Rediscovering Martin Gusinde's century-old herbarium: botanical and ethnobotanical insights from Southern Patagonia

Daniela Salazar, Julián Caviedes, Tinde van Andel, Nina van der Werf & José Tomás Ibarra

Rediscovering Martin Gusinde's Century-Old Herbarium: Botanical and Ethnobotanical Insights from Southern Patagonia

Daniela Salazar[1], Julián Caviedes[1], Tinde van Andel[2,3], Nina van der Werf[4], and José Tomás Ibarra[*,1,5,6,7]

[1] ECOS (Ecosystem–Complexity–Society) Co-Laboratory, Center for Local Development (CEDEL), Villarrica Campus, Pontificia Universidad Católica de Chile, Villarrica, Chile
[2] Naturalis Biodiversity Center, Leiden, The Netherlands
[3] Institute for Biology, Leiden University, Leiden, The Netherlands
[4] Missiemuseum Steyl, Steyl, Venlo, The Netherlands
[5] Cape Horn International Center for Global Change Studies and Biocultural Conservation (CHIC), Universidad de Magallanes, Puerto Williams, Chile
[6] Department of Ecosystems and Environment, Faculty of Agriculture and Natural Systems (FASN), Pontificia Universidad Católica de Chile, Santiago, Chile
[7] Bernardo O'Higgins 501, Villarrica, La Araucanía Region, Chile
*Corresponding author; e-mail: jtibarra@uc.cl

Abstract: Ancient herbaria are invaluable archives for botany and ethnobotany, offering unique historical baselines on plant diversity, distribution, and human–plant relationships that are sometimes absent from modern datasets. We studied a rediscovered, century-old herbarium collected by Austrian ethnologist Martin Gusinde in southern Patagonia. Preserved at the Missiemuseum in Steyl, the Netherlands, the collection comprises 105 specimens representing 90 species, 71 genera, and 43 families, with approximately 35% likely to be unicates (specimens for which no duplicates are known in other herbaria). By combining taxonomic review, archival research, and analysis of Gusinde's ethnographic writings, we identified 71 documented uses for 24 species, spanning food, medicinal, technological, and ceremonial domains among the Yagán, Kawésqar, and Selk'nam Peoples. Our study reveals the scientific and cultural significance of Gusinde's botanical work, highlighting its interdisciplinary nature and relevance for contemporary biocultural research, conservation, and historical justice. We digitized the herbarium and allowed open access via the Global Biodiversity Information Facility (GBIF), enabling global availability while fostering ethical and reciprocal research practices. This work underscores the importance of reexamining overlooked collections to enrich biodiversity knowledge and strengthen intercultural education.

Keywords: Biocultural heritage, Chile, Global Biodiversity Information Facility (GBIF), Historical herbarium, Indigenous Peoples and local communities, Tierra del Fuego

Received: 12 August 2025; accepted: 7 April 2026; published online _____

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s12231-026-09677-1.

Ethnobotany and Economic Botany, XX(X), 2026, pp. 1–13

Published online: 30 April 2026

Resumen: Los herbarios antiguos son archivos invaluables para la botánica y la etnobotánica, ya que ofrecen referencias históricas únicas sobre la diversidad, distribución y relaciones entre las plantas y las personas, a veces ausentes en las bases de datos modernas. Estudiamos un herbario redescubierto y centenario, recolectado por el etnólogo austríaco Martin Gusinde en la Patagonia austral. Conservada en el Missiemuseum de Steyl, Países Bajos, la colección incluyó 105 especímenes que representan 90 especies, 71 géneros y 43 familias, con aproximadamente un 35% que probablemente sean únicos. Mediante la combinación de revisión taxonómica, investigación de archivos y análisis de los escritos etnográficos de Gusinde, identificamos 71 usos documentados para 24 especies, que abarcan los ámbitos alimentario, medicinal, tecnológico y ceremonial entre los pueblos Yagán, Kawésqar y Selk'nam. El estudio revela la relevancia científica y cultural de la obra botánica de Gusinde, destacando su carácter interdisciplinario y su vigencia para la investigación biocultural contemporánea, la conservación y la justicia histórica. Digitalizamos y así permitimos el acceso abierto al herbario a través de la plataforma Global Biodiversity Information Facility (GBIF), logrando su disponibilidad global para fomentar prácticas de investigación éticas y recíprocas. Este trabajo subraya la importancia de reexaminar colecciones pasadas por alto para enriquecer el conocimiento sobre la biodiversidad y fortalecer la educación intercultural.

Introduction

By studying plants we can learn from geological, ecological, and historical processes and from cultures that are considered on the brink of extinction (Łuczaj 2023; Marston et al. 2015). For the latter, ethnobotanical collections and herbaria have proven useful for a number of reasons, including (a) biocultural documentation, as they provide insights into the knowledge, practices, and beliefs of Indigenous Peoples and local communities through time, containing information on how plants have been understood and used for medicinal, nutritional, religious, and ceremonial purposes; (b) biodiversity conservation, as they may help understand plant diversity and biogeography, which is crucial for conservation efforts; (c) medicinal research, as the documented traditional uses of plants have informed modern pharmacological research, albeit not without practices of biopiracy; (d) anthropological study, as they offer a glimpse into the interactions between Western societies and Indigenous Peoples, highlighting the dynamics of cultural exchange and adaptation; and (e) historical record, as these archives document biodiversity and plant use before the significant changes brought by globalization, urbanization, and industrialization (Clément 1998; Łuczaj 2023; Martin 1995).

Martin Gusinde, a renowned Austrian priest and ethnologist, devoted much of his career to anthropological research among Indigenous Peoples of Tierra del Fuego in the southern Patagonia of Chile and Argentina. As a member of the Catholic missionary congregation Society of the Divine Word (SVD), Gusinde left an indelible mark on the field of anthropology, especially through his meticulous documentation of the cultural and spiritual lives of the Yagán, Selk'nam, and Kawésqar Indigenous Peoples (Gusinde 1989). Born in 1886 in Breslau (current Poland), Gusinde embarked on his mission to South America under the auspices of the Chilean Museum of Ethnology and Anthropology. Originally, his work in Chile was driven by a quest to understand the origins of monotheism among Indigenous populations. During his fieldwork in Patagonia, Gusinde provided unprecedented insights into the southernmost Indigenous Peoples, groups that had previously been subjected to cursory and often superficial observations, for example by Charles Darwin during his voyage on the HMS Beagle (Darwin 1989). Gusinde's ethnographic work is of great importance not only for its anthropological depth but also for its overlooked botanical and ethnobotanical contributions (Quiroz 2024). Although Gusinde is predominantly acknowledged for his anthropological achievements, in

this paper we stress that his plant collections deserve more attention, study, and recognition, particularly following the recent discovery of a 100-year-old herbarium collection in the Missiemuseum in Steyl, a small town in the south of the Netherlands. The herbarium, which has remained largely unexplored until this study, comprises a unique opportunity to delve into Gusinde's botanical legacy and its implications for understanding the ethnobotanical knowledge of Indigenous Peoples from Tierra del Fuego.

In this paper, we shed light on the neglected contribution of Gusinde's work, highlighting its relevance in contemporary botanical and ethnobotanical studies. The recent opening of Gusinde's packages of dried plant specimens in Steyl marks a significant milestone in botanical research in southern South America, as it fills a crucial gap in the scientific understanding of the region's flora. Through this study, we identified the species, genera, and families present in the herbarium, explored potential duplicates in other botanical collections, and assessed the ethnobotanical uses of these species documented earlier by Gusinde. Furthermore, we investigated additional sources to provide a more comprehensive background on Gusinde's botanical endeavors and uploaded the herbarium to the online open access GBIF platform (www.gbif.com) for disseminating this valuable information. By systematically examining the specimens collected by Gusinde, this study is aimed not only at honoring Gusinde's contributions but also at enriching the broader scientific and ethnobotanical discourse, fostering a deeper appreciation of the intertwined nature of human cultures and their botanical environments.

Gusinde's Work in the Southern Patagonian Region

Martin Gusinde conducted fieldwork between 1922 and 1924 in the southern Patagonian region of Chile and Argentina, focusing primarily on the Chilean side (Fig. 1). Specifically, he traveled around the Smith Channel and the Beagle Channel (*Onashaga* in Yagán language). The regional bioclimatic classification surrounding the Smith Channel and Beagle Channel is "Magellanian Antiboreal Forest" (Luebert and Pliscoff 2006), characterized by mean annual temperatures of 6 °C in the north and 3 °C in the south, with mean annual precipitation ranging from 700 mm in the east to 4000 mm in the west of Tierra del Fuego (www.explorador.cr2.cl). The vegetation comprises Magellanic tundra, Patagonian steppe, and Magellanic deciduous and evergreen sub-Antarctic forests, dominated by three species of the genus *Nothofagus*: *Nothofagus antarctica* (G. Forst.) Oerst., *Nothofagus pumilio* (Poepp. & Endl.) Krasser, and *Nothofagus betuloides* (Mirb.) Oerst. (Molina et al. 2016; Pisano 1981).

Martin Gusinde embarked on four expeditions in consecutive years: the first trip between 1918 and 1919, the second between 1919 and 1920, the third between 2021 and 1922, and the fourth between 1923 and 1924 (Palma and Osorio 2025). During his interdisciplinary research, he engaged in various tasks, including ethnography, photography, ethnozoology, and ethnomusicology, while also collecting numerous plant specimens (Fig. 2; Palma and Osorio 2025; Quiroz 2024).

Indigenous Peoples in this region include the nomadic Yagán and Kawésqar, seafaring canoe peoples who inhabited the coastal areas and did not venture far inland, and the Selk'nam, a terrestrial people of the interior. Gusinde referred to them in his records as Yamanas, Halakwulup, and Selk'nam, respectively. These Indigenous groups have a longstanding relationship with their territory and have been living in the area for more than 10,000 years (Alvarez et al. 2005). However, since the arrival of European settlers late in the nineteenth century, these groups have experienced a significant population decline due to violent interactions, targeted persecution, and the arrival of new diseases brought by settlers (Gusinde 2003). This context of vulnerability imparted a profound sense of urgency and precision to Gusinde's anthropological and ethnographic endeavors, which he himself expressed, stating: "*During my first journey through the Magellanic regions, in early 1919, I had ample opportunity to realize how imperfect and incomplete our knowledge of that territory still was. I became aware of the urgent need to resolve the enigma, present until this day, of its highly distinctive flora and fauna, geology and paleontology, and—above all—the ethnology and anthropology of the*

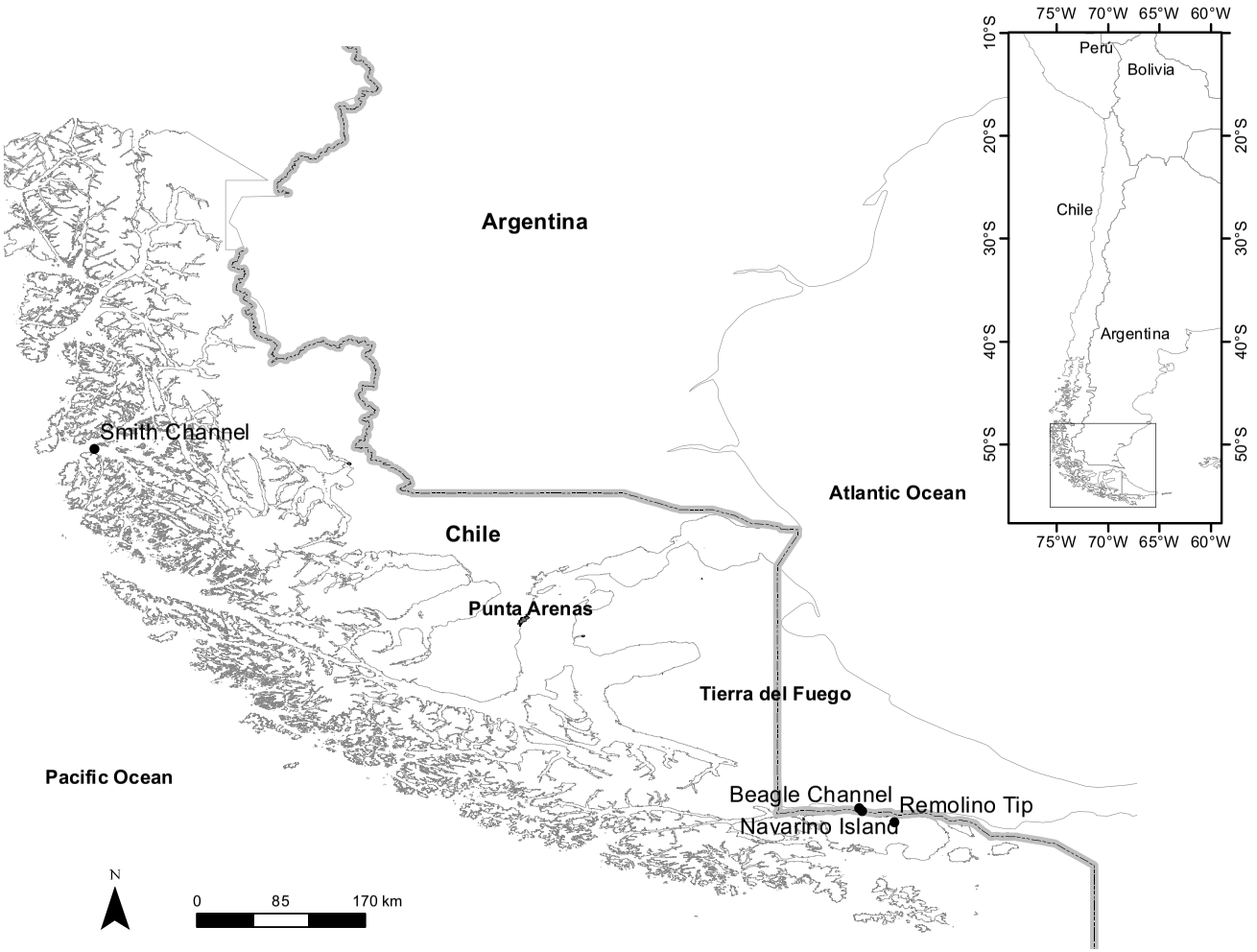

Fig. 1. Map of southern Patagonia with locations where Martin Gusinde collected the plant specimens preserved in the herbarium of the Missiemuseum in Steyl, The Netherlands Source of map: authors' own elaboration

Fig. 2. Historical photograph of ethnologist Martin Gusinde with Yagán individuals associated with the Chiejaus ceremony, taken during his fieldwork in southern Patagonia in 1921. The image is included as a historical document that situates Gusinde's botanical collecting within the broader ethnographic encounters through which knowledge about Yagán plant use was recorded. It reflects the ceremonial context in which some of these interactions occurred, as well as the early twentieth-century anthropological practices and unequal power relations under which such images were produced. Importantly, standards of informed consent and representation differed significantly at the time, and such photographs may not fully reflect the perspectives or wishes of the Yagán people themselves. Top row (left to right): Martin Gusinde, Masemikens, Usipinjis, and Wilhelm Koppers. Bottom row (left to right): Kinas, Elise, Julia, and Walter. Photograph taken by Martin Gusinde in 1921 and first published in Koppers (1924) (Ojeda 2012)

Fuegians continue to represent. This last point was especially pressing, given that these Peoples are heading toward definitive extinction at a pace impossible to halt" (Gusinde 1920: p. 134).

Methods

Opening a Wooden Cabinet with Specimens from Southern Patagonia

To this day, the botanical collections of Martin Gusinde have been dispersed across various museums worldwide, including the Naturhistorisches Museum Wien and the Natural History Museum of Chile. In 2021, an unmounted collection with wrapped plant specimens collected by Gusinde was discovered inside a wooden cabinet at the Missiemuseum in Steyl, a small town in the south of the Netherlands. The Missiemuseum was founded in 1929 to exhibit objects, animals, plants, and other items collected by the missionaries of the Society of the Divine Word (SVD) during their worldwide Catholic missions (www.missiemuseum.nl). This wooden cabinet (Fig. 3) had remained unexplored until it was opened in the presence of Tinde van Andel during her visit to Steyl. To facilitate further research, Nina van der Werf, collection manager in the Missiemuseum, digitized the entire herbarium in 2023, with help from Bart Beurskens.

The cabinet measured 76 cm in height, 52 cm in width, and 45 cm in depth. It had eight slots for drawers, with seven drawers present. Each drawer, measuring $7 \times 40 \times 34.5$ cm, had a glass bottom and a removable glass lid. The cabinet held 105 plant specimens, wrapped in paper sheets and newspaper pages. The newspaper pages were identical, likely resulting from a misprint by the SVD printing house in Steyl. The specimens were not mounted on the paper, and, except for one, all had accompanying labels handwritten by Martin Gusinde. Each label included the species name, family name, collection date (month/year), and location. Additionally, Gusinde assigned a unique number to each sample, except for two labels that lacked this identifier (Fig. 3).

Fig. 3. The wooden cabinet that housed the Gusinde specimens and the label of *Plantago barbata* G. Forst., assigned Gusinde's number 112, collected at Smith Channel in January 1924

Review of Specimens and Search for Duplicates

In May 2023, we reviewed the original specimens for taxonomic identification, using the *Flora of Tierra del Fuego* (Moore 1983) and the *Flores de Alta Montaña de los Andes Patagónicos* (Ferreyra et al. 2006). Scientific names written by Martin Gusinde were updated according to APG IV and PPG1 through taxonomic Authority Plants of the World Online (www.powo.science.kew.org). To gain a comprehensive understanding of the botanical collection discovered at Steyl, we searched for information on missing collection numbers within the range of specimens present in the Steyl collection and potential duplicates. This involved examining botanical specimens collected by Gusinde in the collection at the Naturalis Biodiversity Center in the Netherlands and digital herbariums worldwide through online search platforms such as JACQ (www.jacq.org) and GBIF (www.gbif.org), with searches filtered for specimens explicitly collected by Gusinde.

Complementary Sources of Information and Ethnobotanical Uses

Following his four expeditions to Tierra del Fuego, Martin Gusinde consolidated his research findings in a four-volume work entitled *Los Indios de Tierra del Fuego* (Gusinde 1989). This comprehensive examination detailed the social organization, habitat and history, economic life, and spiritual world of the Indigenous Peoples of Tierra del Fuego. To identify references to his botanical collections and ethnobotanical uses of the specimens found at the Missimuseum herbarium, we reviewed this work. Our review focused on the chapter "The World of Plants" in each volume, as well as relevant chapters such as "Use of Fire," "Utensils and Tools," and "Women in Search of Food." The index of illustrations in each volume was also examined for ethnobotanical references. Each use was classified into one of the following categories: (i) food, (ii) building material, (iii) domestic, (iv) hunting and fishing, (v) magical, (vi) medicinal, (vii) tool material, and (viii) weaving and handicrafts. During our research, we discovered that some of Gusinde's other research material was stored in boxes at the Anthropos Institute of the SVD, located in Sankt Augustin, Germany, near Bonn (Bornemann 1971; Palma Behnke 2019). Palma Behnke (2019) described one of the boxes as containing notebooks from his various research trips, including those to Tierra del Fuego. To further investigate Gusinde's botanical legacy, we visited the Anthropos Institute and examined these diaries.

As part of this project, the Missiemuseum digitized their Gusinde herbarium and published it

on the platform of the Global Biodiversity Information Facility (GBIF). All specimens can be viewed online at https://www.gbif.org/dataset/29d32957-3126-474f-9c90-a1d03e4323be (van der Werf and Creuwels 2024).

Results

Specimen Information and Duplicates

There are 105 plant specimens in the herbarium collection at the Missiemuseum, numbered 1 to 142 (with gaps) by Gusinde. Among these 105 specimens, two were unnumbered. We identified 90 different species from 71 genera, corresponding to 43 different families (ESM 1). At the genus level, the genus *Nothofagus* was the most represented, with 9 specimens (13%), followed by *Azorella* with 5 specimens (7%). At the family level, the Asteraceae were best represented, with 21% ($n = 22$) of the specimens, followed by Nothofagaceae with 9% ($n = 9$) and Apiaceae with 7% ($n = 7$).

All but one of the 105 specimens had an associated label. Based on the information on the labels, we found that Gusinde collected these specimens near Smith Channel ($n = 50$) in northern Tierra del Fuego, mainly during 1924, and at Remolino ($n = 55$) in the Beagle Channel during 1922 (Fig. 1, Table 1). We found seven labels that do not describe where in the Beagle Channel they were found, making it impossible to identify the Indigenous Peoples who inhabited the area from which they were collected.

For the 103 specimens numbered in the Missiemuseum collection, we identified duplicates and missing specimens at the Royal Botanic Garden in Edinburgh (E), the Natural History Museum in Vienna (W), the Meise Botanical Garden in Belgium (BR), the Gaspar Suarez Herbarium in Argentina (BAA), and the Missouri Botanical Garden in the United States (MO). During our online herbarium review, we identified 20 additional numbered specimens that were not present in the Missiemuseum collection. Of the 105 specimens in the Missiemuseum collection, there are duplicates for 68 specimens at the above-mentioned herbaria. Consequently, it is likely that 37 (35%) of the 105 specimens in the Missiemuseum in Steyl are unicates. Interestingly, many identified duplicates in European herbaria were labeled as originating from the Vienna herbarium. However, despite our efforts and the goodwill of the museum staff, access to information from Gusinde's botanical collection at the Vienna herbarium was limited due to the incomplete digitalization of Gusinde's herbarium collection.

Within the Missiemuseum collection, Gusinde collected a species that he believed to be new. Based on this material, another author later described and named it in his honor as *Calamagrostis gusindeii* Pilg. The specimen, numbered 40 on Gusinde's handwritten labels, was annotated as "sp. nova?" by Gusinde (Fig. 4). However, subsequent taxonomic work demonstrated that this species corresponded to one described much earlier as *Deyeuxia rigida*

Table 1. Detailed account of the specimen collection locations, classified by year, the number of specimens collected, and the Indigenous Peoples that inhabited this territory at the time of the collection

Collection site	Country	Year	Number of specimens	Indigenous Peoples inhabiting this area
Remolino, Beagle Channel	Argentina	1922	42	Selk'nam
Remolino, Beagle Channel	Argentina	1923	5	Selk'nam
Remolino, Beagle Channel	Argentina	no date	1	Selk'nam
Smith Channel	Chile	1922	4	Kawésqar
Smith Channel	Chile	1923	3	Kawésqar
Smith Channel	Chile	1924	37	Kawésqar
Navarino island, Beagle Channel	Chile	1922	3	Yagán
Navarino island, Beagle Channel	Chile	1923	2	Yagán
Beagle Channel	Not mentioned	1922	7	-

Fig. 4. Specimen no. 40 in Gusinde's collection at the Missiemuseum in Steyl, which he believed to be new and which was later named in his honor, *Calamagrostis gusindeii* Pilg

Kunth, later transferred to *Cinnagrostis rigida* (Kunth) P. M. Peterson, Soreng, Romasch. & Barberá, and the two names were therefore treated as synonyms. Gusinde's collection remains the type material for *Calamagrostis gusindeii*, although that name is no longer in use, but it does not constitute type material for *Deyeuxia rigida*, which is only a taxonomic synonym. Gusinde himself referred to this specific species in the chapter "El Mundo de Las Plantas" in book 3 of *Los Indios de Tierra del Fuego*, stating: "*Among the herbs I collected in the most distant Tierra del Fuego, I found one of a type previously unknown, which has been named Calamagrostis gusindei*" (Gusinde 1989: V1, p. 11).

Ethnobotanical Uses

After reviewing the four volumes of "Los Indios de Tierra del Fuego," we found records for 71 ethnobotanical uses, involving 24 different species. These uses were categorized as follows: 24% corresponded to food uses, 21% to hunting and fishing, 17% to building materials, and 14% to medicinal applications. Specifically, we identified records for 32 ethnobotanical uses for the Yagán, 25 for the Kawésqar, and 14 for the Selk'nam. *Berberis ilicifolia* L.f. and *Nothofagus betuloides* (Mirb.) Oerst. were the species with the highest number of ethnobotanical uses ($n = 10$ each), utilized by all three Indigenous Peoples. Six species were reportedly used by these three groups, including *Nothofagus antarctica* (G.Forst.) Oerst., *Nothofagus betuloides*, *Berberis ilicifolia*, *Berberis microphylla* (G. Forst.), *Empetrum rubrum* Vahl ex Willd., and *Juncus grandiflorus* L.f. Notably, the three species of *Nothofagus* found in the area were extensively used for hunting and fishing ($n = 6$) by the three Indigenous Peoples, building materials ($n = 5$) by the Kawésqar ($n = 4$) and Yagán ($n = 1$), and medicinal ($n = 3$) by the Yagán.

Palma Behnke (2019) described the documentary archive at the Anthropos Institute in Sankt Augustin as well-organized and categorized into approximately one hundred boxes, sorted by periods, regions, and document types. Among these is a dedicated box containing notebooks from Gusinde's various research expeditions. Our visit to the Anthropos Institute revealed a substantial amount of unpublished material collected during Gusinde's lifetime, particularly from his field research expeditions. We found diary clippings, letters, photographs, issues of the Anthropos Institute journal, and other documents. Among these materials, none of which are digitally available, we discovered a travel diary documenting his first two visits to Tierra del Fuego (first trip: 1918–1919 and second trip: 1919–1920). Although the diary from the third trip was listed in the Anthropos register of

materials, we could not find it. The diary from the fourth trip remains unaccounted for.

Discussion

Scientific Significance of the Steyl Herbarium

Our study stresses that the rediscovery of Martin Gusinde's herbarium in the Missiemuseum of Steyl constitutes a singular botanical and ethnobotanical event. The Steyl herbarium is not merely a historical curiosity; it is a scientifically invaluable archive comprising 105 specimens, including 90 species across 71 genera and 43 families, of which approximately 35% are unicates not known from other herbarium collections. It bridges a century-old knowledge gap regarding the flora of southern Patagonia and offers a rare look into early 20th-century botanical collecting practices in extreme southern latitudes. Similar rediscoveries of overlooked missionary collections have yielded important contributions elsewhere, for instance, in the ethnobotanical collections and archives reported for the Americas (de Mösbach 1992; Schiebinger 2009). These parallel cases show how missionary collections can complement institutional herbaria and enrich biocultural research with unique specimens and contextual narratives.

Unlike many missionary collectors whose only focus was zoological or anthropological material, Gusinde's assemblage reveals a thoughtful and systematic botanical practice. This includes detailed labeling and careful specimen preservation. In doing so, the Steyl herbarium underscores the relevance of integrating forgotten or dispersed collections into global biodiversity inventories (Lavoie 2013), particularly in regions like southern Patagonia where herbarium records remain sparse (Rozzi 2012).

Gusinde's Interdisciplinary Research

Martin Gusinde's contributions extend well beyond plant collection. His work embodies an interdisciplinary approach that integrated ethnography, human anatomy, linguistics, photography, geography, geology, musicology, and botany. As such, he exemplifies what would now be considered a holistic or systems-based approach to scientific inquiry, a mode of fieldwork that resonates strongly with contemporary ethnobiological paradigms (Fernández-Llamazares et al. 2024). The interdisciplinary nature of his methodology allowed Gusinde to capture the co-evolution of cultural and ecological systems across time and space, setting a precedent for modern integrative field sciences.

The photographic and ethnographic archives that Gusinde compiled—alongside his botanical efforts—remain critical resources for understanding the material and immaterial heritage of the Yagán, Kawésqar, and Selk'nam Peoples. His botanical collections, particularly when integrated with his ethnographic writings, offer a nearly unparalleled view of biocultural relationships at the edge of the inhabited world. Few researchers in his time, especially working in such remote and politically peripheral regions, achieved this level of disciplinary integration. The quality of Gusinde's botanical work is evident in his specimen curation and detailed labeling. However, significant gaps and contradictions also persist. For instance, despite his meticulous documentation of plant materials and uses, Gusinde occasionally underestimated the ethnobotanical knowledge of peoples he studied, describing their plant use as limited or marginal (Gusinde 1989). Yet the data itself, when reviewed systematically, reveal a rich and sophisticated understanding of plant resources, with 71 uses identified for 24 species across food, medicinal, technological, and ceremonial domains. This disconnection reflects broader biases common in early 20th-century anthropology and ethnobiology, in which Indigenous ecological knowledge was often undervalued (Hunn 2007). Modern ethnobotany challenges these assumptions by framing Indigenous knowledge as dynamic, adaptive, and deeply embedded in local ecologies (Pironon et al. 2024). Indeed, the three major Indigenous groups of Tierra del Fuego (Yagán, Kawésqar, and Selk'nam) demonstrated extensive biocultural knowledge of keystone plant species such as *Nothofagus betuloides*, *Berberis ilicifolia*, and *Juncus grandiflorus*. Future research should revisit Gusinde's field notes, unpublished letters, and possibly overlooked materials to reassess his full contribution to Patagonian botany.

The Contemporary Relevance of Gusinde's Legacy

In the twenty-first century, Gusinde's legacy finds renewed relevance as scholars, educators, and Indigenous organizations seek to revitalize historical memory, biocultural diversity, and intercultural education. Botanical archives, such as the Steyl herbarium, serve as a botanical basis for valuable ethnobotanical knowledge and can play a transformative role in historical reparation and community-based education (Smith Tuhiwai 2021). These collections are not just scientific; they are pedagogical and cultural tools that can strengthen processes of biocultural memory and historical justice in the face of cultural erosion.

In Chile, the digitization and open access to the Steyl herbarium through GBIF, as well as plans to archive it through the Fundación Martin Gusinde, represent important steps toward decolonizing science and ensuring that knowledge produced from Indigenous territories is returned, acknowledged, and made useful for local communities (Nelson and Ellis 2018; Rozzi 2012). At the same time, linking digitized specimens to ethnobotanical and ethnographic knowledge entails ethical responsibilities related to Indigenous data governance, including consent, control, and benefit sharing, which call for explicit alignment with the CARE principles (Hart et al. 2025; Smith Tuhiwai 2021).

Future Directions: Research and Dissemination

This study opens several avenues for future investigation. First, a complete inventory of Gusinde's botanical specimens should be undertaken by cross-referencing digitized collections at Naturalis, the Naturhistorisches Museum in Vienna, and other institutions where duplicates or missing items may reside. Second, field-based ethnobotanical work in Tierra del Fuego should engage directly with Yagán and Kawésqar communities to examine current plant knowledge, identify continuities and losses, and support cultural transmission. Gusinde's collections and writings are increasingly relevant for contemporary research agendas at the intersection of ethnobotany, conservation biology, and historical ecology. His data provide important historical baselines for species distribution, use, and habitat, vital in a region undergoing ecological transformations due to climate change, tourism, and development pressures (Castilla et al. 2021). They also inform current efforts in intergenerational knowledge transmission, cultural revitalization, and participatory conservation among Indigenous Peoples and local communities in Chile and Argentina.

The dispersal of Gusinde's botanical specimens across multiple European and North American institutions—often with incomplete metadata or limited access—speaks to the enduring legacies of colonial science. Although Gusinde worked respectfully within Indigenous communities, he operated within extractive structures that prioritized European knowledge systems and institutions. Ethnobotanists have a responsibility to not only critique but actively challenge these structures by promoting open access, co-curation, and reciprocal partnerships. Repatriation—whether digital or material—may be a guiding principle for future research involving Gusinde's legacy.

Collaborative projects combining herbaria, oral histories, and community knowledge can build on this foundation to document how social-ecological systems have evolved or persisted over time (Ibarra et al. 2023). Associated with the dissemination and democratization of knowledge, particularly in Chile, the country from which a significant number of the botanical samples originate, collaborative links have been established with local institutions, such as the Yagán community in Puerto Williams, the Yagán Usi Museum, and the Martin Gusinde Foundation. Furthermore, Gusinde's work, when integrated with modern methods such as GIS mapping, phytochemical analysis, and collaborative ethnography, offers a compelling framework for longitudinal biocultural research (Fernández-Llamazares et al. 2024). In Chile, public and private institutions could serve as hubs for educational programs, digital archives, and citizen science initiatives that reconnect communities with Gusinde's botanical materials. Additionally, exploring Gusinde's unpublished archival materials (e.g., letters, sketches, or annotated photographs) may reveal further undocumented plant uses or species of interest. Finally, the case of Gusinde's herbarium should prompt broader efforts to audit and reassess missionary and ethnographic collections in museums across Europe

and the Americas, with the aim of restoring hidden histories and deepening our understanding of Indigenous botanical heritage. One of the central objectives of this research is to ensure that new discoveries in botany are accessible to all, not only to the scientific community but also to the public. To achieve this, the digitization of the herbarium by the Missiemuseum in Steyl was crucial. The high-quality images of each specimen and the collaboration with the Global Biodiversity Information Facility (GBIF) platform have been fundamental to ensuring that these data are openly and freely available to anyone interested in exploring them.

Conclusion

The Steyl herbarium bridges historical and contemporary knowledge, revealing the remarkable depth of Indigenous plant use in Tierra del Fuego and the intertwined nature of ecological and cultural heritage in one of the world's southernmost inhabited regions. By integrating dispersed and overlooked collections into both global scientific inventories and locally grounded initiatives, we not only fill critical gaps in biodiversity data but also contribute to the revitalization of biocultural memory. Such efforts can support community-led education, participatory conservation, and the return of knowledge to the territories from which it originated. In this way, Gusinde's century-old specimens become more than historical artifacts—they are living resources for intercultural dialogue, historical justice, and the co-creation of future research that honors Indigenous knowledge systems alongside scientific inquiry.

Acknowledgements

We thank all the people at the Missiemuseum Steyl who have created the conditions for us to carry out this research. We are grateful to the Naturalis Biodiversity Center in the Netherlands and the Centro Internacional Cabo de Hornos-CHIC (ANID PIA/BASAL PFB210018, Chile) for providing financial support. We also acknowledge the support from ANID/Fondecyt Regular 1240070, CIIR–ANID/FONDAP 15110006, and CAPES–ANID PIA/BASAL AFB240003. We thank Francisca Santana for her help preparing Fig. 1. We also acknowledge the help of the Anthropos Institute in Germany, for allowing us access to their archives and documents. Research by D. Salazar in the Netherlands was supported by the Martin & Temminck Fellowship of Naturalis Biodiversity Center.

Author Contribution

D.S. and N.V. conducted the botanical and analitical work; T.V. and J.T.I. secured funding; J.C., D.S. and J.T.I. wrote the main manuscript text; all authors reviewed the manuscript.

Funding

Naturalis Biodiversity Center,ANID PIA/BASAL,PFB210018,PFB210018,PFB210018,ANID/Fondecyt Regular ,1240070,1240070,1240070,ANID/FONDAP,15110006 ,15110006,15110006,Martin & Temminck Fellowship.

Data Availability

No datasets were generated or analysed during the current study.

Declarations

Competing Interests The authors declare no competing interests.

References

Alvarez, R., F. Massardo, R. Rozzi, U. Berghöfer, A. Berghöfer, and J. Fredes. 2005. Patrimonio cultural de la Reserva de Biosfera Cabo de Hornos propuesta. In: Reserva de Biosfera Cabo de Hornos: Una propuesta de conservación y turismo para el desarrollo sustentable en el extremo austral de América, eds. R. Rozzi, F. Massardo, and C. B. Anderson, 153–175. Punta Arenas, Chile: Ediciones de la Universidad de Magallanes.

Bornemann, F. 1971. P. Martin Gusinde (1886–1969): Mitglied des Anthropos Institutes. Collegio del Verbo Divino.

Castilla, J. C., J. J. Armesto, and M. J. Martínez-Harms, eds. 2021. Conservación en la Patagonia chilena: Evaluación del conocimiento, oportunidades y desafíos. Santiago: Ediciones UC.

Clément, D. 1998. The historical foundations of ethnobiology (1860–1899). Journal of Ethnobiology 18(2): 161–187.

Darwin, C. 1989. The voyage of the Beagle. Eds. J. Browne and M. Neve. London: Penguin Classics.

de Mösbach, E. W. 1992. Botánica indígena de Chile. Santiago: Editorial Andrés Bello. http://www.memoriachilena.gob.cl/602/w3-article-9224.html

Fernández-Llamazares, Á., I. Teixidor-Toneu, C. G. Armstrong, J. Caviedes, J. T. Ibarra, D. Lepofsky, A. C. McAlvay, Z. Molnár, R. M. Moraes, G. Odonne, M. R. Poe, A. Sharifian Bahraman, and N. J. Turner. 2024. The global relevance of locally grounded ethnobiology. Journal of Ethnobiology and Ethnomedicine 20(1): 53. https://doi.org/10.1186/s13002-024-00693-w

Ferreyra, M., C. Ezcurra, and S. Clayton. 2006. Flores de alta montaña de los Andes patagónicos. Buenos Aires: Editorial Lola.

Gusinde, M. 1920. Segundo viaje a la Tierra del Fuego. Santiago: Publicaciones del Museo de Etnología y Antropología.

Gusinde, M. 1989. Los indios de Tierra del Fuego: Resultado de mis cuatro expediciones en los años 1918 hasta 1924. Buenos Aires: Centro Argentino de Etnología Americana.

Gusinde, M. 2003. Expedición a la Tierra del Fuego. Santiago: Editorial Universitaria.

Hart, R., V. Fonseca-Kruel, E. Dalcin, E. da Silva Luís Alexandre, M. Pace, M. Schmull, L. Beltran-Rodríguez, M. Murguía-Romero, D. G. Flores-Camargo, C. Mapes-Sánchez, M. Nesbitt, C. Romero, A. Townesmith, J. Salick, A. McAlvay, K. R. Otero-Walker, M. J. Balick, J. Golan, B. Hoffman, and I. Vandebroek. 2025. Repositories of biocultural diversity: Toward best practices for empowering ethnobotany in digital herbaria. Plants, People, Planet 2025: 1–9. https://doi.org/10.1002/ppp3.70052

Hunn, E. 2007. Ethnobiology in four phases. Journal of Ethnobiology 27(1): 1–10. https://doi.org/10.2993/0278-0771(2007)27[1:EIFP]2.0.CO;2

Ibarra, J. T., J. Caviedes, C. Marchant, S.-L. Mathez-Stiefel, S. Navarro-Manquilef, and F. O. Sarmiento. 2023. Mountain social-ecological resilience requires transdisciplinarity with Indigenous and local worldviews. Trends in Ecology & Evolution 38(11): 1005–1009. https://doi.org/10.1016/j.tree.2023.07.004

Koppers, W. 1924. Unter Feuerland-Indianern: Eine Forschungsreise zu den südlichsten Bewohnern der Erde mit M. Gusinde. Vienna: Anthropos.

Lavoie, C. 2013. Biological collections in an ever changing world: Herbaria as tools for biogeographical and environmental studies. Perspectives in Plant Ecology, Evolution and Systematics 15(1): 68–76. https://doi.org/10.1016/j.ppees.2012.10.002

Łuczaj, Ł. 2023. Descriptive ethnobotanical studies are needed for the rescue operation of documenting traditional knowledge. Journal of Ethnobiology and Ethnomedicine 19(1): 37. https://doi.org/10.1186/s13002-023-00604-5

Luebert, F., and P. Pliscoff. 2006. Sinopsis bioclimática y vegetacional de Chile. Santiago: Editorial Universitaria.

Marston, J. M., J. d'Alpoim Guedes, and C. Warinner. 2015. Method and theory in paleoethnobotany. Boulder: University Press of Colorado.

Martin, G. J. 1995. Ethnobotany: A methods manual. London: Chapman and Hall.

Molina, J. A., A. Lumbreras, A. Benavent-González, R. Rozzi, and L. G. Sancho. 2016. Las comunidades vegetales como indicadores bioclimáticos en Isla Navarino, una de las áreas forestales más australes del planeta. Gayana Botánica 73(2): 391–401.

Moore, D. M. 1983. Flora of Tierra del Fuego. Königstein: Lubrecht & Cramer.

Nelson, G., and S. Ellis. 2018. The history and impact of digitization and digital data mobilization on biodiversity research. Philosophical Transactions of the Royal Society B: Biological Sciences 374(1763): 20170391. https://doi.org/10.1098/rstb.2017.0391

Ojeda, J. P. 2012. Disciplina científica colonial y coproducción etnográfica: Las expediciones de Martín Gusinde entre los Yámana de Tierra del Fuego. Magallania 40(2): 61–87. https://doi.org/10.4067/S0718-22442012000200004

Palma Behnke, M. 2019. Diario del tercer viaje de Martín Gusinde a Tierra del Fuego (1921–1922). Anthropos 114: 355–372.

Palma, M., and F. Osorio. 2025. Retrospectiva de los viajes de Martin Gusinde a Fuego-Patagonia. Magallania 53. https://doi.org/10.22352/MAGALLANIA20255311

Pironon, S., I. Ondo, M. Diazgranados, R. Allkin, A. C. Baquero, R. Cámara-Leret,

C. Canteiro, Z. Dennehy-Carr, R. Govaerts, S. Hargreaves, A. J. Hudson, R. Lemmens, W. Milliken, M. Nesbitt, K. Patmore, G. Schmelzer, R. M. Turner, T. R. van Andel, T. Ulian, and K. J. Willis. 2024. The global distribution of plants used by humans. Science 383(6680): 293–297. https://doi.org/10.1126/science.adg8028

Pisano, E. 1981. Bosquejo fitogeográfico de Fuego-Patagonia. Anales del Instituto de la Patagonia 12: 159–171.

Quiroz, D. 2024. The forgotten trip of Martin Gusinde to Western Insular Patagonia (1921). Magallania 52: 1–22.

Rozzi, R. 2012. Biocultural ethics. Environmental Ethics 34(1): 27–50. https://doi.org/10.5840/enviroethics20123414

Schiebinger, L. 2009. Plants and empire: Colonial bioprospecting in the Atlantic world. Cambridge, MA: Harvard University Press.

Smith Tuhiwai, L. 2021. Decolonizing methodologies: Research and Indigenous peoples. London: Bloomsbury Publishing.

van der Werf, N., and J. Creuwels. 2024. Missiemuseum – Herbarium Martin Gusinde. https://doi.org/10.15468/ggwyg3