

SEARCHING FOR BOTANICAL KNOWLEDGE: THE PLANT HUNTERS OF THE NOVA SCOTIAN INSTITUTE OF (NATURAL) SCIENCE, 1862-1902

RICHARD H. FIELD*

*Former Adjunct Professor, Atlantic Canada Studies Program,
Saint Mary's University, Halifax, NS*

ABSTRACT¹

Accepting Suzanne Zeller's notion that maddening historical and scientific enticements are lurking in the 150 years [now 162 years] of the *Proceedings and Transactions* of the Nova Scotian Institute of Science, this paper examines the botanical contributions of eight prominent Institute plant hunters who published papers on their findings between 1863 (volume one) and 1902 (volume ten). Some members of this varied group of clergy, naturalists, botanists, lawyers and physicians, whose interest in nature often transcended their professional and private lives, studied plants and assembled herbaria as leisurely indulgences; others viewed the natural world through a theological lens, but many considered the accumulation of botanical knowledge an essential science. Rather than a single narrative thread, this paper intertwines a series of brief biographies of each plant hunter, followed by summaries of published reports about important botanical questions that occupied the Institute during its formative years and contextually relevant commentaries to tell the wider story of the evolving and often controversial relationship between the Institute and the role of natural history to both science and society during its first four decades.

Keywords: botany, plant hunters, NSIS, herbarium, phenology, natural history, natural science

* Author to whom correspondence should be addressed: A00002239@outlook.com

¹ The reader should keep in mind that the various operational practices that make up the search for botanical knowledge were intrinsically embedded in a series of global networks that enslaved humans, exploited Indigenous knowledge and resources, and disenfranchised people from the geography of their birth. Therefore, the author acknowledges the existence of harmful content in some of the sources referenced in this manuscript. Equally important is the awareness of ongoing, often contentious efforts to decolonize the history of plant collecting from its imperial past by natural history museums and collectors. These activities may include explaining how the plant was acquired, commenting on or removing derogatory notes on plant labels, identifying the practitioners who assisted plant collectors in finding a plant and informing plant hunters about its uses and properties, and giving greater recognition to the importance of plants in the Indigenous and non-Indigenous societies where the specimens were acquired.

INTRODUCTION: PLANT HUNTING AS SCIENCE²

“I Staid [sic] at 13000 ft. very much on purpose to collect the seeds of the rhododendrons and with cold fingers, it is not very easy.... Botanizing during March is difficult. Sometimes the jungle is so dense that you have enough to do to keep hat and spectacles in company, or it is precipitous...certainly one often progresses spread-eagle fashion against the cliff, for some distance, and crosses narrow planks over profound Abysses, with no handhold whatever.”

John Hooker [1817-1911] to William Hooker [1785-1865] from Darjeeling, 1849. Kew Royal Botanic Gardens, 2023. Joseph Hooker Correspondence Project. JDH/1/10, ff. 146-147.

Several years ago, I purchased an old volume of the complete plays of Shakespeare at a secondhand bookstore, dedicated on the title page in fine italic script to a woman named Virginia. As I thumbed through the pages of the Bard's comedies and dramas, many with hand-printed annotations along their margins, a dried, red tulip slipped from its silent resting place and fell to the bookstore floor. Unwittingly, I conjured the moment Virginia pressed the flower between the pages of the book, opening a portal into her past in another time and another place, and although I could not extract the stored memories that the flower contained, I was able to access them from an outsider's point of view. Whether the pressed tulip symbolized pleasure, love, loss or unbridled desire was now up to my imagination.

As much as I enjoyed finding an exquisite one-volume edition of Shakespeare's complete plays and surmising that Virginia pressed the tulip, symbolic of eternal love and passion, between its pages to memorialize a loved one, the one thing that I knew absolutely nothing about was the flower's origin, where it was picked and by whom and what species of tulip it was. As Ann Shteir observed, the publication of the hierarchal system of plant identification by Carl Linnaeus in 1735 delineated the boundary between botany as a serious science

² Before the terms science and scientist were invented at Cambridge in 1833 by William Whewell [1794-1866] as parallels to the terms art and artist, people who studied nature were known as naturalists and natural philosophers. The shift from naturalist to scientist marked a turning point in the way the natural world was studied, which the German sociologist Max Weber [1864-1920] described as “the disenchanting of the world” (Bergland 2024).

carried out by enlightened gentlemen from the genteel forms of plant activities “associated with girls and women in the polite culture of eighteenth and nineteenth-century Britain and its colonial and imperial domains” (Shteir 2022).

The point here is that where a plant comes from, whether it be found in an urban or rural setting, deep within a tropical rainforest or pressed between the pages of an old book, has nothing to do with its value as a viable botanical specimen unless accompanied by the date and place where it was collected, its specific habitat, the composition of the soil, the plant’s colour, smell, height and growth habits. Traditionally, this documentation is recorded in a notebook (Field 2023) or directly onto the sheet of paper on which the plant is pressed and mounted to create a “dry garden” or *hortus siccus*.³ As Walter Lack wrote, “The triad of specimens, printed description and printed illustration, plus supplementary annotations such as the specific location where the specimen was found, is to this day regarded as the ideal standard because it provides a comprehensive notation of the plant in question” (Lack 2009). Consequently, plant hunting only becomes a science when this information accompanies each species collected.

As Hooker recounted, searching for and documenting undiscovered plants or collecting seeds and type specimens of known species in hazardous terrains could be a challenging and sometimes dangerous enterprise. Michel Sarrazin [1659-1734], exploring the meadows, bogs and forests of the St. Lawrence River Valley in the summer of 1707, faced humid weather, ravenous mosquitoes and black flies, capricious Indigenous informants and good fortune at not being abandoned by his Voyageur guides in his efforts to collect plants (Young 1993). Once collected, it was necessary to preserve them, which Sarrazin accomplished by creating a large herbarium at the Hôtel Dieu in Québec (Young 1993). Here, he studied, conserved and prepared his botanical specimens for shipment to the Jardin du Roi, now the Jardin des Plantes, in Paris (Young 1993). Although destroyed by fire, Sarrazin’s Québec herbarium was an early 18th-century example of a research station serving as a specialized site of scientific activity to acquire botanical knowledge (Livingstone 2003). Over 30 years,

³ Luca Ghini [1490-1556] revolutionized plant collecting with his *hortus siccus*, or herbarium, a system that provided plant hunters with the ability to preserve living specimens. (Livingstone 2003, Pavord 2005, Flannery 2023).

Sarrazin collected and shipped thousands of seeds and plants to Paris. In 1704, his Québec herbarium contained over 200 species of plants waiting for transport. Sarrazin, who died in 1734 at age 74, was one of the most remarkable field naturalists and plant hunters of the 18th century.

No matter how carefully one collected, prepared and mounted their specimens, preserving and shipping plants remained challenging. Listen to the lamentations of Alexander von Humboldt [1769-1859] in a letter to his mentor Carl Ludwig Willdenow [1765-1812]. “But Oh! We open our boxes of plants almost in tears.... The endless humidity of the American climate and the rankness of the vegetation, which makes it so difficult to find mature, fully-grown leaves, have ruined over 1/3 of our collection. Every day we find new insects that destroy paper and plants” (Lack 2009). But few losses can compare to those of Alfred Russel Wallace [1823-1913] and Henry Walter Bates [1825-1892]. After more than four years [1848-1852] of collecting thousands of birds, beetles and butterflies from Brazil’s Amazon rainforest, on their return to England, their ship caught fire and sank with almost all of their specimens and field notes. Dampness, darkness, neglect, insects and even fire urgently necessitated appropriate devices and shipping methods to protect plant specimens during hazardous sea voyages and overland journeys.

One of the earliest pieces of equipment used to collect and safely transport field specimens was a vasculum, an oval-shaped, flattened cylinder fabricated from tin and similar in construction to 17th-century candle boxes. William Dampier [1652-1715], the first Englishman to collect plants from parts of New Holland, New Guinea, Java, Timor and Brazil, whose patrons included Samuel Pepys [1633-1703] and John Evelyn [1620-1706], used vasculums and plant presses to preserve his living and dried specimens (Stuart 2002, Preston & Preston 2004). While the London apothecary James Petiver [1663-1718] printed a broadside in 1689 for his correspondents and plant suppliers with instructions for preserving, packaging and preparing seeds and young plants for shipment (Magee 2007), it was only in the late 18th century that protecting botanical material became more efficient using an array of tin and wooden box designs. In 1770, John Ellis [1710-1776] published *Directions for Bringing Over Seeds and Plants from the East Indies*, and two years later, John Coakley Lett-som [1744-1815] published *The Naturalist’s and Traveller’s Compan-*

ion, which included a chapter devoted to preparing and packaging plant specimens.

Finally, in 1833, Nathaniel Ward [1791-1868] revolutionized the transportation of plant material with his Wardian case when he successfully shipped ferns, mosses and grasses in two sealed glazed wooden boxes from London to Sydney, which were then replanted with specimens for the return voyage to England. Arriving eight months later, when Ward and his nursery-owner friend George Lodiges [1786-1846] inspected the shipment, they found the healthy fronds of a delicate coral plant unknown in Britain and black wattle seedlings sprouting from the soil (Keogh 2020). Ward's invention, which he never patented, led to two types of Wardian cases: the ornamental case, which was the forerunner of the Victorian terrarium that often housed delicate orchids and ferns, and the nautical case designed to protect plants from the perils of long sea voyages secured on the decks of ships where they benefited from sunlight, were watered by the condensed moisture that collected inside the glazed case and protected the plants from salt sea spray (Keogh 2020).

For the patient, self-confident plant hunter, botanizing requires observing and recording empirical data and knowing how to survive in an unfamiliar wilderness. Consider the experiences of Francis Masson [1741-1805], Kew Gardens' first official plant hunter, who made three journeys into the southern parts of Africa between 1772 and 1774. "January 10, 1773: I endured this day much fatigued in these sequestered and unfrequented woods, with a mixture of horror and admiration. The greatest part of the trees that compose them are unknown to botanists. Some I found in flower; others, were not so. I was obliged to leave for the research of those who may come after me in a more fortunate season" (Masson 1776). Again, during his second journey, Masson seemed overwhelmed by the vast assortment of new plants he saw. "September 27, 1773: From Saldana Bay, we journeyed to Witte Klip, a white granite stone of enormous size, from the top of which we had a charming view of the seacoast from St. Helena Bay to the Cape of Good Hope. The whole country affords a fine field for botany, being enamelled with the greatest number of flowers I ever saw, of exquisite beauty and fragrance" (Masson 1776). Some plant hunters, however, are driven to the point of addiction, as exemplified by Hooker freezing his fingertips at 13,000 feet in the

Eastern Himalayas, in the northernmost region of the Indian state of West Bengal, trying to collect *Rhododendron* seeds.

DISCUSSION THE INSTITUTE PLANT HUNTERS⁴

“We must consider the distinctive characters and the general nature of plants from the point of view of their morphology, their behaviour under external conditions, their mode of generation and the whole course of their life.” Theophrastus [371-287 BCE] *Historia Plantarum*.

Ball, E.H. (fl. 1870-1890)

Reverend Ball⁵ arrived in Nova Scotia as an itinerant evangelist missionary for the Society for the Propagation of the Gospel in Foreign Parts, founded in 1701 to provide clergy to minister to settlers and convert non-believers in the colonies. Shortly after his arrival, he joined the Nova Scotian Institute of Natural Science [hereafter NSIS] as a correspondent on 29 November 1871. Between 1871 and 1890, Ball preached to congregations at different parishes throughout Nova Scotia, including Mahone Bay, Springhill, Maccan and Tangier on the Eastern Shore. In his first botanical contribution to the NSIS *Proceedings and Transactions* [hereafter *Proceedings*] published in 1876, Ball provided an extensive list of ferns endemic to Nova Scotia, “taking some care not to repeat what has already been published by Dr. Asa Gray [1810-1888] in his *Manual of Botany* and by Dr. George Lawson [1827-1895] in his ‘Synopsis of Canadian Ferns’” (Ball 1876, Lawson 1864 and 1864a, Moore *et al.* 2010). In his second contribution, published six years later in 1882, Ball specifically examines the varieties of *Aspidium spinulosum*, commonly referred to as the shield fern. Ball’s interest in this particular species possibly stemmed from the plant’s indecisive characteristics, as discussed in an article published by George E. Davenport in November 1878 in *The American Naturalist* (Davenport 1878).

⁴ The scientific and common plant names are those supplied by the authors. Confirmed birth and death dates for individuals mentioned in this paper and ancillary comments by this author are in brackets. Also, note the occasional disconnect between the date a paper was read, sometimes by someone other than its author, and its date of publication.

⁵ In the *Cumulative Author and Subject Indices* for the NSIS *Proceedings*, there is only one entry for an E.H. Ball, to which both the 1876 and 1882 published articles on ferns are attributed. The attribution of one of these papers to an E.N. Ball is a typographical error.

* * * *

It is clear from Philip Carteret Hill's [1821-1894] inaugural presidential address delivered in 1863 and published in the NSIS *Proceedings* in 1867 that some of the Institute's earliest members pushed back against Charles Darwin's [1809-1882] evolutionary theory of natural selection. Although Darwin's work was published in 1859, three years before the founding of the NSIS, Hill and Reverend Ball remained "supportive of the missions of natural theology [the search for the Christian God in the natural world] and inventory science" that defended divine creation against Darwin's perceived heresy, which denied the beginning that Genesis demanded (Pittman 1993, Reynolds *et al.* 2020).

Hill received his law degree from King's College in 1858, was mayor of Halifax from 1861 to 1864 and premier of Nova Scotia from 1875 to 1878. He was one of the original founding members of the Institute, described by Harry Piers [1870-1940] as a "man of education and literary, but not scientific tastes, who possessed cultivated manners and financial means" (Piers 1913). Hill believed that the works of nature were the manifestations of the Creator's skill and one of the reasons for the Institute's foundation (Hill 1867, Reynolds *et al.* 2020). "It is then to aid in this important work and to afford a well-constructed and organized channel for the contributions to the general stock of knowledge of those among ourselves who are interested in the fascinating fields embraced in the term 'natural science' that the Nova Scotian Institute has been established" (Hill 1867, Lawson 1896).

In the first decades of the NSIS, some members of Nova Scotia's scientific community, such as Ball and Hill, remained firmly locked in a theological form of conservatism that viewed the study of nature as proof and knowledge of God beyond divine revelation, providing corroboration for the truths of Christianity through the living world (Reynolds *et al.* 2020). For those believers, studying plants was more a spiritual pursuit than a scientific endeavour. As Ball stated, "Botany is essentially a healthful study. Everything green speaks to the botanist. Flora, if I may be allowed the personification, is a companion that is ever by His side; and if but an attentive ear be turned towards much that she has to impart—for she is a holy handmaiden—she will teach (as the lilies of the field are being considered) that 'the works of the Lord are great'" (Ball 1876).

Hardy, Campbell (1831-1919)

On 12 May 1919, during the monthly meeting of the Nova Scotian Institute in the Physiological Lecture Room at Dalhousie College on Carleton Street, Harry Piers and Dr. Alexander Howard MacKay [1848-1929], Principal of Pictou Academy, announced with deep regret the death of Major General Campbell Hardy, R.A. Born in Norwich, England, in 1831, he died at Dover on 11 April 1919. In his lengthy obituary published in the Institute *Proceedings*, Piers stated that Hardy was the last “surviving original member of 1862, one of its former vice presidents, [who] possessed a splendid Christian character, was a good naturalist and an admirer of nature, a fine sportsman, and was gifted with an accomplished pen and a brush, [with] which portrayed local scenery with skill and fidelity” (Piers 1919). Hardy followed in the footsteps of other military artists stationed in Halifax, including Richard Short [*fl.* 1754-1766], Joseph Partridge [1792-1832] and John Elliot Woolford [1778-1866] who also depicted the province’s nature, landscapes, European settlements and Indigenous encampments. His drawing depicting the diggings at Gold River published in the *Illustrated London News* on 14 September 1861 and his panoramic view of the same river from Mahone Bay published on 1 October 1870 in the *Canadian Illustrated News* are particularly notable. But his painting titled “Cow Moose and Calf on the Edge of a Nova Scotia Lake,” dated 1863, is one of his finest works.

Hardy was an avid sportsman and hunter who shot his first moose near Ship Harbour shortly after arriving in Halifax, “a fine bull nearly 7 feet to the shoulder and weighing 1100 or 1200 pounds” (Piers 1919). Andrew Downs [1811-1892], the founder of the first Zoological Garden in North America north of Mexico City at the head of the Northwest Arm, mounted Hardy’s numerous trophies and served as his naturalist mentor. While Hardy’s submissions to the Institute *Proceedings* covered a wide range of subject matter, including one on the Beaver in Nova Scotia (Hardy 1867d), a long article “On provincial acclimatization” (Hardy 1867b), a study of the “nocturnal life of animals in the forest” (Hardy 1867), a review of the distribution of conifers throughout the North American colonies (Hardy 1867c) and a report on the caplin (*Mallotus villosus*), a small forage fish of the smelt family (Hardy 1867a), his final submission, read to the members on 11 March 1907, was dedicated to his friend and mentor Andrew Downs (Hardy 1908).

However, it was Hardy's love of the sporting life for which he was best known through his illustrated two-volume *Sporting Adventures in the New World, or Days and Nights of Moose-hunting in the Pine Forests of Acadia*, published in 1855, followed in 1869 by his *Forest Life in Acadia: Sketches of Sport and Natural History in the Lower Provinces of the Canadian Dominion*. Hardy's revealing observations and comments about the disposition of Nova Scotia in the mid-19th century, boldly expressed in his *Sporting Adventures in the New World*, concern us here. He described Nova Scotia as a young country, only partly cleared and settled. "The traveller or casual passenger through Halifax, one who has landed there on his way from Europe to Canada, or the United States, and perhaps been a few miles into the country out of curiosity, might leave the capital of Nova Scotia with a very poor and erroneous opinion of the fertility, romantic beauty, and internal resources, developed or undeveloped, of the province, though gratified by the manners, air of contentment, and hospitality evinced by its inhabitants" (Hardy 1855). While Hardy attempts to put a positive spin on the poor appearance of Halifax and the surprising underdevelopment of the province's resources, the simple fact is the colony had changed little since its founding in 1749.

* * * *

In 1774, two farmers from York, John Robinson and his friend Thomas Rispin, travelled to Halifax to investigate economic opportunities in Nova Scotia. They published their experiences and observations in *A Journey through Nova Scotia: Containing a particular account of the country and its inhabitants; with observations on the management in husbandry, the breed of horses and other cattle, and everything material relating to farming; to which is added an account of several estates for sale in different townships of Nova Scotia, with their number of acres and the price at which each is set*, which remains a superior example of 18th-century travel writing describing the colony's people, customs, culture and potential development while also advancing Britain's imperialist agenda to attract new colonists. (De Wolfe 1997, McNairn 2007). As they and their fellow passengers entered Halifax Harbour on board *Prince George*, "The prospect appeared very discouraging; nothing but barren rock and hills presented themselves to our view along the coast. This unfavourable appearance greatly damped the spirits of most passengers, and several

of them wished themselves in old England before they had set foot in Nova Scotia” (Robinson and Rispin 1774).

Their disappointment at seeing the bleakness and apparent desolation of the settlement was understandable for those passengers who based their expectations on the optimistic portrayals of Halifax published in popular London magazines. British outposts in North America were not exact replicas of English towns. Repeated mimesis fixed the standardized image of the British colony by emulating, copying and transferring a common assemblage of social, cultural and material traditions from centre to periphery through which the “original” model was replicated, creating a network of colonial settlements symbolic of imperial authority. Britain’s colonial identity-making also generated a parallel between old and new familiar to everyone, which was the explicit graphic reality portrayed in the maps and illustrations of the colony printed in various London magazines, and anticipated, if not expected, by the passengers arriving with Robinson and Rispin in Britain’s newest North American Colony (Lennox 2007, Crowley 2005, 2011, Jiménez 2010).

“It is indeed surprising what commercial notions many persons entertained of Nova Scotia previous to their leaving this country with a view to settling at this place. They imagined they would find lands cultivated, fields sown, and houses built...and they would have nothing to do but take possession” (Robinson and Rispin 1774). Like Hardy, Robinson and Rispin also found signs of English gentility and refinement among the residents regardless of class or wealth, noting, “Indeed the inhabitants, in general, poor, as well as rich, possess much common grace and good manners with which they treat each other as well as strangers.” Two years later, when Walter Barrell [1737-1815] arrived in Halifax accompanied by his wife and six children with General Howe’s [1729-1814] fleet following the evacuation of the Loyalists from Boston, his assessment of the colony was much less diplomatic. “Halifax was little more than a hamlet; at best it was a miserable village, inhabited chiefly by fishermen [and] most of the houses were in a dilapidated state, letting in the bleak winds of the season through manifold chinks, hardly a room ever having known the luxury of being plastered” (Stayner 1951). Undoubtedly, this reaction influenced Barrell’s decision to return to London.

When Lord Durham [John George Lambton, 1st Earl of Durham, 1792-1840] arrived in Canada in 1837 to investigate the circumstances

surrounding the Rebellions of Louis-Joseph Papineau [1786-1871] and William Lyon Mackenzie [1795-1861], Halifax had a population of less than 18,000 residents. Following a series of commissions, Durham compiled information about the people, geography, resources, agriculture and immigration in Lower Canada, Upper Canada, the Eastern Provinces and Newfoundland. In his final report, Durham's description of the Eastern Provinces was indeed bleak. While they had none of the alarming political features of the two Canadas and their loyalty and attachment to the Mother Country were warm, their varied and ample resources were turned to little account, and the scanty population exhibited an aspect of poverty, backwardness and stagnation. Several of Durham's assistant commissioners went so far as to describe them as melancholy, with lands abandoned and falling into decay, comments that reflected Titus Smith Jr.'s [1768-1850] testimony about the disposition of Nova Scotia (Durham 1839, Durham and Buller 1839).

In September 1838, Smith was selected as one of the delegates to testify before Lord Durham's Commission about the natural history, geography, geology, agriculture, fishing, mineral resources and people of Nova Scotia (Durham 1839, Durham and Buller 1839). After informing the commission that he had travelled extensively throughout the province for the government, a reference to his 1801-1802 surveys of the interior of Nova Scotia for Lieutenant Governor John Wentworth [1737-1820] and explaining that Nova Scotia consisted of 14 counties, the commissioners interrogated Smith about each county in turn, beginning with Digby and Annapolis. Most of the questions concerned the nature of the soil, the capabilities for agriculture and the availability of mineral resources, particularly iron and coal. Smith stated that the lands in Digby and Annapolis bordering the sea were considerably cultivated and the lands in the interior were good for cultivation but not settled for lack of roads. When asked about the slowness of improvement in Annapolis County, Smith replied that the general depression that existed for a long time was slowly improving. Other delegates from Nova Scotia⁶ gave similar

⁶ The other delegates from Nova Scotia included: J.S. Morris, Esq.; Sir Rupert George Bart, Secretary of the Province of Nova Scotia; Richard Brown, Esq., Mining Engineer; James McKenzie, Draftsman in the Surveyor-General's Office; John Fairbanks, Esq.; Laurence Hartshorne, Esq.; The Honourable Samuel Cunard; William Mackay, Land-Surveyor; The Honourable Thomas Baillie; The Honourable George Shore; and R. Hayes, Commissioner, N.B. and N.S. Land Company.

opinions about increasing the population and attracting investment capital to take advantage of natural resources, particularly fisheries, agriculture and mining (Field 2020). In 1841, two years after Durham's report, Halifax was incorporated, but little had changed. The population was down to 15,000, and except for the elegant neo-classical Province House, it remained a wooden town. Long rows of old "dirty" and "dingy" houses dating from the colony's founding had earned Halifax "its reputation of being the meanest-looking city in the civilized world in proportion to its wealth and other advantages" (Buggey 1980).

Regardless of these depressing and desolate assessments, seemingly unaccounted for by Durham and his commissioners were the educated colonists coming from places with well-established intellectual and literary enjoyments who encouraged efforts to improve the social and cultural prospects of the colony. Consequently, it was not the development of natural resources as Durham had predicted that would lead Nova Scotia out of its doldrums. Instead, the founding of educational institutions, subscription libraries, scientific and literary associations, and mechanics' institutes led the way. While the King's College Library in Windsor, founded in 1789, contained works that gentlemen would own on classical literature, agriculture, mathematics, theology and medicine, the colony's earliest public subscription library was formed in Truro in 1812. In 1817, as part of Britain's policy to provide recreational and educational opportunities for troops active in colonial service, George Ramsey [the 9th Earl of Dalhousie, 1779-1838], Lieutenant-Governor of Nova Scotia [1816-1820], established the Garrison Library in Halifax, which "served both the military community and the general public as a centre for reading and social interaction" (Elliott 1988).⁷ One year later, in 1818, Lord Dalhousie founded Dalhousie University on the Grand Parade in downtown Halifax.

⁷ The Garrison Library was renamed the Cambridge Military Library in 1902 after His Royal Highness Prince George, Duke of Cambridge [1819-1904]. Currently housed at Royal Artillery Park in Halifax, it is the oldest military library in Canada. Notably, in the 1860s, the library received a transfer of books from Corfu after the British evacuation in 1864, which included early works on voyages and travels, natural history, geography, science and military history. By 1886, the library contained over 30,000 volumes. Surprisingly, the list of subscribers between 1818 and 1835 included several women who were mostly the wives of officers, including Lady Dalhousie (Halifax Garrison Library 1835, Elliott 1988).

In 1821, subscription libraries opened in Newport and Amherst, followed by Yarmouth and Pictou in 1822 (Bruce 2018), the same year Phillip Holland [*fl.* 1821-1837], co-owner of the *Acadian Recorder* with his brother Anthony [*fl.* 1813-1837], deplored the lack of a library in Halifax and challenged Halifax's men of influence to come forward to form one. Supported by a successful subscription drive, the Halifax Library opened in a room in Province House in August 1824. However, it soon became evident that the library's elite location and membership costs created an exclusive clientele, which the Hollands jointly lamented in an editorial urging the library to lower its fees and admit more members.⁸ Dissatisfaction with the exclusive nature of the Halifax Library eventually led Joseph Howe [1804-1873], a self-educated journalist and reformer, to advocate for the establishment of a mechanics' library and institute similar to those in Glasgow and London (Smith 2004).

Howe's proposal recognized the increasing need for mechanics' institutes to help prepare workers to meet the challenges of mechanized production replacing long-established handcrafted traditions. In 1827, the editors of *The Colonial Patriot*, *The Novascotian* and the *Acadian Recorder* proposed establishing a mechanics' institute and library of useful knowledge to benefit workers, artisans, apprentices and journeymen (Fergusson 1960). Four years later, on 17 October 1831, the first books donated by subscribers to the Mechanics' Library Association were available to the public. As Karen Smith pointed out, the goals of the two libraries were very different. The Province House Library was established to advance the social and cultural image of its leading citizens, while the Mechanics' Library was intended to serve the educational needs of the working classes (Smith 2004). On Christmas Eve of that same year, the library association advertised a meeting for 27 December in Mr. George Thompson's schoolroom on Argyle Street to discuss the creation of a mechanics' institute. Finally, on Wednesday evening, 11 January 1832, in a room rented at Dalhousie College located on the Grand Parade, Joseph Howe rose to deliver his inaugural address to the 52 members of the newly formed Halifax Mechanics' Institute.

⁸ The number of shareholders was limited to 120, and each share was valued at nine pounds with an additional annual fee of 30 shillings paid by each shareholder for expenditures related to procuring books and maintaining the Institution (*Rules* 1833).

Howe had just turned 28 and was on the verge of becoming a political force in the province. His remarks on that cold winter evening posed the organization as a new fixture in the city's social, economic and cultural life, and he devoted much of his lecture to how science and the mechanical arts strengthened and elevated the mind and improved national prosperity. Howe catalogued Newton, Galileo and Franklin as men who effectively combined science with the mechanical arts, stating, "That its successful cultivation has an important effect, not only on the character, influence, and fortunes of individuals but also upon the advancement, resources, and happiness of nations." Howe also encouraged his audience to remember that "these anticipations [are not] damped by anything in the natural aspect of Nova Scotia," and boldly suggested that "Nova Scotia may, at some future period, stand in relation as important to the New World as Britain now does to the Old World" (Howe 1832). The influential men meeting on that chilly January evening were confident about the benefits and improvements the Halifax Mechanics' Institute could contribute to Nova Scotia's educational and economic growth.

Following the mandate of the Institute to aid craftsmen, artisans and journeymen weather the uncertainties posed by industrialization, the members present adopted as their primary aim the public instruction of the populace in the mechanical and applied sciences. In line with these objectives, a resolution passed that evening set forth a series of goals that included sponsoring lectures, accumulating scientific apparatus and mechanical models, acquiring technological knowledge and introducing mechanical improvements. While the Institute "became very popular and a most interesting series of lectures were given, by prominent local men, on scientific subjects, the fine arts, literature, etc., and art exhibitions were held, all of which were well attended," the promising future that Howe predicted never materialized (Piers 1913).

But Howe's dream remained alive. Even before the Institute became dormant in 1860, a newly established Nova Scotia Literary and Scientific Society "was doing some active work, no doubt formed about then, from the salvaged wreckage of the mechanics' institute" (Piers 1913). The initial meeting of this Society on 4 January 1859, at which members of the original Mechanics' Institute were present, "met in No. 1 Dalhousie College, at 3 P.M., to promote the formation of a Society "for the discussion of interesting and important questions

in literature, science, commerce, and the arts” (Canadian Research Knowledge Network 2023). Called to attention by Andrew Mackinley, Esq. [1800-1867], who was the last President of the Halifax Mechanics’ Institute, the mission statement adopted that evening proposed “that a society be established in this province to meet in Halifax, or at times in other places, for the reading and discussion of original communications on such subjects as literature, science, political economy, commerce, statistics, and the arts as may tend to draw forth talent and useful information...to encourage the study of history, natural history, products and the capabilities of the province; to foster a spirit of enquiry and enterprise; and to generally promote the advancement of science, learning, and the useful arts” (Canadian Research Knowledge Network 2023). But as Piers pointed out, almost immediately conflict erupted among those attending the meeting over the plan to endorse a range of subject matter similar to that of the dormant Halifax Mechanics’ Institute.

“There seems to have been various interests working in this society, which possibly did not harmonize, and the scientific men proposed to form an organization that would be all their own” (Piers 1913). One of the driving forces behind this conflict was the disagreement over provincial representation at the second International Exhibition in London that opened on 1 May 1861, which was considered an opportunity to bring Nova Scotia to the attention of the world. “Those who had been engaged in this work felt the need for more scientific help and fuller information regarding our animal, vegetable, and mineral resources. Thus, it was suggested that the necessity of a permanent organization might foster the scientific spirit among us. In other words, a few men of scientific tastes had individually devoted energy to studying our flora, fauna, and geology, but it was felt that they should have a technical society of their own to publish the results of their observations” (Piers 1913).

The hoped-for cooperation between scientists, politicians, tradesmen and merchants, who had created the Halifax Mechanics’ Institute in 1832 to once again come together and combine the study of science, nature and the fine arts into a new organization, failed. As Campbell Hardy explained, “We were a band of enthusiastic lovers of nature, hunters and woodsmen, zoologists and geologists, botanists and fishermen, historians and antiquarians, each zealous of improvement in his own particular sphere of knowledge” (Piers 1913).

Consequently, on 31 December 1862, a new scientific association established itself, like the Halifax Mechanics' Institute once did, as the newest fixture in the scientific, social, political and economic life of the province. Forged by former members of the Halifax Mechanics' Institute [1832-1862] and the Nova Scotia Literary and Scientific Society [1859-1862], the Nova Scotian Institute of Natural Science would eventually break Nova Scotia's intellectual and philosophical dependence on Britain and Europe, successfully segregate natural philosophy from science and science from the arts [see footnote 2], and over time introduce a modern methodological system of scientific inquiry based on empirical proof (Zhu and Goyal 2018, Field 2020).

During its first two decades, scientific activities focused on an inventory tradition of observing, describing, collecting and classifying what John Pickstone described as Natural Historical Ways of Knowing (Pickstone 2001), eventually opening out "to analytical searches for units in nature as components of larger systems" (Zeller 2015), which drew inspiration from Alexander von Humboldt.⁹ "Scientific knowledge accrued, in the Humboldtian view, through the cooperation of widely dispersed participants using standardized instruments in synchronized observations. In return, it promised the greatest possible accuracy in the search for patterns in nature that would ultimately reveal natural laws" (Zeller 2015).

As the 19th century waned, however, questions about the value of natural history to a society preparing for the scientific, social, economic and technological revolutions of the 20th century were heatedly being debated on a national level. As David Pearce Penhallow [1854-1910], a Canadian-American botanist and educator who assisted Asa Gray at Harvard University and who later became the first Macdonald Chair of Botany at McGill, stated in his *Review of Canadian Botany from the First Settlement of New France to the Nineteenth Century*, "So far as we are aware, no attempt has yet been made to bring together in connected form the more important facts relating to the development of botanical science in Canada.... One of the first and most striking facts... is the very great paucity of botanical works prior to the present century, which can be regarded as in any sense Canadian.... Finally, it must be kept in mind that the

⁹ In Humboldt's view, nature and humans are interconnected. The biological web of life, or biosphere, is inextricably linked to the human web of life, or ethnosphere, where fluctuations in one realm rebound in the other, a concept easily visualized by the algebraic lemniscate for infinity (∞).

titles given to the writings of many of the early travellers are often sadly misleading as to the actual contents of the volume, and while an elaborate title conveys the impression that a rich store of information may be found within, nothing but disappointment is met with” (Penhallow 1887). More importantly, he observed that when natural history is discussed, it is often solely referred to animals, while plants are dealt with briefly (Penhallow 1887, De Vos 2007).

These conflicting viewpoints were an extension of the larger 19th-century conversation about the negative impacts of industrial capitalism on nature and society that first emerged in Nova Scotia in the writings of Titus Smith Jr. In 1835, his paper published in London’s *The Magazine of Natural History* deplored the consequences of the mechanized destruction of old-growth forests and other natural resources to feed the needs of science and industry (Field 2019). The implications of this union between “man and machine” gave humans unchecked powers that reduced nature to an exploitable commodity and sent struggling tradesmen and farmers to look for work in the ever-expanding, poverty-ridden urban centres of industry so eloquently portrayed by Charles Dickens [1812–1870] (Field 2019).¹⁰

As Zeller (2015) observed, even as science and industry “came under unprecedented critical examination, the Institute chose not to retreat but advance.” An ambitious institution dedicated to the advancement of science could not ignore the emerging domination of the physical and industrial sciences as a means to once again “find its Nova Scotia moorings” and redefine its place in the world. Consequently, on 10 October 1888, Dr. James Gordon MacGregor

¹⁰ There were many imaginative responses in Britain by various authors cautioning the public about the dangers of science and mechanization. Mary Shelley [1797–1851], the controversial muse of the Romantic Age, was one of the first to condemn the failure of science to save humankind. In 1826, Shelley published *The Last Man*, an existentialist, apocalyptic novel set in England in the 21st century governed by an elite ruling class. Science fails to cure humanity ravaged by a viral pandemic, reminiscent of the recent Covid-19 outbreak, sweeping across the globe, resulting in conflict, violence, social injustice and near-species extinction (Hunt 2022). Other mid-19th-century “industrial novels” included Elisabeth Gaskell’s [1810–1865] *Mary Barton* (1848) and *North and South* (1855), *Sybil* (1845) by Benjamin Disraeli, written before he became prime minister of Great Britain in 1864, *Felix Holt* (1866) by George Eliot [1819–1880], and *Hard Times* (1854) by Charles Dickens with its grim portrayal of Coketown, an industrial nightmare “of red brick or brick that would have been red if the smoke and ashes allowed it, but as matters stood it was a town of unnatural red and black like the painted face of a savage. It was a town of machinery and tall chimneys, out of which interminable serpents of smoke trailed themselves forever and ever and never got uncoiled” (Dickens 1854, Watson 2005).

[1852-1913] assumed the chair as the newly elected president of the NSIS (Piers 1913). Born in Halifax in 1852, MacGregor graduated from Dalhousie University, where he was awarded the Gilchrist Scholarship to study with Peter Guthrie Tait [1831-1901] at the University of Edinburgh and Gustav Heinrich Wiedeman [1826-1899] at the University of Leipzig. He returned to Dalhousie in 1879 as the George Munro [1801-1878] Professor of Physics at age 27. As the late Peter Busby Waite [1922-2020] observed, “MacGregor was brilliant, energetic, nervous, and impatient” (Waite 2003), all personality traits that drove his confidence to prepare the Institute for the 20th century by making revisions to a founding principle that Piers would describe “as an epoch-making one in the annals of the society” (Piers 1913).

Recognizing that the Institute had reached a critical point, MacGregor found that the period of its greatest activity was in the first few years of its existence when it was easier and more acceptable to make contributions to natural history and geology. And in what proved to be the “epoch-making” event Piers alluded to, after much lively opposition and debate from the older members, it was decided by majority vote on 24 March 1890 that the word “natural” should be dropped from the Institute’s name so it would not be considered merely an association of naturalists. MacGregor felt that “natural science” was implied in its new title, which in his opinion also “widened the scope of the society.” Changing the Institute’s identity also appealed those members who still felt constrained by the Institute’s original mandate. As early as 1872, the Edinburgh-trained physician Dr. A. P. Reid [1836-1919] urged members to embrace the interest in modern physical science and technology already reflected throughout its *Proceedings and Transactions*, and despite resistance from George Lawson and others, successfully moved a resolution in 1874 to divide the NSIS into three sections (natural history, ethnology, and technology), a decision that seemingly altered little in the Institute’s unified operations until MacGregor assumed the presidency (Zeller 2015).

The new name not only downplayed the importance of natural history but altered the Institute’s public persona, which remained a point of contention for several years. President George Lawson defended the importance of plant catalogues at the Annual Business Meeting that closed the 1893-1894 session, suggesting that some members deemed plant collections unimportant to the Institute’s

scientific aims. "Such lists as these, when prepared with care, form valuable material for the preparation of local floras, as well as for provincial or more general works, and the opportunity should not be lost to call attention to the substantial service that may be rendered to botanical sciences by the preparation of such lists for localities throughout the province by those who have opportunities, by residents or otherwise, for local observation and collection" (Lawson 1894).

For Lawson, the public members who did the work of plant collection and study remained a valuable resource. Lawson ended his remarks by noting the decline in new members and monthly papers: "In conclusion, I would like to call attention in a prominent manner to the fact that we are no longer limited to the domain of *natural science*. With the abbreviation of the name made some years ago to that of the Institute of Science, we extended our range so as to embrace all departments. Our membership has not, in consequence, increased in the proportion that might have been expected. With our advanced civilization and industrial development, surely there must be more persons in the province devoting some portion of their time to scientific work than those [whose names] are inscribed on the membership roll of the Institute of Science" (Lawson 1896).

Four years later, at the annual business meeting that ended the 1898-1899 session, President Alexander Howard MacKay expressed similar concerns about the unexpected difficulty in attracting new members and in securing papers for presentation at the regular monthly meetings. "I should, at the beginning of another year's work at this institute, review briefly the progress made during the past year. This was, in many respects, most unsatisfactory. Never before did we have so much difficulty in securing papers for our ordinary meetings" (MacKay 1899b). In a nostalgic reverie, he stated, "A little enthusiasm, a vasculum, an insect net, and a pocket glass comprised all the outfits necessary to enable a man to write valuable papers and to give him a good standing in our institute. Now he requires thorough scientific training, costly scientific apparatus, and years of patient toil to be able to add a single new or valuable idea to our scientific knowledge" (MacKay 1899b). The study of nature was no longer a spiritual or personal pursuit; many Institute members were professional academics with advanced degrees in various branches of science and medicine who represented the educated

elite of provincial society, which undoubtedly discouraged less well-informed practitioners from becoming members.

As previously noted, “There were long-term challenges faced by an ambitious institution dedicated to the ‘promotion of science’ – a mission that began as a measure of Nova Scotia’s material and cultural progress in a modern world, changing its meaning over time in ways that repeatedly challenged the Institute’s understanding of its place in the world” (Zeller 2015).

How, Henry (1828-1879)

Born in London on 11 July 1828, How died in Windsor, Nova Scotia, on 28 September 1879. After graduating from the Royal College of Chemistry, he assisted the accomplished, multitalented scientist, administrator and politician, the Rt. Honourable Lord Playfair, F.R.S. [1818-1898], who was a professor of chemistry at the College for Civil Engineers at Putney. Lord Playfair had a profound influence on How and encouraged him, at age 18, to submit his first scientific paper to the journal of the Chemistry Society of London. However, after arriving in Nova Scotia in 1854 at age 26 to become a professor of chemistry and natural history at the University of King’s College, Windsor, his wunderkind reputation received a mixed reception from his Nova Scotia colleagues. “From the moment he landed in this country, fresh from the wonderful laboratories of Europe and glowing with enthusiasm for the prosecution of his favourite studies, he lived a life of obscurity, almost seclusion. A few there were, and only a few, who had come to appreciate his talent as an analyst, his great learning as a chemist, and his industry in the fields of original research. I may add that the last sentence is true as regards this province alone, for abroad his great ability was recognized fully” (Piers 1913).

While Piers does not provide the reasons for How’s apparent social isolation, his 1870 lecture on scientific education, delivered at the Encoenia Festival of Founders at King’s College, Windsor, provides a tantalizing clue. He asked his audience, “How carefully should we preserve the characteristics of those people who still persist in asking what the use of studying science is, for they are the lingering types of beings prevailing in the pre-modern period.” Later in the lecture, he elaborated on this point. “In fact, the answer which a majority of scientific men might give to the question I am speaking of might well be: The material advantages derived from our labours, so far as they

benefit all, we share, but the greater part of them is for others only: they turn our thoughts into money and live more or less luxuriously while we are no better off than the juniors in some good mercantile establishment” (How 1870).

Those views suggest a familiarity, if not agreement, with the previously mentioned public debates concerning the social evils and inequities brought on by capitalism and industrialization [see footnote 10]. It seems, like Titus Smith Jr., who bemoaned the impact “of unbounded luxury and extravagance, which turned the labour of multitudes from producing the necessities of life to furnishing articles of luxury for a few very rich individuals” (Smith 1835, Field 2019), How also shared some of the same critiques of capitalism that Smith did. For a province, which Joseph Howe suggested in 1832, “may, at some future period, stand in relation as important to the New World as Britain now does to the Old World” (Howe 1832), these anti-capitalist, egalitarian ideas would have made How an unpopular and unwelcome “outsider” by some members of Halifax’s upper and middle classes whose cultural and intellectual bonds and shared political, social and economic interests helped to govern the city and create its cultural, scientific and educational institutions, which reinforced the founding hierarchy of Halifax’s social network based on class distinctions.

As a polymath, Professor How moved easily between disciplines ranging from geology, mineralogy, chemistry, natural history and botany (Piers 1913). In his lifetime, he published over 44 books and articles in various scientific and philosophical journals in London, Edinburgh, Dublin and Halifax (Piers 1913). As a founding member of the NSIS, he helped to prepare the collections of minerals for both the London International Exhibition of 1862 and the Paris Exposition of 1867. As a Professor of Chemistry and Natural History at King’s College, his main contributions were in the fields of mineralogy and botany. His most important publications were his five-part groundbreaking series titled “Notes on the Economic Mineralogy of Nova Scotia,” published in the *Institute Proceedings* between 1867 and 1869, which eventually led to *The Mineralogy of Nova Scotia, a report to the provincial government* published in Halifax in 1869 (Piers 1913, Blakeley 2003).

Two years after How’s death in 1879, the once-hoped-for industrial future of Nova Scotia, as touted by Joseph Howe, Lord Durham and Campbell Hardy, finally materialized, thanks in some part to How’s

research and his numerous reports on mineralogy. Between 1881 and 1891, the industrial growth of Nova Scotia outstripped all other provinces in eastern Canada following a significant transfer of capital and human resources into a new manufacturing base (Acheson 1972, Inwood 1991).

* * * *

On 14 January 1878, Dr. George Lawson delivered before the members of the Nova Scotian Institute Dr. Henry How's paper on the herbarium of East Indian plants at King's College, Windsor (How 1878). According to Lawson, this herbarium of 168 specimens was formed at the close of the 18th century by Dr. Johan Peter Rottler [1749-1836] and Dr. Johann Gottfried Klein [1766-1821], who worked as missionaries and botanists in southern India (Stewart 1982). In 1804, the Honourable Sir Thomas Strange [1756-1841], who received the collection from Rottler and Klein two years earlier, donated the specimens to King's College, where on their arrival they were inspected by Rev. Dr. William Cochran [1757-1833] before being placed into storage. How inspected them again in 1877 in preparation for his report and found the specimens in an excellent state of preservation, with some unmounted plants on sheets of coarse paper accompanied by identifying labels (How 1878). Lawson added that Dr. Cochran, who served as President of the College for more than forty years, had amassed another large herbarium of Nova Scotia plants, which for some reason did not become the property of the College but were "diverted to other keeping in an Upper Province" (How 1878). Lawson concluded his introduction by personally noting that, while this is not a large collection of plants considering the "richness of Indian Flora and the immense territory it occupies," he hoped "to be able to go over the Windsor Herbarium with Dr. How and, by comparing the specimens with those in my own Indian Herbarium, to identify them with modern names" (How 1878).

Herbaria of pressed and mounted plants were compiled and maintained by several of the NSIS plant hunters discussed in this paper. Unfortunately, those for whom botanizing was a gentlemanly vocation often were not taxonomically trained or sophisticated enough to correctly identify plant species within an existing genus and tended to see a plant with different traits as a novelty. Piers, who rarely criticized colleagues, stated that the plant determinations of John

Somers/Sommers¹¹ [1840-1898], who joined the NSIS in 1875 and served as president for two terms from 1880 to 1883 and from 1885 to 1888, “were sometimes too hastily made” (Piers 1913). Piers noted, “Somers had formed a large herbarium, which was, unfortunately, destroyed after his death, which [made] a revision of identifications impossible.” Other herbaria compiled by NSIS members between 1862 and 1902 include Henry How, Alexander Howard MacKay and Andrew Walter Herdman Lindsay [1851-1915], which now form part of the Nova Scotia Museum of Natural History botany collection.

But the King’s College East Indian herbarium of dried plants was special, from a mysterious realm filled with exotic human and natural marvels that, even before Benjamin Disraeli [1804-1881] had Queen Victoria [1819-1901] proclaimed Empress of India and India the jewel of Victoria’s crown in 1877, attracted European and British explorers, plant hunters and adventurers. As early as 1830, Lady Dalhousie [1786-1839], the wife of the newly appointed Governor General and Commander-in-Chief of India [1830-1832] Lord Ramsey, who as Governor of Nova Scotia [1816-1820] had founded the Garrison Library and Dalhousie University in Halifax, collected, catalogued and preserved plants after they arrived in India. “She amassed hundreds of specimens of plants there, with ferns and orchids notably among them, and shipped large collections to Hooker” (Shteir and Cayouette 2019). In one of her many letters to Hooker, Lady Dalhousie expressed her disbelief at how unfamiliar the flora was. “You can scarcely even imagine the extreme confusion caused to a mere ‘tyro’ [slang for novice or amateur] & unknowing Dabbler in Botany such as I am by being plunged at once into an extremely new & unknown vegetation — when all is strange it is some time before one tree can be distinguished from another.”¹² (Shteir & Cayouette 2019).

¹¹ Somers’ surname is also spelled Sommers throughout the Institute *Proceedings*. They are apparently the same person.

¹² Lady Dalhousie carried out botanical research wherever her husband was posted, which included Nova Scotia between 1816 and 1820, when Lord Dalhousie served as Lieutenant Governor. In 1824, she delivered a paper to the Literary and Historical Society of Quebec about her catalogue of Canadian plants and donated her Nova Scotian specimens to the society (The Countess of Dalhousie 1829). In 1837, two years before her death, her entire East Indian herbarium was donated to the Botanical Society of Edinburgh, now the Royal Botanic Garden.

Jones, John Matthew (1828-1888)

Born in Wales on 7 October 1828, Jones was the son of Admiral Sir Charles T. Jones [1778-1853], descended from the Jones of Frontraith, a family seat since 1608. He was educated to be a barrister at the Middle Temple but never practiced law. In 1854, he travelled with his eldest brother, who was flag-lieutenant to Admiral of the Fleet Sir Alexander Milne [1806-1896], intending to shoot game in the Rocky Mountains. However, after arriving in London, Ontario, a cholera outbreak forced him to travel to Halifax, where he took up residence with his relative, the Earl of Mulgrave [Henry Phipps, 1st Earl of Mulgrave, 1755-1831], who was governor of the province (Piers 1902 & 1913). Jones was a fellow of the Linnaean Society of London and the Royal Society of Canada and served as the second president of the NSIS from 1863 to 1873, publishing 15 of his 23 publications in the *Proceedings* on a wide range of natural subjects, including ichthyology, herpetology, marine zoology, geology, lepidopterology and botany. Jones passed away in Halifax on 7 October 1888, coincidentally the same day as his birth exactly sixty years earlier.

While many 19th-century men born into a legacy of privilege and independent means turned to natural history as a gentlemanly pursuit, Jones chose to study zoology as a serious vocation. He wisely left Nova Scotia in the winter months to reside at “The Hermitage” in Bermuda. These winter sojourns also committed Jones to complete his life’s work focused on the natural history of those islands, which he published in 1859 as *The Naturalist in Bermuda: A Sketch of the Geology, Zoology and Botany of that Remarkable Group of Islands, together with Meteorological Observations*. Darwin, who owned a copy of this work, made numerous comments in the page margins and on the end slips of the book, which reflected his interest in human influences on natural adaptations that occurred throughout the island complex following European discovery. These included, “Sea-birds tame on the discovery of Island” (annotation ix), “At discovery 1609, no rats and mice” (annotation 12), “Hogs run wild and swarmed” (annotation x), and (annotation 43) “variation in tail feathers in Snipes” (Biodiversity Heritage Library).

In 1860, Jones purchased “Ashbourne,” a charming country estate at Dutch Village that is now the Ashburn Golf Club, from his meteorologist father-in-law, Colonel W.J. Myers [1807-1867], who was not only one of the original founding members of the NSIS but also the

first president of The Halifax Club, founded in the same year as the NSIS on 20 January 1862 (*The Rules of the Halifax Club* 1863). Jones erected a new building at Ashbourne to display his collections of fauna and flora, which by 1866 numbered close to 8,000 specimens. He also provided important examples of plants and animals to the British Museum, the Smithsonian Museum and the Provincial Museum of Nova Scotia (Piers 1902, 1913).

Following the publication of his natural history of Bermuda (Jones 1859), Jones presented three papers on this subject to members of the Institute (Jones 1867, 1867b, 1873). In his 1873 paper on vegetation, Jones attributed the origin of endemic plant life throughout Bermuda's seven main islands to the accidental distribution of seeds, shrubs and plants carried by the Gulf Stream, undoubtedly a conclusion he based on Charles Darwin's research that proved seeds could travel between islands and across oceans and still germinate on reaching new land. Darwin experimented by soaking seeds of various species in beakers of seawater. Most of these simply drifted to the bottom, but some germinated after one month, and a few even after four months. Darwin postulated that seeds did not travel alone but became attached to leaves, twigs and small logs (Darwin 1855, 1857). Jones also attributed the introduction of European species of flora to consignments of field and garden seeds forwarded by the Bermuda Company of London, also known as the Somers Isles Company [1612-1684], and to the packets of seeds sent from the Royal Botanic Gardens at Kew, representing no less than 600 species, principally of trees and shrubs suited to sandy coastal soils (Jones 1873). The introduction of English flora by the British into foreign ecosystems intended to "civilize" the wilderness was at the heart of imperial enterprises designed to portray distant colonies as familiar, conquered and primed for British investment and colonialization (Rojas-Sandoval *et al.* 2017).

Shortly after Jones arrived in Halifax, he had the opportunity to join an expedition sent to report on the state of the timber in the Admiralty Reserves in the western part of the province, just north of Shelburne (Jones 1867c). This was the same western region that Titus Smith Jr. surveyed during his 1801 journeys through Nova Scotia looking for naval resources, which included mast-grade pine [*Pinus strobus*] and, like Smith, Jones also mentioned the ravages caused

by the extensive fires in and around Shelburne, leaving the present growth of small and stunted timber (Jones 1867c, Field 2020, 2023).

The two weeks Jones spent exploring the backwoods around Shelburne and Weymouth are a mid-19th century example of “nature writing,” in which the natural realm serves as the dominant subject matter of the narrator. In these diary-like accounts, nature is often glorified either by breathtakingly spiritual encounters experienced by naturalist clergymen or the philosophical and sometimes harsh life-threatening realities faced by the lone European explorer. Surprisingly, in a romantic-style reverie, Jones described the western woods as a wild and untamed realm. “It would be useless for me to dilate upon the feelings of one who, fresh from the cultivated vales of old England, finds himself suddenly placed in the midst of the ‘forest primeval,’ with no sounds of civilization to mar the sweet stillness which reigns amid these western wilds; and especially upon those of a naturalist, who loves to look upon nature in her pristine garb; to see the land untouched, and the trees and shrubs in every stage of decay, just as they have lived and died through succeeding ages; to listen to the unknown sounds and cries proceeding from animals and birds, and participate in the many other events hourly taking place as he journeys on through these trackless solitudes” (Jones 1867c). In the year Jones wrote this, nature writing was transitioning from romantic responses to studies on the lives and habits of birds and animals and then to scientific papers that often advocated for the protection of wildlife and the conservation and maintenance of natural habitats, as exemplified by the writings of George Perkins Marsh [1801-1882], Susan Augusta Fenimore Cooper [1813-1894]¹³ and John Muir [1838-1914].

* * * *

The inclusion of Bermuda in the Institute’s purview revealed the challenges faced by the newly formed Nova Scotian Institute of Natural Science in finding its rightful orbit in the global scientific community during its first decades (Hill 1867, Zeller 2015). With the Institute’s desire to study and accumulate natural knowledge well beyond the geographical limits of Nova Scotia, the decision to include

¹³ The daughter of novelist James Fenimore Cooper [1789-1851], Susan Cooper’s *Rural Hours*, published in 1850, is considered the first major work of American literary environmentalism that anticipated and influenced Henry David Thoreau’s [1817-1862] *Walden*, published in 1854 (Walls 2009).

Bermuda expanded its scientific sphere of study, as did the Institute's aspirations concerning the pivotal role that the *Proceedings and Transactions* could perform as a channel of communication between the NSIS and other scientific and philosophical societies. As Philip Carteret Hill noted in 1867 in his inaugural address, "Should our hopes not be disappointed, we look forward to the time when our 'transactions' shall be exchanged with older and more important institutions, and any new and well-authenticated fact, having passed the ordeal of our own local organization, shall be transmitted to the great centres of science and become the property of the whole world" (Hill 1867).

Following Hill's remarks, a brisk trade in journals and books began almost immediately. Between 1863 and 1871, the works exchanged between the NSIS and other associations included the *Proceedings of the Boston Society of Natural History*, the *Proceedings and Transactions of the Dumfries and Galloway Natural History and Antiquarian Society*, the *Annals of the Lyceum of Natural History* [New York], the *Journal of the Franklin Institute* [Philadelphia] and the *Proceedings of the Essex Institute* [Salem]. The works presented to the NSIS by authors and other institutions included books on meteorology, astronomy, geology and mining, with additional contributions from the *Boston Society of Natural History*, the *Essex Institute* and the *Smithsonian Institute* (NSIS 1867). Over time, the exchange program proved amazingly successful, particularly after MacGregor increased the print run of the *Proceedings* to 1,000 copies, "adding 300 international exchanges during the first year alone" (Zeller 2015), prompting Lawson to declare in 1894, "There is now no country under the sun whose scientific societies (where such exist) do not have our Transactions on their library shelves as exchanges for our own" (Zeller 2015). When Piers delivered the Librarian's Report to the membership in 1911, Hill's desire for the NSIS to be known worldwide was finally realized. "The Provincial Science Library (with which those of the Institute were incorporated) had received 3,088 books and pamphlets, while the total number in the Science Library on 31st December 1911, was 45,497, and of these, 34,085 [c. 75%] belonged to the Institute and 11,412 to the Science Library proper" (Piers 1913).

Lawson, George (1827-1895)

Lawson was born in Scotland on 12 October 1827. Privately schooled as a youth, following his apprenticeship to a solicitor in Dundee, he left to enroll at the University of Edinburgh to study the natural and physical sciences. Lawson strongly believed that scientists had a responsibility to instill in the public a wider appreciation for the role of science in society through the establishment of natural history societies and publications. Even before Lawson left Scotland, he was responsible for founding the monthly *Dundee Natural History Magazine* and the Dundee Naturalists' Association. After arriving in Canada in the autumn of 1858 as a professor of chemistry and natural history at Queen's University in Kingston, Ontario, he founded the Botanical Society of Canada, which folded in 1863 after Lawson left Kingston for Halifax to take up his post as professor of chemistry and mineralogy at Dalhousie College (Connor 1986).

Lawson consistently championed scientific collaboration and engagement with laypersons and the general public, whom he believed could provide valuable meteorological and botanical information (Lawson 1894, Guinel and Doubt 2023). At Dalhousie, he successfully applied popular forms of experiential and hands-on learning to the study of nature by incorporating both field and laboratory assignments in his courses on botany and medical chemistry (Zeller 2003, Connor 1986). Considered by many as the "father of Canadian botany," Lawson passed away in Halifax on 10 November 1895, "just as professional botany was becoming an established discipline in Canadian universities" (Zeller 2003). Unfortunately, labelling Lawson "the father of Canadian botany" does not truly capture his expansive interdisciplinary knowledge before science became specialized, and a single mind like Lawson's, MacKay's or How's could move seamlessly between disciplines, allowing each to inform the other.

In the year the NSIS was founded, the study of plants was overshadowed by several ongoing scientific preoccupations relating to plant distribution, the misidentification of species, and the relationship between native North American plants and those found in Britain. As early as 1867, Lawson addressed these issues in one of his first articles published in the NSIS *Proceedings* about discovering heather (*Calluna vulgaris*) at St. Ann's Bay on Cape Breton Island (Lawson 1867b). Lawson's opening remarks are enthusiastic, woven with that sense of discovery which often enthralls plant hunters when they

find, or think they have discovered, a new or unexpected species in an unexpected place. "It gives me much pleasure to bring under the notice of members of the Institute information and specimens that will, I trust, be sufficient to show that *Calluna vulgaris*, the common heather of Scotland, is a genuine native of our Province of Nova Scotia" (Lawson 1867b). Lawson arrived at this conclusion after examining a specimen of *Calluna* discovered in boggy land among stumps of spruce trees on Ulster Farm, belonging to John Robertson, Esq., President of the St. Ann's Agricultural Society.

One of the reasons for Lawson's enthusiasm about this discovery was the similarity between the geographical and ecological associations of the St. Ann's specimen to those found in Scotland. "The surroundings of the heather at St. Ann's are most appropriate. Both the scenery and vegetation resemble those of the Scottish Highlands. The cloudberry (*Rubus chamaemorus*), sundew, and many other highland plants were abundant on the neighbouring hills. The *Calluna* station is probably not more than one hundred feet above sea level." Based on these observations, Lawson boldly stated, "I believe it to be a genuine native" (Lawson 1867b). Lawson was well aware that his enthusiastic declaration that the specimen of *Calluna* at St. Ann's evolved there naturally and not through human agency would be open to debate. "Within the last few years, an animated controversy has been going on among both European and American botanists as to whether *Calluna* is indigenous to the American continent or adjacent islands. This is, in reality, a matter of great interest from a strictly scientific point of view, for it has important bearings on the questions of distribution, age, and origin of species, and therefore, a reference to the opinions expressed and facts adduced by others may not be unacceptable as an appendix to my own observations" (Lawson 1867b).

Lawson, seemingly unable to accept the possibility that Scottish heather was an introduced species, returned to the subject nine years later in his submission to the NSIS *Proceedings* on "Notes on some Nova Scotian Plants" (Lawson 1876). Again, he suggested that heather was originally a widely distributed native plant that "still exists as such in very small quantity on the Peninsula of Halifax; that it is probably indigenous to other parts of Nova Scotia and Newfoundland; and that at Point Pleasant, at Dartmouth, and possibly other places, the stations for the plant are artificial, but the plants are probably

native, having been transferred from one spot to another, or grown from seed dropped by plants that were so transferred; and lastly that the various traditions as to the foreign origin of the heather, are not unlikely to have been suggested by the desire to account for the presence of what was regarded as necessarily a foreign plant rather than by actual historical facts” (Lawson 1876).

Lawson also investigated the origins of other Nova Scotia plants. While reports reached him of *Sarothamnus scoparius* [English broom], growing abundantly around Shelburne, it was the lone specimen of *Rhododendron maximum*, discovered “in the wild country in Sheet Harbour,” that created extensive public correspondence when reported in the *Agricultural Journal* and the Halifax papers, which spearheaded a much wider debate about the introduction of invasive species by colonists into North America. Seven pages of conflicting editorials by the likes of Henry How, George Lawson, Asa Gray and others once again fuelled the debate between endemic and introduced plant species in Nova Scotia and elsewhere (Lawson 1876, Gioria *et al.* 2018).

Londa Schiebinger described bioprospecting “as ‘big science and big business’ that radically transformed the global landscape and made vegetation into a key resource for facilitating economic and imperial expansion” (Schiebinger 2007, Kuhn 2023). The mutual exchange and circulation of plants and seeds between Britain and its colonies was a powerful botanical strategy for constructing a transnational identity between colony and homeland (Kuhn 2023). Sustained efforts by Lawson and others to discover species of native colonial flora, like English broom and heather, identical to the same species of plants found in Britain, were likely motivated by colonial notions of botanical nationalism. Proving that Heather was indigenous to Nova Scotia would have provided a powerful symbol of connection to Scotland and the empire. As it turns out, heather is an invasive species, albeit a popular one, likely introduced into Cape Breton by Scottish settlers. Found in Point Pleasant Park, on both Seal and Sable Islands, and in Kings, Victoria and Richmond counties, it is also known as common heather, Scotch heather, Ling and Bruyère commune. This sprawling, freely branched shrub grows in peat or damp organic soil, and its flowers, which appear in August, are pink or mauve on long terminal racemes (Munro *et al.* 2014).

Lawson's continuing pursuit to identify plants indigenous to North America before European settlement was often prompted by correspondence from botanists in America and Europe. In an article titled "On the northern limit of wild grape vines" (Lawson 1884), Lawson responded to a letter from Professor Axel Gudbrand Blytt [1843-1898], a Norwegian botanist and author of books on the flora of Norway¹⁴ "about the Northern Limit of the Grape Vine [*Vitis vinifera*], as bearing upon the early discovery of America by Norwegian sailors" (Lawson 1884). In response to Blytt's query, Lawson reached out to the public through advertisements in Halifax's *The Morning Chronicle*, *The Morning Herald* and the *Acadian Recorder* asking for information from "old records or reliable traditions" about the distribution of wild grapes along the Atlantic Coast. In doing so, Lawson was acting on his belief that the public had an important part to play in botanical studies, mindful of the vast repository of communally shared information integral to historical systems of knowledge passed on through oral tradition and recorded in settler diaries and correspondence to friends and relatives in the home country (Carvalho and Frazão-Moreira 2011).¹⁵

As previously stated, the search for botanical knowledge was often hampered by the misidentification of plant species. Even though Carl Linnaeus published his hierarchal system of plant classification in 1735, issues relating to accurate species identification remained a problem for those who studied plants as a pastime. As Lawson remarked in his "Note on *Lemania variegata* of Agardh" (Lawson 1867c), "The correction of errors in science is a very slow process. In the first part of the second volume in Bishop Agardh's 'Species Algarum,' published in 1828, an alga said to have been found in "*fluviis Americae borealis*" was described under the name *Lemania variegata*. Agardh's original description of the plant appears, however, to have been published in the Stockholm Transactions in 1814, to which

¹⁴ Axel Blytt and Rutger Sernander [1866-1944] were co-developers of the Blytt-Sernander theory of climate change. Based on their study of Danish peat bogs, they identified a sequence of North European climatic phases.

¹⁵ Wild grapes were frequently recorded by early explorers and illustrated by cartographers on their maps of Atlantic Canada. When Isaac de Razilly [1587-1635] landed at LaHave in Nova Scotia in 1632, he reported that Mass was celebrated with wine made from local wild grapes (Fernald 1910, Andrews 1913, MacBeath 2003, Dawson 2020). Of the sixty species of grapes scattered across the northern hemisphere, only two, the Fox Grape [*Vitis labrusca* L.] and the Riverbank or Frost Grape [*Vitis riparia* Michx.], are found in Nova Scotia (Munro *et al.* 2014).

I have no means of access at the present time. Not having been met with by subsequent observers, *Lemania variegata* has been looked upon as a long-lost plant” (Lawson 1867c). After outlining the history of the genus *Lamani*, Lawson suggested that “the various forms deserve a careful examination, and I would beg to direct the attention of British botanists to the subject” (Lawson 1867).

Even today, many plant specimens remain unidentified or misidentified for three main reasons. “First and most important, too few taxonomic revisions across the entire geographical distribution of taxa in recent times mean that the taxonomy and nomenclature of these groups are provisional, and many specimens remain wrongly named, unrecognized, and/or not determined for decades. Second, the number of available specimens for any sizeable group is considerable. Third, the number of herbaria has greatly increased, which means that there are too many herbaria for a given expert to visit or request loans from. Rapidly increasing numbers of specimens in increasing numbers of herbaria are not being revised because there are too few taxonomists” (Goodwin *et al.* 2015).

To address this expanding problem, in 2010, the Royal Botanic Gardens at Kew joined with the Missouri Botanical Garden to launch a project called “The Plant List” (TPL) in response to Target 1 of the 2002-2010 Global Strategy for Plant Conservation (GSPC). Originally designed to compile a digitized record of all known vascular plants and bryophytes in 2013, the TPL became the taxonomic backbone of the World Flora Online (WFO) in response to the new 2011-2020 GSPC initiative to achieve an online flora of all known plants. The searchable WFO Plant List (www.worldfloraonline.org) currently lists as of October 2024, 1,565,481 names, 383,054 accepted species and 1,498,445 names with associated content, which includes 57,419 images, 160,097 descriptions, 36,159 distributions and 1,498,375 references.

* * * *

On 29 May 1891, Lawson helped to organize the Botanical Club of Canada under the auspices of the Royal Society of Canada “to promote by concerted local efforts and otherwise the exploration of the flora of every portion of British America, to publish complete lists of the same in local papers as the work goes on, to have these lists collected and carefully examined to arrive at a correct knowledge of

the precise character of our flora and its geographical distribution, and to carry on seasonal observations on botanical phenomena” (H.M.A. 1900, Connor 1986). The decision to establish a botanical club grew out of the broader scientific vision of “plant geography” championed by Alexander von Humboldt, particularly as it related to ecological factors such as elevation, temperature and humidity, which controlled what plants grew where (Lack 2009, Flannery 2019). As early as 1864, Lawson quoted Humboldt and applied his methodology to his plant studies. “Humboldt, with his great power of generalization and true appreciation of poetry as well as the science of nature, summed up the results of all our botanical statistics when he said ‘The carpet of flowers and verdure spread over the naked crust of our planet is unequally woven; it is thicker where the sun rises high in the ever-cloudless heavens and thinner toward the poles’” (Lawson 1867). Consequently, Lawson embraced Humboldt’s global vision and emphasis on “collective scientific work” by envisioning the Botanical Club as the central clearinghouse for a national “army of explorers” (Zeller 2015) to assist in collecting phenological observations, such as the first flowering of a specific plant or the date of the arrival and departure of migratory birds, which will be discussed in fuller detail in the biographical segment on Andrew Howard MacKay.

Waghorne, Arthur C. (1851-1900)

The Reverend Arthur Waghorne arrived in Newfoundland in 1875 as a Church of England missionary for the Society for the Propagation of the Gospel and, like the previously mentioned Reverend Ball in Nova Scotia, was assigned to various parishes throughout Newfoundland and Labrador. Although untrained, he is considered Newfoundland’s first *resident* botanist. Beginning in 1887, at a time when much of the province was sparsely populated and most of the flora unidentified, Waghorne collected algae, mosses, liverworts, lichens and vascular plants while also corresponding with botanists in America and Europe, to whom he sent specimens for identification. Waghorne also augmented his meagre church stipend by selling individual plants and sets of specimens to museums and private collectors worldwide. Between 1893 and 1894, he collected in the plant-rich “limestone” areas of the “Labrador Straits,” and between 1895 and 1899, in the region around Birchy Cove [now Curling] (Waghorne 1898a).

Waghorne’s three reports on “The flora of Newfoundland, Labrador and St. Pierre et Miquelon” published in the NSIS *Proceedings*

between 1893 and 1898 (Waghorne 1893, 1896, 1898) represent his daring attempt to compile a flora of not only Newfoundland and Labrador but also the islands of St. Pierre and Miquelon. The publication of these papers in the *Proceedings* also represented the ongoing efforts to extend the Institute's influence, expand its knowledge of the wider Atlantic World, and increase its membership through categories of Associate and Corresponding Members, who often served as local informants (Zeller 2015).

Besides his three NSIS contributions, Waghorne also published "A Summary Account of the Wild Berries and Other Edible Fruits of Newfoundland and Labrador" (Waghorne 1888), stating that his investigation is presented to the public "in preparation for a more ambitious and extended examination of the wild fruits and berries of Newfoundland." His interests also extended to folklore. Between 1892 and 1893, he produced a series of essays on "The Folk-Lore of Newfoundland and Labrador" for *The Evening Herald*, Newfoundland's oldest newspaper (Brassard 1980, Smith and Thorne 2010).

* * * *

Seventeen years after Halifax was founded and two years before Captain James Cook's [1728-1779] first voyage into the Pacific [1768-1771], a scientific expedition to Newfoundland and Labrador took place in 1766 when Sir Joseph Banks [1743-1820] sailed with Constantine John Phipps [The Lord Mulgrave, 1744-1792] on HMS *Niger* to collect specimens of flora and fauna. While the French were forced to abandon Newfoundland under the terms of the 1713 Treaty of Utrecht, the rich fishing grounds of coastal Labrador were not conceded to the British until the 1763 negotiations at Paris that ended the Seven Years' War, reducing 150 years of French influence and rule in Atlantic Canada to ownership of the islands of Saint-Pierre and Miquelon. The British acted quickly to secure administrative control of Labrador by placing it under the existing authority of the Commodore-Governor of Newfoundland, Captain Thomas Graves [1725-1802], who was responsible for conveying the English fishing fleet to and from the Grand Banks (Pringle 1995).

European plant hunting in Labrador began with the Moravian Brethren or *Unitas Fratrum*. Formed in Bohemia in 1457, they established their first Protestant mission in 1732 on the Danish island of St. Thomas in the West Indies, and in the following year, they

founded missions to the Inuit of Greenland, where they learned of similar linguistic communities in Labrador. In 1752, their first voyage to Nisbet's Harbour on the Labrador coast ended when the Inuit murdered the foreigners for their goods (Whiteley 1966). In 1765, under the protection of the British, Jens Haven [1724-1796] joined Captain Thomas Adams [1738-1770] and Naval Governor Sir Hugh Palliser [1723-1796] on board HMS *Niger* bound for Chateau Bay to find suitable locations for new Moravian settlements along the Labrador coast. Haven was joined by three other Moravian Brethren: Christian Larsen Drachardt [1711-1778], who spoke fluent Inuit, having served previously as a missionary in Greenland; John Hill [1714-1775]; and Christian Andrew Schläezer [*fl.* 1760-1775] (Gilbert 1911, Lysaght 1971). Moravian missionaries trained in European herbal remedies eagerly solicited botanical knowledge from Inuit practitioners to supplement the medicinal herb gardens and pharmacies that were traditional features of all Moravian settlements (Whiteley 1966).¹⁶

After arriving at St. John's on 11 May 1766, Banks immediately began collecting plants and shooting land and sea birds. Although snow still covered the ground in some places to a depth of five feet, he identified four species of lichen and several rare clubmosses. He also shot a Black-capped Chickadee [*Poecile atricapillus*] and an American Thrush with a reddish-brown breast that was either the common American Robin [*Turdus migratorius migratorius*] or the Black-backed Robin [*Turdus migratorius nigriceus*]. In August, when Banks arrived in Chateau Bay, Labrador, the plant collector and artist Christian Andrew Schläezer presented him with specimens of *Solidago multiradiata*, a species of goldenrod used since medieval times as an aromatic and stimulant effective for bladder stones, and *Senecio pseudo-arnica* [Seaside Ragwort] collected by Schläezer at Hancock's Inlet that was used as a poultice to drain cuts and boils, while the fleshy stems and young leaves were edible when cooked (Lysaght 1971).

However, this was not Banks's first encounter with the Moravians. As a young man, he had listened to tales about Greenland narrated by his Chelsea neighbours who resided at the London headquarters of

¹⁶ The *Herbarium Barbiense* of the Moravian Church, dating from the mid to late 18th century, was recently rediscovered in Dresden, which contains plant specimens collected in India, Greenland, Labrador, Russia, North Carolina and Tahiti (Wagner *et al.* 2023).

the Moravian Church in Lindsey House at Cheyne Walk. Banks was also familiar with the Canadian plants in the nearby Chelsea Physic Garden and knew about the North American botanical specimens at the Fulham Nursery of Christopher Gray, so closely associated with Mark Catesby [1689-1749], the author of *The Natural History of Carolina, Florida and the Bahama Islands* (Lysaght 1971).

Banks spent five months collecting and identifying 91 species of birds, and a small number of fish from the coastal waters of Newfoundland and Labrador. Unfortunately, his herbarium of 340 species of flora (Lysaght 1971) was water-damaged on the return voyage to London. The surviving plants deposited in the British Museum were believed to be the only remaining specimens collected during his 1766 expedition until two centuries later. In 1986, two additional specimens were discovered in the National Herbarium of Canada, prompting the search for further material that revealed another forty-three sheets of mounted plants collected by Banks from Newfoundland and Labrador (Shchepanek and Darbyshire 1990).

Banks arrived back in England with groundbreaking ideas about scientific excursions that would prove revolutionary and provide a model for the famous maritime surveying and collecting expeditions of the 18th and 19th centuries, such as Cook's first voyage into the Pacific accompanied by Banks in 1768, Darwin's five-year circumnavigation of the globe on HMS *Beagle* [1831-1836] and the pioneering four-year expedition [1872-1876] of HMS *Challenger* to conduct scientific oceanic surveys in various latitudes that docked in Halifax in May 1873. (Zeller 2015, Mills 2023, Marsters 2024).

Lindsay, Andrew Walter Herdman (1851-1915)

Andrew Lindsay was born in Pictou, Nova Scotia, and educated at Pictou Academy and Dalhousie University, where, as an undergraduate, he was an assistant to Professor Lawson, graduating with his B.A. in 1870 at age 19 (Dalhousie University 1937). After earning his M.B. and C.M. [Bachelor of Medicine and Master in Surgery] in 1877 from the University of Edinburgh, he returned to Halifax, where he was appointed professor of anatomy at Dalhousie. Lindsay also served as the secretary to the Faculty of Medicine from 1885 to 1915 and was a member of the Medical Board of Nova Scotia for almost 30 years. He died of a heart attack in 1915 while attending a board meeting.

Lindsay's contribution to the *Proceedings*, "A Catalogue of the Flora of Nova Scotia," arranged according to Gray's *Manual of Botany* (Lindsey 1876), represents the findings of the first official botanical survey of Nova Scotia plants spearheaded by members of the Nova Scotian Institute that included Lindsey, Professor Lawson, Professor Sommers, A. H. MacKay, Reverend E.H. Ball and Dr. D.A. Campbell [1849-1917]. "Without pretensions to a checklist of native and naturalized plants so far described, it may be accepted as the most complete synopsis of Nova Scotian Flora yet offered. It has been compiled with care from materials supplied by several observers working independently in different sections of the province. Corrections and additions have been made previous to placing it in the hands of the publisher, and a further guarantee of its accuracy will be found in the correspondence existing between different observers" (Sommers 1876). Lindsay's catalogue marked the beginning of a coherent, systemized provincial program of plant classification and distribution, which eventually led to Albert E. Roland's [1911-1991] groundbreaking *The Flora of Nova Scotia*, first published in the Institute *Proceedings* in 1946, followed in 1969 and 1998 by independently published revised editions, and finally to the current online catalogue of *Nova Scotia Plants* by Marian C. Munro, Ruth E. Newell and Nicholas M. Hill published by the Province in 2014.

* * * *

With the publication in 1848 of Asa Gray's *The Manual of the Botany of the Northern United States, from New England to Wisconsin and South to Ohio and Pennsylvania* (Gray 1848), plant hunters finally had an authoritative field guide to identification and classification. Known simply as *Gray's Manual*, it was instrumental in unifying the taxonomic system for classifying flora in North America and also served as a link with Gray's network of collectors throughout America and Europe. "Keeping botanists well informed of the advances and ongoing research in their field was a challenging task in the 1840s. Correspondence between prominent botanists contained the most current information, yet those left out of the letter-writing circle were ignorant of what was being discovered day by day. Asa Gray realized the need for a work to be published that would be within the financial grasp and scientific understanding of both the professional botanist and the inquisitive amateur" (Moore *et al.* 2010, Harvard University

Herbaria and Libraries 2020). This Humboldtian view that nature, science and society are not distinct entities but deeply intertwined and that “inquisitive amateurs” have a part to play in the search for botanical knowledge encouraged members of the NSIS, such as Lawson and MacKay, to fully support the public’s involvement in botanical studies, which remains important to our current community-based responses to climate change (Carvalho and Frazão-Moreira 2011).

MacKay, Alexander Howard (1848-1929)

Born on 19 May 1848, MacKay grew up in rural Pictou County, where he attended Pictou Academy. In 1873, he graduated from Dalhousie University with a B.A. in mathematics and physics, and in 1880, he received his B.Sc. in biology, during which time he compiled his herbarium of Nova Scotia plants. Like Lawson, MacKay also advocated for the public’s involvement in the study of nature and as Superintendent of Education for Nova Scotia [1891-1926], introduced into the public school curriculum hands-on programs of science and nature studies. MacKay remained an active botanist throughout his life, contributing more than thirty papers to various scientific journals, particularly on his phenological observations. MacKay was president of the Institute from 1899 to 1902 and, beginning in 1908, editor of the NSIS *Proceedings and Transactions* until he died in 1929 (Guildford 2005, Zeller 2015).

* * * *

Nature is a perpetually repeating phenomenon. To understand nature’s cyclical sequences, one must be able to calculate the beginning and the end of each recurrence. Phenology measures nature’s periodic events by monitoring the seasonal cycles of plants and animals. Such data provide ongoing reference points about climatic trends, past fluctuations in species composition and distribution, the spread of invasive plant species, temporal changes in morphological traits and the impact of climatic variations on plant phenology (Delisle *et al.* 2003, Primack and Miller-Rushing 2009, Buswell *et al.* 2010, Vellend *et al.* 2013, Holopainen *et al.* 2023). While Robert Marsham [1712-1793] is generally credited with being the first in Britain to systematically record the indications of spring on his estate at Stratton Strawless in Norfolk (Marsham 1789), long before Europeans landed on the shores of the Americas, Indigenous societies were recording the predictable cycles of the tides, moon phases, seasons and species

growth, which included phenological indicators such as the first blooming of flowers and the migration of birds, mammals and fish. The continued monitoring and deep knowledge of these seasonal indices allowed Indigenous peoples to successfully respond and adapt to environmental changes for generations (Turner and Reid 2022).

The phenological program in Nova Scotia, framed by MacGregor and Lawson but successfully implemented by MacKay, was directly inspired by Humboldtian ideas about the importance of collective scientific work (Zeller 2015). “While Lawson and MacGregor lent their broader scientific vision to this Humboldtian project, it was the Botanical Club’s first secretary, the Nova Scotia-born Alexander Howard MacKay, whose Herculean efforts lent it longevity with increasing analytical sophistication” (Zeller 2015). Nonetheless, MacKay expressed reservations about the project in the introduction to his first report published in the NSIS *Proceedings*. “The observations...although not very complete, seem to be worth preserving in some such accessible form, not alone on account of their value, but as a stimulus to more complete, extensive, and systematic observations each year in the future” (MacKay 1893).

Between 1893 and 1903, MacKay compiled and published in the NSIS *Proceedings* a series of phenological observations for the earliest dates of the flowering of 10 plant species¹⁷ recorded by students and trained observers connected to the public schools of the province at five stations: Yarmouth (Miss Janet Keith Bruce Kelley), Berwick, Kings County (Miss Ida A. Parker), Musquodoboit Harbour, Halifax County (Rev. James Rosborough), Wallace (Miss E.G. Charman) and East Wallace (Miss A.B. Mackenzie), both in Cumberland County. Other stations were located in Prince Edward Island (Charlottetown), Ontario (Beatrice, Muskoka), Assiniboia (Pheasant Forks), Saskatchewan (Willoughby) and Vancouver in British Columbia (Irish 1900, MacKay 1902b, Zeller 2015).

Unfortunately, MacKay’s phenological program was perhaps too successful in meeting its goals. On 28 September 1910, at a meeting of the Royal Society of Canada, the Botanical Club of Canada was officially dissolved. The reasons given were:

¹⁷ These were the mayflower (*Epigaea repens*), blue violet (*Viola cucullata*), red maple (*Acer rubrum*), dandelion (*Taraxacum officinale*), strawberry (*Fragaria virginiana*), wild red cherry (*Prunus pennsylvanica*), blueberry (*Vaccinium angustifolium*), buttercup (*Ranunculus acris*), cultivated apple (*Pyrus malus*) and lilac (*Syringa vulgaris*).

“First, the impossibility of holding representative meetings of the Club on account of the great expense of its members meeting annually at one centre from the distant provinces of the ‘Dominion.’ Second, the only successful work of the Club was the collection of phenological statistics, the expense of which (with the exception of the printing of the phenological summaries by the Royal Society) was borne entirely for many years by the Secretary. Third, this work has now been very successfully undertaken by the Meteorological Service, and it is expected will in future be carried on even more effectively. Fourth, the stimulation of botanical exploration and research, one of the most important original objects of the Club, can now be more effectively guided by the botanical officials in Ottawa. The dissolution of the Club does not, therefore, indicate retrogression. It indicates evolution-expansion from voluntary club work to the permanently subsidized and well-staffed departments of Meteorology and Biology of the Dominion of Canada” (Royal Society of Canada 1910).

While MacKay continued compiling phenological data until 1923 (Vasseur *et al.* 2001), the Royal Society’s decision to disband the Botanical Club of Canada in 1910 marked the beginning of the transfer of the study of natural history from the domain of private individuals and regional scientific associations to municipal, provincial and federal government agencies (Loydlangston 2006, Guinel and Doubt 2023). Nonetheless, the importance of MacKay’s phenological records cannot be underestimated, particularly in light of the looming climate crisis. Historical phenological records, along with maps and land surveys, archival photographs, planting journals, meteorological records, field notebooks, herbaria and florilegia provide important points of reference to aid in “predicting future ecological impacts of global change drivers [by] understanding how these same drivers have acted in the past to produce the plant populations and communities we see today” (Vellend *et al.* 2013), further helping us to prepare for fluctuating plant dynamics across time and space (Crumley 1994, Balée 1998, Egan and Howell 2005, Scholl *et al.* 2010).

Currently, many online databases provide access to historical records, including the Pan European Phenological Project (PEP) with 12 million records dating from 1868 (Templ *et al.* 2018) and the Plant Phenological Online Database (PPODB) with over 16 million plant observations from Central Europe dating between 1880 and 2009 (Dierenbach 2013). Since 1996, Scotia Plantwatch has collected the

earliest flowering dates for 12 plant species at 200 sites in Nova Scotia. When the 1996-1998 results were compared with records collected by MacKay, most flowering dates were not significantly different from the present except during the 1998 season of unprecedented warmth (Vasseur *et al.* 2001). While human observations remain important to phenological studies at the local level, the current employment of ground-based cameras and other remote sensing technologies to monitor seasonal phenological changes is providing an enormous amount of information on variations in plant flowering, distribution and biodiversity occurring across large-scale geographical regions (Katal *et al.* 2022). One can only imagine what MacGregor, Lawson and MacKay would have thought of these technological developments.

CONCLUSION

“Today people talk about our alienation from Nature, from the natural world, from ‘wilderness’ (Thoreau’s ‘wildness’), from the environment which we have been treating as a mere instrument, where it really should be a source of spiritual nourishment” (Taylor 2024).

By 1862, when the NSIS was founded, Britain’s Empire was still expanding, driven by colonization, military conquest, and an extensive global trade and exchange network. After all, who can doubt the imperial origins of the exotic flora from far-flung colonies growing in Britain’s public and private gardens, or the imposing tropical palms transplanted into the English soil of the Victorian glass-and iron-structured Palm House at Kew? While the beginning of the end of the British Empire was marked by the passing of Queen Victoria in 1901, more important were the influences of the moral and ideological social, scientific and political transformations impacting the traditional Victorian relationships between science and society as the 20th century loomed.

President MacGregor responded to these unfolding end-of-century developments as threats to the future of the Institute and its place in the world by moving away from the previous generation’s romantic views of nature. “A society, such as ours, which exists in a community as yet but slightly developed in the direction of scientific education, ought to do something to stimulate outsiders to an interest in scientific work” (MacGregor 1889). In the end, what MacGregor

did not understand, but Lawson and MacKay clearly did, was that studying natural history was more than just a leisurely pursuit but a serious science with sweeping social, cultural and environmental implications. By removing the word “natural” from the Institute’s name, the long-established public support for scientific and literary associations extending back to the founding of the Halifax Mechanics’ Institute in 1832 changed forever. Amateur stargazing, after-school nature clubs, the popular fashion of identifying plants using Linnaean classification, pressing flowers into books or mounting them in personal herbaria, collecting and identifying butterflies and beetles, displaying seashells, sand dollars and sea urchins retrieved from beach drift, and participating in public programs of phenological and meteorological observations were some of the portals through which young people and adults first learned about science and the natural and physical world they lived in, making “natural history” both relatable and relevant and outwardly all other forms of science more approachable.

Today, public trust in scientists and scientific organizations threatened by political, social and ideological conflicts is eroding the established affiliations between science and society, as demonstrated by the heated debates during the COVID-19 outbreak and the contentious, ongoing arguments about climate change. In a recent editorial, Peter Wells addressed these issues. “It is crucial to have the engagement of NSIS members with those from other societies in NS and the region – working together, sharing reliable information, encouraging the engagement of young people, discussing key issues, and looking for solutions that work” (Wells 2023).

Acknowledgements I want to thank the two anonymous peer reviewers for their comments and Julia Swan for her valuable editorial suggestions.

REFERENCES

- Acheson, T.W.** (1972). The national policy and the industrialization of the Maritimes, 1880-1910. *Acadiensis* 1(2): 3-28.
- Andrews, A.L.** (1913). Philological aspects of the “Plants of Wineland the Good.” *Rhodora* 15(170): 28-35.
- Balée, W.** (1998). Historical ecology: premises and postulates. In: Balée, W. (ed.). *Advances in Historical Ecology*. Columbia University Press, New York, USA. p. 13-29.

- Ball, E.H.** (1876). The indigenous ferns of Nova Scotia. *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 4(2): 146-157.
- Ball, E.H.** (1882). On Nova Scotian ferns. *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 5(1): 13-15.
- Bergland, R.** (2024). *Natural Magic: Emily Dickinson, Charles Darwin, and the Dawn of Modern Science*. Princeton University Press. p. 1-2, 107-108.
- Biodiversity Heritage Library.** (nd.) Supplementary material in Darwin's copy of *The Naturalist in Bermuda*. www.biodiversitylibrary.org (Accessed 30 July 2024)
- Blakeley, P.R.** (2003). Henry How. *Dictionary of Canadian Biography Online*.
www.biographi.ca/en/bio/how_henry_10E.html
(Accessed 24 April 2024)
- Brassard, G.R.** (1980). Rev. Arthur C. Waghorne (1851-1990). *Canadian Botanical Association Bulletin* 12(2 Supp.): 17-18.
- Bruce, L.D.** (2018). Subscription Libraries for the Public in Canadian Colonies, 1775-1850. *Library & Information History* 34(1): 40-63.
- Buggey, S.** (1980). Building Halifax 1841-1871. *Acadiensis* 10(1): 90-112.
- Buswell, J.M., Moles, A.T. & Hartley, S.** (2010). Is rapid evolution common in introduced plant species? *Journal of Ecology* 99(1): 214-224.
- Canadian Research Knowledge Network. (CRKN/RCDR).** (2023). *Transactions of the Nova Scotia Literary and Scientific Society* 1: 7.
(Accessed August 2024).
- Carvalho, A.M. & Frazão-Moreira, A.** (2011). Importance of local knowledge in plant resources management and conservation in two protected areas from Trás-os-Montes, Portugal. *Journal of Ethnobiology and Ethnomedicine* 7(36): 1-12.
- Connor, J.T.H.** (1986). To promote the cause of science: George Lawson and the Botanical Society of Canada. *Scientia Canadensis* 10(1): 3-33.
- Crowley, J.E.** (2005). A Visual Empire: Seeing the British Atlantic World from a Global British Perspective. In: Mancke, E. and Shammas, C. (eds.). *The Creation of the British Atlantic World*, The John Hopkins University Press, Baltimore, USA. p. 289.
- Crowley, J.E.** (2011). *Imperial Landscapes: Britain's Global Visual Culture*. Yale University Press, New Haven, USA. p. 47-73.
- Crumley, Carole L.** (1994). Historical Ecology: A Multidimensional Ecological Orientation. In: Crumley, C.L. (ed.). *Historical Ecology: Cultural Knowledge and Changing Landscapes*. School of American Research Press, Santa Fe, USA. p. 1-16.
- Dalhousie University.** (1937). *Directory of Graduates and Former Students of the University*. Dalhousie University, Halifax, NS. p. 84.
- Darwin, C.** (1855). Does seawater kill seeds? *The Gardeners' Chronicle and Agricultural Gazette* 21: 356-357.

- Darwin, C.** (1857). On the action of seawater on the germination of seeds. *Journal of Proceedings of the Linnean Society of London (Botany)* 1: 130-140.
- Davenport, G.E.** (1878). *Aspidium spinulosum* (Swartz) and its varieties. *The American Naturalist* 12(11): 707-717.
- Dawson, J.** (2020). LaHave, Capital of New France. Historic Nova Scotia. historiconovascotia.ca/items/show/156 (Accessed 4 January 2024)
- Delisle, F., Lavoie, C., Jean, M. & Lachance, D.** (2003). Reconstructing the spread on invasive plants: taking into account biases associated with herbarium specimens. *Journal of Biogeography* 30(7): 1033-1042.
- De Vos, P.** (2007). Natural History and the pursuit of empire in eighteenth-century Spain. *Eighteenth-Century Studies* 40(2): 211-212.
- De Wolfe, B.** (1997). Discoveries of America: Personal Accounts of British Emigrants to North America during the Revolutionary Era. Cambridge University Press, Cambridge, USA. p. 51-52.
- Dickens, C.** (1854). *Hard Times*. Penguin, London, UK. p. 27-28.
- Dierenbach, J., Badeck, F.W. & Schaber, J.** (2013). The plant phenological online database (PPODB): An online database for long-term phenological data. *International Journal of Biometeorology* 57(5): 805-812.
- Durham, J.G.L.** (1839). Report on the Affairs of British North America. Robert Stanton, Toronto, ON. p. 84-85, 134.
- Durham, J.G.L. & Buller, C.** (1839). Appendix (B.) to the Report on the affairs of British North America: from the Earl of Durham, Her Majesty's High Commission. London. p. 134. The original 1839 report and all appendices are available online: www.archive.org.
- Eagan, D. & Howell, E.A.** (2005). *The Historical Ecology Handbook: A Restorationist's Guide to Reference Ecosystems*. Island Press, Washington, DC, USA. p. xxiii-xxv.
- Elliott, S.B.** (1988). *The Cambridge Military Library: A Library for the Garrison Town: A History of the Cambridge Military Library*, Royal Artillery Park, Halifax, NS. *Epilogue* 8: 1-15. hmhps.ca/pdf/A-Library-for-the-Garrison-and-Town-Shirley-Elliott-1988.pdf (Accessed in September 2024).
- Fergusson, C.B.** (1960). Mechanics' Institutes of Nova Scotia. Public Archives of Nova Scotia, Halifax, NS. p. 27.
- Fernald, M.L.** (1910). Notes on the "Plants of Wineland the Good." *Rhodora* 12(134): 17-20.
- Field, R.** (2019). Titus Smith Jr. and the unity of nature: Environmental advocacy in early 19th century Nova Scotia. *Proceedings of the Nova Scotian Institute of Science* 50(1): 119-127.
- Field, R.** (2020). Into the wilderness: Rediscovering Titus Smith Jr.'s philosophy of nature. *Proceedings of the Nova Scotian Institute of Science* 50(2): 363-372.
- Field, R.** (2023). Arboretum Nova Scotia: Titus Smith Jr.'s observations of the nature and uses of trees. *Proceedings of the Nova Scotian Institute of Science* 53(1): 61-66.

- Flannery, M.** (2019). Humboldt: Essay on the Geography of Plants. [Herbariumworld.wordpress.com](https://herbariumworld.wordpress.com) (Accessed August 2024)
- Flannery, M.** (2023). In the Herbarium: The Hidden World of Collecting and Preserving Plants. Yale University Press, New Haven, USA. p. 188-201.
- Gilbert, W.G.** (1911). Labrador: its discovery, exploration and development. John Lane Company, New York, USA. p. 260-262.
- Gioria, M., O'Flynn, C. & Osborne, B.A.** (2018). A review of the impacts of major terrestrial invasive alien plants in Ireland. *Biology and Environment: Proceedings of the Royal Irish Academy 118B* (3): 157-179. doi.org/10.3318/bioe.2018.15 (Accessed 3 May 2024)
- Goodwin, Z.A., Harris, D.J., Filer, D., Wood, J.R.I. & Scotland, R.W.** (2015). Widespread mistaken identity in tropical plant collections. *Current Biology* 25(22): 1066-1067.
- Gray, A.** (1848). Manual of the Botany of the Northern United States, from New England to Wisconsin and South to Ohio and Pennsylvania. James Munroe and Company, Boston and Cambridge, USA.
- Guildford, J.** (2005). MacKay, Alexander Howard. *Dictionary of Canadian Biography* 15. www.biographi.ca/en/bio/mackay_alexander_howard_15E.htm (Accessed 27 May 2024)
- Guinel, F. & Doubt, J.** (2023). The George Lawson Medal, Part I: An expanded portrait of George Lawson, an outstanding contributor to Canadian Botany. *The Canadian Botanical Association Bulletin* 50(1): 25-28.
- Halifax Garrison Library, Rules and Catalogue.** (1835). John Munro, Halifax, NS. p. 1-82.
- Hardy, C.** (1855). Sporting Adventures in the New World; or, Days and Nights of Moose-Hunting in the Pine Forests of Acadia, 2 Vols. London, Hurst and Blackett. Vol. 1: 2-3.
- Hardy, C.** (1867). Nocturnal life of animals in the forest. *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 1(1): 11-19.
- Hardy, C.** (1867a). On the caplin (*Mallotus villosus*). *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 1(2): 4-13.
- Hardy, C.** (1867b). On provincial acclimatization. *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 1(3): 15-30.
- Hardy, C.** (1867c). Nova Scotian conifers: *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 1(4): 120-130.
- Hardy, C.** (1867d). On the beaver in Nova Scotia. *Proceedings of the Nova Scotian Institute of Natural Science* 2(1): 17-25.
- Hardy, C.** (1869). Forest life in Acadia: Sketches of Sport and Natural History in the Lower Provinces of the Canadian Dominion. D. Appleton and Company, New York, USA. p. 1-371.
- Hardy, C.** (1908). Reminiscences of a Nova Scotia naturalist: Andrew Downs. *Proceedings of the Nova Scotian Institute of Science* 12(1): xi-xxix.

- Harvard University Herbaria & Libraries.** (2010). Asa Gray at 200: Gray's Manual of Botany. huh.harvard.edu/book/grays-manual-botany (Accessed 19 October 2023)
- Hill, P.C.** (1867). Inaugural address. *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 1(1): 1-4.
- H.M.A.** (1900). The Botanical Club of Canada. *Science* 12: 229-230.
- Holmes, R.** (2009). The Age of Wonder: How the Romantic Generation Discovered the Beauty and Terror of Science. Harper Press, London, UK. p. xviii-xix.
- Holopainen, J., Helama, S. & Väre, H.** (2023). The written history of plant phenology: shaping primary sources for secondary publications. *The Science of Nature* 110(4): 34.
- Hovenkamp, H.** (1978). Science and Religion in America, 1800-1860. University of Pennsylvania Press, Philadelphia, USA. p. 1-272.
- How, H.** (1870). Address on scientific education: delivered at the Encaenia of King's College, Windsor, N.S., by Prof. How, D.C.L., Thursday, June 30th, 1870. p. 2-3. onlinebooks.library.upenn.edu/ (Accessed 27 May 2024)
- How, H.** (1878). The East Indian Herbarium of King's College, Windsor, by Professor How, D. C. L. with an introduction by George Lawson, Ph.D., LL. D of Dalhousie College, Halifax. *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 4(4): 369-373.
- Howe, J.** (1832). An Opening Address, Delivered at the first meeting of the Halifax Mechanics' Institute on Wednesday, January 11, 1832, by Joseph Howe. P. J. Holland, Halifax, NS. p. 4-8.
- Hunt, E.M.** (2022). Mary Shelley's *The Last Man*: Existentialism and IR meet the post-apocalyptic pandemic novel. *Review of International Studies* 49(5): 832-854.
- Inwood, K.E.** (1991). Maritime industrialization from 1870 to 1910: A review of the evidence and its interpretation. *Acadiensis* 21(1): 132-155.
- Irish, H.C.** (1900). Phenological observations in Canada. *The American Naturalist*. 34(401): 445-446.
- Jiménez, A.** (2010). Reproducing Difference: Mimesis and colonialism in Roman *Hispania*. In: van Dommelen, P. and Knapp, A.B. (eds.). Material Connections in the Mediterranean: Mobility, Materiality and Identity. Routledge, London and New York, USA. p. 39-57.
- Jones, J.M.** (1859). The Naturalist in Bermuda: A Sketch of the Geology, Zoology and Botany, of that Remarkable Group of Islands; with Meteorological Observations. London, Reeves and Turner. 200 p.
- Jones, J.M.** (1867a). Contributions to the natural history of the Bermudas. Part I. Mollusca. *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 1(2): 14-26.
- Jones, J.M.** (1867b). On the geological features of the Bermudas. *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 1(4): 18-26.

- Jones, J.M.** (1867c). A fortnight in the backwoods of Shelburne and Weymouth. *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 2(1): 48-60.
- Jones, J.M.** (1873). On the vegetation of the Bermudas. *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 3(3): 237-280.
- Katal, N., Rzanny, M., Mäder, P. & Wäldchen, J.** (2022). Deep Learning in Plant Phenological Research: A systematic literature review. *Frontiers in Plant Science* 13.
www.frontiersin.org/journals/plant-science/articles/10.3389/fpls.2022.805738/full (Accessed 26 May 2024)
- Keogh, L.** (2020). The Wardian Case: How a Simple Box Moved Plants and Changed the World. Kew Publishing, Royal Botanical Gardens, London and University of Chicago Press, Chicago, USA. p. 1-2, 5-6.
- Kuhn, M.** (2023). The Garden Politic: Global Plants and Botanical Nationalism in Nineteenth-Century America. NYU Press, New York, USA. p. 25-57.
- Lack, W.** (2009). Alexander von Humboldt and the Botanical Exploration of the Americas. Prestel, London, UK. p. 11, 28, 46.
- Lawson, G.** (1864). Synopsis of Canadian ferns and filicoid plants. *Edinburgh New Philosophical Journal* 19: 102-116, 273-291.
- Lawson, G.** (1864a). Synopsis of Canadian Ferns and Filicoid Plants. Neill and Company, Edinburgh, UK. p. 1-33.
- Lawson, G.** (1867a). On the flora of Canada. *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 1(2): 75-77.
- Lawson, G.** (1867b). Notice of the occurrence of heather (*Calluna vulgaris*) at St. Ann's Bay, Cape Breton Island. *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 1(3): 30-35.
- Lawson, G.** (1867c). Note on *Lemania variegata* of Agardh. *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 1(3): 35-38.
- Lawson, G.** (1876). Notes on some Nova Scotian plants. *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 4(2): 167-179.
- Lawson, G.** (1884). On the northern limit of wild grape vines. *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 6(2): 101-109.
- Lawson, G.** (1894). Address to the Nova Scotian Institute of Science read at the opening meeting of session 1894-1895, November 12, 1894. Nova Scotia Printing Company, Halifax, NS. p. 6-7.
- Lawson, G.** (1896). Presidents Address. *Proceedings of the Nova Scotian Institute of Science* 9 (1): i-xxii.
- Lennox, J.** (2007). An Empire on Paper: The Founding of Halifax and Conceptions of Imperial Space, 1744-1755. *Canadian Historical Review* 88(3): 373-312.

- Lindsay, A.W.H.** (1876). (Appendix). A catalogue of the flora of Nova Scotia, arranged according to Gray's Manual of Botany for the N. United States of America. *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 4(2): 184-222.
- Livingstone, D.A.** (2003). Putting Science in its Place: Geographies of Scientific Knowledge. University of Chicago Press, Chicago, USA. p. 21-23, 48-54.
- Loydlangston, A.** (2006). Women in Botany and the Canadian Federal Department of Agriculture, 1887-1919. *Scientia Canadensis* 29(2): 99-130.
- Lysaght, A.M.** (1971). Joseph Banks in Newfoundland and Labrador, 1766: His Diary, Manuscripts and Collections. Faber and Faber, London, UK. p. 443, 346-348, 44-46, 293-310.
- MacBeath, G.** (2003). Razilly (Rasilly), Isaac de. Dictionary of Canadian Biography, vol. 1. University of Toronto/Université Laval Press, Toronto. www.biographi.ca/en/bio/razilly_isaac_de_1E (Accessed 4 January 2024)
- MacGregor, J. G.** (1889). Opening address. *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 7(3): 185-196.
- MacKay, A.H.** (1893). Natural history observations, made at several stations in Nova Scotia during the year 1892. *Proceedings and Transactions of the Nova Scotian Institute of Science* 8(3): 378-379.
- MacKay, A.H.** (1899b). Presidents Address. *Proceedings of the Nova Scotian Institute of Science* 10(1): i-iii.
- MacKay, A. H.** (1902b). 1: Phonological [Phenological] observations of the Botanical Club of Canada, 1900; 2: Abstract of phonological [sic] observations on the flowering of ten plants in Nova Scotia, 1900; with 3: Remarks on their phenochrons. *Proceedings and Transactions of the Nova Scotian Institute of Science* 10(3): 379-398.
- Magee, J.** (2007). The Art and Science of William Bartram. Pennsylvania State University and Natural History Museum, University Park. p. 83.
- Marshall, R.** (1789). Indications of spring, observed by Robert Marshall. Esquire, R.R.S. of Stratton in Norfolk. Latitude 52° 45'. *Philosophical Transactions of the Royal Society of London* 79: 154-156.
- Marsters, R.** (2024). HMS *Challenger*, Nova Scotia and the maritime world. *Proceedings of the Nova Scotian Institute of Science* 53(2): 185-194.
- Masson, F.** (1776). An account of three journeys from Cape Town into the southern parts of Africa; Undertaken for the discovery of new plants, towards the improvement of the Royal Botanical Gardens at Kew. By Mr. Francis Masson, one of His Majesty's gardeners. Addressed to Sir John Pringle, Bart. P. R. S. *Philosophical Transactions of the Royal Society of London* 66: 275, 278. www.jstor.org/stable/106280 (Accessed 19 October 2023)
- McNairn, J.L.** (2007). "Everything was new, yet familiar" British travellers, Halifax and the ambiguities of empire. *Acadiensis* 36(2): 8-54.

- Mills, E.L.** (2023). Endless novelties of extraordinary interest: The voyage of the H.M.S. *Challenger* and the birth of modern oceanography. *Proceedings of the Nova Scotian Institute of Science* 53(1): 147-150.
- Moore, G., Macklin, J. & DeCesare, L.** (2010). A brief history of Asa Gray's Manual of Botany. *Harvard Papers in Botany* 15(2): 277-286.
- Munro, M., Newell, R. & Hill, N.** (2014). Nova Scotia Plants. Province of Nova Scotia, Halifax, NS. p. 504, 981-982.
- NSIS.** (1867). Donations to the library. Nov. 20, 1865 to August 31, 1866. *Proceedings of the Nova Scotian Institute of Science* 1(4): 8-9.
- Pavord, A.** (2005). The Naming of Names: The Search for Order in the World of Plants. Bloomsbury, London, UK. p. 221-225.
- Penhallow, D.P.** (1887). A review of Canadian botany from the first settlement of New France to the nineteenth century. *Transactions of the Royal Society of Canada* 3(IV): 45-46.
- Penhallow, D.P.** (1897). A review of Canadian botany from 1800 to 1895. *Transactions of the Royal Society of Canada* 3(IV): 6-61.
- Pickstone, J.V.** (2001). Ways of Knowing: A New History of Science, Technology and Medicine. University of Chicago Press, Chicago, USA. p. 1-288.
- Piers, H.** (1902). Sketch of the life of J.M. Jones. *Proceedings and Transactions of the Nova Scotian Institute of Science* 10(3): lxxx-lxxxii.
- Piers, H.** (1913). A brief historical account of the Nova Scotian Institute of Science and the events leading to its formation; with biographical sketches of its deceased presidents and other prominent members. *Proceedings and Transactions of the Nova Scotian Institute of Science* 13(3): liii-cxii.
- Piers, H.** (1919). Obituary: Major General Campbell Hardy, R.A., sportsman, naturalist, artist and author; last surviving original member of the Nova Scotian Institute of Science; born 1831, died 1919. *Proceedings and Transactions of the Nova Scotian Institute of Science* 15(1): vii-xvii.
- Pittman, J.N.** (1993). Darwin and evolution: three Nova Scotia religious newspapers respond, 1860-1900. *Acadiensis* 22(2): 40-60.
- Preston, D. & Preston, M.** (2004). A Pirate of Exquisite Mind. Walker and Company, New York, USA. p. 292-295.
- Primack, R.B. & Miller-Rushing, A.J.** (2009). The role of botanical gardens in climate change research. *New Phytologist* 182(2): 303-313.
- Pringle, J.S.** (1995). The history of the exploration of the vascular flora of Canada. *The Canadian Field-Naturalist* 109(3): 294-296.
- Reynolds, A., MacNeil, C. & Jabalee, M.** (2020). Reception of Darwinism in mid-to-late nineteenth-century Nova Scotia. *Scientia Canadensis* 42 (1): 5-28.
- Robinson, J. & Rispin, T.** (1774). A journey through Nova Scotia: Containing a particular account of the country and its inhabitants; with observations on the management in husbandry, the breed of horses and other cattle, and everything material relating to farming; to which is added an account of several estates for sale in different townships of

- Nova Scotia, with their number of acres and the price at which each is set. C. Etherington, York, UK. p. 1-56.
- Rojas-Sandoval, J., Tremblay, R.L., Acevedo-Rodríguez, P. & Díaz-Soltero, H.** (2017). Invasive plant species in the West Indies: geographical, ecological and floristic insights. *Ecology and Evolution* 7(13): 4522-4533.
- Roland, A.E.** (1946). The Flora of Nova Scotia. *Proceedings of the Nova Scotian Institute of Science* 21(3): 94-642.
- Royal Society of Canada.** (1910). Dissolution of the Botanical Club of Canada. *Proceedings and Transactions of the Royal Society of Canada* Series 3 (4): cxiv.
- Rules and Catalogue of the Halifax Library.** (1833). J.S. Cunnebell. p. 3.
- Schiebinger, L.** (2007). Plants and Empire: Colonial Bioprospecting in the Atlantic World. Harvard University Press, Cambridge, USA. p. 5.
- Scholl, M.D., Murray, D.S. & Crumley, C.L.** (2010). Comparing trajectories of climate, class and production: an historical ecology of American yeoman. In: Vaccaro, I., Smith, E.A. and Aswani, S. (eds.). *Environmental Social Sciences: Methods and Research Design*. Cambridge University Press, Cambridge, USA. p. 322-348.
- Shchepanek, M.J. & Darbyshire, S.J.** (1990). Collections of Sir Joseph Banks from his 1766 expedition to Newfoundland and Labrador at the National Museum of Natural Sciences, Ottawa, ON. *Taxon* 39(1): 33-44.
- Shteir, A.** (2022). Women and Plant Practices in Nineteenth-Century Canada beyond “the Usual Records.” In: Shteir, A. (ed.). *Flora’s Fieldworkers: Women and Botany in Nineteenth-Century Canada*. McGill-Queen’s Press, Montreal, QC. p. 3-4.
- Shteir, A. & Cayouette, J.** (2019). Collecting with “botanical friends”: four women in colonial Quebec and Newfoundland. *Scientia Canadensis* 41(1): 7-9.
- Smith, K.** (2004). Early libraries in Halifax. *Royal Nova Scotia Historical Journal* (7): 1-6.
- Smith, P. & Thorne C.** (2010). The Folk-Lore of Newfoundland and Labrador: Essays by the Reverend Arthur C. Waghorne from The Evening Herald 1892-1893, with contributions from Fanny D. Bergen, William Wells Newell and Albert J. Waghorne. Memorial University of Newfoundland, St. John’s, NL. p. 1-55.
- Smith, T., Jr.** (1835). Conclusions on the results on the vegetation of Nova Scotia, and on vegetation in general, and on man in general, of certain natural and artificial causes deemed to actuate and affect them. *The Magazine of Natural History* 8(56): 660-662.
- Sommers, J. [Somers].** (1876). Introduction to a synopsis of the flora of Nova Scotia. *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 4(2): 181-183. (Appendix).
- Stayner, C.** (1951). The Sandemanian Loyalists. *Collections of the Nova Scotia Historical Society*. Halifax, Halcraft Printing Limited. 29: 62-123.

- Stewart, R.R.** (1982). Missionaries and clergymen as botanists in India and Pakistan. *Taxon* 31(1): 57-64.
- Stuart, D.** (2002). *The Plants That Shaped Our Gardens*. Harvard University Press, Cambridge, USA. p. 7-8
- Taylor, C.** (2024). *Cosmic Connections: Poetry in the Age of Disenchantment*. Harvard University Press, Cambridge, USA. p. ix.
- Templ, B., Koch, E., Bolmgren, K., Ungersböck, M., Paul, A., Scheifinger, H., Rutishauser, T., Busto, M., Chmielewski, F.M., Hájková, L., Hodžić, S., Kaspar, F., Pietragalla, B., Romero-Fresneda, R., Tolvanen, A., Vučetič, V., Zimmermann, K. & Zust, A.** (2018). Pan European Phenological database: a single point of access for European data. *Int. J. Biometeorology* 62(6): 1109-1113.
- The Countess of Dalhousie.** (1829). Catalogue of Canadian plants, presented to the Literary and Historical Society. *Transactions of the Literary and Historical Society of Quebec* 1(1): 255-262.
archive.org/details/transactionslit02unkngoog/page/n296/mode/2up
(Accessed 7 September 2024)
- The Rules of the Halifax Club.** (1863). James Bowles and Sons, Halifax, NS. p. 1-12.
- Turner, N.J. & Reid, A.** (2022). When the wild roses bloom: Indigenous knowledge and environmental change in Northwestern North America. *GeoHealth* 6(11): 1-21.
- Vasseur, L., Guscott, R.L. & Mudie, P.J.** (2001). Monitoring of spring flower phenology in Nova Scotia: Comparison over the last century. *Northeastern Naturalist* 8(4): 393-402.
- Vellend, M., Brown, C.D., Kharouba, H.M., McCune, J.L. & Myers-Smith, I.H.** (2013). Historical ecology: using unconventional data sources to test for effects of global environmental change. *American Journal of Botany* 100(7): 1294-1305.
- Waghorne, A.C.** (1888). A Summary account of the wild berries and other edible fruits of Newfoundland and Labrador. St John's, NL. p. 1-11.
- Waghorne, A.C.** (1893). The flora of Newfoundland, Labrador [sic] and St. Pierre et Miquelon. Part I. *Proceedings and Transactions of the Nova Scotian Institute of Science* 8(3): 359-373.
- Waghorne, A.C.** (1896). The flora of Newfoundland, Labrador and St. Pierre et Miquelon: Part II. *Proceedings and Transactions of the Nova Scotian Institute of Science* 9(1): 83-100.
- Waghorne, A.C.** (1898). The flora of Newfoundland, Labrador and St. Pierre et Miquelon: Part III. *Proceedings and Transactions of the Nova Scotian Institute of Science* 9(4): 361-401.
- Waghorne, A.C.** (1898a). Newfoundland and Labrador plants: List of plants collected in Newfoundland and Labrador and offered for sale by Arthur Waghorne. Bay of Islands, Newfoundland. Advertising pamphlet. p. 1-4.
dai.mun.ca/PDFs/cns/NewfoundlandandLabradorPlants.pdf
(Accessed August 2024)

- Wagner, S.T., Ehrlacher, R., Frenzke, L., Müller, F., Neinhuis, C. & Rhuland, T.** (2023). Network analysis of the herbarium collection of the Moravian Church from the 18th century. *Bauhinia* 29: 141-142.
- Waite, P.B.** (2003). MacGregor, James Gordon. *Dictionary of Canadian Biography Online*. www.biographi.ca/en/bio/macgregor_james_gordon_14E.html (Accessed 20 February 2024)
- Walls, L.D.** (2009). The Passage to Cosmos: Alexander von Humboldt and the Shaping of America. University of Chicago Press, Chicago, USA. p. 285.
- Watson, P.** (2005). Ideas: A History from Fire to Freud. Orion Books, London, UK. p. 745, 770.
- Wells, P.G.** (2023). Living in a global environmental emergency ward – the need to address problems with science, action and speed. *Proceedings of the Nova Scotian Institute of Science* 53(1): 1-4.
- Whiteley, W.H.** (1966). The Moravian missionaries and the Labrador Eskimos in the eighteenth century. *Church History* 35(1): 76-77.
- Young, K.A.** (1993). Crown Agent-Canadian correspondent: Michel Sarrazin and the Académie Royale des Sciences, 1697-1734. *French Historical Studies*. 18(2): 423-425.
- Zeller, S.** (2003). Lawson, George. *Dictionary of Canadian Biography Online*. www.biographi.ca/en/bio/lawson_george_12E.html (Accessed 02 November 2023)
- Zeller, S.** (2015). Reflections on time and space: The Nova Scotian Institute of Science in its first 150 years. *Proceedings of the Nova Scotian Institute of Science* 48(1): 5-61.
- Zhu, L. & Goyal, Y.** (2018). Art and science: Intersections of art and science through time and paths forward. *Science and Society* 20(2): 1-6.