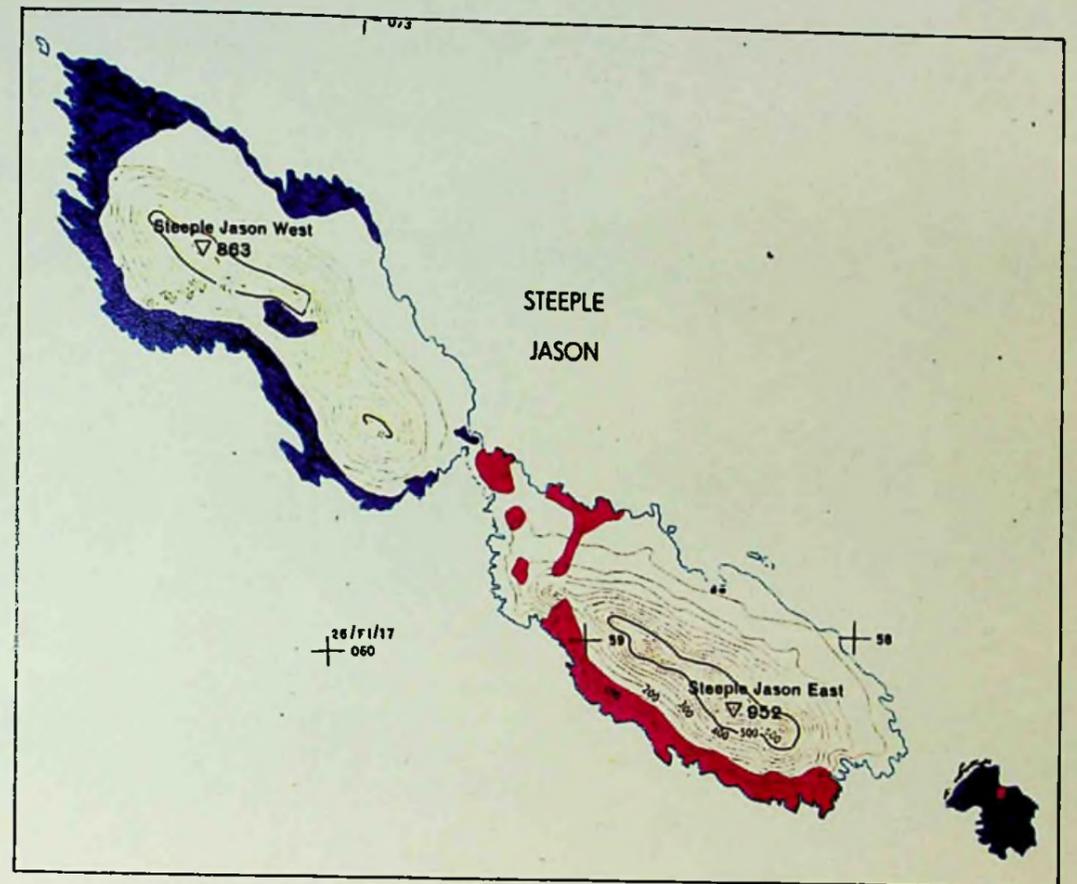
1956



1:50,000

Note: Areas drawn only where 1983 airphotos have been studied.

1983



Steeple Jason. Tussac cover has increased following removal of sheep in 1968. Regeneration is most marked on the sites of former Gentoo Penguin colonies.

Flat Jason. On this unstocked island, comparison between 1956 and 1983 shows only a slight increase in scattered tussac cover.

1956



1983



Scattered



Dense

1:50,000

Note: Areas drawn only where 1983 airphotos have been studied.

Carcass Island. Tussac paddocks are managed for sustainable use through a pattern of seasonal, controlled grazing. The 1983 mapping shows an increase in scattered tussac since 1956.

