From the "Norwegian Flora" (Eighteenth Century) to "Plants and Tradition" (Twentieth Century): 200 Years of Norwegian Knowledge about Wild Plants

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Abstract. From the "Norwegian Flora" (eighteenth Century) to "Plants and Tradition" (twentieth Century): 200 Years of Norwegian Knowledge about Wild Plants. Much ethnobotanical knowledge is documented through history in books of various kinds, which allow diachronic studies of plant use. These texts can also contribute to investigate plant knowledge transmission. Here we evaluate the influence of the first Norwegian Flora, *Flora Norvegica* (J. E. Gunnerus 1766–1776), a major Enlightenment natural history work in Norway, by comparing it to *Planter og Tradisjon* ("Plants and Tradition," O. A. Høeg 1974), Norway's most important ethnobotanical compilation. We systematized information from these two key historical sources of plant knowledge in Use Reports per category of use. In total, 2449 Use Reports for 552 taxa were collected, including vascular plants, ferns, mosses, algae, lichens, and fungi. We find over 100 unchanged traditions (i.e., plant-use combinations recorded in both books): only 270 Use Reports and 185 taxa are recorded in both sources. Plant knowledge may have changed, been lost or newly developed in Norway, but it is also possible that it has largely been under-documented. We argue that differences are explained to a great extent by the differing aims and socio-economic contexts of the two texts. Ultimately, perceptions of what nature is and what it is for determine what ethnobotanical knowledge is documented in historical sources.

Norwegian Abstract. Fra *Flora Norvegica* (18th århundre) til *Planter og Tradisjon* (20th århundre): Norsk kunnskap om ville planter gjennom 200 år. Etnobotanisk kunnskap, kunnskap om menneskers plantebruk, finnes bevart i forskjellige typer bøker fra flere århundrer. Diakrone sammenlikninger av. plantebruk er mulig ved å analysere slike bøker. Tekstene gir også innsikt i hvordan plantekunnskap er blitt formidlet. Her undersøker vi hvilken innflytelse den første norske flora, opplysningstidens *Flora Norvegica* (J. E. Gunnerus 1766–1776) har hatt på senere utbredelse og formidling av. plantekunnskap. Det gjør vived å sammenlikne den med Norges viktigste etnobotaniske oppslagsverk, *Planter og Tradisjon* (O. A. Høeg 1974). I artikkelen har vi systematisert og deretter sammenliknet plantekunnskap fra disse to verkene i kategorier av. angitte bruksområder (UR). Vi har samlet 2449 bruksområder for 552 ulike planter, inkludert bregner, moser, alger, lav og sopp. Selv om intensjonen bak de to verkene og de sosio-økonomiske kontekstene er svært ulike, finner vi over 100 uendrede tradisjoner (bruksområder angitt i begge verk), mens bare 270 bruksområder og 185 taxa er angitt i begge verk. Kunnskapen kan ha blitt endret, gått tapt, eller er ny i Norge, men det er også mulig at plantekunnskapen ikke har vært godt nok dokumentert over tid. Vi argumenterer for at det skyldes at intensjonen bak de to verkene og de sosio-økonomiske kontekstene er svært ulike. Vi diskuterer hvordan en grunnleggende forståelse av. naturen og bruken av. naturen har påvirket formidlingen av. plantekunnskap i de historiske kildene.

[1] Received 27 April 2020; accepted 29 September 2020; published online 9 October 2020

Electronic supplementary material The online version of this article (https://doi.org/10.1007/s12231-020-09507-y) contains supplementary material, which is available to authorized users.

Economic Botany, 74(4), 2020, pp. 398–410
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Key Words: Transmission, Written tradition, Historical sources, Scandinavia, Enlightenment.

Introduction

Local and indigenous plant knowledge is dynamic and changes over time, but elements of this knowledge may persist for many generations (e.g., Ellen 1996; Van Andel et al. 2014). Understanding cultural transmission of plant knowledge is a central area of inquiry in ethnobotany. When written down, botanical traditions tend to be conserved and are found in oral knowledge of rural populations even centuries after information was first printed. This has been attributed to the potential of books to transmit the same knowledge to many people simultaneously and consistently through time (Leonti 2011). Studies in southern Italy observed that Dioscorides' and Galen's *De Materia Medica* medicinal plant formulations resulted in the homogenization of contemporary medicinal plant knowledge (Leonti et al. 2015). In China, non-Chinese ethnic groups have medicinal plant knowledge strongly influenced by mainstream Traditional Chinese Medicine, knowledge acquired through books distributed with the aim of improving rural population's health (Weckerle et al. 2009). Fireweed (*Epilobium angustifolium* L.) has recently become fashionable as a "traditional" tea in Estonia due to the recommendation of its use in popular, but somewhat misguided, literature (Sõukand et al. 2020). The transmission of knowledge from books to the general population may depend on factors such as the books' purpose, the audience or audiences targeted, the frequency of reproduction of the material, and how widely it is disseminated, among others. Whether or not books have a direct impact on popular knowledge, they provide historical evidence to study change or persistence of plant knowledge over time. For example, most plant uses documented in *Historia Naturalis Brasiliae* (seventeenth century), a publication that could not have had much influence on local knowledge, are still present in Brazil, showing a great time depth of the Brazilian ethnobotanical knowledge (Alcantara-Rodriguez et al. 2019).

This article aims to gain further insight into the transmission of utilitarian and folk plant knowledge (as well as moss, algae, lichen, and fungi) through time by comparing two major Norwegian ethnobotanical works written 200 years apart and which represent crucially different socio-cultural contexts in the North: *Flora Norvegica* ("Norwegian Flora," 1766–1776), written in Latin by the Norwegian priest and botanist J. E. Gunnerus, and *Planter og Tradisjon* ("Plants and Tradition," 1974), written in Norwegian by botany professor O. A. Høeg. *Flora Norvegica* was written during the Enlightenment period and is the first comprehensive floristic compilation in Norway. It includes many and diverse references to the uses not only of vascular plant species, but also mosses, algae, lichens, and fungi. *Planter og Tradisjon* is written with a concern for loss of traditions and compiles folk plant knowledge in Norway from the early- to mid-twentieth century. It also includes mosses, algae, lichens, and fungi. We quantitatively evaluate the knowledge presented in these two works and their overlap. *Flora Norvegica* was an academic work translated to Norwegian only a few years ago (Jørgensen et al. 2016) and its ethnobotanical content remains unstudied. Jørgensen et al. (2016) mention that a quick comparison of *Flora Norvegica* with *Planter og Tradisjon* reveals the loss of much knowledge since the eighteenth century. Here we critically evaluate this assumption by exploring to what extent changes in material conditions motivating plant use on the one side, and discursive conditions underlying the aims for transmission of knowledge in Norway's society on the other, can explain differences and similarities between the two works. The effort made by Gunnerus in the eighteenth century to document, share, and improve people's usage of natural resources is analyzed and its impact discussed.

Johan Ernst Gunnerus and the *Flora Norvegica* Project

Johan Ernst Gunnerus (1718–1773) was born in Christiania (Oslo), a son of the city's physician. Fatherless at a young age, with help from family, friends, and generous scholarships he completed his grammar school education. Following a few years at the University of Copenhagen, Gunnerus was granted a royal traveling stipend and set off for Halle. During his two-year stay, he studied theology, physics, mathematics, and history. He then moved to Jena, where he settled for a decade, earning a master's degree and giving public lectures. In 1754, Gunnerus was called back to Copenhagen to teach at the university. Four years later, and to his

own surprise, he was appointed bishop of Trondheim (or Nidrosia) in his native Norway, then under Danish rule. Although the diocese was large, covering all of northern Norway, from Romsdal to Finnmark, it was sparsely populated, and Trondheim was a backwater. Once established, the new bishop became instrumental in creating a learned society, which in 1767 was formally established as the Royal Norwegian Society of Sciences and Letters (*Det Kongelige Norske Videnskabers Selskab*; DKNVS). The society had a library, a museum, and a journal, and soon placed Trondheim on the map as the foremost Norwegian center of learning.

During his early years in the city, Gunnerus met the botanist Georg Christian Oeder, who was on an expedition to collect specimens for the state-funded Danish flora, *Flora Danica*. Gunnerus developed an interest in botany, became a frequent correspondent and close friend of Linnaeus, and harnessed his network of parish clergymen as a scientific resource. The local clergy were encouraged to study the flora and fauna of their respective parishes and to supply their bishop with information and specimens from all corners of the diocese. His extensive correspondence (preserved at the DKNVS archives) documents Gunnerus' own network of sources in distant parishes, while their local informants tend to fade in the background. Gunnerus published the first volume of *Flora Norvegica* in Trondheim in 1766. A second volume, posthumously edited by his nephew, appeared in Copenhagen in 1776. The book's title, its format, general plan (or lack thereof), as well as the plates, show that it was conceived as a counterpart to Oeder's work, even though *Flora Danica* also included Norwegian plants and *Flora Norvegica* was mostly limited to plants found in the northern diocese of Trondheim (Bjerke 2018a:401ff; Jørgensen et al. 2016). On the other hand, *Flora Norvegica* allowed for more generous descriptions of particularly Norwegian plants, their local names, uses, and distribution. Thus, *Flora Norvegica* provides an insight into Norway's everyday life in the 1760s through the notes describing plant use in all aspects of society, often among farmers or Sámi people (indigenous Finno-Ugric people inhabiting large parts of northern Norway, Sweden, Finland, and the Kola Peninsula in Russia, best-known for their semi-nomadic reindeer herding traditions).

Flora Norvegica is not a handbook and does not directly encourage the implementation of the practices it describes (Jørgensen et al. 2016). However, to reach its full potential, in accordance with general Enlightenment principles, scientific knowledge about the natural world had to be disseminated among the people who could make practical use of it, to their own and the state's benefit (Koerner 1999; Wagner 1994). While *Flora Danica* was published in Latin for an international, scientific readership, parallel Danish and German editions were published for a domestic audience, and copies were deposited in all dioceses for use by scientists and laymen alike. *Flora Norvegica*, on the other hand, was published privately and only in Latin (Jørgensen et al. 2016). Thus, its domestic audience was limited to the classically educated. Its intended readership was the country clergy, who—ideally—would disseminate its knowledge among the "unlearned."

Ove Arbo Høeg and *Planter og Tradisjon*

Ove Arbo Høeg (1898–1993) was born into a well-established family of industrialists, civil servants, and politicians. Both his father and uncle were successful shipowners and members of parliament, while his maternal grandfather and uncle were shipowners and merchants in Larvik. That Høeg would receive an education at the University of Oslo was a given. As a student, he followed courses in botany, geology, and paleontology, a recently established discipline at the university. He combined these in the study of paleobotany, which he himself introduced to Norway. Høeg worked as conservator at the Museum of Paleontology in Oslo and subsequently as head of the botanical collections of the Royal Norwegian Society of Sciences and Letters (DKNVS, established by Gunnerus) in Trondheim, before receiving his doctorate in 1942. In 1947, he became professor of botany at the Institute of Pharmacy, and in 1958 head of the Botanical garden and museum at the University of Oslo.

Høeg had many interconnected interests, among them ethnobotany. Throughout his career, he collected local plant names and uses, and in 1974 his more than 100,000 notes became the foundation for his most widely known work, *Planter og Tradisjon*. As a young man, Høeg had taught at a teacher training college in Trondheim. Its students came from all parts of the country, most had rural backgrounds, and Høeg found them to be valuable informants. The same was the case with his students in Oslo. He corresponded with informants throughout Norway, and conducted interviews when circumstances allowed it. Some 1000 informants contributed to *Planter og Tradisjon*, and 800

of them are named in the work itself. In addition, Høeg made use of ethnobotanical collections compiled by botanists such as Jens Holmboe, Knut Fægri, Rolf Nordhagen, and Johannes Lid (Høeg 1974:1). Although, as Høeg states, there was a Norwegian tradition of documenting plant names and uses going back to the Enlightenment, "I have almost completely ignored the older material in the literature and archives" (Høeg 1974:1). His task, rather, was to document what was still left of the oral traditions surrounding plants. *Planter og Tradisjon* is strictly descriptive: "Information about what people have used the plants for, what has been said and believed about them, has been presented as it was shared with me" (Høeg 1974:3).

WWII and post-war periods in Norway contributed to an increasing interest in ethnology in general, and ethnobotany in particular (Amundsen 1961; Borgen 2007). Rebuilding of a war-torn society and establishing a modern welfare state influenced the study of ethnology, giving it a new sense of urgency. The experience of German occupation fostered interest in preserving national customs. Accelerating and politically encouraged processes of industrialization and urbanization, not to mention the modernization of agriculture, threatened to eradicate what was left of the traditional, agrarian society and the culture associated with it. Facing the loss of traditional ways of life, and with them traditional knowledge, customs, and beliefs, ethnobotany became a question of "saving an important part of Norwegian cultural heritage" (Høeg 1974:v).

Materials and Methods

Data Collection

Our first step in understanding the two works was to systematically collect the ethnobotanical information that they provide. Data from *Flora Norvegica* (Norwegian edition, Jørgensen et al. 2016) and *Planter og Tradisjon* (Høeg 1974) was translated to English and organized in Use Reports (URs). Each UR was one single mention of one usage of one taxon per book. Each UR (one row in the spreadsheet; Kool and Teixidor-Toneu 2020) is accompanied by bibliographic information including page number, recorded and accepted taxonomic identification (genus, species, author), vernacular names (keeping original eighteenth century spelling, as presented in Jørgensen et al. 2016) and language, and comments on where the use information came from, when this was provided. Plant uses were classified according to two hierarchical levels of use, general and specific. General categories included food, animal food, medicine, veterinary, technology (i.e., industry and craft uses), construction, fuel, agricultural/ecological, and social/ritual/symbolic. Classifications were adapted from standard ethnobotanical categories (Cook 1995), except for medicinal categories, which were based on the International Classification of Primary Care (WHO 2003; as recommended by Staub et al. 2015).

Taxonomy

Botanical names were first recorded as in the literature. Then they were checked against The Catalog of Life (Roskov et al. 2019) and updated to accepted names when necessary. Jørgensen et al. (2016) confirmed plant identities of *Flora Norvegica* by revising Gunnerus' herbarium. We recorded their taxonomic suggestions along with the ones provided by Gunnerus, using Jørgensen et al.'s identifications for comparative purposes. Høeg organizes information in *Planter og Tradisjon* per species and provides detail on taxonomy where needed. Høeg did collect numerous herbarium specimens and he sometimes asked his informants to provide dried material when an identity was not clear, but he does not refer to specimens in his work. A certain degree of uncertainty on taxonomic identities can occur in both works, as the authors may have collected knowledge on plant uses and plant specimens separately, bringing these together in hindsight and identifying species based on vernacular names.

Analyses

The number of URs and the diversity of species cited per book and category were compared (see ESM 1) to elucidate if much knowledge has been lost since the eighteenth century, or on the contrary, Gunnerus' aim to improve people's use of natural resources through the *Flora Norvegica* was successfully achieved. Given that the two works differ in their geographical reach (i.e., *Flora Norvegica* mostly contains plants in the former Nidaros diocese, which spans the current Norwegian regions of Møre og Romsdal, Trøndelag, Nordland, Troms, and Finnmark; Fig. 1), we evaluated possible geographical biases in two ways. First, by comparing the books excluding taxa in *Planter og Tradisjon* not cited in *Flora Norvegica* (because they are not native to Norway, do not grow in northern Norway, or

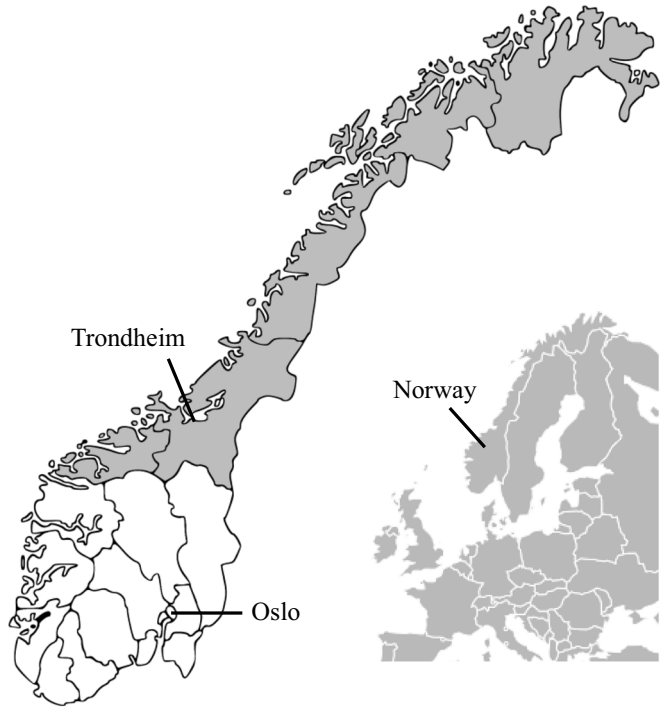

Fig. 1. Map of Norway highlighting the current Norwegian regions that constitute the former Nidaros diocese, and localizing the cities of Oslo and Trondheim (Nidaros). Adapted from Wikimedia Commons.

were not identified by Gunnerus for other reasons; ESM 2). Second, given that uses in *Planter og Tradisjon* are often associated with a location, a subset of all the Use Reports localized in the former Nidaros diocese was also studied (ESM 3).

Results

We documented 2449 Use Reports for 552 taxa including vascular plants, ferns, mosses, lichens, and fungi (hereafter "taxa" or just "plants"). Ten taxa in *Flora Norvegica* and 21 in *Planter og Tradisjon* were only identified at genus level. Of the 1025 taxa listed in *Flora Norvegica,* 358 are mentioned as used in some way (821 URs in total). In *Planter og Tradisjon*, a similar number of used taxa are cited, 377, but a higher diversity of uses is collected (1629 URs). One hundred and eighty-five taxa are cited in both texts, of which 93 were used in at least one same way, and 135 URs were found to be the same in both sources (thus representing 270 URs of the total count; ESM 4). Taxa cited in both texts often, but not always, have at least one vernacular name in common (~70%, Kool and Teixidor-Toneu 2020). Eighty-six plants in *Planter og Tradisjon* are listed in *Flora Norvegica*, but no use is mentioned there. One hundred seventy-six plants mentioned as useful in *Flora Norvegica* are not listed in *Planter og Tradisjon*. About one-quarter of all food and medicinal plants documented are cited in both texts (Table 1). Little overlap is found for the rest of the use categories (below 20%, Table 1).

Table 1 shows that the two books emphasize different kinds of uses. Medicine is the category with the highest number of use reports and taxa. Then, animal and human food are then most documented in *Flora Norvegica,* and technology and social, symbolic, and ritual uses in *Planter og Tradisjon*.

This comparison may underestimate overlap between the two sources in two ways. First, Gunnerus may have omitted some species in the flora that are difficult to distinguish from congenerics. This is likely why *Betula pendula* Roth, a very common tree in the north of Norway, is not listed in *Flora Norvegica* or present in Gunnerus' herbarium (Jørgensen et al. 2016:190).

TABLE 1. NUMBER OF USE REPORTS (URS) AND TAXA PER GENERAL USE CATEGORY IN *FLORA NORVEGICA* AND *PLANTER OG TRADISJON*, AS WELL AS THE NUMBER OF URS AND TAXA DOCUMENTED IN BOTH WORKS. HIGHLIGHTED IN BOLD ARE THE THREE MOST POPULAR CATEGORIES IN EACH BOOK. FOR A DETAILED COUNT PER SPECIFIC CATEGORY OF USE, SEE ESM 1

	<TH>Total		*Flora Norvegica*		*Planter og Tradisjon*		In both books	
<TB>Use category	URs	taxa	URs	taxa	URs	taxa	URs	taxa
Food	365	210	**149**	**121**	216	142	25	51 (24%)
Animal food	299	212	**165**	**137**	134	112	29	37 (17%)
Medicine	793	292	**335**	**177**	**458**	**183**	42	70 (24%)
Veterinary	144	93	31	28	113	76	5	12 (13%)
Technology	396	190	85	71	**312**	**152**	23	33 (16%)
Construction	43	32	11	11	32	24	2	3 (9%)
Fuel	20	19	5	5	15	15	0	1 (5%)
Agricultural & ecological	116	103	8	8	108	98	1	1 (2%)
Social & symbolic	273	176	32	29	**241**	**161**	8	15 (8%)

Euphrasia L. is not identified to species level in *Flora Norvegica*, while *Euphrasia officinalis* L. is listed in *Planter og Tradisjon*. *Rumex acetosa* L., *Avena fatua* L., and *Barbarea vulgaris* (L.) W.T. Aiton are listed, but their descriptions and herbarium specimens indicate that Gunnerus was referring to different species (Jørgensen et al. 2016:126, 287). *Luzula multiflora* (Retz.) Lej. is present in Gunnerus' herbarium, but it is not distinguished from other *Luzula* species (Jørgensen et al. 2016:189). Second, we compared taxa at the level of botanical and not vernacular names and some botanical species may be part of a generic complex (sensu Berlin 1973). However, we did not identify many generic complexes. One of the only instances is *Rumex crispus* L. and *R. longifolius* DC. being referred by the same vernacular name (*heimul* in *Flora Norvegica* and *høymol* in *Planter og Tradisjon*; Kool and Teixidor-Toneu 2020).

GEOGRAPHICALLY CORRECTED COMPARISONS

Geographically corrected comparisons do not result in a strikingly higher overlap between *Flora Norvegica* and *Planter og Tradisjon* (ESM 2, ESM 3). When we exclude *Planter og Tradisjon* plants not listed in *Flora Norvegica*, the percentage of shared taxa and URs increases ~3% for most categories (1–5%), except for social, symbolic, and ritual uses, where similarity does not change (ESM 2, Table 1). The subset excluding uses explicitly outside the former Nidaros diocese does not show higher percentages of overlap than the overall comparison (Table 1), except a 3% increase for medicinal taxa and 1% for veterinary (ESM 3; Table 1). Hence, overall differences observed must stem from reasons other than geographical data collection biases.

FOOD

A similar number of edible taxa were cited by both authors (130 ± 10), with a higher number of taxa and URs in *Planter og Tradisjon* (Table 1). Similar numbers of plants used in alcoholic drinks, cereals, leaf vegetables, and fruits are mentioned, though few species are the same in both sources (see Kool and Teixidor-Toneu 2020). *Planter og Tradisjon* documents a much higher number of non-alcoholic drinks (i.e., teas), sweets, and spices. Gunnerus mentions a number of food uses from abroad, including *Crambe maritima* L. eaten by the English, *Nephroma arcticum* (L.) Torss. and *Rhodiola rosea* L. eaten by Greenlanders, or *Cakile maritima* Scop., made into bread in times of emergency in North America. Twenty-five uses are found to be the same, most referring to leaf vegetables (ESM 4). Fifty-one edible plants (24% of the total food taxa) are mentioned in both texts (Table 1).

ANIMAL FOOD

More uses and taxa are recorded for animal food in *Flora Norvegica* than *Planter og Tradisjon* (137 and 112 taxa, respectively). Entries treating animal fodder constitute about 20% of all the different uses in *Flora Norvegica*, whereas they are only about 7% of those from *Planter og Tradisjon*. While two-thirds of animal food URs in *Planter og Tradisjon* are related to harvested fodder, *Flora Norvegica* lists

many plants that animals graze while pasturing. Fewer animal than human food taxa are shared between the two books, but these are more often used in the same way (Table 1, ESM 4).

Medicine

Medicinal taxa are the most popular category in both books (Table 1). A similar number of taxa (180 ± 3) is reported in both sources, with a higher diversity of uses documented in *Planter og Tradisjon* (458 URs vs 335 URs in *Flora Norvegica*). Thus, Høeg reports a higher multi-functionality for medicinal plants. Of the taxa in *Flora Norvegica*, 104 are not documented in use in the twentieth century and 114 "new" medicines are reported. Differences in the relative importance of types of ailments are observed: higher numbers of nutritional and urological URs are reported from the eighteenth century. Some plants for which Gunnerus cites many uses are not cited by Høeg, or with one or a few uses (e.g., *Rubus* spp., *Paris quadrifolia*, *Symphytum officinale* L., *Ajuga pyramidalis* L., *Fraxinus excelsior* L., *Humulus lupulus* L., and *Rhodiola rosea*), but it is more often the other way around. Seventy medicinal plants are cited in both books and 42 URs are the same. These include many medicinal plants that also appear in classical sources (e.g., *Hypericum perforatum* L., *Achillea millefolium* L., *Silene vulgaris* (Moench) Garcke, *Arnica montana* L.), but also less-known, typically Nordic plants (e.g., the leaves of *Arctostaphylos uva-ursi* [L.] Spreng. to treat urological problems, or the exudates of *Picea abies* [L.] H. Karst as a plaster on wounds; ESM 4).

Veterinary Medicine

A higher number of veterinary uses and plants is documented in *Planter og Tradisjon* (113 URs, 76 taxa) than in *Flora Norvegica* (31, 28). Of these, only 12 species are shared (Table 1) and five URs are the same (ESM 4). Differences may stem, at least in part, from the ailments that plants were used to treat: *Flora Norvegica* is concerned with animal respiratory issues to a much larger extent than *Planter og Tradisjon*. The latter source focuses mostly on digestive issues and leaves many veterinary uses unspecified. Both works emphasize treating cattle, but also mention treatments for sheep, horses, pigs, and other domestic animals.

Technology

Planter og Tradisjon has four times the number of industry and craft URs and more than double the number of taxa than *Flora Norvegica* (Table 1). Of all kinds of technological uses, Gunnerus seems to be concerned only about dyes, for which he describes almost as many URs and taxa as Høeg, and tanning, reporting a higher number of URs and taxa (ESM 1). Yet, only eight of these dye plants are the same and none of the tanning are (ESM 4).

Construction and Fuel

Few plants are mentioned to be used for construction purposes in both works. These include Nordic timber species such as Norwegian spruce (*Picea abies*), aspen (*Populus tremula* L.), and various willow and alder species, as well as plants used in thatched roofs, planted on green roofs, or used as isolation between wooden-wall planks and logs. A trend similar to that for other use categories is observed, with fewer plants and uses documented in *Flora Norvegica* and little overlap between the two works (Table 1). *Planter og Tradisjon* also has a higher number of fuel taxa (15) than *Flora Norvegica* (5; Table 1).

Agriculture and Ecology

The greatest difference in agricultural and ecological uses is due to the fact that *Planter og Tradisjon* collects folklore around the agricultural calendar (e.g., flowering times indicating when the mowing season could begin) and ecological information of interest to agriculture (e.g., weather predictions based on plant characteristics), while *Flora Norvegica* does not (Table 1, ESM 1). A handful of fertilizer taxa are mentioned in both books, though none in both.

Social, Symbolic, and Ritual Taxa

Given that one of the aims of *Planter of Tradisjon* is to document folklore and that this falls completely outside of the aims of *Flora Norvegica*, it is unsurprising that a wealth of social, symbolic or ritual uses are mentioned in the first (241 URs, 161 taxa) and very few in the latter (32 URs, 29 taxa). Of the eight coinciding uses, two correspond to tobacco substitutes (*Cirsium heterophyllum* [L.] Hill and *Potentilla erecta* [L.] Räusch.) and two to

children's games (*Angelica sylvestris* L. and *Phleum pratense* L.; ESM 4).

Discussion

A significant portion of the taxa and uses cited in *Flora Norvegica* are not collected in *Planter og Tradisjon*. And the other way around. Here, we discuss why *Flora Norvegica* did not have the intended influence on Norwegian ethnobotanical knowledge and the differences observed between the two books in general. These differences mostly stem from disparate socio-economic circumstances, audience, and purpose of the books, as well as from the fact that each book reflects a distinct historical conception of nature and nature-human relationships.

Historical books of plant knowledge are, first and foremost, situated and time-bound representations of people's relationships with nature. The period of Enlightenment saw a need to scientifically explain and classify nature and natural phenomena, to which Gunnerus contributed with *Flora Norvegica*. Nature was no longer considered to be imbued with spirits and virtues as it was in the medieval period (apparent for example in the Old Norse word for nature, *náttúra*, semantically referring to biophysical properties, virtues, power, spirits, and supernatural qualities; Sigurðardóttir et al. 1989–2020), but resembled a complex hierarchy of endless organisms who influenced one another and were objectified through science. This view, in combination with economic interests, eventually led to the exploitation of nature. Høeg's strong interest in collecting traditional plant knowledge and in encouraging people to make use of their local flora is, on the one hand, a continuation of Gunnerus' focus on a nature that was created for people to make use of. On the other, Høeg's view of nature was not motivated by economy. Rather, he focused on traditions that everyone could learn and use when discovering their local flora. He was interested in and communicated a wide range of nature values, such as plants' properties, putting special focus on social-ritual uses (Table 1). In this sense, Høeg rediscovers the earlier, medieval view on nature.

Additionally, the two collections of information are socioeconomic and political imprints of their time, correlating with the circumstances in the 18th and 20th centuries. Gunnerus was particularly interested in the utility of plants and plant knowledge to potentially pave the way for improvements in animal husbandry and diet, or the local industries of dyeing or pharmacology. In *Flora Norvegica* he lists not only local knowledge, but also plant uses from abroad (see "Geographical Area" in Kool and Teixidor-Toneu 2020). This was also, to a large extent, a question of theology: God had created the natural world to Man's benefit, and God would not have created anything useless. As steward of creation itself, it was Man's responsibility to investigate the intended uses with which the creator had imbued every one of his creations (Bjerke 2018b; Koerner 1999; McGrath 2001). Furthermore, the clergy were servants of the state, and, as loyal subjects, obliged to further its interests (Cooper 2007; Koerner 1999; Liedman 1986). The flora and fauna within a territory represented a vast repository of potentially valuable resources, which Enlightenment naturalists and theologians felt compelled to uncover for the benefit of king and country (Cooper 2003, 2007; Koerner 1999). The preoccupation with the use and possible agricultural or industrial utility of plants is reflected even in the title of the *Flora Norvegica*, as the work is said to be "enriched with economic observations" ("observationibus … œconomicis … locupleta"). Interestingly, this aspect of the flora has been downplayed by Scandinavian historians of science, who have seen it simply as a means of complying superficially with explicit government policies of utilizing natural resources in order to lessen the strains of "unnecessary" foreign trade (see also Bjerke 2018c:15f; Rausing 2003; Schiebinger 2000). In this view, the concerns of modern scientists are projected backwards onto Enlightenment naturalists in order to create a narrative in which description and systematics form the constant, unchanging backbone of the science, and other, contingent preoccupations are disregarded. The editors of the new Norwegian translation of the *Flora Norvegica*, who belong to this school of thought, do concede that the title of the work emphasizes "economically important species;" however, they add, "this was no doubt mostly for show, as it is difficult to detect such a selection" (Jørgensen et al. 2016:15).

Our results show a useful flora as rich and diverse as that documented in the twentieth century, if even with a lesser number of plant use mentions. In any case, Gunnerus' aim was never to compile a catalog of already "economically important" plants, a registry of known and already utilized resources, but to inventory the state's *potentially* valuable natural assets. As all species were a priori believed to be useful, all species had the potential to become "economically

important" once their true purpose was discovered (Bjerke 2018a; Cooper 2007:43, 45; Koerner 1999). In this respect, all species were equally important, even from an economic point of view. Indeed, Enlightenment naturalists viewed the discipline of *oeconomia* (the study of among other things agriculture, industry, and forestry), simply as applied botany or *botanica applicata* (Bjerke 2018b:382). *Flora Norvegica* was not a handbook for the general population, and not simply a contribution to Norwegian botany as such, but an inventory of natural resources, which could in turn be utilized in industry and agriculture. Like much of Enlightenment natural history, *Flora Norvegica* was conceived of as an instrument of state governance (see Koerner 1999; Müller-Wille 2003; Rausing 2003). *Flora Norvegica* was written in Latin and its audience was a learned class of state-employed clergy who shared a national plan of economic growth and national self-sufficiency (Supphellen 1979–81). In the light of our findings, we assume that *Flora Norvegica's* impact on local practices must have been negligible.

The two authors' motivations behind their collection of information about plants are reflected in the knowledge prioritized (i.e., food versus symbolic uses) and the species included. Gunnerus worked with a motivation of uncovering valuable resources for the king and the country. Within the constraints of state mercantilism, this project offered an alternative to the dangers of international trade. Foreign crops might be grown at home (Linnaeus envisaged the production of silk in Scania and saffron in Lappland), while domestic plants could be put to new economic uses, as substitutes for costly imports which were emptying the state coffers. In the early twentieth century, plant knowledge was not viewed as a source of information regarding resources with potential economic value to be exploited, but rather as endangered cultural heritage that needed protection (Høeg 1974). Consequently, while Gunnerus gathers much knowledge from non-Norwegian written sources including authors like Linnaeus, Paulli, and Gouan (making up to 46% of his medical citations; see Kool and Teixidor-Toneu 2020, for a full list see Jørgensen et al. 2016:26–38), Høeg explicitly doesn't. However, traditional knowledge of the people themselves was a key source of information about the utility and use of domestic natural products for Gunnerus as well, and this made practices related to what we would today term ethnobotany a mainstay of natural history.

Materially, a shift happened between the 18th and 20th centuries from reliance on mostly local plants to meet all human needs to resources being facilitated by non-local produce and new technologies. In the eighteenth century, the Norwegian population consisted of peasants and fishermen; the total urban agglomeration counted 40,000 inhabitants (Statistics Norway 2020). Most of the population did not have access to educated doctors and had to rely on local resources for food, medicine, and crafts. For example, while Gunnerus writes prior to the invention of artificial dyes, readily made, off-the-shelf alternatives slowly displaced plant-based dyes in the twentieth century. Economic growth and urbanization, as well as the implementation of national level health programs, had medicinal plants substituted by formal medicine as the primary means of treatment for at least some ailments. Some of the differences in medicinal use of plants can be explained by changes in people's health conditions between the 18th and 20th centuries. For example, 11 URs in *Flora Norvegica* are dedicated to scurvy (two in *Planter of Tradisjon*) and 15 to gout (none in *Planter of Tradisjon*), both ailments related to poor nutrition (Kool and Teixidor-Toneu 2020). Famine years were common in the eighteenth century. After the industrial revolution in the nineteenth century and the improvement of infrastructure through the development of a railway network, agricultural produce was being sold across the country, and famine years were limited to major sociopolitical events such as war.

Industry expanded rapidly from the mid-nineteenth century and resulted in economic and social restructuring and rapid agricultural change. Changes in the agrarian life in Norway are reflected in Høeg's strikingly smaller collection of plants and use reports regarding animal fodder than Gunnerus' (Table 1, see also ESM 2 and ESM 3). From the late eighteenth century to the twentieth century, revolutionary processes in technology made fodder cultivation more efficient. Manual work decreased and motorized harvesting was preferred. Long before the combustion engine revolutionized agriculture, new practices such as cultivation of new plant varieties, use of new fertilizers and feeding methods contributed to changing old working conditions. More and more food could be cultivated, harvested, and stored indoors (Fægri 1944; Høeg 1974). In the eighteenth century, pastures were still the main source of animal food. Gunnerus lists a high number of plants suitable for pasturing, with many descriptions explaining that sheep, goats, horses, and pigs may or may not eat the same plant. This knowledge is

not gathered by Høeg, supposedly because alternatives to pasture had been in place long enough. However, higher veterinary plants, especially linked to treating digestive diseases, may be linked to this shift.

Economic interests in raising cattle may have been the motivation behind several descriptions of plants with an impact on milk production in *Flora Norvegica*. Gunnerus reports plants that result in bitter milk (*Cicerbita alpina* [L.] Wallr.), decrease milk production (*Sullius bovinus* [L.] Roussel and *Boletus edulis* Bull.), and cause milk to spoil or turn to butter (*Tilia cordata* Mill.). *Allium* spp. (*A. schoenoprasum* L. and *A. oleraceum* L.) are described to add bad smell to the milk and the meat. Høeg has no entries about plants that ruin meat's taste, but he describes how certain plants affect the milk quality positively (*Lathyrus palustris* L., *Melampyrum pretense* L., *Angelica archangelica* L.) and negatively (*Allium ursinum* L.). None of the plants affecting milk quality are included in the two books, and overall, the smaller number of plants cited in *Planter og Tradisjon* may be indicative of a change in financial motives. The economic benefits of using or not using different plants are more apparent in *Flora Norvegica.*

In the 18th century and during the Napoleonic wars the traditional use of domestic plant surrogates had been a main concern of many Norwegian naturalists, not only to alleviate suffering in times of famine, but to protect the economy (Bjerke 2018c, 2009). Interestingly, Høeg's work is also driven by the concern with traditional surrogate foodstuffs in times of war or famine. In 1942, during the German occupation, Høeg contributed to *Nyttevekstboka*, a practical guide to useful plants published with the support of the Department of Agriculture. Perhaps this explains the higher overlap in reports of vegetables between the two books (Table 1). Høeg promoted eating mosses and lichens, particularly *Cetraria islandica* (L.) Ach. (a lichen both books mention as edible, ESM 4), which centuries earlier had already been advocated as a staple in times of crop failure. Gunnerus (Jørgensen et al. 2016:216) notes that it could be boiled with milk to supplement meager diets.

However, Høeg's conservationist motivations were well beyond economic uses of plants. Although often seen as the seminal work of Norwegian ethnobotany, *Planter og Tradisjon* is a work of traditional folkloristics or ethnology. In *Planter og Tradisjon*, Høeg defines "folk botany" as popular, tradition-based knowledge and practices, beliefs, and superstitions about plants and plant names (Høeg 1974). This explains the abundance of plants for which he documents social, symbolic, and ritual value as well as the presence of ecological knowledge (not present to a comparable extent in *Flora Norvegica*; Table 1). Høeg explains that one of the main purposes of collecting this knowledge is to explore how much has survived to the early twentieth century and 1970s and to save as much of the remaining knowledge as possible. Concerned with oral traditions rather than discovering native useful plants, Høeg not only documents native flora, but includes cultivated and traded plants (e.g., *Salvia officinalis* L., *Solanum tuberosum* L., and *Pelargonium graveolens* L'Hér.). In line with much of the current ethnobotanical descriptive work, Høeg does not specify how this, often embodied, knowledge is to be preserved.

According to Morin (2016), sets of information, such as ethnobotanical knowledge, are expected to be transformed, customized, forgotten, reinvented, and selected over time, given changing socio-economic conditions in history. Beyond the authors' different intentions, the differences we observe between the two books are likely a combination of adaptive new inventions and innovations of prior traditional uses. Overlap, on the other hand, could either result from long chains of unchanged cultural transmission or from reinvented traditional uses. When Høeg documents traditional plant uses, these traditions need not come from long-lasting cultural transmission chains to be perceived as such (Boyer 1990; Hobsbawm and Ranger 1992). A great proportion of the knowledge documented in *Planter og Tradisjon* could well have emerged since the 18th century, along with knowledge present then but not documented by Gunnerus.

Interestingly, despite the major differences between the two works discussed above, a number of unchanged plant traditions in Norway are identified between the 18th and 20th centuries (ESM 4). These mostly oral plant traditions survived the passing of generations through the turn of two centuries, proving resilient to changing socio-economic contexts. They likely include most "accessible" knowledge, as many of the common medicinal plant records in our and other sources suggest (ESM 4; Leonti 2011), and the most "attractive" (most relevant to people's livelihoods; Morin 2011). The irreplaceable wood of *Picea abies*, the typical flavors of *Filipendula ulmaria* (L.) Maxim. and *Myrica gale* L., or the rare dyeing qualities of *Galium boreale* L. are such accessible and attractive long-standing traditions. These plants are easily found in Norway and their

contributions to society not easily replaced. For example, not all colors are equal when it comes to natural dye. While yellow dyes are common and cheap, and most colors fade easily, persistent red colors (like that obtained from *Galium boreale*) keep being used while most other dye plants are replaced over time (ESM 1, ESM 4). Another example is the permanence of use of some of the few aromatic Nordic plants to flavor alcoholic drinks (notably *Filipendula ulmaria*, *Myrica gale,* and *Angelica archangelica*; Kool and Teixidor-Toneu 2020). Høeg noted that it is "astonishing how much [plant folk knowledge] has survived well into this century and partly to the present day" (1974:683). What he did not consider is that ethnobotanical knowledge is highly adaptive to changing socio-economic conditions, always reflecting historically-bound conceptions of nature.

Conclusions

Presumably, *Flora Norvegica* had a negligible impact on local plant knowledge in Norway. Different motivations and audiences for which the two books were written result in different kinds of plant use in focus (e.g., a lower number of taxa and use reports for animal food and higher numbers for taxa with social, symbolic, and ritual value in *Planter og Tradisjon*), resulting in some categories of use (e.g., veterinary) likely to be under-documented by both sources. Differences also reflect changes in agricultural practices, technology, and health between the 18th and the 20th centuries. When categories of use are just as well documented in both works, for example in the case of dyes, we cannot be certain that differences are due to loss and innovation of knowledge, or evidence much richer and undocumented Norwegian plant traditions. Yet, over a hundred unchanged traditions are identified. As we show through the comparison of *Flora Norvegica* and *Planter og Tradisjon*, although Enlightenment naturalists strove to make their work accessible for the populace, the scientific description of natural products and their uses at this time remained largely without impact on local practices in Norway.

Acknowledgments

This research has been funded by the Research Council of Norway through their SAMKUL program (Project Number: 283364 "People and Plants—Rediscovering and safeguarding Nordic ethnobotanical heritage"). We would like to thank Magali Courtade for her collaboration collecting data from *Planter og Tradisjon*, the UiO:Life Science Initiative for funding her internship, and the Nordic People and Plants research team for their valuable feedback on an earlier version of the manuscript. Special thanks to Hildur Hauksdóttir Rebecca Blakeney, and Margret Veltman, as well as two anonymous reviewers, for their in-depth comments.

Funding

Open Access funding provided by University of Oslo (incl Oslo University Hospital).

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