THE ECOLOGY OF SABLE ISLAND, 1952

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Abstract

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This article describes Sable Island in 1952 with special attention to the flora. Lists of plants collected there are given and are compared to previous records of native and introduced vascular plants, of mosses and of lichens, Birds observed are listed. Attention is given to erosion by wind and by sea, and the conclusion is reached that the gradual attrition of sand-grains, rather than direct wind and wave erosion, is the principal factor in reducing the size of the island. The theory is advanced that the island is, in its present emergence, of late post-Pleistocene age.

SOURCES

The only legitimate source of material for another paper on Sable Island should be first-hand observations, but the past reports deserve reference for comparison with newer records. The Rev. George Patterson collected a great deal of historical, factual and traditional material with regard to the island and published it in 1894 in the Transactions of the Royal Society of Canada. Dr. John Macoun was sent to botanize the island in 1899; his observations were published in the reports of the Geological Survey for that year and his amended lists of plants in his "Catalogue of Canadian Plants." Dr. Harold St. John spent a month on the island in 1913, making a thorough study of the vascular flora, and his results including a very well summarized version of Patterson's and other material, appeared in 1921 in the Transactions of the Boston Society of Natural History. Finally we have a few charts and some pages of discussion of the geology of the island in J. W. Goldthwait's book, "Physiography of Nova Scotia."

SABLE ISLAND TODAY

Sable Island is the emergent part of a great sand-bar about one hundred miles southeast of Canso. At high tide the island is about twenty miles long and up to three-

quarters of a mile wide. The island runs nearly east and west in a shallow crescent, concave to the north, and consists of two lines of dunes, those on the north being much the higher, and a low undulating central valley with ponds of fresh or brackish water and one great salt lake, Wallace Lake or "the lagoon." The freshwater which fills the ponds is rainwater which has soaked into the sand and, being of less density than sea-water, rides on top of the salt water which permeates the island at sea-level. Wallace Lake is said to be now about eight miles long, only a fraction of its former great size, and the sea enters the lake readily at the south side where the dune is reduced to a few hummocks. In the eastern end the dunes are higher, newer-looking and more waterless.

The Old Main Station of maps and botanical records lies near the western end where the sea has cut across the single dune. Some houses, the flag-station and the barn remain, but the lifeboat-sheds and the rollways have been undermined and collapsed by the encroachment of the sea. The present Main Station has been established around the wireless station two miles to the east and consists of a few frame houses and several black Quonset huts. Some of these house the staff and others are storehouses for the year's supplies which are landed by surfboat from the supply-ship in August. Two miles farther east is the meteorological station, a single modern residence with a few surrounding sheds. Then, about three miles from the extreme eastern end, is the "East Light", a wooden lighthouse and, in the shelter of a dune, the small frame house of the lighthouse-keeper. Even more conspicuous at this point is the towering hull of a freighter wrecked on the far side of the island some years ago.

At low tide the island is said to be about forty-five miles long. This I report from hearsay, for, during most of my short visit, visibility varied from twenty yards to one mile. On the northern side low tide exposes merely a few yards more of fairly steep beach and brings the outer bars near to the sur-

face, but on the southern shore the sand-flats seem to extend for miles, although the sound of distant breakers confirms the surveyors' statement that here, too, is a triple line of bars.

Sable Island was long famous for its wrecks and for a number of reasons. For one, the island was low and difficult to see even in clear weather, while its sandspits were dangerous for many miles east and west. Also it was along the line of meeting of the Labrador Current and the Gulf Stream which swirled around the island in a gigantic eddy, the speed of which was sufficient to throw navigators miles out of their reckonings. These currents, one warm, one cold, produced frequent fogs, and, as the island was almost on the outer edge of the continental shelf, it was exposed to the full fury of Atlantic gales. Because of all these dangers life-saving stations have been kept on the island continuously for a century and a half. Today, however, radar, wireless direction-finding and storm-warnings have reduced the losses almost to zero, and the life-saving installations may be due for reorganization.

Variations of temperature are rather less than on the mainland. St. John records a maximum of 77° and a minimum of 5° F. for the years 1898-1901 inclusive, and recently neither of these extremes has been exceeded. Rainfall is much as on the mainland, but the wind is excessive, averaging eighteen miles per hour throughout the year. Even on very calm days one sees patches of brilliance and shadow scurrying up the wind-tunnels among the dunes, little whirlpools of sand in motion, and, when the great gales blow, this sand has the force of birdshot. Bottles that have lain about for a year are frosted on the surface by the friction, and great hills are undermined and shifted in a few hours. The tattered vegetation is subjected in winter to burying, sand-blasting and a frequent salt spray from the sea.

VEGETATION

The terrain of the island may be divided into about six categories, each with its own flora. The sea-beaches, par-

ticularly the northern one, are remarkably soft, and the surf in rough weather runs up to the very foot of the sand-bluffs, churning up the beach so that plants find no footing. Here and there, however, in the mouths of wind-channels in the dunes, a few salt-loving plants find foothold. *Cakile edentula* is common, *Atriplex patula hastata* is commoner on the south beach. St. John recorded that in 1913 *Arenaria peploides robusta* was in great clumps much visited by the ponies, but today only small fragments remain. *Senecio Pseudo-Arnica* was found in this habitat by all previous collectors, but I failed to find it.

Next inland come the high dunes. These are continually being eroded on the sea-side and built up on the landward side by sand blown up from the beach. Small plants cannot stand such burying or the dryness of the site, so that the flora consists chiefly of marram-grass, *Ammophila breviligulata*, beach-pea, *Lathyrus japonicus*, yarrow, *Achillea lanulosa*, and seaside goldenrod, *Solidago sempervirens*, the last two growing to unusually great size. On the high narrow dune that separates the west end of Wallace Lake from the north shore, there is often a thin covering of *Poa subcaerulea*, a native blue-grass. In this area the beach-pea is thick and luxuriant in agreement with St. John's description of the whole island in 1913, whereas in the rest of the island the growth seems feeble, probably becaise the peas are overgrazed in spring in the neighbourhood of the freshwater ponds. This high dune is grazed in winter, at least, as is shown by the droppings of the ponies, which consist of compacted fibres of sand-grass roots.

The middle of the island receives less and finer sand. The low dunes are covered with much vegetation a few inches in height. Beach-grass is consistently overgrazed; tall plants of *Spartina pectinata* are untouched by the ponies, common juniper makes thick mats, *Juniperus horivontalis* droops like a blue valance over the edge of raw bluffs dug out by the wind. *Rosa virginiana*, *Rubus arcuans*, *Viburnum cassinoides* and

Myrica pensylvanica are the tallest shrubs On the open dunes are evening primroses, *Oenothera parviflora* and *O. cruciata sabulonesis.* Near the houses and ponds there is an abundance of centaury, *Centaurium umbellatum*, a pink-flowered gentian common on sandy soils in Europe but hardly known in North America. Both St. John and Macoun found no difficulty in distinguishing native from introduced plants and both considered this plant to be native. I find the greatest difficulty in making up my mind about several plants of the island, but I should have no doubt that this gentian was introduced, probably in the ballast of wrecked ships. It spreads readily in the sand and is not eaten by the ponies, an important factor in survival. *Centunculus minimus*, chaffweed, a cosmopolitan sand-plant, was found only once by me, although earlier collectors considered it to be abundant. This plant is known also from Prince Edward Island.

Near the ponds cranberries, *Vaccinium macrocarpon*, make a thin lace over the sand, and *Eleocharis parvula* and *Myriophyllum tenellum* grow into a turf grazed by the ponies. *Limosella subulata* reaches three inches in height, and *Tillaea aquatica* grows both as compa tufts and as erect reddish plants with pedicelled lower flowers.

Brackish ponds have waterweeds, *Potamogeton bupleuroides* and *P. oblongus* and *Ruppia maritima.* On the salt flats *Ranunculus Cymbalaria* creeps in wide rosettes, while greater plantain and *Chenopodium rubrum* are thinly scattered. Wallace Lake is said by St. John to be full of eel-grass, *zostera marina*, and to have a lush beach growth on the inner shore. I had time to follow only the western side of the lake and I saw no trace of eel-grass, either growing or as wrack, though I had come in search of it. The shores seemed to be bare of life, and the lake was silting up rapidly. Perhaps St. John was referring to the western section of the lake which has now silted up completely, but which was still four miles long in the 1899 survey.

The last category includes the neighbourhood of buildings where there is the usual shifting population of weeds, grasses and clovers.

PREVIOUS COLLECTORS

Our knowledge of the botany of Sable Island is still incomplete. The first serious records were made by Jonathan Dwight, Jr., who visited the island in 1895 to observe the nesting of the Ipswich sparrow. Then Macoun, in 1899, gave us our most complete lists of vascular plants and cryptogams. Mr. H. P. Glazebrook, master of one of the life-saving stations, collected a few plants, and in 1911 Dr. H. T. Gussow visited the island and listed plants observed. In 1913 Dr. Harold St. John, inspired by Fernald's coastal-plain hypothesis, spent four weeks on the island and collected vascular plants with great care. To this visit we owe the naming of many endemic varieties and species peculiar to Sable Island and otherwise known only from similarly isolated areas of poor sandy soil. For my part I should have entirely overlooked these differences, except in the case of *Juncus pelocarpus sabulonensis.* In variable species ten generations of inbreeding will produce a variety recognizably different from the average of the ancestral stock, and a single cross back to that stock will re-establish the older type. The fact that in two cases St. John found two varieties, one normal and one new, of the same species in the island, were the number of individual plants is so limited, would cast suspicion upon the importance of such differences.

In my list of the vascular native plants of the island I have shown the name as it appears in St. John's list. St. John had checked Macoun's specimens and had modernized the names, while I have not seen St. John's. I have added the names now used in the 1950 Gray's Manual and have queried some identities. I have included also a number of his varieties which, I think, might as well be lumped with the species.

Macoun and St. John found a number of plants that I missed, and the source of most of these is given by St. John. as the eastern end of Wallace Lake, an area which I could not reach in the time. Some that St. John found and that Macoun and I missed are, like Bartonia, not recognizable until late in August. Macoun and I found four that St. John missed: *Danthonia spicata, Habenaria viridis bracteata, Menyanthes trifoliata minor*, and *Drosera intermedia.* The first two are plants of early summer and were barely recognizable when I found them, although the summer that year was very late; St. John, collecting even later in a normal season, might well have missed them. The last two are plants of wet places, and I found them on pond-bottoms exposed after an almost rainless July. If St. John was collecting after a wetter July, they might have been submerged at his passing. Such accidental differences in the lists, and the fact that a lifeboat master could find in June a violet missed by four experienced collectors in August, suggests that our knowledge is probably still incomplete.

My own additions to the native vascular flora are small. I found one patch of *Triglochin palustris* which is never very common nor easy to see. Near the cookhouse, in a swampy sump, I found a plant which has the key-characters of *Scirpus maritimus Fernaldii.* I have included it doubtfully, for I have yet to be convinced that the species, as we know it here, is more than an environmental form of *S. paludosus. Poa subcaerulea* is new to the list but was probably included in *Poa pratensis* which St. John classed as a native species. It should be borne in mind, however, that natural introductions of new species are probably still going on, so that the finding of a new plant may not mean that previous collectors missed it.

I have kept separate a list of introduced vascular plants, because I had not at first intended to collect these, owing to lack of space in my presses. Gussow's list is similarly incomplete in this field, while St. John had not only much leisure

in which to pick over the weeds of garden and midden but also the great afforestation scheme of 1901 to elegize. Very few introduced plants have spread widely. *Rumex Acetosella* is everywhere, but I consider this doubtfully an introduction. *Agropyron repens pilosum* and *Plantago minor* have spread along the southern beach, but St. John considers them native and I do not. Of the afforestation I found only one fifteen-inch shrub of buckthorn, *Rhamnus Frangula*, of which I collected half, quite unconscious of the fact that it must have cost ten thousand dollars to establish this plant.

My third list is of mosses and my fourth of lichens. I have found no previous records of these except in Macoun's Catalogue. No fungi were observed and only floating fragments of seaweeds. Lichens were fairly frequent but of few species. *Cladonia rangiferina* and *C. uncialis* grew in thin patches; *Cetraria aculeata* was occasional as on most mainland sandhills; *Parmelia physodes* frilled the six-inch stems of shrubs or crept over the sand. Mosses, too, were infrequent, and, after the dry July, none were in fruit or with gemmae. *Sphagnum subsecundum* grew in small white patches on wet sand, growing upward as it was buried, and harbouring *Aulacomnium palustre*. *Sphagnum papillosum* grew in more robust but rarer patches. *Drepanocladus aduncus*, a form with plicate leaves, grew among the rushes at the edge of ponds, and this may be the same species as Macound's *D. fluitans*. *Leucoryum glacum* and sterile *Pphlia* and *Bryum* grew along the edges of low bluffs near the ponds.

FAUNA

I had too little time and no equipment to investigate the fauna. Patterson has a list of molluscs found on the island, but I know nothing of this group and, perhaps that reason, observed none. I noticed a freshwater sponge abundant in the ponds, and I suppose this to be *Heteromeyenia Macunii*, an endemic species said by MacKay to have affinities with New

England sponges. Insects were not observed, but insect-eating birds were present.

Birds observed were: Double-crested Cormorant, at sea; Black Duck, abundant in ponds; Semipalmated, or perhaps Piping, Plover, at sea and on beaches; Ruddy Turnstone, on beaches; Spotted Sandpiper, by ponds; Least Sandpiper, on beaches and by ponds; Sanderling, not certainly identified, on beach; Greater Shearwater, at sea, hunting with porpoises; Black-backed Gull, common; Herring Gull, commoner; Common Tern, very common; Barn Swallow, around buildings; Yellow Warbler, seen in distance and rather uncertainly confirmed by residents; Wilson's Snipe, rare; Ipswich Sparrow, abundant everywhere. One crow is said to live on the island, and Macoun saw "Canadian nuthatches", and the history of the island mentions snowy owls. The Ipswich sparrows were tame and easily watched. They are large grey Savannah sparrows which breed, as far as is known, only on Sable Island. I heard none singing, although at that time the Savannahs of the mainland were still in good song, and the residents say that the "greybirds" do not sing at any season. Some remain all winter.

It is said that foxes, red and black, were native to the island in early days and were later exterminated. Rats from wrecked ships are said to be common, but I saw no trace of them. There is said to be one rabbit, probably a tame one and not descended from any of the frequent introductions. Seals used to haunt the beaches in thousands, but I saw only two harbour-seals which lifted themselves shoulder-high out of the breakers to watch the men unloading the surfboats. Porpoises were once seen at sea, and many were found stranded on the south beach.

The ponies are a most attractive feature of the island. Their origin is lost in the hearsay of island history. Horses and cattle were introduced by the Portuguese in the sixteenth

century and became abundant, but both are said to have been killed out in the eighteenth century. In 1738 LeMercier is said to have stocked the island with cattle, and it is presumed that he brought horses from New England at the same time. Certainly they are mentioned frequently thereafter, for the island was never again uninhabited for long periods. Today ponies are almost always in sight, grazing in family groups called "gangs" which consist of a stallion, two or three mares and some young ones. They seemed in excellent condition, but the mares were rearing, by my estimate, a foal to every three and one-third years, not a high birth-rate. There were no old or sickly animals about, and frequent skeletons left over from the winter explained why. I kept a rough count of those seen and estimated that I had observed one hundred and forty in two-thirds of the island, which would give a total of about two hundred for the whole. Ponies were much more abundant in the east end, which suggests that an averaging estimate may be very inaccurate. These ponies are, of course, descended from horses of normal domestic size and have in forty generations reverted almost to the size of their wild ancestors.

PHYSICAL HISTORY

Geologists have not agreed upon the origin of Sable Island. Goldthwait suggests the analogy of the double sandbars that link pairs of the Magdalen Islands but admits that there are no known planed-off islands to initiate such a formation. Others have suggested that the sand has been swept together by the fairly rapid currents which eddy around this spot. A third possibility would have been a great drumlin or moraine now sifted into sand and not yet scattered.

The first description of the island is from French sources of 1633 and describes it as being forty miles in "circumference" and much longer than wide. This would be true today. A student of the island, S. D. Macdonald, was indignant at this and estimated that, if erosion had been constant, the is-

land at that date must have been two hundred miles long and eight hundred feet high. The figures on which he based his theory have been gathered by Patterson. They report the destruction from the west end of: four miles, 1814; four miles, 1820; eleven miles in the thirty years before 1851, according to Joseph Howe; three miles, 1881-3; and I was told of another three miles lost in the nineteen-thirties. Of the original nine miles west of Wallace Lake thirty-three have been washed away and six are left. These are typical Sable Island statistics.

The charts tell a different story, although their gloss is often as confusing. Two surveys, made independently in 1766 and in 1770, show the island to have measured twenty-four miles in a straight line from tip to tip. I have not found a copy of the chart of 1828. In 1850 Capt. Bayfield, a famous maker of maps, surveyed the island and found that it had lost two miles from the west end and had gained nothing on the east end since 1828. Another author says that this survey shows that the island had lost six miles from the west end and had gained five miles on the east. The chart shows the island then to have been twenty-three miles from tip to tip. In 1899 the Geological Survey again mapped the island, and their chart shows it to have been twenty-four miles from tip to tip. I have seen no more recent survey. What is obvious from the charts as well as from descriptions is that the island has narrowed progressively throughout this period. Today few places can be more than half a mile wide.

On going ashore on Sable Island I was struck immediately by the extreme looseness of the sand. On the dunes, and even on the damp beach, one sank almost ankle-deep. I noticed that the waves came up the beach but did not run back again; instead, they sank into the sand. It occurred to me that this would be reasonable if the sand-grains were rounded. I did not think to collect sand from the beach, but I had plenty on the roots of my plants, and I have drawn and measured samples and compared them to three other lots of quartz sand. The

samples were collected by passing a slide of unsorted sand under the microscope and measuring and drawing each grain as it appeared in the field. Measurements are in microns. The rotundity quotient is the result of dividing the longest diameter of each grain by the shortest diameter, each line to pass through approximately the centre of the grain. Measurements are based on the average of ten grains of which only the first five are pictured.

Origin of Sand.	Maximum	Minimum	Average	Rotundity
Lake Mockingigh, Hants County.....	667	238	442	58
Sand Lake, Outram, Annapolis County.	2125	119	539	56
Cape North Corner, Victoria County...	646	204	423	48
Sable Island.....	1105	425	624	80

Only the roundness and the minimum measurements of the Sable Island grains seem to be significant. This roundness of the grains must affect the building up of the island. A sphere presents the maximum average cross-section to forces from all directions, and has the minimum average surface touching other surfaces, and has the smallest area of surface for its volume. Waves passing over sands will lift such spherical particles most readily and will also drop them most readily. Waves of water will be accompanied by slower waves of sand, the bars, which will move towards the shore and break at last upon the beach. Winds from north or south will be pressed upwards by the coastal dunes and, increasing in volocity, will funnel the beach-sand upward. On passing the dunes they will lose speed and will drop it again. So the dunes will move slowly inland. The smallest sand-particles will be carried farthest and will be most often lost. Larger particles which fall soon into the sea, will be brought back again by the waves until in time they are worn down into smaller ones and so lost. Thus the total bulk of the island diminishes.

Patterson pointed out that periods of erosion alternated with periods of stability, and he attributed the erosion of the island chiefly to the wind which carried away hundred-foot sandhills in a single gale. Macoun disagreed with this and considered the wind to be the builder and the sea the destroyer. I consider the sea and the wind to be both builders and both destroyers, the sea being the more powerful in each category.

Macoun also thought that Sable Island had never had trees and was incapable of harbouring them. However, the government carried out a huge experimental afforestation of the island in 1901. Dr. Saunders visited the coasts of Brittany to get information about the trees hardiest on the coastal sands, the soils of Sable Island were analyzed and fertilizers were sent out, everything was done to make the project a success, except small-scale experiment. Then more than eighty thousand trees and shurbs were planted out and thirty pounds of pine-seed was scattered. By 1913 the plantings were reduced to seventy-seven survivors; in 1937, according to a lifeboat man, one pine-tree, growing flat to the ground, was still to be seen; and in 1952 there remained only one small shrub of buckthorn. Güssow and St. John found heather, introduced accidentally then, and it is possible that the holly-shrubs now scattered over the west end of the island may have come in with the trees, for Macoun did not see them.

Today anti-erosion schemes are again afoot, and it is possible that the extensive use of *Rosa rugosa* and tamarisks might reduce the shifting of the inland sands and speed the building up of dunes. A reduction of the number of ponies to the point where the sand-grasses again found it possible to seed, might help to bind the high dunes on the inner side. But such measures should be justified only by their effect upon the amenities of the island. They will not lengthen its life by one percent.

My own view of the island does not include any possibility that this huge sandbank has any long future before it

or any long past behind it. Almost certainly it is built of sand ground from rocks of the neighbouring shore. Any such material exposed on the continental shelf must have, in the course of centuries, been reduced to sand. During the glacial period when millions of cubic miles of water were locked up on the land in the form of ice, the sea-level was reduced progressively by about three hundred feet, and, during this long period, perhaps twenty thousand years, no island such as Sable could have failed to be cut down to below the level of the waves. However, if this sand could again have been collected on the shelf, whether by the Labrador Current or other means, when the sea-level was lowered again by some fifty feet during the twelfth century, the top of this bank would again have emerged sufficiently to be acted upon by the waves.

A flat table of sand at about the five fathom depth would, of necessity, have given rise to an island of sand. If it were high enough to slow down the waves, the waves would carry more sand inward than outward as on a beach. Bars would roll inward and build up to tide-level. Then a beach would emerge and be drifted into ripples, waves, dunes, by the action of the wind. So the island would emerge like an atoll of sand, highest at the outer edge parallel to the edge of the submerged sandbank, holding in its centre a lake, at first of the original depth of the surface of the sandbank but slowly filling up. The prevailing westerly winds would tend to drift the island eastward, but the average force of the waves would be least strong from the west, in which direction they have the shortest run, so that the sea would tend to push it back again. The inward movement of the dunes of Sable Island, unmistakable on the charts, is a measure of the gradual attrition of the mass of sand upon which it rests. If the present island were to be erased in a night of storm, a few years of waves and wind would rebuild it in much its present form, for the emergent island must be less than one percent of the submerged bank. But, when the bank is worn down, the island must go with it, and all the sand-binding plants in the world will not stop it. We

may expect in the next two centuries to see the dunes squeezing together until they meet and then are cut down to a fifty-mile bar below the level of the tide.

St. John's visit to Sable Island was inspired by Fernald's "coastal-plain hypothesis" which tried to explain an interrupted distribution of beach-plants from Maryland to Nefoundland. If the present fishing-banks had emerged above the water, they would have provided the desired stepping-stones of unglaciated land along the coast. This theory was at first welcomed by New England geologists who needed some such row of islands during the glacial period to explain why their coast had been then so little eroded. However, other geologists have insisted that the banks are too deep to have emerged, and Fernald himself was later obliged to push his coastal-plain back in time to the beginning of the Tertiary period when it was, in the author's opinion, not needed. If, however, our theory of the origin of Sable Island is correct, and such an island can result from a comparatively small lowering of sea-level, we should have expected many such islands to have emerged during the progressive lowering of the sea during the ice-age. Each of these would have been built up and cut down again during its brief thousand years, only to emerge again with the next lowering of the sea. Yet during their short lives they may have offered temporary footing for many sand-plants which the ice killed out on the neighbouring shore, while the present level of the banks, a few fathoms below the lowest level of the recent sea, is the state in which we expect Sable Island to remain in another thousand years.

St. John found confirmation for Fernald's theory, as he held it in that time, in the presence of southern species, such as *Centaurium* and *Centunculus* and Macoun's sponge, as well as of northern species, *Tillaea*, *Epilobium nesophilum*, *Potamogeton oblongus* and *Juncus bulbosus*, whidh were not known on the Nova Scotian mainland. Since that time, however, *Tillaea* has been found in Shelburne and Cape Bretoh counties, *Pota-*

mogeton oblongus twice in Inverness County, and *Centunculus* in Prince Edward Island. *Centaurium* is probably introduced. There remains two northern plants not known from nearer than Newfoundland, and an endemic sponge of southern affinities, to support the theory of the antiquity of the island. Theories have been built on less. On the other hand, my suggestion that the island may have emerged as recently as 1100 A.D. must be viewed rather as an antithesis to the older thesis than as a serious hypothesis. We can only reach a sound dating when geologists can give us a clear table of the relative movements of land and sea in this area during the post-Pleistocene period.

SUMMARY

The flora of Sable Island remains much as in previous reports. A few new species have been added to the lists for the island, but many, chiefly woodland species, were not observed, while the abandonment of all farming has reduced the variety of weeds. The pony-population is only half what earlier records claimed, yet the grass seems badly overgrazed. The author saw no evidence of antiquity in the plants named as endemics by Fernald and St. John and considers them rather to be inbred and depauperate mainland species. Geologically the island can scarcely be older than the peak of the Wisconsin glaciation, about 6000 B.C., and may be as recent as the last confirmed lowering of sea-level associated with the regrowth of northern glaciers in the twelfth century A.D.

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ADDENDUM

A visit to the island in 1953, from 28th to 30th August, yielded some additional observations.

Geological; The previous winter had had unusual storms which had driven saltwater far into the brackish ponds, resulting in the death of much vegetation. However, the storms had also driven up on the beach at the eastern end of the island large quantities of pebbles which were not noticeable the year before. These were of quartz, quartzite, granite, felsite and less definitely classifiable igneous rocks. They were somewhat water-rounded, but the larger ones usually showed a flattened "sole" suggesting glacial origin. Professor Cameron of Acadia University was of the opinion that these stones had been through the glacial mill and were of varieties to be expected in local glacial deposits. Of course, one cannot eliminate the possibility that wrecked ships may have been ballasted with similar material from the mainland, but, if so, many such ships must have been wrecked along some ten miles of coast and all of them ballasted with the same assortment of rocks. With this reservation, the origin of the island as a glacial moraine is supported, since no ocean current could have swept together such pebbles.

Botanical: A few weeds but no new native vascular plants were added to the lists for the island, but some additions to the author's list were made by Mrs. Cameron of the Meteorological Station and by the author.

Schools of small fish were observed in the ponds, and some *additional birds were*: Pied-billed Grebe; Leach's Petrel; Heron; Bluewinged Teal (with young); Blackbellied Plover; Golden Plover, Dowitcher; Knot; Solitary Sandpiper; White rumped Sandpiper; Semipalmated Sandpiper; Greater Yellowlegs; Lesser Yellowlegs; Upland Plover (new to the author and so not reliable); Sanderling; Bonaparte's Gull; Blackbilled Cuckoo; Nighthawk; Bank Swallow; Crow (flock of nine); Mockingbird!; Cedar Waxwing.

SABLE ISLAND VASCULAR PLANTS—NATIVE

(In order to link this list with St. John's, his name is given first and, when this has been changed, it is bracketed and the Gray's Manual, 1950, name added. For brevity, references are omitted.) Legend: J.M. = Macoun; HG = Gussow; SJ = St. John; JSE = Erskine. x = collected; – = not collected.

	JM	HG	SJ	JSE	Others
Polypodium virginianum L.	x	–	–	–	–
Osmunda cinnamomea L.	x	x	x	–	–
Lycopodium inundatum L.	x	x	x	–	
Juniperus communis **megistocarpa** Fern. & SJ	x	x	x	x	
Juniperus horizontalis Moench.	x	–	x	x	
Typha latifolia L.	x	–	x	–	
Sparganium angustifolium Mx.	x	–	x	x	
(*Potamogeton polygonifolium*) = *P. oblongus* Viviani	x	–	x	x	
Potamogeton epihydrus Raf.	x	–	x	–	
(*Potamogeton bupleuroides* Fern.) = *P. praelongus* L., *bupleuroides*	x	x	x	x	
P. pusillus (*capitatus*) L.	x	–	x	–	
Ruppia maritima f. *longipes* Hagstr.	x	–	x	x	
Zostera marina L.	x	x	x	–	
(*Panicum huachucae* Ashe) = *P. languinosum fasciculatum* (Torr.) Fern.	x	–	x	x	
Agrostis alba (*maritima*)	x	x	x	x	
A. (*hyemalis*) *geminata* Trin.	–	–	x	–	
Ammophila breviligulata Fern.	x	x	x	x	
Deschampsia flexuosa (L.) Trin.	x	x	x	–	
Danthonia spicata (L.) Beauv.	x	–	–	x	
(*Spartina Michauxiana* Hitchc.) =*S. pectinata* Bose	x	x	x	x	
Poa pratensis L. (if *P. subcaerulea* Sm. was intended)	x	x	x	x	
Glyceria Fernaldii (Hitchc.) St. John	x	–	–	–	
Festuca rubra L.	x	x	x	–	
F. rubra glaucescens (Hartm.) Holm.	–	–	x	x	
Agropyron repens (var.) =f. *pilosum*	–	–	x	x	
Elymus arenarius villosus Mey.	–	–	x	x	
Eleocharis palustris (L.) R. &. S.	x	x	x	–	
E. palustris glaucescens	x	–	x	–	

	JM	HG	SJ	JSE	Others
E. halophila Fern. (probably both of above)	–	–	–	x	
(*Scirpus nanas* Spreng.) =*Eleocharis parvula* (R. & S.) Link.	x	x	x	x	
S. americanus Pers.	x	x	x	x	
(*S. acutus Muhl.*) =*S. validus Vahl*	x	x	x	x	
S. (*campestris* var.) *paludosus*	x	–	x	x	
S. maritimus var. *Fernaldii* (Buckn.) Beetle	–	–	–	x	
Carex hormathodes Fern.	x	–	x	x	
C. silicea Olney	x	–	x	x	
C. echinata Murr.	x	–	x	–	
C. (*echinata* var.) *cephalantha*	x	–	–	–	
C. canescens L. var. *disjuncta* Fern.	x	–	x	x	
C. deflexa Hornem.	x	–	–	–	
(*C. Oederi* var. *pumila*) =*C. viridula* Mx.	x	–	x	x	
Triglochin palustris L.	–	–	–	x	
Eriocaulon septangulare With.	x	–	x	x	
Juncus bufonius L.	x	x	x	x	
J. b. var. *halophilus* Buchenau & Fern.	–	–	x	–	
J. tenuis Willd.	x	x	x	x	
J. balticus Willd., var. *littoralis* Engelm.	x	x	x	x	
J. canadensis J. Gay	x	x	x	x	
J. pelocarpus var. *sabulonensis* St. John	x	–	x	x	
J. bulbosus L.	x	–	x	x	
J. articulatus var. *obtusatus* Engelm.	–	x	x	x	
(*Luzula campestris acadiensis*) =*L. multiflora acadiensis* Fern.	–	–	x	–	
Smilacina stellata (L.).Desf.	x	x	x	x	
Iris versicolor L.	x	x	x	x	
(*Sisyrinchium gramineum*) =*S. angustifolium* Mill.	x	–	x	x	
(*Habenaria bracteata*) = *H. viridis* (L.) R. Br., var. *bracteata* (Muhl) Gray	x	–	–	x	
Habenaria clavellata (Mx.) Spreng.	x	x	x	x	
Habenaria lacera (Mx.) R. Br.	x	x	x	x	
Calopogon pulchellus (Sw.) R. Br.	x	x	x	x	
C. p. (forma) *var.* **latifolius** (St. J.) *Fern.*	–	–	x	x	

	JM	HG	SJ	JSE	Others
(probably a late-summer form)					
Spiranthes Romanzofiana Cham.	x	–	–	–	
Myrica carolinensis Mill.	x	x	x	x	
(*Rumex Britannicus* L.)	x	–	x	–	
= *R. orbiculatus* Gray					
Rumex (*maritimus* var.) *fueginus*	x	–	x	x	
Polygonum Raii Bab.	–	–	x	–	
P. hydropiperoides var. psilostachyum					
St. J.	x	x	x	x	
Chenopodium rubrum L.	x	x	x	x	
Atriplex patula L., var. *hastata* (L.)					
Gray	x	x	x	x	
(*Spergularia leiosperma* Kindb.)	x	x	x	x	
= *S. marina* (L.) Griseb., var. *leios-*					
perma (K.) G.					
Sagina procumbens L.	x	–	x	x	
Arenaria lateriflora L.	x	x	x	x	
A. peploides L., var. *robusta* Fern.	x	x	x	x	
(*Nymphozanthus variegatus* (Engelm.)					
Fern.)	x	–	x	x	
= *Nuphar variegatum* Engelm.					
Ranunculus Cymbalaria Pursh.	x	–	x	x	
R. reptans L.	x	x	x	x	
Thalictrum polygamum Muhl, var.					
hebecarpon F.	x	x	x	x	
Coptis trifolia (L.) Salisb.	x	–	x	–	x
Cakile edentula (Bigel.) Hook.	x	x	x	x	
Drosera rotundifolia L.	x	x	x	x	
(*Drosera longifolia* L.)	x	–	–	x	
= *D. intermedia* Hayne					
Tillaea aquatica L.	x	–	x	x	
(including records of *T. Vaillantii*)					
(*Pyrus atropurpurea*)	x	–	x	x	
= *P. floribunda* Lindl.					
Fragaria virginiana Duch., var. *terrae-*					
novae	x	x	x	x	
Potentilla norvegica L.	x	x	x	x	
P. palustris (L.) Scop.	x	–	x	x	
P. palustris, var. *parvifolia* (Raf.) Fern.	–	–	x	–	
P. tridentata Ait.	x	x	x	x	
(*P. pacifica* Howell)	x	x	x	x	

	JM	HG	SJ	JSE	Others
= *P. Oederi groendlandica* (Tratt.) Pol-					
Rubus hispidus L.	x	–	–	–	
Rubus **arcuans** *Fern. & St. J.*	x	x	x	x	
Rosa virginiana Mill.	x	x	x	x	
(*Lathyrus maritimus* (L.) Bigel.)	x	x	x	x	
=*L. japonicus* Willd.					
L. palustris L., var. *macranthus* (T.G. W.) F.	x	x	x	?	
(some plants nearer to v. *linearifolius*)					
L. P., var **retusus** *Fern. & St. J.*	–	–	x	?	
(some plants have some such leaves)					
Empetrum nigrum L.	x	x	x	x	
Ilex verticillata (L.) Gray	–	–	x	x	
Hypericum boreale (Britt.) Bickn.	x	x	x	x	
H. virginicum L.	x	x	x	x	
Viola septentrionalis Greene	–	–	–	–	x
V. lanceolata L.	x	x	x	x	
V. primulifolia L.	–	–	x	x	
V. pallens (Banks) Brainerd	–	–	x	x	
V. incognita Brain., var. *Forbesii* Brain.	–	x	–	–	x
(*Epilobium molle sabulonense*)	x	–	x	–	
=*E. nesophilum* Fern., *var.* **sabulonense** F.					
Oenothera cruciata Nutt., *v.* **sabulonensis** *F*	x	–	x	x	
(probably a form of next species)					
(*Oenothera muricata* L.)	x	–	x	x	
= *O. parviflora* L.					
Myriophyllum tenellum Bigel.	x	x	x	x	
Hippuris vulgaris L.	x	x	x	x	
Ligusticum scothicum L.	–	–	x	–	
Coelopleurum lucidum (L.) Fern.	x	x	x	x	
Cornus canadensis L.	–	–	–	–	x
(*Vaccinium pensylvanicum* Lam.)	x	x	x	x	
=*V. angustifolium* Ait.					
Vaccinium macrocarpon Ait.	x	x	x	x	
Lysimachia terrestris (L..(BSP	x	x	x	x	
Trientalis borealis Raf.	x	–	x	x	x
Centunculus minimus L.	x	–	x	x	
(*Bartonia iodandra sabulonensis*)	–	–	x	–	
= *B. paniculata* (Mx.) Muhl., **sabulonensis** Fern.	–	–	x	–	

	JM	HG	SJ	JSE	Others
Menyanthes trifoliata L.	x	–	–	x	
Centaurium umbellatum Gilib.	x	x	x	x	
Convulvulus sepium L.	x	–	x	x	
Teucrium canadense L. (var. *littorale*)	–	–	x	–	
Lycopus uniflorus Mx., (*var.* **ovatus** F & SJ (variety now suppressed even by Fernald)	x	x	x	x	
Mentha arvensis L.	–	–	x	–	
Limosella subulata Ives	x	–	x	x	
(*Agalinis paupercula neoscotica*) = *Gerardia neoscotica* Greene	x	–	x	x	
(*Euphrasia purpurea* Randii) = *Euphrasia Randii* Robins., v. Far-Robins., forma *iodandra* (F. & W.) Fern.	x	(x)	x	x	
Rhinanthus Crista-galli L.	x	x	x	x	
Utricularia cornuta Mx.	x	–	–	–	
Plantago major L., (var. *intermedia*)	x	x	x	x	
(*P. decipiens* Barn.) = *P. juncoides* Lam., v. *decipiens* (B) Fern.	x	x	x	x	
Galium trifidum L.	x	x	x	x	
G. Claytoni Mx.	–	–	x	–	
Mitchella repens L.	x	x	x	–	x
(*Lonicera caerulea calvescens*) = *L. villosa* (Mx.) R. & S., v. *calvescens*	x	–	–	–	x
Linnaea borealis L., var. *americana*	x	x	x	–	
Viburnum cassinoides L.	x	x	x	x	
Lobelia Dortmanna L.	x	–	x	x	
Solidago sempervirens L.	x	x	x	x	
Aster novi-belgii L.	x	x	x	x	
A. n-b., var. *litoreus* Gray	x	–	x	–	
Anaphalis margaritacea subalpina	x	–	x	x	
Gnaphalium obtusifolium L.	x	x	x	x	
Bidens frondosa L.	x	–	–	–	
B. connata Muhl., var. *petiolata* (Nutt.) Far.	–	x	x	–	
Achillea lanulosa Nutt.	x	x	x	x	
Senecio Pseudo-arnica Less.	x	x	x	–	
Prenanthes trifoliolata (Cass.) Fern.	x	x	x	x	

	JM	HG	SJ	JSE	Others
(*P. nana* (Bigel.) Torr.) = *P. t.*, var. *nana* (Bigel.) Fern.	–	–	x	–	
Hieracium scabrum Mx., *var.* **leiocaule** F & SJ	x	x	x	x	

INTRODUCED VASCULAR PLANTS

Pinus montana Mill.	–	–	x	–	
P. sylvestris L.	–	–	x	–	
Picea canadensis (Mill.) BSP	–	–	x	–	
Echinochloa Crusgalli (L.) BSP	–	–	x	–	
Anthoxanthum odoratum L.	–	–	x	–	
Phleum pratense L.	x	–	x	x	
Avena sativa L.	–	–	x	x	
A. S., var. *orientalis* (Schreb.) Richter	–	–	x	–	
Poa annua L.	x	–	–	x	
P. palustris L.	x	–	–	–	
P. pratensis L. (See *P. subcaerulea*)	?	?	?	x	
Bromus secalinus L.	x	–	–	–	
Agropyron repens L.	x	–	x	x	
Hordeum jubatum L.	x	–	x	–	
Betula pendula Roth.	–	–	x	–	
B., alba L.	–	–	x	–	
Rumex crispus L.	x	–	x	–	
R. Acetosella L.	x	x	x	x	
Polygonum aviculare L.	x	–	x	–	
P. l., var. *prostratum Wimmer*	–	–	x	x	
Chenopodium album L.	x	–	x	x	
C. Bushianum Aellen	–	–	?	x	
Spergula arvensis L.	x	–	x	–	
Stellaria graminea L.	x	–	x	x	
S. media (L.) Cyrill.	x	–	x	x	
Cerastium vulgatum L.	x	–	x	x	x
Silene noctiflora L.	–	–	x	–	
Ranunculus repens L.	x	–	–	–	
R. acris L.	x	–	x	x	
Portulaca oleracea L.	–	–	?	–	
Capsella Bursa-pastoris (L.) Medic.	x	–	x	–	
Raphanus sativus L.	–	–	x	–	
R. raphanistrum L.	–	–	–	x	
Brassica arvensis (L.) Ktze.	x	–	x	x	
Sisymbrium officinale (L.) Scop.	–	–	x	–	

	JM	HG	SJ	JSE	Others
Hydrangea paniculata grandiflora Sieb.	–	–	x	–	
Rosa rugosa L.	–	–	–	x	
Cytisus scoparius (L.) Link.	–	–	x	–	
Trifolium pratense L.	–	x	x	x	
T. repens L.	x	–	x	x	
T. hydridum L.	x	–	x	–	
Vicia Cracca L.	–	–	–	x	
Acer plantanoides L.	–	–	x	–	
Rhamnus Frangula L.	–	–	x	x	
Pastinaca sativa L.	–	–	x	–	
Daucus Carota L.	–	–	x	–	
Calluna vulgaris (L.) Hull.	–	x	x	–	
Lappula echinata Gilib.	–	–	x	–	
Galeopsis tetrahit L., v. *bifida* (Boehm.) L & C	–	–	x	–	
Solanum nigrum L.	x	x	x	x	
Lycium europaeum L.	–	–	x	–	
Gnaphalium uliginosum L.	x	–	x	–	
Rudbeckia hirta L.	x	–	–	–	
Anthemis Cotula L.	x	x	x	–	
Matricaria matricarioides (Less.) Port.	–	–	–	x	
Chrysanthemum leucanthemum pinnatifidum	–	–	x	x	
Cirsium arvense (L.) Scop.	x	x	x	–	
Cichorium Intybus L.	–	–	x	–	
Leontondon autumnalis L.	x	x	x	x	
Taraxacum officinale Weber	x	–	x	x	
Sonchus asper (L.) Hill	–	–	x	x	
Sonchus arvensis glabrescens GGW	–	–	–	x	

MOSSES

(*Sphagnum molle* Sull.) = *S. tabulare* Sull.)	x			–	
*Common by freshwater ponds.					
S. subsecundum Ness	–			x	
*As above, perhaps the same plant.					
S. imbricatum Hornsch.	–			x	
*Occasional by fresh ponds.					
Dicranum Bergeri Bland.	x			–	
Leucobryum glaucum Schimp.	x			x	
Ceratodon purpureus Hedw.	x			x	

	JM	JSE
Aulacomnium palustre Schwaeg.	–	x
Bryum inclinatum B. & S.	x	–
(*Webrea pseudo-carnea* Kindb.) = *Pohlia bulbifera* (Warnst.) Warnst.	x	–
(*Bryum Knowltoni* Barnes) = *B. lacustre* (Web. & Mohr) Bland	x	–
Drepanocladus fluitans Hedw.	x	–
D. aduncus Hedw. Perhaps the same as the above species.	–	x

LICHENS

Parmelia saxatilis (L.) Fr., v. *sulcata* Nyl. On old boards and posts.	x	–
P. physodes L., var. *vulgaris* Krob. As above JM; on shrubs and sand JSE	x	x
P. olivacea (L.) Ach., var. *sorediata* (Ach.) Nyl. On old boards and posts JM.	x	–
Sticta pulmonaria (L.) Ach. On Empetrum.	x	–
Peltigera canina (L.) Hoffm. On sandy earth, east end.	x	–
Lecanora subfusca (L.) Ach., v. strynea Ach. On fences near sea.	x	–
L. varia (Ehrh.) Nyl. On old rails.	x	–
L. varia, var. *symmicta* Ach. On old rails.	x	–
Centraria aculeata (Schreb.) Fr. Once, on dryish sandhill.	–	x
Cladonia pyxidata (L.) Fr. On earth, east end.	x	–
C. fimbriata (L.) Fr. On earth, rather rare.	x	–
C. gracilis (L.) Nyl., v. *verticillata* Fr. On old land, rather rare.	x	–
C. furcata (Huds.) Fr., var. *subulata* Floerk.	x	–

	JM	JSE
Not uncommon.		
C. uncialis	–	x
Occasional.		
C. rangiferina (L.) Hoffm.	x	x
On earth, frequent.		
C. sylvatica L.	x	–
On earth.		
C. s., var. *alpestris* L.	x	–
On earth, east end.		
C. diformis (L.) Hoffm.	x	–
On earth, old land.		
C cristatella Tuckerm.	x	–
On old land.		
Buellia myriocarpa (DC) Mudd.	x	–
On old boards.		
Xylographia parallela (Ach.) Fr.	x	–
On old fences.		

ADDENDA From Visit of 1953

Vascular Plants: *Potamogeton epihydrus* Raf., var. *Nuttalli* (C. & S.) Fern.; *Zostera marina* L.; *Hordeum jubatum* L., *Spiranthes Romanzoffiana* Cham.; *Lycopodium inundatum* L.; *Polygonum cuspidatum* Sieb. & Zucc.; *P. Persicaria* L.; *Trifolium hybridum* L.; *Calluna vulgaris* (L.) Hull; *Teucrium canadense* L.; *Mentha arvensis* L.; *Plantago lanceolata* L.; *Bidens connata* Muhl., var. *petiolata* (Nutt.) Farw.

Mosses: *Sphagnum Girgensohnii* Russ.; *S. cuspidatum* Ehrn.; *Polytrichum commune* Hedw.; *Dicranum Bergeri* Bland.; *Bryum Bimum* Schreb.; *Mnium hornum* Hedw.; *Drepanocladus exannulatus* (Guemb.) Warnst. and two doubtful and sterile specimens which Dr. Andrews considers to be (1) *Fontinalis* but with some differences both from *F. dalecarlica* Bry. Eur., which furthermore does not normally live in brackish ponds, and from *F. Sullivantii* Lindb., which would be about a thousand miles north of its known range; (2) a small Pleurocarp which the author thought might be *Amblystegium compactum* (C.M.) Aust. but which Dr. Andrews thought nearer to *Eurhynchium praelongum* (Dill L.) Bryhn, as this species was formerly conceived.

Hepatics: *Cladopodiella fluitans* (Nees) Joerg.