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Botanical collecting in Yukon, Canada (1826–2025)

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ABSTRACT. The territory of Yukon has a 200-year history of botanical collecting that began with the British Arctic explorer Sir John Franklin in 1826. Over time there have been fluctuations in annual collection numbers, discoveries of new taxa, and a procession of transient collectors. Coinciding events that may have influenced the growth in collection numbers included the discovery of gold in 1896, construction of the Alaska Highway and Canol Road in 1942, and a decline in the number of individuals involved in collecting after 2011. Included on the herbarium labels of Yukon-based plant specimens are the names of prominent 20th century North American botanists, including women as early as 1914. But just as importantly or more so, many lesser known and Yukon-based collectors also made substantial contributions. The worldwide number of Yukon plant specimens in publicly accessible databases is modest (82,372) compared to the total number of specimens held by many Canadian herbaria. Most (83%) Yukon specimens reside in herbaria outside the territory, often where the collector had a professional affiliation, whether in Canada or, more often, elsewhere. The far-away location of these herbaria from Yukon and the lack of a large centralized territorial collection is a limitation to Yukon-based botanical and ecological research. The recent establishment of a territorial herbarium could re-energize plant collecting activities and serve as a focus for future research revolving around the territory's amphi-Beringian and unique endemic flora. Successful development of a territorial herbarium would represent a new phase of botanical collecting and research in Yukon.

Keywords: botanical collecting; chronology; herbarium; history; plants; Yukon

RÉSUMÉ. La collecte d'espèces botaniques dans le territoire du Yukon a commencé il y a 200 ans avec l'explorateur britannique de l'Arctique, Sir John Franklin, en 1826. Au fil des décennies, le nombre annuel d'espèces cueillies a connu des fluctuations, de nouveaux taxons ont été découverts et une série de collectionneurs occasionnels se sont succédé. Parmi les facteurs ayant pu contribuer à l'augmentation du nombre de collections, notons la découverte d'or en 1896 et la construction des routes de l'Alaska et de Canol en 1942. Le nombre de personnes faisant des collectes a diminué après 2011. Des étiquettes d'échantillons contenus dans les herbiers de plantes du Yukon portent le nom de botanistes nord-américains éminents du XXe siècle, dont des femmes dès 1914. Toutefois, il y a lieu de souligner que des collectionneurs moins connus basés au Yukon ont fait de grandes contributions dans ce domaine. À l'échelle mondiale, le nombre d'échantillons de plantes du Yukon se trouvant dans des bases de données publiques est modeste (82 372) comparativement au nombre total d'échantillons présents dans de nombreux herbiers canadiens. La majorité (83 %) des échantillons du Yukon sont conservés dans des herbiers situés en dehors du territoire, généralement dans des lieux où les collectionneurs avaient une affiliation professionnelle, au Canada ou, plus fréquemment, à l'étranger. L'éloignement de ces herbiers se rapportant au Yukon et l'absence d'une grande collection territoriale centralisée entravent les études botaniques et écologiques du Yukon. L'établissement récent d'un herbier territorial pourrait relancer l'activité de collecte de plantes et servir de cible pour les recherches futures sur la flore amphi-béringienne et la flore endémique unique du territoire. La création réussie d'un herbier territorial représenterait une nouvelle étape de la collecte d'espèces botaniques et de la recherche au Yukon.

Mots-clés : collecte d'espèces botaniques; chronologie; herbier; histoire; plantes; Yukon

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INTRODUCTION

Collecting plants or their components for food, heating, shelter construction, or as a source of medicines (McCune and Cuerricea, 2020) has occurred throughout human history. However, the institutionalization of plant collecting for scientific study dates from about 1570, when herbaria were first formally established in Germany (Kassel Naturkundemuseum) and Italy (University of Bologna) (Cooperrider and Cooperrider, 1994). The oldest surviving herbarium in North America was founded at Salem College [Index Herbariorum code, SC], North Carolina, in 1771, and the first Canadian herbarium (Royal Ontario Museum [TRT]) was established in 1838 (Thier, 2025). Four of Canada's 136 registered herbaria are located north of 60˚N latitude (Thier, 2025). None were formally recognized before 2005, although privately held and small territorial and federal government collections existed. Most contemporary Canadian herbaria are located in the southern one third of the country, with some having large holdings. For example, the Canada Museum of Nature [CAN] (2025) reported having 1,190,000 specimens. In contrast, the four most northern herbaria collectively hold fewer than 16,200 specimens from their respective region: Aurora College Fort Smith [ACFS, *n* = 1911]; Bruce A. Bennett Yukon [BABY, a privately held collection, *n* = 5494]; Canadian High Arctic Research Station [CHARS, *n* = ~500]; and Yukon University [YUKONU, *n* = 8249] as of April 2025 (Peter Lin, Aurora College, pers. com. 2025; Consortium of Pacific Northwest Herbaria, 2025; NYBG, 2025; and North American Network of Small Herbaria, 2025, respectively). This does not mean that plant collecting has been neglected in northern Canada, but instead, most specimens are held in institutions located outside of the Northwest Territories, Nunavut, and Yukon. The nearest herbaria to Whitehorse (Yukon) with more than 50,000 specimens are the University of Alaska Museum of the North [ALA, ~950 km to the northwest, in Fairbanks] and the University of Alberta [ALTA, ~2000 km to the southeast, in Edmonton].

The original purpose of science-oriented botanical collecting was to develop an understanding of plant distributions and floristic diversity, and as a basis for constructing morphologically based taxonomic keys to differentiate and classify taxa. Herbarium specimens are also being increasingly used in genomic analyses (Davis and Knapp, 2025) and studies of temporal variations in regional to global biodiversity, phenology (Meineke et al., 2018a, b; Park et al., 2018), and plant migration patterns (Strong, 2024a), as examples. Inadvertently incorporated among herbarium specimens is a history of botanical collecting, discovery, and a record of contributors. Most collectors of plants have made small donation of specimens (e.g., <100) to the worldwide Yukon herbarium total, but some have contributed hundreds and thousands of specimens due to the financial and infrastructural support provided by governments, academic institutions, botanically focused organizations, and alike.

Yukon is a biological and ecological curiosity for many botanists and plant ecologists due to its remoteness, the allure of a supposed primeval environment and adventure, and unique palaeoecological history, which tends to encourage plant collecting. It has a unique history because a large portion of Yukon with Alaska was an ice-free refugium (Eastern Beringia) for plants and animals during the last continental glaciation, unlike most of North America north of 49° latitude. During this time, western Alaska was connected with Siberia (Hultén, 1937; Dyke et al, 2003) until about 11,000 years ago, when the Bering Strait formed (Jakobsson et al., 2017). This partitioning resulted in the stranding of Beringian plant taxa in Alaska and Yukon that would have been unknown elsewhere in North America at the time. Various studies have revolved around the evolution of Yukon's contemporary flora. Such studies have attempted to determine which of its 1112 vascular species (Cody, 2000) survived in Eastern Beringia (e.g., Guest and Allen, 2014; Strong, 2021) and which migrated to or from Yukon after deglaciation (e.g., Hultén, 1937; Marr et al., 2012, 2013; Strong, 2023, 2024a). Large and geographically extensive botanical collections are a necessity for such studies. The following analysis identifies: (1) temporal variations in the long-term trend of botanical specimen collecting in Yukon based on worldwide herbarium records; (2) local events that potentially influenced collection rates; (3) taxa that were first scientifically described based on Yukon specimens; and (4) the principal contributors. Creation of a chronology of botanical collecting will highlight a facet of Yukon's past that does not occur in history textbooks. Knowing its history will also provide an appreciation of what past collectors accomplished and help to explain the present-day status of herbarium resources in the territory.

MATERIALS AND METHODS

Yukon Area

The territory of Yukon (482,443 km^2) is located in the northwest corner of Canada, immediately east of the U.S. State of Alaska (Fig. 1). Included in this area are the traditional territories of several First Nations (Environment Yukon, 2021). It has a population of 47,952 people, which has grown more than 50% during the past 20 years (Yukon Bureau of Statistics, 2025). Nearly 80% of this population is concentrated in the Whitehorse area (Yukon Bureau of Statistics, 2025). Contemporary road access to Yukon is primarily by the Alaska Highway, which extends from Dawson Creek, British Columbia, to Delta Junction, Alaska. The distance from Dawson Creek to Whitehorse is about 1400 km, with only a few settlements along the route. This access route can be tenuous, because it is not unusual for a portion of the road to be closed for a day or more due to a wildfire, flood damage, or vehicle accident. Before construction of the Alaska Highway to and through

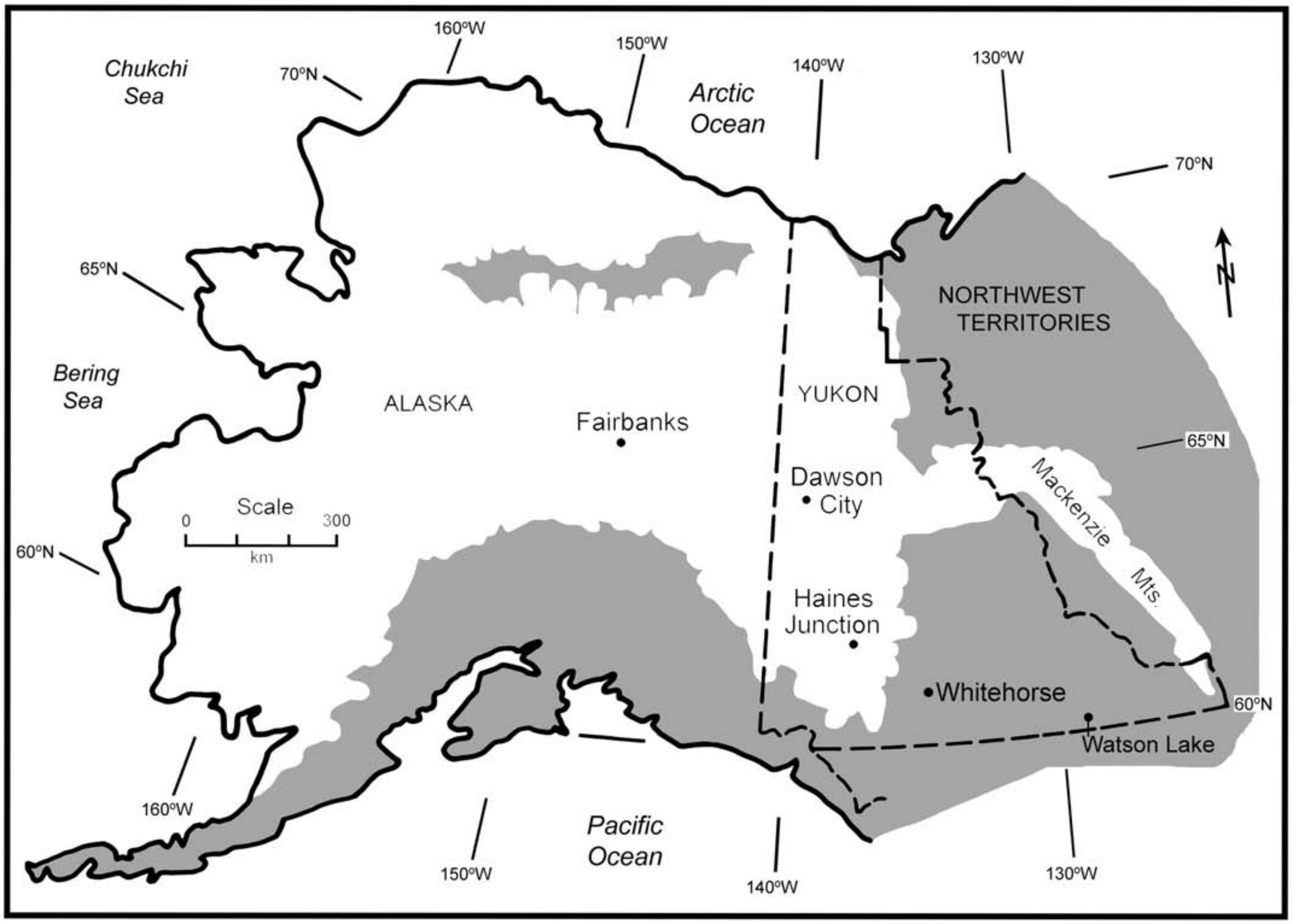

FIG. 1. Location of Yukon relative to Alaska in northwestern North America. Shaded areas indicate the maximum extent of glaciation during the Last Glacial Maximum (Dyke et al., 2003).

Yukon in 1942 by the U.S. Army (Virtue, 2013), access to the interior of the territory was through the Skagway area (Alaska) and over the Chilkat or White Pass (Hultén, 1940), over the Chilkoot Pass and down the Yukon River, or later, by the White Pass & Yukon Route Railway to Whitehorse. Travel further north to Dawson City (~500 km), the territorial capital until 1952 and the area where gold was discovered at Bonanza Creek in August 1896, was either by sternwheel river boat down the Yukon River during the ice-free season, or along the Overland Trail by horse-drawn wagon in summer or sleigh in winter (Government of Yukon, 2019). The construction of new roads and the linkage of various trails or roads eventually replaced these modes of transportation during the early 1950s to late 1960s (Connolly, 1990) and became known as the North Klondike Highway. Despite the passage of time, large areas of the territory are still inaccessible by motorized ground transport, especially north of 64° latitude (Fig. 1).

Specimen Records

Yukon plant collection dates, collector names, and collection locations were obtained from publicly accessible online herbaria databases. The goal was to compile as large a dataset as possible. This was accomplished by searching online websites that included multiple herbaria, which are collectively referred to as a consortium. An individual consortium is typically organized around regional floristic similarity (Consortium of the Pacific Northwest, Midwest, Northeast, Mid-Atlantic, or Southern Rocky Mountain herbaria), herbarium size (North American Network of Small Herbaria), or a particular group of organisms (Consortium of Bryophyte or Lichen herbaria). Data were also obtained directly from institutions such as the CAN, ALTA, New York Botanical Garden [NY], Smithsonian Institute [US], British Museum of Natural History [BM], Royal Botanic Garden Edinburgh [E], and Sweden Museum of Natural History [S] herbaria; and from the Global Biodiversity Information Facility (GBIF, 2025). Duplicate records were removed when noted. This was an important issue with the GBIF and Mid-Atlantic consortium data. Included in the final dataset were vascular plants, bryophytes (mosses and liverworts), lichenized and some nonlichenized fungi, and a few macroalgae specimens. The VASCAN database (Brouillet et al., 2024) and the Flora of North America Editorial Committee (2007, 2014) were used as the taxonomic authority

TABLE 1. *G*-test for goodness of fit to determine if Yukon vascular plant and cryptogam collection numbers differ by latitude according to geographical area (km^2).

Latitude (˚N)	Herbarium specimens		*G*-test for goodness of fit value		
	Observed frequency (*o*)	Expected frequency 1 (*e*)	Σ [*o* × ln(*o/e*)] × 2 (Sokal and Rohlf, 1981:707)	Probability of difference[2] (*p*-value)	Number of times over- or under- represented (*o* – *e*)/*e*
68 – 70	10,072	3323	22,337	< 0.001	+ 2.03
66 – 68	2466	7095	– 5212	> 0.050	– 0.65
64 – 66	9636	11,338	– 3118	> 0.050	– 0.15
62 – 64	7141	15,777	– 11,321	< 0.025	– 0.55
60 – 62	26,938	18,730	19,579	< 0.001	+ 0.43
Total	56,253	56,253	*G* = 22,265		
Critical test value of *G* (α = 0.001)		8467			

[1] Expected values based on percent of Yukon area between latitudinal limits multiplied by the total number of observed specimens. From north to south, the bands included 5.9%, 12.6%, 20.2%, 28.0%, and 33.3% of the territory, respectively.
[2] Based on four degrees of freedom and the associated chi-square critical values (Rohlf and Sokal, 1981).

for vascular plants and bryophytes, respectively. The original type specimen description was used as the authority for the one included lichen because of its recent publication.

Statistical Methods

A *G*-test for goodness of fit (Sokal and Rohlf, 1981:698) was used to test whether a spatial bias occurred in specimen collection frequencies across the territory. For this analysis, Yukon was divided into five 2˚ latitudinal bands. Specimens with adequate location information were assigned to the appropriate band to determine observed (*o*) frequencies. The expected (*e*) frequencies for the test were based on the percentage of Yukon land that occurred in each latitudinal band multiplied by the total number of valid specimen observations. The manually calculated *G*-test statistic was compared with chi-square critical values based on 5 – 1 degrees of freedom. The specimen frequency of an individual band was considered to indicate a significant difference between observed and expected values if its *G*-test value exceeded the $\alpha = 0.05$ critical value.

Polynomial regression was used to characterize the temporal trend in specimen collection numbers. The year 1860 was used as the starting date for the model because it represented when collections began to be more frequent and quantities were reported. Calculation of the trend line was based on Microsoft Excel Office 2003 software. General temporal breaks were established along the regression trend line where notable deviations in collection numbers occurred relative to the expected amount.

RESULTS

Dataset Characteristics

A total of 82,372 Yukon plant specimen records were sourced from 182 herbaria. More than half of all records were from the University of British Columbia [UBC, 16.8%], NY (14.9%), ALA (13.2%), and CAN (8.2%) herbaria. Two thirds of the overall collection was vascular plants and 26% bryophytes or lichens. Approximately 95% of all records had a collection year and collector names, and 68% had location coordinates.

Almost half of the specimens with latitudinal coordinates were collected between 60˚N and 62˚N latitude, or southernmost Yukon (Fig. 1; Table 1). Specimen occurrences in this and the 68˚N – 70˚N band or the Arctic portion of Yukon were more frequent than would be expected based on its geographical area (Table 1). Specimens in the three intermediate 2˚ latitudinal bands were what might be expected or under-represented relative to their associated amount of geographical area. The 62˚ – 64˚ band was the most deficient with respect to statistical differences ($p < 0.05$) in number of expected, compared to observed, specimens (Table 1, see two right-hand columns).

Yukon Plant Collecting

The earliest collection of Yukon plants for scientific purposes appears to have occurred in July 1826 as part of an 1825 – 27 overland expedition by the British Royal Navy explorer Sir John Franklin (1828). His mandate was to investigate the natural resources along the coast of northwest British North America, now Yukon and the Northwest Territories. These areas are part of the Inuvialuit Settlement Region (Environment Yukon, 2021). After descending the Mackenzie River in the Northwest Territories, the expedition's crew, with both non-Indigenous and Indigenous members, was divided between Franklin and Sir John Richardson, who was their "naturalist and surgeon" (Franklin, 1828:x). The latter proceeded east along the Arctic Ocean coast to the Coppermine River, whereas Franklin travelled west to Russian territory (Alaska). Franklin and his crew skirted the coast in "twenty-six feet" boats (Franklin, 1828:81) and mentioned collecting plants on the east side of Yukon (Franklin, 1828:113), Babbage River – Kay Point area, and immediately east of the present-day Alaska – Yukon border (Franklin, 1828:137). They also ventured inland to sites such as Mount Conybeare (Franklin, 1828:134), which is located 10 – 12 km south of the coast. Some of the expedition's specimens have survived the passage of time. However, they lack sufficient information to determine definitively if they were collected by Franklin in Yukon, or by Richardson in the Northwest Territories. Among Royal Botanic Garden Edinburgh Herbarium [E] specimens, most were designated only as part of the "Franklin expedition" collection. However, specimen E01391462 (Rocky Mountain white heather – *Cassiope tetragona* var. *saximontana* (Small) A.E. Porsild) could have been collected in Yukon based on its site designation being the "Rocky Mountains." Franklin (1828:96 and 114) often referred to the Richardson and British mountains by this name, which would have included Mount Conybeare. As well, the coastal area of the Northwest Territories has low relief and low elevations, and *C. tetragona* var. *saximontana* tends to occupy high elevation sites and has a more southerly distribution in the Northwest Territories (Porsild and Cody, 1980). Therefore, this specimen could be one of the earliest to be collected in Yukon. Whether collections were made in Yukon by Russian explorers before 1826 is unknown, but no earlier specimens were reported in the GBIF (2025) database, which included Russian herbaria.

Two plant collections were made after the Franklin expedition during the early to mid portion of the 19th century, or the early portion of the first phase of plant collecting in Yukon (Fig. 2). The first collection was made in 1849 by William Pullen (British Royal Navy), who was participating in the search for the lost 1845 Franklin expedition along the Arctic coast between Wainwright, in northwest Alaska, and the Mackenzie River (Seemann, 1852 – 57). In 1860 – 61, the American naturalist Robert Kennicott, who had links with the Smithsonian Institute and Northwestern University and was involved with establishing the Chicago Academy of Sciences (Foster, 1870), traveled between Fort McPherson (Northwest Territories) and Fort Yukon (Alaska), based on Foster (1870), Hultén (1940), and herbarium specimen dates. Three specimens in his collection are purportedly from Yukon (NY 2381152, NY 1215292, and US 423628).

Small collections (typically < 20 specimens) were later made by various individuals from 1862 to 1896 (Fig. 2A, Phase I). The more well known of these collectors were Fredrick Funston (US Department of Agriculture), George Dawson (geologist) and John Macoun (botanist) with the Geological and Natural History Survey of Canada, and Isaac Stringer (Anglican missionary) (Porsild, 1951; Hultén, 1968). Only 187 specimen records in the present dataset had 1860 – 96 collection dates.

A substantial uptick in collecting by botanists on behalf of major institutions occurred less than two years after the discovery of gold in August 1896 (Fig. 2, Phase II). Others also collected; for example, Hultén (1940) reported that miners sometimes covered some of their expenses by selling plant specimens. From 1898 to 1914, four years had exceptionally large collection numbers relative to Phase I (Fig. 2B). A total of 2447 specimens were collected in 1898 – 99 by several individuals (Fig. 2B, a), but mostly by Robert Williams (1450 specimens), who was affiliated with the New York Botanical Garden (Porsild, 1951). Two years later, John Macoun collected another 2205 specimens. Both collections were mostly bryophytes. The first major territorial collection of vascular plants (~1000, Fig. 2B, c) was made in 1914 for the Arnold Arboretum (Hultén, 1940:328) by Canadian-born Alice Eastwood, who was the curator of the California Academy of Sciences herbarium from 1893 to 1949 (Mathrani, 2019). The peak in Yukon plant collecting activity in the late 19th to early 20th century roughly coincided with the pattern reported in the northeastern U.S. (Meineke et al., 2018b: Fig. 1a). Collections during the subsequent 28 years were relatively few and small (Fig. 2), with the total number of documented Yukon specimens reaching 8274 in 1942 (Fig. 2A). At the end of Phase II (Fig. 2A), Martha Black (1940), who was a former member of the Canada House of Commons, published *Yukon Wild Flowers*, which was likely the first book of its like for the territory; and Eric Hultén (1941 – 49), with the Swedish Museum of Natural History, began publishing the first of his 10-volume *Flora of Alaska and Yukon*.

Plant collection numbers increased in 1943 and 1944, which marked the start of Phase III in the Yukon plant collecting chronology (Fig. 2A). The number of accumulated specimens during these years almost equaled the total collected during the previous 118 years. The primary contributors during this time were A. Erling Porsild (National Museum of Canada) and Hugh Raup (Harvard University), who collected mostly vascular plants along the Canol Road and the Alaska Highway, respectively (Figs. 2B and 3). Collecting in subsequent years increased, but the pace was slower and more varied until 1964.

After 1964 and until 1978, or the later part of Phase IIIA (Fig. 2A), collection numbers rose steadily at a faster rate (average 2175 yr^{-1}) than during Phase II (average 815 yr^{-1}). During the 36 years that comprised Phase IIIA, 56% of all presently compiled herbarium specimens were collected. The most prolific vascular plant collectors were Stanley Welsh (Brigham Young University, n = 2022), David and Barbara Murray (University of Alaska, n = 1349), Robert Porsild (brother of A. Erling Porsild) while on contract with the National Museum of Canada (Whyard, 1978, n = 937), and Katherine Beamis (University of British Columbia, n = 802). These contributions were small compared to those by Diana Horton and Dale Vitt (University of Alberta) and George Scotter (Canadian Wildlife Service), who individually collected 3200 – 4100 nonvascular or cryptogamic specimens (Fig. 2B). During Phase IIIA, the *Flora of Alaska and Neighboring Territories* (Hultén, 1968)

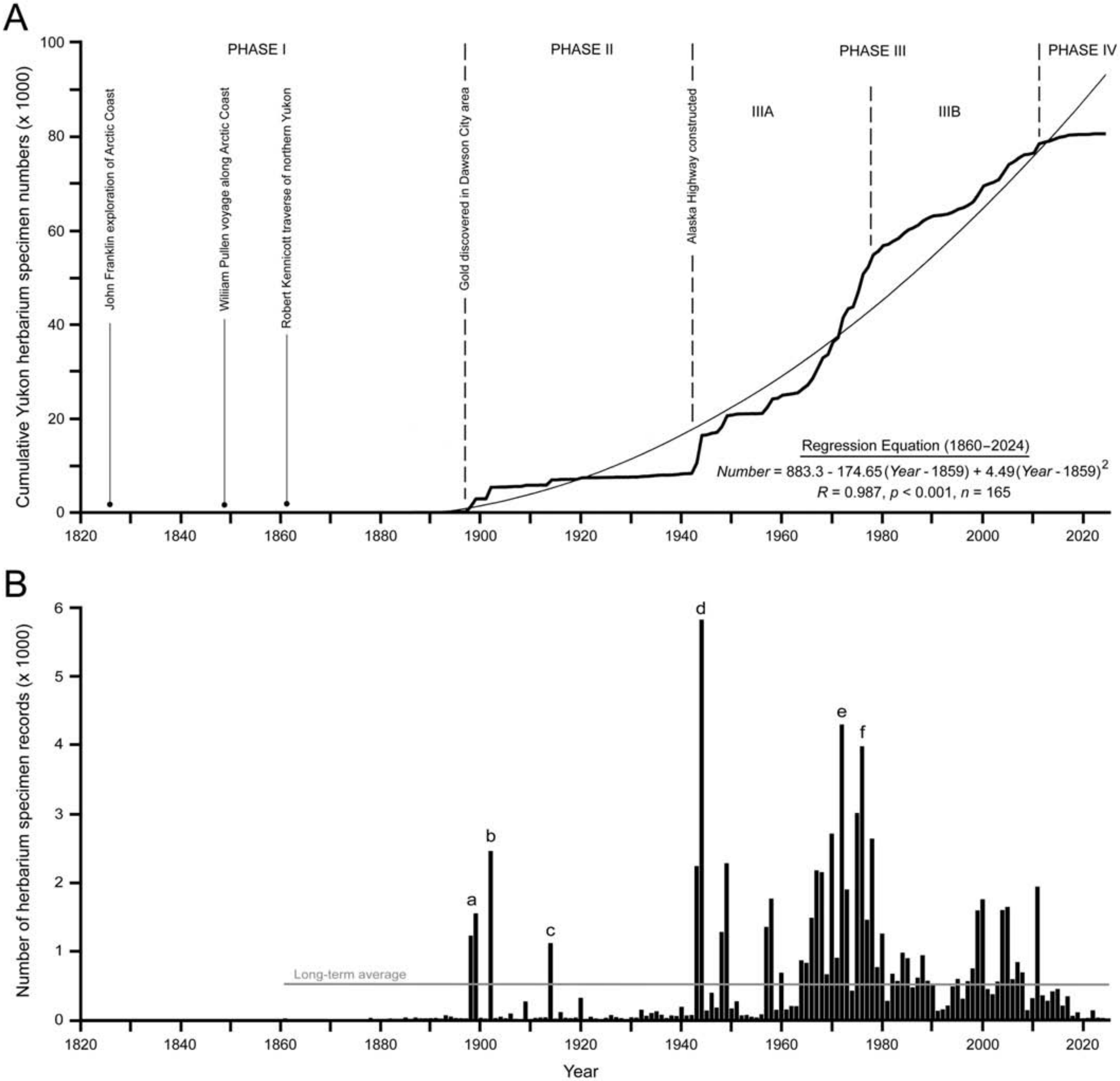

FIG. 2. Temporal variation in the cumulative (A) and annual number (B) of collected Yukon herbarium specimens. The curved line in diagram A is a polynomial regression model that characterizes the botanical collection trend from 1860 to 2024 and explained 97% of the variance in specimen numbers. Letters in diagram B indicate individual botanists with exceptional contributions in specific years: (a) Robert Williams, New York Botanical Garden; (b) John Macoun, Geological and Natural History Survey of Canada; (c) Alice Eastwood, California Academy of Science; (d) A. Erling Porsild (National Museum of Canada) and Hugh Raup (Harvard University); (e) George Scotter (Canadian Wildlife Service); and (f) Diana Horton (University of Alberta).

was published, and A. Erling Porsild (1975) advocated for the development of a stand-alone flora identification manual for Yukon (Porsild, 1943).

The post-1978 period (Phase IIIB) had a slower pace of collection (710 specimens yr^{-1}) than occurred in Phase IIIA and lasted until 2011 (Fig. 2A). Although at a slower pace, the rate remained above the 1861 – 2024 average of 489 specimen yr^{-1} (Fig. 2B) and the long-term regression trend (Fig. 2A). Despite this decline, more than 21,524 specimens were collected and cataloged during Phase IIIB. More than half were collected by Bruce Bennett (Yukon Government) with various associates, Catherine Kennedy (Yukon Government), and William Cody (Agriculture and Agri-Food Canada). Those collected by Bennett ($n = 8105$), Kennedy, and other local botanists during Phase IIIB represented the earliest example of when collection numbers by Yukon botanists exceeded those of individuals from outside the territory. As well, the specimens were mostly retained in local herbaria. During this collection phase, the first comprehensive and stand-alone taxonomic flora for Yukon was published (Cody, 1996).

From 2012 until 2024 (Fig. 2A, Phase IV), the addition of new specimens to the Yukon's global total slowed to an average rate of 152 specimens yr^{-1}. This decline represented the first substantial downturn since 1915 (Fig. 2A). The number of contributing botanists was 39 in Phase IV, which was down from 100 during the equivalent 1999–2011 timeframe. Only six of these 39 botanists contributed more than 300 specimens during the latter period (Bruce Bennett, Philip Caswell (independent botanist), William Cody, Catherine Kennedy, Paul Peterson (Smithsonian Institute), and Jennifer Line (Yukon Government)), but only Bennett contributed substantially to both timeframes (5219 of 9859 specimens, and 1364 of 1980 specimens, respectively). Three new taxa were recognized during Phase IV (Table 2). The first formally recognized Yukon herbarium (BABY) was registered about 2005 (B.A. Bennett, pers. comm. 2025). In 2021, the Yukon Government transferred its in-house plant collection to the newly instituted Yukon University, which formed the basis for YUKONU, formally registered in 2023 (Thier, 2025). Nearly all specimens held by BABY and YUKONU are vascular plants. Specimen images and label information are digitally available online for both herbaria (Consortium of Pacific Northwest Herbaria and North American Network of Small Herbaria, respectively).

Prominent Collectors

Among 956 contributors reported on Yukon plant specimen labels, only 21 botanists or pairs of botanists each contributed 800 or more specimens to the current dataset (Fig. 3). This group represents 2.2% of all contributors, but they collected 62% of all documented specimens. More than twice as many of these collectors focused primarily on vascular, as opposed to cryptogamic, specimens (Fig. 3). The most prominent contributor was Bruce Bennett, who added specimens to the former Yukon Government collection and built BABY. The majority of collectors were active in the territory for only one or two years.

Included among Yukon plant collectors were prominent 20th-century North American botanists, such as John Macoun, A. Erling Porsild, and Hugh Raup. Yukon also attracted renowned botanists and ecologists, such as Rex Daubenmire (Washington State University), Vladimir Krajina (University of British Columbia), and Charles Bird (University of Calgary). The latter of these made the largest contribution, which consisted of both vascular plants ($n = 441$) and lichens ($n = 164$).

Plant collections by Yukon-based botanists before 1970 represent only a small percentage of all Yukon herbarium specimens. Currently, less than 17% of all digitized and publically accessible Yukon specimens (13,743) reside in territorial herbaria.

Type Specimens

A total of 51 vascular plants, two bryophytes (*Encalypta vittiana*, *Pohlia andrewsii*), and one lichen (*Aberratus uittathallus*) were first described based on Yukon specimens, which are referred to as holotypes or type specimens (Table 2). Of these taxa, 13 are considered endemic to the territory, and 15 have distributions that are, or are essentially, limited to the Alaska–Yukon region (Table 2). Before 1905, Per Rydberg and Nathaniel Britton, who were affiliated with the New York Botanical Garden, described most of these taxa. An additional 22 taxa were described for the first time between 1906 and 1960, inclusive (Table 2). A. Erling Porsild was involved with describing nine taxa, most of which were from his Canol Road collection. Various botanists were involved in the description of the post-1960 wave of new taxa discoveries, which included a 20-year gap between 1979 and 2000. Gerald Mulligan (Agriculture and Agri-Food Canada) and Ihsan Al-Shebaz (Missouri Botanical Garden), who sometimes collaborated, described four of the 12 identified taxa (Table 2). All of their described taxa, and one by Hultén, were members of the Brassicaceae (mustard) family. Among the individuals who described new taxa (Table 2), only A. Erling Porsild and Stanley Welsh also made large botanical collections within the territory (Fig. 3). Type specimens of only the three most recently described taxa occur in territorial herbaria (Table 2).

DISCUSSION

Herbaria as Assets

Herbaria are important scientific assets that grow over time. They serve as a reference for verifying the identities of common, as well as critical, specimens (e.g., rare species). Larger and spatially extensive collections are useful for recognizing morphological differences within a taxon population that might not be apparent among only a few specimens. Such differences can lead to the recognition of new subspecies and varieties that have evolved due to differences in ecological conditions, or as a result of regional isolation. Herbarium specimens can also play an important role in the investigation of broad temporal environmental changes. Herbarium collections that do not extend across a long timeframe make such studies much more difficult to conduct. Development of an herbarium is a slow process that requires decades of specimen collecting; preservation and cataloging; and maintenance (e.g., regular nomenclatural updates).

An often overlooked and underappreciated aspect of an herbarium is the monetary value of its specimens. Considerable labor and expense are involved in the collecting and processing of specimens before they reach the shelves of an herbarium cabinet. Sometimes

TABLE 2. Holotype or type specimens described using Yukon derived materials.

Taxon name	Taxonomic family	Year type specimen collected	Author and publication date of type specimen description	Type specimen source area
Potentilla jepsonii var. *kluanensis* Ertter	Rosaceae	2017	Ertter, 2019	Kluane National Park
Aberratus uittahallus W.L Strong[1]	–[2]	2013	Strong, 2024b	West of Whitehorse
Draba bruce-bennettii Al-Shehbaz[1]	Brassicaceae	2012	Al-Shehbaz, 2016	Langham Mountain
Pinus contorta var. *yukonensis* W.L Strong[1]	Pinaceae	2009	Strong 2010	Whitehorse
Draba caswellii G.A. Mulligan & Al-Shehbaz[1]	Brassicaceae	2000	Al-Shehbaz and Mulligan, 2013	Kluane National Park
Pohlia andrewsii A.J. Shaw	Mielichhoferiacdae[2]	1979	Shaw, 1981	Dawson City area
Draba kluanei G.A. Mulligan[1]	Brassicaceae	1976	Mulligan, 1979	Kluane National Park
Encalypta vittiana D.G. Horton	Encalyptaceae[2]	1976	Horton, 1979	Bonnet Plume Range
Draba scotteri G.A. Mulligan[1]	Brassicaceae	1973	Mulligan, 1979	Kluane National Park
Silene uralensis ssp. *ogilviensis* (A.E. Porsild) Brunton[3]	Caryophyllaceae	1968	Porsild, 1975	Ogilvie Mountains
Artemisia woodii (Neilson) C. Riggins[1]	Asteraceae	1967	Neilson, 1968	Kluane Lake area
Draba ogilviensis Hultén 1	Brassicaceae	1964	Hulten, 1966	Ogilvie Mountains
Oxytropis nigrescens var. *lonchopoda* Barneby[3]	Fabaceae	1960	Barneby, 1963	Ogilvie Mountains
Physaria calderi (G.A. Mulligan & A.E. Porsild) O'Kane & Al-Shehbaz[1]	Brassicaceae	1960	Mulligan and Porsild, 1969	Ogilvie Mountains
Claytonia ogilviensis McNeill[1]	Montiaceae	1958	McNeill, 1972	Ogilvie Mountains
Draba yukonensis A.E. Porsild[1]	Brassicaceae	1957	Porsild 1975	NW of Haines Junction
Papaver kluanense D. Löve	Papaveraceae	1953	Löve and Freedman, 1956	Kluane Lake area
Betula × *dugleana* Lepage	Betulaceae	1951	Lepage, 1976	Dawson City area
Cherleria yukonensis (Hultén) A.J. Moore & Dillenberger[3]	Caryophyllaceae	1949	Cody, 2004	Dawson City area
Podistera yukonensis Mathias & Constance[3]	Apiaceae	1948	Mathias and Constance, 1950	McQueston area
Oxytropis borealis var. *sulphurea* (A.E. Porsild) S.L. Welsh	Fabaceae	1944	Porsild, 1951	Canol Road
Oxytropis huddelsonii A.E. Porsild[3]	Fabaceae	1944	Porsild, 1951	Whitehorse area
Potentilla furcata A.E. Porsild[3]	Rosaceae	1944	Porsild, 1951	Canol Road
Senecio sheldonensis A.E. Porsild	Asteraceae	1944	Porsild, 1950	North Canol Road
Symphyotrichum yukonensis (Cronquist) G.L. Nesom	Asteraceae	1944	Cronquist, 1945	Kluane Lake area
Tephroseris yukonensis (A.E. Porsild) Holub	Asteraceae	1944	Porsild, 1950	Canol Road
Noccaea arctica (A.E. Porsild) Holub[3]	Brassicaceae	1934	Porsild, 1951	Kay Point
Montia bostockii (A.E. Porsild) Welsh[3]	Montiaceae	1933	Porsild, 1951	Dawson Range
Papaver nudicaule ssp. *americanum* Rändel ex D.F. Murray[3]	Papaveraceae	1916	Murray, 1995	White River area
Lupinus kuschei Eastwood[3]	Fabaceae	1914	Eastwood, 1942	Bennett Lake
Phacelia mollis J.F. Macbridge[1]	Hydrophyllaceae	1914	Macbridge, 1917	Coffee Creek
Smelowskia borealis (Greene) W.H. Drury & Rollins	Brassicaceae	1911	Greene, 1912	Nahoni Range area
Glyceria grandis var. *komaronii* Kelso	Poaceae	1909	Kelso, 1934	Dawson City area
Oxytropis campestris var. *roaldii* (Ostenfeld) S.L. Welsh[3]	Fabaceae	1906[4]	Ostenfeld, 1910	Herschel Island 4
Betula × *eastwoodiae* Sargent	Betulaceae	1902	Sargent, 1919	Dawson City area
Carex microchaeta Holm	Cyperaceae	1902	Holm, 1904	Five Finger Rapid area
Oxytropis campestris var. *varians* (Rydberg) Barneby	Fabaceae	1901	Britton and Rydberg, 1901	Yukon River area
Astragalus williamsii Rydberg[3]	Fabaceae	1899	Britton and Rydberg, 1901	Big Salmon area
Carex bonanzensis Britton	Cyperaceae	1899	Britton and Rydberg, 1901	Dawson City area
Carex williamsii Britton	Cyperaceae	1899	Britton and Rydberg, 1901	Dawson City area
Castilleja pallida var. *yukonis* (Pennell) J.M. Egger	Orobanchaceae	1899	Pennell, 1934	Upper Yukon River
Douglasia gormanii Constance[3]	Primulaceae	1899	Constance, 1938	North of Stewart Crossing
Erigeron purpuratus Greene	Asteraceae	1899	Greene, 1900	Fort Selkirk
Erigeron yukonensis Rydberg	Asteraceae	1899	Britton and Rydberg, 1901	Dawson City area
Erysimum angustatum Rydberg[3]	Brassicaceae	1899	Britton and Rydberg, 1901	Dawson City area
Glyceria pulchella (Nash) K. Schumann	Poaceae	1899	Britton and Rydberg, 1901	White River area
Oxytropis campestris var. *varians* (Rydberg) Barneby	Fabaceae	1899	Britton and Rydberg, 1901	Yukon River Valley
Penstemon gormanii Greene	Plantaginaceae	1899	Greene, 1902	Yukon River Valley
Sabulina dawsonensis (Britton) Rydberg	Caryophyllaceae	1899	Britton and Rydberg, 1901	Dawson City area
Salix alaxensis var. *longistylis* (Rydberg) C.K. Schneider	Salicaceae	1899	Britton and Rydberg, 1901	Dawson City area
Silene williamsii Britton[3]	Caryophyllaceae	1899	Britton and Rydberg, 1901	Dawson City area
Nestotus macleanii (Brandegee) R.P. Roberts et al.[1]	Asteraceae	1898	Brandegee, 1899	Dawson City area

TABLE 2. Holotype or type specimens described using Yukon derived materials – *continued.*

Taxon name	Taxonomic family	Year type specimen collected	Author and publication date of type specimen description	Type specimen source area
Papaver mcconnellii Hultén	Papaveraceae	1888	Hulten, 1941–1949	Richardson Mountains

[1] Yukon endemic or essentially so (GIBF, 2025).
[2] A cryptogamic specimen (lichen or mosses), all other taxa are vascular plants.
[3] Alaska-Yukon endemic or essentially so (GBIF, 2025).
[4] Specimen reported as *Oxytropis roaldii*, information derived from specimen label NHMD 1687820 (GBIF, 2025).

a specimen requires the expertise of a taxonomic specialist, thereby increasing costs further. A conservative estimate suggests that specimens might have an average value of \$50–\$100, based on only direct input costs. The lower dollar value assumes a collector is paid minimum wage (\$17–\$20/hr in northern Canada), and the collector is capable of completing all travel, collecting, identification, and plant handing tasks for an individual specimen based on two hours of work and field expenses of less than \$20. Even an herbarium with a modest collection of 10,000 to 20,000 specimens could have a replacement value of a million dollars, although some specimens would be irreplaceable, such as type specimens.

Challenges and Opportunities

The worldwide number of Yukon herbarium specimens may be underreported because not all herbaria have digitized their entire collection and made it fully available. For example, NY has digitized only 60% of its 7.8 million plant specimens (NYBG, 2025). If the worldwide number of publicly available Yukon plant specimens was 50% greater than reported, or 123,558 specimens, this total is still small. For example, the NY herbarium possesses more Asteraceae (2.5×), Poaceae (1.6×), or Fabaceae (1.3×) specimens (NYBG, 2025) than all potentially curated Yukon vascular, bryophyte, and lichen specimens combined. Known Yukon specimens (n = 82,372) are also only about half the number that would be expected, based on the global number of Canadian plant specimens (3.3 million, GBIF, 2025) relative to the size of Yukon in Canada (4.83%). This suggests that the botanical resources of Yukon are under-collected.

Besides the lack of territorially based academic programs oriented towards botanical research, critical constraints to developing a comprehensive territorial plant collection (e.g., 250,000 specimens) include (1) a small number of botanists involved in long-term collecting, and (2) challenging terrain with poor ground access throughout much of the region. Poor access might be considered a positive attribute because it means that extensive areas are unmodified by anthropogenic activity. The small number of botanists is likely due to the size of the resident territorial population. What is not obvious is why a distinct decline occurred in specimen collection numbers after 2011 despite an increase in the territorial population. Potential reasons for the decline might include a response to reductions in academic research funding or a shift in academic research interests by non-residents; changes in federal or territorial government environmental resource development requirements; introduction of iNaturalist (Canadian Wildlife Federation, 2026) software as an alternative to collecting; or a change in the economy. Whereas these considerations may have had some influence, none appeared to have had a persistent dampening effect. A more likely reason for the decline may be related to changes in life-related circumstances of individual collectors, such as a change in employment or job responsibilities, retirements, and the death of prominent collectors (e.g., Philip Caswell in 2005, William Cody in 2009). This would appear to demonstrate the potential effect of even a single collector on activities in the territory and the precariousness of long-term northern research.

Herbarium Development

For more than a century (1860 to about 1980), the scientific investigation of Yukon botanical resources has been dominated by individuals who were affiliated with organizations located outside the territory, and often outside of Canada. As a result, most Yukon plant specimens are scattered among herbaria that are thousands of kilometers from the territory, which is not conducive to their use by locally based researchers or their scientific scrutiny. These distant collections may also be a low research priority by non-resident academics due to the small number of available specimens and the remoteness of the source area. At present, development of a territorial herbarium (presumably YUKONU) is in its infancy. In the short-term (1–5 years), the total number of specimens might be increased by absorbing known local collections that are thought to include 22,000–24,000 Yukon specimens, thereby more than tripling the territorial herbarium collection size. In addition, members of the public; government and independent biologists;

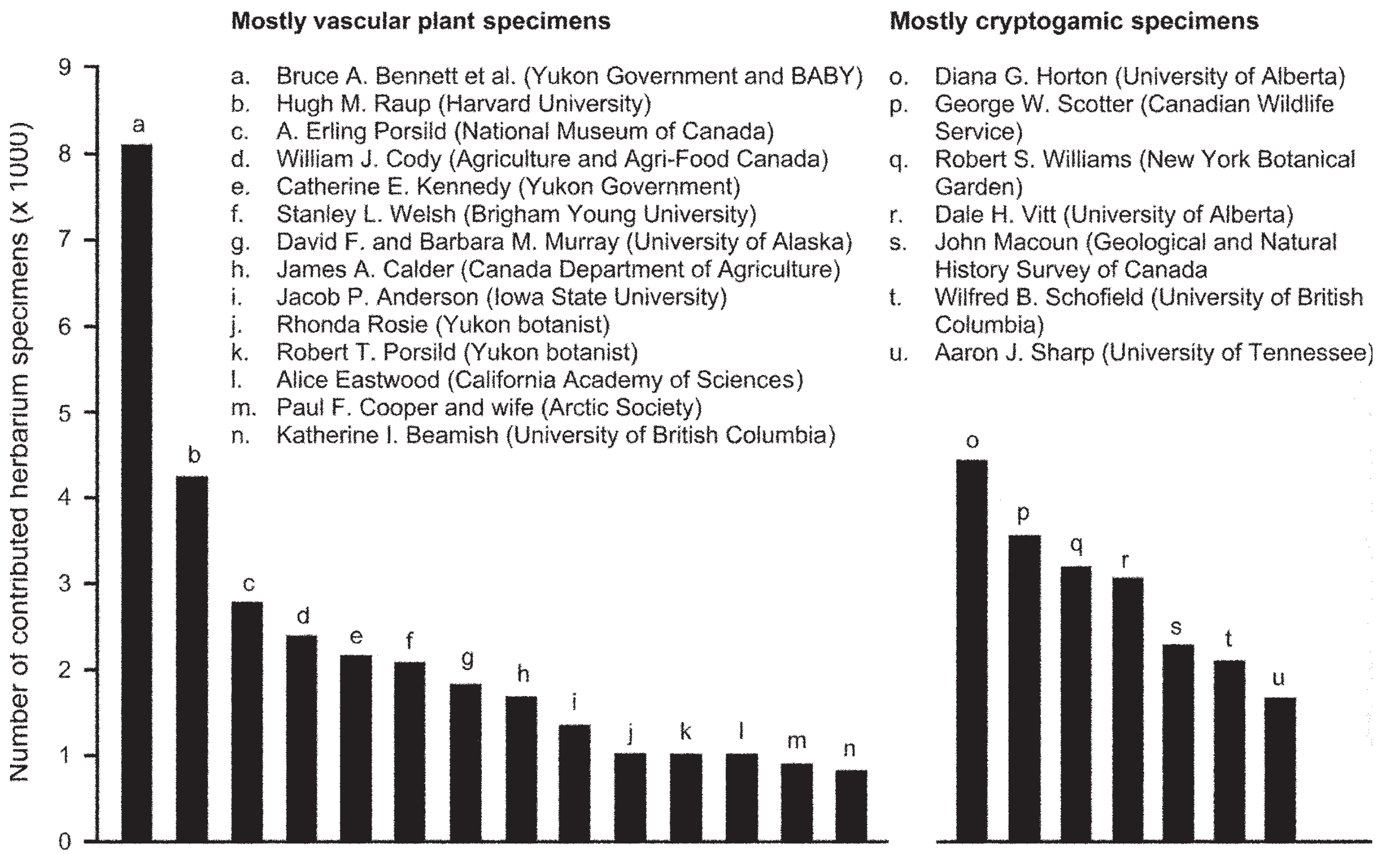

FIG. 3. Most prominent collectors of Yukon plants from 1826 to 2024, inclusive, based on the number of contributed specimens. Included were contributors with >800 specimens in the compiled database.

and nongovernment environmental organizations might be encouraged to contribute their annual collections through a public outreach program. If collections become available, priority could be given to previously uninvestigated geographical areas to expand the scope of the collection. The territory may continue to attract non-resident researchers because of its unique botanical research opportunities, and such should be encouraged. However, these researchers should also expect to donate collected plants, especially type specimens, to the territory under the terms of their mandatory Scientists and Explorers Act Licence (Government of Yukon, 2003; Section 5).

Beyond developing an herbarium by specimen additions, inclusion of applied and artistic practices, cultural perspectives, user applications, public engagement, events programming, transdisciplinary collaborations, and an identification of potential research opportunities would be useful enhancements to its functionality. For the latter possibility, future research might focus on Yukon's rich amphi-Beringian (n = 835, Strong, 2021) and endemic (n = 13 – 28, Table 2) taxa. This palaeobotanical situation does not exist elsewhere in Canada or further south. Relative to the latter, the ecologically similar Northwest Territories reports only two endemic taxa (i.e., *Symphyotrichum nahanniense* [W.J. Cody] Semple, *Poa ammophila* A.E. Porsild – Porsild and Cody, 1980; GBIF, 2025). Of the five most recently described taxa in the territory (Table 2), three were found at readily accessible locations, which suggests the possibility of others in more remote locations (e.g., *Draba bruce-bennettii* and *D. caswellii*, Table 2; also compare with Spribille et al., 2010). Yukon's palaeoecological history also offers unique botanical research possibilities. For example, did isolation during the last glaciation result in the large number of endemic *Draba* taxa in the territory (n = 6, Table 2), or did postglacial speciation occur? Are the morphological differences recognized by Argus (1973) between *Salix glauca* L. var. *glauca* ("Beringia" phase) and var. *villosa* (D. Don ex Hooker) A.E. Murray ("Rocky Mountain" phase) the result of genetic drift when the *S. glauca* population was split by Wisconsinan glaciers? Are there other similar parallels between Yukon and other more southerly taxa? Pursuing answers to these questions would help to explain Yukon's ecological past and the evolution of its contemporary flora, while helping to grow its herbarium collection.

CONCLUSIONS

Yukon has a history of botanical collecting for scientific purposes that dates from 1826 but has lagged in developing its own plant collection. As a result, most Yukon botanical specimens occur in herbaria outside of the territory. Botanical collections are both valuable biological and monetary resources that can be used in applied and scientific analyses. They can also be used in novel ways, such as to document the history of scientific discovery and activity. However, if an herbarium is to have a viable future in Yukon, it will need to expand its scope beyond just a scientific perspective. Realizing this fuller potential will not only benefit the collection, individuals, and the territory scientifically, but culturally and environmentally as well.

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