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MISCELLANEOUS REPORT NO. 72

LAND SYSTEM ANALYSIS OF THE FALKLAND ISLANDS, WITH NOTES ON THE SOILS AND GRASSLANDS

R. B. KING, D. M. LANG
AND A. BLAIR RAINS

LAND RESOURCES DIVISION
DIRECTORATE OF OVERSEAS SURVEYS
TOLWORTH SURREY
ENGLAND
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Land Resources Division, Directorate of Overseas Surveys,
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1969

CONTENTS

PART 1. INTRODUCTION

PREFACE

This report describes a land system analysis of the Falkland Islands based on air photo interpretation. Analysis data of soil and herbage samples are presented and discussed. The report is not a detailed study of land resources and because of insufficient field data it has not been possible to describe the soil and vegetation of all the land system facets. The report is intended to provide information for the research workers who will subsequently be concerned with the problems of grassland and sheep husbandry and it should facilitate the identification of those areas where grassland improvement may be feasible. Much of the information presented here has been derived from earlier reports, many of which are listed.

ACKNOWLEDGEMENTS

A large number of individuals have assisted in this project and their contribution is warmly acknowledged. Their contribution is described in detail under 'Team Composition', Part 2. The Project.

ABSTRACT

This report maps forty-five land systems with four land system variants which are described. Thirty-three soil profiles have been examined, analysed and discussed; herbage samples from twenty-five of the soil pit sites have been analysed, and their composition is discussed. In a brief account of the vegetation, derived from the descriptions of Skottsberg (1913), Davies (1939) and Moore (1968), eleven communities are described.

SUMMARY OF CONCLUSIONS

It would still seem that the greatest need is to diversify an economy which is entirely dependent on wool, but the failure of recent attempts to diversify, combined with the scarcity of labour, and possibly with political uncertainty, appear to have discouraged the necessary search for new sources of income.

Despite the need for a more diverse economy, we recognise that the immediate task is to improve wool production. Sheep husbandry may be considered in

terms of nutrition, health and genetics.

Nutrition is a matter of grassland improvement and possibly of mineral or even amino-acid supplements; improvements must be evaluated in economic terms. It may be possible to improve or modify the existing routine practices of sheep management as a result of veterinary investigation.

The possible gains from genetic improvement are likely to be limited unless there is improvement in the standard of husbandry, although further reduction of inherited susceptibility to "wool-blindness" may still be possible.

PART 2. THE PROJECT

LOCATION AND HISTORY OF THE FALKLAND ISLANDS

The Falkland Islands lie in the South Atlantic Ocean between the latitudes 51° and 53° South and longitudes 57° and 62° West. In addition to the larger East (5 000 km^2/1930 sq mi) and West (3 500 km^2/1351 sq mi) Falklands there are approximately 230 smaller islands.

The Islands are 484 km/300 miles east of the nearest point on the South American Continent and are 1610 km/1 000 miles from Montevideo from which point boats connect the territory with the outside world.

In 1833 Britain established a permanent settlement in the Islands including a strategic naval base. Throughout the second half of the nineteenth century the islands were a ship repair centre and supplied food and water to whaling ships and to ships rounding the Cape.

Cattle which had been introduced in the eighteenth century had increased to an estimated 50 000 but these wild cattle were hunted down for food during the 19th century and replaced by sheep.

A variety of breeds of sheep have been introduced including Leicester, Cheviot, Lincoln and Merino, but at the present time Romney Marsh and Corriedale dominate the national flock.

Sheep numbers are shown -

1870	65 000
1880	411 000
1898	807 000
1910	725 000
1920	641 000
1930	607 000

Since 1930 sheep numbers have remained fairly stable rather over 600 000.

Wool has been virtually the only export during the present century; in the twenty-year period (1940-1960) yield of wool per sheep has risen from 6.69 lb to 8.57 lb. The overall carrying capacity is 1:4.56 acres (1:1.85 ha).

The average annual export of wool in the period 1963-65 was 4 900 000 lb (2 200 tons) valued at £1 100 000.

There are 29 farms owned by 22 companies or partnerships; the largest of which, the Falkland Island Company, owns 46% total land (1 330 000 acres/ 539 000 ha) and enjoys a trade monopoly but is required to provide shipping services.

The population numbers 2 000.

THE ORIGIN OF THE PROJECT

In August 1967 the Land Resources Division received a request from the Dependent Territories Division of the then Commonwealth Office for a soil survey of the Falkland Islands.

At a subsequent meeting in the Ministry of Overseas Development, at which the Governor Sir Cosmo Haskard K.C.M.G., M.B.E. was present, it was agreed that the Land Resources Division would initiate a small soil sampling programme; a full scale soil survey was not considered possible because of the need to rely on others for the field work. In order that the limited sampling should be meaningful, it was decided that a Land System Analysis was necessary and that this analysis would determine the location of sampling sites.

It was made clear at the outset that the survey would have severe limitations and would be mainly useful as a source of information for subsequent research workers.

TEAM COMPOSITION

The members of Land Resources Division concerned with this project were R. B. King geomorphologist, D. M. Lang soil scientist with first-hand knowledge of the islands, and A. Blair Rains, agro-ecologist. It was not possible for any member of the Land Resources Division team to visit the territory for the purpose of this survey.

The team worked in close cooperation with individuals from a number of organisations. The field work was undertaken by Dr. C. M. Clapperton of

Aberdeen University and by Mr. C. Young formerly Pasture Officer, Falkland Islands. Mr. A. Robertson of the Macauley Institute advised on the sampling technique and subsequently arranged for the analysis of the peat samples, the results of which were discussed by Dr. J. W. S. Reith. The herbage samples were analysed and the results discussed by Dr. T. B. Miller of North of Scotland College of Agriculture. In addition Messrs J. Varley and J. Coulter of the Land Resources Division contributed to the study by analysing the mineral soil samples and interpreting the results.

PROCEDURE

The preliminary air photo interpretation and the delineation of fifty two land systems and three land system variants was completed in the two and a half months mid-August to October 1967.

Towards the end of this period sampling methods were decided and the necessary equipment including a peat borer was obtained.

The sampling was undertaken by Dr. Clapperton and Mr. C. Young during November 1967 and January 1968. From West Falkland it was possible to visit 24 of the 37 selected sites; on East Falkland samples were obtained from nine of the 32 sites.

The samples were received in Britain in May 1968 and analysed during the period August to November.

During April and May 1969 the Land System Analysis was revised and reduced to forty-five systems and the information presented in this report was assembled.

PART 3. THE ENVIRONMENT

This report is not intended to be a land resource or soil survey. The land system analysis should provide a useful framework for subsequent detailed investigations on the ground; leading to a resource assessment and the selection of areas suitable for improvement. The soil and herbage analyses represent only a most superficial sampling, but they provide a guide to the nature of the problems involved in pasture improvement.

Sources of environmental and agricultural information are given in Part 4.

GENERAL DESCRIPTION

The land surface is broken and hilly, with hills rising to 700 m in both East and West Falkland. A distinctive feature which can be seen clearly on the air photographs are the stone rivers. Streams and shallow ponds are very common and the coastline is heavily dissected.

The geology has been described by Baker (1924), Adie (1958) and Cawkill et al (1960). It has been summarised by Moore (1968) in his introduction.

The Falkland Islands have a cool oceanic climate with frequently overcast skies and strong winds. Metereological data have been collected at Port Stanley since 1923 and at a number of other stations for a shorter period.

Precipitation at Port Stanley amounts to 607 mm (20 year average) but can vary from 492 mm to 780 mm. The monthly average based on a twenty-year period (1944-63) is shown below.

	mm		mm
Jan.	70.3	July	45.9
Feb.	57.0	Aug.	44.2
Mar.	49.5	Sept.	39.5
April	47.4	Oct.	33.8
May	54.8	Nov.	41.0
June	50.3	Dec.	73.8
		Total	607.5 mm

The driest months are September, October and November. The more southerly areas tend to be drier than the northern areas and 'rain shadow' effects are probably important in a number of areas.

Temperatures show limited diurnal and seasonal variation. Ground frosts and snow can occur in any month of the year.

Summer and winter temperatures (°C) recorded over 22 years at Port Stanley are shown -

	Mean	Min.	Max.	Mean Min.	Mean Max.
Jan.	8.8	0	23.9	5.4	12.9
July	2.3	-7.8	8.9	0	4.3

LAND SYSTEMS

Three parameters are used to define land systems: altitude, geology and dominant facets. The altitudinal ranges, which were chosen with regard to land use, are 0-250 ft (L)*, 250-600 ft (M) and greater than 600 ft (U). However, for both cartographic and land use reasons, mountain and hill lower slopes, i.e. slopes in the region of 25°-30° are included in the altitudinal ranges to which these slopes reach. For this reason the altitudinal ranges in the land system table are prefixed by "Up to".

The geological divisions are lithological. Although occupying a very small area, the rocks of the Cape Meredith Series, consisting of igneous and metamorphic rocks, are so different from the rest of the islands, which are composed of sedimentary rocks with very sporadic dolerite dykes, that they have been designated separately (C). The Port Stephens Beds (P) consist of sandstones, quartzites and conglomerates. The Fox Bay and Port Philomel Beds, consisting of shales with thin sandstone bands have been classed together (F), because of their lithological similarity and difficulty of differentiation by air photograph interpretation. The Port Philomel Beds have a greater density of sandstone horizons but as in South Africa where both beds are amalgamated into the Bokkeveld Series, their lithological similarity with the Fox Bay Beds allows them to be classed with the latter. The Port Stanley Beds (Q) are composed of quartzites and quartzitic sandstones with intercolated shales. The Lower Lafonian Series (t) is predominantly tillite whose upper horizon is a 100 m thick resistant horizon of Lafonian Sandstone which is a useful marker between this series and the Upper Lafonian Series (S), consisting of alternating sandstones and shales.

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*Letters in brackets refer to symbols used in the land system tables

Since lower altitudes have a greater land use potential than higher ones, the former have been differentiated by a greater number of dominant-facet parameters than the latter. In fact, for the highest altitudinal range, it was not considered necessary to differentiate land systems at all according to dominant facets. Strata attitudes are primarily responsible for the differences in the middle and low altitudinal ranges. Steeply dipping resistant sandstones or quartzites produce ridges (r), while less steeply dipping resistant horizons produce dipslopes (d). Structural plateaux are found at approximately 500 ft (5 P) and 250 ft (2P). The latter level may be eustatic (Andersson, 1907; Adie, 1953, p.5). Where there is no structural control, i.e. the dominant facet is a smooth convex slope, no dominant facet symbol is shown (e.g. MQ). Structural benches and plateaux below 250 ft are given the symbol (P). Between Mount Sulivan and Queen Charlotte Bay in West Falkland, there is an area dominated by ridges and infill (R+I) and on the northern and eastern sides of Mount Sulivan, Lakes (LL). Denuded ground (D) and areas covered by tussac (SI) are shown separately.

Air photograph grey tones appear to correspond roughly with vegetation and seem to have a pedological significance (see section on land units and soils). Where there is a dark grey tone, correlating roughly with Empetrum, the symbol (dk) is placed after the other land system symbols. Poa annua, which is not visible on the air photographs and was copied from Davies' map (1938), is shown as (PA), also placed after the other land system symbols. Where there is a dark grey tone on the interfluves and a light grey tone in the valley bottoms, the symbol (FC) is used. Where none of the symbols mentioned in this paragraph are shown, the grey tone is light and there is probably Cortaderia.

One other symbol (h/), placed before the other land system symbols, is used to designate high drainage density. Further details of the land systems are given in Appendix Table 2.

LAND UNITS AND SOIL

The (dk) land system variant has predominantly mineral soils, except where it is a variant of UQ. Soils overlying Fox Bay, Port Philomel and the Upper Lafonian Series are mostly mineral, whereas soils overlying Port Stanley Beds are organic. Land System R+I is also mostly organic. Terrace* soils are mostly organic, but soils found on ridge crests and slopes are mostly mineral. Where a terrace coincides with the (dk) land system variant, the soil is mineral.

*The terraces referred to in this section are mostly estuarine.

The (dk) land system variant is also associated with less altered and shallower peats. Greater peat depths are found in land systems LQ and R+I and with the M and U land systems. Greater peat depths are also found on the dipslope facet and on the ridge slope and terrace facets which are not coincident with the (dk) land system variant.

Land systems LL, R+I, those found on the Upper Lafonian Series and the (dk) land system variant at low altitudes are less acidic than the others. Soils overlying Port Stanleys Beds are generally more acidic.

The terrace facet has the best phosphorus values. The only other two samples which do not have low phosphorus values are W16 (LFd Piedmont) and W19 (LF (dk) Valley Bottom) but both of these have low extractable phosphorus. Land system LFr and the terrace facet have slightly higher extractable phosphorus values than the other land systems and facets. Land systems R+I, UQ and those on the Upper Lafonian Series are particularly low in phosphorus.

Land system R+I appears to have low potassium and magnesium values. The plateau facet seems to contain more potassium and magnesium than the ridge slope facet.

The only calcium values which are not very low are those of the terrace and valley bottom facets and these are very variable. The sample from the latter facet is near sea level and probably contains a horizon derived from a former terrace. These facets also have high sodium values. The (dk) land system variant also tends to have higher sodium values.

SOME CHARACTERISTICS OF FALKLAND ISLAND SOILS

The important division of the Falkland Islands soils is between the organic or peaty soils (referred to as Histosols in the most recent American classification) and the mineral soils. The American classification makes use of diagnostic master horizons which must be at least 30 cm thick if drained and 45 cm thick if undrained. The diagnostic horizon is described as fibric if it consists of relatively undecomposed organic materials. Amongst other properties, it should yield a saturated sodium pyrophosphate extract, when a white filter paper is inserted into a paste, which is higher in value or lower in chroma than 10 YR 7/3. The horizon is described as sapric if it

consists of highly decomposed organic materials with very little original plant fibre remaining. It yields a saturated sodium pyrophosphate extract which is lower in value or higher in chroma than 10 YR 7/3. In addition to these criteria, the amount of mineral matter i.e. ash in the soils, though not used as a diagnostic criteria in the American classification, is obviously important.

The profile descriptions show that virtually all the soils have a fibrous peaty top-soil; in other words the top horizon normally consists of relatively undecomposed organic material. However the percentage of ash shows that the organic materials form a relatively small proportion of the top-soils in a considerable number of the profiles. This high ash content is usually associated with profiles in which the non-peaty horizons are less than 45 cm from the surface. Using the definitions of depth and ash content of the top horizons, it is relatively easy to separate out the peats from the non-peats referred to hereafter in the report as mineral soils, though they might be more closely described as muck soils.

The samples from 32 profiles were analysed at the Tropical Soils Analysis Unit for the following: ash on oven dry peats (ignition at 490°C) pH in water and N.KCl, total N on mineral soils, 'total' P, K and Mg in mineral soils following digestion with perchloric acid and 'total' P, Na, K, Mg and Ca by acid extraction of the ash on peats. Exchangeable cations (with ammonium acetate) and base saturation were determined on the mineral soils and phosphates soluble in NH_4F and HCl were also determined in these soils; results are given in Table 4. A selection of the peats were analysed by the Macaulay Institute for Soil Research, Aberdeen by their methods for examining peaty soils in which the lime, phosphate, potash and magnesium contents are determined by extraction with 2.5% acetic acid; results are given in Table 5. Trace elements were not determined in any of the soils but trace element levels in grass samples were determined at the Agricultural Chemistry Department, Aberdeen University and their results are given in Table 6. It should be noted that the analytical results for peats are based on weight. Since the bulk density of some of the peats may be only about one-third that of mineral soils, the figures for peats in Table 4 should be divided by a factor of about 3 for realistic comparison with the values for mineral soils.

All samples are very acid, most pH values being in the range of 4.1 to 5.0 with a few profiles, exceptionally, exceeding 5.0. Most samples show the characteristic lower pH values when determined in N.KCl, though there are some

samples where this depression is very small and isolated examples where pH in N.KCl > pH in water. Such a phenomenon is usually associated with soils having a net positive charge but it is doubtful if this is the explanation in this case.

With two exceptions the mineral soils are extremely low in calcium; many of the samples have nil levels of exchangeable calcium. The two exceptions are samples from a marine terrace and a valley bottom facet. In both profiles the high calcium levels are confined to one horizon; in profile W4 (land system LFd) this layer is at the bottom of a profile (at 22 cm) overlain by peat. In profile W16 (a valley bottom) only the 15-25 cm horizon has high exchangeable calcium. The rather high exchangeable sodium levels in these two profiles suggest marine influence and the high calcium probably came from banks of shells. Samples from other marine terraces do not have these relatively high calcium levels so soils with this are probably of very limited distribution. In the peat soils, calcium levels are very low especially when allowance is made for the low bulk density of the peat. There is no indication that any of the other land facets have near adequate calcium levels.

Some of the values for 'total' phosphorus are extremely low, soils associated with ridge crests being particularly low, possibly because the crests consist mainly of siliceous rocks. The higher phosphorus levels appear to be associated with the marine terraces. The values for 'total' phosphorus in peats appear higher but on allowing for the low bulk density the re-calculated values are quite low. The results from both the Macaulay Institute and from the Tropical Soils Analysis Unit suggest that phosphate levels in these soils are very low.

Levels of potassium and magnesium are sometimes high; profile W25 for example having more than one per cent total potassium in the subsoil. The peat soils are nearly always much lower in potassium than the mineral soils. The high levels of 'total' potassium also influence the exchangeable potassium, some of the values exceeding one m.e./100 g. The high levels of potassium and magnesium are possibly associated with shaly soil parent material. On the ridge crests, as for example in profiles W18 and W21, very low values are obtained. The herbage analysis bears out the very low values for calcium and phosphorus and also for some trace elements in these soils, so that animals undoubtedly suffer from the poor quality of the herbage. Overall the soils, as would be

expected from the climatic conditions and nature of the parent material, are very poor but the survey suggests that the marine terraces and valley bottoms are the slightly more promising. The extent of the calcium rich subsoils is not known; deep ploughing, to mix some of these with the peaty overlay could be beneficial; it would appear however that such areas are not extensive so that such a treatment would contribute little overall to agricultural improvement. Other things being equal the deep peats have probably less potential than the shallow peats over clay.

Whilst mineral licks could improve the nutrition of animals, the quality of the herbage can only be improved by the addition of lime and phosphate. Unfortunately we have no information on the effect of these on yield or composition of herbage in the Falklands and furthermore the economics of fertilizer use, even as a long term capital investment, are most probably unfavourable.

VEGETATION

The natural vegetation is grassland or low heath; trees are absent and can only be grown with difficulty in the most sheltered situations; physiognomically the vegetation is comparable with upland areas in Britain.

Skottsberg (1913) describes the vegetation and Moore (1968) amplifies this description. Davies (1938) describes and maps the main vegetation communities in terms of their agronomic significance.

Physiognomic units can be distinguished on the aerial photographs although the relatively low-growing vegetation makes interpretation difficult. The following subdivision of the vegetation is made as a result of A.P.I. in conjunction with the existing descriptions. It must be emphasised that there are many gradations and that some of the transitional areas may be of significance as sites which are suitable for grassland improvement.

1. Coastal Grassland
    i. Poa flabellata Association
    ii. Poa annua Association

2. Inland - Upland Grassland

i. Upland Grassland

ii. Poorly Drained Grassland

iii. Wet Grassland

3. Dwarf-shrub Formation

i. Empetrum - Pernettya Association

ii. Empetrum - Blechnum - Bolax Association

4. Hydromorphic Formation

i. Juncus scheuzericides Associations

ii. Rostkovia - Astelia - Cortaderia Associations

5. Sparse or Denuded Formations

i. Montane (Feldmark) Association

ii. Coastal Dunes

1. Coastal Grassland

i. Poa flabellata Association

This tall-growing tussock grass, occurs as a narrow coastal fringe but because of its very palatable ~~native~~ nature, extensive areas have been grazed to destruction, and it is only on some of the smaller islands that it can be seen in an undisturbed condition.

It appears to have a high nitrogen requirement which is provided by the excreta of marine animals; it remains green in winter and withstands cutting but is sensitive to uncontrolled summer grazing.

This association occurs as the 'Tussac' of the land system map.

ii. Poa annua Association

The introduced annual meadow grass is widespread, including coastal sites, and often forms relatively pure stands. In coastal areas it is common on abandoned penguin resting grounds with high levels of soil nutrients. The occurrence of this grass is shown by the quatifying letters PA on the land system map.

2. Inland-Upland Grassland

Large areas of the Falkland Islands are covered by white grass Cortaderia pilosa, e.g. E1 & W20. It may occur in pure stands but more frequently it occurs as the dominant or the co-dominant in association with other species. It occurs under a wide range of soil conditions and in its various associations is the most extensive plant formation.

i. Upland Grassland

On upland sites, some of which are marked by 'stone rivers' of boulders, Cortaderia pilosa occurs with Festuca ovina and Poa alopecurus. The soils are shallow with a limited organic matter content. These pastures at elevations of between 1 000 and 2 000 ft represent a soft camp farm property, but as Davies indicates, are usually unsuitable for any form of improvement which requires mechanical operations, on account of the boulder - strewn terrain.

ii. Poorly Drained Grassland

On level ground and gentle slopes up to an altitude of 700 ft there is a Cortaderia pilosa - Gunnera magellanica association. This association is found on indifferently drained shallow peaty soils, and there may occur a number of other species including Deschampsia flexuosa, Pratia repens and Blechnum pinna-marina. A very large number of sampling sites are in this category.

iii. Wet Grassland e.g. W24

Under conditions of poorer drainage and on soils which usually have a higher organic matter content, there is a Cortaderia pilosa - Oreobolus obtusangulus association in which Carex fuscula may sometimes be present. This community represents the transition between a hydromorphic condition and the better drained grassland. Davies (1939) regards this association as the most useful of the 'soft' camp types and suitable for improvement, by higher stocking, by surface seeding with Holcus lanatus and other species after a burn, and possibly by drainage.

3. Dwarf Shrub Formation

Empetrum rubrum (Diddle-dee) is the most important component of the shrub Formation; it occurs in a number of different associations and is widespread both on coastal and inland sites including stony ridges and rincons. The soils are hard, mainly mineral soils with variable amount of organic matter and we found overlying coarse well drained rocky subsoils. Although E. rubrum and Cortaderia pilosa e.g. W37 & W31 are found together, other associations are more common. Two E. rubrum associations, one on a marine terrace (W27) and the other on a slope (W31) produced the only herbage samples to have even moderate levels of both calcium and phosphorus (the phosphorus levels would still be generally regarded as inadequate). E. rubrum is indicated by the letter 'dk' on the land system map.

i. Empetrum - Pernettya Association e.g. W27

An association of E. rubrum and Pernettya pumila either with or without Baccharis magellanica is common. Davies suggests that overgrazing combined with burning may have destroyed the most useful components of this association.

ii. Empetrum - Blechnum - Bolax Association e.g. W31

On shallow well drained soils in sites such as the margin of scree slopes Blechnum pinna-marina, B. magellanicum and Bolax gummifera occur either singly or together as co-dominants in association with E. rubrum.

4. Hydromorphic Formation

i. Juncus scheuzerioides Association

Under eutrophic conditions of seepage and drainage, often adjacent to streams particularly near to the sea a Juncas scheuzerioides Association may occur. These sites are grazed by geese as well as by sheep. Davies suggests that these pastures of rushes and forbs are likely to be nutritively valuable and that they might be suitable sited for improvement by cultivation and reseeding.

ii. Astelia - Rostkovia - Cortaderia Associations

In the absence of lateral movement of water and under conditions of impeded drainage bog-like conditions are encountered. Under the most extreme conditions Astelia pumila is the dominant species, but with Rostkovia magellanica appearing in many facies. Under drier conditions there is an association of Astelia - Rostkovia - Cortaderia W32 & W22 and Moore suggests that this is probably the most extensive of these described in this section.

5. Sparse or Denuded Formations

i. Montane (Feldmark) Association

Above 2 000 ft there is a sparse cover of 'cushion' plants as well as other angiosperms and cryptogams.

ii. Coastal Dunes

Areas devoid of vegetation are common around the coast. Some of these areas may have once been covered by Poa flabellata and there have been some attempts to reclaim some areas by establishing grass.

NUTRITIVE VALUE OF THE HERBAGE

A sample of the vegetation, including both herbage and leafy shoots of shrubs, was collected from about two-thirds of the soil sampling site and was subsequently analysed.

The samples which were collected between 20 November 1967 and 20 January 1968, were obtained by taking a number of small clips from within the vicinity of the soil pit; the actual number of clips varied according to the amount of material present which could be grasped in the hand.

Samples were air dried.

The analysis of these samples indicates that they are seriously deficient in many of the nutrients generally regarded as essential for satisfactory animal production. It must be realised that the selectively grazing animal is able to

obtain a ration of considerably higher nutritive value than that indicated by the analysis of normal samples. In the case of many of these samples even the ability of the animal to select those plants or parts of plants with double the average calcium and phosphorus content would still result in serious nutritional deficiency. It had been assumed that young shoots of Empetrum rubrum would be eaten but we have been informed that this is not so and that apart from the berries the shrub is not browsed, and that the better levels of calcium in samples W21A and W27 and W31B are not significant in the diet of the sheep.

In any discussion of the nutritive requirements of livestock, it is necessary to remember that different classes of stock differ very considerably in their nutrient requirements, and that although animals may survive on inadequate diets, their productivity will be reduced. There are very big differences between the requirements of mature wethers and those of lactating ewes, of ewes in the later stage of the gestation period and of young animals.

Because of the selective ability and of the different requirements of the different classes it is perhaps unwise to attempt to indicate the level of a nutrient at which it constitutes an adequate supply or deficiency; in addition the utilisation of a number of minerals is affected by the level of other minerals in the food. To a limited extent animals may become adapted to near deficiency conditions.

Potassium is excluded from any discussion because it is unlikely to be inadequate.

Crude Protein (total N x 6.25)

The level of protein is affected by the stage of development and by earlier defoliation. In these samples the range is from 3.2% to 6.3% and indicates that there is little available nitrogen in the soil. Any improvement will depend on either encouraging the break-down of some of the organic matter or the introduction of a legume, and both will depend on the ability to raise the pH. Animal production is likely to be adversely affected by these low levels.

Digestible Organic Matter

No reliance can be placed on the D.O.M. figures because unsuitable organisms were employed in the digestion of these samples.

Calcium

The requirements of the animal for calcium cannot be separated from its phosphorus requirements and the satisfactory assimilation and utilisation of these two elements which are essential for bone formation also depend on adequate supplies of Vitamin D. Vitamin D can be synthesised in the skin provided there is sufficient exposure to ultra-violet light but in the high latitudes of the F.I. most of the ultra-violet light will be absorbed by the atmosphere during the winter months.

Calcium deficiency is unusual but can occur when the content of the herbage is less than 0.2% (dry matter basis) and is likely when it is below 0.1% which is the case with a very large number of these samples.

Phosphorus

As has been indicated, phosphorus requirements cannot be separated from the animal's calcium requirements. However it is probable that a level of less than 0.10% is inadequate for semi-mature wethers and that the mineral requirement of this class of stock is approximately 0.15%.

Lactating ewes and lambs require higher levels of both calcium and phosphorus. Of the herbage samples analysed only one (W24) contained more than 0.10 phosphorus (0.11%) and only nine of the twenty-nine contained more than 0.10% calcium.

Any investigation should determine the significance of these low levels of calcium and phosphorus for animal production and if necessary devise remedial measures; the possibility of Vitamin D deficiency during winter months should also be investigated.

Magnesium

Requirements of magnesium are related in a complicated way with those of calcium and to some extent of phosphorus, but evidence suggests that herbage with not less than 0.07% magnesium is sufficient for growth and that a level of 0.10% is sufficient for the lactating ewe. These samples are generally satisfactory in respect of magnesium.

Copper

Utilisation of copper is affected by the level of other nutrients in the food. Under some conditions, feed containing 1 ppm copper has been sufficient for maintenance, but under more usual conditions wool sheep probably require between 5 ppm and 10 ppm; only a small number of samples contain more than 5 ppm. Sheep are however very susceptible to copper poisoning - the copper accumulates in the liver - and there have been many losses as a result of overdosage with mineral supplements and with anthelmintics. Unless there is reliable evidence of a copper deficiency accompanied by adequate long-term investigation of remedial requirements copper containing licks should not be recommended.

Manganese

The samples have high levels of manganese.

Zinc

The zinc content of herbage can vary from 8 ppm to 300 ppm and the F.I. samples indicate relatively low levels of zinc which could be inadequate; however the deficiency of this element is not likely to be significant until other more serious deficiencies have been rectified.

Conclusion

It seems probable that calcium and phosphorus are the most serious deficiencies in the diet of the Falkland Island sheep; and that mineral supplementation is necessary. Supplementary Vitamin D may also be needed.

An improvement in the level of protein and digestible organic matter, is essential for increased production. Although the overall improvement of these extensive camps would seem impracticable it might be possible to create some really first-class pastures, even if limited in extent; these could be used in a complementary grazing system by those classes needing a higher plane of nutrition.

SEAWEED

Around the coast there are good supplies of seaweed mainly the 'brown' Macrocystis pyrifoa. The value of this kelp for supplementary feeding and as a manure is discussed here. Its value for the industrial production of alginates, mannitol etc, is outside the scope of this report.

	Macrocystis pyrifera (Falkland Island)	Macrocystis pyrifera (British Columbia)	Ascophyllum nodosum (Scotland)
	Analysis of Moist Sample*	- % dry matter	-
Moisture	7.26	-	-
Crude Protein	13.92	8.2	3 - 10
Crude Fat	2.95	0.33	2.5 - 4.3
Fibre	13.7	-	-
Cellulose			2 - 3
N.F.E.		44.2	58 - 74
Ash	21.47	38.5	16 - 25
Ca)		1.3	1.64
P) not yet		0.33	0.10
K) available		10.59	2.24
Mg)		0.83	0.94
Iodine)		0.18	0.07-0.20
Cu		9 ppm	4 ppm

*analysis by T.P.I.

It will be seen that there are major difference in the composition of these seaweeds particularly in the levels of phosphorus and potassium.

In Britain dried seaweed or seaweed meal has been recommended for feeding to hill sheep. It has not been found possible to incorporate more than 10% seaweed meal in compound rations; and dried kelp alone is not likely to be palatable; there is also some uncertainty about its digestibility and consequently its nutritive value. It would seem improbable that a ration of seaweed would appreciably improve the animal's proteain and energy supply.

As a source of minerals the calcium content of both samples is good, but while the phosphorus content of the Canadian Macrocystis satisfactorily complements the Calcium, the low level of phosphorus in the Scottish Ascophyllum could result in worsening the phosphorus metabolism because of the imbalance with the calcium. Seaweeds are a poor source of the antirachitic vitamin D.

Kelp has been traditionally used by Crofters in Western Scotland as an organic manure on oats and potatoes. It is a useful source of potash, and possibly of minor elements; in a near-subsistence economy the fact that it has been freely available is important.

In the Falkland Islands the mineral soils appear adequately supplied with potassium and the application of seaweed to grassland on peat soils is unlikely to bring about any improvement either in their nutrient status or in their physical condition.

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APPENDIX. TABLES 1 - 6

TABLE 1 Land System Classification (A)

Up to 2 300 ft

Geology	Land system
Port Stanley Beds	UQ
Port Stephens Beds	UP

Up to 250-600 ft approx

Geology	Ridges	Dipslopes	Plateaux		No structural control
			At approx 500 ft	At approx 250 ft	
Port Stanley Beds	MQr	MQd	5PQ	2PQ	MQ
Port Philomel Beds) Fox Bay Beds)	MFr	MFd	5PF	2PF	MF
Port Stephens Beds	-	-	5PP	2PP	MP
Cape Meredith Series	-	-	-		C

TABLE 1 (cont'd)

Up to 250 ft approx

Geology	Ridges	Dipslopes	Benches and plateaux	Ridges and infill	Predominance of lakes	No structural control	Denuded ground	Tussac	Dark grey tone on interfluves; Light grey tone in valley bottoms
Upper Lafonian Series	LSr	LSd	LSP	-	-	LS	DS	SSI	FCS
Lower Lafonian Series	Ltr	-	-	-	-	Lt	-	tSI	-
Port Stanley Beds	LQr	LQd	-	-	-	LQ	DQ	QSI	-
Port Philomel Beds) Fox Bay Beds)	LFr	LFd	LFP	R+I	LL	LF	DF	FSI	FCF
Port Stephens Beds	LPr	LPd	-	-	-	LP	DP	PSI	-

Land System Variants

	Before Land System symbol	After Land System symbol
High drainage density	h/	
Dark grey tone Probably Empetrum		(dk)
Poa Annua		(PA)

Elsewhere light grey tone (mostly Cortaderia)

Table 2. Land system classification B.

The table below is intended so that the Falkland Islands land systems can be fitted into a world-wide classification system. It should be stressed, however, that stream frequencies and dominant facets (facets occupying greater than ten per cent of the land system) are only approximations. The land zone can be considered periglacial without permafrost (Tricart and Cailleux, 1965, Fig. 49).

Land System	Process	Geomorphic Position	Drainage Pattern	Stream Frequency in km^{-2} at 1:50,000	Relief in m	Maximal Altitude in m
UQ	Pg+G+M	vD(C?-P)	19-6	0.6	200	700
UP	Pg+M	vD(C?-P)	19-3	0.5	100-200	300
MQr	Pg+M	D(C?-P)	19	4	30	200
MQd	Pg+M	D(C?-P)	19	3	15-150	200
5PQ	Pg	D(C?-P)	19	1	50-200	250
2PQ	Pg+M	D(HPG?-P)	19	1	<50	80
MQ	Pg	D(C?-P)	19	5	60-150	200
MFr	Pg+M	vD(C?-P)	19	1	200	250
MFd	Pg+M	D(C?-P)	19	2	60	150
5PF	Pg	D(C?-P)	19	2	<50	200
2PF	Pg+M	D(HPG?-P)	19	2	<50	80
MF	Pg+M	D(C?-P)	19	2	50	100
5PP	Pg+M	D(C?-P)	19	1	100	200
2PP	Pg+M	D(HPG?-P)	19	2	50-100	100
MP	Pg+M	vD(C?-P)	19	1	200	200
C	M+Pg	vD(C?-P)	0	0	200	200
LSr	Pg+M	D(HPG?-P)	4	2	15	50
LSd	Pg+M	D(HPG?-P)	19-22	2	15	15
LSP	Pg+M	D(HPG?-P)	19	2	30	70
LS	Pg+M	D(HPG?-P)	19	2	20	60
DS	A+M	D(HPG?-P)	19	2	15	45
SSI	M+Pg	D(HPG?-P)	0	0	15	15
FCS	M+Pg	D(HPG?-P)	0-19	0-3	15	15
Ltr	Pg+M	D(HPG?-P)	19-4	5	20	80
Lt	Pg+M	D(HPG?-P)	19-22	6	15	80
tSI	M+Pg	D(HPG?-P)	0	0-0.8	15	15
LQr	Pg	D(HPG?-P)	4-19-22	3	50	100
LQd	M+Pg	D(HPG?-P)	19	2-7	<60	80
LQ	Pg+M	D(HPG?-P)	19	2	30	60
DQ	A+M	D(HPG?-P)	19	3	15	30
QSI	M+Pg	D(HPG?-P)	0-19	0-1	15	15
LFr	Pg+M	D(HPG?-P)	4-19	2	30	90
LFd	Pg+M	D(HPG?-P)	19-22	3	30	90
LFP	Pg	D(HPG?-P)	19-22	7	30	60
R+I	Pg+M+Md	D(HPG?-P)	26	2	15-60	60
LL	A+Pg	D(HPG?-P)	26	2	15	60
LF	Pg+M	D(HPG?-P)	19-22	5	30	80
DF	A+M	D(HPG?-P)	19	3	15	50
FSI	M+Pg	D(HPG?-P)	0	0	15	15
FCF	Pg+M	D(HPG?-P)	19	3	15	50
LPr	Pg+M	D(HPG?-P)	19	2	60	60
LPd	Pg+M	D(HPG?-P)	19	4	50	90
LP	Pg+M	D(HPG?-P)	19	2	30-90	90
DP	A+M	D(HPG?-P)	0	1	<60	60
PSI	M+Pg	D(HPG?-P)	0	0	15	15
h/	Pg+		23	7		

Land System	Dominant Facets	Characteristic facets or variants *	Characteristic plan-profile	Dominant Geology
UQ	s(p-c)S mxS (m-s)cR		4L	Q>Sh vs
UP	gxP hm(p-x)S	T	3//	SS+Q+C f
MQr	hmxS		4	Q>Sh vs
MQd	mpD hmcC gcM		4	Q>Sh m
5PQ	fp gcS		1	Q>Sh f
2PQ	fp gcS		1	Q>Sh f?
MQ	mcS		4	Q>Sh v
MFr	(g-lm)xS gcS		3	Sh>SS vs
Mfd	mkD hmcC		4	Sh>SS m
5PF	fp gcS		1	Sh>SS f
2PF	fp gcS		1	Sh>SS f?
MF	vgxS vgcS hmpS		2	Sh>SS v
5PP	gxS scS		2//	SS+Q+C f
2PP	gxS scS		2//	SS+Q+C f
MP	hmcS		4//	SS+Q+C s
C	iG vsL	Light mottled tone	1	I+M

Land System	Dominant Facets	Characteristic facets* or variants	Characteristic plan-profile	Dominant Geology
LSr	(g-lm)xS gcS		4L//	SS+Sh vs
LSd	gpD lmpC		4L//	SS+Sh g
LSP	fP fB gcS		3	SS+Sh f
LS	gxS gcS		4	SS+Sh v
DS	gxS	U Light tone	3	Sd/(SS+Sh) v
SSI	gxS gcS	Coarse mottling	2	SS+Sh v
FCS	gxS	(1)	3	SS+Sh v
Ltr	gxS		1L//	t vs
Lt	gxS		3	t v
tSI	gxS gcS	Coarse mottling	2	t v
LQr	gxS mcS		2L//	Q>Sh vs
LQd	gpD lmpC rgcM		6//	Q>Sh g
LQ	gcS (f-vgx)P		3L//	Q>Sh v
DQ	(vg-g)xS E gcS	U Light tone	1L// -4	Sd/(Q>Sh) v
QSI	gxS gcS	Coarse mottling	2	Q>Sh v

Land System	Dominant Facets	Characteristic facets* or variants	Characteristic plan-profile	Dominant Geology
LFr	gcS gxS		3L//	Sh>SS vs
LFd	(g-lm)cD (g-lm)pC		4L//	Sh>SS g-lm
LFP	lmcM (f-vgx)P		3	Sh>SS f
R+I	K hmcH gxS gcs		6L	Sh>SS vs
LL	K Y ygxS		7	Sh>SS ?
LF	gcS (f-gx)P		3	Sh>SS v
DF	Y gxS U	Light tone	2-7	Sd/(Sh>SS) v
FSI	gxS gcS	Coarse mottling	2	Sh>SS v
FCF	gxS	(1)	2	Sh>SS v
LPr	gxS lmcS		4L//	SS+Q+C vs
LPd	lmpD		4L//	SS+Q+C lm
LP	gcS lmxS		3L	SS+Q+C f
DP	lmxS lmcS	U Light tone	4	Sd/SS+Q+C) v
PSI	gxS gcS	Coarse mottling	2	SS+Q+C v

*If not included under "dominant facets"
1 Light grey reticulate pattern on a dark grey background.

Key

Process
Pg = periglaciation
G = glaciation
M = marine
A = aeolian
Md = marine deposition

Geomorphic Position
v = very
D = dissected zone of transference
C = Cainozoic erosion surface
P = present erosion cycle
HPG = highest post-glacial eustatic level

Drainage Pattern
0 = None
1 = Parallel
2 = Colinear
3 = Rectangular
4 = Trellised
5 = Centripetal
6 = Radial
7 = Annular
8 = Phantom
9 = Dendritic
10 = Pinnate
11 = Barbed
12 = Asymmetrical
13 = Braided
14 = Anastomatic
15 = Distributory
16 = Ephemeral
17 = Meandering
18 = Dichotomic
19 = Angulate
20 = Swallow hole
21 = Deranged
22 = Subdendritic
23 = Subparallel
24 = Contorted
25 = Reticular
26 = Lacunate

Dominant Facets
Slope
vs = very steep = 30° - 45°
s = steep = 17° - 30°
hm = high moderate = 10° - 17°
lm = low moderate = 6° - 10°
g = gentle = 2° - 6°
vg = very gentle = 30' - 2°
f = flat = 0 - 30'

S = slope
R = stone run
P = plateau
T = tor
D = dipslope
C = scarp slope
M = piedmont
L = cliff
B = structural bench
U = dune
E = raised beach
K = lake
H = hogback
Y = raised estuary

Slope shape
p = planar
x = convex
c = concave
iG = irregular topography

Characteristic plan-profile (after van Lopik and Kolb, 1959)

CHARACTERISTIC PLAN-PROFILE

HIGHS OCCUPY		HIGHS ARE → / SCHEMATIC PLAN / SCHEMATIC PROFILE	NON-LINEAR AND RANDOM	LINEAR AND RANDOM	NON-LINEAR & PARALLEL	LINEAR AND PARALLEL
>60% OF AREA	FLAT-TOPPED		1	1L	1//	1L//
40-60% OF AREA	FLAT-TOPPED		2	2L	2//	2L//
<40% OF AREA	FLAT-TOPPED		3	3L	3//	3L//
>60% OF AREA	CRESTED OR PEAKED		4	4L	4//	4L//
40-60% OF AREA	CRESTED OR PEAKED		5	5L	5//	5L//
<40% OF AREA	CRESTED OR PEAKED		6	6L	6//	6L//
NO PRONOUNCED HIGHS OR LOWS			7			

REPRESENTATIVE PLAN-PROFILES

Dominant Geology

Q = quartzite and quartzitic sandstone
Sh = shale
SS = sandstone
C = conglomerate
I = igneous rocks
M = metamorphic rocks
Sd = sand
t = tillite

Lower letters refer to angle of dip of strata; same symbols as for slope.
v = variable.

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TABLE 3

Land Systems Soil Data

Sample	Land System	Facet	% Ash	Organic Type	Peat depth cm	pH	P			Na	K			Mg		Ca		
							Total	Ext.	Rating	Ext	Total	Rating		Total	Rating	Ext	Org. Total	Rating
E 1	LSP	Plateau	70-90*	Fibric/Sapric	21	4.9-5.9	190	6		0.1	3 400			2 300		Nil		
E 2	LSd	Scarp Slope	80*	Fibric/Sapric	24	4.9	240	9		0.2	5 400			3 900		Nil		
E 3	LSd	Dipslope	80*	Fibric/Sapric	35	5.0	230	9		0.35	11 100			6 700		Nil		
E 4	LSP	Lower Concave Slope		Fibric/Sapric	25													
E 5	LSd	Dipslope	46*	Fibric/Sapric	37	4.2			S.L.			S.-S.L.			S.			V.L.
E 6	LSr	Ridge Crest (4)	65-80*	Fibric/Sapric	38	4.9	200	7		0.3	3 800			1 600		Nil		
E 7	LSr	Floodplain	65-85*	Fibric/Sapric	23	4.7-5.1		10		0.3	2 000-13 000			4 500-6 500		Nil		
E23	LQ	Lower Concave Slope	10-30	Fibric/Sapric	>70	4.5	500 - 800/		L.		600 - 1 800/	S.-S.L.		800-1 300/	S.		1 200-1 600	V.L.
E24	LQ	Plateau	<10	Fibric/Sapric	>45	4.1-4.6	200 - 600/		L.		250 - 850/	S.L.		1 000-2 000/	S.		1 300-2 100	V.L.
E29	LQ	Marine Terrace	30-55	Fibric/Sapric	>35	4.4	800-1 100/				2 300 - 6 100/			2 200-3 100/			800-4 500	
W 2	MF	Plateau (5)	25-45*	Fibric/Sapric	>35	3.5-5.3	500 - 950/				800 - 1 800/			700-1 200/			500-1 300	
W 3	LFr(dk)	Ridge crest (6)		Fibric	6	4.9-5.2	230	5-11		0.1-0.2	3 000-10 000			1 300-2 100		Nil		
W 4	LFd	Marine Terrace	18-30*	Fibric/Sapric	25	4.3-4.8	390	16		1.0	5 000			5 000		6.25		
W 5	LF	Lower Concave Slope	80*	Fibric	6	5.0	250 - 330	8-12		0.2	9 000-11 000	S.L.		6 500-7 000		Nil-0.25		V.L.
W 6	LFr	Convex Slope	55-90*	Fibric/Sapric	27	4.8	100 - 400	11-35		0.2	5 000 - 8 000	S.L.		3 500	S.-S.L.	Nil-0.25		V.L.
W14	LL	Marine Terrace	96	Alternating Peat and Sand		5.5	60/				300/			300/			400	
W15	LL	Marine Terrace	32	Fibric/Sapric	>90	4.7	1 400/				2 500/			1 500-4 000/			1 400	
W16	h/LF(dk)	Valley Bottom	65*	Peaty sand		5.5	200-1 000	12		0.1-1.0	2 500 - 5 500			3 000-5 000		4.5 / Nil		
W17	h/LF(dk)	Ridge crest (6)	68*	Fibric	12	4.8			V.L.			S.-S.L.			S			L.
W18	MF	Ridge crest (1) (5)	60-80*	Fibric/Sapric	37	4.7	300	11		0.2	4 300			3 000		Nil		
W19	LFd	Piedmont	70*	Fibric/Sapric	37	4.9	300 - 450	3-7		0.1-0.2	5 500			3 000-4 500		Nil		
W20	R+I	Marine Terrace	20-35	Fibric/Sapric	>45	4.7	500-1 000		S.L.-V.L.		600- 2 000/	S.-S.L.		1 200-1 800/	S.-S.L.		2 000-4 500	L.-V.L.
W21	R+I	Ridge crest (7)	15-55*	Fibric/Sapric	57	4.3-5.2	50	6	L.-V.L.	0-0.1	800 - 1 200	S.-S.L.		400-1 000	S.-S.L.	Nil		V.L.
W22	LFr	Alluvial Terrace	10-20	Mesic-Sapric Basin Peat	>42	4.4	600-1 300/		S.-S.L.		600 - 2 500/	S.-S.L.		800-2 500/	S.-S.L.		1 000-2 000	V.L.
W23	LFr	Plateau (6)	80*	Fibric/Sapric	20-30	5.0	170	10-15	L.	0.2	6 500	S.-S.L.		5 000	S.	Nil		V.L.
W24	LF	Plateau	20-40*	Fibric/Sapric	27	4.7	300 - 600	15-45		0.3	6 000 - 8 000			4 500-6 500		0.25-0.75		
W25	MFr	Plateau (4)	65*	Fibric/Sapric	27	4.8	300	7-11		0.3	6 000-13 500			5 000-9 000		Nil		
W27	h/LFr (dk)	Dissected Marine Terrace	75*	Fibric	5	5.0	270 - 470	10-35		0.4	5 000- 7 000			5 000-7 000		Nil		
W28	LF	Plateau	45-75*	Fibric/Sapric	35	3.6	75 - 150	10-14		0.2-0.5	4 000-11 000			3 000-7 000		Nil-1.00		
W29	MFd	Scarp Slope	15	Fibric/Sapric	48	3.9			L.-V.L.			S.-S.L.			S.			V.L.
W31	UQ(dk)	Steep Slope (2)	11/74*	Fibric	21	4.5	300	5-8		0.2-0.3	4 500 - 6 000			2 000		Nil		
W32	UQ(dk)	Plateau (3)	25	Fibric Blanket Peat	45	4.5	600/				600 - 1 500/			950-1 300			1 200	
W36	FCF	Ridge crest (6)	80	Rootmat	23	4.9	600/				3 000/			2 500/			800	
W37	LFd	Cuesta crest	10-40	Fibric	45	4.3	750/		S.L.-L.		650 - 950/	S.L.-L.		550-2 100	S.-S.L.			V.L.

* Overlying mineral soil / Values for organic soils (1) 350 ft (2) 500 ft (3) 1 175 ft ((4) (g-lm)xS (5) vgxS (6) gxS (7) hmcH) of Table 2

TABLE 4

SOIL ANALYSES

Survey No.	Moisture % of oven dry soil	Ash % of oven dry soil	pH 1:5 H_2O	pH 1:5 N.KCl	Conductivity mmhos 1:5 H_2O	Organic matter % of oven dry soil	Total Nitrogen % of oven dry soil	Total Element Content ppm in oven dry soil - Mineral Soils P	K	Mg	Total Element Content - ppm in oven dry soil - Organic Soils P	Na	K	Mg	Ca	Exchangeable Cations me/100g air dry soil Na	K	Mg	Ca	Total Exchangeable bases me/100g air dry soil	Cation Exchange capacity me/100g air dry soil	% Base Saturation	Extract. P NH_4F+HCl p.p.m.	Pyro-Phosphate Extract Munsell 10 YR
E1/1	3.9	72.5	4.9	3.5	0.11						319	399	1 418	630	651									63
1/2	2.0	90.9	4.9	3.7	0.05						991	504	1 995	903	819	0.11	0.03	0.08	Nil	0.22	6.34	3	6.4	54
1/3			5.9		0.03	2.2	0.07	186	3 440	2 260														73
E2/1	24.5	75.7	4.8	4.2	0.08						286	452	1 628	756	767									63
2/2	14.7	82.2	4.9	4.2	0.07						227	347	1 365	609	504	0.24	0.20	0.21	Nil	0.65	21.61	3	8.7	74
2/3			5.0		0.03	6.2	0.22	236	5 400	3 860														64
E3/1	3.9	78.5	4.9	3.7	0.13						412	399	2 573	1 145	924									
3/2	7.9	85.6	5.1	3.9	0.05						227	294	2 625	1 113	546	0.35	0.31	0.59	Nil	1.25	28.40	4	8.7	83
3/3			4.9		0.07	3.4	0.20	232	11 100	6 700														53
E6/1	11.5	65.6	4.8	3.2	0.10						307	399	1 680	372	1 008									
6/2	7.5	81.9	4.9	4.5	0.07						168	294	1 313	368	546	0.28	0.08	0.38	Nil	0.74	18.13	4	7.0	53
6/3			4.9		0.05	5.8	0.20	200	3 840	1 640														54
E7/1	4.6	64.2	4.7	3.3	0.11						470	452	1 575	924	1 092									
7/2	3.5	84.6	4.7	4.6	0.07						206	242	1 890	735	441	0.33	0.18	0.50	Nil	1.01	20.63	5	9.3	
7/3			4.9		0.05	6.6	0.22	234	2 060	4 680						0.26	0.26	0.59	Nil	1.11	22.51	5	10.5	
7/4			5.1		0.03	2.0	0.09	188	12 700	6 740														66
E23/1	8.9	11.7	4.7	4.0	0.16						832	1 134	1 155	1 176	1 638									64
23/2	9.9	15.8	4.5	5.0	0.18						840	924	683	872	1 260									43
23/3	7.4	17.0	4.5	4.2	0.21						764	819	630	788	1 208									32
23/4	7.9	21.1	4.3	3.4	0.28						647	819	578	809	1 208									33
23/5	4.9	22.7	4.6	3.5	0.15						378	714	788	735	1 208									42
23/6	6.6	31.8	4.7	3.5	0.21						521	609	1 838	1 334	1 334									86
E24/1	9.4	6.7	4.6	3.6	0.13						458	1 134	840	1 911	2 100									66
24/2	9.5	8.6	4.2	4.3	0.20						580	977	473	1 418	1 701									64
24/3	8.7	10.9	4.3	3.6	0.23						521	872	525	1 008	1 334									56
24/4	9.6	10.0	4.1	3.1	0.26						378	872	368	1 071	1 575									58
24/5	8.2	7.6	4.1	3.8	0.28						252	872	263	1 197	1 890									74
24/6	9.1	9.0	4.1	4.1	0.34						218	924	315	1 449	1 323									76
E29/1	9.5	32.9	4.6	3.1	0.36						1 067	1 029	2 363	2 153	4 452									56
29/2	7.7	49.6	4.3	3.5	0.23						840	714	4 463	2 604	1 260									54
29/3	6.0	56.3	4.4	3.6	0.21						815	767	6 405	3 087	924									64
29/4	6.0	56.2	4.3	3.5	0.23						916	819	6 563	2 898	872									64
29/5	6.3	56.2	4.3	3.7	0.26						890	767	5 933	2 667	819									43
29/6	6.7	49.1	4.5	4.2	0.20						840	819	4 515	2 226	924									84
W2/1	11.2	25.5	5.1	4.5	0.08						949	819	1 785	1 208	1 334									84
2/2	7.7	23.2	4.7	5.3	0.18						966	872	1 050	1 071	1 208									64
2/3	14.8	25.0	4.5	3.5	0.20						630	714	788	872	924									64
2/4	7.3	39.7	4.5	3.5	0.15						508	557	1 313	725	714									43
2/5	6.7	46.2	4.6	3.7	0.13						840	504	1 680	903	504									64
W3/2			4.9		0.03	1.1	0.05	218	10 220	6 960						0.22	0.51	1.09	Nil	1.82	24.65	7	10.6	63
3/3			5.2		0.02	0.2	0.01	230	3 140	1 340						0.07	0.13	0.25	Nil	0.45	6.07	7	5.7	
3/4			5.2		0.02	0.2	0.01	234	4 560	2 120						0.07	0.20	0.46	Nil	0.73	8.48	9	8.9	
W4/1	7.9	18.0	4.5	5.0	0.34						1 495	452	1 260	1 239	2 678									66
4/2	7.5	23.0	4.3	4.8	0.23						1 092	504	840	903	2 604									53
4/3	7.7	29.8	4.6	4.5	0.18						941	504	1 050	872	2 373									53
4/4			4.8		0.10	8.8	0.41	388	5 020	4 760														74
W5/1	7.4	80.5	5.0	4.2	0.07						504	399	3 675	2 478	819	0.96	0.38	5.12	6.25	12.71	32.69	39	16.2	
5/2			4.9		0.05	3.0	0.11	249	8 480	7 020						0.24	0.54	1.30	0.25	2.33	27.69	8	8.1	
5/3			5.1		0.03	0.9	0.05	296	9 300	6 760						0.24	0.56	1.39	0.25	2.44	23.22	11	9.9	
5/4			5.1		0.03	1.0	0.04	337	8 940	6 500						0.24	0.54	1.47	0.25	2.50	21.52	12	11.0	
5/5			5.2		0.03	0.8	0.05	330	11 000	6 580						0.28	0.67	2.06	Nil	3.01	25.81	12	11.7	

TABLE 4 (Continued)

Survey No.	Moisture % of oven dry soil	Ash % of oven dry soil	pH 1:5 H_2O	pH 1:5 N.KCl	Conductivity mmhos 1:5 H_2O	Organic matter % of oven dry soil	Total Nitrogen % of oven dry soil	Total Element Content ppm in oven dry soil - Mineral Soils P	K	Mg	Total Element Content - ppm in oven dry soil - Organic Soils P	Na	K	Mg	Ca	Exchangeable Cations me/100g air dry soil Na	K	Mg	Ca	Total Exchangeable bases me/100g air dry soil	Cation Exchange capacity me/100g air dry soil	% Base Saturation	Extract. P NH_4F+HCl p.p.m.	Pyro-Phosphate Extract Lunsell 10 YR
W6/1	5.8	55.6	4.7	3.6	0.20						1 025	557	2 205	1 376	819									73
6/2	2.6	88.6	4.9	3.9	0.05						294	399	3 045	2 751	651									74
6/3			5.1		0.03	1.6	0.06	129	4 880	3 880						0.15	0.13	0.46	Nil	0.74	12.86	6	17.1	
6/4			5.3		0.03	0.5	0.03	177	5 260	3 520						0.20	0.26	1.09	Nil	1.55	12.32	13	11.6	
6/5			5.1		0.03	0.4	0.02	371	7 920	3 760						0.22	0.36	1.97	0.25	2.80	15.00	19	27.8	
6/6			5.3		0.03	0.3	0.02	375	5 920	2 800						0.17	0.38	1.93	0.25	2.73	13.13	21	35.2	
W14/2	0.9	95.7	5.5	4.4	0.07						59	137	315	336	441									83
W15/3	7.7	32.9	4.8	4.2	0.57						1 378	1 449	2 153	1 743	1 638									56
15/5	8.4	32.8	4.7	4.3	0.66						1 495	1 607	2 310	1 554	1 260									64
15/6	7.2	31.6	4.7	3.7	0.54						1 369	1 659	2 415	1 480	1 334									64
W16/1	4.7	64.5	5.5	4.4	0.18						1 126	609	2 940	3 938	3 948									84
16/2			5.5		0.10	11.6	0.67	1 000	4 240	3 500						1.02	1.43	6.68	4.50	13.63	29.83	46	9.2	
16/3			5.4		0.07	7.9	0.42	838	4 340	3 220						0.78	1.00	2.31	Nil	4.09	24.20	17	9.9	
16/4			5.4		0.07	6.0	0.30	700	4 840	3 520						0.68	0.79	1.05	Nil	2.52	19.65	13	11.2	
16/5			5.3		0.10	2.1	0.11	210	5 620	5 680						0.70	0.54	2.06	Nil	3.30	15.63	21	12.5	
16/6			5.4		0.11	0.8	0.05	198	4 480	3 840						0.41	0.38	1.39	Nil	2.18	9.65	23	12.8	
16/7			5.6		0.08	0.4	0.01	308	2 680	2 520						0.15	0.18	0.55	Nil	0.88	5.54	16	17.4	
W18/1	5.4	60.7	4.7	3.4	0.15						470	609	1 733	809	767									63
18/2	3.5	80.1	4.6	3.6	0.10						353	399	1 680	494	504									73
18/3			4.9		0.05	2.5	0.10	300	4 300	2 780						0.24	0.08	0.13	Nil	0.45	10.63	4	10.6	
W19/1	5.8	66.0	4.9	3.8	0.16						588	662	2 835	1 208	987									73
19/2	4.2	77.6	4.9	3.8	0.08						420	452	2 835	704	546									63
19/3			5.1		0.05	6.5	0.27	316	5 440	3 020						0.24	0.15	0.55	Nil	0.94	21.79	4	6.9	
19/4			4.9		0.03	1.2	0.05	469	6 100	4 780						0.11	0.13	0.25	Nil	0.49	13.66	4	3.1	
W20/1	7.6	26.2	5.2	4.0	0.26						991	1 397	1 995	2 100	3 402									83
20/2	7.2	34.9	4.7	4.0	0.22						731	977	840	1 208	2 237									74
20/3	7.0	29.6	4.7	4.0	0.29						638	977	683	1 113	2 373									54
20/4	9.9	19.6	4.7	3.8	0.32						563	1 082	630	1 785	3 308									64
20/5	8.7	21.5	4.8	3.8	0.35						479	1 187	630	1 544	4 452									43
W21/1	12.3	15.5	4.3	4.0	0.13						756	819	1 155	1 271	1 575									54
21/2	9.1	16.9	4.3	3.1	0.14						647	714	735	452	546									54
21/3	8.3	27.9	4.3	3.8	0.14						815	557	1 050	452	504									44
21/4	5.9	55.8	4.7	3.7	0.11						630	452	1 995	704	504									44
21/5			5.1		0.03	2.1	0.05	78	1 720	1 060						0.07	0.05	0.08	Nil	0.20	7.23	3	9.1	
21/6			5.2		0.03	0.6	0.01	35	780	400						0.07	0.03	0.04	Nil	0.14	2.14	7	5.2	
21/7			5.1		0.02	0.4	0.01	25	1 240	540						0.04	0.05	0.25	Nil	0.34	2.23	15	3.3	
W22/1	11.8	12.1	4.6	3.5	0.29						1 453	1 344	2 415	2 478	2 163									86
22/2	8.3	13.4	4.4	3.0	0.21						1 344	977	840	1 575	1 638									86
22/3	8.5	18.0	4.2	3.1	0.14						840	767	683	903	1 050									74
22/4	9.1	18.5	4.2	3.1	0.14						647	819	630	788	1 050									56
W23/1	5.3	71.5	4.8	4.7	0.11						1 268	557	4 095	1 869	2 027									84
23/2	3.7	87.1	4.9	4.1	0.06						529	504	5 250	3 738	651									84
23/3			5.1		0.03	1.8	0.09	167	6 180	5 040						0.20	0.41	0.59	Nil	1.20	15.36	8	10.8	
23/4			5.2		0.03	0.7	0.04	163	6 940	5 300						0.22	0.38	1.30	Nil	1.90	16.70	11	14.0	
23/5			5.1		0.03	0.5	0.03	200	6 680	5 060						0.24	0.41	2.10	0.50	3.25	16.70	19	15.6	
W24/1	11.1	23.6	4.5	3.7	0.14						1 176	819	1 365	1 197	1 334									74
24/2	7.7	42.3	4.6	3.3	0.08						1 445	609	1 785	788	714									53
24/3			4.7		0.05	7.4	0.27	579	5 840	4 560						0.35	0.23	0.80	0.25	1.63	32.33	5	18.9	
24/4			5.0		0.03	1.5	0.07	324	6 380	5 580						0.24	0.23	1.01	0.25	1.73	20.18	9	14.9	
24/5			4.7		0.03	0.8	0.04	414	7 840	6 520						0.31	0.44	2.06	0.75	3.56	22.42	16	45.5	

TABLE 4 (Continued)

Survey No	Moisture % of oven dry soil	Ash % of oven dry soil	pH 1:5 H_2O	pH 1:5 N.KCl	Conductivity mmhos 1:5 H_2O	Organic matter % of oven dry soil	Total Nitrogen % of oven dry soil	Total Element Content ppm in oven dry soil - Minersl Soils P	K	Mg	Total Element Content - ppm in oven dry soil - Organic Soils P	Na	K	Mg	Ca	Exchangeable Cations me/100g air dry soil Na	K	Mg	Ca	Total Exchangeable bases me/100g air dry soil	Cation Exchange capacity me/100g air dry soil	% Base Saturation	Extract. P NH_4F+HCl p.p.m.	Pyro-Phosphate Extract Munsell 10 YR
W25/1	6.0	62.0	4.8	3.5	0.04						151	294	1 838	872	504									82
25/2	5.8	65.2	4.8	3.6	0.09						899	557	2 940	1 050	609									82
25/3			4.9		0.04	3.2	0.13	306	5 980	5 240						0.24	0.18	0.25	Nil	0.67	20.81	3	7.3	
25/4			4.7		0.06	1.8	0.08	343	13 400	9 240						0.33	0.74	0.84	Nil	1.91	36.17	5	10.6	
W27/1	5.1	70.4	5.0	3.6	0.07						1 260	609	4 043	2 814	1 208									83
27/2	5.8	82.2	4.9	3.7	0.06						1 201	609	4 673	3 402	714									84
27/3			5.0		0.06	3.1	0.13	471	5 000	5 180						0.31	0.33	0.50	Nil	1.14	19.83	6	10.8	
27/4			5.2		0.06	0.8	0.04	277	6 920	6 840						0.39	0.38	1.64	Nil	2.41	17.50	14	18.4	
27/5			5.0		0.04	0.6	0.04	379	6 680	7 040						0.41	0.41	2.94	Nil	3.76	18.93	20	34.2	
W28/1	6.8	46.9	4.5	3.7	0.28						1 016	872	2 520	1 166	1 050									84
28/2	5.0	73.1	4.6	3.5	0.07						664	557	3 150	1 113	546									63
28/3			4.9		0.04	2.5	0.09	143	3 920	3 060						0.20	0.15	0.25	Nil	0.60	15.99	4	10.2	
28/4			4.7		0.04	1.1	0.05	84	7 760	5 080						0.46	0.59	1.93	1.00	3.98	22.24	18	12.6	
28/5			4.5		0.04	0.7	0.03	78	11 200	5 340						0.33	0.82	1.93	0.25	3.33	22.60	15	13.8	
W31/1	11.7	11.2	4.5	3.8	0.34						1 042	977	1 412	2 646	8 274									82
31/2	4.3	73.5	4.4	3.3	0.16						487	504	3 930	809	714									74
31/3			4.5		0.06	7.6	0.26	377	6 000	1 640						0.28	0.28	0.63	Nil	1.19	23.22	5	5.3	
31/4			5.0		0.04	5.1	0.16	273	4 740	1 960						0.26	0.26	0.67	Nil	1.19	20.99	6	7.8	
31/5			5.1		0.06	2.8	0.10	233	6 040	2 240						0.22	0.26	1.26	Nil	1.74	15.99	11	6.8	
W32/1	8.6	22.4	4.8	3.5	0.16						622	1 029	1 470	1 302	1 512									74
32/2	9.4	26.0	4.5	3.8	0.18						655	819	992	1 145	1 208									74
32/3	9.5	23.4	4.5	3.2	0.15						638	872	788	1 113	1 260									74
32/4	9.3	24.1	4.5	3.2	0.19						563	767	735	1 050	1 155									74
32/5	8.9	28.8	4.4	3.2	0.16						521	767	630	956	1 092									84
W36/1	6.2	77.7	4.9	3.7	0.06						588	504	3 045	2 415	767									82
W37/2	12.3	11.5	4.4	3.3	0.33						815	1 607	683	2 100	1 890									84
37/4	9.6	32.8	4.3	3.3	0.32						756	1 082	945	840	924									73
37/5	9.8	37.9	4.3	3.6	0.28						714	924	893	567	924									63

TABLE 5 Status of some mainly peat soils

Sample	pH value	Lime content	Phosphate content	Potash content	Magnesium content	Approx % organic matter
E5/1	4.2	V.L.(100)	S.L.(18)	S.-S.L. (93)	S.(153)	54
E23/1	4.6	V.L.(160)	L.(10)	S.-S.L.(120)	S.(184)	38
E24/1	3.7	V.L.(110)	L.(12)	S.L. (60)	S.(196)	93
E24/2	3.7	V.L.(130)	L. (8)	S.L. (40)	S.(160)	91
W5/1	4.4	V.L.(100)	V.L. (2)	S.L. (46)	S.(102)	33
W6/1	4.0	V.L. (30)	V.L. (2)	S.L. (41)	S.-S.L.(78)	42
W17/1	4.8	L.(210)	V.L. (4)	S.-S.L. (66)	S.(182)	32
W20/1	4.1	V.L.(230)	S.L.(21)	S.(190)	S.(225)	72
W20/2	4.0	V.L.(190)	V.L. (4)	S.L. (60)	S.-S.L.(133)	62
W21/1	4.0	V.L.(180)	L. (8)	S.(144)	S.(208)	83
W21/2	3.6	V.L. (20)	V.L. (1)	S.L. (36)	S.L. (47)	78
W22/1	3.9	V.L.(110)	S.-S.L.(50)	S.-S.L.(120)	S.(230)	90
W22"2	3.8	V.L. (90)	S.L.(22)	S.L. (60)	S.(150)	86
W23/1	4.0	V.L.(120)	L. (6)	S.-S.L.(116)	S.(160)	87
W29/1	3.9	V.L.(120)	L.(12)	S.(151)	S.(210)	86
W29/2	3.9	V.L.(100)	V.L. (4)	S.L. (58)	S.(143)	82
W37/1	3.8	V.L.(110)	L.(15)	S.L. (40)	S.(190)	87
W37/2	3.8	V.L. (20)	V.L. (2)	L. (20)	S.-S.L.(96)	64

The figures in brackets in the columns headed lime, phosphate, potash and magnesium contents are in mg CaO, P_2O_5, K_2O and MgO per 100 g air-dry sample.

The symbols have the following significance:

S. = Satisfactory
S.-S.L. = Satisfactory, possibly slightly low
S.L. = Slightly low
L. = Low
V.L. = Very low

Observations by Dr. J. M. S. Reith

The pH values have been determined using water. The lime, phosphate, potash and magnesium contents are based on the amounts extracted from the samples by 2.5% acetic acid, 5 g of the sample being shaken with 200 ml acetic acid for two hours. The results have been classified in the same way as the values for similar Scottish peaty soils and this classification may not be applicable to samples from the Falkland Islands where soil and climate conditions are different from those in Scotland.

TABLE 5 (cont'd)

All the samples are very acid and generally very low in lime. For the production of grass, or crops such as oats, we would consider it necessary to apply dressings of lime of at least 20 cwt. calcium carbonate per acre. For such soils, however, we would normally recommend lime at the rate of 60 cwt calcium carbonate per acre or its equivalent.

Sample W22/1 seems to have a somewhat higher phospate content than the others. In general, however, most of the samples have low to very low contents of readily soluble phosphate. For grass or crops we would normally recommend at least 100 lb P_2O_5 and preferably over 200 lb P_2O_5 per acre as initial dressings. Under the acid soil conditions ground mineral phosphate could be expected to be reasonably effective but if grass seeds or crops are being sown we would consider it necessary to apply some water soluble phosphate at a rate of about 80 lb P_2O_5 per acre to assist in establishment.

The potash supplies are relatively much better than those of lime and phosphate. It is possible that the readily soluble potash contents in most of these samples are reasonably adequate for crop growth for a few years. If, however, crops are to be grown or grass is improved with the object of cutting it for conservation then there is likely to be a need to apply potash particularly on areas where potash is considered slightly low.

The samples seem to contain quite good supplies of magnesium. We do not think that magnesium is likely to limit herbage or crop growth for a considerable number of years.

In addition the amounts of readily soluble sodium in the samples have been estimated, and all the samples contain higher amounts of sodium than comparable samples from Scotland, except samples from land on the sea shore. It is unlikely that the sodium contents are high enough to have any serious adverse effect on growth, but the growth of plants such as clover on areas near the sea may be restricted by precipitation containing relatively high amounts of sea water salts.

No estimates for nitrogen have been made. If crops are to be grown or if reseeding is undertaken moderate dressings of nitrogen, such as 40-50 lb N per acre, are likely to be required to encourage early growth.

No estimates have been made of the abilities of these peaty soils to supply trace elements.

TABLE 6. HERBAGE ANALYSIS (% D.M.)

Sample	Land System	Date	Dry matter	Crude protein	Digestible organic matter (D.O.M.)	Ca	Mg	Na	K	P	Cu ppm	Mn ppm	Zn ppm
E 1	LSl	N.A.	89.0	6.0	32.56	0.036	0.1	0.025	0.21	0.04	2	121.9	10.4
E 2	LSd	13/1	89.1	4.5	14.46	0.14	0.07	0.022	0.24	0.05	1.78	588	12.9
E 3	LSd	12/1	88.7	4.2	11.25	0.09	0.1	0.024	0.16	0.04	3.38	298.8	10.9
E 4	LSP	12/1											
E 5	LSd	12/1	89.7	4.6	19.69	0.026	0.05	0.015	0.14	0.03	0.94	98.1	6.9
E 6	LSr	12/1	89.7	4.4	13.89	0.126	0.1	0.02	0.21	0.05	3.38	348.2	11.3
E 7	LSr	12/1	89.1	5.2	18.85	0.07	0.11	0.02	0.23	0.07	3.28	188.8	10.8
E 23	LQ	6/1	91.3	4.9	29.05	0.09	0.15	0.06	0.21	0.05	1.56	176.6	10.8
E 24	LQ	6/1	88.3	4.5	26.44	0.06	0.1	0.05	0.15	0.06	1.47	130.6	7.4
E 29	LQ	20/11											
W 2	MF	24/11	90.3	4.3	24.30	0.024	0.06	0.02	0.13	0.02	1.56	89.7	8.4
W 3	LFr(dk)	24/11	89.3	3.5	21.29	0.06	0.15	0.04	0.13	0.04	3.13	503	14.6
W 4	LFd	24/11	88.5	6.3	31.11	0.04	0.09	0.04	0.29	0.06	1.25	175.6	7.4
W 5	LF	24/11	90.0	5.0	24.39	0.04	0.07	0.017	0.18	0.06	1.25	102.8	8.1
W 16	h/LF(dk)	19/1				0.029	0.05	0.016	0.15	0.03			
W 17	h/LF(dk)	19/1											
W 19	LFd	N.A.	89.8	3.5	21.25	0.20	0.14	0.04	0.15	0.04	1.25	116.3	8.6
W 14	LL	16/1	90.8	3.3	15.45	0.20	0.14	0.04	0.14	0.03	3.38	897	18.2
W 20	R+I	20/1	90.4	5.5	24.83	0.07	0.12	0.05	0.26	0.07	3.38	271.2	10.8
W 21	R+I	19/1	90.1	3.3	16.40	0.11	0.15	0.06	0.08	0.04	2.03	267.6	17.5
W 21A		19/1	91.0	3.2	10.76	0.49	0.21	0.04	0.1	0.04	6.5	563	16.0
W 22	LFr	25/11	89.7	5.1	29.18	0.07	0.14	0.06	0.16	0.09	2.5	151.3	9.5
W 23	LFr	25/11	89.5	4.8	28.59	0.05	0.08	0.04	0.18	0.08	2.03	126.6	7.9
W 24	LF	25/11	90.5	5.2	34.59	0.07	0.09	0.04	0.20	0.11	2.82	122.8	10.4
W 25	MFr	25/11	91.2	4.7	31.38	0.059	0.10	0.05	0.17	0.07	2.03	136.3	6.9
W 27	h/LFr(dk)	26/11	92.7	3.6	20.67	0.32	0.15	0.05	0.11	0.08	6.5	825	15.6
W 28	LF	25/11	90.9	3.6	33.58	0.09	0.12	0.06	0.14	0.07	1.78	167.2	10.4
W 29	MFd	26/11	91.8	3.8	28.69	0.05	0.08	0.04	0.14	0.02	2	124.1	6.3
W 31A	UQ(dk)	27/11	91.9	4.4	14.72	0.28	0.30	0.20	0.2	0.07	5.63	232.5	15.4
W 31B	UQ(dk)	27/11	88.7	5.6	20.99	0.38	0.06	0.03	0.14	0.08	4.06	196.9	7.9
W 31C	UQ(dk)	27/11											
W 32	UQ(dk)	27/11											
W 36	FCF	19/1											
W 37	LFd	19/1	92.4	3.5	27.17	0.03	0.04	0.03	0.08	0.03	0.94	48.1	8.6
W 6	LFr	25/11	90.3	5.4	28.66	0.03	0.08	0.03	0.2	0.02	1.25	85.9	5.6

DECODE.

No. 14.

TELEGRAM RECEIVED.

From SECRETARY OF STATE *to* GOVERNOR.

Despatched: 10. 3. 47 *Time:* 21.35 *Received:* 11. 3. 47 *Time:* 09.00

No. 104. Your telegram No. 129 Soil samples.

Following for Joyce begins. Your soil samples welcome but last sentence not understood. Please expand. Ends.

SECRETARY OF STATE.

G.T.C.

Send on by phone to T.L. ✓ to P.S. if not here by telegram Carlos

ABL 11.3

Phoned to Mr Joyce at Dangers Stn "2000 ft" & he does not wish to "expand" JS. 11/3.

LJH.

3

O i/c Ag. Depts.

I did not know until after he had gone that Mr Toye had left with the Bartonia Cameroni. I presume you are aware of the circumstances? I told him he was only to act in close cooperation with you & Mr Fleuret, who has, I believe, already collected soil samples from most parts of the Islands.

G.B.
13/3

C.S.O. No..................

Minute Paper. Sheet No. 4

Hon. Col. Sec.

Ref. to your minute of 13/3

Mr Joyce had spoken of trying to get more soil samples before he left the Falklands, but did not know if he would be able to arrange it.

2. Mr Fleuret rang me the evening before they left to say that Mr Joyce would be going out to camp to collect soil samples, and he understood from Mr Joyce that he was to assist him, thinking of course that you knew all about it, and, providing it was alright with me.

3. I thought this was arranged at the C.S.O., but, I told Mr Fleuret to let Dr. Sladen know where he was going, and also keep in touch with Dr Sladen by phone, in case he might need him, in connection with horses arriving from South America by S.S. Fitzroy.

J.B.B. O/c Ag Dept.
15/3/47

[illegible] Joyce [illegible]
[illegible]
16.3

§2. I didn't know Mr F. had come too. I said nothing about his coming — should not have done so without consulting O.i/c Ag. Dept. I did, at the beginning, ring up Mr F. at Mr Joyce's request to pass him on to Mr F. whom I asked to give such assistance as he could, having regard to x & 3/2. Has Mr F. come on Deptl. duties also?

2. Mr Joyce seems to have 'bounced' us. Let Mr Browning see B.C. on his return.

[illegible]

O/c Ag. Dept

To see HCS's minute at foot of (4), pl.

JB
for C.S.
17.3.47.

Hon Col Sec

Seen: thank you. Mr Fleuret went out to assist Mr Joyce.

J. B. B O/c Ag Dept
18/3/47.

O/c Ag. Dept.

I am obliged to Mr Fleuret & only regret if he & he has been inconvenienced.

2. Pl. report scientific value of his going away with Mr Joyce when he returns.

ABL
18.3.47

Hon Col Sec.

(6)

I submit Mr Fleuret's report, as requested.

J.B.B O/c Ag Dept.
24/3/47

6

Stanley.

24th. March 1947.

The Officer-in-Charge.
Department of Agriculture.
Stanley.

During the period 10th. March 1947 to 18th. March 1947, Mr. Joyce and Fleuret visited the following properties of the East Falkland Is.

(a) Teal Inlet, Douglas Station and Salvador. Problems of peat formation, drainage and physical geography were investigated and soil samples were taken at Salvador with a view to solving wind and rain wash erosion, which constitutes a serious problem over some 2000 acres of this property. A potential supply of lime for Agricultural purposes was also x/ investigated. — This occurrence is merely a stone beach.

(b) San Carlos. On this property personnel were joined by Mr. J. Wordie and problems of drainage etc. were discussed. A soil sample of land (about to be put into cultivation) was taken with the view to the advisability to continuing cultivation along a topographical feature.

(c) Falkland Islands Company's properties. (1) From Darwin a visit was made to San Carlos to take a series of samples on the upper Lafonian beds.

(2) On the return journey to Stanley an unsuccessful search was made for a reported Magnesian limestone. ~~In the Black Rock and Mount Pleasant~~ y/ area ~~is a possible source of lime for Agricultural purposes~~. Reported as occurring by Niddrie not seen by Joyce.

(3) Owing to the pressing demand for my return to Stanley, Mr. Joyce alone 3 was able to examine the only feasible source of Agricultural lime at Fitzroy.

(4) When the question of a soil survey was first raised from the Geological standpoint by Dr. Gibbs, Niddrie and Joyce about a year ago, selected sites for sampling [illegible] were completed by the samples taken during this journey.

B. Fleuret.
Stanley Common Ranger.

O i/c Ag. Dept.

Thank you.

x. y I believe one of these is extensive that Mr Joyce is reporting in detail on it. Pl. confirm saying which it is.

[initials] 25.3

C.S. It is neither x nor y but 3. Dr Hambleton has seen the material and has most of the details. [initials].

7

G.N.

6 2

Can you tell me anything about this deposit, which Mr Joyce thought might contain 100,000 tons?

ABl

ACS.

There is a horizontal layer of the shells at a level of about 20 ft. above the sea at "Shell Point" about 2 mi. S.W. of Fitzroy House.

The exact place visited by Mr. Joyce is a little uncertain but seems to be immediately South of the Corral Creek shown on the map.

Mr. Joyce seems to think it may extend further than he saw.

2/ I have a sample which I shall be pleased to show you. It must contain a very high percentage of lime. ?Is there an analysis in reptiles. prly. under "Imperial Institute". x/

3/ "Shell Point" is well known at Fitzroy.

G.N. 27.iii.47

x pp. re. about analysis of lime deposit from samples sent to Imperial Institute?

ABl

1.4

ACS.

Regret unable to trace. Under Imp. Institute in Despatch Registers from 1924 onwards no correspondence recorded to S. of S. on subject.

W.H. 2/4.

Let us await Mr Joyce's report

B. 2/7 ABl

2.4

~~B.U. 15/7/47~~

FALKLAND ISLAND SOILS.

17 in 383/24 "Soil Analysis"

Colonial Secretary's letter No. 383/24, of 2nd July, 1924. Soil samples collected in East Falkland.

Lafonia Station.

Sample No. 1.

From camp adjacent to the coast at the upper reach of Darwin Harbour (Block 8). There is an average depth of approximately 7 inches of chocolate coloured soil over a subsoil of free working clay with which is mixed a soft sandstone rubble. Rock is found at an average depth of approximately 6 ft. This camp is dry and very healthy for stock. The vegetation is mostly heath (diddle-dee) and a very scant growth of fine grasses.

Sample No. 2.

From inland camp in the vacinity of "High Hill" (Block 25).
There is an average depth of 7 inches of black loam over a subsoil consisting of a free working yellow clay and soft sandstone rubble mixed. Rock is found at an average depth of approximately 5 feet. The vegetation consists of balsam bog (plentiful), some diddle-dee and a very scant growth of fine grasses.
This camp is dry and healthy for stock.

Sample No. 3.

From inland camp in the vicinity of Tranquilidad between Cutter Cove and Brenton Loch.
An average of 10 - 12 inches of peaty soil on rock. This camp is very wet during the greater part of the year and is not healthy sheep country. As is usual with this class of camp, the vegetation is almost exclusively white grass with a few fine grasses and herbs growing between.

Fitzroy Station.

Sample No. 4.

From camp adjacent to the coast at Pleasant Point (Block 15).
An average depth of approximately 12 inches of black loam over a subsoil of free working clay about 6 feet deep with rock underlying. This camp is dry and very healthy for stock. The vegetation consists of mixed tussock grasses.

Sample No. 5.

From inland camp at Pleasant Point (Block 15).
The camp from which this sample was taken is similar to that from which No. 4 was secured except that it is some distance from the coast.

Sample No. 6.

From inland camp about the centre of Block 2.
This camp appears to be in every way similar to that from which sample No. 5 was taken.

Sample No. 7.

From inland camp about the centre of Block 16.
This camp is very similar to that from which samples 4, 5 and 6 were taken excepting that the vegetation, in place of tussock pasture, is mostly small fern with a sprinkling of Christmas bush and some diddle-dee.

COLONIAL SECRETARY'S 25 APR 1947 FALKLAND ISLANDS

1/44c

Sparrow Cove Station.

Sample No. 8.

From inland camp about midway between Islet Point and Sparrow Cove (Block 57). A peaty formation varying in depth from 12 to 30 inches with rock underlying. It is very wet during the greater part of the year and is not healthy camp for stock. The principal vegetation is white grass tussock with rushes and moss between. This is considered very poor camp.

Sample No. 9.

From camp in the vicinity of the coast about the centre of Block 4.
A peaty formation similar to that from which sample No. 8 was taken, but the camp here is considerably drier. The vegetation consists of a mixture of diddle-dee, small fern and rushes with a few straggling roots of fine grass. This is very poor pasture and not healthy camp for stock.

San Carlos North Station.

Sample No. 10.

From camp adjacent to the coast at Careening Cove, Port San Carlos (Block 37). There is an average depth of approximately 8 inches of black loam overlying a subsoil consisting of a free working yellow clay which contains a quantity of soft sandstone rubble. This camp is dry and very healthy for stock.

Sample No. 11.

From camp about the centre of Block 36.
There is an average depth of approximately 10 inches of peaty soil over a subsoil of clay and rubble with rock at an average depth of about 6 ft. This is dry camp and good healthy sheep country. The vegetation consists of mixed tussock pasture.

Sample No. 12.

From inland camp about the centre of Block 42.
There is an average depth of approximately 2 feet of peaty soil overlying rock. This camp is very wet during the greater part of the year, and is not healthy sheep country. The vegetation is mostly white grass with some herbs and fine grasses between.

COLONIAL SECRETARY'S OFFICE
25 APR 1947
FALKLAND ISLANDS

13
449

San Carlos South Station.

Sample No. 13.

From camp at the head of the harbour (Port Sussex) (Block 28).
There is an average depth of 11 inches of black loam with a free working yellow clay subsoil about 1 foot deep with rock underlying. This is dry camp and good healthy sheep country. The vegetation is mostly diddle-dee and Christmas bush with a sprinkling of fine grasses.

Sample No. 14.

From inland camp about the centre of block 39.
There is an average of approximately 9 inches of black loam with a subsoil of yellow clay and soft sandstone rubble about 18 inches in depth overlying rock. This is dry camp and healthy for stock. The vegetation is mostly balsam bog with some Christmas bush, moss and a sprinkling of fine grasses. The carrying capacity of this country in its present condition is very small.

Sample No. 15.

From the centre of Block 74 (Bodie Peak).
About 18 inches of peaty soil over 12 inches of slate coloured clay with rock underlying. This camp is very wet and unhealthy for stock and can only be grazed during the summer months. The vegetation is white grass with a few herbs and fine grasses between.

Mrs. T.R. Robson's Station "Port Louis North".

Sample No. 16.

About 12 inches of black loam over a subsoil of yellow clay mixed with soft sandstone rubble. This camp is dry and healthy for stock, but in its present condition its carrying capacity is extremely low. The vegetable covering is fine grass, moss and some Christmas bush and diddle-dee.

FALKLAND ISLANDS.

SOILS.

Soil No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Moisture	12.56	14.49	13.28	13.88	10.88	10.72	7.03	12.44	13.75	14.76	11.15	13.36	8.35	9.39	9.47	9.16
Loss on Ignition minus Moisture	22.37	35.95	34.27	30.53	30.55	31.97	23.59	60.54	73.48	43.13	31.20	71.42	26.82	28.03	33.09	27.97
Nitrogen	0.65	1.152	1.01	1.09	1.07	1.104	0.731	1.845	1.786	0.69	0.950	1.481	0.811	0.915	1.057	1.088
Total P_2O_5	.0341	0.114	.094	.158	.136	.171	.0981	.1706	.1365	.0512	0.0853	0.128	.0853	.147	0.0725	0.209
Total K_2O	.4579	.1580	.2450	.2664	.2986	.2330	.3870	.1580	.1044	.3602	.5412	.1406	.4485	.3575	.2370	.3602
Total Na_2O	.2009	.1234	.1732	.1373	.1342	.1141	.1131	.1356	.1361	.1064	.1042	.1385	.1230	.1762	.1218	.1565
Available P_2O_5	.0116	.0312	.0198	.0167	.0263	.0359	.0109	.0070	.0114	.0145	0.0469	.0237	.0391	.0471	.0174	.0512
Available K_2O	.0441	.0266	.0637	.0477	.0458	.0272	.0376	.0594	.0410	.0146	.0348	.0495	.0820	.0310	.0400	.0543
Available Na_2O	.0664	.0572	.1238	.0634	.0721	.0507	.0426	.0752	.0716	.0308	.0341	.0731	.0637	.0690	.0703	.0847
Lime Requirement	0.530	0.827	0.665	0.577	1.045	1.185	0.91	1.595	1.810	0.932	1.145	1.810	0.905	1.040	1.255	0.885
% CaO	0.192	0.0605	0.0939	0.138	0.148	0.118	0.105	0.126	0.188	0.065	0.0675	0.0998	0.250	0.0800	0.0457	0.138

FALKLAND ISLANDS COLONIAL SECRETARY'S OFFICE 25 APR 1941

15

A.E.

1–7 give the background to these correspondence. I had not been much impressed by Mr. Joyce's researches & was awaiting his report.

2. Mr Fleurot collected soil samples from all over the Islands in 1946. They were sent home to Rothamsted with Mr Joyce.

3. 11 is the same as (27) in 383/24 letters.

4. We can do nothing else in get Mr Joyce's report: unless A.E. wishes to mention this d/o to Mr Barton (C.O.).

CBe
17.6

No. Nor do I propose to include reverse in the Report which would convey nothing to layman and little to most Camp Managers. It will be B.U. to the new AO when appointed.
MC 17/vi

Bu.
17.8

ABe
17.6

0102

2to 28.

1st August 67

26

The other day I sent you a telegram suggesting that if you visited the Ministry of Overseas Development it would be useful if you could look into the possibility of getting a soil survey provided out of U. K. Technical Aid funds.

The S.O.A. view, supported by the Natural Resources Committee, is that -

"Consideration be given to conducting a soil survey of all grazing land under 500' above sea level. It is further considered that if this is coupled with a geological survey it would be of great value to the economic development of the Islands and their pastoral industry.

25

The main reasons for an adequate soil survey are as follows:

(1) To reduce expenditure on experimentation.
(2) To stimulate interest in development of pasture and grassland.
(3) Investigation into trace element deficiency and its effect on animal health and nutrition.
N.B. Known instances of cobalt deficiency have occurred and others suspected."

The wording I have given is that provided by the S.O.A.

It was also felt that Technical Aid might well be able to provide a veterinary. Guillebaud and I think the idea worthy of consideration.

I am sorry to have burdened you with this but I feel that the personal touch might well be more productive than a paper approach to the Ministry.

(W.H. Thompson)

Sir Cosmo Haskard K.C.M.G., M.B.E.,
c/o Sir Robert Stanley K.B.E., C.M.G.,
80 Aberdeen Park,
Highbury,
LONDON N.5.
pmc.

BW 30.9.67

EXTRACT FROM MINUTES OF THE MEETING OF THE NATURAL RESOURCES

COMMITTEE HELD ON THE 24th JULY 1967.

He has also asked the Governor to look into the possibilities of getting aid for a soil survey of the Falkland Islands, possibly an investigation on the same lines as that of the economist.

GOVERNMENT TELEGRAPH SERVICE

FALKLAND ISLANDS

SENT

P2538 P4776 [redacted]401381 500 11/66 R. Ward 843

Number	Office of Origin	Words	Handed in at	Date
	Stanley			21.7.67

To

LTF HASKARD 01-226-2702 LONDON HOA/c

If you visit Ministry Overseas Development request you sound out possibility of aid for visit of soil sampling team to make comprehensive soil survey and visiting vet to look at animal side including disease control and our legislation stop Both these arose SOA

Thompson

Time AA

Copy in 1837/A

Soil Survey

It is requested that consideration be given to conducting a soil survey in the Falkland Islands of all grazing land under 500' above sea level. It is further considered that if this is coupled with a geological survey it would be of great value to the economic development of the Islands and their pastoral industry.

The main reasons for an adequate soil survey are as follows:-

(1) Reduce expenditure on experimentation.

(2) Stimulate interest in development of pasture and grassland.

(3) Investigation into trace element deficiency and its effect on animal health and nutrition.

N.B. Known instances of cobalt deficiency have occurred and others suspected.

See 27

22

3rd July, 1948.

Dear Carter,

19 In his letter to me dated the 11th of September, 1947, about research into Falkland Islands soils, Barton stated that Joyce of the Falkland Islands Dependencies Survey had had access to soil samples which had been sent to the Director, Discovery Research, British Museum (Natural History) South Kensington, S.W.7, in 1946, and that he (Joyce) was being pressed for his report.

So far the report has not turned up and I should be grateful if you would let me know what the position is.

Yours sincerely,

(Sgd.) A. B. MATHEWS

P.A. Carter, Esq.,
COLONIAL OFFICE.

VP.

10/9/48
3/8
BM
3/8

23

Y.E.

may have gone with him to London?

2. Pl. see also 45/45 and SF 0319 below.

[signature] 14.9

I saw Mr. Joyce in London (he has a Leverhulme scholarship) and he arranged to take me down to Rothamsted where, as I understand, the soils are under examination. He did not turn up.

Files below minuted.

MC. 4 IX

15/12/49

[illegible] 1948 [illegible]

See 19 in 0319

B.U. [illegible] 17/9/48

[illegible] 16/9

[illegible] 2019

C.S.O. No..................... 21

Inside Minute Paper.

Sheet No..............

A.C.S.

50 pl. 'Phoned Mr. Browning, Ag. Dept. who reports that samples sent in to Mr. Evans (late O. i/c. Ag. Dept.) from Carcass Island and Port Stephens were sent to U. K. in care of Mr. Joyce in February, 1947.

W. H.
1.7.48.

YE.

5-21 We might ask Mr Carter w.r.t. 19 what is being done about Mr Joyce's report?

2.7

Yes. MC. 2/vii d/o

acs
Dept. M
2.7

Colonial Office,
The Church House,
Great Smith Street,
S.W.1.

88334/47

11th September, 1947.

Dear Mathews,

Thank you for your letter of the 11th August, about Falkland Islands soil samples.

I may have been wrong in my letter to the Governor in referring to soil samples brought home by Joyce. He has had access to the samples to which you refer and I am pressing him for his report.

Yours sincerely,

Juxon Barton.

(Juxon Barton)

A. B. MATHEWS, ESQ.

BM 15/2/45
[illegible] 31/

CO

When I was at Caicos Island, Jason Hanson told me he had sent soil samples in last year at Government request that had no report upon them.

Another farmer told me a similar story of Cubbs's time – he had gone to great trouble to collect samples from different areas and found later that precisely nothing had been done about them. MC 30 vi

18

11th August, 1947.

My Dear Barton,

1 in 0214 – Lime Deposits.

In your confidential letter of the 12th of April, 1947, to the Governor you referred to Joyce's researches into soils.

This is to let you know that other soil samples from all parts of the Falkland Islands were sent in December, 1946, to

The Director,
Discovery Research,
British Museum (Natural History),
South Kensington,
LONDON, S.W.7.

and you may care to put them in touch with Rothamstead and vice versa.

Yours sincerely,

(Sgd.) A. B. MATHEWS

Reply at 19

Juxon Barton, Esq., C.M.G., O.B.E.,
COLONIAL OFFICE.

VP.

Br. (15) ~~30.8~~ 28.x
ABC 31.8 1345

EXTRACT FRM LETTER FROM J.G. GIBBS OF THE 30th July, 1946.
Original filed in P/235 - Dr. Gibbs' P/F.

16

See 137 on P/235.

.....

PPs. Sorry there is still one more point. The Geologist to FIDS Joyce by name, has requested several soil samples for geomorphological survey. They could be collected in a few days by Fleuret, one each from the ground over each geological formation (see Baker's Report, 1924?) Joyce and Niddries marked the locations for samples. They should be taken from a spot that can be re-identified by cross bearings to topographical features, with a clean spade free from contamination with rust, and each sample should be separated as different types of soil are revealed. Each location should be given a special letter and the different types of soil from the surface to the rock layer numbered in sequence e.g. A1., A2., ... A.x. etc. Certain letters have already been used and are listed with the Department. There are a number of bags suitable for samples in the Ag. Office. Samples should be addressed "Director, Discovery Research, British Museum Natural History, South Kensington, for attention Pedologist and particulars of their origin should accompany them.

The object of these samples is to determine the origin of the peat and the amount of weathering of the underlying rock if possible. Originally it was intended to take the samples with an auger, but a telegram was received recently saying that the different "Horizons" were clearly distinguishable, and that sampling with a spade was sufficient. If the soil is deep an auger would be more easy to handle than a spade.

The horizons are the different layers of soil. Each should be kept separate and a scraping of the basic rock should be included if it is possible, in a separate bag. Thus the surface fibrous peat might make sample P.1.; the underlying layer to the level of the clay would make P.2.; A thin sandy quartzy layer on the surface of the clay would be P.3.; the underlying yellow clay would be P.4.; and the blue lower clay P.5.; the scraping of basic rock P.6.

One or two samples of soils for the determination of pollen contents have been requested. These should be taken at two inch intervals, from the surface of the soil to the clay layer. Samples about two inch cubes are sufficient for this. I would suggest that one suitable site would be one of the peat banks on Stanley Common, and a second the site of the "buried forest" at West Point Island. Sufficient bags should be marked and sent to Mr. Napier, Say 40 or 50. This would give an indication of the botanical history of the Colony and probably indicate whether the "buried forest" is indeed buried or "drift wood". The various authorities are not unanimous about it.

The Discovery people have agreed also to make analyses of Falkland Islands Soils for Agricultural purposes and samples should be addressed as previously indicated "Director Discovery Research etc." The Rowett Institute would also accept some samples (requested by one of the expedition). The Pollen samples should be indicated as such. It would be interesting to compare samples from both white grass camp and diddle-dee bogs.

We circularised the Camp managers concerning soil samples about four months ago, but with their natural self sufficiency they have neither acknowledged the letter nor made inquiries. Sample bags were sent to West Point Island and Carcass Is, and will be used by these people. Modern analyses and much easier and very much more comprehensive than any which were possible 20 years ago. I think the opportunity of having them made should be accepted, and the chances are greater if the samples can be sent fairly soon before the workers become clutteres with material from the Dependencies.

The samples should be air dried if possible before despatch.
N.B. Avoid contamination with rust.

(intld.) J.G.G.

17

EXTRACTS FROM P/235 - Dr. Gibbs. P/F.

17

a

.....

See 168.B. in P/235

What happened about the soil and pollen samples?

(intld.) M.C.

29/vii.

Hon. Col. Sec.

b

See 170 B. in P/235

.....

These samples were sent by Mr. Evans in Dec. last to

Director,
Discovery Research,
British Museum (Natural Histroy),
South Kensington,
LONDON, S.W.7.

but to date nothing further has been heard.

(intld.) J.B.B.
C i/c Ag. Dept.
31/7/47

c

H.E.

.....

B above

Yes.

2. Soil and Pollen samples. Pl. see B of 170. We might link this up to Mr. Barton (C.O.) with the pp. about Mr. Joyce's survey.

See 171 para 2 in P/235.

(intld.) A.B.M.
1.8.

FALKLAND ISLAND SOILS.

Colonial Secretary's letter No. 383/24, of 2nd July, 1924.

383/24
"Soil Analysis"

Soil samples collected in East Falkland.

Lafonia Station.

Sample No. 1.

From camp adjacent to the coast at the upper reach of Darwin Harbour (Block 8). There is an average depth of approximately 7 inches of chocolate coloured soil over a subsoil of free working clay with which is mixed a soft sandstone rubble. Rock is found at an average depth of approximately 6 ft. This camp is dry and very healthy for stock. The vegetation is mostly heath (diddle-dee) and a very scant growth of fine grasses.

Sample No. 2.

From inland camp in the vacinity of "High Hill" (Block 25).
There is an average depth of 7 inches of black loam over a subsoil consisting of a free working yellow clay and soft sandstone rubble mixed. Rock is found at an average depth of approximately 5 feet. The vegetation consists of balsam bog (plentiful), some diddle-dee and a very scant growth of fine grasses.
This camp is dry and healthy for stock.

Sample No. 3.

From inland camp in the vicinity of Tranquilidad between Cutter Cove and Brenton Loch.
An average of 10 - 12 inches of peaty soil on rock. This camp is very wet during the greater part of the year and is not healthy sheep country. As is usual with this class of camp, the vegetation is almost exclusively white grass with a few fine grasses and herbs growing between.

Fitzroy Station.

Sample No. 4.

From camp adjacent to the coast at Pleasant Point (Block 15).
An average depth of approximately 12 inches of black loam over a subsoil of free working clay about 6 feet deep with rock underlying. This camp is dry and very healthy for stock. The vegetation consists of mixed tussock grasses.

Sample No. 5.

From inland camp at Pleasant Point (Block 15).
The camp from which this sample was taken is similar to that from which No. 4 was secured except that it is some distance from the coast.

Sample No. 6.

From inland camp about the centre of Block 2.
This camp appears to be in every way similar to that from which sample No. 5 was taken.

Sample No. 7.

From inland camp about the centre of Block 16.
This camp is very similar to that from which samples 4, 5 and 6 were taken excepting that the vegetation, in place of tussock pasture, is mostly small fern with a sprinkling of Christmas bush and some diddle-dee.

COLONIAL SECRETARY'S 25 APR 1947 FALKLAND ISLANDS

1 44c

Sparrow Cove Station.

Sample No. 8.

From inland camp about midway between Islet Point and Sparrow Cove (Block 57). A peaty formation varying in depth from 12 to 30 inches with rock underlying. It is very wet during the greater part of the year and is not healthy camp for stock. The principal vegetation is white grass tussock with rushes and moss between. This is considered very poor camp.

Sample No. 9.

From camp in the vicinity of the coast about the centre of Block 4.
A peaty formation similar to that from which sample No. 8 was taken, but the camp here is considerably drier. The vegetation consists of a mixture of diddle-dee, small fern and rushes with a few straggling roots of fine grass. This is very poor pasture and not healthy camp for stock.

San Carlos North Station.

Sample No. 10.

From camp adjacent to the coast at Careening Cove, Port San Carlos (Block 37). There is an average depth of approximately 8 inches of black loam overlying a subsoil consisting of a free working yellow clay which contains a quantity of soft sandstone rubble. This camp is dry and very healthy for stock.

Sample No. 11.

From camp about the centre of Block 36.
There is an average depth of approximately 10 inches of peaty soil over a subsoil of clay and rubble with rock at an average depth of about 6 ft. This is dry camp and good healthy sheep country. The vegetation consists of mixed tussock pasture.

Sample No. 12.

From inland camp about the centre of Block 42.
There is an average depth of approximately 2 feet of peaty soil overlying rock. This camp is very wet during the greater part of the year, and is not healthy sheep country. The vegetation is mostly white grass with some herbs and fine grasses between.

COLONIAL SECRETARY'S OFFICE
25 APR 1947
FALKLAND ISLANDS
13
449

San Carlos South Station.

Sample No. 13.

From camp at the head of the harbour (Port Sussex) (Block 28).
There is an average depth of 11 inches of black loam with a free working yellow clay subsoil about 1 foot deep with rock underlying. This is dry camp and good healthy sheep country. The vegetation is mostly diddle-dee and Christmas bush with a sprinkling of fine grasses.

Sample No. 14.

From inland camp about the centre of block 39.
There is an average of approximately 9 inches of black loam with a subsoil of yellow clay and soft sandstone rubble about 18 inches in depth overlying rock. This is dry camp and healthy for stock. The vegetation is mostly balsam bog with some Christmas bush, moss and a sprinkling of fine grasses. The carrying capacity of this country in its present condition is very small.

Sample No. 15.

From the centre of Block 74 (Bodie Peak).
About 18 inches of peaty soil over 12 inches of slate coloured clay with rock underlying. This camp is very wet and unhealthy for stock and can only be grazed during the summer months. The vegetation is white grass with a few herbs and fine grasses between.

Mrs. T.R. Robson's Station "Port Louis North".

Sample No. 16.

About 12 inches of black loam over a subsoil of yellow clay mixed with soft sandstone rubble. This camp is dry and healthy for stock, but in its present condition its carrying capacity is extremely low. The vegetable covering is fine grass, moss and some Christmas bush and diddle-dee.

FALKLAND ISLANDS.

SOILS.

Soil No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Moisture	12.56	14.49	13.28	13.88	10.88	10.72	7.03	12.44	13.75	14.76	11.15	13.36	8.35	9.39	9.47	9.16
Loss on Ignition minus Moisture	22.37	35.95	34.27	30.53	30.55	31.97	23.59	60.54	73.48	43.13	31.20	71.42	26.82	28.03	33.09	27.97
Nitrogen	0.65	1.152	1.01	1.09	1.07	1.104	0.731	1.845	1.786	0.69	0.950	1.481	0.811	0.915	1.057	1.088
Total P_2O_5	.0341	0.114	.094	.158	.136	.171	.0981	.1706	.1365	.0512	0.0853	0.128	.0853	.147	0.0725	0.209
Total K_2O	.4579	.1580	.2450	.2664	.2986	.2330	.3870	.1580	.1044	.3602	.5412	.1406	.4485	.3575	.2370	.3602
Total Na_2O	.2009	.1234	.1732	.1373	.1342	.1141	.1131	.1356	.1361	.1064	.1042	.1385	.1230	.1762	.1218	.1565
Available P_2O_5	.0116	.0312	.0198	.0167	.0263	.0359	.0109	.0070	.0114	.0145	0.0469	.0237	.0391	.0471	.0174	.0512
Available K_2O	.0441	.0266	.0637	.0477	.0458	.0272	.0376	.0594	.0410	.0146	.0348	.0495	.0820	.0310	.0400	.0543
Available Na_2O	.0664	.0572	.1238	.0634	.0721	.0507	.0426	.0752	.0716	.0308	.0341	.0731	.0637	.0690	.0703	.0847
Lime Requirement	0.530	0.827	0.665	0.577	1.045	1.185	0.91	1.595	1.810	0.932	1.145	1.810	0.905	1.040	1.255	0.885
% CaO	0.192	0.0605	0.0939	0.138	0.148	0.118	0.105	0.126	0.188	0.065	0.0675	0.0998	0.250	0.0800	0.0457	0.138

FALKLAND ISLANDS ★ COLONIAL SECRETARY'S OFFICE ★ 25 APR 1947

15

H.E.

1–7 give the background to this correspondence. I had not been much impressed by Mr. Joyce's researches & was awaiting his report.

2. Mr. Fleurent collected soil samples from all over the Islands in 1946. They were sent home to Rothamsted with Mr. Joyce.

3. All is the same as (27) on 383/24 below.

4. We can do nothing here to get Mr. Joyce's report: unless H.E. wishes to mention this d/o to Mr. Barton (C.O.).

CBE
17.6

14

No. Nor do I propose to include reverse in the Report which would convey nothing to layman and little to most Camp Managers. It will be B.U. to the new DO when appointed.

MC. 17/vi

B.U.
17.8
CBE
17.6

10
444

THE ROWETT RESEARCH INSTITUTE,
BUCKSBURN,
ABERDEENSHIRE.

4/10/46

Dr J. G. Gibbs
% New Zealand House
415 Strand
London

Dear Dr Gibbs

Further brief conversation about the conditions on the Falkland Islands. I have now had a copy prepared of the notes and figures about the soil samples of which I showed you the original data. I hope that you will find these of some interest and value.

I trust that you felt the somewhat long visit North was worth while. We were very glad to meet you and talk over problems & to revive our interest in the Islands.

With best wishes

Yours sincerely

W Godden

TELEPHONE: BUCKSBURN, 8. TELEGRAMS: "NUTRITION, ABERDEEN." RAILWAY: BUCKSBURN, L.N.E.R.

44

THE ROWETT RESEARCH INSTITUTE

Director: D. P. CUTHBERTSON, M.D., D.Sc.

Secretary and Treasurer: W. MIDDLETON, N.D.A.

383/24 (102)

COLONIAL SECRETARY'S OFFICE 25 APR 1947 FALKLAND ISLANDS

BUCKSBURN,
ABERDEENSHIRE.

Ref. D/1/46.

8th November, 1946.

Dr. J.G. Gibbs,
c/o New Zealand House,
415, Strand,
London, W.C.2.

Dear Dr. Gibbs,

Many thanks for your letter. I am sorry to hear that your plans have been upset owing to the illness of your small son. I hope he will soon be fit again.

With regard to your proposal as to work on the soils of Falkland Islands, I am afraid we could not now undertake work along those lines. We are essentially a Nutrition Station and the work we did previously was really incidental to the pasture work. Your best plan is to write to -

The Director,
The Imperial Bureau of Soil Science,
Rothamsted Experimental Station,
Harpenden, Herts.

and state what you have in mind and ask for his advice. He will probably pass your letter on to Dr. W.G. Ogg, the Director of the Rothamsted Station, or, if you refer to spectrographic analysis, to Dr. D.N. McArthur of the Macaulay Soil Research Institute, Craigiebuckler, Aberdeen, since they specialize in spectrograph work. They might agree to second a man or would advise you as to your best line of action.

N.B. If you wish, by all means append the data to your report. Any acknowledgment might simply read "Data communicated privately by Mr. W. Godden, The Rowett Research Institute, Aberdeen, from analysis of soil samples submitted in 1924."

I hope you will be able to get your plans carried out and that the work will provide you with the information and guidance which you require. We were only too happy to be of any help to you.

With best wishes,

Yours sincerely,

W. Godden

H.C.S. For your information & records. Publication?

Hereunder, the detailed analyses of Falkland Soils made by Dr Godden in 1924; which I was unable to locate on papers within the Colony. A further set of analyses from the same P.T.O.

See 27 in 383/24 Soil analysis

locations would be very interesting as indicative of the change in soil fertility over 23 years. What about interesting Joyce in it if he is still about

J. Chibbs 12/2/47

6

CS. Please BU on file 0102. Have we had anything more from London? [initials] 9/10/67 [signature] 30

SI 9/10

Notes on a Meeting held at the Ministry of Overseas Development on the 14th August, 1967.

Present:

Sir Cosmo Haskard, K.C.M.G., M.B.E.	Governor of the Falkland Islands
Mr. A. St. J. Sugg, C.M.G.	Commonwealth Office (D.T.D.)
	Ministry of Overseas Development:-
Mr. A.R. Melville, C.M.G.	Agricultural Adviser
Mr. M.F.H. Selby	Deputy Agricultural Adviser
Mr. A.L.C. Thorne, C.B.E.	Deputy Animal Health Adviser
Mr. A.B. Rains	Directorate of Overseas Surveys, Land Resources Division.
Mr. D.M. Lang	Directorate of Overseas Surveys, Land Resources Division.
Mr. A.E. Phillips	Caribbean and Latin American Department.
Miss J.A. Chambers	Natural Resources Department

A meeting was held at the Ministry of Overseas Development on the 14th August to enable Sir Cosmo Haskard, Governor of the Falkland Islands, to discuss with the Agricultural and Animal Health Advisory staff and members of the Directorate of Overseas Surveys, problems affecting the Falkland Islands.

Sir Cosmo Haskard said that the Falkland Islands relied on wool exports from sheep to keep their economy going and that there was a definite need to improve methods of sheep production. There was a shortage of labour in the Colony. There had been a move towards better work by individual farmers by the use of silage, fencing and rotation of stock but other farmers had lagged behind. There were minor sheep diseases. Sir Cosmo Haskard said that he was expecting to receive a letter about the outcome of the meeting of the Sheep Owners Association which took place in mid July. He anticipated requests stimulated by the Acting Governor for a soil survey and for a visit by a Veterinary Officer who would be able to spend a reasonable time in the Colony giving advice on general matters on farms. The full time employment of a Veterinary Officer would not be likely to be supported. Little was known about soils. Farmers did not know how to improve their soils. There had never been a geological survey of the Islands.

Somewhat misquoted

Sir Cosmo Haskard said that he would be glad if the Ministry of Overseas Development would indicate what their views would be on these problems to which the Sheep Owners Association had been encouraged to give some thought, by the Government of the Falkland Islands. He also pointed out that the Falkland Islands might have to seek financial aid in future.

/Mr. Thorne

Copy in 0102/A

Mr. Thorne referred to the problems of the poverty of the pasture and minerals in the soil. Productivity needed to be looked into as well as animal diseases. Mr. Melville said that someone with practical ideas was needed - an Animal Husbandry Specialist. A link arrangement could perhaps be formed with a university or research organisation in the United Kingdom. A discussion followed and there was general agreement that a team of experts would be needed and that organisations should be involved at an early stage.

Mr. Lang discussed the need for a soil survey. He said that the Land Resources Division could undertake to determine morphological units from air photographs. It would, however, be necessary for some soil survey to take place based on the morphological map. He suggested that Mr. Draycott who is in this country could perhaps go back with information about the digging of pits and could send back samples from selected sites. This would provide a basic framework; experts might then have to be brought in, for example, from the Macauley Institute.

Sir Cosmo Haskard said that Mr. C.D. Young the Grasslands Officer, appointed by the Ministry of Overseas Development was attempting to improve the grass and to find out which grasses would grow. He was hoping to interest farmers in more up-to-date methods. He had in mind to have a Central Experimental farm, but it was easier for each farm to have experimental plots. Grasses and clover were being tried out. Sir Cosmo Haskard thought that Mr. Young could obtain the samples of soil provided he was told what was required. He thought that Mr. Young was due to leave the Falklands in February. Mr. Lang thought it might be easier to brief Mr. Draycott who was in the U.K. and suggested that perhaps Mr. Draycott could then pass the information on to Mr. Young. Sir Cosmo Haskard said that he was in favour of Mr. Young doing the initial work of collecting samples.

Mr. Rains considered herbage analysis was essential and asked whether Mr. Young was sending home samples. The Grassland Institute at Hurley could undertake the analysis.

It was agreed that the Directorate of Overseas Surveys would undertake the initial work for a general soil survey. Mr. Lang considered sixty or seventy pits would be needed at selected sites. A number of samples would have to be taken at different levels. He thought about three months' work would be needed. It was decided that it would be necessary to look up Mr. Young's particulars on his file; if any further information was needed a telegram could be sent to the Falkland Islands. (Mr. Young's particulars have since been examined by Messrs. Selby, Lang and Rains and it was felt that he was fully competent to undertake the collection of samples under direction of Land Resources Division.) Sir Cosmo Haskard said that it would be difficult to obtain labour after the 1st November up to approximately the 15th March. It was agreed that Land Resources ~~Development~~ Division of the Directorate of Overseas Surveys would see how quickly they could get on with the initial study, bearing in mind their present commitments. No cost would arise from the preliminary mapping and survey to be undertaken by the Directorate of Overseas Surveys.

Mr. Selby said that costs would arise for the experts and asked what source of funds was appropriate. It was stated that C.D. & W. funds would not be available. Mr. Phillips said that the Ministry of Overseas Development would be prepared to spend some technical assistance on the Falkland Islands at the official request of the Falkland Islands' Government. Very little had been spent on the Falkland Islands in the past. Mr. Phillips asked whether the costs would arise in the present financial year, or in 1968/9. Sir Cosmo Haskard said that he would like something done soon.

/As

As a result of discussion, it was agreed that an Animal Husbandry Specialist (Sheep) and a Veterinary Investigation Specialist would be needed to work in the Falkland Islands for a period of not less than six months. It would be convenient if the two specialists could work as a team to study the inter-related problems of Animal Husbandry, Nutrition and Management.

It might be necessary, subsequently, for other specialists to become involved in sheep development in the Falkland Islands. It was thought, therefore, that there would be advantages in establishing a link with suitable United Kingdom organisations who might take an interest in the problems and provide for visits of additional experts as may be necessary. Appropriate bodies who might be approached to do this were put in the following order of priority:

1. The Moredon Institute, together with the Hill Farming Research Organisation, both at Edinburgh.

2. The University of Bangor, coupled with the Veterinary Investigation Centre for Wales.

3. The University of Aberdeen.

It was agreed that the Agricultural and Animal Health Advisers would contact the organisations concerned.

It was also agreed that after contact had been made with appropriate institutions, advisers would try and draw up an outline scheme to cover the integrated survey proposed above, which could form the basis of a request to be submitted by the Government of the Falkland Islands.

29.

The Falkland Islands Sheepowners Association,
(LOCAL COMMITTEE)
STANLEY, FALKLAND ISLANDS.

18th August, 1967.

COLONIAL SECRETARY'S OFFICE
18 AUG 1967
FALKLAND ISLANDS

6/6.

SD 21/8 RA.

The Colonial Secretary,
The Secretariat,
Stanley.

1/BOB.

Dear Sir,

Consequent on discussion at the Annual Meeting of this Association in July 1967 I am directed to request that consideration be given to conducting a soil survey in the Falkland Islands of all grazing land under 500' above sea level. It is further considered that if this is coupled with a geological survey it would be of great value to the economic development of the Islands and their pastoral industry.

/ See 28.

The main reasons for an adequate soil survey are as follows :-

(1) Reduce expenditure of experimentation.

(2) Stimulate interest in development of pasture and grassland.

(3) Investigation into trace element deficiency and its effect on animal health and nutrition.

N.B. Known instances of cobalt deficiency have occurred and others suspected.

Yours faithfully,

B. Barnes

SECRETARY.

Acid
JA
A8.67

10.1.67
BU ~~30.9.67~~

32

NATURAL RESOURCES

Memorandum for the information of Executive and Legislative Councils

Summary of Notes on a Meeting held
at the Ministry of Overseas Development
on 14th August 1967

W1
3/hw

A meeting was held at the Ministry of Overseas Development on 14th August to enable Sir Cosmo Haskard to discuss with the Agricultural and Animal Health Advisory staff and members of the Directorate of Overseas Surveys problems affecting the Falkland Islands.

Present: Mr A. St.J. Sugg, CMG, Commonwealth Office

and the following officers of the Ministry of Overseas Development:

Mr A.R. Melville, C.M.G., Agricultural Adviser
Mr M.F.H. Selby, O.B.E., Deputy Agricultural Adviser
Mr A.L.C. Thorne, C.B.E., Deputy Animal Health Adviser
Mr A.B. Rains, Directorate of Overseas Surveys, Land Resources Division
Mr D.M. Lang, Directorate of Overseas Surveys, Land Resources Division
Mr A.E. Phillips, Caribbean and Latin American Department
Miss J.A. Chambers, Natural Resources Department

Sir Cosmo Haskard described the economy of the Falkland Islands and emphasised the Colony's present dependence on wool; there was a shortage of labour in the Colony; there had been a move towards improved methods of farming but there was still much to be done.

Sir Cosmo Haskard felt that in two respects the Ministry of Overseas Development could give welcome material assistance. One was a comprehensive soil survey of the islands; the other was an authoritative report by a veterinary specialist on the livestock of the Colony. Sir Cosmo Haskard would be glad if the Ministry of Overseas Development would indicate what their views would be on these problems. He also pointed out that the Falkland Islands might have to seek financial aid in future.

Mr Thorne referred to the problems of the poverty of the pasture and minerals in the soil. Productivity needed to be looked into as well as animal diseases.

Mr Melville said that someone with practical ideas was needed - an animal husbandry specialist. A link arrangement could perhaps be formed with a university or research organisation in the United Kingdom. A discussion followed and there was general agreement that a team of experts would be needed and that organisations should be involved at an early stage.

Mr Lang discussed the need for a soil survey. He said that the Land Resources Division could undertake to determine morphological units from air photographs. It would, however, be necessary for some soil survey to take place based on the morphological map. He suggested that Mr Draycott could perhaps take back to the Falkland Islands information about the digging of pits and could send back to London samples from selected sites. This would provide a basic framework; experts might then have to be brought in, for example, from the Macauley Institute.

Sir Cosmo Haskard described the work being undertaken by Mr C.D. Young, the Grasslands Officer, recruited by the Ministry of Overseas Development. He thought that Mr Young could obtain the samples of soil provided he was told what was required. Mr Young was due to leave the Falkland Islands early in 1968. Mr Lang thought it might be easier to brief Mr Draycott who was in the United Kingdom on leave and suggested that perhaps Mr Draycott could then pass the information on to Mr Young.

Mr Rains considered herbage analysis was essential. The Grassland Institute at Hurley could undertake the analysis.

It was agreed that the Directorate of Overseas Surveys would undertake the initial work for a general soil survey. Mr Lang considered sixty or seventy pits would be needed at selected sites. A number of samples would have to be taken at different levels. He thought about three months' work would be needed. Mr Young's qualifications were examined by Messrs Selby, Lang and Rains and it was felt that he was fully competent to undertake the collection of samples under direction of Land Resources Division.

Sir Cosmo Haskard said that it would be difficult to obtain labour after the 1st November up to approximately 15th March. It was agreed that the Land Resources Division of the Directorate of Overseas Surveys would see how quickly they could get on with the initial study, bearing in mind their present commitments. No cost would arise from the preliminary mapping and survey to be undertaken by the Directorate of Overseas Surveys.

Mr Phillips said that the Ministry of Overseas Development would be prepared to give technical assistance to the Falkland Islands at the official request of the Falkland Islands Government. Very little had been spent on the Falkland Islands in the past. Mr Phillips asked whether the costs would arise in the present financial year or in 1968/69. Sir Cosmo Haskard said that he would like something started as soon as possible.

As a result of discussion, it was agreed that an animal husbandry specialist (sheep) and a veterinary investigation specialist would be needed to work in the Falkland Islands for a period of not less than six months. It would be convenient if the two specialists could work as a team to study the inter-related problems of animal husbandry, nutrition and management.

It might be necessary subsequently for other specialists to become involved in the problems of sheep development in the Falkland Islands. It was thought therefore that there would be advantage in establishing a link with suitable United Kingdom organisations who might take an interest in the problems and provide for visits of additional experts as may be necessary. Appropriate bodies who might be approached to do this were put in the following order of priority:

1. The Moredon Institute, together with the Hill Farming Research Organisation, both at Edinburgh.
2. The University of Bangor, coupled with the Veterinary Investigation Centre for Wales.
3. The University of Aberdeen.

It was agreed that the Agricultural and Animal Health Advisers would contact the organisations concerned. After contact had been made with appropriate institutions, advisers would try and draw up an outline scheme to cover the integrated survey proposed above which could form the basis of a request to be submitted by the Falkland Islands Government.

Note: A further communication from the Ministry of Overseas Development is now (October 1967) awaited.

Spare copy for: Mr Rains
Mr Lang

31

Copy

11th August 1967

Ref.No. LRD/N/2

A. St.J. Sugg Esq.,
Dependent Territories Division,
Commonwealth Office,
London S.W.1

d/o

C.S. This helps to fill in some of the background and should be read in conjunction with (30) which it precedes in date.
Falklands Officer should see please.
Seen but G.O.
Ro 31/10/67

ref: ASSISTANCE TO THE FALKLAND ISLANDS AND YOUR YC 7/6 OF 2ND AUGUST 1967

Arising from your letter as above and the reports by Mr William Davies and Mr A.R. Wannop, Rains of this Division has provided the following notes:-

"Falkland Islands Soil Survey Inquiry

The detailed mapping of the Falkland Islands soils could be undertaken. There is complete photographic cover (flown Oct/Nov. 1956 at 12,500 ft) and maps at 1:50,000 and 1:250,000 are available. The geomorphology could be elucidated using Baker's (1922) description of the geology and the subsequent reports by Joyce (1949/1950) and by Adie (1953). Davies (1939) provides an outline of the vegetation and a map of the communities which to some extent indicates the deep peat areas.

The soil survey would presumably be part of an integrated survey which would assess land capability; carried to its conclusion in this way I would have serious misgivings about the value of such a survey and of the suitability of L.R.D. staff to undertake it. It is a cool temperate area comparable with marginal land in western and northern parts of Britain.

The recommendations contained in the report by Davies were never implemented because of the second world war. In 1956 the Falkland Island Company with the assistance of Rothamsted investigated some soils and also the use of sea shells as a possible source of calcium. (Freight charges make the cost of imported lime astronomical).

The most recent report by Wannop (1961) whose experience of hill farming and sheep husbandry in Britain was unrivalled, indicates that the only solution must be research which is subsequently implemented.

It is recognised that the climate and the problems of marketing are responsible for the development of and dependence on wool, but for approximately a century the only investment has been in fencing while there has been a steady deterioration of the natural pasture through the lack of any satisfactory management.

Because camps are so large the investment in fencing is relatively modest (approximately 8/- per acre at current prices); additional expenditure on fencing would facilitate rotational grazing and could be expected to improve the carrying capacity. The output from the unimproved natural pastures is 1.3/5 lb wool per acre per year and this low return has undoubtedly discouraged attempts to improve properties.

The urgent need is for research in both plant and animal problems - including major and micro plant nutrients, the introduction and assessment of grasses and legumes, the investigation of improved pastures, both establishment and subsequent management and the problems of sheep husbandry particularly nutrition. In every case the solutions will have to be translated into economic practicalities, but this proviso does not lessen the need for this work to be done.

/....

Copy in 0102/A

In short, if there is any serious attempt to develop a modest research programme then a survey will be necessary, but a survey without a research programme will be of relatively little value. The Land Resources Division has been mainly concerned with tropical and sub-tropical areas and has only limited experience of cool temperate areas although one member has spent some time in the Falkland Islands."

As indicated on the telephone to you this morning, and in my telephone discussions with Melville and Thorne, Agricultural and Deputy Animal Health Advisers in O.D.M., I think that the research and at least the detailed survey aspects could best be handled by an O.D.M. supported University and/or Hill Farming Research Centre project. We in this Divison could assist with the preparation and production of basic framework maps and print laydowns. As agreed in our telephone conversations, A.Blair Rains who handles pasture appraisal matters in this Division, and D.M. Lang, soil scientist, who before becoming a soil scientist served as a Meteorological Officer in the Falkland Islands, will attend the meeting with the Governor of the Falkland Islands at 2.30 p.m. on Monday, 14th September, in Room 629 of the O.D.M. annexe. They will take with them the Davies and Wonnacp reports.

Sgd. P.C. Chambers
Deputy Director.

cc. A.R. Melville Esq., C.M.G.
Agricultural Adviser,
O.D.M., A.624.

A.L.C. Thorne Esq.,
Deputy Animal Health Adviser,
O.D.M., A.605 (as Sugg is moving his office over the weekend, I am sending his copy to you).

D/22/59

5th June, 68.

Dear Dr. Clapperton,

I shall be obliged if you will let me have £39. 10s. in settlement of the attached account for your messing when at South Georgia. We have not raised any charges in respect of lodging and services.

I hope you arrived home safely and not too much ladened down with our soil samples.

Yours sincerely,

(W.H. THOMPSON)
COLONIAL SECRETARY.

Dr. C. Clapperton.

c.c. A.O.S.G.
c.c. Acting Col. Treas.
c.c. Soil Survey File. √ S1

ENCL:

SC

CS for filing please
Ch 30/5

Gd. 31/5

30 May 1968

You will remember that in August last year there was a meeting at your Ministry about the Falkland Islands which John Sugg and I attended.

Arising out of that meeting a soil survey of the Falklands has been started and the position now is that 33 of the 60 samples requested have been returned to England and are presumably now with the Land Resources Division of the Directorate of Overseas Surveys.

I am sending for your information a copy of a progress report dated 24th May which was considered last week by our newly formed Development Committee here. This committee has absorbed our former Natural Resources Committee and its chairman is Mr Sydney Miller, J.P., who is an elected member of Legislative Council and an appointed member of Executive Council here.

Mr Miller is leaving Stanley for England at the end of this week and is due to arrive in London about 7th June. He would be very glad of an opportunity to meet those concerned with the soil survey at the English end and it occurred to me that the best way to arrange this would be for me to ask you whether you would be good enough to lay on a meeting.

As you will see from the progress report, our Development Committee was asked to recommend the next step which should be taken. The committee came out strongly in favour of follow-up action; it was felt that it would be beneficial if an animal health specialist and a veterinary specialist were to work in the Colony for a reasonably lengthy period.

Mr Miller is farm manager at Roy Cove, a 74,000 acre farm in West Falkland, where he has pioneered grassland improvement. He can therefore speak with authority on our problems here and I am sure that he will be able to explain how the time and money spent on further research in the Falkland Islands can result in increased efficiency on the Islands' farms.

Mr Miller is due to visit Tasmania in August ~~and so~~ before returning to the Falkland Islands. I imagine that he will be getting in touch with you very soon after his arrival in England and so that he should know what I have written I am giving him a copy of this letter. I am also sending a copy of this letter to John Sugg in the Commonwealth Office for his information.

Ch

M.F.H. Selby Esq., O.B.E.

P.T.

42

0102

30th April, 68.

Dear Sirs,

Soil Survey in the Falkland Islands.

The only reference I have on my file which may be of assistance to you is your LRD/W/2 of the 11th August, 1967, addressed to Mr. Sugg in the Commonwealth Office. 31

Dr. Clapperton of the Department of Geography at Aberdeen University called upon me just before he sailed northbound and said that, in his opinion, the peat boring machine should be kept in the Falkland Islands with a view to completing the soil sampling process in the southern Spring. Accordingly, we have kept the machine here, but if you wish for its return I will arrange for it to be sent by the next voyage of the M.V. "A.E.S.". In view of the time factor involved a brief telegram from you would be desirable.

Dr. Clapperton also thought that you might be satisfied with the sampling already done, and he felt that the figure of 60 trial holes was very much an optimum one. As you know, we have taken 33 samples. Would you be good enough to let me know whether you wish us to continue or whether the 33 samples will be enough.

Yours faithfully,

(W.H. THOMPSON)
COLONIAL SECRETARY.

Directorate of Overseas Surveys.

Reply at 45.

SC

c.c. Harbour Master - Please recover the peat boring maching from the B.A.S. store and take care of it until we know the outcome of this letter.

W.H.T.

1.5

See 58.

Dr. Clapperton of the Department of Geography at Aberdeen University called upon me this morning concerning soil survey. He said that, in his opinion, the peat boring machine should be retained in the Falkland Islands with a view to completing the soil sampling process next Spring. He also thought it wise for a letter to be sent to the Directorate of Overseas Surveys telling them this, thus offering them a chance to dissent, in which case the machine can be returned on the next voyage of the "A.E.S.".

Clapperton also thought that the Directorate of Overseas Surveys might be satisfied with the sampling already done. He felt that the number of 60 trial holes given to us was very much an optimum figure.

I agreed to write to D.O.S. on the above points.

Dr. Clapperton arranged to off-load the peat machine from R.R.S. "John Biscoe" into the B.A.S. store. I accepted responsibility for getting the machine from the store back into our own hands.

D.I.

COLONIAL SECRETARY.

11th April, 1968.

b/f 30 April 1968.

DECODE.

TELEGRAM SENT.

From GOVERNOR to SECRETARY FOR TECHNICAL CO-OPERATION

Despatched: 14.2.68 Time: 1445 Received: Time

MODEV 5

37.

Your modev 5 soil sampling. 33 out of 60 sites sampled and being sent UK BAS ship in April. Unable yet give firm date for balance

Acting Governor

P/L : AA

DECODE.

37

TELEGRAM SENT.

From SECRETARY OF STATE to GOVERNOR

Despatched: 12.2.68 Time: 1750 Received: 13.2.68 Time: 0915

MODEV 5 From Lang DOS please advise progress soil sampling in order facilitate planning examination of samples

Ministrant

P/L : AA
Intld H.L.B.

Reply at 40.

38a

C/S. 39

33 out of 60 sites have been sampled. and will be sent home BAS in April. Further progress seems unlikely.

Grasslands Officer

for reply

Falkland Island Soil Samples - further notes

A. It is probable that most of the chosen sites are covered with blanket peat although its depth will vary with the site and may be completely missing in some of the lowland areas. The following are the sites considered likely to exhibit deep peats.

1. Basin peats or raised bogs

W.15, ~~W.20~~, ~~W22~~? E.14, E15

Probable NB

2. Deep blanket peat

~~W8~~, W7, W13, ~~W29~~? ~~W31~~ ~~W32~~ ~~W35~~?

E24, E31

NB. Probable

NB

NB

3. Sampling tussac sites may prove difficult. We have no suggestions as to the most effective method, but the mineral soil from below a single tussock should be taken if possible and comparison samples from equivalent depths below the inter-tussock space.

E24. W4 E23

Falkland Islands Soil Reconnaissance

Using information derived from Baker's map of the geology and Davies' vegetation map a preliminary interpretation of air photographs of the Falklands has been carried out and boundaries between provisional land systems have been transferred to 1:50,000 maps. Sites have been selected and located on these maps to characterise the range of soils in the islands with special emphasis on lowland areas. It is anticipated that the limited sampling programme (about 60 profiles) should be completed during this summer - sampling is likely to be difficult because of high water tables in many areas but will be virtually impossible to complete satisfactorily during the winter. After the soil and vegetation samples have been examined and described the land system analysis will be revised and the desirability of further work determined.

Pit Sites

Dr. Clapperton or Mr. Young are requested to see that pits are dug at each of the sites indicated on the maps (by a coloured symbol and in some cases additional information such as 'on terrace' or 'middle of slope' where necessary to indicate the location more precisely). The sites have been chosen as far as possible within reach of the larger settlements but avoiding lands which are likely to be atypical because of man induced modifications near camp stations. If any site indicated is known to have been seriously modified an alternative site nearby within the same boundary may be selected. Simple burning over can be ignored unless very recent or frequently repeated, but peat cutting, ploughing fertilising (whether by buried animals or chemicals) and compaction at paths or former corrals should disqualify the site, as should drainage if more recent than the date of the air photography (October 1956). In all cases a brief

indication of the history of the site should be recorded on the sampling record. A photograph of the landscape at the pit preferably with the pit in the foreground identified by its number and where practicable a photograph of the pit face are desirable in addition to the vegetation photography referred to elsewhere. In addition to the description of the vegetation the following should be recorded for each pit site

1. Date of sampling
2. Recent weather
3. Depth at which water encountered
4. Slope, aspect, distance of pit site from head of slope
5. Surface stone of the area around the pit
6. Evidence of erosion in the vicinity of the pit
7. Serial Nos. of photographs taken

Sampling the pit

The attached diagram suggests the types of pit normally used which should be satisfactory for all soils with mineral horizons within 4 feet of the surface. Taking a"dissected monolith" may prove difficult in stony soils and any necessary modifications of method for such soils should be described, making certain that the profile can be reconstructed from the description. A description of the soil profile is not required but a copy of a Soil Survey Manual and a sample description sheet accompany the sampling material. A pit 4'6" deep or to solid parent material if that is reached sooner, should be dug and spoil thrown to one site avoiding the front face of the pit in order to avoid contaminating the top sample. The monolith should then be cut at the front face of the pit (after any photograph is taken) and cut into six inch slices. Each slice should be packed in a polythene bag together with a plastic number and the number recorded against depth on the sample record sheet. The number should also be written on the bag or a label attached

The samples should be sealed by an elastic band, string or sealing strip and carried with as little disturbance as possible and packed in biscuit tins or wooden boxes for transportation.

2. Blanket peats with possible mineral horizons at depths greater than 4 feet, should be sampled as described above at three inch intervals to 18 inches depth. Additionally samples should be taken using the auger at 50 cm. intervals from the surface to the base following the instructions in Alan Robertson's letter of Nov 3rd Where blanket peat is deep it would be advantageous to have a number of depths taken by probing along a line following the maximum slope of the landscape element on which the profile site is located.

3. Raised bogs. 4 sites on raised bog or basin peats have been located, but [redacted] not very precisely [redacted] and Mr. Young should use his discretion whether to sample these or other more extensive basin peats or to sample more than four. Dr. Clapperton is conversant with the sampling technique used by the Macaulay and the equipment arriving on the Biscoe.

Equipment and materials consigned to the Falklands all to be returned in April with the soil samples.

a. L.R.D. equipment via Biscoe

2 pairs of clippers for vegetation sampling

250 plastic sample bags

100 cloth vegetation sample bags

b. Macaulay Peat Survey equipment via Biscoe

Peat auger estension rods 4 sample cans.

c. LRD materials by hand of Dr. Clapperton

2 sets of annotated 1:50,000 maps

4 rolls 36 exposure colour film

string, elastic bands

1000 numbered plastic labels

1 Soil Survey Manual (property of D. M. Lang)

d. L.R.D. materials by Perla Dan

750 plastic sample bags

Roll of sealing strip.

Vegetation Sampling

The analysis of herbage from the vicinity of each soil/peat pit should be of value both in the interpretation of the soil data and in any subsequent animal nutrition investigations.

The Grassland Officer will be aware of local problems in sampling vegetation and he will decide on the method to adopt. The following notes are only written for guidance if for any reason he is not able to organise this part of the field work.

Quantitative measurements will rarely justify the work involved unless there is a detailed record of the management, including stocking density and any burning, in each area. In addition measurements of yield may be of little value without botanical analysis, if there are big variations in the palatability of the different species.

However if it is decided to determine the amount of herbage the steps are as follows:-

1. Cut 10 random square yards/metres or 2 random strips 1 yard x 5 yards.
2. Weigh fresh herbage
3. Immediately remove a representative sample of about 500 gms and weigh accurately
4. Dry this sample and reweigh
5. Bag and label sample for chemical analysis.

If Botanical analysis is undertaken preserve sufficient material of each species for drying and subsequent chemical analysis. In this connection it may be desirable to determine the chemical composition of any shrubs which make an important contribution to the diet of the sheep. Separate samples should be obtained by clipping short lengths of leaf shoots - simulating the observed grazing pattern - these are dried and labelled. The suggested method of obtaining a representative non-quantitative sample from each site is as follows:-

1. Walk along a series of random short straight traverses within a 25 yard radius of the pit.

2. Clip the herbage, if any, which is easily grasped in a closed hand near to the ground, and which occurs at the tip of the boot on every second pace.

3. Obtain about 500 gm (~~116~~ 116 plus) of fresh material at each site

4. Note the number of clippings, including any blanks, which were required for each sample.

5. As soon as possible dry the sample either by heating (temp $\leq 104^{\circ}C$) or spread the samples in a thin layer for air drying. (Avoid respiration and fermentation heating of the samples)

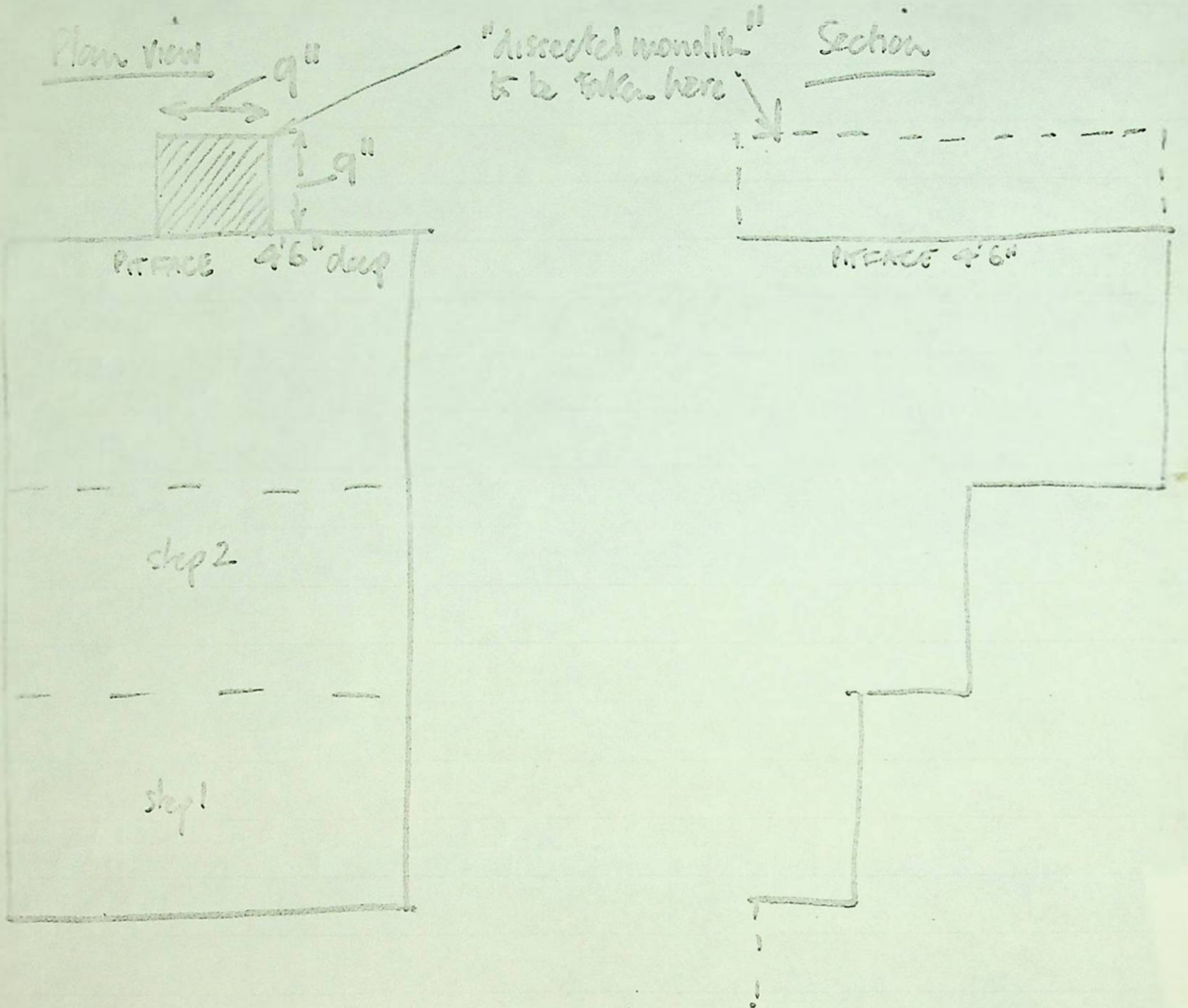
6. When dry repack the complete sample avoiding any loss of leafy material which shatters easily.

7. Label the samples to match the corresponding peat/soil samples.

Transparencies showing close-up of vegetation - the immediate foreground of a normal photograph would be valuable; this is in addition to a landscape view of the site. The limits of the camera will decide what is possible - clear detail is required.

In the subsequent analyses we would determine the levels of major constituents, trace elements of significance in animal nutrition and also some *in vitro* digestibility determinations. We would request that the Grassland Officer should indicate any special determinations which he considers are desirable.

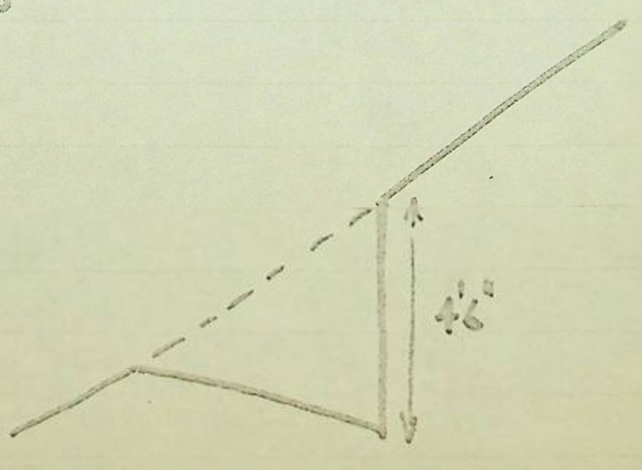
PITS ON FLATS OR GENTLE SLOPES



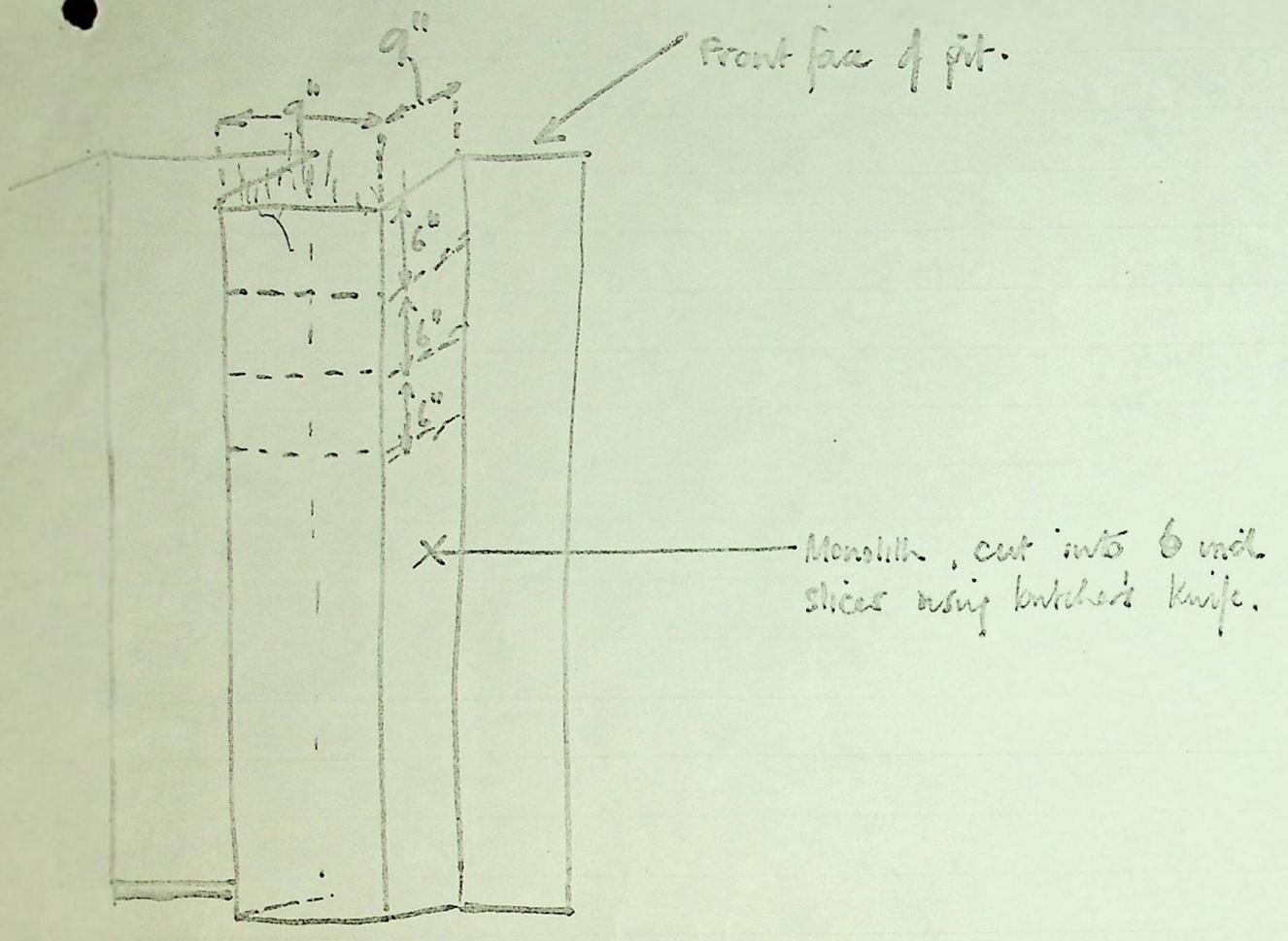
1. To photograph the pit face it is simplest if the deep end of the pit faces the Sun.

2. All spoil should be thrown to one side and kept well away from the pit face to avoid contaminating the surface layer of the monolith.

PITS ON STEEP SLOPES



DISSECTED MONOLITH



BASIC RECORD SHEET - EXAMPLE

Profile no. 6 Date.
Location 1 mile SW from Fox Bay West Station

Bag No.	Depth.
72	0-6"
73	6-12"
74	12-18"
75	18-24"
76	24-30"
77	30-36"
78	36-39" (base of soil)

37

Ref: RAR/EAF/280/67 3rd November, 1967

Mr. D. N. Lang,
Land Resources Division,
Directorate of Overseas Surveys,
Tolworth Tower,
SURBATON,
Surrey.

Dear David,

Many thanks for your letter and enclosure of 23rd October.

I have had another meeting with Dr. Clapperton to discuss sampling procedure and he has also spent a short time with Peter Jowsey in the field trying out the new peat sampler. In case of any difficulties we have provided Dr. Clapperton with a suitable knife and advised him to acquire a sharpener (very essential). As a result of our discussion some minor amendments were made to the programme as follows:-

1) Sampling pits are to be dug on all the bog types investigated, but the depth of sampling at intervals of 3" has been reduced to 18". This means that there will be six samples (3" x 8" x 8" approx.) per pit and in polythene bags these will conveniently fill two biscuit tins. Labelling should be numerical and careful notes kept of the location and depth of sampling etc. The bags could be labelled on the outside with a marker (e.g. a felt pen), but it would also be advisable to have a label of some sort (e.g. metal tag) inside the bag.

2) At each site samples are to be taken from the surface (not from a depth of 18") to the bottom with the peat sampler (~~and~~ 0.5 m samples). These are to be packed into the tins provided. The number already marked on each tin should be recorded in relation to site and sampling depth etc.

3) Additional depths of the ~~pit~~ peat are to be recorded as mentioned in your memo so as to obtain some indication of the variation. In taking depths the leading rod should be inserted with the pin end down.

4) Because of the reduced number of pit samples (6 instead of 10) it has been agreed that, if possible, a few more sites should be investigated e.g. the total number being between 10 and 20.

5) It is suggested that if there are three main types of deposit e.g. high level and intermediate blanket bog and low level raised bog, then approximately five sampling sites might be selected on each. It is important to obtain a representative selection from the raised bog types if these in fact show much variation. It is unlikely that the blanket bog types will vary to any great extent except perhaps in depth.

6) Finally we decided that it might be possible to take up to a maximum of three profiles for pollen analysis. The samples would be taken from the chamber of the peat sampler at 5 cm intervals before removing the bulk of the peat for canning. Dr. Clapperton has taken one gross of tubes for this purpose and any additional supply will be sent to Mr. Young in the Falkland Isles in a day or so. Labelling again should be numerical as before. Dr. Clapperton has in fact done such sampling before and could advise Mr. Young on the procedure to adopt.

Please excuse these hurried notes but I want you to get this letter by Monday. I understand you are seeing Dr. Clapperton on Tuesday and would be glad if you could give him a copy of this letter which I enclose for his information.

With best wishes,

Yours sincerely,

R. A. Robertson.

Enc.

0102

36

EXTRACT FROM MINUTES OF MEETING OF THE NATURAL RESOURCES COMMITTEE

HELD ON THE 18TH OCTOBER 1967.

SOIL SURVEY AND VETERINARY INVESTIGATION

The Chairman explained that in August, while on leave, he had attended a meeting at the Ministry of Overseas Development. (A memorandum on the subjectsdiscussed had been distributed to members of the Natural Resources Committee prior to the meeting). 32

Decisions made at the August meeting in London could be summed up as:-

(1) the Agricultural and Animal Health Advisers at the Ministry would approach appropriate universities and research organisations with a view to encouraging their practical support of investigations in the Falkland Islands;

(2) an outline scheme would be prepared in the Ministry to cover a visit by an animal husbandry specialist (sheep) and a veterinary investigation specialist, working as a team for not less than 6 months to study the inter-related problems of animal husbandry, nutrition and management;

(3) this outline scheme would be sent to the Falkland Islands Government to form the basis of a request for funds by the Government to the Ministry of Overseas Development;

(4) meanwhile, the Directorate of Overseas Survey would go ahead with the initial work for a general soil survey, determining morphological units from the air photographs which were taken prior to the mapping of the Colony. An essential part of this work would be the digging of some 60 or 70 soil sampling pits at various points in the islands.

The Chairman said that further news of progress in London is now awaited but meanwhile the Directorate of Overseas Survey had already indicated that full instructions regarding the soil sampling were being sent out by R.R.S. John Biscoe.

After some discussion as to whether the Ministry would be familiar with the sort of problems met in the Falkland Islands, Mr Young said that in recent years greatly increased interest was being taken in the problems of what is described as "range land" farming.

The Chairman said that members would be kept informed of developments.

DECODE.

34

19/10

TELEGRAM SENT.

From SECRETARY FOR TECHNICAL CO-OPERATION *to* GOVERNOR

Despatched: 19.10.67 *Time:* 1140 *Received:* 19.10.67 *Time* 0945

MODEV 32 Following for Grassland Administration Stanley for D.O.S.

Please advise on following 2 points

(a) reference survey requested by Governor. We require analysis starter relating to soil and herbage if results available in U.K. cable details.

(b) Maps and Instructions for soil reconnaisance arriving Biscoe with Clapperton advise if you cannot provide biscuit tins (preferred) or wooden boxes for soil samples

Ministrant

P/L : ER
Copy to G.O.

Reply. Your Modev 32 Soil Survey

~~(a) see my tel~~

(b) no difficulty.

Governor.

DECODE.

TELEGRAM SENT.

From GOVERNOR to SECRETARY FOR TECHNICAL CO-OPERATION

Despatched: 19.10.67 Time: 1545 Received: Time:

33 34

No 40 Your DOS/LRD/N/2 Saving and telegram MODEV 32 soils and herbage:

(a) Some soil analysis figures for experimental plot samples obtainable from Edryd Jones, N.A.A.S., Trawscoed, Aberystwyth. Some 1924 figures available from Rowett. Only available figures for herbage analysis in Davies' report Grasslands of Falkland Islands published 1939 available Commonwealth Office library or WPBS, Aberystwyth.

(b) No difficulty

Governor

P/L : ER
Copy to G.O.

ORIGINAL

33

Saving

From the Minister of Overseas Development

To The Officer Administering the Government, FALKLAND ISLANDS

Date 20 SEP 1967

No. DOS/LRD/N/2 Saving

For attention of Mr. Young, Grassland Officer - Administration Stanley
From Blair-Rains - D.O.S.

Ref Survey requested by Governor. We require analysis data relating to soils and herbage. If results available in U.K. cable details. Letter follows.

Letter addressed to Mr Young came in same envelope as this.

MINISTRANT

53

21st October 68

Dear Sirs,

Soil Survey in Falkland Islands

I am enclosing two films found here very recently. We very much regret the long delay and inconvenience caused but, unfortunately, the fault was not of our making.

2. By sea mail (with a copy of this letter) I am also sending a further box of soil samples which have also been found.

Yours faithfully,

(W. H. THOMPSON)
COLONIAL SECRETARY

Directorate of Overseas Surveys,
Land Resources Division,
Tolworth Tower,
Surbiton,
SURREY
England.

FA

DECODE.

54

TELEGRAM SENT.

From GOVERNOR *to* MINISTRY FOR OVERSEAS DEVELOPMENT

Despatched : 21.10.68 *Time :* 1000 *Received :* *Time :*

MODEV 35

For attention Lang DOS. Falkland Islands soil survey. Missing photographs found and leaving airmail 25th October. Further soil samples following by sea mail

COLONIAL SECRETARY

P/L : AA

EXTRACT FROM MINUTES OF MEETING OF DEVELOPMENT COMMITTEE HELD ON

17TH OCTOBER 1968.

0102

(f) Soil survey - Mr Miller reported on his visit to the Directorate of Overseas Surveys. Mr Lang of that Department explained to him during his visit that the scratch team of assistants and the incomplete set of samples from the Colony made the product of a final report somewhat difficult. It was expected, however, that the report would be available during 1969.

EXTRACT FROM A LETTER FROM MR. C. D. YOUNG TO THE COLONIAL SECRETARY

Original filed at f. 106 in 2373.

.....

With reference to the photos of the Soil survey I have sent the ones I have to Mr Lang at DOS - This is only one film however. The remainder are in the large cardboard box on the right of my office. You will remember we discussed this and I said that it was essential that this was sent home on the 'Biscoe' at the end of the season along with the rest haven etc. This does not seem to have been done.

.....

51

P/1034

30th August 1968

Dear Mr. Young,

The Directorate of Overseas Survey report that the photographs connected with the soil survey have not arrived and the whole project is held up.

As a matter of urgency will you please let us know where they are. A note direct to Dr. C. Clapperton at Aberdeen University would also be a help.

Please treat this as very important. The next stage cannot proceed until you provide the information. I also hope you have now been able to respond to my previous pleas for part one of your Report.

Yours faithfully,

(W. H. THOMPSON)
COLONIAL SECRETARY

Mr. C. D. Young,
35, Marlborough Ave.,
Glasgow W.1.,
SCOTLAND

FA

Copy to 0102.

12.10.68.
By ~~10.~~ 4 68
(mail?)

EXTRACT FROM MINUTES OF A MEETING OF THE DEVELOPMENT COMMITTEE HELD ON 25TH JULY 1968.

3. MATTERS FOR MENTION:

(a) Soil survey - A letter from the Land Resources Division of the Directorate of Overseas Surveys dated 21st May 1968 was read out by the Clerk. Their report is awaited.

Rem 31. 8. 68. (mail ?) No Mail

Copy in 1760/II

49

COPY

EXTRACT FROM LETTER WRITTEN BY H.E. REPLYING TO THE HON. SYDNEY MILLER, J.P.

MR

26th July, 1968.

48

Thank you so much for your very long and informative letter of 7th July. It was very good of you to take so much trouble to send such a comprehensive account of your activities.

I am glad that you met Galsworthy and that through him you were able to have a meeting with Selby and others at the Ministry of Overseas Development.

It is very satisfactory to know that you formed a good opinion of Thorne and Moss. I met Thorne last year and thought him good value.

I am glad that you discovered a reason for the soil sampling holes having to be four feet in depth. I can understand that soil scientists might wish to know what lay four feet beneath the surface but I am surprised that it should be suggested that ploughing should take place to a depth of four feet.

As you say you will certainly have some interesting material for discussion at the October meeting of the Development Committee. This Committee met last week and again this week under the chairmanship of Richard Hills. I attended for part of one of the meetings and there was no doubt that the members are very keen to show results.

.....

Copy in 1760/II ~ ~~2168~~ 2423

48

COPY

EXTRACT FROM A LETTER WRITTEN BY THE HON. MR SYDNEY MILLER, J.P. TO H.E.

July 7th 1968.

Dear Sir Cosmo,

I am posting this a little early to insure connection with southbound "Darwin" this month; I can write again by hand of flying passenger if there is anything to add by then.

Overseas Development. Mr Barton and I had a very pleasant lunch party with Sir Arthur Galsworthy, Deputy Under-Secretary of State, and Sir Arthur, whom we saw again at the S.O.A. party, very kindly got in touch with Mr Selby (to whom you had also written).

Mr Selby arranged a meeting for me in his office at the Ministry of Overseas Development and ha had collected there the following:-

Mr Fry. Carribean & Latin America Area (which includes Falkland Islands).

Mr D.M. Lang. Land Resources Division (Soil Survey).
(N.B. Mr Lang told me he was in Stanley 1953-54 in Met. Office, so some people may remember him).

Mr A.L. Thorne. Deputy Animal Health Adviser (Veterinary Div.)

Mr R. Moss. Divisional Veterinary Officer was unable to be present (hence the presence of Mr Thorne), but Mr Moss telephoned me twice the following morning.

I had queried to Sir Arthur Galsworthy the decision of H.M.G. in 1962 when we last imported stud stock from Tasmania. This Veterinary Division in that year refused to allow rams from Tasmania to be lightered in London river in transit from Tasmania to the Falklands. This prevented us from getting the rams by direct "AES" and we had to receive them via Antwerp and Montevideo which of course resulted in a 90 days quarantine period at the Camber in Stanley.

It was because of this query that Mr Selby had arranged for the presence of Mr Thorne at our meeting and later the 'phone conversations I had with Mr Moss.

To deal with the livestock transit position first, neither Mr Thorne nor Mr Moss could on the face of it see any particular reason for the 1962 refusal by H.M.G. and have undertaken to examine all the pros and cons of this question. On my return from Tasmania by which time I shall presumably be better armed with information re Tasmanian export certificates, shipping dates etc., I am then to get in touch again with Mr Moss and the Veterinary Division expect then to advise me of their considered views on the transit of the rams later this year via lighter in the port of London.

Both these gentlemen I found extremely sympathetic, practical and helpful.

/Cont. ....

Soil Survey. Mr Lang said that this was being carried out (the analysis) at the Land Resources Division (Directorate of Overseas Surveys) at their establishment at Tolworth in Surrey.

On my return from Tasmania I have been invited to visit them at their laboratories at Tolworth and discuss the whole question there. Mr Lang said that there had been much delay and that the samples they had were over-dry. This appears to me to be a bit feeble as they may well have to repeat the operation.

He did tell me that the reason for the holes being four feet in depth was to discover the type of soil at that depth and its mineral content; when he said further that such investigation could well indicate the desirability of turning the 4' subsoil to the surface, I felt it necessary to point out that in our grassland work at Roy Cove we found it expensive enough just to turn up soil at a depth of 9 inches. No farm in the Colony would have either the equipment or the cash to plough four feet deep!

However, I am looking forward later next month to visiting the Tolworth laboratories and examining the results of their various analyses, and their resulting opinions.

In any case I should have some interesting material for discussion at the October meeting of our Development Committee.

.....

24th May 1968

DEVELOPMENT COMMITTEE

Soil Survey: Progress Report

In August 1967 the Sheep Owners Association recommended that consideration should be given to conducting a soil survey of all grazing land below the 500' contour.

This recommendation coincided with a meeting which the Governor attended at the Ministry of Overseas Development at which he met agricultural and animal health advisers of the Ministry and officers of the Land Resources Division of the Directorate of Overseas Surveys.

As a result the Land Resources Division undertook the preparation and production of basic framework maps for a soil survey. This work was started by Mr A. Blair Rains who deals with pasture matters in the Land Resources Division and Mr D.H. Lang, a soil scientist who, before qualifying as such, had at one time served at the meteorological station in Stanley.

Mr Rains considered that detailed mapping of the Falkland Islands soils could be undertaken, using the complete photographic cover which was flown in 1956 at a height of 12,500 feet and from which the 1:50,000 and 1:250,000 maps were prepared. The geomorphology was to be elucidated using Baker's (1922) description of the geology and the subsequent reports by Joyce (1949/50) and by Adie (1953).

The first task was to produce outline maps and these were sent out to Stanley in November 1967 with a request for soil sampling to take place at sixty specified sites located throughout the Colony.

By February 1968 samples had been taken at 33 out of the 60 sites. Sampling in the North Arm and Fox Bay areas was undertaken by Messrs Lellman, Trevelyan and Dodds, and elsewhere by the Grasslands Officer, Mr C.D. Young, with whom Dr Clapperton and Mr Conroy of the British Antarctic Survey worked for part of the time.

The 33 samples were despatched to the Land Resources Division by R.R.S. John Biscoe in April and have now reached England.

Before sailing north in April Dr Clapperton, who is a lecturer at the Department of Geography at Aberdeen University, expressed the view that the requirement to take samples at 60 trial pits was an optimum figure and he felt that the Land Resources Division might well be satisfied with the sampling already done.

Once the 33 samples have been examined, it is expected that the Land Resources Division will state whether it is necessary to take further samples. Ultimately a soil map will be produced by the Directorate of Overseas Survey. No charge is expected to fall on the Falkland Islands Government.

The completion of a soil survey is not an end in itself. It would form part of the groundwork upon which, if required, a survey could be made to assess land capability. But from the point of view of practical application to the present and future needs of the Falkland Islands, the question must be asked whether a survey to assess land capability is necessary. The reports of Davies (1939) and Wannop (1961) are well known to the farming community here and have received a large measure of acceptance.

/The Ministry....

The Ministry of Overseas Development has shown that it is willing to give technical assistance to the Colony. Assistance would probably take the form of research paid for by H.M.G., such research being into plant and animal problems including plant nutrients, the introduction and assessment of grass and legumes, the investigation of improved pastures (both their establishment and subsequent management) and the problems of sheep husbandry with particular reference to nutrition. It would probably involve visits to the Colony of an animal husbandry specialist and a veterinary investigation specialist for a period of not less than 6 months. The time and money spent on such research would however be largely wasted if the results are not subsequently translated into practice.

To summarise, the stage has now been reached at which the soil survey is well under way and a recommendation by the Development Committee is sought as to the next step which should be taken.

4-8-

O.i.C. Agric,

Pl. read (4-5) with (4-2).

for C.S. 25.6.68.

JD

45.

LAND RESOURCES DIVISION
DIRECTORATE OF OVERSEAS SURVEYS
TOLWORTH TOWER
SURBITON SURREY

Elmbridge 5281

Our reference: LRD/N/2

Your ref: 0102

COLONIAL SECRETARY'S OFFICE 12 JUN 1968 FALKLAND ISLANDS

21st May, 1968

C/c HE to see [illegible] 12/6

Dear Sir,

Soil Reconnaissance in the Falkland Islands

Thank you for your letter (42) of 30th April received here today.

We have received some site data sheets from Young and the information that altogether 33 sites have been examined. We expect to receive the soil samples, within the next week but until these have been at least briefly examined and the information mapped, it is not possible to say definitely that further sampling is required. However it does seem probable that at least a few more pits will be needed. I agree that you should retain the peat auger and shall let you know as soon as possible what further work, if any, is required.

Yours faithfully,

D. M. Lang

D. M. Lang

46

The Colonial Secretary,
Stanley,
Falkland Islands.

Mr Browning:
Three points
1. Please ensure that Mr H.T. [illegible] reads this letter i.c.w. (42).
2. Note for mention at July meeting of Development Committee
3. Place on this file a copy of his progress report mentioned at (43).
(f.47)
[illegible] 14/6/68

Sender's name and address: D. M. Land Esq.,
Land Resources Division,
Directorate of Overseas Surveys,
Tolworth Tower, Surbiton,
Surrey, England.

AN AIR LETTER SHOULD NOT CONTAIN ANY ENCLOSURE; IF IT DOES IT WILL BE SURCHARGED OR SENT BY ORDINARY MAIL.

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Second fold here

ON HER MAJESTY'S SERVICE

BY AIR MAIL
PAR AVION
AIR LETTER
AEROGRAMME

The Colonial Secretary,
Stanley,
Falkland Islands.

LIH 02373 58

LAND RESOURCES DIVISION
DIRECTORATE OF OVERSEAS SURVEYS
TOLWORTH TOWER
SURBITON SURREY

01-399 5281

Our reference: N2

17th July, 1969

Dear Mr. Thompson,

Herewith a copy of the report describing our analysis of the land systems of the Falkland Islands.

The leaders of the recently appointed team to investigate grassland and sheep husbandry problems have been provided with copies of the accompanying maps.

We would be grateful if you will ensure that the peat sampling tool (your letter of 30th April 1968 refers) returns to Britain with the team on the conclusion of their investigation.

Yours sincerely,

Anthony Blair Rains

A. Blair Rains

Colonial Secretary,
Stanley,
FALKLAND ISLANDS

A.C.S. I have read the Report. It might be a good idea for ~~Dev~~ Comm. Members to read it also, before the Team arrives. Copy this copy be passed to Mr Miller for that purpose. 29/8
& letter in file to me.

Report sent to Mr Miller 11/9.

59

H.C.S.

? Where is the tool referred to at pp. 42 + 58.

2. Mr Mullen will be kind enough to return the Report (for retention in the (SO) before the weekend?

18/9

C.S.

60

Ref. above. Report at b.c.

61

20/10/69.

C.S. A letter of thanks for (58) and his report ought to go if not already done. LH 27/10/69

0102

56

13th January 69.

Dear Sir, 55

Your letter of the 5th November 1968 arrived here on the 4th January and this reply will travel to you by the first available outward mail scheduled to leave here on the 18th January.

We welcome your proposed research into the vegetational history and the botanical nature of the peat of these islands.

The Falkland Islands Government is extremely small and our resources are very limited and I must make it clear that our support cannot be financial.

I look forward to hearing your detailed plans in due course.

Two very valuable contacts would be:

Doctor Clapperton,
Dept. of Geography,
Aberdeen University.

and

Mr D.M. Lang,
Land Resources Division,
Directorate of Overseas Surveys,
Tolworth Tower,
Surbiton, Surrey.

As I shall shortly be leaving the Falkland Islands I shall be grateful if any further correspondence be addressed to the Colonial Secretary and not to me by name.

Yours faithfully,

(W.H. THOMPSON)
COLONIAL SECRETARY

Dr. S.E. Durno.,

RRB.

P1

55.

THE MACAULAY INSTITUTE FOR SOIL RESEARCH

DIRECTOR: R. L. MITCHELL, B.Sc., PH.D., F.R.I.C., F.R.S.E.

TELEPHONE AND TELEGRAMS
(0224) 38611

HEAD OF DEPARTMENT
R. C. MACKENZIE,
D.Sc., PH.D., F.R.I.C., F.G.S., F.R.S.E.

Department of Pedology
CRAIGIEBUCKLER
ABERDEEN
AB9 2QJ

5th Nov. 1968

COLONIAL SECRETARY'S OFFICE
- 4 JAN 1969
FALKLAND ISLANDS

The Colonial Secretary,
Colonial Secretary's Office,
Stanley,
The Falkland Islands.

Dear Sir,

I am tentatively planning to carry out a research project in the Falkland Islands involving the sampling and examination of peat at many sites throughout the colony. In order to comply with the wishes of the Royal Society (to whom I am applying for a financial grant) I write to inform you of my intention and to ask for the favour of your approval and cooperation in this matter.

The object of the proposed research, which would take perhaps two months in 1969-70, is to investigate (i) the vegetational history of the islands, and (ii) something of the botanical nature of the peat. As a member of the staff of the Macaulay Institute I have had many years experience in this type of research, and I would hope to produce results of considerable scientific interest.

Yours sincerely,

S.E.Durno.

(Dr.S.E.Durno)

Reply 56

Bn. 13.1.69

File Ref. 0102

62

Y.E.

? has/had not seen the Land System Analysis Report, copy of which is at b. o. f.

2. All members of the Agricultural Team, I understand, have copies of this document which reached us a couple of weeks or so before the team arrived.

J.A.J.
21/10/69

C.S. Thanks.
Minute as (59).

27/10/69

0102

63

29th October, 69

Land System Analysis of the Falkland Islands.

Thank you for your letter of the 17th July, 1969, reference N2, forwarding a copy of the report of the land system analysis of these Islands. We are glad to receive this document and I should like to express, on behalf of the Colony Government, our thanks to you and your colleagues for the hard work which you have put into it.

The report will, I am sure, be most useful to the Advisory Team which has been supplied to us by the Ministry of Overseas Development to investigate our agriculture problems.

(J. A. Jones)
Colonial Secretary.

A. Blair Rains, Esq.,
Land Resources Division,
Directorate of Overseas Surveys,
Tolworth Tower,
SURBITON,
Surrey.

JML

64 ~~101~~ 122

In reply please quote reference :- B/2.

COLONIAL SECRETARY'S OFFICE
29 JUL 1971
FALKLAND ISLANDS

The Falkland Islands Sheepowners' Assn.,
(Local Committee),
STANLEY.

28th July, 1971.

Dear Sir,

SOIL TESTING SURVEY

I am directed to enquire when the results of the Soil Testing Survey carried out in the Colony in 1967 are expected to be received, and published for general information.

Yours faithfully,

B Barnes.

Reply at 67.

SECRETARY.

The Colonial Secretary,
The Secretariat,
Stanley.

65

C.S.

Submitted pl. I am not sure that it was ever intended that the Report would be circulated for general information – the under-lined paragraph on p. 4 of the Report (at b.c.) suggests that it is useful for research workers only (and therefore presumably produced in a limited edition only) [illegible] 30.7.71.

~~H.E.~~ [illegible] 31/7 66

has, I believe, not seen the Report at b.o.f.

2 You may wish to see my draft reply to C.U.A. The Report is not one which it would be useful to pass to a general Association. [illegible] 30/7

0102

3rd August, 67 71

Dear Sir,

Soil Testing Survey

64

I have to refer to your letter No. B/2 of the 28th of July and to say that the report to which you refer was not intended and is not designed for publication. Its use is as a source of information for other research workers and it was in this context that it was, for example, made available to the team which in 1969/1970 investigated and reported upon the Sheep and Cattle Industries of the Falkland Islands.

Yours faithfully,

(J. A. Jones)
COLONIAL SECRETARY

The Secretary,
Falkland Islands Sheepowners' Assn.,
STANLEY

MJ

0102

68

20th October 71

Land system analysis of the Falkland Islands, with notes on the soils and grasslands

Some Members of our farming community have enquired whether it would be possible for the contents of the report "Land System Analysis of the Falkland Islands, with notes on the Soils and Grasslands" by R. B. King, D. M. Lang and A. Blair Rains (Miscellaneous Report No. 72 of 1969) to be rendered into layman's language since, apart from the fact that it is not in any case currently designed for wide circulation, it would not be readily comprehensible even if it were.

2. Perhaps you would let me know whether a layman's version is feasible and if so, when and how it might be possible to put the production of it in hand.

(J. A. Jones)

The Directorate of Overseas Surveys,
Kingston Road,
Tolworth,
Surbiton,
Surrey.

JB

Rm 2 months.

Thank you for your letter of the 20th ult. I am afraid I do not think it is possible to make a layman's version of our report; and in any event, I would have thought that the report by Davies et al entitled 'Sheep and cattle industries in the Falklands", which is due to be published on the 19th of this month (but I believe you already have advance copies), would be of much greater immediate relevance to your farming community. In addition, another report is in preparation, which deals with points raised in Davies et al's paper and whose author is a Mr Thorne, who together with Mr MacKenzie visited the Falkland Islands subsequent to the visit of Davies et al. Both of these reports should be of much greater immediate value to your farming community than any attempt at a layman's version of our report.

69

X

Yours sincerely

K B King

R B King

GJP

Foreign & Commonwealth Office,
Overseas Development Administration

Directorate of Overseas Surveys

Land Resources Division

Tolworth Tower Surbiton Surrey England

Our reference: N/2

Your reference: 0102

17 November 1971

Mr J A Jones
Colonial Secretary's Office
Stanley
Falkland Islands

Dear Mr Jones

TO OPEN SLIT HERE

SENDER'S NAME AND ADDRESS

LAND RESOURCES DIVISION,

DIRECTORATE OF OVERSEAS SURVEYS,

TOLWORTH TOWER,

SURBITON, SURREY.

AN AIR LETTER SHOULD
NOT CONTAIN ANY ENCLOSURE;
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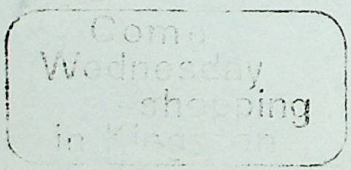

Mr J A Jones

Colonial Secretary's Office

Stanley

FALKLAND ISLANDS