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# The Ethnobiology of Wild Foods

Edited by
Andrea Pieroni

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# The Ethnobiology of Wild Foods

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Editor

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*Editorial*

# Wild Foods: A Topic for Food Pre-History and History or a Crucial Component of Future Sustainable and Just Food Systems?

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The ethnobiology of wild foods has garnered increasing attention in food studies in recent years, since traditional foodways in less urbanized and globalized areas of the world are sometimes still based on often neglected or even largely unknown wild plant, animal, fungal, microorganism, and mineral ingredients, as well as their food products and culinary preparations.

In recent decades, wild foods in different parts of the world have been the subject of historical and cultural heritage studies, as well as—increasingly for what specifically concerns wild food plants—evaluation studies in terms of their nutritional and nutraceutical assessment. Within these processes, wild foods are attracting immense attention from food activists and consumers, as well as chefs and gastronomic entrepreneurs, not to mention stakeholders working on food security, food sovereignty-centered policies, and sustainable diets and agro-ecology. This is especially due to the explosion of interest in foraging practices and to the attention paid by the entire gastronomic sector, which is bridging innovation and the (re)invention of wild food "traditions". The current Special Issue, which is aimed at presenting original research on the biocultural aspects of wild foods, as well as their temporal and spatial dynamics, offers a broad spectrum of approaches and inspirational scientific investigations concerning this topic from diverse areas of the globe.

Of the five European case studies presented in this Special Issue, one investigates the Catalonian portion of the Mediterranean region, while four contributions focus on the Eastern fringe of the continent, and in particular, the Western border of the former Soviet Union. Gras et al. [1] provide an impressive and comprehensive review of Catalan wild plant food ingredients and identify 291 plants representing the "foraging" plant heritage, which the authors still consider largely underestimated and underutilized. The contribution also proposes that some of these "forgotten foods" could be newly introduced into the market, first, but not only, at a local level, which could be interesting for new crop development in the framework of further valorization of territorial identity.

On the Eastern European periphery, Kalle et al. [2] focus on the historical and contemporary trajectory of wild food plant gathering and processing among the Seto minority group in SE Estonia and analyze the possible effects of the state border established between Estonia and Russia in the early 1990s. The authors find that while the exchange of food knowledge and skills, as well as commercial activities around wild food plants, have been fading in recent decades, the popularity of a healthy lifestyle, however, seems to have introduced new wild food plant preparations.

Belichenko et al. [3] further analyze the wild plant ingredients used on the two sides of the Estonian–Russian border, and while finding substantial homogeneity for the most commonly used plants, the investigated communities appear ethnobotanically closer to the dominant ethnic groups immediately surrounding them than to those across the border.

Kolosova et al. [4] investigate wild food plant gathering in Karelia, NW Russia and observe that while throughout the lifetime of the interviewees the list of used wild items did not change considerably, the ways in which they are processed and stored underwent several stages as a function of centrally available goods, people's welfare, technical progress, and ideas about the harm and benefit of various products and technological processes.

Stryamets et al.'s work focuses instead on the southern portion of the former western Soviet Union and investigates the contemporary use of wild food plants among Romanians divided for several decades by the border between Ukraine (formerly the Soviet Union) and Romania; the authors observe how wild food plant-centered jams, *sarma*, and homemade alcoholic beverages predominate among Romanians living in Romania, while tea, soups, and birch sap-based beverages are more common among Romanians living on the northern, Slavic side of the border [5]. The authors suggest that cross-ethnic marriages promoted by different state authorities during the past decades, as well as markets and women's networks, i.e., "neighbors do so", may have had a great impact on changes in wild food uses.

In Asia, the four case studies presented in this Special Issue touch on the south and SE portions of the continent. Aziz et al. [6] compare the use of wild plant ingredients among different linguistic and religious groups in a remote mountain area of Gilgit Baltistan in northern Pakistan. The authors observe that a rich food heritage in the use of wild plant ingredients still survives, but at the same time, this seems to be threatened by changes in lifestyle and globalization processes. Moreover, the documented wild food plant heritage is largely shared by the very diverse considered communities; the authors suggest that this may possibly be attributed to the cultural pluralism of the study area, fostered by the Ismaili branch of Islam, which may have enhanced cultural exchanges for centuries. Furthermore, the authors postulate that the recorded biocultural wild food heritage could represent a crucial driver, if properly revitalized, for assuring the food security of the local communities and also for further developing ecotourism and the associated sustainable gastronomic initiatives.

Majeed et al. [7] conducted extensive fieldwork on the eastern side of northern Pakistan in the Jhelum District of Punjab and compared the wild plants foraged by six religious groups; they found a high homogeneity of use among the two Muslim (Shia and Sunni) clusters, while the other four religious groups showed less extensive, yet diverse uses. Moreover, the field study reveals a remarkable erosion of the wild plant knowledge among the non-Muslim groups, which are more engaged in urban occupations and have possibly undergone stronger cultural adaption to a modern lifestyle.

Jugli et al. [8] address the cultural value and ritual uses of wild food animals among the Tangsa and Wancho communities of Eastern Arunachal Pradesh (India). Very diverse uses of animals and their parts are used during rituals and festivals and their significance in decorations and adornments, in supernatural beliefs, and in connection with tribal folklore (stories) reveal the reasons some species are hunted and consumed while others, for no apparent reason, are killed or simply ignored. Furthermore, the authors suggest the crucial roles that the government as well as tribal leaders and the communities may play in managing animal biodiversity and in slowing the erosion and gradual disappearance of traditional knowledge.

In the southern portion of the Asian continent, Pawera et al. [9] document the diversity of wild plant ingredients and perceptions, attitudes, and drivers of change in their consumption among Minangkabau and Mandailing women farmers in West Sumatra, Indonesia. Respondents attributed the erosion of traditional skills in recognizing and processing wild plant foods to the decreased availability of wild plants and changes in their lifestyle (time constraints, and a limited knowledge of the nutritional value of wild plants); while the key motivations for their use were that they are perceived as "unpolluted natural foods". The authors reflect that, despite socio–economic factors and changes in agriculture and markets, the persistence of a strong cultural link to wild plant foods appears to slow potential unhealthy dietary changes and as a result, communities, governments, and NGOs should work together to optimize their use in a sustainable way.

Finally, Shai et al. [10] conducted an ethnobotanical survey on the wild fruits gathered and consumed in three villages of Mpumalanga Province, South Africa, and analyzed how these locally sourced ingredients still play a significant role in the daily lives of the Mapulana people. The authors suggested that the identified fruit species have the potential to be an important alternative food source to help meet the dietary requirements and health needs of communities, especially those in remote rural areas.

To summarize, the main findings of this Special Issue focus on the following four core concepts:

- Traditional knowledge and practices linked to wild foods are rapidly changing and are nowadays severely endangered by globalization processes, even in the most remote areas of the globe;
- Wild foods represent a complex and fascinating part of local bio–cultural and food heritage, with projections in terms of identity, values, and ecological and cultural meanings which go well beyond the food domain;
- A remarkable resurgence of interest in the procurement, processing, and consumption of wild foods is to be observed in some contexts, mainly promoted by the interest communities have in "natural", local, and healthy foods;
- A substantial need for more systematic strategies of the bio–nutritional–pharmacological evaluation of these ingredients, as well as of their socio–economic valorization processes, is addressed by the scientific community.

Even though ethnography-centered field studies aimed at documenting wild foods in many remote areas of the world are still essential, the authors in this Special Issue suggest that there is an emerging need to (further) explore the ethnobiology of wild foods along the following trajectories:

- Cross-cultural comparisons focusing on different ethnic/linguistic/religious groups, in order to foster both ecological and social sustainability, so as to valorize those portions of the biocultural food heritage that are environmentally practicable in a time of global warming, as well as those specifically held by marginalized groups; and to frame all this within rural development policies devoted to shaping germane perspectives for threatened peripheral communities and environments;
- Temporal comparisons employing both ethnographic and historical analysis, with particular attention paid to the issue of the mobility of goods and people (e.g., "newcomers" and migrant communities), in order to provide more inspiring instruments for realizing peaceful social co-existence;
- Social media and its role in new "alphabetization processes" in foraging, hunting, and fishing, i.e., the contemporary foraging-euphoria and new sustainable gastronomies;
- Sensory and cognitive analysis on cultural perceptions and preferences of wild foods, in order to see how "old" and new consumer behaviors can contribute to the valorization of wild foods;
- Studies on the socio–economic valorization processes of wild foods, i.e., investigating the ambiguous nature of their commodification that can sometimes lead, in different contexts, to over-harvesting and may in some cases even threaten the continuation of their use.

Subsequent years and decades will certainly tell us more about the future of wild foods in scientific research and in societies as well, and how these old historical food trajectories will continue to leave their irreplaceable and also fascinating traces in our dishes, food environments, cultures, and aesthetics.

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# The Power of Wild Plants in Feeding Humanity: A Meta-Analytic Ethnobotanical Approach in the Catalan Linguistic Area

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**Abstract:** Wild food plants (WFP) have always been present in our kitchen, although they have not always been given the same importance as crops. In the Catalan linguistic area (CLA), covered in this paper, WFP were of great importance as a subsistence food not only during the years of the Spanish civil war (1936–1939) and World War II (1939–1945), but also long before these periods and in the years thereafter. The CLA has been well studied at the level of traditional knowledge on plant biodiversity, and much of this information is collected in a database by the EtnoBioFiC research group. The aim of this work is to carry out a meta-analysis of the WFP dataset of the CLA (only regarding edible uses, drinks excluded) and to identify the most quoted plants, and the information associated with them. With data from 1659 informants, we recorded 10,078 use reports of 291 taxa (278 of which at specific or subspecific levels and 13 only determined at generic level) belonging to 67 families. The most reported taxa, also with highest cultural importance indexes, are *Thymus vulgaris*, *Foeniculum vulgare* subsp. *piperitum*, *Laurus nobilis*, *Rubus ulmifolius* and *Mentha spicata*. The ethnobotanicity index for food plants is 6.62% and the informant consensus factor, also for food uses, is a very high 0.97, supporting the robustness of the information. The results provided and discussed in this work concern a significant part of the edible resources in the territory considered, which is, often and mainly, underestimated and underutilised. Its consideration could be an opportunity to promote closer and more sustainable agriculture. From the state-of-the-art of this question, it is possible to propose old, in some cases forgotten foods that could be newly introduced onto the market, first, but not only, at a local level, which could be interesting for new crop development in the frame of a valorisation of territorial identity.

**Keywords:** Catalan countries; Catalan linguistic area; edible plants; ethnobotany; traditional knowledge; wild food plants

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## 1. Introduction

Wild food plants (WFP) have always been present in the human diet, although in general, and particularly in industrialised areas, they have not always been given the same importance as crops. If Kunkel [1] recorded ca. 13,000 species used in human food (a representative figure, even if it has been increased in the most recent literature), human nourishment depends on slightly less than 100 plant species, around 30 producing the vast majority of what we consume, and only three (*Oryza sativa* L., *Triticum aestivum* L. and *Zea mays* L.) contributing more than half the diet calories [2].

Nevertheless, as a reflection on the long tradition concerning the management of many plants, a non-negligible amount of them is still used, and may have an important significance at a local level. In the Catalan linguistic area (CLA, i.e., the Catalan-speaking regions) studied in this paper the knowledge on WFP has had great importance during the Spanish civil war, World War II, and the years after these wars, as a subsistence or famine food, as also in other places [3], then their use decreased. Similarly, preserved popular knowledge about food plants was useful for subsistence during the siege of Sarajevo and elsewhere in Bosnia and Herzegovina during the war, between 1992 and 1995 [4,5]. Indeed, when the Soviet Union broke up, and Cuba experienced economic difficulties, losing Soviet contributions, traditional agricultural practices regained prominence [6] and ethnobotanical knowledge regarding cultivated and wild plants served to organise food plant supply and significantly alleviated the effect of the crisis [7]. In any case, WFP were also known, appreciated and used before these periods, and the traditional knowledge, which was cumulated not only in emergency episodes, persisted, thus allowing the current use of some taxa even further than at local level [8,9]. In industrialised areas, a couple of generations ago WFP were associated with difficult periods, and acculturation processes have occurred but this has not prevented the continued use of various WFP (e.g., in different places [10–19]).

In another very different framework, the persistence of traditional knowledge on WFP has been, and is, relevant in the development of high cuisine ([16], and references therein). As a representative example, French (and the World's) *nouvelle cuisine* would not have been the same (or would not have been) if the Troisgros brothers, Jean and Pierre, had not seen their mother with a handful of *Rumex acetosa* L., and had not been told by her about its use when they were developing an innovative cooking method for salmon [20]. In this respect, in a book titled "*Les recettes de mes grands-mères*" [My grandmothers' recipes], the Michelin-starred chef Hélène Darroze [21] states "there is an age and an epoch in which we slightly neglect what we received from ours" (cultural erosion, see next paragraph), but "today [ ... ] I fall again in the emotion and the recognition of what I learned from mine" (value of traditional knowledge, including that of WFP). The heritage of ethnobotanical knowledge about food plants, and particularly that of wild plants, semi-domesticated taxa or minor, underutilised or neglected crops is of great relevance in food security and sovereignty, comprising both the right of any person to a sufficient and healthy nutrition and the right of peoples to culturally adequate food [22–25]. Indeed, food and raw materials have been considered important for food security in different areas of the world, and WFP are important within these raw materials [26]. Ethnoculinary approaches, influencing researchers from different fields in tracing connections between populations often living in different geographic regions, also importantly deal with WFP [27]. WFP are also taken into account in the ever more relevant concept of ecosystem services, as a survival value of cultural ecosystem services, basic for livelihood [28]. In addition, WFP are important as ancestors or relatives of cultivated, including major crop, plants [29], and as a reservoir of genes not present in domesticated taxa or races that could be useful for new crop developments [30]. Irrespective of their relevance, WFP have been the object of cultural erosion [31] and face conservation problems [32], this making their study and possible protection plans (comprising both plants and associated traditional knowledge) highly desirable.

Food composition parameters, basic for the human consumption of any product, are increasingly available for wild edible plants (e.g., [33–37]), suggesting that they could be incorporated into the habitual diet, in some cases even with nutraceutical values [38], in agreement with popular attribution of medicinal properties to many WFP recorded in ethnobotanical prospection ([39] and references therein).The conjunction of traditional knowledge, phytochemical and pharmacological data and cultivation essays resulted in *Reichardia picroides* (L.) Roth, a typical Mediterranean WFP, being proposed as a new health food crop [40], opening a seducing and promising axis in the search for food products.

Ethnobotany of WFP has been intensively addressed in all continents with a permanent population since the classical times of modern ethnobotanical research (e.g., among numerous papers [10–12,14,15,17,19,41,42]). The CLA is among the best-studied areas in Europe at the level of traditional knowledge on plant biodiversity ([43] and references therein), and much of this information is collected in a database of our research group. This database currently contains information of 3039 informants and 1778 plant taxa. This represents a total of 118,537 use reports (UR), of which 69,170 (58.35%) correspond to medicinal uses, 31,415 (26.50%) to food (including beverages) uses, and 17,952 (15.15%) to other uses. Several ethnofloristic or review papers focused on food plants have been published from this cultural area [13,44–46] as well as more general papers containing information on WFP [18,47,48] or dealing with reasons for the use of WFP [9], but to date no attempts to carry out a global or at least major analysis has been performed. Indeed, meta-analytical work on WFP in large areas is, as far as we can see, lacking elsewhere.

In accordance with the reasons stated in the last paragraph, the aim of this paper is to present a meta-analysis of a significant part of the WFP dataset of the Catalan-speaking territories, inventorying the plants and the information associated with them, and identifying the most relevant ones. With this work we intend (a) to build a catalogue of Catalan-culture WFP, as in other ethnic groups often underestimated and underutilised, (b) to analyse data recorded from different points of view in order to pave the way for a meta-analysis on this subject that could help to envisage a further comparative study at higher levels (European, Mediterranean), (c) to identify, according to the ethnobotanical information, the WFP that could have the added value of being considered as nutraceuticals, and (d) to indicate, suggest or propose old, in some cases forgotten traditional foods that could be newly introduced onto the market, first -but not only- locally, or that could be of interest for new agronomic and commercial possibilities.

## 2. Methodology

### *2.1. Study Area*

The CLA, often also called Catalan-speaking or Catalan-language territories or Catalan Countries, constitute a unit that has been considered and well studied from geographic [49], physiographic [50], floristic [51,52], vegetation [53], linguistic and cultural [54], and ethnoculinary and gastronomic [55,56] points of view. It occupies the eastern part of the Iberian Peninsula, including a northern Pyrenean portion, the Balearic Islands and the city of l'Alguer on the island of Sardinia (Figure 1). Politically, it is currently made up of four states, Andorra (all the territory), France (Northern Catalonia or Eastern Pyrenees department), Italy (l'Alguer), and Spain (Balearic Islands, Carxe -a small area in Murcia-, Catalonia, a portion of eastern Aragon, and Valencia). Its extension is ca. 70,000 km$^2$ [52] and it is inhabited by around 14,000,000 people [57].

From the Mediterranean Sea level to 3143 m a.s.l. in Pica d'Estats (Pyrenees), the landscape of the area considered is structured in several parts with distinct floristic and vegetation traits [52,53]. The main part, at the lowest altitudes, belongs to the Mediterranean region, with *Quercus ilex* L. and derived communities, complemented with *Quercus coccifera* L. and *Thymus vulgaris* L. communities in warm and dry places. Low and median mountain parts are dominated by deciduous *Quercus* and *Fagus sylvatica* L. communities, with *Pinus sylvestris* L. High mountain areas in the southern, more arid zones present landscapes with *Pinus sylvestris* and *Juniperus sabina* L. In the Pyrenees, the dominant trees of the high mountain areas are *Abies alba* Mill. and *Pinus mugo* Turra subsp. *uncinata* (Ramond ex DC.) Domin, with alpine meadows and a small snow level being found at the highest altitudes. The approximate number of plant taxa (including species and subspecies) in these territories is 4300 autochthonous plus 1200 allochthonous [58].

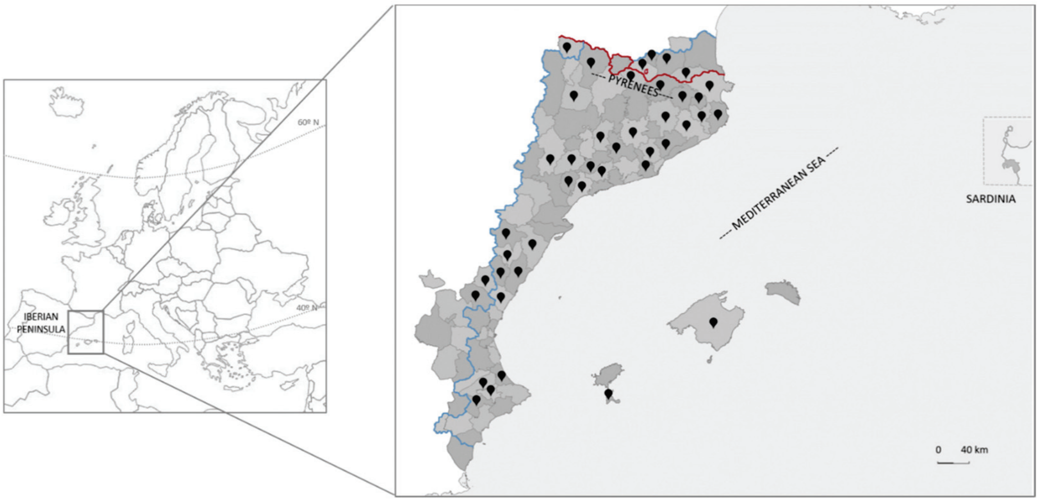


**Figure 1.** Territories studied (black drops) in the Catalan linguistic area and its location in Europe. The blue line defines the current zones where Catalan language is spoken and the red line the borders between states. The small subdivisions in the continental part correspond to administrative districts (called '*comarca*', pl. '*comarques*', in Catalan).

Even though it includes several big or very big cities (in decreasing order of inhabitants: Barcelona, Valencia, Palma, Perpignan), and not ignoring the importance of industry and tourism to its economy, the area studied still has a relevant rural component, and agriculture and natural spaces (including reserves, parks and other protected zones) are important. Catalan is the common language to the whole area, with two main dialects (eastern-including, among others, Balearic subdialects- and western -including, among others, Valencian subdialects-) [59] and it has official, co-official or a protected status in the different places. Phytonymy in Catalan language is quite rich, with ca. 35,000 Catalan plant names recorded for around 6000 taxa [60], indicating a rather intense contact between humans and plants in the area. Apart from this, French, Italian, Occitan, Sardinian and Spanish languages are also spoken and have different degrees of official status in one or another of the zones. The area considered includes the places where Catalan language is spoken, was spoken in the past (such as Oriola/Orihuela, where it was spoken at least until 17th century and has left an interesting substrate) or was not spoken but, by geopolitical reasons, it has had some influence (as current Catalan-speaking areas receive influences from neighbouring languages), in some cases reflected on folk plant names, such as in a few Spanish-speaking districts in Valencian community and a few Occitan-speaking areas in Spanish and French CLA. In addition, it is remarkable that, in the biggest city of this area, Barcelona, alone, more than 300 languages are spoken, due to migration flows [61]. In some cases, this is associated with the use of specific food plants (usually cultivated or even freshly imported ones) by some linguistic and cultural groups (e.g., in a city bordering Barcelona, [62,63]).

### *2.2. Databasing and Data Selection*

Traditional knowledge on plant biodiversity has been collected by ethnobotanical prospection in the studied area in modern times from the pioneering work of Pius Font i Quer [64] and more recently, and in a continued manner to date, from the first academic works of Mulet [65] and Muntané [66]; see a review in Vallès [42]. The information has been collected through semi-structured ethnobotanical interviews (see details in [18] and references therein) and included in a database by our research group (www.etnobiofic.cat). The meta-analytic work performed in the present paper covers 31 research studies belonging to different regions throughout the CLA (Figure 1, Supplementary Material S1). They constitute a representative set from both a geographic and a dialectal point of view: Catalan language is divided in two main dialects, western and eastern [59]. As first-level subdialects, within western we find north-western and Valencian, both represented, and within Eastern, apart from Algherese -the only one not represented, among other aspects because the current pandemic made impossible a first prospection that was foreseen-, we find northern, central and Balearic, all included in the study. Indeed, within Valencian, Central and Balearic, some second-level subdialects are also represented.

The information concerning WFP has been recovered from the mentioned database. A minor bias exists, because in one out of the 31 studies included in the dataset [65] each taxon is assigned to a municipality instead of to an informant, as is the case in all the other works. This can result in a slight underestimation of use reports and also of the indexes that include them. As WFP, we consider in this work wild vascular plants used for food purposes. Only edible uses have been taken into account, and a work is in progress on beverage uses (Gras et al., in prep.). Neither fungi and non-vascular plants, including algae, nor cultivated plants are considered. In both cases, interesting results for further papers exist; in the last one particularly with attention to local, neglected or underutilised minor crops. Under the term ‘wild’ we include strictly wild autochthonous taxa as well as some introduced or naturalised taxa recorded in the manual flora of the Catalan Countries [52].

For taxa nomenclature we follow Bolòs et al. [52], a flora specifically covering the area considered, and for family attribution we follow APG IV, the last Angiosperm Phylogeny Group’s arrangement to date [67].

### 2.3. Data Analyses

We calculated the ethnobotanicity index (EI; [68]), the quotient between the number of plants used (here taking into account WFP) and the total number of plants that constitute the flora of the territory (authochthonous plants, see an estimation above), expressed as a percentage, in order to have a general idea of the relevance of WFP in the area considered. We also calculated the informant consensus factor ($F_{IC}$; [69]), the ratio of the number of UR minus the number of used taxa to the number of UR minus one, in order to assess the consistency or robustness of the traditional knowledge of WFP in the territory. The cultural importance index (CI; [70]), the sum of the proportion of informants that mention each species use, has also been calculated to identify the plants most valued by the informants.The descriptive statistics were carried out with Excel (Office 2008, Microsoft Ibérica, Pozuelo de Alarcón, Spain). The relationship between the preparation form and the most quoted plants was visualized by an alluvial diagram using RAWGraphs [71].

### 2.4. Complementary Interviews

In addition to the analysis of the results compiled in the database as mentioned, we performed brief, directed ethnobotanical interviews performed in September 2020 on nine people in several areas covered by this study to obtain only qualitative information on aspects related to the appreciation of some particular plants or on WFP going beyond the local use, even including current use in restaurants (see Subsector 3.6 in the Results and Discussion section). The informants were selected following our experience in this field, just to have complementary information. On the one hand, two interviewees were, respectively, the brother and the son of an informant -already deceased- present in the database analysed. On the other hand, seven interviewees were more or less connoisseurs of current wild plant appreciation, commerce or use in markets or restaurants. The information provided by these people and used here is explicitly indicated in Section 3.8 (in one case in Section 3.2) and all of them are summarised in Supplementary Material S2. We followed the ethical principles of the International Society of Ethnobiology [72], the interviewees gave their oral informed consent prior to the conversations, and the interviews were developed in the Catalan language, common to interviewers and interviewees.

## 3. Results and Discussion

The pool of WFP traditionally used for food—excluding beverages—in the Catalan linguistic area is constituted by 291 taxa, 278 at specific and subspecific level and 13 determined only at generic level, belonging to 193 genera and to 67 families, according to the information gathered in ethnobotanical prospection from 1659 informants (53.65% men, 46.35% women). The total number of UR is 10,078. Data on scientific names, part of plant used and preparation are presented in Supplementary Materials S3 and S4.

The number of WFP recorded can be considered high, when it is compared with those reported from other zones, which in most cases comprise drinks apart from foods, which are the only products considered in this paper: Spain (419; [73]), several areas of Greece, Italy and Spain (318 in total, 147, 84 and 173 in each country; [74]), North West Iberian Peninsula (97; [75]), Northern American native peoples (103; [41]), in Karelia (70; [19]), several Turkish areas (27—in a small island—, 61, 86, 154; [76–79] or West Sumatra (106; [80]). We quoted here works dealing with socioeconomically and geographically different areas, including the one our studied zone belongs to. We are aware that the number of plants used may depend on the number of plants of the local flora and on the sampling effort in each case; this is why we considered works from quite different places, to show variability and give at least an approximate idea. In a review of 64 Mediterranean and neighbouring areas, the biogeographical region, which our studied area belongs to, Rivera et al. [81] recorded between 14 and 565 (mean 133.11) wild food taxa, including fungi and considering drinks, again raising the number of taxa recorded in this paper to a high level.

### 3.1. Quantitative Ethnobotany

The ethnobotanicity index (EI), considering the taxa at the specific and subspecific level, and considering for the total number of taxa present in the flora the above-mentioned estimation of 4200 [58], is 6.62%. This is the percentage of the total autochthonous flora in the territory studied with traditional food (drink excluded) use. It is slightly lower than the 8.90% reported for one of the areas here analysed [13], which is logical because in the latter case the flora is much more restricted and, in addition, beverages are taken into account. In Spain, Tardío et al. [73] report 419 WFP restricted to edible use, as in the present paper, and Tardío and Pardo-de-Santayana [82], 464 WFP, including those used in beverages. Using the number of species and subspecies of Iberian, Balearic and Canarian flora (8882) provided by Pando et al. [83] minus 136 taxa endemic to continental Portugal [84], the EI for WFP in Spain as a whole is 4.79% (edible plants) or 5.31% (all food plants, including drinks), lower than the one calculated for the Catalan linguistic area for edible uses only.

Out of the 278 specific and infraspecific taxa recorded, 157 (56.47%) fit the reliability requisites indicated by Le Grand and Wondergem [85] and Johns et al. [86] of having three or more reports from independent informants. The number and proportion of taxa that would be the most indicated for further food development processes is high, encompassing clearly more than half the WFP recorded. Of course, plants with less than three user reports should not be neglected, since their low reports could be either the remnants of an earlier wider knowledge or the product of local cultural specificities and preferences, even in a globalised world. This is why all recorded WFP are presented in Supplementary Materials S3 and S4.

The informant consensus factor ($F_{IC}$), calculated for the 278 taxa determined at specific and subspecific levels, has a value of 0.97, in a scale where the maximum is 1.00. It is slightly higher than the 0.92 reported for one of the areas here analysed [16], and it is placed among the highest in different territories where this index has been calculated (Ref [47], and references therein). This fact strongly reinforces the above-mentioned reliability requisites assessed in terms of a minimum number of UR. This index was created as "a new approach for identifying potentially effective medicinal plants", and it can also be used for the same purpose regarding food or other kinds of useful plants. A solid consensus (and not a dispersion of uses with very scarce reports) among informants in the use of a pool of WFP for a purpose (in the present case, food) indicates a trial and error process, and the subsequent agreement of people as concerning some plants with a kind of use rather than random individual uses. This accounts for the robustness and reliability of the useful plants claimed, this being an important factor to identify plants that could be used as food in the future beyond the local level.

Apart from the two evidences of plant-use reliability (three or more independent quotations and $F_{IC}$), there is another indication of the appreciation that the informants have for the plants they use: the cultural importance (CI) index. Its values are highest in the first plants of the UR ranking (see more comments in Section 3.2), the maximum being 0.52 for *Thymus vulgaris*. This index, combined with the two commented earlier, could be of good value when selecting WFP that would be positively received in local markets.

### *3.2. Most Used Taxa at Family, Genus and Species Levels: Facts and Reasons*

The five most quoted ones are Lamiaceae (29 taxa, 28.46% of UR), Asteraceae (54, 15.72%), Rosaceae (21, 10.67%), Apiaceae (15, 7.19%) and Lauraceae (one, 4.71%), the first three encompassing more than half of the total UR (Figure 2). All but the last one are large or very large families, in terms of number of taxa, have a wide distribution, are among the most common in the Mediterranean region [52], and appear as leading families in most ethnobotanical prospections in this area, either regarding food or medicinal uses ([48,75] and references therein). In addition, all but the last one are among the five first families in the present work in number of taxa used. The outstanding presence of Lamiaceae in the first place, with more than one quarter of the total UR, is explained by the richness of this family in essential oils, which makes it particularly suitable as spice or condiment. In its turn, the Lauraceae are not a very big family and have only one autochthonous species in the territories studied (*Laurus nobilis* L.), but its importance as a condiment makes it highly valued by the informants and present in almost all houses.

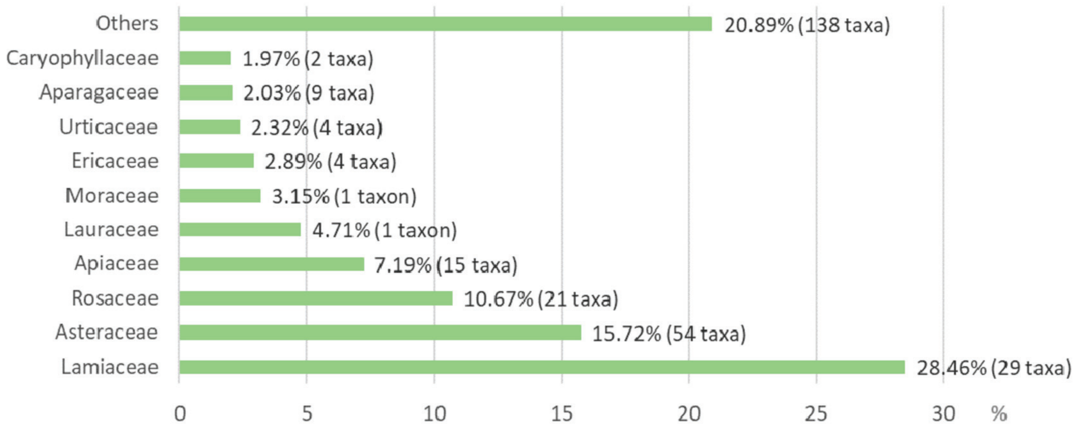


**Figure 2.** Most reported families, with number of taxa per family, of wild food plants in the area studied.

The families numerous in taxa and widely distributed, as those here mentioned, are good candidates for leading the ranking of more traditionally known, and used not only for these rather evident reasons, but also for taxonomically-directed processes inducing people to choose useful plants. Saslis-Lagoudakis et al. [87] found close phylogenetic relationships between taxa used for the same medicinal purposes in three distant ethnofloras. Concepts such as ethnobotanical convergence [88–90] or utilitarian equivalence [91] insist, with different nuances, on the relationship between taxonomical affinities and plant use. Most of the examples from the works dealing with this subject refer to traditional medicinal uses, but the idea perfectly applies to food plants, and this idea can even be extended to the genus level. Indeed, Garnatje et al. [89] mention the case of two *Origanum* (Lamiaceae) species used as the condiment of the same kind of food preparation in the Western and Eastern parts of the Mediterranean region, and of food consumption of *Cucurbita pepo* (Cucurbitaceae) flowers in Mesoamerica and South-West Europe. Thus, the territories studied in the present paper, less distant that in the examples quoted, and sharing language and culture, but with important different ecological conditions along the area, make good candidates for processes of taxonomically-oriented plant selection. Chemical composition, close in phylogenetically-related taxa, is claimed as responsible for this phenomenon in medicinal uses ([91] and references therein), and the same can be stated for food utilisation, even more so taking into account the fact that many food plants also have medicinal uses, as we will comment later. Related with chemical composition and also sensitive to phylogenetic closeness, sensorial profiles are relevant for the acceptance of edible plants by people [92,93].

Out of the 193 genera, the first 10 represent not far from 50% of the UR. Nine out of those 10 genera belong to the five most reported above-quoted families. The first one is *Thymus*, with a few species, the most relevant among which, *T. vulgaris*, will be commented on later. *Laurus* appears in the fifth position, with 4.71% of the UR. The only top ten taxon not belonging to the most quoted families is *Ficus carica* L. (Moraceae), the fruits of which are much appreciated and eaten either fresh, dried or in jam.

As for the species, the most frequently used one is *Thymus vulgaris*, not far from 10% of the total food plant UR (Table 1). The statement of one informant "*n'hi ha a totes les cases*" ('it is present in every house') [94,95] is a clear description of the situation, well complemented with the following assertion: "*jo esmorzo cada dia d'un plat de sopa de pa i frigola*" ('I have for breakfast every day a dish of bread and thyme soup') [96].The predominancy of *Thymus vulgaris* is very common in Mediterranean ethnobotanical research ([18,48] and references therein). The top five plants account for more than one quarter of the total UR and the 30 first ones, near three quarters of them (respectively 27.85% and 73.57%, Table 1). The five first plants in the ranking, the only ones with more than 4% of the total UR, belong to the top five genera and to four out of the top five families, thus reinforcing their relevance in the territory considered. The first-classed taxa exhibit the highest CI index values (Table 1), which adds a cultural reason to the frequency of citation. To exemplify this, we need only to refer to an ethnobotanical survey in a geographically not very distant area, located in northern Iberian Peninsula, but belonging to another cultural group [70], the plant ranking is quite different and, particularly, the only coincidence in both areas within the top 20 taxa (*Origanum vulgare* L.) has there a CI index of 0.42 whereas in our study it has a value of 0.20.

Of the 30 taxa first classed in the ranking, there are many with current uses, despite an apparent acculturation, or traditional knowledge erosion, which takes place in industrialised zones. Even if in more of the studies occupying the present meta-analysis there are not quantitative appreciations of persistency of uses, our experience in ethnobotanical prospection allows us to comment on a few situations with the plants that occupy the first positions in the list. First, *Thymus vulgaris*, *Foeniculum vulgare* Mill. subsp. *piperitum* (Ucria) Cout., *Laurus nobilis*, *Rubus ulmifolius* Schott and *Mentha spicata* L., the top five taxa, are nowadays frequently used in many homes throughout the territory. Conversely, there is a pool of plants that are very well known and remembered by people but that have fallen into absolute disuse or that are very rarely used. This is the case of a set of plants that used to be employed as salads and which, since the ease of availability of lettuce and related plants in the markets, are now seldom used. Some plants of the lettuce family (in decreasing order of UR, *Reichardia picroides*, *Chondrilla juncea* L., *Taraxacum officinale* Weber in Wiggers and *Cichorium intybus* L.), and some other taxa (*Papaver rhoeas* L. and *Portulaca oleracea* L.) are in this situation. The description recorded for this change in use is clear: "*ara no cal anar a buscar aquestes misèries*" ('now there is no need to look for these lowly plants') [97], but see later some nuances in Section 3.6. Finally, there are, in the first 20 positions, some other plants that continue to be in rather frequent use, in a similar way to those commented on in the top five taxa, e.g., *Asparagus acutifolius* L., *Origanum vulgare*, *Rosmarinus officinalis* L. and *Satureja montana* L. It is worth mentioning that in one case, *Origanum vulgare*, the modern, recent use complements -and probably surpasses- the traditional one, as perfectly reasoned in this statement, "*s'usa per a preparar patates a la cassola, guisats, guisats de pollastre, conill i en el cuinat de caragols, però també com a aromatitzant de la pizza*" ('it is used to prepare potatoes in the casserole, stews, chicken stews, rabbit, and in cooking snails, but also as a flavouring for pizza') [98], which mentions first what is probably the most common use.

**Table 1.** The top 30 taxa and their preparation forms.

| Taxon, Family and Herbarium Voucher | Catalan Names | Used Part | Preparation Form | Total UR | CI | PFAF Validation | FFF Validation |
|---|---|---|---|---|---|---|---|
| *Thymus vulgaris* L. (Lamiaceae) BCN 96,764 | Farigola, tem, timó, timó femella, timó mascle, timonet, timonet femella, timonet mascle, tremoncell | Cortical parenchyma, flower, flowering stem, flowering top, leaf, inflorescence, aerial part, flowering aerial part, stem with leaves/branches, young aerial part | Air dried, boiled in water, boiled in water and oil, condiment, cooked in oil, preserved in brine, raw, unknown | 957 | 0.52 | * | * |
| *Foeniculum vulgare* Mill. subsp. *piperitum* (Ucria) Cout. (Apiaceae) BCN 125,404 | Fenoll, fonoll | Aerial part, bulb, fruit, flower, flowering aerial part, inflorescence, infructescence, leaf, ripe fruit, root, seed, stem, stem with leaves/branches, unknown, young aerial part, young leaf | Air dried, boiled in water, boiled in water and fat, boiled in water and oil, condiment, cooked in oil, preserved in brine, preserved in oil, raw, unknown | 482 | 0.24 | * | * |
| *Laurus nobilis* L. (Lauraceae) BCN 150,355 | Llaurer, llor, llorer, llort | Fruit without seeds, leaf | Air dried, boiled in water and oil, condiment, preserved in oil, preserved in vinegar, raw, unknown | 475 | 0.27 | * | |
| *Rubus ulmifolius* Schott (Rosaceae) BCN 156,557 | Albarzer, abatzer, barder, barsa, barser, esbarzer, romeguera, romiguera, verder | Fruit, infructescence, ripe fruit, stem, young aerial part, young shoot | Boiled in water, condiment, cooked in sugar, raw, unknown | 425 | 0.25 | * | |
| *Mentha spicata* L. (Lamiaceae) BCN 125,414 | Herba de Santa Maria, herba-sana, herba-sana vera, menta, menta de bou, menta de les faves, menta del consol, terongina | Aerial part, flowering top, leaf, unknown, young leaf | Air dried, boiled in water, condiment, raw, unknown | 415 | 0.23 | * | * |
| *Rosmarinus officinalis* L. (Lamiaceae) BCN 156,603 | Romaní, romanyí, romer, romer femella, romer mascle | Aerial part, flower, flowering aerial part, flowering stem, flowering top, inflorescence, leaf, stem with leaves/branches, unknown | Boiled in water, condiment, raw, unknown | 356 | 0.21 | * | * |
| *Origanum vulgare* L. (Lamiaceae) BCN 125,392 | Herbamusca, moraduix, moraduix bord, moraduix de la Mare de Déu, orenga, roca morera | Aerial part, flowering aerial part, flowering top, inflorescence, leaf, unknown | Condiment, raw, unknown | 341 | 0.20 | * | * |

**Table 1.** *Cont.*

| Taxon, Family and Herbarium Voucher | Catalan Names | Used Part | Preparation Form | Total UR | CI | PFAF Validation | FFF Validation |
|---|---|---|---|---|---|---|---|
| *Ficus carica* L. (Moraceae) BCN 150,361 | Figuer, figuera | Fruit, infructescence, latex, leaf, ripe fruit, stem, unknown, young aerial part, young shoot | Air dried, boiled in milk, boiled in water, condiment, cooked in sugar, curd, raw, toasted, unknown | 317 | 0.17 | * | |
| *Satureja montana* L. (Lamiaceae) BCN 125,403 | Herba de les olives, saboritja, sajolida, salseta de pastor | Aerial part, flowering aerial part, flowering top, inflorescence, leaf, cortical parenchyma, stem with leaves/branches, unknown | Condiment, preserved in brine, unknown | 285 | 0.14 | * | * |
| *Reichardia picroides* (L.) Roth (Asteraceae) BCN 113,704 | Cosconia, cosconilla, llicsó | Aerial part, leaf, unknown, young aerial part, young leaf | Boiled in water, condiment, cooked in oil, raw, unknown | 249 | 0.15 | * | |
| *Arbutus unedo* L. (Ericaceae) BCN 96,768 | Alborcer, arboç, arbocer, cierre d'arboç, cirerer de pastor, llipoter | Fruit, fruit without seeds, ripe fruit, unknown | Boiled in water, condiment cooked in sugar, preserved in high-grade alcohol, raw, unknown | 234 | 0.14 | * | |
| *Cynara cardunculus* L. (Asteraceae) BCN 29,860 | Card, card coler, card de fer formatge, card de formatjar, card formatger, carxofera borda, carxofera de presó, escard de formatjar, herba presonera, herbacol, preor, presor, presora | Aerial part, flower, leaf, leaf stalk, stem, stem with leaves/branches, unknown | Boiled in water, condiment, curd, preserved in brine, raw, unknown | 222 | 0.13 | * | |
| *Chondrilla juncea* L. (Asteraceae) BCN 150,377 | Cama-roja, enciam, escanyaguineus, masteguera, màstec, xicoia | Leaf, young aerial part, unknown, whole plant, young leaf | Boiled in water, condiment, cooked in oil, preserved in vinegar, raw, unknown | 220 | 0.13 | * | |
| *Silene vulgaris* (Moench) Garcke (Caryophyllaceae) BCN 96,770 | Colís, colitx, coniell, conillet, esclafidor, petador, petapetons, verdura | Aerial part, flower, flowering top, leaf, root, stem, unknown, young aerial part, young leaf | Boiled in water, boiled in water and fat, boiled in water and oil, condiment, cooked in oil, preserved in vinegar, raw, toasted, unknown | 198 | 0.10 | * | |
| *Portulaca oleracea* L. (Portulacaceae) BCN 46,835 | Enciam de frare, enciam de patena, verdolaga | Aerial part, leaf, flower, unknown, young aerial part, young leaf, young shoot | Boiled in water, boiled in water and oil, condiment, cooked in oil, preserved in vinegar, raw, toasted, unknown | 191 | 0.12 | * | |

**Table 1.** *Cont.*

| Taxon, Family and Herbarium Voucher | Catalan Names | Used Part | Preparation Form | Total UR | CI | PFAF Validation | FFF Validation |
|---|---|---|---|---|---|---|---|
| *Urtica dioica* L. (Urticaceae) BCN 29,814 | Estrígol gran, ortiga, ortiga barragana, ortiga blanca, ortiga de bou, ortiga de llei, ortiga de mare, ortiga de riu, ortiga gran, ortiga grossa, ortiga major, ortiga negra | Aerial part, flowering top, leaf, unknown, young aerial part, young leaf | Boiled in water, boiled in water and oil, condiment, cooked in oil, raw, unknown | 188 | 0.11 | * | * |
| *Taraxacum officinale* Weber in Wiggers (Asteraceae) BCN 150,371 | Angelets, apagallums, dent de lleó, herba amarga, lletsó, lletsó d'ase, queixal de verro | Aerial part, inflorescence, leaf, root, unknown, whole plant, young aerial part, young leaf | Boiled in water, condiment, cooked in oil, cooked in sugar, raw, unknown | 173 | 0.10 | * | * |
| *Asparagus acutifolius* L. (Asparagaceae) BCN 125,479 | Espargolera, esparreguera, esparreguera borda, esparreguera silvestre | Stem, unknown, young shoot | Boiled in water, boiled in water and oil, cooked in oil, raw, unknown | 145 | 0.09 | * | * |
| *Cichorium intybus* L. (Asteraceae) BCN 296,600 | Cama-roja, cosconilla, endívia, escarola borda, fuell, màstec, màstec bord, masteguera, raditxa, xicoia, xicoira, xicòria | Aerial part, inflorescence, leaf, root, seed, unknown, young aerial part, young leaf | Boiled in water, boiled in water and oil, cooked in oil, raw, toasted, unknown | 145 | 0.08 | * | |
| *Sorbus domestica* L. (Rosaceae) BCN 150,384 | Moixera, server, servera, serverola | Fruit, ripe fruit | Air dried, boiled in water and oil, cooked in sugar, raw, unknown | 143 | 0.09 | * | |
| *Papaver rhoeas* L. (Papaveraceae) BCN 24,940 | Babol, gallaret, gallgallaret, paparota, pipiripip, quiquiriquic, rosella | Aerial part, leaf, seed, unknown, young aerial part, young leaf | Boiled in water, condiment, cooked in oil, raw, unknown | 140 | 0.09 | | * |
| *Thymus serpyllum* L. (Lamiaceae) BCN 25,019 | Brotònica, essència de pastor, farigola, farigola borda, farigola de muntanya, farigola de pastor, folcó, salseta de pastor, serpoll, timó, timonet bord | Aerial part, flowering aerial part, flowering top, inflorescence, nectar, unknown | Boiled in water, condiment, raw, unknown | 121 | 0.07 | | * |
| *Rorippa nasturtium-aquaticum* (L.) Hayek *nasturtium-aquaticum* (Brassicaceae) BCN 24,971 | Api bord, réixec, créixen, gréixol | Aerial part, leaf, stem, unknown, whole part, young aerial part, young leaf | Boiled in water, cooked in oil, preserved in vinegar, raw, unknown | 118 | 0.07 | | * |
| *Molopospermum peloponnesiacum* (L.) Koch (Apiaceae) BCN 24,934 | Api bord, coscó, coscoll | Aerial part, fruit, leaf, stem, unknown, young leaf, young shoot | Cooked in sugar, raw, unkwnown | 111 | 0.07 | | |

**Table 1.** *Cont.*

| Taxon, Family and Herbarium Voucher | Catalan Names | Used Part | Preparation Form | Total UR | CI | PFAF Validation | FFF Validation |
|---|---|---|---|---|---|---|---|
| *Borago officinalis* L. (Boraginaceae) BCN 68,582 | Borraina, borratja, borratxa, pa amb vi | Aerial part, flower, leaf, stem | Boiled in water, boiled in wáter and oil, cooked in oil, raw, unkwnon | 109 | 0.05 | * | * |
| *Rubus ideaeus* L. (Rosaceae) BCN 24,977 | Gerdera, gerdoner, gerdonera, gerguer, gerguera, jordonera | Fruit, infructescence, ripe fruit, unknown | Condiment, cooked in sugar, raw, unknown | 109 | 0.07 | * | * |
| *Celtis australis* L. (Cannabaceae) BCN 24,741 | Lledoner | Fruit, ripe fruit | Raw, unknown | 108 | 0.07 | | * |
| *Sambucus nigra* L. (Adoxaceae) BCN 24,984 | Benabre, bonabre, bonarbre, menabre, sabuc, sabuquer, saüc, sauguer, saüger, saüquer, sauquer, suc, suguer, suquer | Flowering aerial part, fruit, inflorescence, ripe fruit, seed | Boiled in water, condiment, cooked in oil, cooked in sugar, cooked with wine, raw, unknown | 103 | 0.06 | | * |
| *Sonchus oleraceus* L. (Asteraceae)BCN 25,008 | Llecsó, llenteín, llepsó, lletsó, llicsó, llitsó | Aerial part, leaf, unknown, young aerial part, young leaf | Raw, unknown | 102 | 0.06 | | * |
| *Fragaria vesca* L. (Rosaceae) BCN 24,889 | Maduixa de bosc, maduixa silvestre | Fruit, immature fruit, infructescence, ripe fruit | Cooked in sugar, preserved in wine, raw, unknown | 94 | 0.06 | | * |
| Mean ± SD (30 top taxa) | | | | 242.53 ± 179.11 | 0.14 ± 0.09 | | |
| Mean ± SD (all taxa) | | | | 35.58 ± 94.02 | 0.02 ± 0.05 | | |

BCN: Herbarium of the Centre de Documentació de Biodiversitat Vegetal, *Universitat de Barcelona*. UR: Use reports. CI: Cultural importance index [70]. In the two last columns, the asterisk (*) indicates validation by the sources mentioned. FFF: folk functional food ([39]; validation: [105]). PFAF: Plants for a Future database (validation: www.pfaf.org).

Apart from being commonly distributed in general, the ease of availability, one of the reasons for traditional plant knowledge and collection, is given in terms of the proximity of plants to the place where people live [86], i.e., the floristic composition of the local landscape [99]. This is determinant for plant choosing, as we have verified in many punctual ethnofloristic prospections (e.g., [16]) and we confirm once again in the present meta-analytic work. The informants remark that many plantsthey were or are collected not far from home: expressions similar to "*creix pels marges*" ('it grows by the sides') [96,97], meaning that the plant is found in small slopes or path sides close to home, is almost always pronounced by the informants, for instance, for one of the top ten plants, *Reichardia picroides*. For *Papaver rhoeas*, "*n'hi ha molta*" ('there is a lot of it') [100] is stated, indicating that it is very easy to obtain it. Apart from this, some of the highly appreciated WFP plants were cultivated (often originally collected in the wild, in some cases bought) near the house to ensure ease of collection, such as the above-mentioned *Ficus carica* and *Laurus nobilis*.

Not only most reported plants are interesting and significant. Scarcely-quoted plants are also important, since in many cases they are representative of particular geographical zones and, in addition, very often they incorporate elements of local identity. This is the case, for instance, of *Taraxacum dissectum* (Ledeb.) Ledeb. in high mountain regions of the Pyrenees [16,66], of *Cytinus hypocistis* (L.) L. and *Pyrus spinosa* Forssk. in arid inner areas of Catalonia [18], of *Salicornia patula* Duval-Jouve in littoral areas (Marín et al., unpubl. res.) and of *Origanum virens* Hoffms. et Link and *Thymus piperella* L. in southern Valencian areas (Supplementary Material S2).

Good taste and healthy (most probably including, first of all, nutritive) properties are also important for people when making the decision to use a taxon as food. In a study focused on 21 WFP species in three of the territories considered in the present work, the appreciation of the flavour of a plant was determinant for its use, whereas a disgusting taste was a relevant motivation to stop eating a WFP [9]. Expressions from our informants like "*la farigola és molt bona*" ('thyme is very good') [97], "*fa molt bona olor quan està florit*" ('it smells very good when in flower', concerning *Sambucus nigra* L.) [101], "*la truita d'espàrrecs té gust!*" (the asparagus omelette is tasty!') [95], "*m'agrada molt, té molt bon gust*" ('I like it very much, it is very tasty', for *Papaver rhoeas*) [101] or "*són boníssimes, nosaltres sempre que en trobem n'agafem*" ('they are extremely good, we collect them whenever we find them', referring to *Rubus ulmifolius* fruit) [101] account for the importance of appreciating the organoleptic properties of WFP. The quoted sentences are qualitative appreciations given by informants. Recently, Talavera ([97] and work in progress) started quantitative tests on a high number of informants (over several years) who are asked to taste different preparations with WFP and give responses to different questions on their smell, taste and other characteristics.

Finally, we can also consider an economic motivation for WFP collection or consumption. The informant's statement "*en van a collir de silvestres per a vendre'ls a mercat*" ('someone is collecting wild ones to sell them in the market') [96], referred to *Asparagus acutifolius*, and is quite clear and will be discussed in Section 3.6. "*En veníem, com les maduixes de bosc*" ('we used to sell them, as well as wild strawberries' [102], referred to the fruit of *Rubus idaeus* L., implying also that of *Fragaria vesca* L.), also exemplifies, as in other similar cases, the possible economic revenues resulting from WFP collection. Speaking of *Taraxacum dissectum*, one informant remembered that "*al temps de la misèria passaven dones que n'havien anat a collir a la muntanya i les venien, un plat valia 10 cèntims*" ('in times of scarcity, some women passed after collecting the plants in the mountain and sold them; a dish cost 10 cents') [47]. For *Rubus idaeus*, informants also quote "*la melmelada de gerds és la més bona*" ('red raspberry jam is the best one") [103], indicating they also use them, i.e., both taste and economy causes converge in the use of this WFP. The economic factor is not only the income perceived by selling plants, but can also be considered in terms of saving by using WFP: If, for instance, traditional knowledge allows people to collect and to prepare jams or similar products from *Arbutus unedo* L., *Rubus idaeus*, *Rubus ulmifolius* or *Vaccinium* *myrtillus* L. picked by themselves in the field, they should not therefore have to buy the same products in the supermarket.

### *3.3. Parts of Plants Used*

The parts of the plants used for food purposes are presented in Figure 3. A practically absolute predominance of aerial parts is observed: the stem, the leaf, the complete aerial part (or the whole plant, the distinction between both categories being sometimes difficult), the fruit (including its parts, fructification and infructescence), and the flower (comprising its parts, inflorescence and floral summit) altogether represent 91.59% of the total UR. In contrast, subterranean parts are a small minority: root, tuber, bulb and rhizome encompass 2.20% of the total UR. Plant products (latex, nectar or sap) cover only 0.17% of the total UR. Finally, a 4.70% of UR correspond to parts not reported (most often ignored or forgotten) by the informants. The clear prevalence of aerial parts and minority subterranean ones is shown also, for instance, in research performed in the eastern Mediterranean region [76,77], northern Europe [19] and eastern Asia [80]. This consistency in quite geographically, culturally and socioeconomically different regions suggests a common pattern in parts of WFP used. This pattern is not intuitive, since everyone has in mind the relevance of subterranean parts in cultivated food plants, but it could be interpreted as an adaptation of the idea of Johns et al. [86] that the wild plants growing near the human settlements are among the most used. In this case the ease of accessibility does not regard the plants themselves, but their most apparent parts, which are aerial ones. The fact that the underground parts have to be harvested mainly in the plants' vegetative state, making it difficult in some cases to undoubtedly identify the taxa, could have some influence on the situation described. In any case, a beneficial side effect may be mentioned, since, as stated by Pawera et al. [80], an intensive harvest of subterranean parts of WFP could be harmful in terms of plant conservation issues. Apart from this, a lower palatability of subterranean parts in respect to other parts of plants could be an explanation for their scarce use [97].

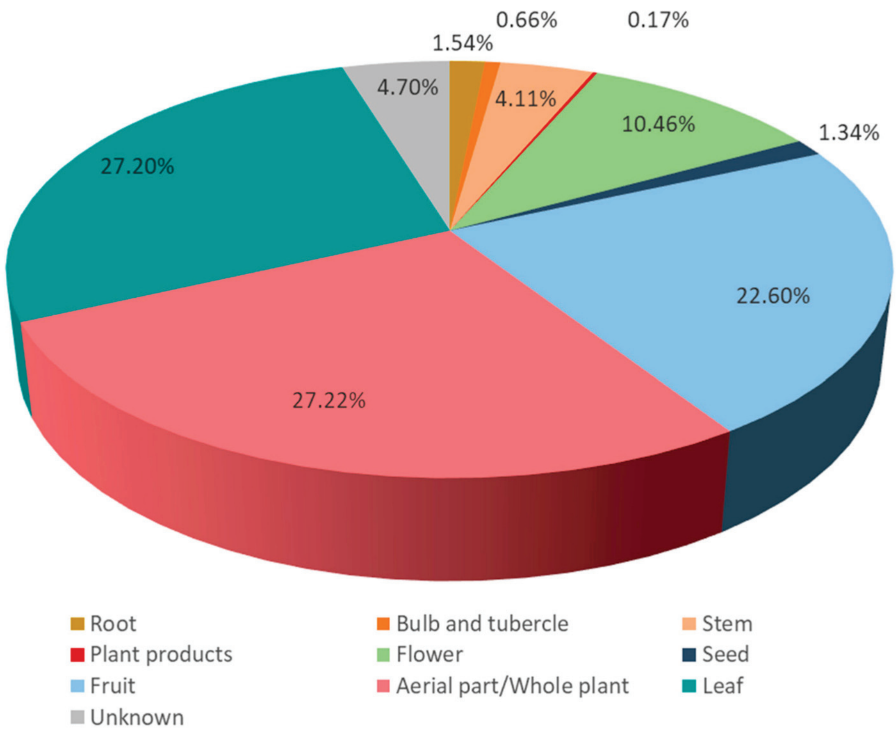


**Figure 3.** Parts of the wild food plants used in the area studied.

### 3.4. Preparation Forms

The types of preparation of the WFP are shown in Figures 4 and 5. In Table 2, 10 kinds of traditional foods elaborated with WFP are presented, with an explanation of their preparation and some examples of plants concerned in each type of food. WFP in the Catalan linguistic area are, in decreasing order, either ingested raw (34.77% of the total UR), used as a condiment (32.71%), ingested cooked (19.22%) or used preserved (3.71%). There is a 7.43% of the UR for which no information of the preparation type is recorded, and a 2.16% of the UR corresponding to the utilisation of a plant as curd. Among these types, the plants that are ingested in high portions are those more representative in feeding terms, even if condiments also represent interesting nuances in this respect.

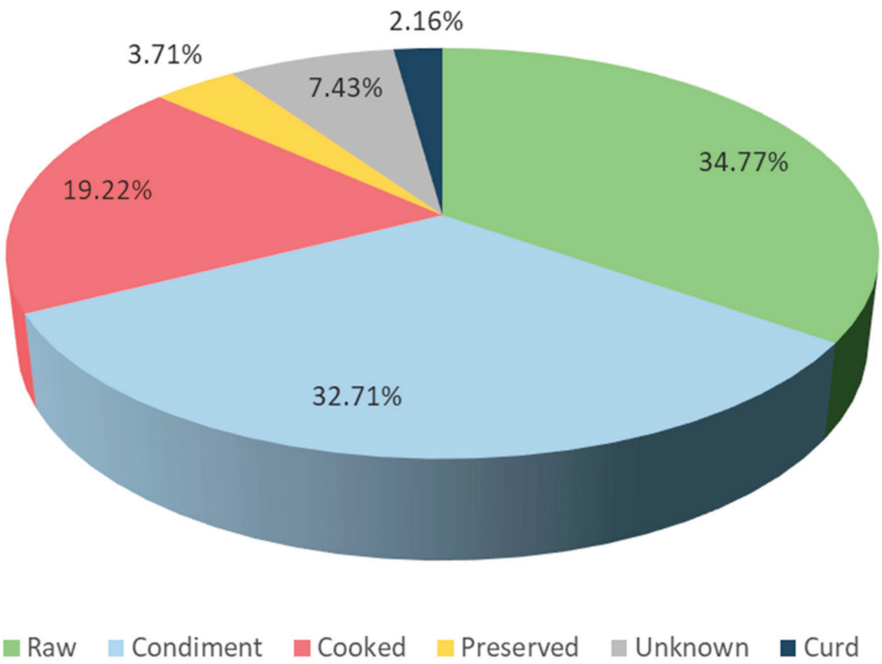


**Figure 4.** Modes of preparation of wild food plants in the area studied.

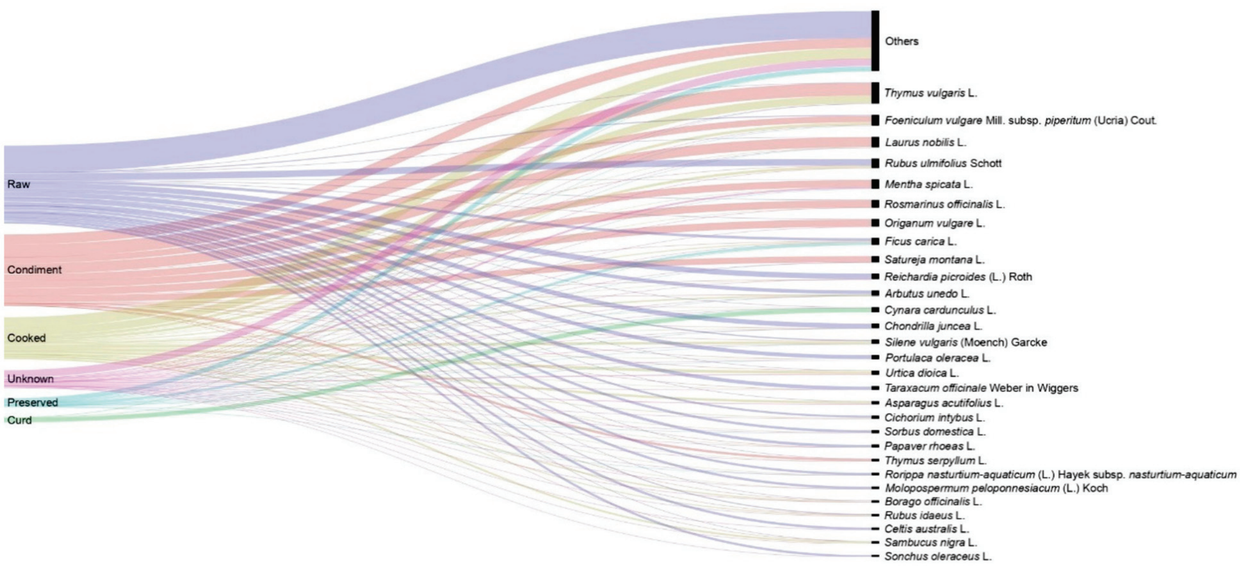


**Figure 5.** Modes of preparation of the most reported wild food plants in the area studied.

**Table 2.** The 10 main kinds of traditional foods and examples of wild food plants involved in each case.

| Kind of Traditional Food | Synthetic Explanation | Examples of Plants Involved |
|---|---|---|
| Cake | Basic preparation of the cake with flour, butter or olive oil and water (and sugar or salt depending on the kind of cake), and addition of the plant inside or in the surface | *Fragaria vesca*, *Papaver rhoeas*, *Silene vulgaris* |
| Condiment | Used to season a salad, a fritter, a pizza or a meat or fish roast or stew | *Carum carvi*, *Laurus nobilis*, *Origanum vulgare*, *Thymus vulgaris* |
| Fritter | Put in batter and fried in olive oil, with salt or sugar depending on the use as meat dishes' complement or as a dessert | *Sambucus nigra* |
| Omelette | Slightly fried in olive oil or sauté, mixed with eggs, and fried in olive oil | *Asparagus acutifolius*, *Chenopodium bonus-henricus*, *Malva sylvestris*, *Urtica dioica* |
| Preserve | Cooked in sugar, preserved in brine or preserved in vinegar | *Arbutus unedo*, *Crithmum maritimum*, *Foeniculum vulgare*, *Rubus ulmifolius* |
| Salad | Cleaned and seasoned with olive oil and sometimes salt and/or condiments | *Molopospermum peloponnesiacum*, *Portulaca oleracea*, *Reichardia picroides*, *Taraxacum dissectum* |
| Soup | Boiled with water, in some cases with bread and an egg added at the end of the preparation | *Mentha spicata*, *Thymus vulgaris*, *Urtica dioica* |
| Stew | Stewed with meat | *Castanea sativa* |
| Sweet delicacy | Cleaned and directly consumed, often in the field just after collection | *Arbutus unedo*, *Celtis australis*, *Prunus spinosa*, *Rubus idaeus*, *Rubus ulmifolius*, *Fragaria vesca* |
| Vegetable | Boiled in water | *Malva sylvestris*, *Silene vulgaris*, *Urtica dioica* |

The simplest procedure of preparation largely dominates, since the use of fresh plant material (implying just cleaning) and the use as a condiment (implying only cleaning and in most cases drying) represent, according to the percentages quoted in the last paragraph, around one third each of the total UR. This may have at least three explanations. First, the importance of salad WFP, in agreement to that of salads with cultivated plants, very typical in every diet. Nevertheless, other preparations than salad exist for fresh WFP, such as the ingestion of *Malva sylvestris* L. or *Rubus ulmifolius* fruits as aperitif and dessert, respectively. Second, the relevance of spices and condiments, again in every diet, and the large number of either cultivated or wild plants, mostly with essential oils, with this function. Finally, the ease of use itself. Preparing (exceptionally or regularly) a WFP salad is simple, and seasoning a pizza, a stew or a salad or flavouring an oil with a condiment, too. This last point parallels the fact that tisanes prepared by a simple infusion or decoction are indicated among the most important pharmaceutical forms of many ethnobotanical studies centred around medicinal plant uses ([18] and references therein). In any case, simplicity in use does not necessarily imply simple or vulgar dishes. Many condiments are very relevant in cooking or preparing plants, such as *Satureja montana* and *Thymus vulgaris* for olive treatment and preservation all along the area studied, or *Thymus piperella* for the same purpose, to cook snails and to prepare '*gaspatxo*' -a traditional SE Iberian solid dish, different from the cold soup called '*gaspatxo*' in Catalan and '*gazpacho*' in Spanish- and *Origanum virens* for cooking typical fish or veal stews, the latter two species in southern Valencian territory. It is worth mentioning that attempts at home cultivation are not at all rare among the informants, at a local level in the homegardens or even in pots on balconies, of some condiment WFP they particularly appreciate and use frequently, as often stated during the interviews, with sentences such as "*aquí al jardí en tenim de plantada*" ('we have it planted here in the garden' [96,103], in this case referring to *Thymus vulgaris*).

Almost one quarter of the total UR belongs to the use of plants cooked or preserved. This is a minority but representative proportion of more complex preparation forms, revealing that not because we are dealing with WFP should their preparation always be reduced to almost nothing. In fact, most of the methods employed in the kitchen for cultivated plants are applicable to WFP, as we shall show with a few examples.

Regarding cooked plants, they may be boiled in water (such as *Silene vulgaris*) or in milk (*Chenopodium bonus-henricus* L.; this was commonly done by the shepherds, who then ate the plant and drank the aromatised milk), fried in oil (*Sambucus nigra*), prepared in omelette (*Asparagus acutifolius*, *Chenopodium bonus-henricus*, *Malva sylvestris*, *Urtica dioica* L.) (Figure 6), stewed, usually in meat dishes (*Castanea sativa* Mill.), prepared in a kind of cake called '*coca*' (*Silene vulgaris*) or in other sweet (*Papaver rhoeas*) or salted (*Silene vulgaris* in Mallorca's traditional salty pie '*cocorroi*') cakes, or as a soup (*Chenopodium bonus-henricus*, *Mentha* sp., *Thymus vulgaris*). In many cases, WFP, in any of the forms of preparation, are cooked and consumed together with other plants, usually cultivated, such as boiled *Urtica dioica* accompanying *Solanum tuberosum* L. or the same WFP species as an ingredient of a soup or even of cannelloni. In Valencian territories, Pellicer [104] indicated that *Asparagus acutifolius* may be a component of a traditional Valencian dish called "*borreta*", together with *Allium sativum* L., *Beta vulgaris* L., *Phaseolus vulgaris* L., *Solanum tuberosum*, *Spinacia oleracea* L., apart from codfish and eggs. Similarly, in the Pyrenees, *Chenopodium bonus-henricus* may be added to a very popular dish, "*trinxat*", based on mashed *Brassica oleracea* L. and *Solanum tuberosum*, with pork bacon.


**Figure 6.** Examples of wild food plants prepared for consumption. (**A**) *Molopospermum peloponnesiacum* in salad; (**B**) *Chenopodium bonus-henricus* in omelette; (**C**) *Arbutus unedo* preserved in jam.

As in the case of cultivated plants, WFP preserves may be prepared salty or sweet. Many berries and other fruits (such as *Arbutus unedo*, *Rosa canina* L., *Rubus idaeus*, *R. ulmifolius* or *Vaccinium myrtillus*) (Figure 6) are boiled with sugar, and the jam or similar products obtained are consumed for breakfast or as a dessert, often spread on bread or cakes. Since these fruits are boiled, we considered them, as cooked, as a preparation form, even if they constitute a preserve. As for salty, *Crithmum maritimum* L. leaves are pickled with wine vinegar and salt, and used to accompany olives, bread spread with tomato and olive oil, '*trempó*' (Balearic salad) and '*sopes*' (a traditional kind of soup typical in Mallorca). Again, simple uses together with more complex ones are found, following a similar model to the one of cultivated plants.

A small number of reports, representing only 2.16% of the total, correspond to plants used to curdle milk and prepare cheese and related dairy products. This use, comparable with that of industrial rennet of animal or other origins, is mostly centred on *Cynara cardunculus* L. flowers, separated from the inflorescence and added, directly or its maceration water, to the milk when it starts boiling or when it is warm but still far from boiling, depending on the places.

### *3.5. A First Step towards the Corpus of the Rarely Reported WFP in the CLA*

To evaluate the range of the use as food of the taxa analysed in this study, we checked our information with a comprehensive repository of useful plants, comprising WFP, as is the Plants for a Future database (PFAF) (https://pfaf.org). This validation is a first approach to detect the rarely reported plants.

Out of the 278 WFP taxa recorded in this paper, 218 (78.42%) appear in the PFAF database as edible. Some of these WFP are considered with a high edibility rating, such as *Rumex acetosa*, whereas some others, such as *Cytinus hypocistis* have attributed a low edibility rating. This means that most WFP employed in the CLA are more or less common and well known as edible. Nonetheless, a non-negligible pool of plants, more than one fifth of the total, does not appear in this database. Some of them are widely distributed and for sure used in other regions, such as *Apium nodiflorum* (L.) Lag. subsp. *nodiflorum*, but some others are rarer.

A number of the 60 taxa (21.58%) not present in the PFAF database are importantly reported in the CLA and, although they are not endemic, most of them are not so common elsewhere. We provide here a few examples of different territories. *Molopospermum peloponnesiacum* (L.) Koch, *Saxifraga aquatica* Lap. and *Taraxacum dissectum* are common in the Pyrenees and actively searched during a specific time of the year. In inland, dry territories *Pyrus spinosa* constitutes a similar case, as well as *Thymbra capitata* (L.) Cav. in the Balearic Islands and *Thymus piperella* in the south Valencian area. A much more in-depth revision, including almost all European literature should be undertaken in order to definitely establish a pool of WFP particularly representative of the CLA, but now a not inconsiderable first approach is done.

### *3.6. Links between Nourishment and Medicine: WFP as Folk Functional Foods*

Many food plants (including WFP) have been reported to also have medicinal uses, entering within the concept of nutraceutical [81,105]. *Thymus vulgaris*, the top plant in terms of UR and CI in this study, provides a clear example of what we called folk functional food [39]. This taxon is claimed to possess many food (Table 1 and Supplementary Material S3) and medicinal ([18] and references therein) properties. One of the most typical preparation forms for food use is a soup made with water or a broth, bread, olive oil and the plant, sometimes complemented with *Allium sativum* and eggs. This soup is reported to have medicinal properties, and in some cases it is indicated that it was prepared for cold or digestive problems, and that it reinforces the organism: *"la farigola és molt bona; els pastors se'n feien, de sopa de farigola, per això estaven tan forts"* ('thyme is very good; shepherds prepared thyme soup every morning, this is why they were so strong') [106].

Out of the 278 taxa here recorded, 39 (14.03%) appear in the comprehensive dictionary of nutraceutical and functional food [105], indicating that a non-negligible amount of WFP has medicinal properties that make these plants, apart from nutritious, particularly salutary, and confirming the role of ethnobotany in healthy eating [107]. Some examples cited as nutraceuticals and present among the most cited plants (see Table 1) in our territory are *Thymus vulgaris*, *Foeniculum vulgare* subsp *piperitum*, *Mentha spicata*, *Rosmarinus officinalis*, *Origanum vulgare*, *Satureja montana*, *Urtica dioica*, *Taraxacum officinale* and *Asparagus acutifolius*. The number of nutraceutical plants would increase taking into account recent research, complementing the mentioned dictionary. For instance, see the information on this subject regarding *Portulaca oleracea*, not included in the dictionary, in the section on markets and industrialised products of Section 3.6. Just to give a few more examples of plants not present in the dictionary, Guijarro-Real et al. [108] report nutraceutical properties for *Apium nodiflorum*, and propose it as a potential new crop, an interesting activity against intestinal parasites has been reported for *Origanum virens* [109], used as a condiment, and a position as a commercial spice is proposed for *Crithmum maritimum*, after describing a chemical composition compatible with nutraceutical properties [110]. These medicinal properties provide WFP with an added value for their local consumption that may be used in the development of new, healthy food.

Studies about the nutrients and the bioactive compounds of the WFP are very important to demonstrate the big potential of these plants as nutraceuticals. Sánchez-Mata et al. [17] have carried out several nutritional studies on WFP with very interesting results, some of them related with the plants quoted in this meta-analysis. Examples of that are *Rumex pulcher* L. with a level of vitamin $B_9$ (folic acid) higher than the 100% daily recommended intakes; *Urtica dioica*, *Arbutus unedo*, *Chenopodium album* L., *Capsella bursa-pastoris* (L.) Medik. and *Eruca vesicaria* (L.) Cav. with levels of vitamin C higher than the 100% recommended intakes; *Celtis australis* L., *Parietaria officinalis* L. subsp. *judaica* (L.) Béguinot and *Urtica dioica* with calcium sources higher than the 50% daily advised; or *Celtis australis*, *Sanguisorba* *minor* Scop. and *Chenopodium album* also with values of magnesium higher than those recommended.

### *3.7. Particularly Representative Plants and Plants Associated with Believes*

Some WFP, basically, but not only, among the most quoted ones, may be considered iconic in terms of their particularly relevant use on a quotidian basis and for the appreciation people has of them. Three clear examples are *Laurus nobilis*, *Origanum vulgare* and *Thymus vulgaris*, with their abundant daily use as condiment (among other not so frequent uses), equalling or overcoming the use of very important condiments from foreign, cultivated plants, such as *Capsicum annuum* L. and *Piper nigrum* L. Similarly, but to a slightly lesser extent, another aromatic plant, *Rosmarinus officinalis*, has also a place among the most habitual used plants, also as a condiment, completing, with *Thymus* and *Laurus*, a classical *bouquet garni*. These plants, in their daily use, are not the protagonists of the dishes in terms of volume or weight, but many popular, typical -from old or modern tradition- and highly appreciated dishes (soups, rice, stews, roasts, salads, even pizzas) could not be conceived without them. Moving to sweet, we find a similar example. To give the necessary and distinctive flavour to '*bunyol*' or '*brunyol*' (fritter), very typical of Easter week and nowadays eaten all along the year, if cultivated *Pimpinella anisum* L. fruits are not available, or if others are preferred to confer the anis smell and taste, *Carum carvi* L. or *Foeniculum vulgare* subsp. *piperitum* fruits are used.

Other plants may also be considered as very appreciated, but are not consumed daily, mainly due to their seasonality. This is the case of *Rubus ulmifolius* fruits, eaten directly or prepared in jam, and, most relevantly, of *Asparagus acutifolius* spears, collected in big amounts every spring and eaten boiled or in salad, soup or, mostly, omelette.

Some WFP are associated with magic or religious believes, and, to some extent, fall within the concept of taboo, which is frequently related to foods [111]. All *Ruta* species are claimed to be abortive, and this is usually maintained as an old secret, but they are consumed as foods, although with the warning of this possible side effect. A very common tradition in the area studies consists in blessing leafed branches of the above-mentioned *Laurus nobilis* (and, not so commonly *Thymus vulgaris* and *Rosmarinus officinalis*) in the Palm Sunday celebration, and the belief that these blessed branches protect the house and its inhabitants is general. It is not at all rare, in addition, to consider that blessed *Laurus* is better than normal one for cooking, expressed with sentences such as "*millor si està beneït el dia de Rams*" ('better if blessed during Palm Sunday') [100]. In this case it is not difficult to deduce that, irrespective of the believes, this was a manner of replacing the existences of last year's *Laurus* leaves for condiment with the new ones, richer in essential oils. In he same magic or religious field, some wild *Allium* species, such as *A. ampeloprasum* L., are called '*all de bruixa*' ('witch's garlic') and are not consumed by some people, who associate the plant to witches and toxicity. Associated with another kind of believes, some people has the opinion that consuming nowadays plants collected in the particularly in a direct manner in salads, is dangerous because they are reached by pesticides and other chemical products.

### *3.8. Uses Beyond the Home: From Past to Future, with Some Case Examples*

Recovering or expanding the use of old foods, in many cases applying the so-called slow food or zero-kilometre cuisine paradigms, is often associated with the concept of '*terroir*', closely linked to traditional knowledge on the food products (importantly of plant or fungal origin) [112,113]. This tendency has been termed as 'nostalgic' ('nostalgia of '*terroir*', [114]; 'nostalgic foods', [115]), not so much in a pejorative sense, but because of the idea of returning to remembered and appreciated sources, with the added value of generating identity. In an anthropological study of Mallorca's cuisine (one of the territories concerned in the present paper), Trias [116] described a desire for food fully imbued with cultural meaning, beyond simply covering the primary nutritional needs. The identity can be created with cultivated plants of foreign origin, as is the case of one of the leaders of Catalan cuisine, '*pa amb tomata*', called in some places '*pa amb oli*' ('bread with tomato', 'bread with oil', prepared by rubbing the bread with tomato and seasoning it with olive oil) [117]. Apart from that, WFP may also play this role of generating identity. For instance, *Molopospermum peloponnesiacum* (Figure 6), appreciated to quite an extent in all Catalan eastern Pyrenees, is considered 'the Catalans' salad' in Northern Catalonia or French Eastern Pyrenees department [118].

These nostalgic or identity issues make WFP recoverable. In fact, regarding WFP for salad, some of them were considered deprivation-time food, but this statement can be nuanced and complemented: for instance, talking about *Reichardia picroides*, we recorded this information: "*Abans hi havia necessitat, però també agradaven. Hi ha avis que encara les persegueixen*" ('earlier, there was a need, but they were also liked. There are some elderly people that still look for them') [97]. It was not only famine, but taste as well. Indeed, the 85-year-old brother of one of our informants (Supplementary Material S2), regularly ate *Portulaca oleracea* salad every summer at his uncles' house, until he was 12–13 years old. Since then he has never eaten it again. He professed that he did not miss the salad, but he would not mind trying it again, because it was tasty. The popularity of this plant and, at the same time, the lack if its current use, is confirmed by the 67-year-old son of one of our informants (Supplementary Material S2) who stated that, when he was 6, 7 or 8 years old, one man used to go regularly to his father's orchard to harvest *Portulaca oleracea* for familiar consumption, but that he did not eat it since a lot of years. Similarly, the use of some plants has definitely or importantly declined. This is the case of eating *Rumex crispus* L., even directly in the field, or the consumption of *Carlina acanthifolia* All. subsp. *cynara* (Pourr. ex Duby) Arcang. as bread. Also the use has at least almost disappeared of *Althaea officinalis* L. root to give consistency to a broth, replaced by modern culinary densifiers. Conversely, some used arise as new in the area in recent times, such the one of *Papaver* seeds in bread and similar products. Other uses come from old times and are maintained. For instance, collecting some WFP such as *Asparagus acutifolius*, *Crithmum maritimum* and *Rubus ulmifolius* for food purposes continues to be very much alive, because people like to eat them (see also Section 3.7). Similarly, sucking *Foeniculum vulgare* inflorescence directly in the field continues alive. For *Crithmum maritimum*, a very common and abundant plant, a protection status has even been established by the government of the Balearic Islands, with personal-use collection allowed, and a permission needed when collecting for commercial purposes [119]. The different reasons stated above (cultural and identity relevance, not-forgotten good taste, economic value), united to sustainable or zero kilometre or slow food currents, give the opportunity of placing at least some WFP onto the market. We will expound, in a qualitative manner, a few case examples of the area studied.

### 3.8.1. Markets and Industrialised Products

Some WFP are regularly sold in local food markets, which is a first step towards commercialisation, with the added value of being seasonal products. These local markets are not always close to the places where plants have been collected. *Taraxacum dissectum*, a Pyrenean endemic, is sold in Barcelona, particularly in one of its most important markets, visited by locals, but also by numerous international people: "*es venen al mercat, sobretot a la Boqueria, en parades especialitzades. Venen del Pirineu*" ('they are sold in the market, particularly in la Boqueria, in specialised stalls. They come from the Pyrenees') [95]. Some other species, such as *Asparagus acutifolius* and *Thymus vulgaris*, are commonly sold in markets. *Portulaca oleracea*, very common as food -and cultivated- in France, has not been a big success currently is Spain, but we have observed it in one market in NE Catalonia [120] (Figure 7), where the seller told us that this was a weed that used to be eaten and, since he had to harvest it to take care of the orchard, he preferred to try to sell it. The food composition data available for this species [17] and the research suggesting its quality or nutraceutical with, among others, antioxidant activity [35–37,121], together with the information on past and possible future consumption of the plant in the present paper, make it a good candidate for new food development in the territories considered and neighbouring areas (except for people with genitourinary troubles, due to its high content of oxalates). Among others, WFP such as *Helianthus tuberosus* L., *Fragaria vesca* and *Rubus idaeus* are regularly present in markets in the area studied, as well.


**Figure 7.** Examples of wild food plants present in markets (**A**,**B**) or restaurants (**C**). (**A**) *Crithmum maritimum*; (**B**) *Asparagus acutifolius*; (**C**) *Urtica dioica*.

Not all plants are presented just fresh in the markets. *Crithmum maritimum*, very common all along the coast in the whole territory studied, is practically only consumed on Mallorca, and is sold preserved in water, wine vinegar and salt (Figure 7). This preserve has advanced to the industrial phase, and several firms prepare, pack and commercialise it. A similar process to this industrialisation is the cultivation, in Catalonia, of *Cynara cardunculus*, established with an agreement to sell to companies of the dairy sector to elaborate curd, cheese and similar products. Semi-industrial jams of *Arbutus unedo* or *Rosa canina* fruits are often sold in traditional markets. Several projects dealing with WFP and implying the commercialisation of their products are available at https://www.eixarcolant.cat/directori.

#### 3.8.2. Restaurants

Another indicator of WFP expansion beyond the local tradition is their transference from home kitchens to restaurants, in some cases, but not always, located near the place where one or another WFP is collected and popularly consumed. Some WFP of the studied area regularly reach the restaurants' menu, as in the markets usually as seasonal dishes, but on some occasions all year round. The latter is the case of condiments, such as *Laurus nobilis*, *Origanum vulgare*, *O. virens*, *Rosmarinus officinalis*, *Satureja montana*, *Thymus piperella* or *T. vulgaris* leaves (Supplementary Material S2), kept dry throughout the year and, in some cases, with WFP cultivated on a small scale near the restaurant. In any case, the former are more interesting, in the sense that they play a protagonist role in some dishes. Omelettes, or other preparations of *Asparagus acutifolius,* are frequent in spring (Supplementary Material S2). A reasonable number of restaurants have contacts with people who collect the plants exclusively for them. Salads based on *Molopospermum peloponnesiacum* or *Taraxacum dissectum* also appear in some menus in spring.

Between spring and summer, we have been told that *Sambucus nigra* inflorescence's fritters may be at least occasionally found. In the same period of time, *Thymus vulgaris* flowers are used to prepare a sorbet as a dessert (Supplementary Material S2), and in similar forms, the fruit of *Opuntia maxima* Mill.

In littoral areas, *Salicornia patula* is used in fish dishes. On the island of Mallorca preserved leaves of *Crithmum maritimum* are frequently offered, during the whole year, as an aperitif or so-called *tapa*, and flowers and stems of *Allium triquetrum* L. appear more scarcely in salads. In areas of Catalonia, *Allium roseum* L., *Chondrilla juncea* L. and *Rumex crispus* are also served in restaurants. Other plants such as *Beta vulgaris* subsp. *maritima* (L.) Arcangeli, *Chenopodium album*, *Diplotaxis erucoides* (L.) DC., *Lactuca serriola* L., *Malva sylvestris*, *Papaver rhoeas*, *Plantago lanceolata* L., *Rumex pulcher*, *Silene vulgaris* and *Urtica dioica* have regularly been furnished to restaurants (Supplementary Material S2).

There are more case examples, and there could in fact be many more. We here explain just one that we have never seen in a market nor in a restaurant, but that we are convinced could be highly appreciated: *Chenopodium bonus-henricus*. During eight years (2004–2011), the senior author of this paper was the co-responsible person for a subject for undergraduate pharmacy and biology students on useful plants of the Catalan Pyrenees, mostly based on field work. Every year, within the framework of this subject, he cooked an omelette with the leaves of this plant, which he proposed the students to taste. In all cases not one of these young people had eaten this plant, but unanimously expressed their appreciation of the omelette, for many of them better than the classical one of another plant from the same Amaranthaceae family, *Spinacia oleracea*. In the Italian Alps, the species is used in a similar way to its use in the Catalan linguistic area [122]. Several *Chenopodium* species, but not this one, appear as interesting Mediterranean WFP [17]. Research on the food composition of this species would surely result in possibilities of its utilisation on a larger scale than nowadays.

The above-mentioned examples regarding the reach of WFP in markets and restaurants are only some without any claim of completeness, which account for the vitality of the traditional knowledge and use of wild plants as food. The presence in restaurants makes it possible the taste of WFP can be experienced by people interested in gastronomy and unfamiliar cuisine, and means in many cases that touristic resorts are furnished with WFP. This opens to the tourists (probably starting for those using rural tourism facilities) the access to WFP, enlarging their reach beyond local people.

Science starts being considered in gastronomy, which, in its turn, is starting to be considered a science (see a reference to a Science & Cooking congress in the concluding remarks). In this context, traditional knowledge on WFP, recorded by a discipline at the interface of social and natural sciences, has a very high value. If, as stated in the introduction, the *nouvelle cuisine* started with an ethnobotanical basis, now culinary facilities are interested on WFP and in combining tradition and innovation. Additionally, some food products, such as the whole Mediterranean diet—to quote the one concerning the area studied in this paper—are inscribed on the UNESCO's list of intangible cultural heritage. This is why restaurants, including high-gastronomy ones, often have contacts with people (not rarely botanists) who provide them with WFP. Further research on these aspects would most probably reveal many more cases than those we have quoted here of traditional WFP present in restaurants or touristic resorts, or permit the introduction, in the fields mentioned, of other WFP, thereby enlarging their utility.

## 4. Concluding Remarks

The results and data analyses performed in the present paper show an important pool of 278 WFP traditionally used in the Catalan linguistic area. The dataset shows a significant consistency and robustness as assessed through several quantitative ethnobotany indexes. Further research should be performed, on the one hand to fill some territorial gaps in order to cover all the territory, and on the other hand to incorporate into the database information from historical and anthropological research (such as the culinary corpuses of Catalonia [123,124] or of Valencia [125], rich on WFP information), which would enrich the already important pool of data on WFP in the Catalan-speaking territories.

In the area considered, WFP are not only remnants of the past, but a treasure trove from the past, still alive today, constituting a very valuable resource for the future. We believe that the examples we have provided clearly show that WFP ethnobotany is one of the most appropriate approaches and bases for selecting candidates for new food development. Adding to this the information from Talavera's (unpubl. res.) surveys on people's appreciation of WFP, it is quite likely that some taxa will emerge as candidates to be counted among the foods of the future, based on current research focused on the past traditional knowledge of plants. Throughout the present paper, we have underlined some taxa (*Apium nodiflorum*, *Crithmum maritimum*, *Reichardia picroides*) that had already been proposed to be launched as new crops or new commercial plants on a scale larger than that of local use. Our results fully reinforce and support these proposals. Some other WFP species could be added to the proposal list, among others the few we will briefly comment now. *Helianthus tuberosus* and *Portulaca oleracea*, already profusely cultivated and sold in France, could enlarge their market area. *Salicornia patula* could be introduced in markets and restaurants, probably collected from the wild, as in the case of *Crithmum maritimum* and similarly to what we have observed to happen in France with this and related taxa. *Origanum virens* could increase its market and could be cultivated. For this and other aromatic and condiment plants, successful cultivation tests have been performed [126]. *Chenopodium bonus-henricus* and *Urtica dioica* could constitute, either collected from the wild or cultivated, interesting commercial products. Public administrations' help would be suitable for initiating the development of the crops and products mentioned. Apart from the economic interest for people involved, these new plants and products put on the market will contribute, in general, to food security and, particularly given their local-origin component and traditional knowledge basis, to food sovereignty.

During the Science & Cooking World Congress, held in Barcelona in 2019, the manifesto "Scientific gastronomy Barcelona 2019" [127] vindicated this concept, understood as culinary and gastronomic science. From the present paper and analogous ones, it is undoubted that ethnobotany, and particularly the research on WFP, may relevantly contribute to this innovative plot of knowledge.

**Supplementary Materials:** The following are available online at https://www.mdpi.com/2304-8158/10/1/61/s1; Supplementary Material S1. Studied areas and research works analysed in the present paper. Supplementary Material S2: Information not coming from the database analysed, but from complementary informants. Supplementary Material S3: Wild food plants and their uses in the Catalan linguistic area (simplified data). Supplementary Material S4: Wild food plants and their uses in the Catalan linguistic area (complete database).

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# Devil Is in the Details: Use of Wild Food Plants in Historical Võromaa and Setomaa, Present-Day Estonia

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**Abstract:** Biodiversity needs to be preserved to ensure food security. Border zones create high but vulnerable biocultural diversity. Through reviewing scattered historical data and documenting the current use of wild food plants among people currently living in historical Setomaa and Võromaa parishes, we aimed to identify cross-cultural differences and diachronic changes as well as the role borders have played on the local use of wild plants. The Seto have still preserved their distinctive features either by consciously opposing others or by maintaining more historical plant uses. People historically living in Setomaa and Võromaa parishes have already associated the eating of wild plants with famine food in the early 20th century, yet it was stressed more now by the Seto than by Estonians. Loss of Pechory as the center of attraction in the region when the border was closed in the early 1990s brought about a decline in the exchange of knowledge as well as commercial activities around wild food plants. National support for businesses in the area today and the popularity of a healthy lifestyle have introduced new wild food plant applications and are helping to preserve local plant-specific uses in the area.

**Keywords:** wild food plants; Estonia; diachronic analysis; local ecological knowledge; influence of literature; borders; ethnic groups; ethnobotany

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## 1. Introduction

The regional importance of the use of wild food plants has been particularly studied in recent years in the context of the Mediterranean diet [1,2] and the references therein. Following the example of the Mediterranean diet, enthusiastic Nordic chefs and promoters of food culture created the trans-national concept "New Nordic Cuisine" in 2004. The manifesto of this "New Nordic Cuisine" consists of 10 points that emphasize local, clean, healthy, traditional, wild, and high-quality food uses in modern gastronomy [3,4]. However, this concept has failed to fulfil its "Nordic" purpose, as national and state interests in the region are of greater importance [5]. In Estonia, the national campaign "Estonian Food" is a very strong identity marker, as are several regional campaigns, among them "Uma Mekk" in Võru County. Within this framework, the use of wild food plants in top restaurants has started to spread in Estonia [6], as they seek to stand out amid intense competition.

Biodiversity needs to be preserved to ensure food security [7]. Due to the need to evaluate ecosystem services, biodiversity has been seen as a potential source of wild food plants in the context of Eastern Europe [8]. Within Estonia, the most biodiverse areas are semi-natural grasslands [9]. Forest management, however, may decrease the availability of ecosystem goods in areas where humans collect them [10]. A study by Hadjichambis et al. [11] reveals that the existence of favorable conditions is not yet a prerequisite for the use of wild food species but rather is strongly linked to the traditions, environment, and cultural heritage of each specific region. Therefore, it is not enough to preserve the agro-biological diversity of food; cultural specificities also need to be preserved [11]. Therefore, when the habit of picking wild plants from nature disappears, the great potential offered by biodiversity is not utilized [12]. Thus, both biological and cultural diversity are important for food security, which should be studied as a complex, i.e., within the framework of biocultural diversity [13].

Many studies have emphasized the importance of comparative analysis of plant use for understanding the biocultural adaptations of different linguistic groups and in different historical periods within Mediterranean countries [1,14,15]. Yet, in the Baltic States and Nordic countries, the use of wild food plants has been little studied. Even in a small country like Estonia, bioculture is highly region dependent: Compare, for example, species-rich marine west Estonia and less species-rich continental east Estonia. In addition, the areas bordering Russia have been greatly influenced by Russian culture, while western Estonia and especially the islands in the Baltic Sea have been influenced by Scandinavian culture. While studies on the use of wild food plants in western Estonia, especially on Saaremaa Island, have already been published [16–18], they do not reflect the situation in other parts of the country. Moreover, there is very little information on the eating of wild plants in southeast Estonia in descriptive historical ethnographic books [19–21]. Current uses are briefly addressed only in ethnic cookbooks written for both the local community and tourists [22–24].

Culturally, the most distinct ethnic minority in Estonia are the Seto (here and hereafter we use the dialectal name; the official name in Estonian is Setu). As the Seto live in a border area between three countries (Latvia, Estonia, and Russia), the issue of border identity has been actively studied there since the beginning of the 21st century. Assmuth [25,26] found that in the Soviet era, when there was no border, the economic situation was better on the Estonian side compared with the Russian side. As a result, border residents travelled frequently from Russia to Estonia, the so-called near abroad, to buy food and consumer goods. Since the border was closed, there has been a surge in Estonia's economic prosperity, whereas on the Russian side, it has tended to remain the same or become more disadvantaged (e.g., limited choice of goods in shops). Assmuth [25,26] also found that the desire for the return of freedom of movement is stronger among the Seto people living in Russia, as the environment there does not support their culture.

South-eastern Estonia, especially Setomaa, has been actively studied by researchers for over 100 years. Setomaa was *Terra Incognita* until the beginning of the 20th century, when folklorist Jakob Hurt (1839–1907), with his articles and books, highlighted the cultural peculiarities of the people living there. Although he was the first to record the use of wild plants by the Seto, Hurt and all subsequent researchers were keener to record folk songs and tales, and not the practical side of the interaction between people and their environment. Hurt's opinion was that the Seto were at least a few hundred years "behind" Estonians in their development at that time. This view was still valid among scientists until the late 1930s. The reason why the Seto, who have been on the frontier of Western and Eastern cultures for centuries, were studied was because they were considered "aboriginal Estonians" whose study would contribute to a better understanding of Estonian (not Seto) history and culture [27].

Through reviewing scattered historical data and documenting the current use of wild food plants among people currently living in historical Setomaa (here and hereafter we use the dialectal name) and neighboring historical Võromaa (here and hereafter we use the dialectal name) parishes, we aim to address the following research questions:

1. What kinds of differences, if any, in the use of wild food plants currently exist between the two ethnolinguistic groups which were considered very different 100 years ago?
2. What kinds of changes and the causes of those changes can be identified when comparing current results with historical wild food plant use in the region?
3. If and how a recently imposed border and being cut-off from the regional attraction center affect the use of wild food plants?
4. What role, if any, do wild food plants play in the current local gastronomy of the region?

## 2. Materials and Methods

### *2.1. The Region*

#### 2.1.1. Nature

The nature of Võromaa and Setomaa has been shaped by the Haanja Upland (the highest point is 318 m above sea level, which marks the highest elevation in the Baltic States) and Lake Peipus (consisting of Lake Peipsi, Lämmi, and Pihkva, which together cover a total area of 3555 km$^2$), one of the largest inland water bodies in Europe. Historically, the area has been dominated by coniferous forests, with low-yielding sandy soils, pine forests, and fertile areas with spruce forests. Setomaa is also characterized by an abundance of water-meadows, which were grazed in the past but are now losing their species richness as many economic activities have ended [28]. There are large cranberry-rich bogs in Võromaa, especially by Lake Peipsi. The vegetation of south-eastern Estonia is one of the oldest in the country as it was the first region that began to be depleted of ice about 14,000 years ago, while the last freeing of Estonian areas occurred about 10,000 years ago. Today, however, it is one of the least species-rich areas in Estonia. In the 20th century, rapid changes in the environment have led to the disappearance of native plants. For example, in the Estonian part of Setomaa, 717 native species (including subspecies) had been registered by 1971, of which 149 species had disappeared and an additional 88 species had become very rare by 2005 [29]. The disappearance of species has continued in the 21st century, during which time common species have also begun to decline in number [30].

#### 2.1.2. Population and Administrative Division

The research area extends across two historical areas: Võromaa and Setomaa (Figure 1). Võromaa represents the area in which the Võro dialect is predominantly spoken. It largely coincides with the historical Livonian Governorate region of Kreis Werro. There are also many people who speak dialects other than Võro in the area, and therefore we will henceforth use the term Estonians to refer to people from this region. Setomaa is an area historically inhabited by speakers of the Seto language and Russian speakers. Today, it is considered an area that was established after the Estonian War of Independence in 1920 and existed until the end of World War II, when most of Setomaa was incorporated into the Russian SFSR on the order of Stalin. While the greatest part of historical Setomaa is today part of the Russian Federation, our fieldwork was carried out in the Estonian side of Setomaa.

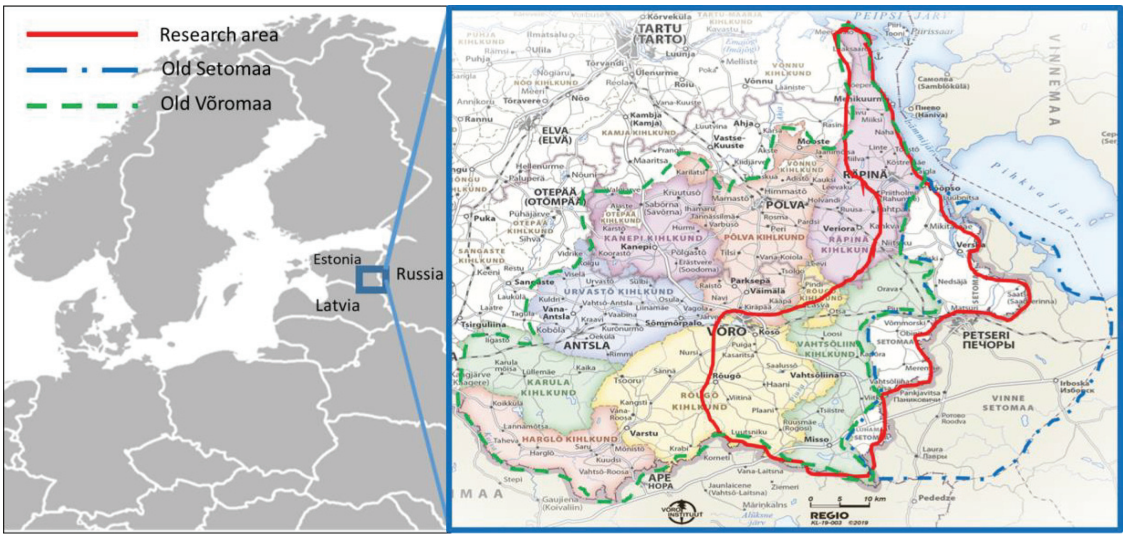


**Figure 1.** Research area: the approximate area is encircled by a red line. On the right are the administrative boundaries of historical Võromaa and Setomaa, in which place names are written in the Võro dialect (Source: Võro Instituut).

Numerous administrative reforms have repeatedly changed the historical boundaries of the municipality as well as the county (Figure 1). According to the latest administrative reform in 2017, there are four official rural municipalities in the study area: Võru rural municipality (10,738 inhabitants), Setomaa rural municipality (3280 inhabitants), Rõuge rural municipality (5427 inhabitants), and Võru city (11,859). In Estonia, all ethnography and folkloristic research is based on the administrative divisions of the late 19th century. According to the administrative arrangements of that time, there were four parishes in our area of interest: Räpina, Vastseliina, Rõuge, and Põlva, the latter of which belonged to Kreis Werro.

Unlike Estonians, until the 1920s, the areas inhabited by Setos did not follow the legal norms of the Estonian or Livonian governorates but that of the Pskov Governorate of Pskov Province. The Seto lived mostly on lands belonging to Pechory Monastery. Although today the Seto consider themselves indigenous, the European Union does not officially consider them as such. In the Russian Federation, the Seto are considered a minority group whose culture and language are at risk.

In the territory of historical Võromaa, village and town schools were established in the 19th century and school subjects were taught in Estonian. The Seto then living in Pskov Province did not have schools that taught in their native language, and only a few Seto people could receive a formal education. As a result, by the beginning of the 20th century, the Seto were predominantly illiterate. Administratively belonging to Pskov Province brought about Russification; however, after the Estonian War of Independence (1920), when the historical settlement of the Seto was incorporated into the Republic of Estonia, the new government started to assign Seto surnames and establish village schools that taught in Estonian, at which time rapid Estonianization began [27,31,32]. Both Võro and Seto are commonly regarded as dialects of the Estonian language; however, the language carriers themselves consider them separate languages, and according to UNESCO, both are endangered languages. The Seto faith is a mixture of paganism and Christian Orthodoxy, whereas in neighboring Võromaa, Estonians are Lutheran and the Russians Orthodox Christians.

Throughout history, Setomaa and part of Võromaa have had a lower standard of living compared with the rest of Estonia. The main reasons for this are the low fertility of the soils and very small farmlands of these regions. Since farms were small, they have always been engaged in growing vegetables: Mainly cucumbers, onions, and strawberries [33–35]. No large-scale industrial production has existed in the area and the small industries, even today, are mostly involved in the production of small-scale crafts, especially ceramics. Today, forestry and the timber industry also provide jobs. Historically, trading and brokerage have also been an important source of income. Overpopulation and poverty have led to many waves of mass emigration. The first was from the end of the 19th century to the beginning of the 20th century, when during the Czarist Siberian colonization campaign, the Seto moved into the area between Yenisei Province (today Krasnoyarsk Krai), and the Kan and Mana rivers. Newcomers were exempt from state taxes, land was given free of charge and settlement infrastructure was supported [36]. Since the 1920s, labor migration has been actively practiced, mainly in the spring-summer-autumn period. Above all, the Seto travelled to the inlands of Estonia as well as to Latvia. In addition, the Seto relocated in order to work in the large industrial enterprises of northern Estonia, forming small but vivid communities in the nearby regions [37–40]. Migration has also occurred within Setomaa. When the majority of the area was incorporated into the Russian SFSR after the Second World War, administration came under Russian control. This and the closure of Estonian-language schools led to the first major movement of people to the Estonian side of the region. The second major migration to Estonia took place in 1997, when the border of the newly independent Republic of Estonia was effectively closed, and the Estonian state began to provide support for relocation [25]. The economic disadvantages of the area have persisted to the present day, which has led to the decline of younger people in the area due to migration to cities [31].

### 2.2. Fieldwork

Fieldwork was carried out in the summer of 2018 and 2019 and covered historical Võromaa and the portion of historical Setomaa, which is still part of present-day Estonia. The sample included people who had either lived their entire lives in the same area or had been studying or working elsewhere in Estonia and had now returned. The youngest interviewee was 35 years old, while the oldest was 93 years old; detailed demographical data for the interviewees is provided in Table 1.

**Table 1.** Demographic information about the interviewees.

| **Language Group** | **Seto** | | **Võro, Estonian** | |
|---|---|---|---|---|
| **Gender** | F | M | F | M |
| Number of people | 22 | 15 | 19 | 16 |
| Total number of people | 37 | | 35 | |
| Mean age | 70 | 66 | 68 | 69 |
| Religions | Orthodox mixed with paganism/non-believer | | Lutheran/Orthodox/non-believer or own religion (mixed religion or tradition/nature believer) | |
| Educational composition | Proportionally divided between primary, secondary and high school and university-level education. | | | |
| Origin | Local Setos and Setos who earlier lived on the Russia side of the border | | Local non-Setos living in the territory of historical Setomaa and Võromaa. | |
| Languages spoken by parents | Seto | | Mostly Võro, less than 10% Tartu dialect or one of the parents a Russian speaker. | |

We asked the interview questions in Estonian but urged interviewees to answer in their native dialect if this was more comfortable for them. The study goals were explained to the interviewees and oral or written consent was obtained. On permission of the participants, the interviews were recorded. The study was approved by the Ethics Committee of Università Ca' Foscari and strictly followed the ethical guidelines outlined by the International Society of Ethnobiology [41]. We conducted semi-structured interviews lasting from 30 min to over 2 h covering food, medicinal, and other uses of plants.

For the wild food plant section of the interview, which was conducted first, initial "free listing" was followed by questions regarding specific foods or additives to specific foods that were made (soups, salads, fermentations, hot dishes, spices, etc.) and the wild food plants involved in their preparation. If some of the plants included in the free listing were not subsequently mentioned, the respondent's attention was guided to those as well. We also asked where the person had learned the use and when exactly was the first/last use of the plant. The initial interview was followed, whenever possible (in ca 50% of cases), by a walk in the interviewee's garden, surrounding meadows, or forest. Quite often people pointed out new plants or uses not mentioned during the main interview when they saw the plant in its natural habitat. We also carried out participant observation in local fairs, markets, and public festivals, and visited small producers, museums, and eateries in the area.

Plants were identified on site and, whenever possible, herbarium specimens and, if offered by interviewees, dry plant samples were collected. All voucher specimens and dried samples were stored at the Herbarium of Ca' Foscari Univeristy of Vence (UVV) bearing herbarium numbers SE001–SE141 and SEDR001–SEDR051. If the specimen was not available, the plant was identified on the basis of its popular name and full description of the plant and its habitat. Latin plant names are provided according to The Plant List [42], and families are assigned according to the Angiosperm Phylogeny Website [43]. Some taxa were identified only on the genus/family level or given as a collective name as they are perceived this way by people, even if voucher specimens were present for specific species of the genus, in order to avoid over-identification.

### 2.3. Data Processing and Analysis

The field recordings were transcribed into text and in the few cases where recording was not allowed, the interview context was reconstructed on the basis of field notes as soon as possible following the interview. The data on the wild food plants was subsequently entered into an Excel spreadsheet based on detailed use records (DUR, a number of use records considering all details of use, e.g., the plant part and specific preparation involved sensu [16]). As wild food plants, we considered all plants used for food that grow without direct human involvement, including those naturalized or those cultivated for non-food proposes (e.g., [44]).

To understand if differences still exist between the groups on an ethno-linguistic level, we divided our interviewees into two groups (see Table 1) and analyzed the results on the following temporal scale:

Past uses (no longer in active use):

CH–abandoned in childhood and used by the informant's parents, grandparents, or themselves as a child (circa 1940s–1950s),

AB–abandoned in adulthood (circa 1960s–1990s), and

AD–temporarily used in adulthood (circa 1970s–2000s).

Current uses:

AT–always used (used more or less continually from childhood to the present), and

NW–learned only recently (since circa 2000, but mainly the last 5 years).

We further compared past and current uses mentioned during interviews to qualitatively assess if and how a recently imposed border and being cut-off from the regional attraction center have affected the use of wild food plants within the lifetime of the person. In the comparative analysis, we used RAWGraphs [45].

### 2.4. Comparison with Historical Data

In the ethnographic literature, as well as in archival texts, we searched for data on Räpina, Vastseliina, Rõuge, and Põlva parishes and also Setomaa. We used articles [46–51] by Aliise Moora (1900–1996), a researcher of Estonian food culture. These articles were based on data collected before the Second World War by the Estonian National Museum (ERM) and the Estonian Folklore Archives (ERA). Before the war, and after, the collection of cultural heritage took place for the preservation of knowledge and the emphasis was mainly on quantity; in other words, to collect a lot of everything. The staff of the Archives published a new survey questionnaire each year and they were mostly engaged in archiving incoming information and preparing new survey plans but not their analysis. Moora later acknowledged the shortcomings of this earlier method of collecting food culture. There was no communication with the correspondents and the archive staff did not notice any limitations in the material submitted or the specifics that could have given the material a qualitative dimension (e.g., [52]). Thus, there were also major shortcomings in the collection of data on the consumption of wild species. Many lists were submitted by respondents, but the information on what the food was made of, how the plants were collected, or whether the listed plants were actually eaten and when was very scarce [47]. Therefore, the ethnographic material allows generalizations only in restricted cases, for example, regarding the use of the culturally most important wild berries [53].

In addition to the ethnographic literature, we also looked through the manuscript collections of the Estonian Folklore Archives (ERA) and the Estonian National Museum (ERM). The most important early ethnobotanical collection [54] was compiled by Gustav Vilbaste (1885–1967), a teacher, conservationist and botanist. Vilbaste began collecting popular plant names and plant uses as early as 1907 and he collected them until his death. He conducted fieldwork and also had a large network of correspondents with whom he actively communicated. From the earlier collections, we also looked through the aforementioned Jakob Hurt's Folklore Collection [55] and the Estonian Folklore Archives

Collection [56]. In the ERM, we reviewed data from the archive of correspondent responses up to the 1960s, mainly on the use of tea and herbs, to which Moora did not pay much attention [57]. Because the ethnobotanical material was collected using various methods and somewhat chaotically, it can only be used for qualitative analysis, while quantitative comparisons with the current data cannot be made. When analyzing popular plant names, we proceeded from the book: "Nomina vernacula plantarum Estoniae" [58].

## 3. Results and Discussion

Of the 63 taxa used in the region, 58 were identified on the species level, 4 on the genus level, and one on the family level (Table 2). Of the 26 families represented, the most numerous were Rosaceae (13 taxa), Lamiaceae and Ericaceae (6 taxa each), and Betulaceae and Poaceae (4 taxa each). The most commonly used taxa were three *Vaccinium* species, including *Vaccinium oxycoccos* (187 DUR), *Vaccinium myrtillus* (177 DUR), and *Vaccinium vitis-idaea* (142 DUR), followed by *Betula* (107 DUR) and *Fragaria vesca* (100). Therefore, the most widely used families were Ericaceae (526 DUR), Rosaceae (365 DUR), and Betulaceae (162 DUR). The most popular food categories were snacks (655 DUR), recreational tea (207 DUR), jam (178 DUR), and drinks (127 DUR) (Figure 2).

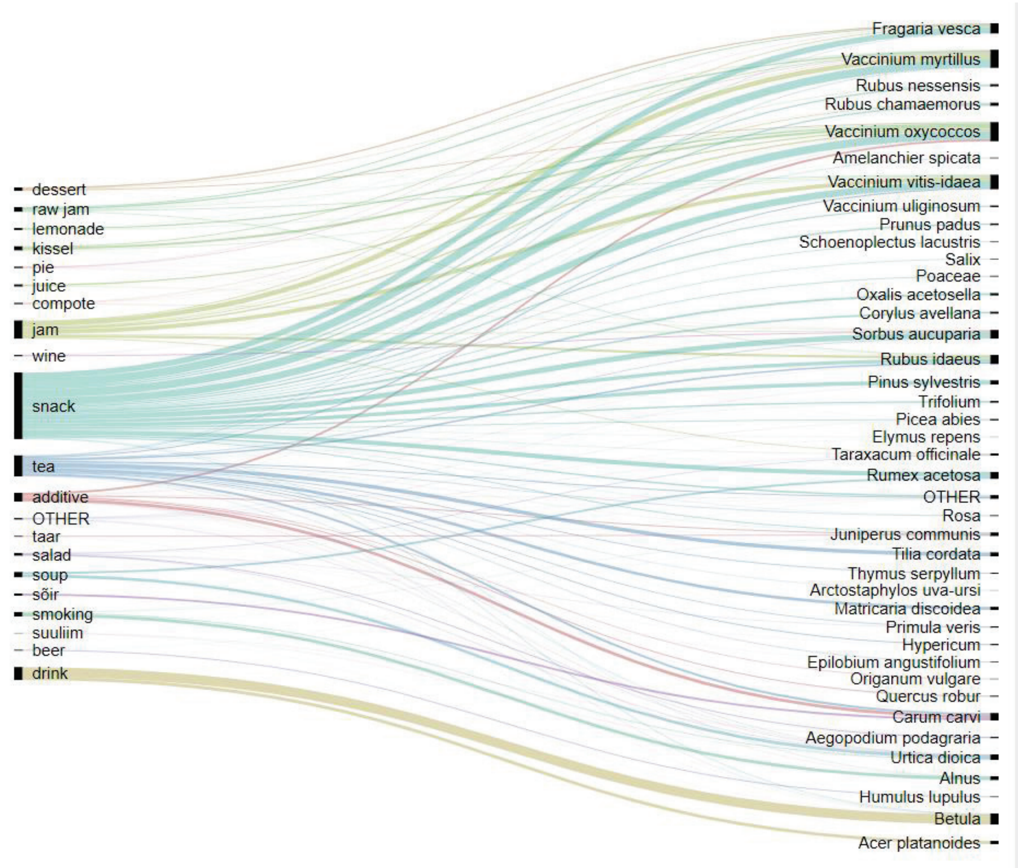


**Figure 2.** Alluvial diagram of the relationship between the food made and the wild taxa used by both Seto and Estonians together. "Other" refers to taxa/uses with less than 4 detailed use records (DUR).

**Table 2.** Wild food plants use by Setos ($n$ = 37)/Estonians ($n$ = 35).

| Latin Name | Local Name (Plural) | Parts Used | Preparation | Food | Past Uses (DUR) | | | Current Uses (DUR) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | CH | AB | AD | NW | AT |
| | | | Adoxaceae | | | | | | |
| *Viburnum opulus* L. | Lodjapuu [B], lodjappuu [B] | Fruits | Frozen | Eaten [V] | | | | | |
| | | | Amaranthaceae | | | | | | |
| *Chenopodium album* L. | Malts [A], hanemalts [A] | Young plants | Cooked | Soup [V] | | | | | |
| | | | Apiaceae | | | | | | |
| *Aegopodium podagraria* L. (UVV.EB:SE108) | Naat(id) [A], varesjalg [B] | Young leaves | Cooked | Omelette | | | /1 | | |
| | | | | Soup [V] | | | 1 | | |
| | | | | Famine food [S] | | | | | |
| | | | Fresh | *Suuliim* | | | | 1/1 | |
| | | | | Snack | | | | /1 | |
| | | | | Salad | | | 5 | 1/2 | |
| *Angelica sylvestris* L. | Tjägil [NF], pütsk [B], pujokõnõ [NA] | Roots | Dried | Additive to vodka | /1 | | | | |
| | | Stems | Fresh | Snack [V] | 1 | | | | |
| *Carum carvi* L. (UVV.EB:SE31) | Köömen (ed) [A], küümen (ed) [B], küümne (d) [B] | Seeds | Dried | Additive to red beetroot salad | 1 | | | | |
| | | | | Additive to sauerkraut | /1 | 3/11 | | | 1 |
| | | | | Seasoning for fish | | | | | /1 |
| | | | | Seasoning for curds [S] | 1/1 | | | | |
| | | | | Seasoning for food [V] | 1 | | | | |
| | | | | Seasoning for bread [S, V] | 3/3 | | | | |
| | | | | *Sõir* | 7/6 | 2/2 | /1 | 1 | 1 |
| | | | | Tea [S, V] | 4/8 | 1/4 | /1 | | 2/4 |
| | | | | Seasoning for white bread [V] | | | | | |

**Table 2.** *Cont.*

| Latin Name | Local Name (Plural) | Parts Used | Preparation | Food | Past Uses (DUR) | | | Current Uses (DUR) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | CH | AB | AD | NW | AT |
| Asparagaceae | | | | | | | | | |
| *Maianthemum bifolium* (L.) F.W.Schmidt | Varsakabja [B] | Fruits | Fresh | Snack [V] | | | | | |
| Asteraceae | | | | | | | | | |
| *Achillea millefolium* L. (UVV.EB: SE062, SE077, SEDR009) | Raudrohi [A] | Inflorescences | Dried | Tea | | | | 2/1 | |
| *Artemisia absinthium* L. | Pälünä [B], pälüna [B], pännüla [B] | Inflorescences | Dried | Tea [S] | | | | | |
| | | | | Seasoning for *taar* [V] | | | | | |
| *Arctium tomentosum* Mill. | takjas [A] | Leaves | Cooked | Soup [Vk, Sk] | | | | | |
| *Cirsium arvense* (L.) Scop. | Põldohakas [A], naadid [NA], ohtkja [B], ohtja [B], ohaka [A], põldohtjas [NA] | Young plant | Cooked | Soup [V] | | | | | |
| | | | | Famine bread [S, V, Vk] | | | | | |
| *Matricaria discoidea* DC. (UVV.EB: SEDR002, SEDR019, SE017, SE066, SE043, SE005) | Murukummel [NF], morokummel [NF], tsäihain [NF], ubinhain [B], upinhain [B], kummel [A], hoovikummel [NA], ubinhein [B], upinhein [B] | Aerial parts | Dried | Tea [S, V] | 14/4 | 4 | 1/2 | | 3/1 |
| | | Flowers | Dried | Tea | | | | | 1 |
| *Taraxacum officinale* F.H.Wigg. s.l. (UVV.EB: SE107) | Võilill [A] | Flowers | Cooked | "Honey" | | 2/3 | 2/2 | | |
| | | Flowers | Fresh | Snack | | | 1 | | /1 |
| | | Leaves | Fresh | Salad | | | 3 | /2 | |
| | | Leaves | Fresh | Snack | | | 1 | | |
| | | Roots | Fresh | Snack | | | 1 | | |
| | | Roots | Roasted | Coffee substitute | | /1 | 1 | | |
| *Tussilago farfara* L. | paiseleht | Leaves | Cooked | Soup [Vk] | | | | | |
| Betulaceae | | | | | | | | | |
| *Alnus glutinosa* (L.) Gaertn. | Must lepp [A] | Wood | Burned | Meat and fish smoking | | | | | /1 |

**Table 2.** *Cont.*

| Latin Name | Local Name (Plural) | Parts Used | Preparation | Food | Past Uses (DUR) | | | Current Uses (DUR) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | CH | AB | AD | NW | AT |
| *Alnus incana* (L.) Moench (UVV.EB: SE121) | Hall lepp $^{A}$, tavaline lepp $^{NF}$, valge lepp $^{A}$, lepp $^{A}$ | Cambium | Fresh | Snack $^{S}$ | /4 | | | | |
| | | Wood | Burned | Meat and fish smoking | 1 | 2/3 | | | /6 |
| | | | | meat smoking | /1 | 3/6 | | | 3/1 |
| | | | Burned to charcoal | Clean homemade vodka | | 2 | | | |
| | | Wood and leaves | Burned | Meat and fish smoking | | | | | 1/1 |
| | | | | Meat smoking | | 1 | | | 1 |
| *Betula* spp. (incl. *Betula pendula* Roth & *B. pubescens* Ehrh.) (UVV.EB: SE117, SE076) | Kask $^{A}$, kõo $^{B}$, kõivo $^{NF}$, kõiv (u) $^{B}$ | Buds | Dried | Tea | | | 1 | /1 | |
| | | Cambium | Fresh | Snack $^{S}$ | 2/4 | | | | |
| | | Leaves | Dried | Tea | 1 | | | | |
| | | Sap | Fermented | Drink $^{V}$ | 6/5 | 5/12 | | | 9/4 |
| | | | | *Suuliim* | 1 | | | | |
| | | | | *Taar* | /1 | | | | |
| | | | Fresh | Drink $^{S, V}$ | 4/4 | 4/7 | | | 14/15 |
| | | | Frozen | Drink | | | | /6 | 2 |
| | | | Boiled | Syrup $^{V}$ | | | | | |
| | | Wood | Burned to charcoal | Clean homemade vodka | | 1 | | | |
| *Betula pendula* Roth | Aro kõiv $^{B}$, mahla kõiv $^{NA}$ | Sap | Fresh | Drink $^{V}$ | | | | | |
| *Corylus avellana* L. (UVV.EB: SEDR015, SE018) | Pähkel $^{A}$, sarapuu $^{A}$ | Seeds | Dried | Snack $^{S}$ | 2/4 | 1/4 | 2/1 | | 2/2 |
| | | | | Milled for cakes $^{V}$ | | | | | |
| Bryophyta | | | | | | | | | |
| Bryophyta | Sammal $^{A}$ | Aerial parts | Dried | Famine bread $^{S}$ | | | | | |

**Table 2.** *Cont.*

| Latin Name | Local Name (Plural) | Parts Used | Preparation | Food | Past Uses (DUR) | | | Current Uses (DUR) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | CH | AB | AD | NW | AT |
| Cannabaceae | | | | | | | | | |
| *Humulus lupulus* L. (UVV.EB: SE028) | Humal [A] | Cones | Fermented | Additive to beer [V] | 2/3 | /1 | 1/1 | | |
| | | | | Additive to taar [V] | | | | | |
| | | Young plant | Cooked | Famine bread [Vk] | | | | | |
| Caprifoliaceae | | | | | | | | | |
| *Valeriana officinalis* L. (UVV.EB: SE123) | Palderjan [A] | Roots | Dried | Additive to vodka [V] | | 1 | | | |
| | | Flowers | Fresh | Additive to vodka [V] | | | | | |
| Caryophyllaceae | | | | | | | | | |
| *Stellaria media* (L.) Vill. (UVV.EB: SE069) | Nätsern [B], vesihein [A] | Aerial parts | Fresh | Salad | | | 1 | | |
| Cupressaceae | | | | | | | | | |
| *Juniperus communis* L. (UVV.EB: SE116) | Kadakas [A], kadaja [B], kattai [B] | Fruits | Dried | Tea | 1/1 | | | | |
| | | | Fermented | *Kali* [S, Vk, Sk] | 1 | | | | |
| | | | | *Taar* [S, V, Vk, Sk] | 6 | 2 | | | |
| | | | | Beer [V, Vk, Sk] | | | | | |
| | | | Fresh | Additive to fermented birch sap | 1 | | | | 1 |
| | | | | Marinade for game meat | | | | 1 | |
| | | | | Snack | 1 | | /1 | 1 | 3/4 |
| | | Twigs | Burned | Meat smoking | 1 | /1 | | | 1 |
| | | | Fermented | Filter for *taar* | 1 | | | | |
| | | | | *Taar* | 1 | | | | |
| | | | Fresh | Additive to *kali* | /3 | 1 | | | |
| | | | Fermented | Filter for beer | | 1 | | | |

**Table 2.** *Cont.*

| Latin Name | Local Name (Plural) | Parts Used | Preparation | Food | Past Uses (DUR) | | | Current Uses (DUR) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | CH | AB | AD | NW | AT |
| Cyperaceae | | | | | | | | | |
| *Schoenoplectus lacustris* (L.) Palla (UVV.EB: SE053) | Pütsk [NF], luga [B], jõeluga [NF], plukna [NF], lug'n [NF] | Lower end of white stem | Fresh | Snack | 4/4 | | | | |
| Dennstaedtiaceae | | | | | | | | | |
| *Pteridium aquilinum* (L.) Kuhn | Käpiline sõnajalg [NA], sõnajalg [A] | Roots | Cooked | Famine bread [S] | | | | | |
| | | Leaves | Cooked | Famine bread [S, V] | | | | | |
| Equisetaceae | | | | | | | | | |
| *Equisetum arvense* L. (UVV.EB: SE020, SE088) | Põldosi [A], maapähkel [NF] | Tubers | Fresh | Snack | /1 | | | | |
| | | Young plant | Cooked | Famine bread [Vk] | | | | | |
| Ericaceae | | | | | | | | | |
| *Arctostaphylos uva-ursi* (L.) Spreng. | Leesikas [A] | Leaves | Dried | Tea | 1 | | | | /3 |
| *Calluna vulgaris* (L.) Hull | Kanarbik [A] | Aerial parts | Dried | Famine bread [Vk] | | | | | |
| *Empetrum nigrum* L. (UVV.EB: SE110) | Karumustikas [NF] | Fruits | Cooked with *Vaccinium myrtillus* | Jam | | | | | /1 |
| | | | Fresh | Snack | | | | | /1 |
| *Ledum palustre* L. | Sookikka [B], sookail [A] | Flowers | Fresh | Additive to *taar* [V] | | | | | |
| *Vaccinium myrtillus* L. (UVV.EB: SE021) | Mustikas (d) [A], mustik [B], mustk' [B], mustka [B] | Aerial parts | Dried | Tea [V] | 1/2 | | /1 | | 2 |
| | | Flowers | Dried | Tea [S] | | | | | |
| | | Fruits | Cooked | Compote | | 1/1 | | | /2 |
| | | | | Jam [V] | 3/4 | 14/11 | 1/1 | | 7/9 |
| | | | | Jam without sugar | 2 | | | | |
| | | | | Kissel | 1/2 | 1 | 1 | | 3/2 |
| | | | | Lemonade | | | | | 1 |

**Table 2.** *Cont.*

| Latin Name | Local Name (Plural) | Parts Used | Preparation | Food | Past Uses (DUR) | | | Current Uses (DUR) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | CH | AB | AD | NW | AT |
| | | | Dried | Snack | | 3 | | | |
| | | | | Additive to vodka [S, V] | | | | | |
| | | | Fermented | Wine [V] | | | 1 | | |
| | | | Fresh | Pie | 1/2 | 1 | 1 | 1 | 1 |
| | | | | Dessert | 1 | 1 | | 1 | /1 |
| | | | | Snack [V] | 2/4 | 7/7 | /1 | | 26/22 |
| | | | Frozen | Raw jam | | /1 | 1 | 6/7 | |
| | | | | Food | | 2 | 1/1 | 3/6 | |
| | | | Jam | Lemonade | | /1 | | | |
| | | | | Tea | 1 | | | | |
| | | | Dried | Tea | | | | | 1 |
| | | | Stored in water | Snack | 1 | /1 | | | |
| | | | Steamed | Juice | | /1 | | | |
| *Vaccinium oxycoccos* L. (UVV.EB: SE109) | Jõhvikas (d) [A], kuremari (ad) [B], kuremara' [B], kurõmari ('a) [NF], kurõmarä [NA] | Fruits | Cooked | Compote | | /1 | | | |
| | | | | Jam | 1/1 | 7/3 | | | 3/2 |
| | | | | Juice | 1 | 5/1 | /1 | | 2/4 |
| | | | | Kissel | 1/3 | 7/5 | /1 | | 5/1 |
| | | | | Semolina foam | | 2/2 | /2 | | 2 |
| | | | Fermented | Additive to sauerkraut [V] | 3/3 | 3/6 | | | |
| | | | | Wine | | | 1/1 | | |
| | | | Fresh | Additive to fermented birch sap | 1 | 1 | | | |
| | | | | Lemonade | 1/1 | 4/3 | | | 3/1 |

**Table 2.** *Cont*.

| Latin Name | Local Name (Plural) | Parts Used | Preparation | Food | Past Uses (DUR) | | | Current Uses (DUR) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | CH | AB | AD | NW | AT |
| | | | | Snack [V] | 1/2 | 12/12 | /1 | | 21/12 |
| | | | | Sugar candies | | 1 | 1 | | 1 |
| | | | | Tea | | | | | /3 |
| | | | Frozen | Raw jam | | | | /1 | |
| | | | | Food | | | 1/1 | 2/3 | 1 |
| | | | Macerated in vodka | Homemade liqueur | | | /4 | | |
| | | | Stored in water | Snack | 1/3 | 5/6 | /1 | 1 | 4 |
| *Vaccinium uliginosum* L. (UVV.EB: SE036) | Joovikad [B], joovhke [NA], sinikas (d) [A], karumustikad [NF] | Fruits | Cooked | Jam | /1 | | | | /1 |
| | | | Fresh | Snack [V] | 4/4 | | | | 2/2 |
| | | | Fermented | Wine [V] | | | | | |
| *Vaccinium vitis-idaea* L. (UVV.EB: SE035, SE127) | | Aerial parts | Dried | Tea [V] | 4/1 | | 1 | | |
| | Pohl (ad) [A], palukas (d) [B], palohkas (d) [B] | Flowers | Dried | Tea [S, V] | | /1 | | | |
| | | Fruits | Cooked | Compote | | /1 | | | |
| | | | | Jam [V] | 1/5 | 11/9 | /2 | 1 | 3/11 |
| | | | | Jam without sugar | | 1 | | 1 | |
| | | | | Juice | | | | 1 | |
| | | | | Kissel | | 1 | /1 | | 2/1 |
| | | | | Lemonade | | | | | 1 |
| | | | Fresh | Toppins to ice cream | | | | 1 | |
| | | | | Pie | | | | 1 | |
| | | | | Snack [V] | /3 | 8/12 | 1/1 | | 18/20 |
| | | | | Raw jam | 1 | | /1 | | |

**Table 2.** *Cont*.

| Latin Name | Local Name (Plural) | Parts Used | Preparation | Food | Past Uses (DUR) | | | Current Uses (DUR) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | CH | AB | AD | NW | AT |
| | | | Frozen | Raw jam | | | | 1 | |
| | | | Frozen | Food | | | /1 | 4/6 | |
| | | | Jam | Additive to red beetroot salad | /1 | | | | |
| | | | Jam | Lemonade | | /1 | | | /1 |
| | | | Jam | Tea | 1 | | /1 | | |
| | | | Stored in water | Snack | 1/1 | 2 | | | |
| | | Leaves | Dried | Tea | | | | | 1/3 |
| Fagaceae | | | | | | | | | |
| *Quercus robur* L. (UVV.EB: SE100) | Tamm [A] | Acorns | Roasted | Coffee substitute [V] | | | /1 | | |
| | | Acorns | Dried | Additive to *taar* [V] | | | | | |
| | | Bark | Fresh | Additive to homemade vodka | | 3 | /3 | | |
| | | Leaves | Fresh | Additive to fermented cucumbers [V] | | 1 | | | 2 |
| Grossulariaceae | | | | | | | | | |
| *Ribes nigrum* L. | Must sõstar [A], sitke [B] | Fruits | Fresh | Snack [V] | | | | | /1 |
| | | Buds | Fresh | Smoothie | | | | /1 | |
| | | Leaves | Dried | Tea | | | | /1 | |
| | | Leaves | Cooked | Famine bread [Vk] | | | | | |

**Table 2.** *Cont.*

| Latin Name | Local Name (Plural) | Parts Used | Preparation | Food | Past Uses (DUR) | | | Current Uses (DUR) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | CH | AB | AD | NW | AT |
| | | | Hypericaceae | | | | | | |
| *Hypericum* spp. (incl. *Hypericum perforatum* L. & *H. maculatum*) (UVV.EB: SE059, SE002, SE003, SEDR012, SEDR028, SEDR020, SEDR031) | | Aerial parts | Dried | Tea | 2 | 3 | 1/1 | 1/1 | /1 |
| | Naistepuna [A] | Flowers | Fresh | Salad | | | /1 | | |
| | | | Lamiaceae | | | | | | |
| *Lamium album* L. | valgete õitega nõges [NF], mesinõges [NF], piimanõges [A] | Flowers | Fresh | Snack, flower sucked | /3 | | | | |
| *Mentha aquatica* L. | Piparmünt [NF], metsik piparmünt [NF] | Aerial parts | Dried | Tea | | | 1 | /1 | |
| *Mentha arvensis* L. | Piparmünt [B], põldmünt [A] | Aerial parts | Dried | Tea | | | /1 | | |
| *Origanum vulgare* L. (UVV.EB: SEDR032, SE082, SE090) | Pune [A], mets-majoraan [NF], majoraan [NF], vorstirohi [A], maioroon [NA] | Aerial parts | Dried | Seasoning for blood pudding [V] | /1 | /5 | | | |
| | | | | Seasoning for food [V] | | | | | |
| *Prunella vulgaris* L. (UVV.EB: SE067, SE081) | Käbihein [A] | Flowers | Fresh | Snack, flower sucked | /1 | | | | |
| *Thymus serpyllum* L. (UVV.EB: SE037, SEDR008) | Nõmm-liivatee [A], jaanihain [NF], jaanilill [NF], liivatee [A], lilla jaanihain [NF], maarjaheina [B], kolmekõrraline rohi [B], tiimjas [NA] | Aerial parts | Dried | Tea [S,V] | 4 | | 1 | | 4 |
| | | | | Seasoning for sausage [V] | | | | | |
| | | | Leguminosae | | | | | | |
| *Lotus corniculatus* L. | Virapool [B] | Aerial parts | Dried | Tea [S] | | | | | |
| *Trifolium hybridum* L. | Roosa ristikhein [NF] | Flowers | Fresh | Snack, flower sucked | | 1 | | | |
| *Trifolium montanum* L. | Tsäihain [NF] | Aerial parts | Dried | Tea | 1 | | | | |
| *Trifolium pratense* L. (UVV.EB: SE085) | Ristik [A], ristikhein [B], ristikhaani [B], punane ristik [A] | Flowers | Fresh | Snack, flower sucked | 3/5 | | | | |
| | | | Dried | Tea [S,V] | | | | | |
| *Trifolium repens* L. (UVV.EB: SE032) | Maa-ristikhein [NF], maa-ristik [NF], valge ristikhein [NF], valge ristik [A], tsäi hain [B] | Flowers | Dried | Tea [S] | | | 1/1 | | |
| | | | Fresh | Snack, flower sucked | /3 | /1 | | | 1 |

**Table 2.** *Cont.*

| Latin Name | Local Name (Plural) | Parts Used | Preparation | Food | Past Uses (DUR) | | | Current Uses (DUR) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | CH | AB | AD | NW | AT |
| | | | Malvaceae | | | | | | |
| *Tilia cordata* Mill. (UVV.EB: SE087, SE006, SEDR007, SEDR023, SEDR025, SEDR030, SEDR040) | | Buds | Fresh | Snack | | | | /1 | |
| | Pärn [A], lõhmus [A], pähn [B], pähnapuu [B] | Flowers | Dried | Tea [V] | 2 | 1 | 2/1 | 1 | 14/17 |
| | | Catkins | Fresh | Tea [V] | | | | | |
| | | Young twigs | Fresh | Tea [V] | | | | | |
| | | | **Oleaceae** | | | | | | |
| *Fraxinus excelsior* L. | Saar [A] | Wood | Burned | Meat smoking | | /1 | | | |
| | | | Onagraceae | | | | | | |
| *Epilobium angustifolium* L. (UVV.EB: SE049, SEDR034, SEDR036, SEDR037) | Põdrakanep [A], ivan-tšai [NF], pajulill [A] | Flowering tops | Dried | Tea | 1 | | /1 | 4 | |
| | | Leaves | Fermented | Tea | | | | /1 | |
| | | | | Salad | | | | /1 | |
| | | | Oxalidaceae | | | | | | |
| *Oxalis acetosella* L. (UVV.EB: SE118) | Jänesekapsas [A], jäneshein [NF], oblikas [NF], hapuoblikas [NF] | Leaves | Fresh | Snack [V] | 7/8 | /2 | | | 1/4 |
| | | | | Soup [V] | /1 | | | | |
| | | | Pinaceae | | | | | | |
| *Picea abies* (L.) H.Karst. (UVV.EB: SE126) | Kuusk [A], kuus [B] | Resin | Fresh | Snack | /2 | | | | |
| | | Shoots | Dried | Pie | /1 | | | | |
| | | | | Tea | | | | /1 | |
| | | | Fresh | Snack | 1/1 | | 1 | 1/1 | /2 |
| | | | | Taste-butter | | | | 1 | |
| | | | Frozen | Smoothie | | | | /1 | |
| *Pinus sylvestris* L. (UVV.EB: SE120) | Mänd [A], pedaja [B], pedäja [B], pettäi [B] | Cambium | Fresh | Snack [S] | 16 | | | | |
| | | Shoots | Cooked | Syrup | | | | 1/1 | |
| | | | Dried | Tea [V] | 1 | | | | |
| | | | Fresh | Snack | 20/2 | | | | 1 |

**Table 2.** *Cont.*

| Latin Name | Local Name (Plural) | Parts Used | Preparation | Food | Past Uses (DUR) | | | Current Uses (DUR) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | CH | AB | AD | NW | AT |
| | | | Poaceae | | | | | | |
| *Elymus repens* (L.) Gould | Orashein [A] | Roots | Cooked | Food | | | /1 | | |
| | | Roots | Fresh | Snack | /1 | | | | |
| | | Stems | Fresh | Snack | /2 | | | | |
| *Phleum* spp. (incl. Phleum pratense L. & P. pratense subsp. bertolonii (UVV.EB: SE124) | Timut [A], timmut [B], timmat [B] | Stems | Fresh | Snack | | | | | 1/2 |
| *Phragmites australis* (Cav.) Trin. ex Steud. (UVV.EB: SE091) | Pilliroog [A] | Spring root shoots | Fresh | Snack | /1 | | | | |
| Poaceae | Kõrrelised [A], kastehein [A] | Stems | Fresh | Snack | 3/5 | | | | 1 |
| | | | Polygonaceae | | | | | | |
| *Rumex acetosa* L. (UVV.EB: SE102, SE024, SE009) | Hapuoblikas (d) [A], oblikas (d) [A], hapuhain [B], hapuhein [B], hublikhain [NF], hublikas (d) [NF], hublik [B] | Leaves | Cooked | Kissel | 1 | | | | |
| | | | Cooked | Soup [V] | 5/4 | 3/1 | 2/1 | /1 | 4/2 |
| | | | Cooked | Famine food [S] | | | | | |
| | | | Fresh | Salad | | | | /1 | |
| | | | Fresh | Snack | 13/13 | 5/2 | /1 | | 6/7 |
| | | | Primulaceae | | | | | | |
| *Primula veris* L. (UVV.EB: SEDR003, SEDR039, SEDR042) | Nurmenukk [A], kikkapüks [B] | Flowers | Dried | Tea | | | 3/1 | /1 | 2/2 |
| | | Flowers | Fresh | Snack, flower sucked | | | | | /1 |
| | | Leaves | Fresh | Salad | | | | /3 | |

**Table 2.** *Cont.*

| Latin Name | Local Name (Plural) | Parts Used | Preparation | Food | Past Uses (DUR) | | | Current Uses (DUR) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | CH | AB | AD | NW | AT |
| | | | Rosaceae | | | | | | |
| *Alchemilla vulgaris* auct. (coll.) (UVV.EB: SE080) | Kortsleht [A] | Leaves | Dried | Tea | | | /1 | | |
| *Amelanchier spicata* (Lam.) K.Koch (UVV.EB: SE019) | Poola kirss [NF], mets-aroonia [NF], saksa-toomingas [NF] | Fruits | Cooked | Jam | | | 1/1 | | |
| | | | Fresh | Snack | /1 | | 3/1 | | /1 |
| *Filipendula ulmaria* (L.) Maxim. (UVV.EB: SE041) | Angervaks [A] | Flowers | Dried | Tea | 1 | | | /2 | |
| *Fragaria vesca* L. (UVV.EB: SE022, SE036, SE086) | Maasikas (d) [A], metsmaasikas (d) [A], maasik (a) [A], maask [B], maaska [B], mõtsamaasik [B], mõtsmaasik [B], mõtsamaasiga [B] | Aerial parts | Dried | Tea [V] | | 1/1 | 1 | /1 | |
| | | Fruits | Cooked | Jam | /4 | 1 | /1 | | /4 |
| | | | Dried | Tea | /1 | | | | |
| | | | Fresh | Dessert | 3/2 | 7 | /1 | 1 | /1 |
| | | | | Pie | /1 | | | | 1 |
| | | | | Snack [V] | 5/9 | 7/3 | 1/1 | 1 | 13/15 |
| | | | Frozen | Raw jam | | 2 | /2 | 3/7 | /1 |
| | | | Jam | Pie | /1 | | | | |
| | | Flowers | Dried | Tea [S, V] | | | | | |
| *Malus domestica* Borkh. | Õunapuu [A], kitseuibu [NF] | Fruits | Fresh | Dessert | /1 | | | | |
| *Malus sylvestris* (L.) Mill. | Mõtsk [NF], metsik õunapuu [NF] | Fruits | Frozen | Snack | 1 | | | | |
| *Prunus padus* L. (UVV.EB: SE013) | Toomõ, toom [A], toomingas [A], toomepuu [A], toomik [NF], toomõkõnõ [NF], tuum [B] | Fruits | Fresh | Snack [V] | 5/6 | 2 | /1 | | 2 |
| | | | Raw jam | Pie | 1 | | | | |
| | | Leaves | Fermented | Additive to fermented cucumbers [S] | | | | | |
| *Pyrus pyraster* (L.) Burgsd. | Kruusa [NF], prusa [NF] | Fruits | Frozen | Snack | 2 | | | | |

**Table 2.** *Cont.*

| Latin Name | Local Name (Plural) | Parts Used | Preparation | Food | Past Uses (DUR) | | | Current Uses (DUR) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | CH | AB | AD | NW | AT |
| Rosa sp. (Rosa majalis Herrm. & R. rugosa Thunb.) (UVV.EB: SE139) | Kibuvits [A] | Fruits | Dried | Tea | | | 1/3 | | /2 |
| | | | Fresh | Snack | | | | /1 | /2 |
| *Rubus caesius* L. | Põldmari [A] | Fruits | Fresh | Snack | | | /1 | | |
| *Rubus chamaemorus* L. (UVV.EB: SE111) | Murakas (d) [A], murel [NF], murahka [B] | Calyx | Dried | Tea | | | | | /1 |
| | | Fruits | Cooked | Compote | /1 | /1 | | | |
| | | | | Jam | /1 | /5 | /2 | | 1/2 |
| | | | Fresh | Snack [S] | | 2/2 | 1/3 | | 3/5 |
| | | | Frozen | Raw jam | | | | /1 | |
| | | | Macerated in vodka | Homemade liqueur | | | /1 | | |
| *Rubus idaeus* L. (UVV.EB: SE027, SEDR029b) | Vaarikas (d) [A], metsvaarikas (d) [A], vabarna (d) [A], vavarna [B] | Fruits | Cooked | Compote | | /1 | | | |
| | | | | Jam | 1/3 | 6/4 | 3/2 | | 1/7 |
| | | | | Juice | | /1 | | | |
| | | | | Kissel | | | | | 1 |
| | | | Raw jam | Pie | 1 | | | | |
| | | | Fresh | Snack [V] | 3/4 | 5/4 | 1/1 | /1 | 6/8 |
| | | | Frozen | Raw jam | | | /1 | 1/8 | |
| | | | Jam | Pie | /1 | | | | |
| | | | Fresh | Dessert | | | /1 | | |
| | | | Dried | Tea [V] | | | | | |
| | | Leaves | Fresh | Additive to fermented cucumbers | | 2 | | | |
| | | Stems | Dried | Tea [V] | 3/5 | 3 | 1/1 | | |
| | | | | Coffee substitute [S, V] | | | | | |
| | | | Fresh | Tea | /2 | /1 | | | /1 |
| | | Stems with leaves | Dried | Tea | 1/1 | | | | |
| | | Flowers | Dried | Tea [V] | | | | | |

**Table 2.** *Cont.*

| Latin Name | Local Name (Plural) | Parts Used | Preparation | Food | Past Uses (DUR) | | | Current Uses (DUR) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | CH | AB | AD | NW | AT |
| *Rubus nessensis* Hall (UVV.EB: SE040) | Tsiavabarna [B], tseavabarna [B], metsvabarna [NF], põldmari [A], põldmurakas [NF], kahruvabarna [B], karuvaarikas [B], must vaarikas [A] | Fruits | Cooked | Jam | | 1 | 3 | | 2 |
| | | | Fresh | Snack | 1 | 2 | /1 | | 8/2 |
| | | | Frozen | Raw jam | | | | 1 | |
| *Rubus saxatilis* L. | Linnohka [B] | Fruits | Fermented | Wine [V] | | | | | |
| *Sorbus aucuparia* L. (UVV.EB: SE026) | Pihlakas [A], pihlapuu [A], pihl [A], pihelgas [A] | Fruits | Cooked | Compote | | /1 | 1 | /1 | |
| | | | | Jam | 3 | 1 | 1/2 | | |
| | | | Fresh | Juice | | /3 | | | |
| | | | Dried | Snack | | | | 1 | |
| | | | | Tea | 2/1 | | /1 | 1 | 1 |
| | | | Fermented | Wine [V] | 1/2 | 1/3 | /2 | | |
| | | | | *taar* [V] | | | | | |
| | | | Fresh | Additive to marinated cucumbers | | /1 | | | |
| | | | | Pie | 1 | | | | |
| | | | | Snack [S] | 12/4 | 6/9 | 2/3 | | 6/4 |
| | | | | Additive to vodka [S,V] | | | | | |
| | | | Frozen | Snack [V] | 1/2 | 2 | | | /2 |
| | | Flowers | Dried | Tea [S, V] | | | | | |
| **Salicaceae** | | | | | | | | | |
| *Populus tremula* L. (UVV.EB: SE104) | Haab [A] | Wood | Burned | Meat smoking | | | 1 | | |
| *Salix* spp. (incl. *Salix cinerea* L., *S. aurita* L., *S. myrsinifolia* Salisb., *S. triandra* L. and their hybrids) (UVV.EB: SE044, SE030, SE083) | Paju [A] | Cambium | Fresh | Snack | 3/4 | | | | |
| | | Leaves | Cooked | Famine bread [Vk] | | | | | |

**Table 2.** *Cont.*

| Latin Name | Local Name (Plural) | Parts Used | Preparation | Food | Past Uses (DUR) | | | Current Uses (DUR) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | CH | AB | AD | NW | AT |
| Sapindaceae | | | | | | | | | |
| *Acer platanoides* L. (UVV.EB: SE125) | Vaher [A] | Sap | Fermented | Drink | | | /1 | | |
| | | | Fresh | Drink [V] | 1/3 | 4/8 | 2/2 | | 1/7 |
| | | | Frozen | Drink | | | 1/3 | | |
| | | Catkin | Fresh | Tea [V] | | | | | |
| Urticaceae | | | | | | | | | |
| *Urtica dioica* L. (UVV.EB: SE074) | Nõges [A], kõrvenõges [A], raudnõges [A] | Young aerial parts, leaves | Cooked | Soup | | /1 | | | /1 |
| | | | | Famine bread [Vk] | | | | | |
| | | | Burned | Fish smoking | | | 1/1 | | |
| | | | | Meat smoking | | 1/1 | | | /3 |
| | | | Dried | Cutlet | | | 1 | | |
| | | | | Seasoning for food | | | /1 | | |
| | | | | Tea | | | 3 | /1 | |
| | | | Fresh | Omelette | | | | 1/1 | |
| | | | | Pan-fried | | | | /1 | |
| | | | | Salad | | | 2 | 1/1 | |
| | | | | Soup [V] | 3/5 | 2/2 | 4/4 | 1/2 | 5/1 |
| | | | | *Suuliim* | | | | 1/1 | |
| | | | | To keep crayfish alive | | /1 | | | |

Abbreviations: AB–abandoned in adulthood, AD–temporary used in adulthood, AT–always used, CH–abandoned in childhood, NW–learned only recently (within the last 5 years). Historical data: archive (1880s to 1960s) [(S,V)] and ethnographic literature [(Sk,Vk)] ([S] = historical Setomaa; [V] = historical Võromaa (Räpina, Vastseliina, Rõuge, Põlva–parishes)) that has studied this period and region [46–51]. Plant name analysis based on [58]: [A] = plant name spread all across Estonia, [B] = dialect plant name (Seto and Võro), [NF/NA] = new plant name from field work/archive. *Suuliim* is a traditional cold soup or cold sauce. *Kali* and *taar* are traditional non-alcoholic fermented beverages. *Sõir* is a traditional non-fermented cottage cheese.

The use of plants has changed considerably over time: A smaller number of uses were reported as used now (37%, 603 DUR) compared to those used in the past (67%, 1017 DUR). The currently used taxa consist of a little less than 8% (127 DUR) that were learned recently and 30% (476 DUR) that were used throughout life. Past uses consist of those used only throughout childhood (28%, 446 DUR), those abandoned in adulthood (25%, 401 DUR), and those used only for short time, e.g., learned during adulthood but no longer used (10%, 170 DUR). The division of taxa and uses on a temporal scale shows that the abandonment or acquisition of uses takes place on a personal not community, level. The exceptions are a few taxa (*Salix* sp., *Schoenoplectus lacustris*, *Lamium alba*–all used as snacks) abandoned in childhood and the use of *Achillea millefolium* as recreational tea recently acquired by at least three people (Figure 3a, Table 2). On the level of use, the use of beer and beer-like drinks has been abandoned, while a new food, a cold soup called "suuliim", has recently emerged and the freezing of (mainly) forest and bog berries has become popular (Figure 3b, Table 2).

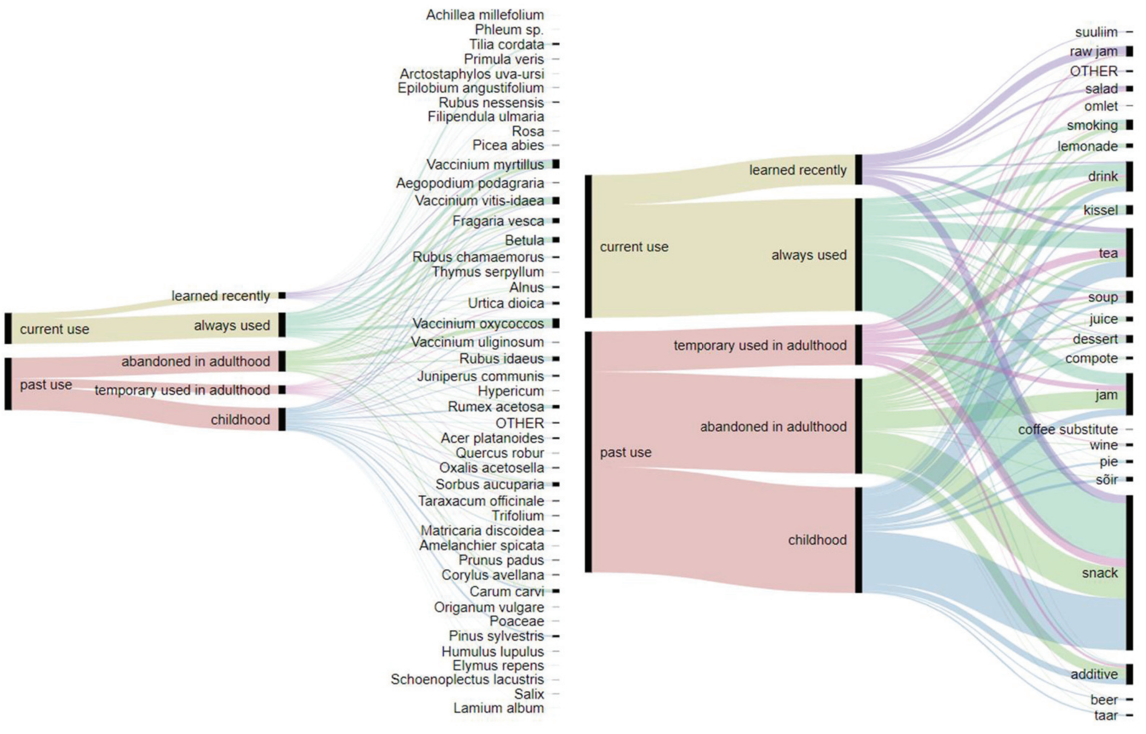


**Figure 3.** Alluvial diagrams outlining (**a**) taxa used and (**b**) food made depending on the time of use.

Only a few forest berries (e.g., *Vaccinium vitis-idaea, Vaccinium myrtillus*) and bogs berries (e.g., *Rubus chamaemorus, Vaccinium oxycoccos*), as well as *Corylus avellana* seeds, were widely collected beyond "walking distance" or outside of random trips in the wild. Table 2 also lists the taxa that people have eaten elsewhere in Estonia if they lived outside of their current area for some time. These uses are exogenous and sporadic, such as eating *Rubus caesius* berries, drinking tea made from *Mentha aquatica*, and eating cooked *Elymus repens* roots. These plants are no longer eaten after returning to a childhood village. For the same reason, *Empetrum nigrum* has been eaten only by those who have lived near bogs, as their parents taught them to recognize the berries. In general, people knew and used more taxa that lived close to their home, and those living close to a bog ate more bog taxa than those who only went to pick specific berries seasonally.

The use of plants by children is a special category, in which uses were passed on only to other children and were not used in later life. Thus, the interviewees who spoke about the use of *Schoenoplectus lacustris, Equisetum arvense, Angelica sylvestris*, and some other childhood snacks had a difficult time recalling their names and were often unsure if the recalled name was correct, as such plants were little spoken about during adulthood. The use of certain plants was copied from other children, older than themselves, without even remembering the clear plant description at that moment. Age-related taste perception was also repeatedly emphasized, as interviewees stated that sour things are no longer desired, and that is why the eating of *Sorbus aucuparia* berries in particular has decreased. They are now being eaten frozen once the bitterness is gone. For the same reason, *Oxalis acetosella* is no longer eaten in adulthood. The same has been observed elsewhere in Estonia, such as on Saaremaa Island [16].

Industrial production has reduced the need for home-made winter conserves and fermented drinks. As in Saaremaa [16], home-made sauerkraut has virtually disappeared and been replaced by shop products. This is the reason why *Vaccinium oxycoccos* and *Carum carvi*, as additives to sauerkraut, were mainly used in the past. Additionally, jam rich in sugar is no longer made, not only because of the availability of jam in shops but also because of the health movement: Jams have been substituted by frozen berries. Our interviewees noted that in the past, fermented beverages, either beer or beer-like low-alcoholic beverages (*taar*), were very common, but today both beverages have been replaced by shop-bought drinks. For this reason, the previously abundant use of wild species as flavoring and preservatives has disappeared. While older people still remembered making fermented *taar*, no one remembered how to make the juniper drink historically typical of the region. The actual making of flavored fermented cereal drinks (*taar*, beer) has disappeared as such drinks are no longer made in homes.

Alcohol culture changed during the Soviet era: We were told that in the pre-Soviet period, vodka drinking was not widespread in villages. On the one hand, this was the result of an active abstinence movement and, on the other, the popularity of home-brewed beer. After World War II, alcohol began to be widely consumed. This custom became more popular after the mass migration of Slavic migrant workers to Estonia, when more people started to drink vodka. Therefore, during Soviet times, illegal alcohol called "handsa" (moonshine) was distilled at home. We were told that after the Moscow Olympics in 1980, when for a short time the shops sold imported berry-liqueurs, various previously unknown home-made berry-liquors emerged.

The planting of a woody tree species near a house has a great impact on its use. *Tilia cordata* is virtually absent in modern (managed) forests and its flowers are harvested from trees planted in gardens and ornamental plots. Planting trees on farms began in the 1930s with the so-called national home decoration campaign. In Soviet times, farm landscapes no longer focused on farmhouses, and new artificial attraction centers, so-called collective farm centers, were created. Lime trees were planted by schools and houses of culture, and their flowers are now being picked from trees in both large courtyards and parks. The same was true for the use of sap from *Acer platanoides*, which rarely grows large enough in modern forests, and thus the sap is taken from trees planted near the house. For a number of interviewees, the tree did not grow close to the house and no one brought it from far away, and as a result many had not even tried the sap.

*Carum carvi* has historically been one of the most widely used seasoning plants. However, there has been a drastic reduction, with only 10 DUR still used nowadays compared to the nearly 60 DUR reported for the past. Even among today's users, only a few pick it from the wild regularly, while most often the seeds are bought from a pharmacy or shop. As in Saaremaa [16], the reason for the decline is that the species is disappearing from the wild mainly because of intensive mowing of roadsides and ceasing maintenance of natural meadows.

In historical Võromaa, smoking meat in a smoke sauna has been one of the most distinctive and well-known ways of preserving meat. Even today, this custom is one of the region's trademarks [59]. Free-standing smoke ovens were first introduced to the region about 50 years ago. The archival data do not contain much information on meat smoking, but this was due to the specifics of the surveys.

### 3.1. Cross-Cultural Analysis

Differences between the Seto and Estonians can be observed on the level of specific taxa or use-group of the plants (Figure 4), i.e., in the details, which need a qualitative approach and further explanation. There were differences on the taxa level depending on the availability of the taxa in the region. A perfect example is *Thymus serpyllum,* which grows in sandy soils in open areas, as this species is common in Setomaa but is only found in some places in Võromaa. Historically, this plant has had many popular names in the area; however, during fieldwork, only the Seto told us about the plant's popular name, collection in nature, and use. Several people pointed out that *T. serpyllum* is disappearing from its usual habitat. Estonians grow this plant in the garden today, but they only use the name derived in the literature and they do not go out to pick it from the wild. Conversely, *Origanum vulgare* is common in meadows, roadside borders, and sparse forests. The use of *O. vulgare* as a tea and herb (for blood sausage) is quite common among Estonians, but we did not record such uses among the Seto. Today, the Seto grow this plant in the garden, using only the official name, but they have never picked it from the wild nor used it as a seasoning in blood sausage. The archives reveal that the first time blood sausages were made in Võromaa (Räpina parish) was in the late 19th century. They were undoubtedly made for Christmas and New Year's; less was done on family holidays. In the 1940s in Võromaa, "vorstirohi" (*Origanum majorana*) was already being grown in herb gardens. However, the Seto that lived near Pechory began to put "vorstirohi" (probably also *O. majorana*) in blood sausages in the 1930s, yet it was bought in shops as a ready-made dry seasoning [57]. This may also be the reason why they did not substitute this seasoning later for the wild one (*O. vulgare*): They could not associate the use of shop-bought seasoning with the local plant.

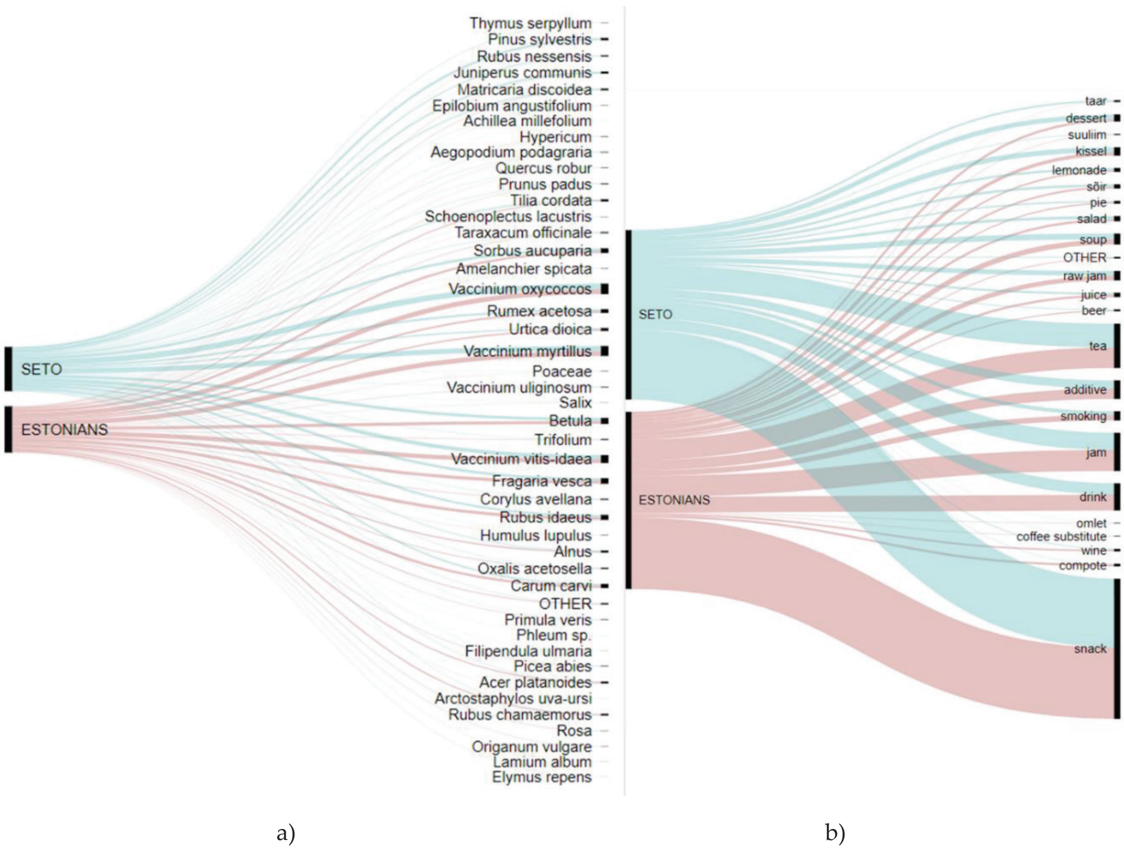


**Figure 4.** Alluvial diagrams representing the differences between the two groups for (**a**) taxa used and (**b**) food made.

Another example is that of *Rubus nessensis*, which is frequently found in south-eastern Estonia. However, this plant had the highest number of local plant names today among the Seto, who claimed to actively collect and eat its berries, while Estonians mentioned eating them solely when living in families together with the Seto. During Soviet times, a warning was circulated that all red berries were poisonous and as parents advised their children not to eat unknown berries, they were not picked. This may also explain why *Rubus saxatilis*, which is not now well known to Estonians and the Seto, and *Rubus nessensis*, which is not common among Estonians, are no longer eaten: The unknown berries were considered to be toxic.

The avoidance of red berries was, in fact, literature driven. While the earliest book introducing fruit use suggested that children should eat the fruits of *Maianthemum bifolium* [60], during the Soviet era, a widespread berry book [61] warned against eating potentially poisonous berries. This is probably the reason why such use is only recorded in the historical data. The same historical book stated that *Viburnum opulus* is poisonous and even birds do not want these berries [60], although for Russians it is quite common as a food plant [62]. The belief that the loss of interest in those berries is related to the reduction in Russian influence in the region is widespread, as historically, in Estonia, this berry has been eaten only in areas adjacent to Russia. Meanwhile, the Russian plant name is still in use: "it is *kalina*, *krasnaja kalina* [in Russian aa]. But we were always warned that they should not be touched, these are poisonous berries" (Seto man, born 1958).

Earlier Estonian literature has clearly had less influence on the Seto. The only herbal book published during the Soviet era, "Eesti NSV ravimtaimed", recommended eating wild plants as a good source of vitamin C [63]; for example, *Primula officinalis* leaves had not been eaten before, but now they are used. The Seto, however, have not embraced this new use. Today's ethnic food cookbooks point out that mashed potatoes with *P. officinalis* leaves are a local Midsummer's Day food [23]. Other iconic examples are desserts (such as syrup) and recreational tea made from the flowers of *Filipendula ulmaria*, which has become a fashionable plant all across Estonia. The use of its leaves in green soups is also common nowadays in Võromaa [22]. The Seto interviewees knew it was popular but had not used it themselves. Only one interviewee recalled that her mother used this plant spontaneously (made tea) because it had flowers that smelled good. However, *Epilobium angustifolium*, which has become popular today due to Russian-language literature, was now used by both Estonians and the Seto (see also [64]). Additionally, the use of *Taraxacum officinale* was not reported in archival texts, and so its use is the result of later literature (ca 1980s). However, respondents noted that due to the bitter taste of this plant, it was only tried for a short time and is therefore not widely used today.

A taste-dependent difference, historically and still today, is that the Seto do not use the cones of *Humulus lupulus* in fermented beverages as they "cause headache". There are many reports of the Seto eating the inner bark of *Pinus sylvestris*, both in the ethnographic literature and in our fieldwork, but no reports from Estonians living in the same area. Additonally, the shoots of pine trees were also mainly eaten by the Seto, while the shoots of another conifer, *Picea abies*, were eaten by Estonians. For the Seto, *P. abies* was considered to have too mild a taste. Although it is mentioned in contemporary literature that the cambium of *Populus tremula* was a widespread treat among Seto children in the spring [19], this was not confirmed in the archives, literature, or our fieldwork.

Differences related to childhood snacks were even more pronounced: When we asked separately about snacks, the Seto reported only eating *Trifolium* sp. flowers, while Estonians also ate the flowers of *Lamium album*, *Prunella vulgaris,* and *Primula veris*. Estonians also snacked on *Tilia cordata* buds, *Elymus repens* stems and roots, *Phragmites australis* spring root shoots, *Rosa* sp. and *Empetrum nigrum* fruits, and *Equisetum arvense* tubers. At the same time, the Seto have exclusively eaten *Pyrus pyraster* and *Malus sylvestris*, which may be due to the fact that those trees are only found in a few places in Setomaa and not in Võromaa.

Among the Seto, there were so-called collective plant names based on utilization. We were repeatedly told by interviewees that in their childhoods, their mothers referred to all herbs (both wild and cultivated) that were used to make tea by the common name "tsäihainad" (translated:

"plants or grass that can make tea"). When asked to recall which particular species their mothers used, they indicated all those that were immediately gathered from the garden and the surrounding environment. Indeed, some species had "tsäihainad" as their only known name (e.g., *Trifolium repens*, *Trifolium montanum*, *Matricaria discoidea*). Our Seto interviewees repeatedly said that *Matricaria discoidea* tea used to be one of the most common recreational teas, but today only a few respondents drink it because the plant has disappeared from yards due to the current intense grass mowing. This tea has never been used among Estonians. Among the Seto, there was also a clear distinction between shop tea and herb tea, the latter of which was called "haina tee" (translated: "grass tea"): "Any plant which could be made into *tšai* (tea) my mum called 'hainad'" (Seto man, born 1953). An important condition for the selection of "haina" (grass tea plants) was the pleasant smell: "There was no (black) tea in my childhood. / — / Mother went to pick plants, and she never said their names to us. At that time, we didn't even know that they were *angervaks*, *põdrakanep*, or those other plants. Mom just showed us the right flowers, and we picked them up. She collected all that smelled good, she said then the tea is good too" (Seto man, born 1958). Similar logic, in which the name of the plant is based on its usage, was also common in Pernau in pre-written South-Estonian (see [65]). An archival text written in the 1940s states that herbal teas began to be widely used in the Võromaa region in the late 19th and early 20th centuries [57]. This coincides with the time when the literature began to promote herbal teas [66].

### 3.2. Diachronic Evaluation (From End of the 19th Century to Today)

The historical use of wild food plants in the region covers only part of the uses that we recorded in this study (Table 2). Our analysis of the historical data shows that compared to the rest of Estonia, the most abundant reports on the use of wild plants during times of famine came from Võromaa and Setomaa, and a large number of the taxa used have not been reported elsewhere in the country. For example, in Rõuge and Põlva parishes, the seeds and aerial parts of *Calluna vulgaris* were crushed, mixed with flour, and made into a kind of cake (*karask*) during the famine of 1860–1870 [47]. The last remembered famine was in the 1860s, when several successive periods of unusual weather caused crop failure and starvation among peasants [67]. Although serfdom was abolished in Estonia in 1868, the archive has several records recalling that during the period of serfdom, food shortages and famine were particularly acute. Later, wild species were used temporarily during spring food shortages, such as in a commonly made hotpot with weeds called "naadiroog", which resembles a thicker soup. When rye flour came to the end in the spring, a "naadikarask" (a cake of weeds) was made with non-fermented barley dough. The wild plants used for making both *naadiroog* and *karask* were approximately 15-cm-long spring shoots of various plants, most commonly *Cirsium arvense*, but also other wild taxa, which were not distinguished by name. The recipe for *naadikarask* was simple: One record from Räpina states that all kinds of plants were picked, such as *Cirsium* sp., young *Urtica dioica* and *Humulus lupulus*, *Ribes nigrum* and *Salix* sp. leaves, and spring chlorophyll-free shoots of *Equisetum arvense*, all finely cut and stewed until soft. This mass was then mixed with the pre-made *karask* dough and placed in the oven for baking. Wild species were also occasionally mixed with rye flour dough [47]. For *Humulus lupulus*, *Ribes nigrum*, and *Salix*, there are no reports of their use in the making of *karask* elsewhere in Estonia.

Moora [47] points out that people living near the border learned to use new plant taxa from Russians. For example, she cites a soup made with the leaves of *Arctium tomentosum*, which has not been mentioned elsewhere in Estonia, and a soup made with the leaves of *Tussilago farfara* and groats not reported elsewhere [47]. Yet, there might have been several other reasons for the high number of plants used during food shortages and famine in historical Võromaa and Setomaa. It is possible that the historical correspondents who returned information to the museum from this region may just have been more attentive and had written down all possible species and their usage. It is also possible that this area was one of the poorest areas of Estonia, where eating wild plant taxa during spring food shortages may have been more widespread than elsewhere. Therefore, those taxa might have had a so-called "famine food" image, and eating them was considered unusual in times of plenty, thus associating wild plants with hunger, whereas elsewhere in Estonia wild food plants were simply eaten for variety in taste. For example, *Rumex acetosa*, *Urtica dioica*, *Cirsium arvense*, *Aegopodium podagraria*, and some other plants were widely used as springtime foods all over Estonia, but in Setomaa and Võromaa they were associated with starvation.

It is remarkable, however, that as in the historical case of *naadikarask,* the same applies to the current use of wild food plants for soups or salads in the spring–the taxa are interchangeable. Many people told us they watch the growth of young grasses and picked all which reach a certain height and are distinguishable. Ethnic recipe books call such foods "keväjäne hainaruug" (spring grass hotpot) or "varakevadine heinasupp" (early spring grass soup) [22]. Such foods were made by both the Seto and Estonians. The soup is very simple: Washed and chopped "grass" is added to bone broth with cereals and potatoes at the end of cooking. "Grass" refers to the young leaves of *Urtica dioica*, *Aegopodium podagraria*, *Filipendula ulmaria*, *Primula veris*, and *Stellaria media* or other similar species. Often, a chopped boiled egg was added to the dish. The same plants, along with *Taraxacum officinale* leaves, are also currently harvested for "spring green salad".

However, in our fieldwork, the negative image of eating wild plants as food during times of hunger was quite evident. It was quite common to receive an answer from an interviewee born in the 1960s along the lines of: "we were not so poor that we had to eat nettle, goutweed and gousefoot, we ate meat in our childhood". This may be the reason why there are no longer any reported widespread wild plants that were used in the past like *Chenopodium album* and *Cirsium arvense*. It could also be because, as our interviewees said repeatedly, in large fields, intensive fertilization and poisoning took place during Soviet times as well as now. Additionally, instead of vegetable gardens, there are now ornamental and herb gardens, so there is literally no place for the weeds to grow.

Several other plant uses and customs that were no longer practiced elsewhere in Estonia were preserved in peripheral areas until relatively late. For example, Moora [51] says that while the fermented beverage made of juniper berries was formerly known all over the country, especially in western Estonia, by the 1930s it was only preserved in Setomaa and Russian villages near Lake Peipsi. Characteristically, in the area beer or *taar* (or near-bear) tare were made not from malt flour but from pre-baked malt cakes [51]. The use of birch sap in the area was historically very common, and the fermented sap was called by a variety of names: *taar, mahlataar, mahlajook, hapumahl, kali, mahlakali,* and *kasekali* [50]. Birch sap was fermented for at least 1–2 weeks with burnt rye flour or rye grain, and often with *vahaliim* (a light honey water obtained through the intense boiling of honeycombs in water); it was claimed to contain alcohol. It is known from Räpina parish that syrup was made by heating the sap, but it was not profitable to do so [50]. Today, local souvenir shops sell 100-mL glass bottles of birch sap syrup for ice cream and for marinating meat and 200 mL glass bottles of maple syrup for drinking made by small local producers ("Kasevetekohin").

Moora [48] indicates one unique way of preserving berries specific to the region, which was not known elsewhere in Estonia. Namely, harvested and washed *Vaccinium vitis-idaea* berries were placed in a barrel along with *miiliim* (honey water) and then put under light press. Later, the berries were eaten along with the *miiliim* [48]. The *miiliim* was obtained by soaking the emptied honey combs in water. It is not clear from the article whether this was done during a sugar shortage or whether it was an archaic use. South-eastern Estonia has a historically very rich forest beekeeping tradition, and so it could be a method of preserving berries conceived locally.

### *3.3. Changed Borders and the Centripetal Effects*

Being in the borderland played a great role in developing the habit of picking wild berries, which was historically more common here than elsewhere in Estonia. It may have been due to the influence of Russian culture, in which berry-picking was a long-standing tradition. As wild berries have good harvest years periodically, depending primarily on the weather, nature signs are read in early spring; for example, the Seto people believe that when heavy snow falls during butter week (8 weeks before Easter), a berry-rich summer is expected that year [68]. The greater harvest in the border area is due to the fact that elsewhere in the area wild berries were harvested mainly for personal use, whereas in the border area they were harvested to make a vital income. The picking of berries to sell was particularly prevalent when the Veriora railway station was opened along the Tartu-Pechory railway in the 1930s. As urban markets (in Tartu and Pechory) sold a kilogram of berries for more than four times the price paid to collectors or middlemen, the pickers themselves were also active in selling in the cities (especially *Vaccinium oxycoccos*, *Vaccinium vitis-idaea*, *Vaccinium myrtillus*, *Rubus chamaemorus*). Still, large quantities, amounting to hundreds of kilograms, were continuously sold to collectors who came to the villages [46,69].

During the Soviet era, there was a so-called women's market at Pechory Monastery, where women sold vegetables, fruits, including berries, and canned homemade garden products [26].

"We went to the Pechory market here to sell berries, meat, potatoes, cucumbers, cabbages and other things. The price at the market was much higher than if we sold to a middleman in the Goods Office. For example, if a middleman in the Goods Office was buying for 10 kopecks a kilo, you could get 20 kopecks in the market. Although you could sell a large quantity, like a hundred kilos, to a middleman in the Goods Office, at the market you could sell only a few dozen kilos. The berries that sold the most at the market were: bilberry, cranberry, lingonberry–we do not grow more here." (Seto man, born 1953).

The collecting of *Vaccinium oxycoccos*, the region's most popular berry, was popularized by high buying-in prices during Soviet times. Planned state purchases under the Soviet economy began in the late 1970s and continued until the late 1980s. At that time, people in border areas took a boat across the lake to pick berries in Russian bogs, which was more convenient than going to Estonian bogs by car:

"We went there in Russia to pick berries. All the time, as the state border was still open. There were big swamps in Russia where we went to pick cranberries and cloudberries. From here, it was very easy for us to take a motorboat across the lake, only three kilometres away. During the Soviet era in the village, almost everyone had a boat. There are also large swamps in Meerapalu [Estonia] where many berries grow, but it's a long way to get there by car, more than half an hour. Once upon a time, there were special dates on the Estonian side when one could start picking cranberries [every year]. On the Russian side, there were no restriction dates. This made it easier to go there to pick berries. Here on the Estonian side there were controls on the highway. The berries were confiscated from those who had previously visited the swamp and picked cranberries." (Estonian woman, born 1939).

Berries were also brought from the other side of the administrative border for personal consumption:

"We have no cloudberries here. My wife is from Russia [Seto]. She knew where in Russia those berries grew. So, we went there a couple of times to pick those berries. Here in Estonia, there are also cloudberries in Meerapalu, but it is a very long way there. We haven't been there to pick cloudberries." (Seto man, born 1947).

On the Estonian side, the purchase prices of wild berries have been higher. In Soviet times, the Russians brought hundreds of kilograms of wild berries to Estonia:

"People from Russia's villages brought huge amounts of cranberries to middlemen in the Goods Office in Värska [Estonia]. Both by car and by boat. People lived in the swamp for several days and harvested 15 or 20 kg a day. They had to pick berries one after the other, because otherwise someone would come and pick them themselves. They picked all the berries from one area. And then 200, 300, 600 kg were brought here at once." (Seto man, born 1960).

This activity generally ceased in the 1990s. However, it continued to a limited extent in Saatse village, as a border crossing point for locals is located there, where one can cross the border on foot or by bike. Until recently, Russians and the Seto living on the Russian side of the border sold both wild berries and mushrooms in Estonia. Then, as we were told, after the raid on customs a couple of years ago (around 2017), the Estonia Customs Office banned the import of berries and mushrooms from this border point.

*3.4. Resurgence and Commodification of Local Gastronomy*

The current commercialization of wild food plants is affected by market demand on the one hand and the distribution of subsidies to poor border areas (Setomaa Development Program, Border Area Development Program, etc.) on the other. Today, market demand is primarily concerned with the purchase of wild mushrooms and berries. During fieldwork, we observed numbers of buying announcements at the area's bus stops, on the walls of small shops, and in the public advertising spaces of village centers (Figure 5). Middlemen with small vans drive around the villages two or three times a week during the season and stop at bus stops at particular times. There are several middlemen working in parallel. Wild mushrooms (mostly chanterelle) and wild berries are purchased. According to interviewees, it is mainly retired people who sell mushrooms to earn some extra income. Indeed, the region has a high proportion of older people. Working-age people, who live in rural areas, are already very busy. Thus, there is a severe labor shortage during the berry ripening and mushroom growing season. We were repeatedly told by interviewees that in Soviet times the forests were full of berry pickers and mushroom gatherers and there were not enough mushrooms or berries for everyone. Now the opposite is true, as forests and bogs are full of mushrooms and berries, but there are no pickers. However, the most recent high-turnover commercial purchase period lasted from the 1990s until the 2000s, when bilberries were bought in abundance. As for today (2018–2019), it was repeatedly said by interviewees that now it is not worth going to pick berries for personal consumption because the long journey does not pay off, and in the past, it only paid off if most of the berries were sold. It was also said that the use of bilberries in particular has been influenced by intensive forest management since the early 2000s. Because of this, old forests suitable for bilberries have been cut down and there are simply no more berries in the areas where people used to pick them. Similar results have been obtained from a recent nationwide survey of bilberry pickers. It turned out that berry-pickers preferred the public forests familiar to them to protected areas, whereas 60% of respondents said that they experienced the loss of berry sites due to clear-cutting [70].


**Figure 5.** Message board in Orava village: "Every day from 25 June, I buy chanterelles, cloudberries, bilberries". Photos: Renata Sõukand 7 July 2018.

Within the last five years, in their search for a niche, small producers in the region have begun to appreciate raw materials from nature. For example, the Nopri Farm Dairy, which we visited during participant observation in the field, started bottling pasteurized and also fermented birch sap a few years ago. However, this is a so-called market test and it is not yet known how the market will adopt this rather expensive product in the long run. Of the wild plants, clover leaves were still used, as they were added to cheese for taste. However, from where the herb is obtained, the owner did not tell us. The biggest problem now, said the owner of a cow farm, is the lack of labor in the region. Today, he hires workers from Ukraine.

We also saw wild berry wines in addition to horticultural wines (strawberry, rowan, apple, red currant, marigold, etc.) at one of the most progressive home restaurants in the region, Maagõkõnõ, in Saabolda village. However, their *Viburnum opulus* wine, for example, has never been made in the region, either historically or today, based on our fieldwork. However, both Nopri Farm and Maagõkõnõ sell the region's special product, namely raw cheese (*sõir*) that is seasoned with *Carum carvi* seeds. However, cumin is no longer picked locally but rather bought in the shop. There are active workshops in the area to prepare different food products. For example, Räpina Creative House offers home wine courses and makes wild berry wines, such as cranberry, which are sold at local fairs. One of the biggest tourism and identity events in the area is the annual Seto Kingdom Day in August. This is the only place where so-called semi-officially sold home-made vodka, *handsa*, can be found. In 2019, for example, one producer sold "handsa" flavored with *Vaccinium myrtillus* berries. This drink is also mentioned in old archival texts. Additionally, in 2018 and 2019, various handmade products were on sale (Figure 6): Pine cone jam; juniper twig syrup, and sea-buckthorn berries in juniper syrup; juniper berry salt and mustard; dandelion flower honey, dandelion syrup and dandelion syrup with rhubarb; rosebay willowherb flower syrup and meadowsweet flower syrup; cowberry jam with apple and pear; spruce needle honey; and birch bud syrup and herbal mixtures for tea. Tourism has therefore created new site-specific products and also helps to keep traditional products alive.

**Figure 6.** Seto Kingdom Day on 5 August 2018 in Lüübnitsa village. A selection of products from small local producers in Setomaa. Kingdom Day is one of the most important events in the region where home-produced products are traded. Photos: Renata Sõukand.

## 4. Conclusions

On the basis of the historical data, we can say that the border area became herbophilic earlier than the rest of Estonia. This might be due to cultural contact with neighboring Russians, who may have taught, for example, the use *Arctium tomentosum* and *Tussilago farfara*, but also to the fact that the region is the poorest in the country. Yet, this has not continued to the present. When the border closed in the early 1990s, the city of Pechory, which was historically the center of attraction in the region, lost its importance. This brought about a decline in the exchange of knowledge as well as commercial activities around wild food plants, as horticultural products and wild berries were sold there. National support for businesses in the area today and also mass cultural events have, on the other hand, introduced new wild food plant applications and are helping to preserve local plant-specific uses in the area.

The Seto have still preserved their distinctive features either by consciously opposing others or by maintaining more historical plant uses. The inhabitants of Setomaa and Võromaa associated wild plants with famine food in the early 20th century, yet it was stressed more now by the Seto than by Estonians. Along with the popularity of a healthy lifestyle, the use of new plants is now based more on examples provided by people within the community (e.g., more influenced by local authorities like schoolteachers) than those directly listed in the literature. The Seto, who have lived for centuries in a more closed cultural space, have tried fewer wild plants as a snack. Estonians who are more open to other cultures have also been more eager to experiment with wild plants.

Prior reforms, such as the collective farms established during the Soviet era, have lost their importance due to several recent changes. The transition from a planned economy to a market economy when the former network of points of purchase ceased to exist also had a major impact. However, the closure of the border in the 1990s has had less impact on the use of wild species in border areas than the change and loss of the natural environment. Thus, *Vaccinium myrtillus* has begun to disappear in the past few decades due to intensive clear cutting. In contrast, some species have been affected by intensive mowing of yards and gardens (e.g., *Matricaria discoidea*) and by the overgrowth of open areas (e.g., *Thymus serpyllum*). The combination of several factors has led to the disappearance of *Carum carvi*. Influenced by literature, people started to experiment with previously unused plants (e.g., *Filipendula ulmaria*, *Epilobium angustifolium*). While earlier there was a need to earn a living by harvesting wild berries, nowadays, the standard of living has risen to such an extent that driving tens of kilometers away to marshes to collect *Vaccinium oxycoccos* is no longer worthwhile.

Future research in the region should record the numerous innovative wild products sold at fairs but not used locally. Only the expansion of narrowly targeted tourism products can secure their success in marketing, yet as it is strongly related to seasonality, the spring-summer tourist season is not enough to sustain the practice of using wild food plants, which is an additional safeguard for the food security of the local population in potential times of crisis. This requires the maintenance of customary practices, i.e., to value "simple work". The common current practice of picking forest berries to sell is kept alive mainly by older individuals, while young people already have the habit of buying berries at the shop rather than picking them themselves, and this is simply not sustainable.

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*Article*

# Language of Administration as a Border: Wild Food Plants Used by Setos and Russians in Pechorsky District of Pskov Oblast, NW Russia

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**Abstract:** Socio-economic changes impact local ethnobotanical knowledge as much as the ecological ones. During an ethnobotanical field study in 2018–2019, we interviewed 25 Setos and 38 Russians in the Pechorsky District of Pskov Oblast to document changes in wild plant use within the last 70 years according to the current and remembered practices. Of the 71 botanical taxa reported, the most popular were *Vaccinium vitis-idaea*, *Vaccinium oxycoccos*, *Vaccinium myrtillus*, *Betula* spp., and *Rumex acetosa*. The obtained data was compared with that of 37 Setos and 35 Estonians interviewed at the same time on the other side of the border. Our data revealed a substantial level of homogeneity within the plants used by three or more people with 30 of 56 plants overlapping across all four groups. However, Seto groups are ethnobotanically closer to the dominant ethnic groups immediately surrounding them than they are to Setos across the border. Further study of minor ethnic groups in a post-Soviet context is needed, paying attention to knowledge transmission patterns.

**Keywords:** wild food plants; local ecological knowledge; Seto; ethnic minority; post-Soviet ethnobotany

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## 1. Introduction

While the influence of environmental factors, such as ecosystem changes, on the patterns of wild food plant use are widely acknowledged, the economic and sociocultural factors are less studied yet equally important for the valorization, maintenance, or abandonment of wild foods [1]. What happens to Local Ecological Knowledge (LEK) after a rapid socio-economic shift? While claims of degradation and erosion of LEK have become common place, the exact nature of the change has yet to be described and interpreted. As stated in a recent review [2], modernization, education, and the market are the main drivers triggering changes in LEK.

A shift to a market economy is perceived differently by poor and more economically stable societies. For the former, wild food plants become an important economic resource [3,4], while for the latter, a trigger for recreational practices and delicacies [5,6]. Food is one of the most important identity markers, so the preference for certain foods, or food plant cultural markers [7], can be regarded as a community-building feature, as can the rejection of certain foods [8]. A study by Quave and Pieroni [9] shows, however, that wild food repertoires in neighboring cultures may converge in the context of food shortages caused by war.

Wild food is considered a relatively stable area of LEK, more homogenous and less subject to change compared to the medicinal use of plants [9]. However, changes inevitably occur. Classical studies on these changes have been carried out related to migration and the phenomenon is relatively well studied: the extent to which migrants adapt to the food culture of a new host country or maintain their own depends on a wide variety of factors (see [10], and the references therein). However, changes also occur due to changing socio-economic conditions. It has already been shown that in some regions geopolitical changes have led to the diverse evolution of wild food plant consumption; however, this is more difficult to track. We have approached this question by studying ethnic groups divided by a state border. For example, in Bukovina, the border between Romania and Ukraine (since the 1940s), which divided an ethnic group (Hutsuls), created the situation in which the ethnogastronomy of wild plants was more similar to the other ethnic group living within the same country than among Hutsuls themselves [11]. For the Bukovina example, the border was solid, impenetrable, and remains so even now, restricting communication on all levels for the last 80 years, with several generations growing apart. The next issue is to understand how long it actually takes LEK to differ enough to be noticed and whether the separation needs to be 'solid'.

In order to describe the impact of administrative and later state border division on LEK, we took as a case study the small ethnic group of Seto people, who live on the border between Estonia and the Russian Federation and were a single cohesive group until 1944. According to the linguistic classification, Seto speak a subdialect of Võro dialect of Estonian language, while Setos consider it a language [12]. Between 1920 and 1940, the territory was part of Estonian Republic. As the ethnobotany of Seto has been recently described as a part of the same project [13], we took a comparative case from Pechorsky District of Pskov Oblast of the Russian Federation, a rural area where two ethnic groups, Setos and Russians, have historically resided side by side [14]. This gives us the possibility to compare the influence of administrative and state division, as the Seto community was divided in two by an administrative border in 1944 and later by a state border in 1991. Attracted by Estonian-language education and better economic conditions, the majority of Setos migrated to Estonia leaving less than 200 Setos on the Russian side of the border. In 2010, the Seto were included in the list of indigenous ethnic minorities of Russia.

In spite of numerous works dedicated to various aspects of Seto society and culture, such as ethnography [14,15], demography [16,17], folklore [18] including the traditional style of singing [19], clothing and costumes [20,21], and religion [22–24], the ethnobotany of Setos on the Russian side of the border has not yet been described. Some fragments of Seto TEK were provided in quantitative comparative works on Finnic ethnobotany [25,26].

The aims of this article are to (1) document current and past practices related to the use of wild food plants in the region, (2) conduct a cross-cultural comparison between Setos and Russians and a cross-border comparison with Setos living on the Estonian side, and (3) outline the factors that have influenced differences and changes in LEK in the region within one generation. Our working hypothesis is that the long-term administrative, and later state-based, division has driven the two Seto groups further apart and closer to their neighboring dominant ethnic and linguistic groups.

This is the first comprehensive description of the wild food ethnobotany of the Pechorsky District. The research is part of a larger study investigating the effect of centralization on the small ethic groups residing on the borders of former Soviet republics. Cross-border studies of this project have already been reported for Estonian Setomaa (Seto 'Seto land') [13], Russian Karelia [27], and Bukovina [11,28].

## 2. Data and Methods

### *2.1. Research Area*

Pechorsky District (1251 km$^2$) is a subdivision of Pskov Oblast located in North-West Russia on the border with Estonia. The landscape and flora of Pechorsky District differ from that of Pskov Oblast. The study area occupies a part of the Haanja Upland that lies in the Southeast of Estonia and Latvia. The north of the region is dominated by Lake Peipus (3550 $m^2$).

### 2.2. Vegetation of Pechorsky District

The natural conditions around Pechory were thoroughly studied for the first time in the 1920s [29]. According to Tammekan [29], while the Pechory area belonged to the Pskov Governorate, the forests in that area had been rapaciously managed for a long time. Due to irrational forest management, only pine forest fractions were growing in low-fertile areas while very small spruce-birch forests were growing in fertile areas. Intensive management was evident by the fact that the forests were less than 50 years old. Most of the area at that time was arable land or semi-natural meadows [29]. A second comprehensive description of the natural conditions of the area [30] showed that during a 10-year period (1990–2000) arable lands were abandoned and decreased in area from 77% to 60%. Natural meadows (14% of the total arable land), which are mainly located on the banks of water bodies, started to become overgrown with shrubs after the cessation of economic activities. Settlement areas increased the most during those 10 years from 0.6% to 14%. Forested land, which is affected by frequent natural fires in the area, remained about the same at 19%. Pine trees (82%) dominate these forests, with a few other trees present in smaller numbers (8.5% birch and 8% spruce). A decrease in the species richness of common plants was also observed [30]. Vegetation also decreased in the part of Setomaa that remained in Estonia: in 1971 there were 717 species, but 149 of them had disappeared by 2005 [31].

### 2.3. Archaic Seto Culture and Early Contact with Russians

Archaeological, linguistic, and genetic analyses have shown that Finnic tribes came to the Baltic Sea area as early as 3500 years ago [32]. The Setos used to live in a large area along the eastern shore of Lake Peipus, around Lake Pskov and the Velikaya River [33]. After the invasion of East Slavs, the Principality of Pskov was established in the year 862 in the Seto territories. In 1456, Muscovite Russia (the Tsardom of Russia beginning in 1547) conquered the Principality of Pskov, and the area was annexed to the Russian state. The new government began to carry out an extensive Orthodox mission at the border, building Orthodox churches and fortifications (e.g., a monastery in Pechory). In 1772, the Pskov Governorate was formed [34]. Although the Finnic speakers in the Pskov Governorate had been described as early as the 18th century, it was not until the end of the 19th century that Seto culture was scientifically examined by folklorist Jakob Hurt (1839–1906). Thanks to him, other scientists became interested in this ethnic group. Hurt himself studied the Seto for more than 20 years, and his scientific articles and monographs are important early sources [34]. As church services in Pskov province were delivered in Slavonic, which the Setos did not understand, until the end of the 19th century Seto culture preserved archaic pagan features [24,35], which have survived in part to this day. The unique Seto style of singing, *leelo*, was added to the UNESCO World Heritage List of intangible culture in 2009. In 2010, the Seto Institute was established, which coordinates Seto research today. In 2017, all Seto settlements in Estonia were merged under one municipality.

### 2.4. Setomaa and Its Separation

According to the Tartu Peace Treaty (2 February 1920), small ethnic groups of Finno-Ugric peoples, including the Ingrians and the Setos, were integrated into the Republic of Estonia [29]. Petseri County was formed in the area inhabited by the Setos when settled in Estonia. In 1928, more than 58,000 people lived in the region, including Russians (65%), Setos (25.6%), and Estonians (7.4%), as well as Latvians, Jews, and Germans. In 1922, municipalities were formed along ethnic boundaries, and thus municipalities with only Russian or only Seto residents emerged [29]. However, in 1944, during World War II, a large part (75%) of Petseri County was annexed to the Pskov region of Russia by order of Stalin. This broke the historical boundaries of ethnic Seto settlements. To date, historians have not found any documentation as to why Stalin needed such a border change, which did not follow any ethnic or geographical logic [36]. There is a point of view that the change was based on the higher proportion of ethnic Russians in the annexed territories [37]. One can only assume that Russia wanted to take control of and have authority over the only consistently operating monastery in Pechory. All other monasteries in the USSR had already been closed and/or destroyed before the opening of the Eastern Front of WWII.

### *2.5. Seto School Education in Pechory*

While in Estonia and Livonia the spread of literacy promoted by Lutheran parochial schools began in the 1840s [38], Setos living in the Pskov Governorate received no schooling at all, because schools were not interested in teaching Setos who did not speak Russian, and so only a few Seto men learned to read [35]. It was only during the time of the Republic of Estonia when the Seto began to receive education in Estonian. The first thing which occurred after the War of Independence was that the Seto people were given family names which they did not have before. Village schools were also established in Petseri County and all Setos were provided with school education in Estonian. The first reading book in Seto was published in 1922. Church congregations were also segregated: ethnic Russians were allowed to preach in Russian, and then Seto congregations began to deliver sermons in Estonian [39]. During World War II, when the Seto area was annexed to the Pskov Oblast, all affairs there began to be conducted in Russian However, a network of primary schools with education in Estonian was preserved, and the secondary education was delivered in Secondary School No2 of Pechory, established in 1956, which became the only school in Russia where all subjects were taught in Estonian until the 2004–2005 academic year [40]. It was the lack of an Estonian-language vocational or higher education that was the main reason for the mass immigration of Setos into the territory of Estonian SSR (see Table 1).

**Table 1.** Seto population of Pskov Oblast according to the estimation by Manakov [41].

| Year | 1959 | 1970 | 1979 | 1989 | 2002 | 2010 |
|---|---|---|---|---|---|---|
| Estimation | 4500 | 2360 | 1630 | 950 | 350 | 230 |
| Census | - | - | - | - | 172 | 123 |

### *2.6. Field Data*

The data were collected during the summers of 2018 and 2019 by interviewing the Seto and Russian populations of the Pechorsky District of Pskov Oblast. The informants were recruited using snowball and convenience sampling methods (Setos and Russians, respectively). The interviews were conducted in the villages traditionally inhabited by the two ethnic groups. The majority of the interviews were conducted within the area surrounded by the town of Pechory, and villages of Izborsk, Panikovichi, and Lavry, while three interviews were conducted near Kirshino in Krupp Parish (Figure 1). Five Seto participants were born to mixed families where only one parent was Seto. Among them, only four participants (two families) belonged to a family where both parents were Seto. In such cases, attribution to a group was made on the basis of the language spoken and self-identification of the person as either Seto or Russian. We also interviewed two people who considered themselves Estonian, whom we included in the Seto group, as this ethnonym is still sometimes used by older generations in accordance with the obligatory Soviet attribution codified in the passport system (in which Seto nationality did not exist). The language of instruction in schools was Estonian, and so all Setos in the region had the possibility of receiving an education in Estonian and sometimes prefer the ethnonym 'Estonians' to refer to themselves.

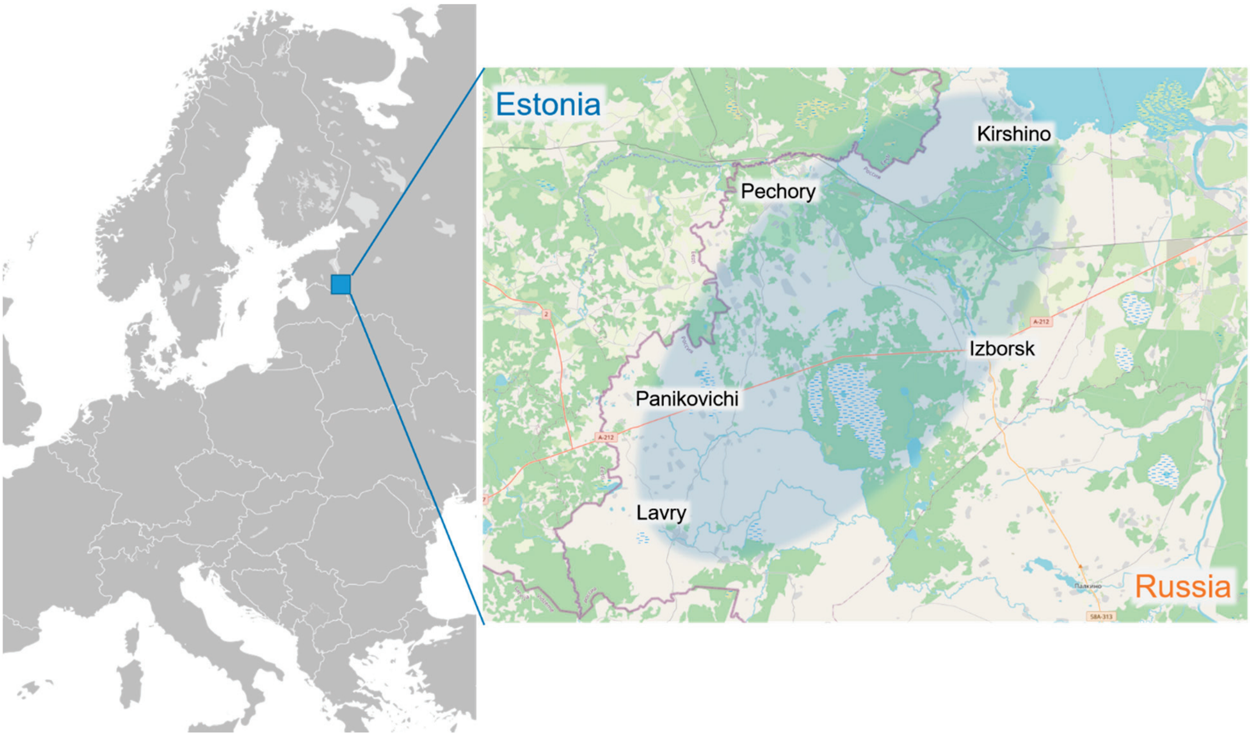


**Figure 1.** Study area in Pechorsky District of Pskov Oblast. Map base: Wikimedia Commons and OpenStreetMap.org.

The youngest informant was born in 1980 and the oldest in 1916. Mean age was 68 for Russian participants and 60 for Seto participants. The interviews were conducted with 25 Setos and 31 Russians. We spoke to 38 female and 18 male participants (Table 2).

**Table 2.** Demographic structure of the study participants.

| Ethnic Group | F | M | Oldest | Youngest | Sample Size | Religion | Education |
|---|---|---|---|---|---|---|---|
| **Seto** | 15 | 10 | Born 1940 | Born 1980 | 25 | Orthodox | Vocational 22, higher 2, secondary 1 |
| **Russian** | 23 | 8 | Born 1916 | Born 1970 | 38 | Orthodox or atheist | Evenly divided among secondary, vocational, and higher education |

Although we looked for local participants, some of our interviewees revealed only at the end of the interview that they were born in another location. In all such cases, the period of residence in Pechorsky District was more than 20 years (which is the reason they considered themselves locals). Novozhilov [42] describes that while "part of autochthonous Russian population left this region, another part has dissolved into the stream of Russian migrants, whose number increased from 1990 to 2000". As our aim was to explore plant use by the autochthonous population, we did not include these newcomers in the main sample and general analysis, as the size of the group is not comparable. However, we will discuss the attitudes and possible influences of the newcomers on the local population, on the basis of the twelve people (four men, eight women, mean age 68 years) we interviewed, in a separate section of the Discussion.

We started our conversations with free-listing and then continued as semi-structured interviews. At the end of the interviews, we asked the informants for permission to take a picture or some dried specimens from their winter stores. We asked informants to describe which wild plants they use in various dishes, such as soups, pies, salads, condiments, smoked meats, desserts, and infusions. We specifically inquired about the use of tree sap. We also asked the informants to describe the wild food plants, they, or their family members, used during their childhood. Whenever possible, we also conducted participant observation at religious and other celebrations and requested to take field walks with the informants to collect voucher specimens. Informed consent was obtained at all times and the guidelines prescribed by the ISE Code of Ethics were strictly followed [43].

Informant interviews were anonymized, transcribed, and organized into an Excel spreadsheet in order to obtain detailed use reports (DUR) sensu [44], where the use of each taxon is distributed across ethnic groups and time of use in the life of an informant. Seto, Estonian and Russian phytonyms were recorded and used to qualitatively evaluate the level of phytonymical knowledge of the local population. Romanization of the Cyrillic script of the original Russian words was done according to the ALA-LC (American Library Association—Library of Congress) Romanization without Diacritics set of standards (https://www.convertcyrillic.com/#/).

The following time categories were identified according to the interviews:

PAST

long ago—during the generation of their grandparents or earlier;

abandoned in childhood—actively used in childhood (as it was considered a children's food or was imposed or requested by the family);

abandoned in adulthood—practiced since childhood and abandoned during adulthood;

abandoned recently—practiced since childhood and abandoned within the last few years;

CURRENT

adulthood—started in adulthood and practiced since then;

only now—acquired within the last five years;

all time—learned within family and practiced since then.

For cross-cultural comparison, we calculated the Informant Consensus Factor (IFC) for use categories following the formula utilized in [45,46]:

$$IFC = \frac{N_{ur} - N_t}{N_{ur} - 1},$$

where $N_{ur}$ is the number of uses in a use category and $N_t$ is the number of taxa in the corresponding category.

We included in the sample not only wild plants in the strict sense, but also some semi-cultivated taxa that easily run wild, such as *Armoracia rusticana*, *Amelanchier* spp., and *Rumex acetosa*, or that are cultivated for non-food purposes, like *Caragana arborescens*.

The data were visualized using RAW Graphs [47] and the Venn diagrams tool published by the laboratory of Bioinformatics & Evolutionary Genomics lab at the University of Ghent (http://bioinformatics.psb.ugent.be/webtools/Venn/ (accessed on 12 May 2019)).

The botanical nomenclature was checked against The Plant List [48], while the botanical family information was additionally verified against the Angiosperm Phylogeny Website [49]. Voucher specimens collected during fieldwork were deposited at the Komarov Botanical Institute of the Russian Academy of Sciences (Saint Petersburg, Russia) under the following numbers: LE 01063392-461, LE 01063463, LE 01063465, LE 01063466, LE 01063469, LE 01063477, LE 01063496, LE 01063498, LE 01063504-6, LE 01063510-14, LE 01063544, LE 01063578, and LE 01063946 (http://en.herbariumle.ru/ (accessed on 30 June 2020)).

### 2.7. Cross-Border Comparison

We compared the data of the present study to that coming from a similar study [13] carried out simultaneously, and according to the same methodology, in Estonian settlements inhabited by Setos and Southern Estonians (Võro). The past and current wild plant uses in Russian Seto (25 people) and Estonian Seto (37 people) samples as well as local Russian (38 people) and Estonian (35 people) groups were compared. To conduct cross-border comparisons, we used the Jaccard Similarity Index (JI), following the methodology used in [50]:

$$JI = \left[\frac{C}{A + B - C}\right] \times 100,$$

where $A$ is the number of wild plant taxa reported in sample $A$ and $B$ is the number of wild plant taxa reported in sample $B$, and $C$ is the number of taxa common to both samples. We compared two sets of data: (1) ethnospecies recorded three or more times to compare the "core" sets, and (2) all recorded ethnospecies to compare ways of experimentation in the observed communities.

For the calculation of JI we considered as one taxon the following species, according to their emic categorization: *Alnus* spp., *Betula* spp., *Mentha* spp., and *Rosa* spp. At the same time, we regarded *Trifolium* spp. (including *T. pratense* and *T. medium*) and *Trifolium montanum* as two taxa, as the latter was referred to by different names or descriptions by the study participants. *Armoracia rusticana* was not included in the Estonian sample as it is cultivated with great care due to the peculiarities of the habitat, but it was kept in the Russian sample as it often escapes from gardens, tends to naturalize more easily, and is generally treated as a weed. Non-essential use of cultivated plants (mainly the leaves of *Ribes nigrum*) was also included in the sample, see [51].

## 3. Results and Discussion

### *3.1. Limitations of the Study*

Before describing the study results, we would like to address some limitations of our study. Since our sample is relatively small, the statistic curation of the obtained data does not provide consistent results for the number of wild plants used in different use categories. We have performed Wilcoxon test and Kruskal–Wallis test that were not sensitive enough and therefore provided opposite results for the compared groups (see Table 3). While for Wilcoxon test, the $p$-value has by far exceeded 0.05 in all groups, meaning that null hypothesis about the group similarity is confirmed. Kruskal–Wallis test reveals that the p-value is significant for all groups except the pairs of Estonians/Russian Seto and Estonians/Russians, thus proving the opposite for almost all groups.

**Table 3.** *P*-values for Wilcoxon test (right top) and Kruskal–Wallis test (bottom left) for the compared ethnic groups.

| | EE | EE Seto | RU Seto | RU |
|---|---|---|---|---|
| **EE** | X | 0.8232 | 0.7977 | 0.4523 |
| **EE Seto** | 0.00638 | X | 0.6551 | 0.3335 |
| **RU Seto** | 0.2106 | 0.03156 | X | 0.5853 |
| **RU** | 0.1289 | 0.04577 | 0.01267 | X |

### *3.2. Current, Past and Historical wild Food Plant Uses*

#### 3.2.1. Current Uses

We recorded 1388 detailed food uses of 72 taxa in 31 families: 60 taxa were identified on the species level, 10 on genus level, and one on family level; one ethnotaxa was not identified (Table 4). The most popular families were Rosaceae (15 taxa), Lamiaceae, and Asteraceae (10 taxa in each). The food uses were distributed across 22 emic use categories that included snacks, soups, soaked berries, jam (boiled and raw), pie filling, drinks made from berries (kissel or mors), drinks made from tree sap (fresh or fermented), infusions (tea and coffee substitutes), frozen preserves, additives for food in general and for lacto-fermentation, salads, mousse, and children's snacks. The most common food categories were tea substitutes (290 DUR), jam (205 DUR), and snacks (186 DUR).

**Table 4.** Use of wild food plants by Setos and Russians today and in the past.

| Latin Name | Local Name | Parts Used | Preparation | Food | Setos (Past) | Ru (Past) | Setos (Current) | Ru (Current) |
|---|---|---|---|---|---|---|---|---|
| **Adoxaceae** | | | | | | | | |
| *Viburnum opulus* L. LE 01063405 | RU Kalina | Fruit | Frozen and boiled | Jam | 1 | | | |
| | | | Frozen and dried | Tea | | | 1 | |
| | | | Frozen | Snack | | | 1 | |
| | | | | Raw jam | | | 1 | |
| | | | | Juice | | | 1 | |
| **Amaranthaceae** | | | | | | | | |
| *Chenopodium album* L. | RU Lebeda | Young leaves | Baked | Bread additive | 1 | 1 | | |
| | | | Boiled | Soup | 1 | 1 | | |
| | | | Fresh | Salad | | | | 1 |
| **Apiaceae** | | | | | | | | |
| *Aegopodium podagraria* L. LE 01063450, LE 01063430 | RU Snyt′, lapka [RD] | Leaves | Baked | Bread additive | | 1 | | |
| | | | Dried | Tea | | | | 1 |
| | | | Fresh | Salad | 1 | 1 | 1 | 1 |
| *Angelica sylvestris* L. | RU Dudochki [NF], dudnik, morkovnik [RD] | Stalks | Fresh | Snack | 3 | 1 | | |
| *Carum carvi* L. dsPCH19-010 | RU Tmin, gun'ba [RD]; Kurinaia lapka [NF] S Küümne [B] | Seeds | Fresh, dried | Seasoning for bread | 4 | 2 | | 2 |
| | | | | Seasoning for sõir | 10 | 2 | 2 | 6 |
| | | | | Seasoning for fermented cabbage | 4 | 6 | 3 | 1 |
| | | | | Seasoning for fermented cucumbers | | | 1 | 1 |
| | | | | Seasoning for salted mushrooms | | | 1 | |
| | | | | Other seasoning | 2 | 2 | 4 | |
| | | | Dried | Tea | 8 | 3 | 4 | 4 |

**Table 4.** *Cont.*

| Latin Name | Local Name | Parts Used | Preparation | Food | Setos | Ru | Setos | Ru |
|---|---|---|---|---|---|---|---|---|
| | | | | | Past | | Current | |
| **Asteraceae** | | | | | | | | |
| *Achillea millefolium* L. LE 01063441, LE 01063544, dsPCH19-006, dsPCH19-004 | RU Tysiachelistnik, tysiachelistvennik [RD] | Leaves | Fresh | Snack | | 1 | | |
| | | Aerial parts | Dried | Tea | | | 1 | |
| *Cichorium intybus* L. | RU Tsikorii | Roots | Dried and roasted | Coffee substitute | 3 | 1 | | 2 |
| *Cota tinctoria* (L.) J.Gay LE 01063394 | RU Zheltaia romashka [RD] | Aerial parts | Dried | Tea | | | 1 | |
| *Tripleurospermum inodorum* (L.) Sch. Bip. (sometimes collected in the wild instead of *Matricaria recutita*) LE 01063445, LE 01063422, dsPCH19-012 | RU Romashka S Kummel [A], teekummel [A] | Aerial parts | Dried | Tea | | 1 | 1 | 2 |
| *Matricaria discoidea* DC. LE 01063395, LE 01063444, LE 01063416, dsPCH19-011, dsPCH19-019 | RU Romashka polzuchaia [NF], r. dvorovaia [NF], r.ulichnaia [NF] S Morohain [NF] | Aerial parts | Dried | Tea | 1 | 2 | 3 | 4 |
| | | | Fresh | Seasoning for fermented cucumbers | | | 1 | |
| *Taraxacum officinale* Weber ex F.H. Wigg (Coll) LE 01063407 | RU Oduvanchik | Flowers | Boiled | Jam | | 1 | 2 | 1 |
| | | Leaves | Fresh | Salad | | | 2 | 1 |
| | | | | Snack | | 1 | | |
| *Tussilago farfara* L.LE 01063452 | RU Mat'-i-machekha | Leaves | Dried | Tea | 1 | | | 1 |
| **Betulaceae** | | | | | | | | |
| *Alnus* spp. incl. *Alnus glutinosa* (L.) Gaertn. & *Alnus incana* (L.) Moench | RU Ol'kha S Lepp [A] | Twigs, wood | Fresh | Meat smoking | 16 | 8 | 5 | 9 |
| *Betula* spp. incl. *Betula pendula* Roth & *B. pubescens* Ehrh.LE 01063453 | RU Bereza S Kask [A], kõiv [B] | Sap | Fresh | Sap | 3 | 10 | 10 | 5 |
| | | | Fermented | Sap | 10 | 11 | 5 | 4 |
| | | | Fermented | *Kvass* | 5 | 1 | 1 | 2 |
| | | | Boiled or pasteurized | Sap | | | 3 | |
| *Corylus avellana* (L.) H.Karst. LE 01063433 | S Leshchina, oreshnik (RU) | Wood, twigs | Fresh | Meat smoking | | | 2 | |
| | | Nuts | Fresh | Snack | 1 | | | |

**Table 4.** *Cont.*

| Latin Name | Local Name | Parts Used | Preparation | Food | Setos | Ru | Setos | Ru |
|---|---|---|---|---|---|---|---|---|
| | | | | | Past | | Current | |
| | | **Brassicaceae** | | | | | | |
| *Armoracia rusticana* G.Gaertn., B.Mey. and Scherb. LE 01063403 | RU Khrion [RD], khren | Leaves, roots | Fresh | Seasoning for fermented cucumbers | | 1 | 1 | 9 |
| | | Leaves, roots | Fresh | Seasoning for fermented mushrooms | 1 | | 1 | 4 |
| | | Roots | Fresh | Preserve | 1 | 1 | | |
| | | Root | Fresh | Added to moonshine | | | | 1 |
| | | **Cannabaceae** | | | | | | |
| *Humulus lupulus* L. LE 01063406 | RU Khmel′ | Cones | Fresh | Beer | 1 | 2 | | |
| | | **Caryophyllaceae** | | | | | | |
| *Stellaria media* (L.) Vill. LE 01063424 | RU Mokritsa | Aerial parts | Fresh | Salad | | | | 2 |
| | | **Cupressaceae** | | | | | | |
| *Juniperus communis* L. LE 01063408 | RU Veres [RD], veresk [RD], veresovka [RD], mozhzhevel′nik S Kadajas [B], kadakas [A], katai [B] | Wood, twigs | Fresh | Meat smoking | 11 | 5 | 3 | 3 |
| | | Twigs | Fresh | *Kvass* (seasoning, filter) | 4 | 4 | | |
| | | | | Seasoning for beer | 1 | | | |
| | | Twigs, fruit | Fresh | Seasoning for birch sap | | 2 | | |
| | | Fruit | Fresh, dry | Seasoning for bread | | 1 | | 1 |
| | | | | Seasoning for cabbage | | | 1 | |
| | | | | Seasoning for food (pilaf) | | | 1 | |
| | | | | *Suslo* | | 1 | | |
| | | | Dried | Tea | 2 | | | |

**Table 4.** *Cont.*

| Latin Name | Local Name | Parts Used | Preparation | Food | Setos Past | Ru Past | Setos Current | Ru Current |
|---|---|---|---|---|---|---|---|---|
| | | **Cyperaceae** | | | | | | |
| *Schoenoplectus lacustris* (L.) Pallas | RU Trosta [RD], trostnik, kamysh | Bottom of stalks | Fresh | Snack | | 2 | | |
| | | **Elaeagnaceae** | | | | | | |
| *Hippophae rhamnoides* L. | RU Oblepikha | Leaves | Dried | Tea | | | | 1 |
| | | **Equisetaceae** | | | | | | |
| *Equisetum arvense* L. LE 01063431 | RU Khvoshch; pupyshi [RD], papushi [NF] | Strobilus bearing stems | Fresh | Snack | 4 | 9 | | |
| | | **Ericaceae** | | | | | | |
| *Calluna vulgaris* (L.) Hull LE 01063447, dsPCH19-005 | S Veres (RU) [RD] | Twigs with flowers | Dried | Tea | 1 | | | |
| *Empetrum nigrum* L. | RU Voronets [NF] | Fruit | Fresh | Snack | | | | 1 |
| *Vaccinium myrtillus* L. LE 01063440, dsPCH19-025 | RU Chernika S Mustik' [B], must'kas [NF], mustikas [A] | Fruit | Fresh | Snack | 1 | | 4 | |
| | | | | Dessert (crushed with sugar) | | | | 1 |
| | | | | Raw jam | | 4 | 1 | 2 |
| | | | Boiled | Kompot | | | 1 | 1 |
| | | | | *Mors* | | | 1 | 1 |
| | | | | *Kissel* | 1 | 1 | 1 | 3 |
| | | | | Jam | 5 | 10 | 22 | 9 |
| | | | | Pie filling | 3 | 4 | 5 | 15 |
| | | | Dried | Dried preserve | 1 | | | |
| | | | Frozen | Snack | | | 12 | 9 |
| | | Aerial parts | Dried | Tea | 2 | 2 | 1 | 3 |

**Table 4.** *Cont.*

| Latin Name | Local Name | Parts Used | Preparation | Food | Setos (Past) | Ru (Past) | Setos (Current) | Ru (Current) |
|---|---|---|---|---|---|---|---|---|
| **Ericaceae** | | | | | | | | |
| *Vaccinium oxycoccos* L. LE 01063435 | RU Kliukva, zhuravina [RD] S Jõhvikas [A], kurõmari [NF], kuremari [B] | Fruit | Fresh | Snack | 1 | 1 | 4 | 4 |
| | | | | Condiment for meat | 1 | | | |
| | | | | Raw jam | 1 | 2 | 3 | 4 |
| | | | | Seasoning for fermented cabbage | 2 | 5 | 5 | 4 |
| | | | | Pie filling | 3 | 1 | 2 | 3 |
| | | | | Added to vodka | | | | 1 |
| | | | Soaked in water | Preserve | 1 | 2 | 5 | 4 |
| | | | Fermented | *Suslo* | | 1 | | |
| | | | Boiled | *Mors* | | 4 | 4 | 6 |
| | | | | *Kissel* | 3 | 3 | 2 | 2 |
| | | | | *Mousse* | 3 | 3 | 3 | 2 |
| | | | | Jam | 5 | 2 | 11 | 7 |
| | | | Frozen | Preserve | | | 9 | 2 |
| *Vaccinium ulginosum* L. LE 01063439 | RU Golubika, gonobol' S Sinikas [A], joovikas [B], johvik [NF] | Fruit | Fresh | Snack | | 2 | 2 | 1 |
| | | | | Pie filling | 1 | | | |
| | | | Boiled | Mors | | | 1 | |
| | | | | Jam | | 1 | 5 | 1 |
| | | | Fermented | Wine | | 1 | | |
| | | | Frozen | Frozen preserve | | | | 1 |

**Table 4.** *Cont.*

| Latin Name | Local Name | Parts Used | Preparation | Food | Setos (Past) | Ru (Past) | Setos (Current) | Ru (Current) |
|---|---|---|---|---|---|---|---|---|
| **Ericaceae** | | | | | | | | |
| *Vaccinium vitis-idaea* L. LE 01063412 | RU Brusnika S Palohka [B], palohkas [B], pohlakas [A] | Fruit | Fresh | Snack | 1 | 2 | 3 | 1 |
| | | | | Soaked berries | 3 | 4 | 6 | 8 |
| | | | | Raw jam | | 1 | | 2 |
| | | | | Liquor | 1 | | | 1 |
| | | | Soaked | Seasoning for meat or potatoes | 1 | 1 | | 1 |
| | | | Boiled | Kompot | | | | 1 |
| | | | | *Mors* | | 3 | 3 | 3 |
| | | | | *Kissel* | | | | 2 |
| | | | | Jam (often mixed with apples) | 6 | 7 | 17 | 10 |
| | | | | Pie filling (often mixed with apples) | 2 | 1 | 8 | 12 |
| | | | Frozen | Frozen preserve | | | 8 | 4 |
| | | Leaves | Dried | Tea | 3 | 3 | | |
| **Leguminosae** | | | | | | | | |
| *Caragana arborescens* Lam. LE 01063449 | RU Akatsiia | Pods | Fresh | Snack | | 3 | | |
| *Trifolium montanum* L. LE 01063393, dsPCH19-009, dsPCH19-021 | RU Gornyi klever [RS], belyi klever, romashka-kashka [NF], gornaia romashka [NF], medunitsa [NF] S Tsäihain [NF] | Inflorescences | Dried | Tea | 2 | 6 | 2 | 1 |
| *Trifolium* spp., incl. *Trifolium pratense* L. LE 01063455, LE 01063456, dsPCH19-024 | RU Klever, krasnyi klever | Inflorescences | Dried | Tea | | | 1 | 2 |

**Table 4.** *Cont.*

| Latin Name | Local Name | Parts Used | Preparation | Food | Setos (Past) | Ru (Past) | Setos (Current) | Ru (Current) |
|---|---|---|---|---|---|---|---|---|
| **Leguminosae** | | | | | | | | |
| *Trifolium repens* L. LE 01063437, LE 01063415 | RU Kashka | Inflorescences, nectar | Fresh | Snack | 5 | | | |
| **Fagaceae** | | | | | | | | |
| *Quercus robur* L. LE 01063451 | RU Dub S Tamm [A] | Leaves | Fresh | Seasoning for fermented cucumbers | | 1 | 3 | 5 |
| | | | | Seasoning for fermented mushrooms | | | | 1 |
| | | Acorns | Fresh or baked | Snack | | 2 | | |
| | | Bark | Fresh | Added to moonshine | 2 | | | |
| | | Wood, twigs | Fresh | Meat smoking | | | | 1 |
| **Grossulariaceae** | | | | | | | | |
| *Ribes nigrum* L. | RU Chiornaia smorodina | Buds | Fresh | Snack | | 1 | | |
| | | Leaves | Fresh | Seasoning for fermented cucumbers | 2 | 1 | 9 | 13 |
| | | | Fresh | Seasoning for fermented mushrooms | 2 | | 5 | 9 |
| | | | Fresh | Seasoning for birch sap | | | 3 | |
| | | | Fresh | Seasoning for *kvass* | | | | 1 |
| | | | Dried | Tea | 3 | | 6 | 13 |
| **Hypericaceae** | | | | | | | | |
| *Hypericum perforatum* L. LE 01063443, LE 01063428, dsPCH19-007, dsPCH19-018 | RU Zveroboi S Naistepuna [A] | Aerial parts | Dried | Tea | 3 | 5 | 13 | 10 |

**Table 4.** *Cont.*

| Latin Name | Local Name | Parts Used | Preparation | Food | Setos | Ru | Setos | Ru |
|---|---|---|---|---|---|---|---|---|
| | | | | | Past | | Current | |
| **Lamiaceae** | | | | | | | | |
| *Lamium album* L. | RU Belaia krapiva, medunitsa [NF] | Flowers | Fresh | Snack | | 1 | | |
| *Mentha* spp. dsPCH19-001 / *Mentha arvensis* L. LE 01063473 | RU Miata, perechnaia m. [RS], m. polevaia [RS], m. lesnaia [NF], m. beregovaia [NF], m. dikaia [RD] S Münt [A], piparmünt [A], mjatad [ER] | Aerial parts | Dried | Tea | 5 | 7 | 14 | 12 |
| | | | Fresh | Seasoning for drinks: birch sap or Kompot | | | 1 | |
| | | | Fresh or dried | Seasoning for meat | | | 1 | |
| *Origanum vulgare* L.dsPCH19-008, dsPCH19-003, dsPCH19-017 | RU Dushitsa | Aerial parts | Dried | Tea | 1 | 1 | 4 | 7 |
| | | | Tincture | Added to moonshine | | | | 1 |
| *Prunella vulgaris* L. | RU Gorlianka [RD] | Aerial parts | Dried | Tea | | | | 1 |
| *Thymus serpyllum* L. | RU Chabrets, bogorodichnaia trava [NF], bogoroditskaia trava [RD], ivanova trava [NF] S Jaanihaina [NF] | Aerial parts | Dried | Tea | 2 | 1 | 1 | 2 |
| | | | Fresh | Seasoning for mushrooms | | | | 1 |
| **Malvaceae** | | | | | | | | |
| *Tilia cordata* Mill. LE 01063409, dsPCH19-022, dsPCH19-032 | RU LipaS Pähn [B], pähnapuu [B] | Flowers | Dried | Tea | 9 | 4 | 4 | 3 |
| | | Leaf buds | Fresh | Snack | 2 | 4 | | |
| | | Sap | Fermented | Fermented sap | 1 | | | |
| **Onagraceae** | | | | | | | | |
| *Epilobium angustifolium* L. dsPCH19-015 | RU Ivan-chai, kiprei, koporskii chai, konevnik [RDX] | Leaves, flowers | Dried, fermented | Tea | 2 | 1 | 11 | 8 |

**Table 4.** *Cont.*

| Latin Name | Local Name | Parts Used | Preparation | Food | Setos (Past) | Ru (Past) | Setos (Current) | Ru (Current) |
|---|---|---|---|---|---|---|---|---|
| **Oxalidaceae** | | | | | | | | |
| *Oxalis acetosella* L. LE 01063434 | RU Zaiach'ia kislitsa RD, zaiach'ia kapusta RD, zaiachii shchavel' NF, kislitsa, kukushkin glaz NF S Jänesekapsas A, käosilm NF | Leaves | Fresh | Snack | 10 | 6 | | |
| | | | Boiled | Soup | | | 2 | |
| **Pinaceae** | | | | | | | | |
| *Pinus sylvestris* L. | RU Sosna S Petäi B, mänd A | Spring shoots, needles | Fresh | Snack | 2 | 1 | | 1 |
| | | Cones | Boiled | Jam | | | 1 | |
| | | Cambium | Fresh | Snack | 1 | | | |
| **Plantaginaceae** | | | | | | | | |
| *Plantago major* L. LE 01063457 | RU Podorozhnik | Leaves | Fresh | Salad | | | | 1 |
| **Poaceae** | | | | | | | | |
| *Elymus repens* (L.) Gould | RU Pyrei | Stalks, juice | Fresh | Snack | | 1 | | |
| Poaceae | RU Trava (lit. 'grass') | Stalks, juice | Fresh | Snack | 2 | 1 | | |
| **Polygonaceae** | | | | | | | | |
| *Polygonum aviculare* L. LE 01063454, LE 01063423 | RU Gorets ptichii | Aerial parts | Fresh | Seasoning for fermented cucumbers | | | | 1 |
| *Rumex acetosa* L. LE 01063414 | RU Shchavel'. kiselka RD, kislitsa RD S Hapuhain B, hublikas NF (EE) | Leaves | Fresh | Snack | 6 | 8 | 1 | |
| | | | | Salad | | | | 1 |
| | | | Boiled | Soup | 8 | 10 | 13 | 12 |
| | | | Cooked | Pie filling | | 1 | | 1 |
| | | | Salted | Preserve | 1 | 1 | | 1 |
| | | | Frozen | Preserve | | | 1 | 2 |

**Table 4.** *Cont.*

| Latin Name | Local Name | Parts Used | Preparation | Food | Setos | Ru | Setos | Ru |
|---|---|---|---|---|---|---|---|---|
| | | | | | Past | | Current | |
| **Primulaceae** | | | | | | | | |
| *Primula veris* L. dsPCH19-027 | RU Petushki [RD], pervotsvet, primula | Leaves, flowers | Fresh | Salad | | | | 1 |
| | | Leaves, flowers | Fresh | Snack | | 1 | | |
| **Rosaceae** | | | | | | | | |
| *Amelanchier* spp. | S Irga (RU) | Fruit | Fresh | Snack | 1 | | | |
| *Crataegus* spp. (incl. *Crataegus submollis* Sarg. LE 01063511) | RU Boiaryshnik | Fruit | Dried | Tea | | | | 2 |
| *Filipendula ulmaria* (L.) Maxim. | RU Tavolga | Flowers | Dried | Tea | | | | 1 |
| *Fragaria vesca* L. LE 01063496 | RU Zemlianika S Metsmaasikad [A], metsmaasikas [A], mõtsmaasik [B], metsmaasik [A], maasikas [A], maask [B] | Fruit | Fresh | Snack | 1 | 2 | 2 | 3 |
| | | | | Raw jam | | | 3 | 1 |
| | | | Boiled | Kompot | | | | 1 |
| | | | | Jam | 1 | 1 | 7 | 6 |
| | | | | Pie filling | 2 | | 1 | 2 |
| | | | | *Mousse* | | | | 1 |
| | | | Frozen | Preserve | | | 5 | 3 |
| | | Leaves | Dried | Tea | 1 | 1 | 1 | 3 |
| *Prunus padus* L. | RU Cheremukha S Toomingas [A] (EE) | Fruit | Fresh | Snack | 5 | 5 | 1 | |
| | | | Fresh | Pie filling | | 1 | | |
| | | | Tincture | Added to moonshine | 1 | | | |
| *Rosa* spp. dsPCH19-030, dsPCH19-014 | RU Shipovnik S Kibuvits | Fruit | Dried | Tea | 1 | 1 | | 4 |

**Table 4.** *Cont.*

| Latin Name | Local Name | Parts Used | Preparation | Food | Setos | Ru | Setos | Ru |
|---|---|---|---|---|---|---|---|---|
| | | | | | Past | | Current | |
| | | **Rosaceae** | | | | | | |
| *Rubus caesius* L., *Rubus nessensis* Hall | RU Ezhevika, kumanika [RD] | Fruit | Fresh | Snack | 2 | 1 | 3 | 4 |
| | | | | Raw jam | | | | 1 |
| | | | | Pie filling | | | | 1 |
| | | | Boiled | Kompot | | | | |
| | | | | Jam | | 1 | | |
| | | | Frozen | Frozen preserve | | | | 2 |
| | | Twigs | Dried | Dried (especially in winter) | 2 | | | |
| *Rubus chamaemorus* L. | RU Moroshka<br>S Murakas [A], murahka [B], murahk [B] | Fruit | Fresh | Snack | 3 | 3 | 2 | 2 |
| | | | | Soaked berries | | | | 1 |
| | | | | Raw jam | 1 | | 1 | 1 |
| | | | | Pie filling | 1 | | 1 | 2 |
| | | | Boiled | Kompot | | | 1 | 1 |
| | | | | Jam, jelly | 5 | 2 | 11 | 2 |
| | | | | *Mousse* | | | 1 | |
| | | | Frozen | Frozen preserve | | | 5 | 2 |
| | | Sepals | Dried | Tea | | | 1 | |
| *Rubus idaeus* L. | RU Malina<br>S Vabarna [A], vabarnas [A], vabarn [A]<br>EE Vaarikas [A] | Fruit | Fresh | Snack | 1 | | 1 | 2 |
| | | | | Raw jam | | | 1 | 2 |
| | | | | Pie filling | 3 | | 2 | 5 |
| | | | Boiled | Jam | 2 | 1 | 14 | 11 |
| | | | | Kompot | | | | 3 |
| | | | | *Kissel* | 1 | | | 1 |

**Table 4.** *Cont.*

| Latin Name | Local Name | Parts Used | Preparation | Food | Setos (Past) | Ru (Past) | Setos (Current) | Ru (Current) |
|---|---|---|---|---|---|---|---|---|
| **Rosaceae** | | | | | | | | |
| *Rubus idaeus* L. | RU Malina<br>S Vabarna [A], vabarnas [A], vabarn [A]<br>EE Vaarikas [A] | Fruit | Fermented | Wine | | | | 2 |
| | | | | Christmas drink | | | 1 | |
| | | | Fresh | Added to moonshine | | 1 | | |
| | | | Frozen | Preserve | | | 8 | 4 |
| | | Twigs, sometimes twigs with berries | Dried | Tea (especially in winter) | 4 | 1 | 5 | 5 |
| *Rubus saxatilis* L. | RU Kostianika | Fruit | Fresh | Snack | | | | 2 |
| | | | Frozen | Frozen preserve | | | | 1 |
| *Sorbus aucuparia* L.<br>LE 01063446 | RU Riabina<br>S Pihlapuu [A] | Fruit | Fresh (frozen) | Snack | 3 | 1 | 3 | |
| | | | | Candied fruit | | 1 | | |
| | | | | Added to moonshine | | | | 1 |
| | | | Boiled | Jam | | | | 1 |
| | | | | Kompot | | | 1 | |
| | | | | *Kissel* | | 1 | | |
| | | | | Pie filling | | | | 1 |
| | | | | Condiment for meat | | | 1 | |
| | | | Fermented | Wine | 2 | | | 1 |
| | | | | Christmas drink | | | 1 | |
| | | | Dried | Tea | 1 | | | |
| **Salicaceae** | | | | | | | | |
| *Populus alba* L. | RU Topol′ | Leaves | Fresh | Snack | | 1 | | |
| *Populus tremula* L.<br>LE 01063429 | S Osina (RU) | Wood, twigs | Incense | Meat smoking | 1 | | | |

**Table 4.** *Cont.*

| Latin Name | Local Name | Parts Used | Preparation | Food | Setos (Past) | Ru (Past) | Setos (Current) | Ru (Current) |
|---|---|---|---|---|---|---|---|---|
| **Sapindaceae** | | | | | | | | |
| *Acer platanoides* L. LE 01063411 | RU Klion S Vaher [A] | Sap | Fresh | Fresh sap | 3 | 6 | 5 | 5 |
| | | | | Added to birch sap | | 1 | | |
| | | | Fermented | Fermented sap | 4 | 2 | | |
| | | | | *Kvass* | 1 | 1 | 1 | |
| | | | Boiled | Sterilized sap | | | | 1 |
| | | Seeds | Fresh | Snack | | 1 | | |
| **Urticaceae** | | | | | | | | |
| *Urtica dioica* L. LE 01063436 | RU Krapiva S Nõgõss [B] | Aerial parts (young plant) | Fresh | Snack | 1 | 1 | | |
| | | | | Salad | | 1 | | 2 |
| | | | Boiled | Soup | 7 | 11 | 2 | 3 |
| | | | Baked | Bread additive | | 1 | | |
| | | | Dried | Tea | | | 1 | |
| | | | Fresh | Meat smoking | 1 | | | 1 |
| Unidentified taxon | RU Barkannik [NF], morkovnik | Aerial parts | Fresh | Snack | | 1 | | |
| | | | Cooked | Seasoning for meat | | 1 | | |

(RU) indicates that all Seto participants only provided a Russian name. (EE) indicates that the participants clearly indicated that the name is Estonian and not Seto. Plant name analysis based on [52–55]: [A] = plant name spread all across Estonia, [B] = dialect plant name (Seto and Võro), [NF] = new plant name from field work, [ER] = Seto name borrowed from Russian, [RD] = Russian dialect name, [RDX] = Russian dialect name outside NW region. Common Russian names are not indicated with superscript. *Kissel*—a viscous drink made from berries with the addition of starch, the more ancient form was made with oats; *kompot*—a sugary drink made from fruits or berries and sometimes stored for winter; *kvass*—a fermented drink made from water or birch sap with the addition of barley malt breads or, more recently, rye bread or industrial concentrate; *mors*—a drink made from fresh berries that is consumed immediately after mixing or is brought to a boil; mousse—a dessert made from whipped boiled semolina with the addition of red berries, which was popular in the 1960s–1980s (some participants claimed to have learned to make it in Estonian culinary schools); *suslo*—a sweet soft drink made from barley malt or flour.

The most frequently reported plants were the berries of *Vaccinium vitis-idaea* (142 DUR), *Vaccinium myrtillus* (141 DUR), and *Vaccinium oxycoccos* (140 DUR), the acidic leaves of *Rumex acetosa* (75 DUR), the fragrant seeds of *Carum carvi* (77 DUR), and the sap of *Betula* spp. (82 DUR).

Figure 2 illustrates the distribution of different emic food categories among locally collected wild plants. The most popular food categories are jams that are primarily made from various *Vaccinium* berries and teas made from fragrant herbs such as *Mentha* spp., *Hypericum* spp., *Trifolium* spp., *Origanum vulgare*, the flowers of *Tilia cordata*, the seeds of *Carum carvi*, and some others. Wild plants are used as condiments in winter preserves: *Carum carvi* seeds and *Vaccinium oxycoccos* fruits go with fermented cabbage, and *Ribes nigrum* leaves, *Quercus robur* leaves, and *Carum carvi* seeds are put into fermented cucumbers.

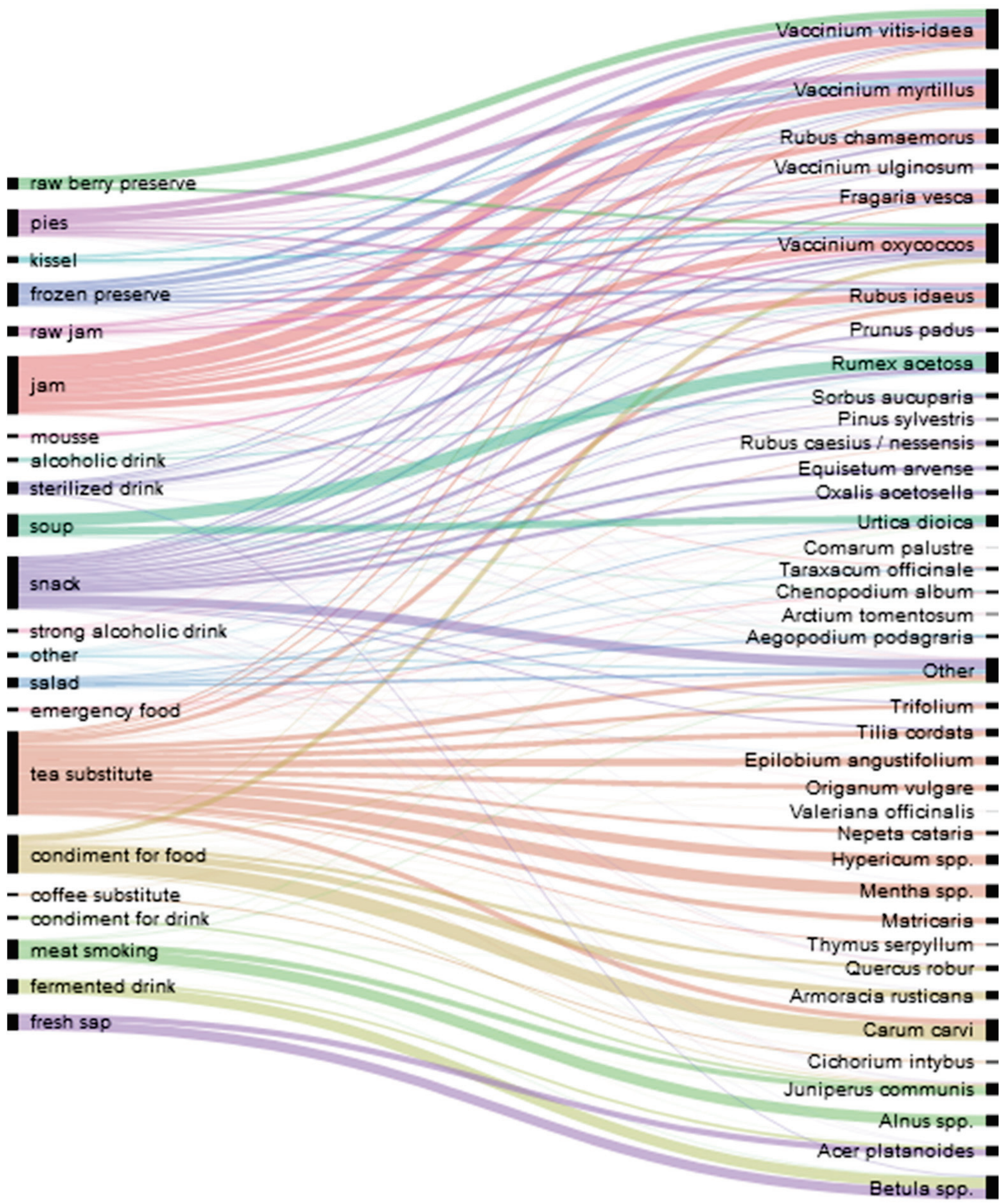


**Figure 2.** Wild plant taxa used by Setos and Russians as well as dishes made from them.

The snacks category mainly represents childhood snacks as we specifically asked about the plants that were consumed or tried during youth but no longer eaten (see also Figure 3). Therefore, this category features all forest berries, acidic plants including *Rumex acetosa* and *Oxalis acetocella*, the berries of *Prunus padus* and the frostbitten berries of *Sorbus* *aucuparia*, and the strobilus of *Equisetum arvense* (Russian 'pupyshi'). Spring shoots, needles, and the cambium of *Pinus sylvestris* were mainly reported by Seto participants. A couple of Russian participants mentioned eating the white sugary stalk bottoms of *Schoenoplectus lacustris (L.)* Palla (Russian 'trosta, kamysh'). A general preference for sugary snacks was characteristic of those who grew up during wartime or shortly thereafter.

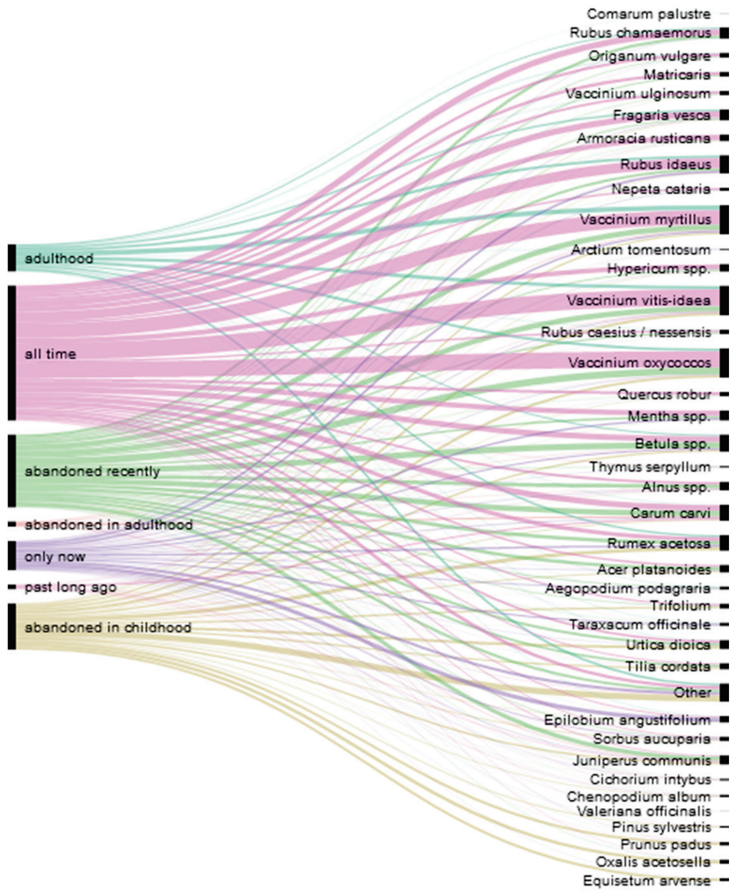


**Figure 3.** Diachronic distribution of wild plant use over the lifetime of the study participants.

> "Well, it's like [ . . . ] a little stem, the size of a finger. There's a little cone, one did not eat it. And this stem, it was sweet. I don't know why but we sucked it. We would suck it and spit it out. We wanted something sweet; there were no sweets then". (F, Russian, b. 1941)

Children used to suck on the sweetish stalks of *Equisetum arvense* as described in the above interview. Otherwise, they would suck nectar from the flowers of *Trifolium pratense* and *Primula veris*, or the sweet juice from the stalks of various Poaceae species (Russian 'trava', grass). One person remembered eating *Claviceps purpurea* growing on rye during her childhood in the post-war years:

> "You know, the post-war famine was terrible. Well, I didn't suffer from hunger as such . . . For some reason we filled our stomachs with kiselka [*Rumex acetosa*], with barkanniki, and horsetails [strobilus-bearing stems of *Equisetum arvense*]. In rye, they say it is poisonous; we ate ergot [*Claviceps purpurea*]. These little black horns. Now they treat rye, and it [*Claviceps purpurea*] doesn't grow. It is considered [ . . . ] and we in childhood, when rye was abundant [ate] these little black horns. Well, ergot, now I know the name. We ate ergot and no one was poisoned". (F, Russian, b. 1945)

3.2.2. Past Uses

Figures 3 and 4 demonstrate the temporal changes in wild plant use. The majority of food uses were preserved over time. It seems that while the set of consumed species remains intact, preparation methods might change. This process is caused by infrastructural, economic, and cultural developments. One of the main tasks in the yearly cycle was to preserve the yield and not let it perish. The ways of preserving wild foods have changed over time. For example, forest berries were preserved without sugar due to its scarcity in the early post-war years. However, due to the risk of over-fermentation and mold, no one was able to predict how much should be preserved. Later, the availability of sugar allowed for the making of sugary jams (Russian 'varen'e'). Some berries were simply crushed with sugar, without thermal processing (raw jam), using widely available manual mincing machines (our participants called it in Russian 'perekrutit's sakharom', mince with sugar). The jams were stored in the basement and later in the refrigerator when villages were connected to the electricity grid. As home freezers became available, the freezing of berries also gained popularity. Raw jams and the freezing of fruits that were acquired in adulthood have become quite widespread, but they have not completely replaced traditional jams.

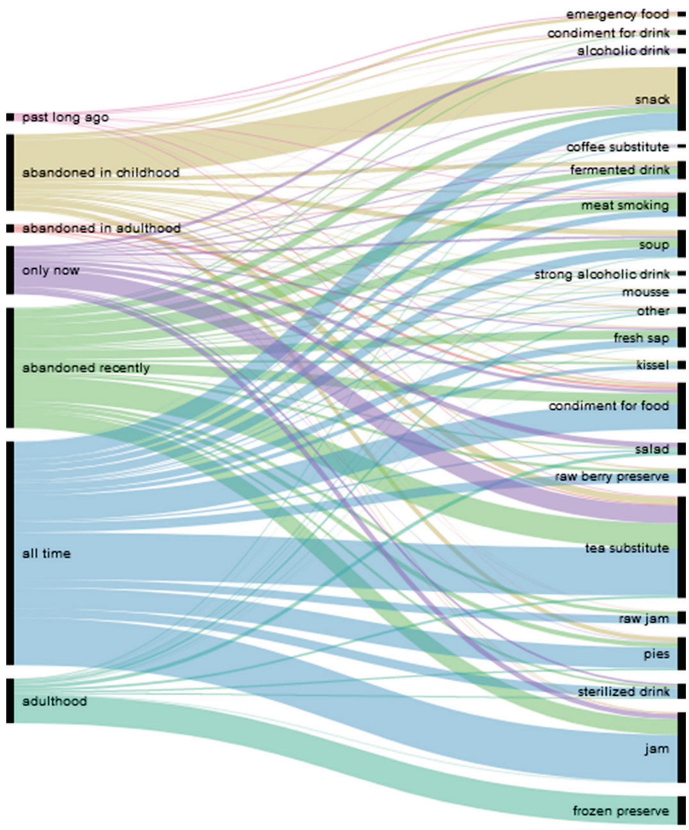


**Figure 4.** Diachronic distribution of the dishes prepared over the lifetime of the study participants.

> "Yes, I freeze it. No, sometimes I make a bit of jam simply [ . . . ] generally I freeze the bilberry". (F, Seto, b. 1950s)

The existence of numerous preservation techniques allows people to choose, for each type of berry, that which best fits their taste or health condition, in the case that they should limit sugar consumption. Below is a quite characteristic monologue about the different ways in which berries are consumed in a family:

> "[Wild strawberries are] better eaten fresh. They add lemon, they say they don't become bitter then, but we freeze them down, you crush them with sugar or simply sprinkle some sugar. And raspberries, too, become so delicious and tasty

> [this way]. [ . . . ] Best of all are frozen raspberries and cloudberries because you take them out in winter—and they taste just like summer. Bilberries, well there're not to everyone's taste, we are not into them but we also freeze them".
> (F, Russian, b. 1955)

Among the reasons for the recent abandonment of multiple wild food plants, interviewees mentioned the lack of time due to working in the field and weak health, which does not permit long walks or crouching over the berries. Some participants mentioned the disappearance of *Thymus serpyllum* and many complained about the loss of *Carum carvi* due to the abandonment of pastures and fields and the subsequent lack of mowing. Some interviewees were able to purchase the most important berries in the market or via their social networks, while others were happy to be regularly supplied by their grown-up children. Some wild plants disappeared from use because people started to cultivate them for food (such as *Rumex acetosa*) or use their cultivated relatives for making tea (like various *Mentha* spp. and *Nepeta cataria*).

One recently abandoned wild food plant is *Betula* spp., and specifically the use of its sap. Study participants mentioned harvesting *Betula* spp. from late Soviet times to until recently. They drank it fresh and also fermented it to preserve it until the summer work in the field, when it was consumed in large quantities. Sometimes raisins were added to start the fermentation process. Refreshing fermented sap is also one of the favored drinks after a steam bath, on par with soaked berries, morses, kompots, and herbal infusions. The generation of the interviewees' parents also used sap as a base for kvass. In this case, special loaves made from barley flour were baked until burnt and then fermented in the sap. In this preparation method, juniper twigs were put in the bottom of the barrel in order to filter out the saturated loaves while pouring the drink from a tap installed in the barrel. Juniper was also used, until the late Soviet era, to sanitize and deodorize all sorts of barrels that were used for fermented or salted winter stocks. For this purpose, a specially selected stone was heated and put in a barrel together with juniper twigs, and then hot water was added. Later, with the appearance of nuclear families, the volume of preserves decreased, barrel makers gradually disappeared, and barrels were replaced by glass jars. In the 1970s and 1980s, with the spread of preservation methods, the technology for sterilized birch sap appeared, and some lemon or orange started to be added, which reached convenience stores at that time. The recipes are still remembered by many study participants. Currently, birch sap is most frequently consumed fresh, and the remains are fermented. Much more rarely, the sap of *Acer platanoides* is harvested. Its taste is often described as sweeter than that of birch, but at the same time it is harder to catch it at the right time as it comes earlier in the year, and fermentation makes the maple sap slimy (Rus. 'soplivyi') and unpleasant for consumption. One interviewee reported drinking the sap of *Tilia cordata*. Historically, such use was also found in Estonia [56].

#### 3.2.3. Historical Uses

The ethnographic descriptions of the traditional food of Pskov region is quite scarce and even those describing the food of peasants very rarely mention any applications of wild plants. At the same time, the use of berries and mushrooms was considered quite common because the recipes using them do not contain any further clarifications or directions on how to find them. Moreover, wild berries were often sold by peasants in the market. This occupation was considered appropriate for young girls who had to earn their marriage dowry [57]. Women who sold berries or mushrooms kept the money they earned for their own use [58].

In 1803, during his travels around the western regions of Russia, which included Pskov, Russian chemist and geologist Vasilii Severgin recorded two recipes with wild berries. He highlighted a recipe for vinegar made from *Vaccinium oxycoccos*, and a recipe for *pastila*, a reduction from fruit juice, indicating that it comes best from *Ribes uva-crispa* and *Sorbus aucuparia* [59].

Starting from the second half of the 19th century, due to the development of zemstva, local government units, peasant life began to be described by medical doctors who aimed to attract attention to the terrible living conditions and social problems leading to poor health [60–62]. Those descriptions agreed that the local diet was predominantly vegetarian as meat was allowed only on non-fasting days, which consisted of 244 days a year. The consumed vegetables were cultivated, the main crops being cereals (rye, barley, wheat, oats, and buckwheat), cabbage, potatoes, onions, beans, peas, and root vegetables (*Brassica rapa*, *B. napus*, beetroots, and carrots). The main dishes were bread, shchi, and kvass. Academic observers indicated not only the poor quality of the bread (see below), but also regular bread shortages that occurred almost every year just before the new harvest.

Among the rare descriptions of wild foods, there are bread additives that were used when flour became scarce in the summer.

> "The main nutrition after rye, here, constitutes potato and cabbage; and also beetroots, cucumbers, radish and others. [ . . . ] In the case of need, peasants use *pushnina* or *pushnoi* bread, i.e., not winnowed, with weeds remaining—*koster* and *metla* [most likely rye shives and *Agrostis* spp.], sometimes they add 'lebeda' (very rarely) [most likely *Chenopodium alba* [Here and further the conclusions are based on Pskov Oblast Dictionary with Historical Data [55] and Botanical Dictionary by Annenkov [63]]; recently in our area they have borrowed from Latvians the habit of adding to rye flour (in leavened dough) a dilution of ground potato (only in the case of need as well); they do not consume bark and leaves here". [58]

The root of *Alisma plantago* (local name *bobovnik*, common Russian name *vodianoi podorozhnik*) was also reported as a flour additive that served to make flatbread during the yearly shortage of bread [60]. The Pskov Oblast Dictionary lists *Caltha palustris*, whose roots were also made into flour, under the name of *bobovnik* [55]. This is, however, most likely a misidentification of the local name, as the description of the plant in the text does not correspond to *C. palustris* and the plant itself is toxic unless boiled.

As the cuisine of Pskov region did not form a local brand like, for example, Karelian cuisine [64], the local culinary tradition was not described until the collapse of the Soviet Union. In 1991, the first book on Pskov and Novgorod culinary traditions was published [65]. It criticized the plain and uniform Soviet cuisine that did not take into account regional traditions and proposed relying on them in order to balance the problems otherwise caused by the planned economy. Curiously, the authors quoted a famous observation of exiled Russian chemist Alexander Engelhardt (1832–1893) regarding the diet of peasants who chose their meals according to the perceived caloric capacity that would be needed to perform manual labor. According to his description, more dense foods were chosen for more physically taxing jobs and less caloric ones for less demanding tasks, cf. [66]. The recipes published in the book featured the most common forest berries and mushrooms. A special section was dedicated to the menu of Pskov-Pechory monastery that inferred the use of mushrooms and potentially berries in jams, but it did not provide any details of preparation or particular plant names. Precise instructions on wild plant use were present only in the section that emphasized their beneficial properties, which contained recipes that did not match either our field experience or the ethnographic data: for example, juice from nettles, carrots and lemons, or a salad made from the leaves of *Arctium lappa* mixed with onion and horse radish. The list of recommended wild species included salads and dressings, snacks, and infusions made from: *Urtica dioica* (salad with *Allium ursinum* and *Ficaria verna* Huds., also juice and nettle powder), *Arctium lappa* (also a preserve from the leaves), *Taraxacum officinale* (salad from the leaves, coffee substitute, and candy from the roots), *Plantago major*, and *Aegopodium podagraria*. The nature of these recipes and other similar examples [67] suggest that these recipes did not actually belong to the local tradition but were suggested by the authors on the wave of popularization of wild plant consumption that started in the late Soviet era.

Another, more recent book on Pskov culinary traditions is a collection of recipes of various traditional meals reported by the local inhabitants [68]. Twenty-five out of 110 recipes contain wild food plant ingredients: *Chenopodium album*, *Rumex acetosa*, and *Urtica dioica* in soups; *Carum carvi* as a condiment in breads (Russian 'komy'), curd cheese (Seto 'sõir') and fermented cabbage; forest berries in desserts and tarts; *Vaccinium oxycoccos* in fermented cabbage and morses; *Vaccinium vitis-idaea* in soaked apples (both fruit and leaves); *Rubus idaeus* in desserts and drinks; *Humulus lupulus* in soft drinks and low alcoholic beverages; *Juniperus communis* in beer; *Menta* spp. and *Tilia cordata* flowers in infusions; and the sap of *Betula* spp. and *Acer platanoides* in fermented drinks (Russian 'ber'ka'). Two recipes presented uses not confirmed in the field. The first one lists the leaves and cambium of *Tilia cordata* as ingredients in flatbread (Kun'ia settlement, south of Pskov Oblast). The second one, Rus.'gorokhovye babashki', is dated to the 1930s and features the seeds of *Vicia sativa* (Rus. 'vika') as the main ingredient of bitter but dense pancakes made during times of hardship.

### *3.3. Cross-Cultural Comparison*

Cross-cultural comparison reveals a high level of homogeneity in the two studied groups with a core of 39 taxa that is the same for both of them (Figure 5). The Seto group has a higher intensity of wild plant use: 27 uses on average, in contrast to 21 for the Russian group. Moreover, Setos have a higher average number of plant taxa mentioned per user at 27.59, while for Russians the average number is 22.08. Both local groups, Setos and Russians, frequently reported drinks and preserves made from the forest berries *Vaccinium myrtillus*, *V. oxycoccos,* and *V. vitis-idaea*, birch sap, condiments, and tea from *Carum carvi*, and soup from *Rumex acetosa* made in the spring. The highest IFC for the Seto and Russian groups (>0.8) are for additives to lacto-fermented cabbage, cucumbers and mushrooms, tree sap drinks, jam, meat smoking, soaked berries, sõir, and soup. In the Russian group, a high rate was also found for mors and tea substitutes. The Seto group showed a high proportion of frozen preserves.

The use of fresh wild greens such as *Chenopodium, Aegopodium podagraria,* and *Taraxacum officinale* in salads is not characteristic of the local population. As one woman put it, "We are not grazers" (F, Russian, b. 1942), implying that "we", or her family at large, do not have a habit of incorporating wild greens into their diet, in contrast to those who do so, usually guided by popular literature on wild plants and also usually having come from elsewhere. While being aware of their potential as edible plants, she chose to adhere to the traditional list of wild taxa known since childhood.

The region avoided the main famines of the USSR, though it experienced some shortages in supply after WWII. The last famine occurred in 1862–1865 due to the potato blight epidemic that originated in the Baltic region. However, due to the unpredictable weather and relatively short vegetation period from May to September, famine bread recipes were widely in use at the end of the 19th century [58]. These techniques were remembered and used again during the supply shortages that occurred during and after WWII. Currently, the plants that are associated with times of hunger are not incorporated into everyday practices. In the local perception, wild greens are usually associated with the abstract hardships of war and post-war times. When we asked informants about wild plants added to salads and then, after receiving a negative response, gave the examples of *Urtica dioica* and *Chenopodium album*, they usually referred us to post-war bread recipes with *Chenopodium*, etc., stating that currently they do not consume such plants. For example, a Russian man born in 1939 said that they used to add *Chenopodium* to bread dough, make flatbread with *Urtica dioica*, and collect "white moss" in the forest, because the village authorities could only provide 2 kg of flour for a family for a month.

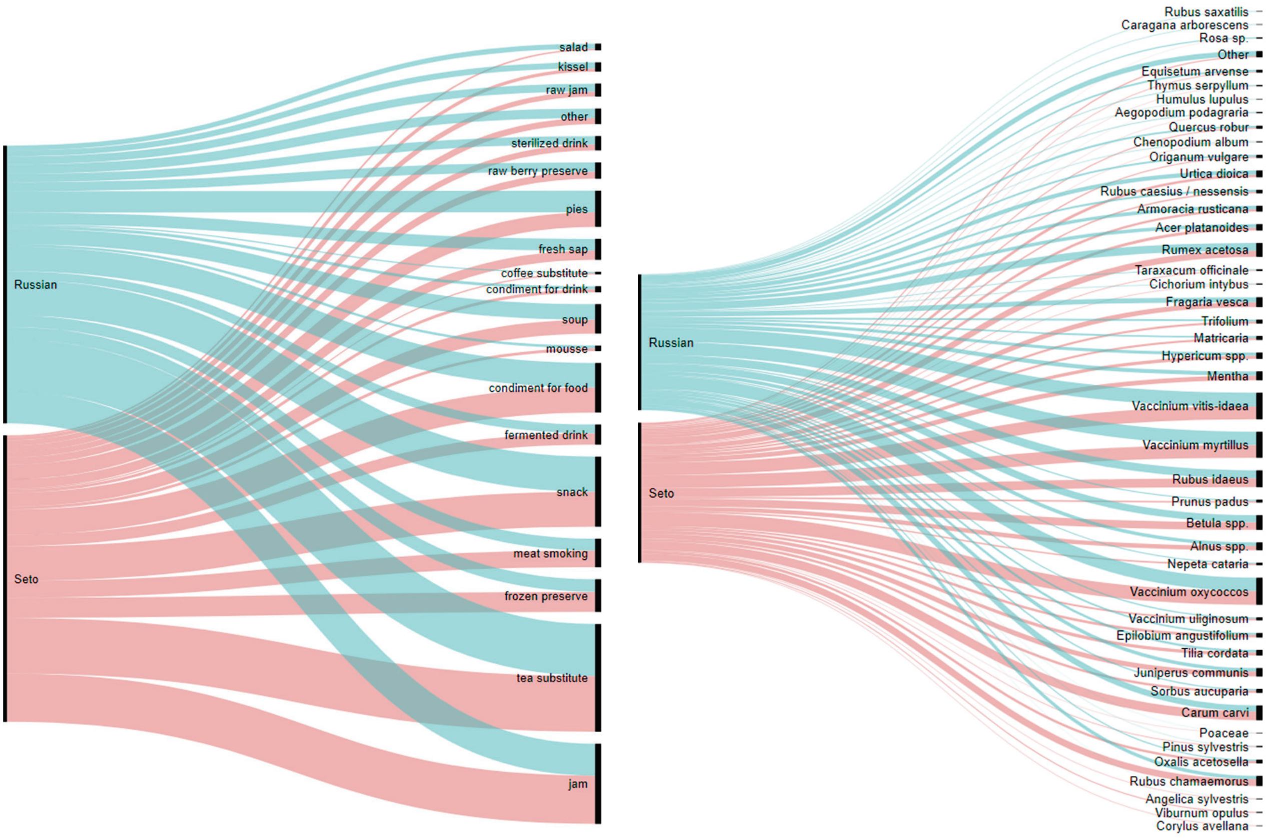


**Figure 5.** Cross-cultural comparison of food categories and wild plant taxa.

Daughter (Russian father, Seto mother, b. 1968): "I remember she [Russian grandmother] said that they used to eat goosefoot when there was a famine, goosefoot in post-war years or something. I don't know what was used afterwards. They added it. So . . . "

**Interviewer:** "Did they eat raw goosefoot or add it to something?"
**Daughter:** "I think, they added it to the bread, when baking, for sure I . . . "
**Mother (Seto, b. 1945):** "No, we didn't have that."
**Daughter:** "Well, my grandma said."
**Mother:** "But it is a Russian grandma."

*Carum Carvi* and Ethnic Stereotypes

In one of the interviews, we shared an interesting exchange about foods with *Carum carvi* seeds acting as a marker of ethnic identity:

**Interviewer:** "You mentioned caraway. We thought that it was more of a Seto tradition . . . What do you consider yourself?"
**Participant (F, Russian father, Seto mother, b. 1955):** "You know, inside me it is even, just like I consist of two halves, it lives inside me in two halves. So one day I do feel Russian, but at times absolutely, I absolutely have a craving for . . . in any case, my food choices are Seto ones because I like this cuisine, like this simplicity. I do like caraway; in curd cheeses, bread, sweets, everything."
**Interviewer:** "Sweets??"
**Participant:** "Yes."
**Interviewer:** "Do you make them yourself?"
**Participant:** "No, I don't. Formerly in Estonia they made chocolate bars with caraway; very tasty. By the way, I can't find them nowadays for some reason. Maybe they exist . . . shortbread with caraway. Well, I like caraway in every form; in every food."

Other Seto informants also linked the use of *Carum carvi* with such food categories as tea substitutes and sõir (Seto homemade curd cheese made with the addition of eggs and *C. carvi* seeds). At the same time, a Russian woman born in 1927, who spoke in very prominent Pskov accent, attributed *Carum carvi* to 'gun'ba' [55] and reported that her mother used to make curd cheese (Rus. 'varila syr'), adding the seeds. Two more Russian people, born in 1952 and in 1960, also mentioned this plant name. It was used as a bread additive, seasoning for sauerkraut, and as an ingredient of 'syr'/sõir.

Overall, we recorded 29 DUR for *Carum carvi* for the Russian group and 43 DUR for the Seto group. While sõir with *Carum carvi* seeds is usually described as a staple of Seto food [69], we encountered nine such uses of *Carum carvi* in the Russian group compared to 11 cases among Setos. None of our Russian interviewees declared a Seto origin of their parents or using the Seto language in the family, nor did they report borrowing this tradition.

*Carum carvi* is also used in sauerkraut (7 Russian/7 Seto DUR) and as a seasoning in other lacto-fermented preserves (1/2), as a tea substitute (7/12), and as a universal additive including bread seasoning (6/10). In the Russian group, there were 14 current, and 15 past uses of *C. carvi*, while in the Seto group there were 15 and 28 uses, respectively.

This finding, as well as the results of the following cross-border analysis, seems to support the interpretation of the ethnic situation in the region by Novozhilov [42], in which attachment to a certain locality can be as important as ethnic identity. See also the data from the cross-border comparison that shows a higher level of cohesion between Setos and dominant Russian and Estonian groups than between Setos across the border.

### 3.4. Cross-Border Comparison

Table 5 demonstrates that for widespread uses (at least three people) the greatest homogeneity of used plants (JI from 80 to 91) is among Russians and Setos living on the Russian side of the border, while the homogeneity of use between Estonian Setos and Estonians is slightly lower (from 73 to 89). For all taxa, however, the highest overlap is between Estonians and Estonian Setos (from 68 to 85), followed by Russians and Setos on the Russian side of the border (from 61 to 69). JI value between Seto groups across the border remains approximately 60 (57–66) in both cases.

The lower similarity indices for all taxa reflect the high level of experimentation and individualization of uses. To some extent this occurred during the Soviet era, yet some experimentation is reflected in the recently acquired uses. Also, we can observe high individual variation in the children's snacks reported by our interviewees and those in Estonia. If we take into account only widespread past uses, the JI remains the same for Russian Setos when compared with both EE Setos and Estonians—this shows that despite the administrative border, RU Setos retained a strong connection with the Estonian side and lived in the Estonian cultural space. As our interviewees still remember the time when there was only an administrative border between the two groups of Setos and cross-border relations were much stronger, there is still a higher level of overlap for current uses between the two Seto communities compared to the overlap with the cross-border dominant groups. We can observe very similar, although even stronger, cross-border differences between members of the same ethnic group in the historical region of Bukovina, which is currently divided between Romania and Ukraine [11]. The relatively high similarity between Setos living in Russia and Estonians for all taxa continually used can be explained by the education provided in Estonian and the spread of Estonian-language media.

**Table 5.** Jaccard Similarity Index (JI) calculated for taxa used by Estonians (EE), Estonian Setos (EE Setos), Russian Setos (RU Setos) and Russians (RU)–Current uses–Past uses–All uses. Right top of each table: all taxa. Left bottom of each table: taxa recorded three or more times.

| | **Current, All Taxa** | | | | |
|---|---|---|---|---|---|
| **Current, ≥3 taxa** | **JI** | **EE** | **EE Setos** | **RU Setos** | **RU** |
| | **EE** | **X** | **68.29** | **54.17** | **49.12** |
| | **EE Setos** | **73.68** | **X** | **65.12** | **46.43** |
| | **RU Setos** | **54.55** | **65.85** | **X** | **61.11** |
| | **RU** | **52.17** | **55.56** | **80.00** | **X** |
| | **Past, All Taxa** | | | | |
| **Past, ≥3 taxa** | **JI** | **EE** | **EE Setos** | **RU Setos** | **RU** |
| | **EE** | X | 85.71 | 57.41 | 60.00 |
| | **EE Setos** | 83.72 | X | **57.41** | 57.14 |
| | **RU Setos** | 64.58 | **64.58** | X | 69.64 |
| | **RU** | 61.22 | 61.22 | 90.48 | X |
| | **All Time, All Taxa** | | | | |
| **All time, ≥3 taxa** | **JI** | **EE** | **EE Setos** | **RU Setos** | **RU** |
| | **EE** | X | 69.49153 | 58.46154 | 53.33333 |
| | **EE Setos** | 88.88889 | X | **59.01639** | 49.35065 |
| | **RU Setos** | 37.93103 | **61.53846** | X | 64.70588 |
| | **RU** | 58.18182 | 58.49057 | 91.11111 | X |

Nevertheless, the level of cohesion across the communities is quite high. Indeed, there are few plants that are unique for each group, and those mentioned by more than three people are even fewer. Out of 56 ethnotaxa mentioned as currently used by at least three people, 30 taxa are used in all four groups (Figure 6). It is important to add that the absolute number of currently used taxa is shrinking, and the present differences are mostly due to the unequal abandonment of plants in the studied communities.

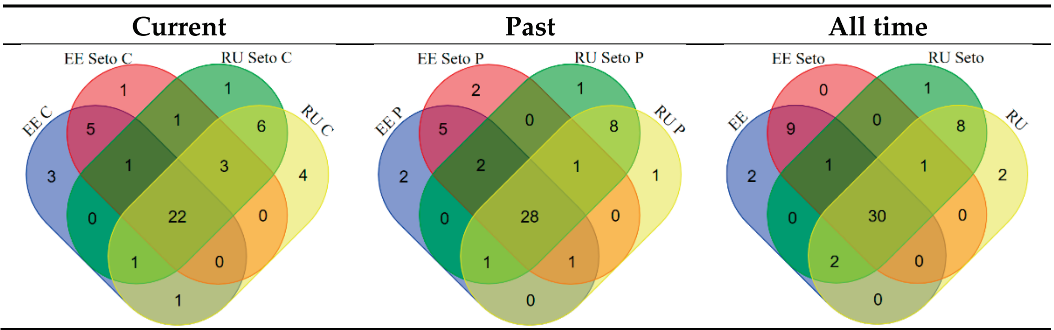


**Figure 6.** Overlapping of taxa used by Estonian (EE) and Russian (RU) Setos in the past (P) and currently (C). Only plants mentioned three or more times are analyzed.

As shown in the diagrams, the majority of plants are used ubiquitously in the region, although there are particular plants specific to each group and two clusters of plants specific to Estonians and Estonian Setos on the one side and Russians and Russian Setos on the other side. These differences can be subdivided into two general cases:

(1a) Plants used in similar ways by different groups at different times—formerly used throughout the whole region but gradually abandoned: *Angelica sylvestris*, *Corylus avellana*, *Trifolium* spp., *Lamium album*, *Rubus saxatilis*, *Amelanchier spicata*, and *Humulus lupulus*.

For *Viburnum opulus* and *Chenopodium album* we recorded their current use in Russia and archival use in Estonia. The stems of various Poaceae taxa are used as snacks across the border, and in Estonia this is namely *Phleum* spp. *Schoenoplectus lacustris* from Cyperaceae is also used as a snack in Estonia.

(1b) Plants that were acquired (and often abandoned) due to recent popularization—for example, the use of *Taraxacum officinale* in jams and salads.

(1c) Plants that are used for different functions on the two sides of the border.

*Origanum vulgare*—while in Estonia it serves as an additive to blood sausage, in Russia it is solely used in infusions. *Achillea millefolium* is used as a tea in Estonia and by Russian Setos and as medicinal plant in Russia. While in Estonia the tubers of *Equisetum arvense* are used as a snack, in Russia strobilus-bearing stems are used for this purpose.

(2) Plants that are unique to ethnolocal groups across the border.

We recorded exclusively in Estonia the use of cambium of various trees, usually as children's snacks: most frequently *Pinus sylvestris* (16 DUR), but also *Betula* spp. and *Salix* spp. The resin and shoots of *Picea abies* are also used predominantly by Estonians.

*Thymus serpyllum* is used in tea by all groups except Estonians.

The use of wild *Ribes nigrum* leaves for the lacto-fermentation of cucumbers and mushrooms was recorded only in Russia. Wild *Cichorium intybus* is used as a coffee substitute in Russia, while in Estonia it was also used for this purpose, but only from cultivation.

There was also an important conceptual difference: in Estonia plants were used just for making tea, while on the Russian side they were used as tea substitutes.

Plant Names

This section provides a comparison of Seto plant names recorded on both sides of the border. Interviews in Estonia and Russia were conducted in Estonian and Russian, respectively (except one interview in Estonian with a Seto informant who traveled from Russia to Estonia). Despite an obvious limitation—difference in efforts needed to switch between dialects of one language than between two different languages—given the lack of data on the Seto language, we draw a preliminary comparison of the available data.

Only a few participants on the Russian side of the border declared that they regularly speak Seto with their peers, and no one admitted to teaching Seto to their children. However, we encountered a willingness to teach at least some Seto to grandchildren residing in Estonia, especially given the recent publication of a Seto ABC-book [70]. The Estonian data also provides evidence of a language shift that started in the 1960s-1980s [12], thanks to the accessibility of professional education and careers that are only compatible with the use of the Estonian language. Nevertheless, Seto remained the home-spoken language, as the majority of the Seto interviewees in Estonia spontaneously answered in the Seto dialect and all claimed to speak the dialect at home.

On the Russian side of the border, 16 of the 66 recorded taxa had recorded dialect names and for eight taxa we recorded previously undocumented names, which were elicited from 18 of the 25 participants (Table 6). Only dialect names were recorded for *Carum carvi*, *Rumex acetosa*, *Tilia cordata* and *Urtica dioica*. The most frequently given Seto and Estonian names were those for *Vaccinium oxycoccos*, *Vaccinium vitis-idaea*, *Rubus idaeus*, *Betula* spp., and *Juniperus communis*. Berries like *Vaccinium myrtillus*, *Rubus idaeus* and *Rubus chamamemorus* were referred to with more conventional Estonian names.

**Table 6.** Wild food plant names recorded from Setos in Russia and Estonia.

| | Russia | | | Estonia | | |
|---|---|---|---|---|---|---|
| | Number of Plant Names | Number of Informants Who Provided Names in Corresponding Language | Number of Taxa | Number of Plant Names | Number of Informants Who Provided Names in Corresponding Language | Number of Taxa |
| Dialectal (Seto/Võro) | 25 | 18 | 16 | 73 | 37 | 37 |
| Russian | 72 | 24 | 66 | 1 | 2 | 1 |
| Spread all over Estonia | 27 | 18 | 19 | 73 | 37 | 51 |
| Total | - | 25 | 66 | - | 37 | 62 |

For comparison, on the Estonian side, 37 of the 62 recorded taxa were named by Setos in a dialect (Seto/Võro) and dialect plant names were encountered quite often. Out of the 647 occasions in which the name of a wild food plant was mentioned, 175 were dialect names, two Russian names (a recent introduction of Ivan-chai [71]), and the rest were names used all over Estonia, including the whole of South Estonia. Five taxa were referred to by their dialectal name on more than 10 occasions: *Vaccinium oxycoccos* (29), *Matricaria discoidea* and *Vaccinium vitis-idaea* (both 18 occasions), *Rubus nessensis* (14), and *Thymus serpyllum* (11). Only one person used a single dialectal name, while five or more dialectal names were used by 17 people, of whom one used 19 dialectal names.

### *3.5. Factors Affecting the Use of Wild Food Plants*

#### 3.5.1. Collectivization and the Generation Gap

Many of our interviewees admitted that they were brought up by their grandparents, and more precisely by grandmothers, as their parents generally had little time while working on collective farms. Those who possessed a private plot of land (almost everyone in Pechorsky District) were also obliged to meet milk, egg, and other farm product quotas. The surplus could be sold in the market. As all the pasture land belonged to sovkhozes, or state-owned farms, they had to harvest hay from around ditches and in the forest.

> "So they woke up in the morning, and they have their own cattle, right? Meanwhile the cattle and all this stuff, some of them you feed, some of them you bring to the pasture. Then work in the kolkhoz. Come home for lunch, it's time to milk the cow. While going to milk the cow, chewing a piece of bread on the go—it's already time to go back to the kolkhoz. Come back home at 7, the cows are back from the pasture, it's time to care for them again. And then in the evening you have to find some hay for your own cattle . . . So it was, I'm thinking about it now, how they lived and how they survived, and when they . . . So they likely woke up at 3 am and went to bed at 12. [ . . . ] They would wake up in the morning, run somewhere, to some ditches—it wasn't allowed to mow anyone's fields, they belonged to the kolkhoz. So, where there were some ditches, somehow they would mow some. Then they would come home, and go to work, and so it was. And then in the evening, the cows would come back, other cattle would get their fodder too, and they had to bring that hay in. It was a total nightmare". (F, Russian, b. 1942)

Some interviewees who lived a couple kilometers from the border remember going to Estonia in order to obtain some hay. As a result, their parents almost never had time to go to forest, and if some berries were collected, it was done while collecting brush wood or harvesting the peat used for heating. Therefore, it was mainly grandmothers who went to the forest with their grandchildren. Thanks to this, some information that was discarded by the informants' parents' generation was passed on to that of the interviewees who were growing up at the time of rising interest by the state in wild resources and new provisions, procured from the wild, passed on via local shops and sometimes schools (see below). The following dialogue between daughter and mother is quite characteristic:

> **Daughter (F, Seto, b. 1968):** "[ ... ] there is kislitsa [Russian 'kislyi'—sour] growing in the woods. Heart-shaped leaf, it is rarely ripe and I remember my grandmother told me that you can pick it, it is sour. [ ... ]"
> **Mother (F, Seto, b. 1935):** "We called it zaiach'ia kapusta [literally rabbit's cabbage]."
> **Daughter:** "It's not zaiach'ia kapusta at all."

The both names are used in the region to indicate *Oxalis acetocella*, and its Seto name jänesekapsas also means rabbit's cabbage. The daughter, who was brought up by her Russian grandmother, had a much better idea of the wild plants collected in the forest and even gave a different name for *Oxalis acetosella* ('kislitsa') than did her mother ('zaiach'ia kapusta') as she learned it from her grandmother.

Biology school teachers and those of primary school grades could not complain about the ecological knowledge of their pupils. As one retired teacher said, the students "would tell you more [than the teacher], as they came from the village" (F, Seto, b. 1950s).

#### 3.5.2. Possible Literature and Media Influence

In general, the local population was quite reluctant to refer to any wild plant guides. The generation of our interviewees' parents used to subscribe to magazines such as *Krestianka* (published between 1922 and 2015, 22 million copies sold as of 1990) and *Rabotnitsa* (published since 1914, 23 million copies sold as of 1990) though the majority of locals did not have either money or time for this:

> **Interviewer:** "Did you use any recipes from culinary magazines, for example, *Rabotnitsa*, *Krestianka*?"
> **Interviewee A (F, Russian, b. 1962):** "Which culinary magazines, dear!"
> **Interviewee B (M, Russian, b. 1964):** "It's expensive, mind you."
> **Interviewee A:** "No culinary magazines."
> **Interviewer:** "So you did not subscribe to any journals?"
> **Interviewee A:** "No, my mother subscribed to *Krestianka* but I do not remember any culinary recipes, I don't remember it."
> **Interviewee B:** "We had other things to worry about than fancy stuff; we had to bring in hay."
> **Interviewee A:** "We had to work from dawn till dusk ... Which recipes? Put the cabbage to ferment, salt the cucumbers [for lacto-fermentation], boil the jam."

Some declared, however, that they used to save or store in scrapbooks some recipes from tear-off calendars that were popular in late Soviet times: "Of course, I do not agree with all of them, they tend to lie much more frequently these days. But earlier we somehow used [calendars] quite so often, it was somehow interesting, I used to buy them" (F, Russian, b. 1960). This was one of most widespread types of calendars in Soviet Russia up until the 1990s: each page of such calendars represented a day of the year and its reverse side contained tips for everyday life or some trivia. There were calendars dedicated to different subjects like winter preserves, household tips, etc. The information published there derived from lengthy household encyclopedias that were more expensive than, and not as handy as, a small calendar (Figure 7).

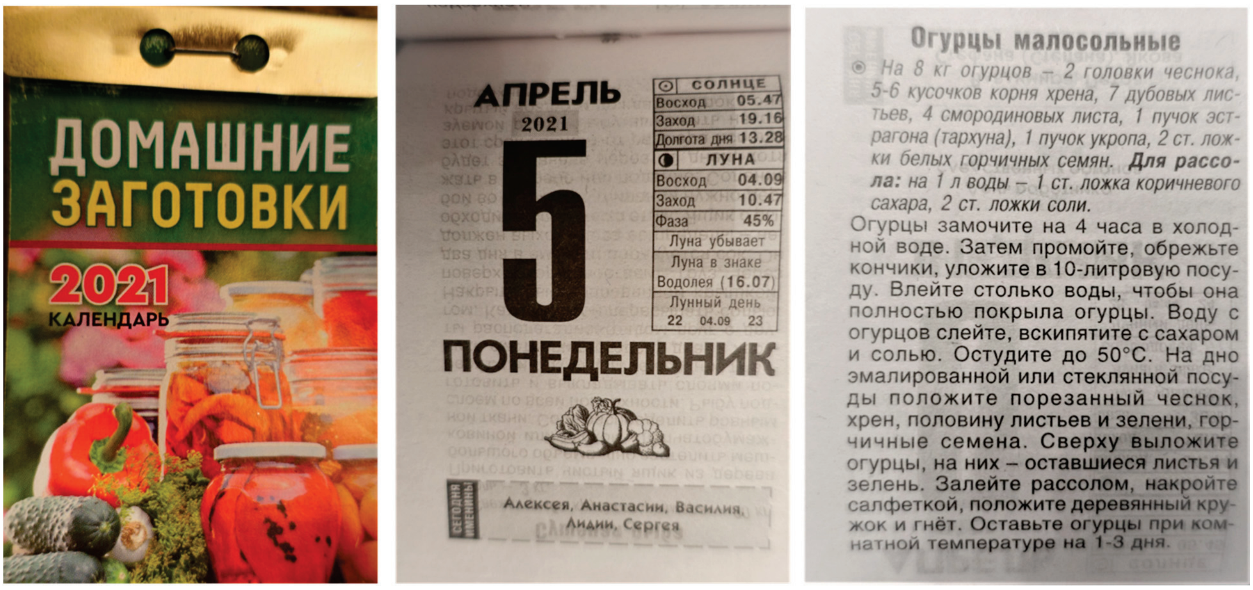


**Figure 7.** Contemporary tear-off calendar 'Homemade preserves' for 2021 bought in Pechory with a recipe of salted cucumbers with leaves of *Quercus robur*, *Ribes nigrum,* and *Artemisia dracunculus* on the reverse-side of a page indicating the date.

One Seto woman with higher education admitted to using some wild plants in salads but she clearly indicated that her knowledge came from written sources, including, for example, 'honey' from dandelions: "I made dandelion jam several times. But this was yet another thing, following magazines or books; goutweed, dandelions, and nettle" (F, Seto, b. 1955).

Currently, those who own a computer or a smartphone occasionally look for new recipes using search engines and social networking sites. However, the Internet is only used to find the details about already known information and not for discovering something new.

**Interviewer:** "You say you would rather look something up on the Internet?"
**Interviewee (F, Seto mother, Russian father, b. 1968):** "Yes, you'll find it quicker."
**Interviewer:** "A recipe for what? What did you look up last time?"
**Interviewee:** "The recipe for salt for fermenting cucumbers—for a liter of brine."
**Interviewer:** "I see, different measures."
**Interviewee:** "Yes, because usually there is a three-liter jar, and this time there was some leftover; and I had to use an unknown container. And you don't know how much salt for a liter of water and not for three liters as usual".

3.5.3. State Procurement of Wild Resources

While collective farms regulated the interaction between farmers and cultivated plants, late Soviet policy introduced another structure that influenced the relationship of the local population with wild plants, the procurement office. This office was organized by the Tsentrosoyuz, Central Union of Consumer Societies, a commercial network aimed at the procurement and distribution of agricultural products that has its roots in late Imperial Russia and was eventually institutionalized in 1928. It procured and redistributed the produce of farmers locally, as well as on the state level, via a network of procurement offices (*zagotkontora* or *zagotpunkt*) and local shops (*raipo*—regional consumer society or *sel'po*—rural settlement consumer society).

Today, the system of *raipo* in the Pskov region is still active in the villages of Pskov Oblast, although now they have to compete with big commercial supply chains with regard to distribution and with individual entrepreneurs in terms of procurement.

According to our study participants, the procurement campaign for wild resources was always present but gained popularity in the 1980s. Procurement offices accepted wild forest resources from the local population: bark of *Salix* spp., fruits of *Vaccinium myrtillus*, *Vaccinium vitis-idaea*, *Vaccinium oxycoccos*, *Sorbus aucuparia*, and others. Some families collected berries that they did not usually utilize themselves, such as rowan.

> **Interviewer:** "Did you use rowan?"
> **M, Seto, b. 1952:** "Rowan, very rarely."
> **F, Seto b. 1950:** "Rowan, we picked them. And why did we pick them? Perhaps, we traded them. Somehow ... they were accepted [at a procurement office]. And ourselves, not sure we made anything from them. But I remember that in childhood we climbed the trees and picked them."

Some participants mentioned that sometimes it was difficult to find berries in the forest due to high competition, which resulted in the harvesting of unripe berries, especially cranberries. Figure 8 demonstrates an order of a regional executive committee setting the start date of cranberry harvesting on 7 September, as well as fines for those who did not respect this date. A collector would be fined 10 rubles for early collection and 9 rubles for each kilogram of cranberries, and a procurement office was to pay 50 rubles if they did not respect the start date.

1

РАСПОРЯЖЕНИЕ ОБЛИСПОЛКОМА

О СРОКАХ СБОРА И ЗАКУПАХ КЛЮКВЫ

В соответствии со ст. 80 Лесного кодекса РСФСР установить на 1991 год срок начала сбора ягод клюквы 7 сентября 1991 года.

Разрешить на территории области закуп клюквы предприятиям и организациям лесохозяйственного территориального производственного объединения, облпотребсоюза и Гдовскому овощеконсервному заводу.

Довести до сведения, что в соответствии со ст. 69 Кодекса РСФСР «Об административных правонарушениях», установлена ответственность должностных лиц и граждан за сбор дикорастущих ягод с нарушением установленных сроков их сбора в виде штрафа, налагаемого в административном порядке в размере до 50 рублей на должностных лиц, до 10 рублей на граждан.

Кроме того, за каждый килограмм досрочно заготовленных ягод клюквы взыскивается 9 рублей.

Райисполкомам оказывать помощь предприятиям лесохозяйственного территориального производственного объединения в предотвращении преждевременного сбора ягод клюквы и соблюдении установленного порядка их заготовки.

Контроль за соблюдением установленных сроков сбора ягод клюквы возложить на райисполкомы, управление внутренних дел облисполкома, комитет по охране природы области и другие органы.

2

ВСЕ ЗАГОТОВИТЕЛЬНЫЕ ПУНКТЫ КООПЗАГОТПРОМА РАЙПО

принимают от населения: рябину красную на кистях по цене — 0-80 копеек за 1 килограмм, яблоки свежие — 0-40 копеек, рябину черноплодную без кистей — 0-80 копеек.

**Figure 8.** Last page of the local newspaper 'Pechorskaia Pravda' from 24 August 1991. 1. Decree of the district executive committee 'On the dates of harvesting and procurement of cranberries'. 2. Announcement from the district procurement office (transformed into a cooperative) about accepting rowan berries at 0.8 rubles/kg, apples at 0.4 rub/kg and x *Sorbaronia mitschurinii* berries at 0.8 rub/kg.

Due to the extremely low cost for raw materials, this task was considered suitable for children. However, later, new incentives were introduced to motivate the local population. Those who bought shares in the local *raipo* (i.e., a local office of the consumer society that operated the village convenience stores and procurement offices), could count on some scarce goods that were not accessible otherwise.

> "There was a thing that you had to be a stakeholder. I remember; when I first had kids, it was nearly impossible to buy diapers for the babies; you had to have

> a certificate, I remember it as clear as day. You had to be a stakeholder; a member of the *raipo*. So, they were only sold to the members of the *raipo*". (F, Seto, b. 1960)

3.5.4. Wild Plants as an Economic Resource

The borderland position of Pechory made it an important market location: a customs point was installed there as early as 1662, and the current check point is only 2 km away from the small historical center. Every weekend, the market is flooded with visitors from across the whole district. Cars with Estonian number plates can also be frequently seen. The stationary stands are attributed to the respective stand renters, confirmed by plates with their surnames, but the weekends are characterized by the abundance of mobile stands of local farmers who do not have time to go there every day. At the market, one can buy fish from Lake Pskov, honey, dairy products, local vegetables (potatoes, onions, carrots, beetroots, tomatoes, and cucumbers), and cultivated and wild berries depending on the season: blackcurrant, *Vaccinium mirtyllus*, *Fragaria vesca* in smaller quantities, *Vaccinium vitis idaea*, *Vaccinium oxycoccos*, *Viburnum opulus*, and *x Sorbaronia mitschurinii*. The most commonly sold mushrooms are *Boletus edulis*, *Leccinum* spp., and *Cantharellus sibarius*. Several stands also sell dried herbs and homemade preserves made from mushrooms and *Armoracia rusticana*.

During the Soviet era, despite the fact that individual trading was often in the grey area, the Pechory market was an important center of trade for the local community, including from the residents of Estonia. An inhabitant of Pechory describes the role of the local market as follows:

> "Even our family had a goat, called Kat'ka. But she was so stubborn. My mother suffered and suffered with her, but then we brought her to the market; sold her. [ ... ] They say, after the war there was famine everywhere. We didn't have it here. Here, we had individual farms, it was them. As soon as they were able to work here, you know, there was everything in the market. Milk, sour cream and butter, whatever you wanted". (M, Russian, b. 1955)

Not only was it possible to get rid of the excess of homemade products, many individuals also aimed to sell their produce at the market. The abovementioned interviewee later mentioned that his father used to grow vegetables, such as tomatoes and cucumbers, in the home garden within Pechory and that his father's favorite pastime was selling them at the market.

During numerous visits to the Pechory market, we observed only a couple of permanent stalls specializing in products made from wild and semi-wild plants, selling mostly fresh greens, dried herbs, or homemade preserves (see Figure 9). We identified the following categories: herbs for the lacto-fermentation of cucumbers; tea substitutes (for example, *Hypericum* spp., *Origanum vulgare*, and the fruits of *Rosa* spp.); fresh greens (*Rumex* spp.); fresh berries and preserves made from them; and fresh, fermented, or dried mushrooms. However, in addition to those stalls, we encountered different sellers, on different days, just at the entrance to the market, indicating that they did not have a permanent license; these sellers had brought forest berries and mushrooms that they collected themselves.

**Figure 9.** Pechory market. Left: Set of herbs for cucumber lacto-fermentation: *Armoracia rusticana* leaves, *Anethum graveolens* stalks with seeds, and *Ribes nigrum* leaves. July 2018. Right: homemade preserves made from mushrooms and wild and cultivated plants. August 2019. Photos by Olga Belichenko.

One of the current sellers (F. Russian, b. 1957) at the Pechory market with the widest choice of homemade preserves, admitted that she adapted her selection of products according to both requests from clients and information learned from fellow sellers at the market (see also [72]). For example, she remembered trying some *Tilia cordata* sap that was sold at the market and declared that she has recently tried to make 'honey' from *Taraxacum* flowers, thanks to the advice of colleagues.

3.5.5. Immigration during Soviet and Post-Soviet Times

Unlike highly urbanized neighboring regions such as Leningrad, Estonia, and Latvia, Pskov Oblast, and more precisely Pechorsky District, remained an agricultural region. Nevertheless, it attracted a wave of incomers that is becoming more evident in the context of overall depopulation. Among our interviewees, we noted three groups:

(1) orthodox believers looking to reside near the only officially operating monastery in the USSR,
(2) military personnel and their families,
(3) 'downshifters'(megapolis residents who came to Pechory in search of a quiet life).

The third group requires more attention as the influx of such downshifters has increased since 2000. Some of the villages that we visited were mostly populated by such immigrants. However, since then the nature of such immigration has changed. While for Soviet downshifters this was a personal choice, the current incomers tend to organize in communities for whom this choice is a life project (see more in [73–75].

Having grown up in an urban context, these groups tend to rely on popular guides to gardening and wild resources that became abundant in the era of procurement of wild resources. The wild food plant uses reported by this group of participants seemed inconsistent with the local tradition, but at the same time coincided with the recommendations found in popular literature (for example, [76]). A Russian woman (b. 1953) with higher education, who came from Leningrad, reported her favorite childhood book by Soviet botanist and wild food popularizer Nikolai Verzilin [77]. The following is the list of diverse plant uses reported by incomers to the study area: wine made from *Taraxacum* flowers; salad made from *Arctium tomentosum* leaves and its stems as a snack; *Taraxacum* and *Arctium* roots as coffee substitutes; salted preserves made from *Aegopodium*, *Taraxacum*, or *Urtica dioica* leaves; snacks and salads made from the leaves and young shoots of *Epilobium angustifolium*; *Plantago major* as a seasoning for fermented cucumbers or mushrooms; tea made from *Agrimonia eupatoria*; and dry powder seasoning for soup made from *Urtica dioica*.

Such practices are observed by the local population in small villages, but they are rarely borrowed or introduced into their own practices. During our research we were often directed by locals to such newcomers (though not described as newcomers) who were presented as being especially knowledgeable about wild plants, in contrast to the people we interviewed.

## 4. Conclusions

While wild plants do not constitute a substantial portion of the local diet, the repertoire of used wild plants is consistent. Almost all taxa are shared by both local communities. The list of plants used by Russian Setos is slightly narrower, yet the number of plant uses higher, than among Russians. Although some locals tend to recognize the use of particular plants like *Carum carvi* as ethnic markers, our data did not correspond to such a distinction.

Wild plants have historically been an economic resource for women and children in the region. The tradition of collecting them did not disappear during the decades of collectivization thanks to the cross-generational knowledge transfer from grandparents (usually grandmothers) to grandchildren. Later, local markets and state induced procurement in late Soviet times played their role in keeping the practice alive, although sometimes traders collected plants that they would not have used themselves. Since then, procurement points have been marginalized due to extremely low purchase prices. Currently, it is the local market in Pechory that plays an important role in the local knowledge transfer.

Interestingly, residents on the Russian side of the border seem to be united around the idea of the rejection of certain wild plants rather than actual use. Setos and Russians are reluctant to use plants associated with famine, such as *Chenopodium album*, *Urtica dioica* (except for soup), and *Aegopofium podagrarium*. However, other recipes, brought by newcomers, or borrowed from popular literature, like ‘honey’ from *Taraxacum* flowers, are sometimes incorporated into practice, mostly by people with higher education.

The cross-border comparison revealed that Seto groups are closer ethnobotanically to the dominant ethnic groups immediately surrounding them than they are to Setos across the border, especially where the most commonly used taxa are concerned. This confirms our assumption that for changes to appear a longstanding solid border is not necessary. Moreover, Setos in Russia seem to be ethnobotanically more Russified than Setos in Estonia are Estonified. The main reason for this, most likely, may be the larger number of Seto residents in Estonia and thus stronger Seto community. As the same tendencies can be seen on the level of plant names, we may conclude that those Setos who decided to remain on the Russian side of the border are highly assimilated with local Russians and have stronger connections, in part through family ties, to Russian than Estonian culture. From a theoretical standpoint, this shows that the evolution of wild food plant use also depends on the administrative choices in the region (such as local legislation, procurements, market regulations, education and other aspects decided on the local level).

Future studies need to pay closer attention to the specific role policies play in the evolution of local ecological knowledge of ethnic minorities, starting from a shift in marriage patterns to sociolinguistic factors such as the home language and the language of education and media.

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**Institutional Review Board Statement:** The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Ethics Committee of Ca’ Foscari University of Venice on the 9 November 2017.

**Informed Consent Statement:** Oral informed consent was obtained from all subjects involved in the study.

**Data Availability Statement:** The datasets generated for this study are available from the authors upon reasonable request. Data from ERC project DiGe will be fully available after the project ends.

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# Foraging in Boreal Forest: Wild Food Plants of the Republic of Karelia, NW Russia

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**Abstract:** While the current consumption of wild food plants in the taiga of the American continent is a relatively well-researched phenomenon, the European taiga area is heavily underrepresented in the scientific literature. The region is important due to its distinctive ecological conditions with restricted seasonal availability of wild plants. During an ethnobotanical field study conducted in 2018–2019, 73 people from ten settlements in the Republic of Karelia were interviewed. In addition, we conducted historical data analysis and ethnographical source analysis. The most widely consumed wild food plants are forest berries (three *Vaccinium* species, and *Rubus chamaemorus*), sap-yielding *Betula* and acidic *Rumex*. While throughout the lifetime of the interviewees the list of used plants did not change considerably, the ways in which they are processed and stored underwent several stages in function of centrally available goods, people's welfare, technical progress, and ideas about the harm and benefit of various products and technological processes. Differences in the food use of wild plants among different ethnic groups living in the region were on the individual level, while all groups exhibited high variability in the methods of preparation of most used berries. The sustainability of berry use over time has both ecological and economical factors.

**Keywords:** ethnobotany; Karelia; wild food plants; Local Ecological Knowledge; Nordic studies; boreal forest

## 1. Introduction

Different ethnic and linguistic groups sharing the same territory do not always use the same wild edibles in similar ways [1–3]. While the current consumption of wild food plants in boreal forests on the American continent is a relatively well-researched phenomenon (see, for example, [4] and references therein), the European taiga area, especially the European part of the Russian taiga, is heavily underrepresented in the scientific literature, both recently as well as historically. Nowadays, collecting wild food plants in the taiga fulfills some additional functions, being a recreational activity and part of the healthy diet of contemporary city dwellers who are concerned about ecologically friendly production, depending on the economic situation of the region and specific person [5–7]. While there has been a comprehensive review of the historical and current uses of wild food plants listed in Russian pharmacopeia [8], ethnobotanical publications on the Russian Federation based on modern field studies are still few in number (but see, for example, [9–13]).

The common narrative one encounters in Russia is that wild food plants have always been an important addition to the diet of peasants in pre-modern societies, especially in the North, where the climate across most of the territory makes agriculture rather unsustainable [14,15]. However, according to pre-revolution Russian statistical tradition, welfare was mainly estimated by the consumption of bread; for instance, in a book devoted to the food of the Russian peasantry [16], mushrooms and berries are not mentioned. Nevertheless, sporadic data can be extracted from the ethnographical literature. A.G. Gudkov analyzed the phenomenon of exporting corn from the Russian North (Vologda, Olonets and Arkhangel'sk gubernias) in spite of regular crop failure. Bread shortage from regular arable land was compensated for by natural food reserves: fish, game, mushrooms, berries, and wild bread substitutes. In the 18th–19th centuries, during lean years, the cambium of *Pinus* was added to flour for making bread. The other bread substitute consisted of a group of wetland plants; a tradition definitely borrowed by Russian peasants from the aboriginal Finno-Ugric population around the 13th century [17].

(The Republic of) Karelia is characterized by limited agriculture due to its northern location and mostly forested landscape and thus a higher percentage of wild food (as products of fishing, hunting, and gathering) in the daily diet. The ethnobotanical knowledge of the Karelian region has not been described or analyzed to date. The works by Lebedeva and Tkachenko [10,18,19] that mention Karelians were based on published sources and primarily concern Karelians living in other parts of NW Russia—Leningrad, Vologda and Tver' regions—and are solely quantitative, paying little attention to detail, such as preparation methods and foods made, time of use, etc.

Karelians, as all peoples of the former USSR, exhibited the tendency to level and erase zonal differences in food, bridging urban and rural foods [20]. While until WWII numerous features of traditional cuisine were preserved in Karelian villages, evacuations during the war, eateries in forest villages and state farms, and everyday communication with all the different ethnic groups living in Karelia contributed to the exchange of culinary knowledge and affected the formation of modern Karelian cuisine. New food products and dishes came into everyday life. Finally, the increase in well-being, the development of gasification and electrification, and the introduction of household appliances contributed to a significant improvement in nutrition, increased calorie content of cooked dishes and their variety, better preservation of products, etc. [21]. However, "a number of national dishes still occupied, in the final years of the Soviet Union, a prominent place in the diet of the Karelian population" [22]. At the end of the Soviet era, a book was published about Karelian cuisine [21], which was re-printed several times and became very popular, being kept in many households, including those of our informants. Unfortunately, this edition included not only recipes of both traditional and contemporary cuisine (in cities and the countryside) but also recipes from other books, Vepsian and Finnish dishes, as well as the specialties of catering enterprises in Karelia, not always indicating the source of the information.

The aims of the current work are:

- to document the food plants used in the Karelian Republic among Karelians and Russians, as well as temporal changes in their collection, storage, and use;
- to compare the uses between different groups and within the lifetime of the interviewees; and
- to evaluate the possible sources of, or influences on, differences in uses and changes during this time period.

## 2. Data and methods

### *2.1. Study Area*

The Republic of Karelia is a region in NW Russia (180,500 sq. km) bordering Finland. According to physico-geographical zoning, Karelia is included in Fennoscandia, occupying its southeastern part [23]. Eighty-five percent of the territory is composed of state forest stock; and it is home to Ladoga and Onega lakes—the largest in Europe. The case study site is characterized by mostly rural settlement

(Figure 1), low population density, and free access to forests and wild plants, as well as hunting and fishing.

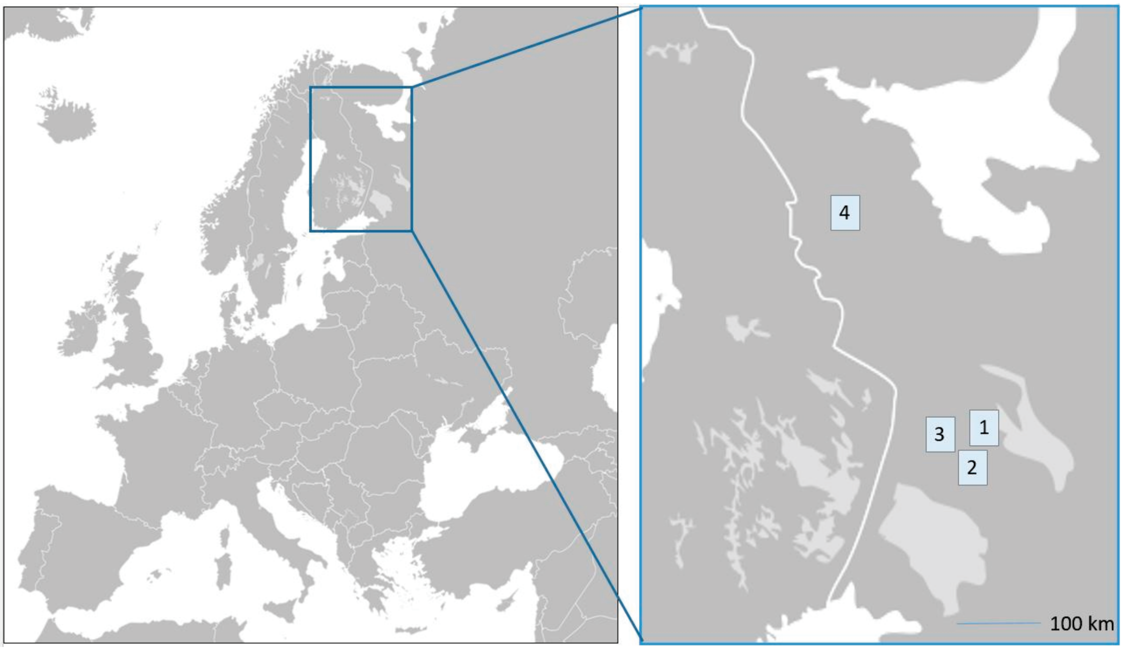


**Figure 1.** List of fieldwork sites: (1) Petrozavodsk, Zaozer'e, Lekhnavolok, Novaya Vilga; (2) Priazha; (3) Essoila, Korza, Rubchoila, Siamozero; (4) Kalevala. Map base: http://upload.wikimedia.org/wikipedia/commons/5/5a/BlankMap-Europe-v4.png.

The contemporary ethnic picture of the region is the result of long processes of economic and political change. In the 1930s–1950s in the USSR, within the framework of the state's repressive policy, repeated mass forced displacements of prisoners were carried out to create the workforce needed for the development of natural resources necessary for industrialization. For instance, in 1937 in the Karelian Autonomous Soviet Socialist Republic, 28,130 political prisoners were forced to work at the Belomor-Baltic factory of the NKVD [Rus. *Narodnyi Komissariat Vnutrennikh Del*/People's Commissariat for Internal Affairs] [24].

In the 1940s, in the southern part of the region—the Karelian Isthmus and Northern Ladoga—was depopulated and repopulated twice. Finns abandoned their homes on two occasions, and both times their houses were occupied by Soviet migrants, who first appeared in these lands in 1940, after the USSR annexed the territory from Finland. But a year later, in the summer of 1941, Finland, supported by German troops, regained the territory, and thus the Soviet residents were hastily evacuated. A significant portion of the former Finnish population returned to the Karelian Isthmus and Ladoga region, yet they were again forced to leave their homes in 1944 due to the advance of Soviet troops. A resettlement campaign was then again launched in the USSR, which included the return of evacuated immigrants of 1940, as well as many new people arriving from regions badly damaged during WWII. As a result, by the 1950s, several ethnic groups were living together in a relatively small area: Russians, Belarusians, Ukrainians, Chuvashs, Tatars, Mordovians, Ingrian Finns and others [25,26]. By 2002, Karelia had become a multinational republic with a predominance of Russians. There are currently about 150 nationalities represented in total, including 548,941 Russians, 65,651 Karelians, 37,681 Belarusians, 19,248 Ukrainians, and 14,156 and 4870 Finns and Veps, respectively [27].

The Karelian language belongs to the Baltic-Finnish branch of the Finno-Ugric language family. Throughout the territory, the Karelian language is divided into three main dialects—Karelian Proper, Livvi, and Ludic—as well as smaller dialects within each. Karelian Proper is widespread in the central and northern parts of the republic, in the territory of present-day Kaleval'skii, Loukhskii, Belomorskii, Kemskii, Medvezh'egorskii, Muezerskii and Suoiarvskii districts. The Karelian Proper dialect is also spoken in the regions of Tver' and Leningrad. The Livvi dialect is widespread on the northeast coast of Lake Ladoga (southern regions of Karelia). Ludic Karelians traditionally live in a number of villages and towns in the southeastern part of the Republic of Karelia in Olonetskii, Priazhinskii and Kondopozhskii regions. The Ludic dialect is an intermediate link between the Livvik dialect and the Veps language [28]. From the point of view of Finnish linguists, "Karelian is divided into two (or three) main dialects, which are sometimes referred to as separate languages: Karelian Proper, consisting of North (White Sea) and South Karelian dialects, and Olonets Karelian (Olonec Karelian, Olonetsian, Livvian)", with Ludic as a separate language [29].

In the Republic of Karelia, Karelian is an autochthonous language, based on the Latin alphabet, which does not have the status of an official language; and the number of speakers has been steadily declining. According to official census data, in 2002 there were 65,651 Karelians, which amounted to 9.2% of the population, which dropped to 45,570, or 7.4%, in 2010 (see Table 1, and [30]). "All dialects of the Karelian language spoken in Russia are under serious threat of extinction. <...> According to the 2010 census, the number of those who consider themselves Karelian and those who have some competence in the Karelian language decreased sharply in just eight years. Now those who indicated "Karelian" in the column "nationality" have become 34.8% less, and only half of them indicated that they know the Karelian language" [31].

**Table 1.** Karelians and Karelian speaker population according to the census. The numbers are compiled from [22,32,33].

| Year of Census | Karelians in Karelia | Named Karelian as Their Native Language |
|---|---|---|
| 1989 | ~79,000 | 40,685 |
| 2002 | 65,651 (9.2%) | 52,880 |
| 2010 | 45,570 (7.4%) | 25,605 |

There are TV and radio programs broadcast in Karelian by the local state teleradio company *Karelia* (http://tv-karelia.ru/?id=14648). There are also two weekly newspapers, Vienan Karjala [Belomorsk Karelia] (in Karelian Proper), and Oma Mua [Own Land] (in Livvik). In these media outlets, "children are seen as the future of the Karelian language. Therefore, great importance is given to education, and implicitly also to politicians and state officials who decide on the sharing of resources" [34].

The prospects of revitalization of the Karelian language have recently been described as bleak [29], but also encouraging based on the teaching of Karelian at schools and pre-schools [35,36]. For example, in Vedlozero, there is the so-called "language nest", a group of children of pre-school age organized as a kindergarten in the Karelian language, which has been open since 2017 [37].

### *2.2. Fieldwork*

In the summer of 2018 and 2019, we visited nine villages and urban-type settlements, as well as the capital city of Petrozavodsk, in the Republic of Karelia, where we interviewed 73 people, including 12 men and 61 women. The oldest respondents were born in 1927, while the youngest was born in 1986. We used the snowball method, asking inhabitants about their oldest and most knowledgeable neighbors.

The language of the interviews was Russian, which is spoken by everyone in the region. The conversation began with free listing, followed by semi-structured interviews, which consisted of questions about the use of wild edibles in foods such as soups, pies, jams and other desserts, spices, salads, snacks, roots, recreational teas, and other drinks, as well as plants for smoking meat and fish. After the interviews, we requested permission to take some dry specimens from our interviewees' winter stores of dried herbs and conducted field walks when the weather and the health of the person permitted in order to collect voucher specimens.

The Plant List database (2019) [38] was used as the basis for plant nomenclature. The botanical families were classified according to the Angiosperm Phylogeny Website [39]. The herbarium specimens are located in the Herbarium of the Komarov Botanical Institute, Russian Academy of Sciences, Saint Petersburg (LE), bearing accession numbers LE 01063338-91, LE 01063417-20, LE 01063464, LE 01063479-95, LE 01063497, LE 01063499-503, LE 01063507-09, LE 01063512-13, and LE 01063533-40.

Before the interviews, we explained the aims of the project to our respondents and received their oral or written consent for the interview and/or using an audio recording device. The study was conducted in accordance with the ethical guidelines of the International Society of Ethnobiology [40]. Ethical approval was granted by the Ethics Committee of Università Ca' Foscari; while the fieldwork was supported by the Institute for Linguistic Studies, Russian Academy of Sciences.

Responses were transcribed from the recordings or in rare cases from notebooks, and subsequently entered into an Excel spreadsheet according to emic Detailed Use Records (DUR, the number of use records considering all details of use, e.g., the plant part and specific preparation involved *sensu* [41]). As wild food plants, we considered all plants used for food that grow without direct human involvement, including those naturalized or those cultivated for non-food proposes [42].

Karelian phytonyms were recorded and used to qualitatively evaluate the level of phytonymical knowledge of the Karelian population. Romanization of the Cyrillic script of the original Russian words was done according to the ALA-LC (American Library Association—Library of Congress) Romanization without Diacritics set of standards (https://www.convertcyrillic.com/#/).

As to illustrate our interpretations, we use quotes from the anonymized interviews with the study participants. In all such cases, we use a reference identifying the particular interview among others indicating gender, ethnic group and the age of the participant in brackets following immediately after a quote, for example (F, Karelian, b. 1934).

The participants were first selected using the convenient selection technique, although later the snowball method was also sometimes used. The main criterion for participation in the study was the claim that the person was local, which was the case at the start of all interviews, as we aimed to interview an equal number of Karelians and Russians. However, some of our interviewees revealed by the end of the interview that they had actually been born elsewhere or were from mixed families. In order to make a sensible comparison, we decided to form three groups to be compared in Table 2:

Karelian—both mother and father speak Karelian;

Russian—originating from nearby villages with both parents Russian-speaking; and

Other—representing other ethnic groups of the region (e.g., Veps, Finns, Inkeri), as well as migrant Russians, Belarusians, Ukrainians, Poles, and Germans, for whom one parent, or very rarely the person themselves, had re-located in youth.

For temporal comparison, we developed specific categories, representing the obtained data, dividing the results into past and current uses.

Past uses (no longer in active use) included:

childhood use only—plant uses learned and abandoned in childhood (circa 1940–1950s);
past use—mainly abandoned a long time ago, predominantly used by the informant's parents, grandparents, or other older relatives, and less often themselves;
abandoned recently—learned in childhood, yet abandoned up to a few years ago for various reasons;
temporarily used in adulthood.

Current uses included:

always used—more or less continually from childhood to the present;
learned as adult—unknown in childhood and learned as adult;
learned only recently (since circa 2000, but mainly in the last five years).
For visualization of the comparative analysis we used RAWGraphs [43].

### *2.3. Historical Data and Published Data*

Presumably the first mention of wild edibles in the territory of modern Karelia can be found in the *Saga of Halfdan* (circa 1230) by Icelandic historian and poet Snorri Sturluson: "After that, you come to the forest which is called Kálfárskógr, it is sixteen by twenty transitions long; there is no food there except berries and wood sap; there is a robber there named Selr, and with him a dog, as big as a bull; it has a human mind and in battle it is better than twelve men" [44]. "Wood sap" (Old Islandic *safa*) in some texts is combined with not only the verb "drink" but also "eat", which suggests that the noun itself may not only mean tree sap but also cambium. In any case, we have very old written evidence of food foraging in the forests of (future) Karelia.

More detailed descriptions of various berries in the food of the local population, as well as some dishes made from these fruits, were provided in 1785 by the famous Russian poet Gavriil Derzhavin [45], who at the time was ruler of the newly formed Olonets governorship, to which the territory of present-day Karelia belonged. Later ethnographic data were taken from books and journals dating from the end of the 18th century to today. The used journals published ethnographic descriptions as well as travel notes. The correspondents were both professionals, like Ivanov (journalist and local historian) and Dokuchaev-Baskov (historian), and just local correspondents (Rogachev, Kalinin, etc.), often publishing under shortened surnames (e.g., Ostr., V-gov) or even just initials (A.A.Zh.), who provided interesting data on the quantity of berries that can be stocked and stored, prices at local markets, etc. Still, most of these publications were descriptive in nature and did not pretend to be scholarly research. That is why they often do not provide many details on cooking or storage; many authors just enumerated berries (and, much more seldom, herbs).

The first ethnographic description of the city of Onega was written by ethnographer S. Korablev [46]. A more popular description of the Russian North was made by a young writer named S. Maksimov [47] as a result of a "literary expedition" in 1855; a number of these expeditions were organized by the Russian Marine Ministry "to study the life of residents involved in sea affairs and fishing, and to compile the articles in the 'Marine Collection'" [48] (p. 19). As researchers mostly paid attention to food, houses, clothes, and crafts, it is possible to find some useful information in chapters concerning traditional dishes, such as in a book by K. Loginov about Zaonezh'e [49], based on materials of the ethnographic expeditions. The same researcher, K. Loginov, the leading ethnographer of the Karelian Research Centre, compiled the corresponding chapters into collective monographs [50–52], based on published data, archival sources (housed at the Karelian Research Centre), and field interviews. Of particular interest for this study are the works of R. Taroeva (Nikol'skaia) [21,22,53]. Taroeva, who also worked at the Karelian Research Centre, had a special interest in folk cuisine, and thus there is more information about processing wild edibles and preparing various dishes with them in her works, based on interviews conducted during her fieldwork.

We gathered all available data into Table 3; however, we did not consider entries that just mentioned "berries" without any specification. In addition, the cases in which the names of the berries are given, but their uses not described, were also omitted. The presumably scientific literature is very heterogeneous, consisting of recommendations for times of famine, and the majority of the books are partly popular scientific, in which the bibliography is included at the end of each chapter. As the ethnobotanical data was not collected purposefully and only mentioned in passing, in most cases it can only be used as material for comparing the variety of plants used in the past with those of the present. Unfortunately, nearly the same style continued in ethnographic publications during Soviet and post-Soviet times. Therefore, it is not possible to understand specifically where the information about wild edibles was obtained and if it is a local use or a generalization of uses from many regions. As a result, we recommend approaching this data with caution.

Taking these considerations into account, the Results section is merged with discussion and is split into two major parts. The first part is dedicated to the description of field data and their comparison with the available historical and ethnographical data. The second part is addressing the problem of recommended WEP (wild edible plant) use that became more and more important during Soviet era.

Some coincidental practices that served as a favorable context for these recommendations, such as state induced harvesting of the wild edible plants, are discussed in the subsection about the phenomenon of procurement offices.

## 3. Results and Discussion

In Table 2, uses of wild edible plants by our informants are shown. It includes official names and families of the plants, their local names (Karelian names are written only in case they were given by the interviewees, details concerning used parts, preparation, and culinary use. KAR—Karelian, RUS—Russian, OTH—other ethnic groups, see description on p. 5. Numbers before and after slash represent current and past uses respectively.

Comment to the Table 2: *Kissel* (Rus. *kisel′*) is a viscous fruit drink. It consists of the sweetened juice of berries thickened with starch. *Kompot* (Rus. *kompot*) is a non-alcoholic sweet beverage, made by cooking fruit in a large volume of water with sugar, sometimes with various spices. *Kvass* (Rus. *kvas*) is a non-alcoholic beverage made of fermented rye bread. *Mors* (Rus. *mors*) is a fruit drink prepared from berries. It is made by boiling berries with sugar or just mixing pure juice with sweetened water; the berries themselves are then filtered out, to differ from *kompot*. *Mousse* (Rus. *muss*) is a sweet dish made of berry juice, semolina, and sugar syrup. *Okroshka* (Rus. *okroshka*) is a cold soup, a mix of raw vegetables, boiled potatoes, eggs, and a cooked meat (or sausage) with *kvass* (more seldom with *kefir* or mineral water). *Tolokno* (Rus. *tolokno*) is a traditional finely milled mixture made of steamed, dried, lightly fried and refined grains of oats. *Vareniki* (Rus. *vareniki*) are filled dumplings made by wrapping unleavened dough around a savory or sweet filling and cooked in boiling water.

Of the 70 taxa used throughout the lifetime of our interviewees, 61 were identified at the species level, eight at the genus level and one at the family level (Table 2). Of the 27 families represented, the most numerous were Rosaceae (13 taxa), Asteraceae (seven taxa), Ericaceae (six taxa), and Poaceae (four taxa). Among the ten most commonly used taxa, berries of three *Vaccinium* species dominated, including *Vaccinium vitis-idaea* (280 DUR), *Vaccinium oxycoccos* (199 DUR), and *Vaccinium myrtillus* (194 DUR), followed by *Rubus chamaemorus* (131 DUR), *Betula* (82 DUR), and acidic *Rumex* (60 DUR). Therefore, the most widely used families were Ericaceae (727 DUR), Rosaceae (383 DUR) and Betulaceae (113 DUR).

The most popular food categories were snacks (294 DUR), drinks (245 DUR), pies (194), jam (172), recreational tea (167 DUR), and *kissel* (122 DUR) (Figure 2). Berries are used for cooking most types of dishes. Recreational teas are the only relatively popular group of food that uses non-berry plants. Soups include only two plants—*Rumex acidic* and *Urtica*—which represent the first sources of vitamins in spring. Taste additives are the least popular food products.

**Table 2.** Current/past uses of the wild food plants in Karelian Republic.

| Plant Taxa | Local Name | Used Part | Preparation | Use | KAR | RUS | OTH |
|---|---|---|---|---|---|---|---|
| *Atriplex patula* L.; Amaranthaceae | Rus. *lebeda*<br>Kar— | aerial parts | dried | add to flour | | | /1 |
| | | | fresh | salad | | 1 | |
| | | | | soup | 1 | | /1 |
| *Allium* sp.; Amaryllidaceae | Rus. *dikii (zelenyi) luk*<br>Kar— | aerial parts | fresh | soup | /1 | | |
| *Aegopodium podagraria* L.; Apiaceae<br>LE 01063539<br>LE 01063364 | Rus. *snyt'*<br>Kar— | aerial parts | dried | condiment for soup | | 1 | |
| | | | fresh | salad | | 2 | |
| | | | | soup | | 1 | 1 |
| *Anthriscus sylvestris* (L.) Hoffm.; Apiaceae<br>LE 01063382<br>LE 01063509 | Rus. *dudki*<br>Kar— | buds | fresh | snack | | /1 | |
| | | stems | fresh | snack | | 1 | /1 |
| *Carum carvi* L.; Apiaceae | Rus. *tmin*<br>Kar— | seeds | dried | spice | | | /1 |
| *Achillea millefolium* L.; Asteraceae<br>LE 01063537<br>LE 01063362<br>LE 01063356<br>LE 01063417 | Rus. *tysiachelistnik*<br>Kar— | aerial parts | dried | spice | | 1 | |
| | | | fresh | cooking with fish | | 1 | |
| | | leaves | fresh | salad | 1 | | |
| *Cichorium intybus* L.; Asteraceae | Rus. *tsikorii*<br>Kar— | root | dried | coffee substitute | | /1 | |
| *Cirsium arvense* (L.) Scop.; Asteraceae | Rus. *shchipitsa*<br>Kar— | root | dried | coffee substitute | | | 1 |
| *Matricaria chamomilla* L.; Asteraceae | Rus. *romashka (lesnaia)*, *romashka aptechnaia*<br>Kar— | flowers | dried | recreational tea | /2 | 3 | 1/1 |
| *Matricaria discoidea* DC.; Asteraceae | Rus. *dushistaia romashka*<br>Kar. päivykukkaine | flowers | fresh | snack | | 1 | |

**Table 2.** *Cont.*

| Plant Taxa | Local Name | Used Part | Preparation | Use | KAR | RUS | OTH |
|---|---|---|---|---|---|---|---|
| *Taraxacum officinale* F.H.Wigg.; Asteraceae LE 01063354 LE 01063387 | Rus. *oduvanchik* Kar— | flowers | boiled with sugar | "honey" | 1/2 | 3/1 | 2/1 |
| | | leaves | boiled or soaked | salad | 1 | | |
| | | | | soup | 1 | | |
| | | | fresh | salad | 3 | 4 | |
| | | | | soup | | | 1 |
| | | | soaked in salted water | salad | | | 1 |
| | | roots | dried and roasted | coffee substitute | 1 | 1 | 3 |
| | | sap | fresh | licked | /1 | /1 | |
| *Tussilago farfara* L.; Asteraceae LE 01063378 | Rus. *mat'-i-machekha* Kar— | leaves | fresh | recreational tea | | | /1 |
| *Alnus incana* (L.) Moench; Betulaceae LE 01063373 | Rus. *ol'kha* Kar. *lepp* | wood | dried | smoking fish | 14 | 5 | 10 |
| | | | | smoking meat | 1 | | 1 |
| *Betula* spp.; Betulaceae LE 01063357 | Rus. *bereza* Kar. *koivu* | buds | fresh | strong alcohol | 1 | | |
| | | leaves | fresh | recreational tea | | | /1 |
| | | | | salad | 1 | | |
| | | | | snack | | | /1 |
| | | sap | fermented | *kvass* | 1/1 | 1 | 4 |
| | | | | *okroshka* | 1 | 1 | |
| | | | | strong alcohol | 1 | | 1 |
| | | | fresh | drink | 9/14 | 7/8 | 5/16 |
| | | | pasteurized | drink | 2 | 1/1 | 2/1 |
| *Barbarea vulgaris* R.Br.; Brassicaceae | Rus. *surepka* Kar— | aerial parts | fresh | cooking with fish | | 1 | |
| | | | | salad | | 1 | |
| | | | | soup | | 1 | |

**Table 2.** *Cont.*

| Plant Taxa | Local Name | Used Part | Preparation | Use | KAR | RUS | OTH |
|---|---|---|---|---|---|---|---|
| *Bunias orientalis* L.; Brassicaceae | Rus. *sergibus*, *dikaia kapusta*<br>Kar— | stems | fresh | snack | | | /1 |
| *Lonicera caerulea* subsp. *pallasii* (Ledeb.) Browicz; Caprifoliaceae | Rus. *zhimolost'*<br>Kar— | fruits | fresh | *mors* | | /1 | |
| | | | | snack | | /1 | |
| *Stellaria media* (L.) Vill.; Caryophyllaceae<br>LE 01063380<br>LE 01063381 | Rus. *lapchatka*, *mokritsa*<br>Kar— | aerial parts | fresh | salad | 1 | 2 | 2 |
| | | | | soup | | 1 | /1 |
| *Juniperus communis* L.; Cupressaceae<br>LE 01063493 | Rus. *veres*, *mozhzhevel'nik*<br>Kar— | fruits | dried | add to meat dishes | | 1 | /1 |
| | | | | addition to tea | | 1 | |
| | | wood | dried | smoking fish | | 3 | |
| *Equisetum arvense* L.; Equisetaceae | Rus. *stolbiki*, *khvoshch*<br>Kar— | stems | fresh | snack | | | /1 |
| *Arctostaphylos uva-ursi* (L.) Spreng.; Ericaceae<br>LE 01063347 | Rus. *toloknianka*<br>Kar— | fruits | fresh | snack | | /1 | |
| *Empetrum nigrum* L.; Ericaceae | Rus. *vodianika*, *voronika*, *medvezh'ia iagoda*, *svinika*<br>Kar. *variksen marja* | fruits | baked | berry porridge | | /1 | |
| | | | concentrated juice | drink | 3 | 1 | |
| | | | fresh | *kompot* | 2 | 1 | |
| | | | | *mors* | | 1 | |
| | | | | snack | 2/2 | /3 | /2 |
| | | | juice | drink | 1 | | |
| | | | soaked in cold water | food | | /1 | /1 |

**Table 2.** *Cont.*

| Plant Taxa | Local Name | Used Part | Preparation | Use | KAR | RUS | OTH |
|---|---|---|---|---|---|---|---|
| *Vaccinium myrtillus* L.; Ericaceae LE 01063348 | Rus. *chernika* Kar. *mušt'oi, must'oi, mussikka* | fruits | boiled with sugar | jam | 7/2 | 8/2 | 9 |
| | | | boiled without sugar | pies | 2 | | |
| | | | | snack | 1 | | |
| | | | concentrated juice | *kompot* | 1 | | |
| | | | | drink | 1 | | |
| | | | | *kissel* | 1 | | |
| | | | dried | *kompot* | | | 1 |
| | | | | drink | | | /1 |
| | | | | *kissel* | 1/5 | 1 | 1 |
| | | | | *mors* | 1 | /1 | |
| | | | | pies | 1/1 | 1 | |
| | | | | recreational tea | 1/2 | /1 | |
| | | | | snack | /1 | /1 | |
| | | | fresh | *kompot* | 1 | 2 | 2 |
| | | | | condiment for birch sap *kvass* | | | /1 |
| | | | | eaten with curd | | 1 | |
| | | | | eaten with milk | | 2 | |
| | | | | eaten with porridge | | 1 | |
| | | | | eaten with sugar | | 1 | /1 |
| | | | | juice | 1 | | |
| | | | | *kissel* | 4/3 | 7 | 3/2 |
| | | | | *mors* | 4/2 | 3 | 2 |
| | | | | *mousse* | /1 | | |
| | | | | pies | 9/2 | 10/1 | 10/1 |
| | | | | snack | 5/3 | 2 | 2/2 |
| | | | | *vareniki* | | | 1 |

**Table 2.** *Cont.*

| Plant Taxa | Local Name | Used Part | Preparation | Use | KAR | RUS | OTH |
|---|---|---|---|---|---|---|---|
| *Vaccinium myrtillus* L.; Ericaceae LE 01063348 | Rus. *chernika* Kar. *mušt'oi*, *must'oi*, *mussikka* | fruits | frozen | *kompot* | | 1 | |
| | | | | eaten unfrozen | 2 | 2 | |
| | | | | eaten with porridge | | 1 | |
| | | | | *kissel* | 1 | | |
| | | | | *mors* | 1 | 1 | |
| | | | | pies | 1 | 2 | |
| | | | jam | moonshine | | | /1 |
| | | | | pies | 2/1 | 2 | 3 |
| | | | juice | drink | 1 | | 2 |
| | | | oven-baked | dessert | /1 | | |
| | | | smashed with sugar | raw jam | | 1 | |
| | | | steamed | jam | | 1 | |
| | | | | *kissel* | 1/1 | | 1 |
| | | | | *kompot* | 1 | | |
| | | | | pies | | 1 | 2 |
| | | | | snack | | 1 | |
| | | leaves | dried | recreational tea | 1/2 | 1 | /1 |
| *Vaccinium oxycoccos* L.; Ericaceae LE 01063360 | Rus. *kliukva*, *zhuravina* Kar. *garbalo*, *karpalo* | fruits | boiled with sugar | jam | 4 | 4 | 3 |
| | | | | jelly | 1 | | |
| | | | | syrup | | | 1 |
| | | | fermented | strong alcohol | | /1 | |

**Table 2.** *Cont.*

| Plant Taxa | Local Name | Used Part | Preparation | Use | KAR | RUS | OTH |
|---|---|---|---|---|---|---|---|
| *Vaccinium oxycoccos* L.; Ericaceae LE 01063360 | Rus. *kliukva*, *zhuravina* Kar. *garbalo*, *karpalo* | fruits | fresh | *kompot* | | | 1 |
| | | | | condiment for birch sap *kvass* | | | /1 |
| | | | | condiment for sauerkraut | 5/1 | 7/4 | 4/3 |
| | | | | drink | 1/1 | /2 | |
| | | | | *kissel* | 6/7 | 11/1 | 7/3 |
| | | | | liquor | | /1 | |
| | | | | *mors* | 15/1 | 12/1 | 11/1 |
| | | | | *mousse* | 1 | /2 | |
| | | | | pies | 2/2 | 2 | 7 |
| | | | | recreational tea | | 1 | |
| | | | | snack | 1 | 3 | 1 |
| | | | frozen | eaten with sugar | 1 | | 1 |
| | | | | *kissel* | 4 | 4 | 1 |
| | | | | *mors* | 5 | 4/2 | 3/2 |
| | | | | pies | 1 | | |
| | | | | snack | 2/1 | 1/1 | |
| | | | jam | *kissel* | 1 | | |
| | | | | *mors* | 1 | | |
| | | | | pies | 2/1 | 1 | |
| | | | juice | addition to vodka | | | 1 |
| | | | smashed with sugar | raw jam | 1 | 1 | |
| | | | soaked in cold water | jelly | 1 | | |
| | | | | *kissel* | 1 | 2 | |
| | | | | *mors* | 1 | 1 | /2 |
| | | | | pies | 1 | | |
| | | | soaked in own juice | eaten with sugar | | | /2 |

**Table 2.** *Cont.*

| Plant Taxa | Local Name | Used Part | Preparation | Use | KAR | RUS | OTH |
|---|---|---|---|---|---|---|---|
| *Vaccinium uliginosum* L.; Ericaceae LE 01063389 | Rus. *golubika*, *gonobel'*, *gonobobel'* Kar. *juopukka*, *sinine marja* | fruits | boiled with sugar | jam | 1/1 | 1/2 | 2/1 |
| | | | dried | pies | | /1 | |
| | | | fresh | *kissel* | /2 | /1 | |
| | | | | pies | /1 | /1 | |
| | | | | recreational tea | | 1 | |
| | | | | snack | 1/4 | 3/1 | 2/3 |
| | | | | wine | | | 1 |
| | | | jam | moonshine | | | 1 |
| | | | wine | wine | /1 | | |
| *Vaccinium vitis-idaea* L.; Ericaceae LE 01063375 | Rus. *brusnika* Kar. *buolu*, *puola*, *puolakka* | fruits | baked | berry porridge | | /1 | |
| | | | boiled | *mousse* | /1 | | |
| | | | boiled with sugar | jam | 6/1 | 8/1 | 5/2 |
| | | | | jelly | | 1 | |
| | | | concentrated juice | drink | 1 | | |
| | | | crumpled and boil with water, sugar and rye flour | berry soup *marjarokka* | /1 | | |
| | | | desiccated berries | pies | 1 | | |
| | | | dried | recreational tea | | 1 | |
| | | | fermented | strong alcohol | | 1/1 | |
| | | | | wine | 1 | | |
| | | | fresh | coloring moonshine | /1 | | |
| | | | | *kompot* | | | 1 |
| | | | | condiment for birch sap *kvass* | | | /1 |
| | | | | condiment for sauerkraut | /1 | 1 | |

**Table 2.** *Cont.*

| Plant Taxa | Local Name | Used Part | Preparation | Use | KAR | RUS | OTH |
|---|---|---|---|---|---|---|---|
| *Vaccinium vitis-idaea* L.; Ericaceae LE 01063375 | Rus. *brusnika* Kar. *buolu, puola, puolakka* | fruits | fresh | drink | | /1 | |
| | | | | eaten | 1 | 1 | |
| | | | | eaten with oatmeal *kissel* | /1 | | |
| | | | | eaten with *tolokno* | /2 | 3/2 | 2/1 |
| | | | | *kissel* | 4/4 | 6 | 4/2 |
| | | | | *kompot* | 1 | | 1 |
| | | | | *mors* | 12/2 | 11/1 | 9/1 |
| | | | | *mousse* | 2/2 | | |
| | | | | pies | 12/4 | 14/2 | 13/3 |
| | | | | snack | 1/1 | 3 | 1 |
| | | | | soup | 1 | | |
| | | | frozen | *kompot* | 1 | | |
| | | | | eaten with bread | | /1 | |
| | | | | eaten with sugar | 1 | | 1 |
| | | | | eaten with *tolokno* | /1 | 1 | |
| | | | | food | /1 | 1 | 1 |
| | | | | *kissel* | 1/1 | 2 | |
| | | | | *mors* | 3 | 1/1 | 2 |
| | | | | pies | 1/2 | 1 | 2 |
| | | | | snack | 1 | /1 | |
| | | | jam | pies | /1 | 1 | 1 |
| | | | juice | drink | 1 | | |
| | | | | *mousse* | 1 | | |
| | | | | addition to vodka | | | 1 |

**Table 2.** *Cont.*

| Plant Taxa | Local Name | Used Part | Preparation | Use | KAR | RUS | OTH |
|---|---|---|---|---|---|---|---|
| *Vaccinium vitis-idaea* L.; Ericaceae LE 01063375 | Rus. *brusnika* Kar. *buolu*, *puola*, *puolakka* | fruits | smashed in own juice | *mors* | | /1 | |
| | | | | pies | | /1 | |
| | | | smashed with sugar | dessert | | 1 | |
| | | | | pies | 1 | | /1 |
| | | | soaked in cold water | *kompot* | | | 1 |
| | | | | snack | | 1 | 1 |
| | | | | drink | | /1 | 2 |
| | | | | eaten with bread and milk | | /1 | |
| | | | | *kissel* | 3 | 2 | |
| | | | | *mors* | 2 | 2 | 1 |
| | | | | pies | | 2/1 | |
| | | | soaked in own juice | drink | /1 | | |
| | | | | eaten with sugar | | 1 | /1 |
| | | | | food | 1/2 | | |
| | | | | jam | | | /1 |
| | | | | *kissel* | 1/1 | | |
| | | | | *mors* | 1 | 1 | /2 |
| | | | | pies | 3/1 | 1 | 1/1 |
| | | | soaked in syrup | *kissel* | 1 | | |
| | | | | pies | 1 | | 1 |
| | | | soaked with sugar | drink | | /1 | |
| | | | | food | | /1 | |
| | | | soaked with sugar and clover and salt | raw jam | | 1 | |
| | | | steamed | pies | | /1 | |
| | | leaves | dried | recreational tea | 1/3 | 1/1 | 1/1 |
| | | | fresh | *mors* | | 1 | |

**Table 2.** *Cont.*

| Plant Taxa | Local Name | Used Part | Preparation | Use | KAR | RUS | OTH |
|---|---|---|---|---|---|---|---|
| *Trifolium hybridum* L.; Fabaceae | Rus. *klever* Kar— | flowers | fresh | sucked nectar | /1 | | |
| *Trifolium* sp. (incl. Trifolium pratense L.); Fabaceae LE 01063464 LE 01063494 | Rus. *klever*, *krasnyi klever*, *kashka* Kar— | flowers | boiled with sugar | jam | | 1 | |
| | | | dried | recreational tea | 1 | 1 | |
| | | | fresh | salad | 1 | | |
| | | | | snack | /1 | /1 | /4 |
| | | | | sucked nectar | /7 | /6 | /4 |
| | | leaves | fresh | salad | 1 | | |
| *Vicia cracca* L.; Fabaceae LE 01063418 | Rus. *dikaia vika* Kar— | fruits | fresh | snack | | | /1 |
| *Quercus robur* L.; Fagaceae LE 01063338 | Rus. *dub* Kar— | acorns | dried and roasted | coffee substitute | | 1 | |
| | | leaves | dried | recreational tea | | 1 | |
| | | | fresh | condiment for cucumbers | /1 | 1 | /1 |
| | | | | condiment for mushrooms | /1 | | /1 |
| *Ribes nigrum* L.; Grossulariaceae LE 01063377 | Rus. *chernaia smorodina* Kar. *viinimarja*, *mušta viinimarja*, *čiihi* | fruits | boiled with sugar | jam | | | /1 |
| | | | fresh | snack | | /1 | /1 |
| | | leaves | fresh | condiment for mushrooms | | 1 | 1 |
| | | | | lemonade | 1 | | |
| | | leaves/shoots | dried | recreational tea | 1/1 | /1 | 1 |
| *Hypericum* spp. (incl. *H. maculatum* Crantz and *H. perforatum* L.); Hypericaceae LE 01063492 LE 01063483 LE 01063538 | Rus. *zveroboi* Kar. *kuzmanhattu* | aerial parts | dried | condiment | | 1 | |
| | | | | cooking with fish | | 1 | |
| | | | | recreational tea | 1/2 | 5 | /1 |
| | | root | fresh | strong alcohol | 1 | | |
| *Mentha* sp.; Lamiaceae | Rus. *miata* Kar. *hajuheinä* | leaves | fresh | recreational tea | /1 | | |

**Table 2.** *Cont.*

| Plant Taxa | Local Name | Used Part | Preparation | Use | KAR | RUS | OTH |
| --- | --- | --- | --- | --- | --- | --- | --- |
| *Origanum vulgare* L.; Lamiaceae | Rus. *dushitsa* Kar— | aerial parts | dried | spice | | 2 | |
| | | | | recreational tea | | 2 | |
| *Thymus subarcticus* Klokov & Desjat.-Shost.; LamiaceaeLE 01063500 | Rus. *tim'ian*, *chabrets* Kar— | aerial parts | dried | spice | | 2 | |
| | | | | recreational tea | | 2 | 1 |
| *Syringa vulgaris* L.; Oleaceae LE 01063339 | Rus. *siren'* Kar— | flowers | boiled with sugar | jam | 1 | | |
| *Epilobium angustifolium* L.; Onagraceae LE 01063353 | Rus. *ivan-chai*, *kiprei*, *koporskii chai*, *koporka* Kar— | aerial parts | dried | recreational tea | 2/4 | 2/2 | 4/9 |
| | | | fermented | recreational tea | 1/1 | 7/1 | 3 |
| | | | smoked | recreational tea | | 1 | |
| *Oxalis acetosella* L.; Oxalidaceae | Rus. *dikii shchavel'*, *zaiachii klever*, *zaiachii list*, *zaiach'ia trava*, *zaiach'i ushki*, *zaiach'ia kapust(k)a*, *zaiach'ia kislika*, *(zaiach'ia) kislitsa*, *lisichkin khleb* Kar— | flowers | fresh | snack | | /2 | /1 |
| | | leaves | fresh | snack | /9 | 1/8 | 1/11 |
| | | | | soup | /1 | | /1 |
| *Picea x fennica* (Regel) Kom.; Pinaceae LE 01063512 | Rus. *el'* Kar. *kuuzi* | cones | boiled with sugar | jam | | 1 | |
| | | needles | dried | recreational tea | | 1 | |
| | | resin | fresh | snack | | | /1 |
| | | wood | dried | smoking fish | | 1 | |
| *Pinus sylvestris* L.; Pinaceae LE 01063372 | Rus. *sosna* Kar. *pedäi* | buds | fresh | snack | | /1 | |
| | | cones | boiled with sugar | jam | | 3 | 1 |
| | | needles | dried | recreational tea | | 1 | |
| | | | fresh | snack | | 1 | |
| | | resin | fresh | snack | | | /3 |
| | | shoots | boiled into syrup and mixed with vodka | strong alcohol | | 2 | |
| | | wood | dried | add to flour | | | /1 |
| *Linaria vulgaris* Mill.; Plantaginaceae LE 01063385 | Rus. *l'nianka*, *iarutka* Kar— | flowers | fresh | snack | | /1 | /1 |

**Table 2.** *Cont.*

| Plant Taxa | Local Name | Used Part | Preparation | Use | KAR | RUS | OTH |
|---|---|---|---|---|---|---|---|
| *Plantago* spp. (*P. major* L./*P. media* L.); Plantaginaceae LE 01063349 | Rus. *podorozhnik* Kar— | leaves | fresh | salad | 1 | | |
| | | | | snack | /1 | | |
| | | seeds | dried | condiment for bread | | 1 | |
| *Elymus repens* (L.) Gould; Poaceae | Rus. *pyrei* Kar— | roots | fresh | salad | 1 | | |
| | | | | snack | /1 | | |
| | | | roasted | snack | /1 | | |
| | | stems | fresh | snack | | | /1 |
| *Phleum pratense* L.; Poaceae LE 01063344 | Rus. *timofeevka* Kar— | stems | fresh | snack | | | /1 |
| *Phragmites australis* (Cav.) Trin. ex Steud.; Poaceae | Rus. *trostnik ozernyi* Kar— | spring shoots | fresh | snack | | 1 | |
| Poaceae | Rus. *trava* Kar— | stems | fresh | snack | | | /1 |
| *Polygonum aviculare* L.; Polygonaceae LE 01063535 LE 01063533 | Rus. *gorets ptichii* Kar— | aerial parts | fresh | salad | | 1 | |
| *Rumex confertus* Willd.; Polygonaceae | Rus. *konskii shchavel'* Kar— | leaves | fresh | snack | | | /2 |
| | | | | soup | | | /1 |
| *Rumex* spp. (*R. acetosa* L./*R. acetosella* L./Rumex longifolius DC./Rumex thyrsiflorus Fingers.); Polygonaceae LE 01063383 LE 01063540 LE 01063513 LE 01063479 | Rus. *zaiach'ia kapusta*, *(lesnoi) shchavel'*, *kislika*, *kislitsa* Kar. *suoluheinä* | leaves | fresh | eaten fresh with sugar | /1 | | |
| | | | | pies | | /1 | |
| | | | | salad | | | /1 |
| | | | | snack | /9 | 2/4 | /11 |
| | | | | soup | 2/8 | 2/7 | 3/8 |
| | | | salted | soup | | | 1 |
| *Alchemilla vulgaris* L.; Rosaceae | Rus. *manzhetka* Kar— | leaves | fresh | salad | 1 | | |

**Table 2.** *Cont.*

| Plant Taxa | Local Name | Used Part | Preparation | Use | KAR | RUS | OTH |
|---|---|---|---|---|---|---|---|
| *Crataegus chlorocarpa* Lenn, & K.Koch; Rosaceae LE 01063507 | Rus. *boiaryshnik* Kar— | fruits | dried | recreational tea | | 1 | 1 |
| *Filipendula ulmaria* (L.) Maxim.; Rosaceae LE 01063341 LE 01063420 | Rus. *tavolga*, *labaznik* Kar— | aerial parts | dried | recreational tea | 3 | 1 | |
| *Fragaria vesca* L.; Rosaceae LE 01063499 | Rus. *zemlianika* Kar. *mandžoi* | fruits | boiled with sugar | jam | 3 | 1 | 1/2 |
| | | | dried | recreational tea | | 2 | /1 |
| | | | fresh | eaten fresh with sugar | | | /1 |
| | | | | *kissel* | | | /1 |
| | | | | snack | 4/3 | 8 | 5/4 |
| | | | jam | drink | | | /1 |
| | | leaves | dried | addition to tea | | 4 | 2 |
| | | | fresh | snack | | 1 | |
| *Malus* sp.; Rosaceae | Rus. *iablonia* Kar— | fruits | fresh | pies | | | 1 |
| *Prunus padus* L.; Rosaceae LE 01063366 LE 01063361 | Rus. *cheremukha* Kar. *tuomi*, *tuomimarju* | fruits | boiled with sugar | jam | | | 1/1 |
| | | | dried | add to porridge | /1 | | |
| | | | | food | /1 | | |
| | | | | pies | | | /1 |
| | | | fresh | *kompot* | 1/1 | 1 | |
| | | | | *kissel* | | 1 | |
| | | | | pies | | 1 | 1/1 |
| | | | | snack | /9 | 1/1 | /6 |
| | | | | wine | | | /1 |
| *Rosa* spp. (incl. *R. rugosa* Thunb.); Rosaceae LE 01063491 | Rus. *shipovnik* Kar— | flowers/fruits | boiled with sugar | jam | | 2 | |
| | | fruits | dried, fresh | recreational tea | /2 | 4 | 1/1 |
| | | | fresh | snack | | /1 | |

**Table 2.** *Cont.*

| Plant Taxa | Local Name | Used Part | Preparation | Use | KAR | RUS | OTH |
|---|---|---|---|---|---|---|---|
| *Rubus arcticus* L.; Rosaceae | Rus. *tsar'-iagoda*, *kniazhenika*, *polenika*, *kumanika*, *ezhevika* Kar. *hepokka* | fruits | boiled with sugar | jam | 1 | | |
| | | | fresh | snack | /1 | 2 | |
| | | | frozen | snack | 1 | | |
| | | | soaked under weight | snack | 1 | | |
| | | fruits, twigs | fresh | *kissel* | /1 | | |
| *Rubus chamaemorus* L.; Rosaceae LE 01063345 | Rus. *moroshka*, *rokhletsy* Kar. *muuroi*, *muur'oi*, *hillo*, *lakka*, *šl'uboi* | fruits | boiled with sugar | jam | 10/1 | 8/3 | 3/1 |
| | | | dried | recreational tea | | 2 | |
| | | | fresh | *kompot* | 1 | 1 | |
| | | | | dessert with sugar | 1 | | /1 |
| | | | | eaten | | /1 | 1 |
| | | | | *kissel* | | /1 | |
| | | | | *mors* | 1 | | |
| | | | | pies | 3/1 | 5 | 2/1 |
| | | | | snack | 5/2 | 7/2 | 4 |
| | | | frozen | pies | 1 | 2 | |
| | | | | snack | 1 | 1 | |
| | | | | *mors* | 1 | | |
| | | | frozen with sugar | eaten with ice-cream | | 1 | |
| | | | | smoothie | | 1 | |
| | | | | snack | | | |
| | | | jam | drink | | | /1 |
| | | | | moonshine | | | 2 |
| | | | | pies | 2 | | |
| | | | | tincture | | | |
| | | | poured with sugar | raw jam | | 1 | |

**Table 2.** *Cont.*

| Plant Taxa | Local Name | Used Part | Preparation | Use | KAR | RUS | OTH |
|---|---|---|---|---|---|---|---|
| *Rubus chamaemorus* L.; Rosaceae LE 01063345 | Rus. *moroshka*, *rokhletsy* Kar. *muuroi*, *muur'oi*, *hillo*, *lakka*, *šl'uboi* | fruits | preserved in bog | eaten in own juice | | | /1 |
| | | | pressed with vodka | pies | | /1 | |
| | | | smashed, poured with vodka | food | | | 2 |
| | | | soaked in own juice | food | 1/1 | 1 | 2/1 |
| | | | | *kissel* | | | /1 |
| | | | | *mors* | | | 1 |
| | | | | pies | | | 1 |
| | | | | snack | 2 | 1 | |
| | | | soaked in syrup | syrup | | 1 | |
| | | | soaked in water | eaten with sour cream | /1 | | |
| | | | | food | /1 | 1/1 | /1 |
| | | | | jam | | | 1 |
| | | | | pies | /1 | | |
| | | leaves | dried | recreational tea | | 1 | |
| | | sepals | dried | recreational tea | 3 | 1 | 1 |
| *Rubus idaeus* L.; Rosaceae LE 01063355 | Rus. *malina* Kar. *vagoi*, *vavoi*, *vavarno*, *malina* | fruits | boiled with sugar | jam | 7/1 | 10/1 | 9/2 |
| | | | boiled with sugar | *kissel* | /1 | | |
| | | | dried | recreational tea | 1/1 | | /1 |
| | | | fermented | strong alcohol | | 1 | |
| | | | fresh | kompot | 1 | 1 | 1 |
| | | | | eaten fresh with sugar | | | /1 |
| | | | | eaten with oatmeal *kissel* | /1 | | |
| | | | | *kissel* | /1 | | |
| | | | | *mors* | 1 | | |
| | | | | pies | 5/1 | 1 | 3/1 |
| | | | | recreational tea | | 1 | |
| | | | | snack | 4 | 1/2 | 2/2 |

**Table 2.** *Cont.*

| Plant Taxa | Local Name | Used Part | Preparation | Use | KAR | RUS | OTH |
|---|---|---|---|---|---|---|---|
| *Rubus idaeus* L.; Rosaceae LE 01063355 | Rus. *malina* Kar. *vagoi, vavoi, vavarno, malina* | fruits | frozen | eaten with sugar | | | 1 |
| | | | | food | 1 | 1 | |
| | | | | *mors* | 1 | | |
| | | | jam | drink | | | /1 |
| | | | | drink after sauna | /1 | | |
| | | | | pies | /2 | | 1/1 |
| | | | juice | drink | 1 | | |
| | | leaves | dried | recreational tea | /2 | 2/2 | 2 |
| | | | fresh | condiment for cucumbers | 1/1 | | |
| | | | | recreational tea | | | 1/1 |
| | | twigs with berries and leaves | dried | recreational tea | 3/6 | 2/1 | 6 |
| *Rubus nessensis* Hall; Rosaceae | Rus. *ezhevika, kumanika* Kar— | fruits | fresh | snack | /5 | 3 | /1 |
| *Rubus saxatilis* L.; Rosaceae | Rus. *kostianika* Kar. *juomoi* | fruits | boiled with sugar | jam | 1 | | |
| | | | fresh | recreational tea | | 1 | |
| | | | | snack | /4 | 2/1 | 2/2 |
| *Sorbus aucuparia* L.; Rosaceae LE 01063371 | Rus. *riabina* Kar. *pihl'u* | branch with fruits | soaked in water | food | | | /1 |
| | | | frozen | eaten frozen | | 1/1 | |
| | | fruits | boiled with sugar | jam | | 1/2 | 1/2 |
| | | | dried | *kompot* | | 1 | |
| | | | | recreational tea | | 3/1 | 2/2 |
| | | | | snack | /2 | 1 | /1 |
| | | | fermented | wine | | 2/1 | |
| | | | fresh | *kompot* | | | /2 |
| | | | | drink | 1 | | |
| | | | | snack | /1 | 1/1 | |

**Table 2.** *Cont.*

| Plant Taxa | Local Name | Used Part | Preparation | Use | KAR | RUS | OTH |
|---|---|---|---|---|---|---|---|
| *Sorbus aucuparia* L.; Rosaceae LE 01063371 | Rus. *riabina* Kar. *pihl'u* | fruits | raw jam | /1 | | 1 | |
| | | | | recreational tea | | | /1 |
| | | | jam | moonshine | | | /1 |
| | | | | *mors* | | /1 | /1 |
| | | wood | dried | smoking fish | 1 | 1 | |
| *Populus tremula* L.; Salicaceae | Rus. *osina* Kar. *pedäi* | wood | dried | smoking fish | 4 | 1 | 2 |
| | | | | smoking meat | | /1 | |
| *Urtica dioica* L.; Urticaceae LE 01063363 | Rus. *krapiva* Kar. *šiiloi, žiiloi* | young aerial parts | dried | sandwich | | 1 | |
| | | | | soup | 1 | | |
| | | | fresh | cooking with fish | | 1 | |
| | | | | salad | | 1 | |
| | | | | soup | 4/7 | 7/5 | 4/11 |
| *Viburnum opulus* L.; Viburnaceae | Rus. *kalina* Kar— | fruits | boiled | snack | | 1 | |
| | | | boiled with sugar | jam | 1 | | |
| | | | | juice | 1 | | |
| | | | fresh | mixed with sugar | | /1 | |
| | | | | *mors* | | 1 | |
| | | | | snack | 1 | | |
| | | | | strong alcohol | | 1 | 1 |
| | | | frozen | snack | | /1 | 1 |
| | | | steamed | preserve | | | /1 |

KAR: Karelian; RUS: Russian; OTH: other ethnic groups.

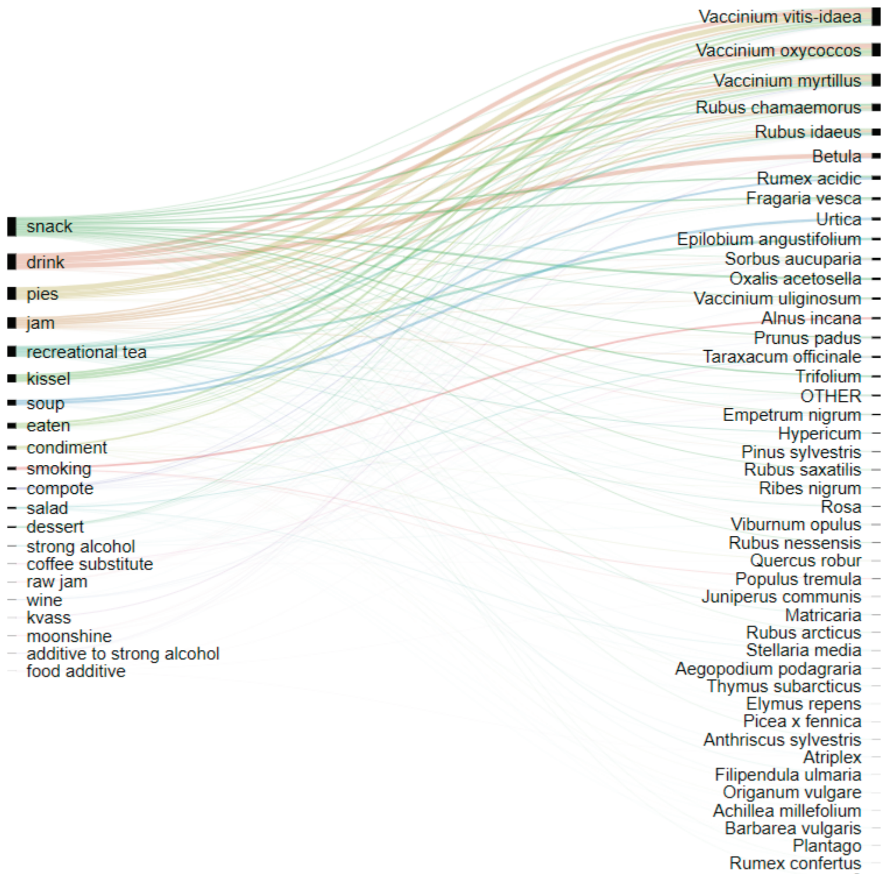


**Figure 2.** Alluvial diagram showing the relationships between foods made and taxa based on DURs during the lifetime of interviewees.

The plants that were used as snack in childhood and abandoned later include all edible forest berries, leaves of *Oxalis acetocella*, resin or needles of *Pinus sylvesris*, sweet juice sucked from the stems of various grasses, and nectar of *Trifolium*. Among them, the berries of *Daphne mezereum* were mentioned as tasted and spat out by children, as if to confirm that they were not suitable for eating: "They are so poisonous, if one eats, for example, five or six berries, it is possible ... in general, it's very, very dangerous. I remember that at the beginning ... it is bitter, eating it ... we spat it out and it was kind of OK [laughs]" (F, Karelian, b. 1948). Of course, the fact that the berry is poisonous was recognized by the adults and communicated to the children. Nevertheless, they tasted it to make sure that the berry was indeed poisonous and to discard it in future. The childhood practice of tasting wild plants, even those that are not edible, is not unique to Karelia. It has also been documented in Estonia [54], while some researchers suggest that the wild plants tasted in childhood could in fact relate to the archaic layer of the same tradition [55]. The same Karelian woman later added that the berries of *D. mezereum* were also used by a local healer to make an ointment that would cure a hernia in a child. To prepare it, the healer would request that the mother of a sick child take a bite of each berry "only if her mouth was okay and her teeth were in good health", otherwise "grandma herself crushed each little berry on an axe in the doorway".

Besides being directly eaten, there are a number of plants that are used in cooking but their "role" in the final product is only to add taste. The largest such group consists of trees and bushes used for smoking meat and fish, with the most used taxa being *Alnus incana* and *Populus tremula*. The second group consists of spices. Most of the population of Karelia never used spices bought from shops as they were very expensive and thus available only to wealthy people: "Seasonings, besides pepper and onion, are unknown, as is vinegar. Tea is drunk by the rich on Sundays" [14]. This tradition turned out to be so sustainable that even during Soviet times, when seasoning dishes became possible, many housewives did without them. The exception being fresh fish soup. In fact, only bay leaves and black pepper were discussed in the abovementioned book [21]. Perhaps this habit of not using seasoning has also influenced the minimalism in spice use today—the spicy herbs mentioned by our respondents were not very numerous.

As shown in Figure 3, the use of wild food seems to be stable, although having changed several decades ago, with very few species acquired recently or used temporarily. The largest category is permanent uses, while the numbers of taxa acquired in adulthood or abandoned in the past are also quite considerable. The majority of taxa, and in particular berries (*Vaccinium*, *Rubus chamaemorus* and *Rubus vitis-idaeus*), are used all the time. The use of *Betula* sap varies between informants: some have always been using it, others used it in the past, while still others acquired it in adulthood. *Rumex acidic* and *Oxalis acetosella* are used as snacks in childhood and later abandoned.

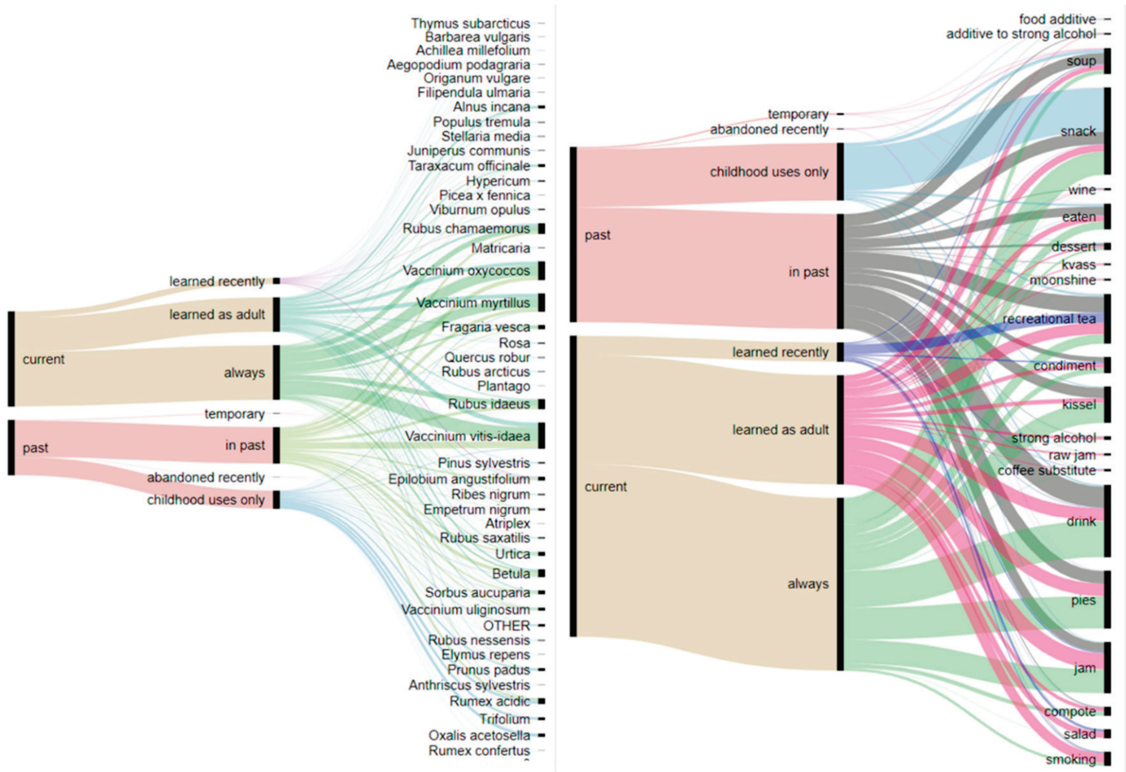


**Figure 3.** Alluvial diagram reflecting changes in use during the lifetime of interviewees.

The tradition of adding wild greens to soups represents mostly a past use. The category of recreational teas is the most fluid due to opposing tendencies: there is no need to substitute currently widely available, commercially produced tea, yet at the same time users stick to the herbal infusions known since childhood and widen their repertoires by adding new wild species like *Epilobium angustifolium*. Strong alcohol is currently made by very few people, and only two interviewees mentioned it in connection with the past.

With respect to changes that are not formally reflected in Table 2, our informants primarily noted a sharp decrease in the quantity of stored products, caused by a decrease in the number of family members: "Cowberries are mainly [stored] by us. Cowberries are collected in autumn, in a barrel. Oh, twelve, ten buckets each—such big barrels. And everything was consumed during the winter. That's how many vitamins people ate! And now, three three-liter jars will collect—'Oh, I've got a lot of cowberries!' Well, now families are... Earlier, the families were not one or two people" (F, Karelian, b. 1934). Another reason for the decrease in stored products is that many informants have moved from large village houses with a basement, attic, and many outbuildings to comfortable, but small flats in urban settlements: "You know, I started to cook *mors*, because there are no conditions to store *kompot*.

My sister cooks *kompot*, keeps it in the basement. I have no place to store it, that's why I put berries in the freezer" (F, Karelian, b. 1960).

Elderly people have to buy berries and mushrooms since they are not able to go to the forest; and some middle-aged people do the same, as their work does not allow them to spend time collecting forest products. On the other hand, unemployment and low salaries compel a part of the population to consider mass harvesting wild plants as a way of generating income, which leads to the over-harvesting of berries and mushrooms. Recently, the increasing levels of deforestation and bears coming into villages hinder the collection of mushrooms, berries and herbs, both for sale and for personal use. Field studies show the same tendency, to be precise, a wave-like decrease in the yield of cranberries even in the most abundant berry-bearing bog areas of Karelia from 2000 to the present. The decline in crop yields is likely due to global climate change: unstable weather conditions during the autumn-winter period negatively affects the formation and wintering of cranberry flower buds [56].

Some people remembered garden bushes and other cultural plants which became wild after Finns left their homes: "There were Finnish farms on the border—there I saw white currants for the first time. They are as sweet as sugar, unlike red and black ones. <...> The first time I saw rhubarb was in the forest, because there were Finnish farms along the border. They were demolished, but the gardens remained. You go through the forest—currants, rhubarb, just thickets. Wild, after the Second World War. In some places, even hops grew in the forest" (M, Russian, b. 1959).

Socio-economic changes in Soviet/Russian society also contributed to changing the set of plant foods, both cultivated (cabbage, cucumbers, tomatoes, etc.) and purchased (fruit, spices). Even the simplest vegetables were not grown until after WWII: "Newcomers became [numerous]. They brought this fashion, cabbage to us; I remember that one came from Molotov region [Perm region in 1940–1957]; our old man got married there. And he brought his wife here from Molotov region. And she was the first to plant cabbages in our village. She even baked bread, she placed it on cabbage leaves—and into the oven" (F, Karelian, b. 1934). Another Russian woman born in 1941 recounted: "Salads appeared, [when] my elder sister married a Ukrainian. They then started living in Petrozavodsk. And gradually it came to us, too. These salads. Tomatoes, cucumbers, all that; people passed [knowledge] to each other".

The methods of processing and storing products have changed as well. So, drying berries, soaking them in water, and storing them in the shed in winter time have given way to storage in freezers, even in villages. Access to sugar in unlimited quantities led to the mass production of jams, which subsequently declined due to the belief in the impact of sugar on the incidence of diabetes: "People did not make jam, because sugar was needed. After all, why was it crushed—there wasn't as much sugar as now. Sugar is a harmful product. People began to live well, so there is a lot of diabetes" (F, Rus/Kar, b. 1948). Homemade pickling, popular in the 1980s–1990s, became limited due to the fear of botulism. Juice cookers and meat grinders with special nozzles are used for making home-made juices and pitted jams, and blenders to make smoothies: "We like making green cocktails and smoothies. It's 70% of any greens, and the rest consists of berries, fruits, vegetables—whatever you want to put in it. Then into a blender, add water, mix, add honey or sugar—and drink" (F, Russian, b. 1986).

Urbanization affected the production of traditional dishes. For example, cooking *kissel* requires starch, which was previously made by country dwellers themselves from their own potatoes: "For us in Karelian village, *kissel* was boiled with potato starch. To eat with a spoon. Starch was self-made. Digging potatoes was over, the biggest was chosen—ugly, one may say. Washed well. I remember; it was not peeled, but grated, rinsed with water several times, the water poured away, there was such a white mass. Dried it, and got potato starch" (F, Karelian, b. 1951). Now starch is bought in the store, but complaints have been raised about its quality. The same applies to the traditional dish "cowberry with *tolokno*", which is even included in the menu of local restaurants (Figure 4). In the past, *tolokno* used to be made at home. Now cereals are not grown on private farms, and the *tolokno* sold in shops is not in demand due to its low quality: "Yes, yes, not edible. I've bought some; one day I wanted cowberry with *tolokno* so badly; my mother-in-law made it all the time, and little children ate it, children were fed with it. And it still remains, I don't use it. That is how bad the quality is" (F, Russian, b. 1957).


**Figure 4.** A page from the menu of the restaurant Karel'skaia gornitsa, Petrozavodsk. The second item on the menu: 'Berries mixed with *tolokno*. Bilberries, cowberries. *Tolokno* for this dish is prepared in a special mortar following an old recipe and only in the mornings so that it good at producing high spirits'.

Smoking appeared, according to different informants, about 20 to 40 years ago, but it did not become a method of fish or meat preservation and storage for a long time; it was rather perceived as a way of pleasantly spending free time: "My parents never smoked fish. We mostly salted it" (F, Karelian, b. 1968). Elderly people even said that they didn't know how to do it: "My son smokes, we don't, we cannot ... And earlier, in Syssoila, I don't remember smoking" (F, Karelian, b. 1944). Those who now do it, describe it as a non-serious pastime: "Fish wasn't smoked. No, Karelians didn't smoke. It is only now that I'm messing around with smoking" (M, German, b. 1950). Using *Alnus incana* for fish smoking, like the smoking itself, seems to be a novelty in this region, practiced by newcomers: "No. Maybe; people smoked after us, but at that time it wasn't used. The easiest methods were salting, boiling and a kind of preservation—cooked for a long-long time, with seasonings—and into jars" (F, Karelian, b. 1954).

The recent fashion for *ivan-chaj* (herbal tea made from *Epilobium angustifolium*; for more details see [57]) has influenced the production of this drink by some respondents themselves for their own consumption and even for sale: "In a jar, my husband kept [leaves] for two weeks without light, then rolled" (F, Karelian, b. 1951). Still, to some people the instructions seem too complicated: "This is common now, all these leaflets, now there's a lot on the Internet, how to ferment it correctly. But we just dry it" (F, Belorussian, b. 1950). It is easy for innovation to appear in such circumstances: "A few years ago, when we started making tea, we had several blends. And we were the only ones to make complex blends with black tea. That is, people made all kinds of herbs, mixed them, but not with black tea. And we, kind of—why not smoke it? And we smoked it in some way; and so far no one else does it" (F, Russian, b. 1986).

It is interesting how one of our informants strongly denied the use of roots and tree bark by Karelians: "I don't remember my friends or anyone digging something up, no. I say, people were not hungry ... maybe there was shortage, of course, as I recall now, but not to that extent. Karelians did not eat bark—I'm sure of that for some reason. They would salt fish, kill some game in the forest, put snares when they had no rifles—but bark ... They write everywhere: "Karelians ate bark"—that's not true! They [lived] not bad at all ... and my husband, he was such a hunter that ... we lived in Severodvinsk, and we were never without game" (F, Inkeri/Karelian, b. 1941). It is obvious that for the current population using the bark of trees (although, in fact, this is about cambium, which they do not realize) is viewed not as a usual and neutral practice, but rather as an unfortunate necessity during war time or an offensive assumption. Only one person mentioned the cambium of some tree (she did not remember which one) as her father's childhood snack: "Dad said, in childhood, they always took a wire, made an incision, removed the bark, and between the wood and the bark there was such a soft white layer, it was the most delicious thing in their childhood" (F, Karelian, b. 1968).

### *3.1. Cross-Cultural Comparison*

Differences in plant use between the different groups appear minimal (Figure 5). The main differences are on the level of the taxa used by only a few people. The majority of plants are used by all three groups, and the differences are observed only with rarely mentioned plants. For Karelians these are *Rubus arcticus, Filipendula ulmaria, Plantago,* and *Elymus repens* (most of them unique to Kalevala, see below), while for Russians they include *Juniperus communis, Origanum vulgare, Barbarea vulgare, Thymus subarcticus* and *Atriplex sp*. For the Other group distinctive plant is *Rumex confertus,* being a childhood snack. The only two food categories not shared by all three groups are "additives to strong alcohol" and "food additives". The use of strong alcoholic drinks as well as that of condiments are not characteristic of the local culture and have been introduced by newcomers.

While there is a little difference on the taxa and food levels, we can observe some more pronounced differences on the level of acceptance of recently learned uses. For example, the highest number of new DURs was reported by Russians, who at the same time reported about 40% of uses learned in adulthood and the lowest proportion of uses abandoned in childhood (Figure 6).

Quite a number of distinctive plant uses come from Kalevala as a result of the remoteness of the region and the cultural and ecological peculiarities of the region related to its isolation. While the use of some plants can be easily explained by characteristics of the habitat (use of the stems of *Eriophorum vaginatum* as a snack in childhood), others are more likely borrowed from the popular literature: for example, the use of *Alchemilla vulgaris* and *Polygonum aviculare* in salads was acquired in the 2000s. The same can be said about the use of flowers of *Filipendula ulmaria* in recreational teas, and the leaves and aerial parts of *Achillea millefolium, Plantago,* and *Atriplex* in salads. One informant mentioned eating the leaves of *Plantago* and various parts of *Elymus repens* in childhood as a snack.

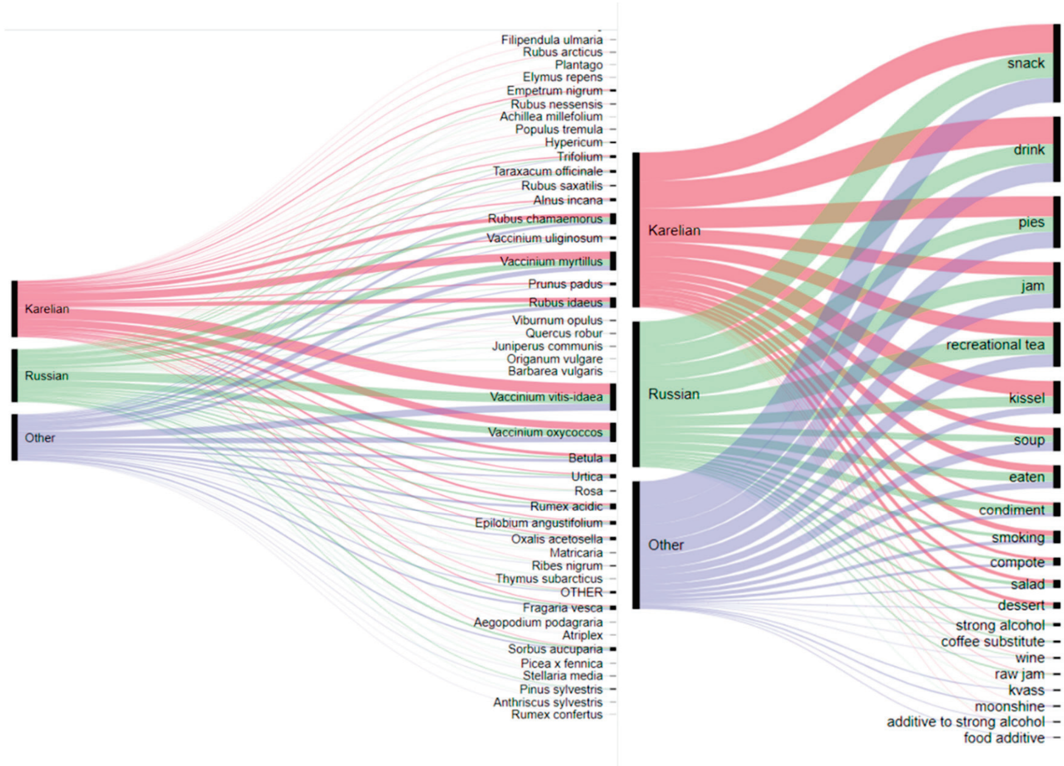


**Figure 5.** Alluvial diagram illustrating the distribution of plants and uses among the three groups.

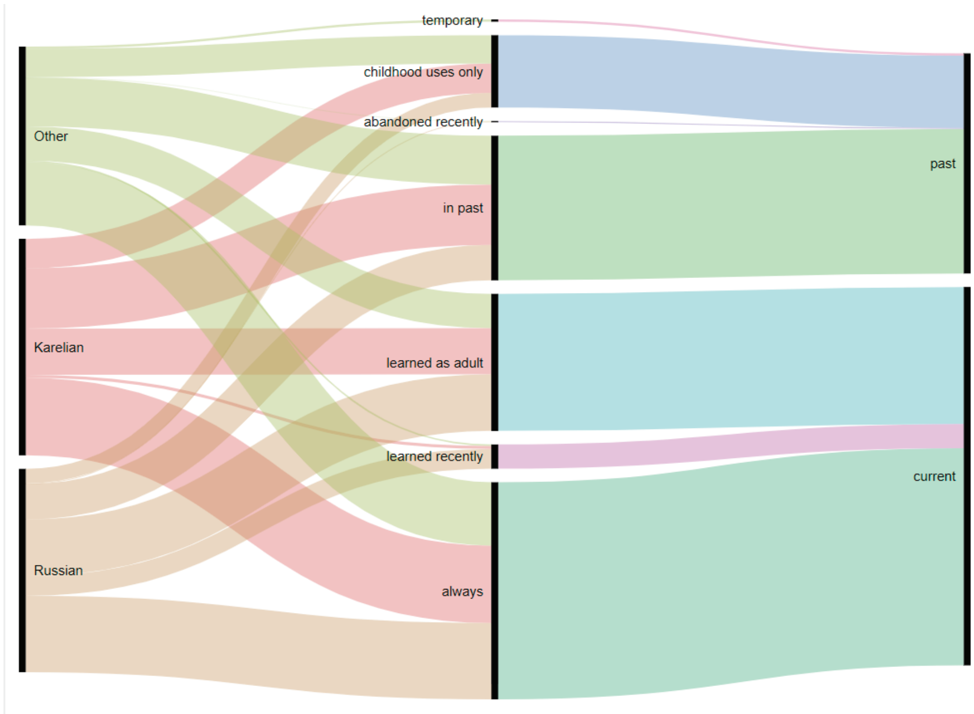


**Figure 6.** Plant uses in the three groups during the lifetime.

### 3.1.1. Comparison with Historical Data

Plants and their uses mentioned in the ethnographic literature are given in Table 3. As can be observed, reporting berries as a snack was more the exception than the rule. We can only presume that this was so obvious to the authors that almost no one considered it worth mentioning.

**Table 3.** Historical uses of wild plants in Karelia.

| Plant Taxa | Local Name | Used Part | Preparation | Use | KAR | RUS | Source |
|---|---|---|---|---|---|---|---|
| *Sagittaria sagittifolia* L.; Alismataceae | Rus. *strelolist* | root | - | additive to flour | - | - | [17] |
| *Allium* sp.; Amaryllidaceae | Rus. *dikii luk* | - | - | - | X | | [47] |
| | | | | | | X | [58] |
| *Heracleum* sp.; Apiaceae | Rus. *borshch* | | boil | cooling drink | | X | [59] |
| *Calla palustris* L; Araceae | Rus. *zhitnitsa*, *khlebnik*, *khlebnitsa*, Kar. *vehka* | rhizomes | - | additive to flour | X | | [45] |
| | | | | | - | - | [17] |
| *Cichorium intybus* L.; Asteraceae | Rus. *tsikorii* | roots | fry | coffee substitute | X | | [50] |
| | | | | | | X | [49] |
| *Betula* spp.; Betulaceae | Rus. *bereza* | sawdust | - | additive to flour | X | | [52] |
| | | bark | - | additive to flour | X | | [52] |
| | | sap | - | moonshine | X | | [53] |
| *Butomus umbellatus* L.; Butomaceae | Rus. *susak* | roots | - | additive to flour | - | - | [17] |
| *Pteridium aquilinum* (L.) Kuhn; Dennstaedtiaceae | Rus. *paporotnik* | shoots | fresh | snack | X | | [52] |
| | | | boil | soup | X | | [52] |
| *Empetrum nigrum* L.; Ericaceae | Rus. *voronika*, Kar. *kuarnehuš*, *puarnahus* | fruits | - | - | | X | [60] |
| | | | crush in barrel | - | X | | [53] |
| *Vaccinium myrtillus* L.; Ericaceae | Rus. *chernika*, Kar. mussikka, mušt'oi, must'oi | fruits | - | - | X | | [44] |
| | | | | - | | X | [60] |
| | | | | - | | X | [61] |
| | | | | - | X | | [51] |
| | | | | soup *marjarokka* | X | | [21] |
| | | | dry | pies | X | | [59] |
| | | | | - | X | | [50] |
| | | | boil | pies | X | | [21] |
| | | | | - | X | | [53] |

**Table 3.** *Cont.*

| Plant Taxa | Local Name | Used Part | Preparation | Use | KAR | RUS | Source |
|---|---|---|---|---|---|---|---|
| *Vaccinium myrtillus* L.; Ericaceae | Rus. *chernika*, Kar. mussikka, mušt'oi, must'oi | fruits | fresh | pies | X | X | [49]<br>[21] |
| | | | | snack | | X | [49] |
| | | | | jam | X | | [21] |
| | | | | smashed with sugar | X | | [21] |
| | | | | eaten with milk | X | | [21] |
| | | | | drink | X | | [21] |
| | | | | sandwich | X | | [21] |
| | | | | - | X | | [50] |
| | | | | | | X | [62] |
| *Vaccinium oxycoccos* L.; Ericaceae | Rus. *kliukva*, Kar. *karpalo*, *garbal*, *guarbalo* | fruits | - | - | X | | [47] |
| | | | | | | X | [60] |
| | | | | | X | | [59] |
| | | | | | X | | [51] |
| | | | | drink | X | | [50] |
| | | | | pies | | X | [22] |
| | | | | | | X | [49] |
| | | | fresh | *kissel* | X | | [53] |
| | | | | dessert | X | | [53] |
| | | | | jam | X | | [21] |
| | | | | mousse | X | | [21] |
| | | | | *kvass* | X | | [21] |
| | | | | condiment for sauerkraut | | X | [49] |
| | | | | - | X | X | [50]<br>[62] |

**Table 3.** *Cont.*

| Plant Taxa | Local Name | Used Part | Preparation | Use | KAR | RUS | Source |
|---|---|---|---|---|---|---|---|
| *Vaccinium oxycoccos* L.; Ericaceae | Rus. *kliukva*, Kar. *karpalo*, *garbal*, *guarbalo* | fruits | soak | garnish | X | | [21] |
| | | | | salad | X | | [21] |
| | | | | *kissel* | X | | [21] |
| | | | | *mors* | X | | [21] |
| | | | | condiment for sauerkraut | X | | [21] |
| | | | smash or mince with sugar | *kissel* | X | | [21] |
| | | | | *mors* | X | | [21] |
| | | | | pies | X | | [21] |
| | | | | dessert | X | | [21] |
| *Vaccinium uliginosum* L.; Ericaceae | Rus. *golubika*, Kar. *juopukko*, *düobukko*, *juamoi* | fruits | boil | eat | X | | [53] |
| | | | fresh | - | | X | [62] |
| | | | - | drink | X | | [53] |
| | | | | soup *marjarokka* | X | | [21] |
| | | | | - | X | | [59] |
| *Vaccinium vitis-idaea* L.; Ericaceae | Rus. *brusnika*; Kar. *puola*, *buol*, *buolu* | fruits | - | - | X | | [47] |
| | | | | - | X | | [63] |
| | | | | - | | X | [61] |
| | | | | - | | X | [60] |
| | | | | - | X | | [64] |
| | | | | - | X | | [51] |
| | | | | - | | X | [62] |
| | | | | ritual dish | X | | [65] |
| | | | | *kissel* | | X | [49] |
| | | | | pies | | X | [49] |
| | | | | | X | | [21] |
| | | | | soup *marjarokka* | X | | [22] |
| | | | | | X | | [21] |

**Table 3.** *Cont.*

| Plant Taxa | Local Name | Used Part | Preparation | Use | KAR | RUS | Source |
|---|---|---|---|---|---|---|---|
| *Vaccinium vitis-idaea* L.; Ericaceae | Rus. *brusnika*; Kar. *puola*, *buol*, *buolu* | fruits | - | tea substitute | X | | [22] |
| | | | | bake in turnip | X | | [21] |
| | | | crush in barrel | eat with boiled turnip | X | | [21] |
| | | | | eat with *tolokno* | X | | [21] |
| | | | | - | X | | [53] |
| | | | | - | X | | [50] |
| | | | freeze | dessert | X | | [53] |
| | | | | pies | X | | [53] |
| | | | | eat with *tolokno* | X | | [53] |
| | | | | eat with rye flour | X | | [53] |
| | | | soak | eat with sweetened water | X | | [59] |
| | | | | cowberry water | | X | [49] |
| | | | | - | X | | [53] |
| | | | | pies | X | | [21] |
| | | | | garnish | X | | [21] |
| | | | | *kissel* | X | | [21] |
| | | | | *mors* | X | | [21] |
| | | | | salad | X | | [21] |
| | | | fresh | eaten with *tolokno* | X | | [66] |
| | | | | | X | | [22] |
| | | | | jam | X | | [21] |
| | | | | fruit puree | X | | [21] |
| | | | | eaten with milk | X | | [21] |
| | | | | pies | X | | [21] |
| | | | | condiment for apples | X | | [50] |

**Table 3.** *Cont.*

| Plant Taxa | Local Name | Used Part | Preparation | Use | KAR | RUS | Source |
|---|---|---|---|---|---|---|---|
| | | leaves | dry | tea substitute | X | X | [49] [53] |
| *Trifolium* sp.; Fabaceae | Rus. *klever* | flowers | dry | additive to flour | X | | [52] |
| *Ribes nigrum* L.; Grossulariaceae | Rus. *smorodina* | leaves | dry | tea substitute | X | X | [49] [52] |
| *Hypericum* spp.; Hypericaceae | Rus. *zveroboi* | - | dry | tea substitute | X | X | [49] [52] |
| | | flowers | dry | tea substitute | X | | [53] |
| *Iris pseudacorus* L.; Iridaceae | Rus. *iris* | rhizomes | - | additive to flour | - | - | [67] |
| *Mentha* sp.; Lamiaceae | Rus. *miata* | aerial parts | dry | tea substitute | X | X | [49] [52] |
| *Thymus subarcticus* Klokov & Desjat.-Shost.; Lamiaceae | Rus. *bogoroditska ia trava* | aerial parts | dry | tea substitute | | X | [49] |
| *Nuphar luteum* (L.) Sm.; Nymphaeaceae | Rus. *odolen' koren'* | rhizomes | - | additive to flour | - | - | [67] |
| *Nymphaea alba* L.; Nymphaeaceae | Rus. *odolen' koren'* | rhizomes | - | additive to flour | - | - | [67] |
| *Cetraria islandica* (L.) Ach.; Parmeliaceae | Rus. *mokh* | thallus | soak in liquor, rinse and dry * | additive to flour | - | - | [68] |
| *Pinus sylvestris* L.; Pinaceae | Rus. *sosna* | cambium | dry, bake, and grind | additive to flour | X | | [45] |
| | | | | additive to fish soup | X | | [45] |
| | | | - | additive to flour | X | | [63] |
| | | | | | X | | [15] |
| | | | | | | X | [69] |
| | | | | | X | | [64] |
| | | | | | X | | [70] |
| | | | | | X | | [52] |
| | | | | | X | | [53] |
| | | | fresh | snack | | X | [59] |

**Table 3.** *Cont.*

| Plant Taxa | Local Name | Used Part | Preparation | Use | KAR | RUS | Source |
|---|---|---|---|---|---|---|---|
| *Glyceria fluitans* (L.) R.Br.; Poaceae | Rus. *mannik* | seeds | - | additive to flour | | | [67] |
| *Rumex* sp.; Polygonaceae | Rus. *shchavel'*, Kar. *suoluheinä* | leaves | fresh | snack | | X | [59] |
| | | | | pies | X | | [21] |
| | | | boil | soup *suoluheinusuupu*, *čuokoisuupu* | X | | [66] |
| | | | | | X | | [21] |
| | | | - | - | X | | [47] |
| *Filipendula ulmaria* (L.) Maxim.; Rosaceae | Rus. *tavolga* | rhizomes | - | additive to flour | | | [17] |
| *Fragaria vesca* L.; Rosaceae | Rus. zemlianika | fruits | fresh | sandwich | X | | [21] |
| | | | | - | | X | [62] |
| | | | - | - | X | | [71] |
| *Prunus padus* L.; Rosaceae | Rus. *cheremukha* | fruits | fresh | snack | | X | [49] |
| *Rosa* sp.; Rosaceae | Rus. *shipovnik* | fruits | fresh | tea substitute | X | | [21] |
| | | | dry | tea substitute | X | | [21] |
| *Rubus chamaemorus* L.; Rosaceae | Rus. *moroshka*, *hillo*, *muuroi* | fruits | soak | - | | X | [46] |
| | | | | | X | | [47] |
| | | | | | X | | [53] |
| | | | | | | X | [49] |
| | | | | | X | | [21] |
| | | | | | | X | [62] |
| | | | fresh | snack | X | | [47] |
| | | | | jam | X | | [21] |
| | | | | - | | X | [62] |
| | | | fermented | eat with sweetened water | X | | [59] |

**Table 3.** *Cont.*

| Plant Taxa | Local Name | Used Part | Preparation | Use | KAR | RUS | Source |
|---|---|---|---|---|---|---|---|
| *Rubus chamaemorus* L.; Rosaceae | Rus. *moroshka*, *hillo*, *muuroi* | fruits | - | - | X | | [60] |
| | | | | | X | | [61] |
| | | | | | | X | [71] |
| | | | | | X | | [72] |
| | | | | | X | | [64] |
| | | | | | X | | [51] |
| *Rubus idaeus* L.; Rosaceae | Rus. *malina*, Kar. *malina*, *vagarm*, *vavarno* | fruits | boil | - | X | | [53] |
| | | | fresh | snack | | X | [49] |
| | | | | jam | X | | [21] |
| | | | | smashed with sugar | X | | [21] |
| | | | | eaten with milk | X | | [21] |
| | | | | sandwich | X | | [21] |
| | | | | - | | X | [62] |
| | | | - | - | | | [61] |
| | | | | | X | X | [71] |
| | | | | | X | | [51] |
| | | | | soup *marjarokka* | X | | [21] |
| | | leaves and stems | dry | tea substitute | X | | [49] |
| | | | | | X | | [53] |
| | | leaves | ferment and dry | tea substitute | X | | [51] |
| | | | dry | tea substitute | | | [52] |
| *Sorbus aucuparia* L.; Rosaceae | Rus. *riabina* | fruits | fresh | snack | | X | [49] |
| | | | | jam | X | | [21] |
| *Typha latifolia* L., *T. angustifolia* L.; Typhaceae | Rus. *chakan*, *rogoz*, *khlebnik*, *kuga*, *sitnik*, *pshenichka*, *boby* | young stems | fresh | snack | | | [17] |
| | | rhizomes | bake | additive to flour | | | [17] |
| *Urtica* sp.; Urticaceae | Rus. *krapiva*, Kar. *šiiloi* | aerial parts | boil | soup *čiiloirokku* | X | | [21] |
| *Viburnum opulus* L.; Viburnaceae | Rus. *kalina* | fruits | steam | *kissel* | | X | [49] |
| "roots" | Rus. *koreshki* | roots | | snack for children | | X | [59] |
| moss | Rus. *mokh* | aerial parts | dry | additive to flour | X | | [53] |

* Recommended use. Information about actual use was not found. 'X' reflects the plant use record.

In Table 3, a notable proportion of food uses are represented by additives to flour, mostly the roots of wetland plants. The lichen *Cetraria islandica* was officially recommended by the Russian government in 1841 in a departmental journal which published the following statement: "The Scientific Committee of the State Property Ministry concerned the sample of tree bark used by peasants of Kem' and Kola counties of Arkhangelsk province to mix with bread, preoccupied with indicating to residents of these counties more suitable substances for this purpose, which could be added to bread and deliver healthier food, and drew attention to Icelandic moss (lichen islandicum) which grows in those lands in great abundance and which, as it is known from the experiments conducted, found fit for food" [68], (p. 258). The following part of the article contained instructions on how to remove the bitter taste from the lichen, dry it, and grind it into flour using ordinary millstones [68]. As there are not references on its actual use for making bread among locals, it may be just a resonance of the campaign of the promotion of the use of wild plants in famine time (see [73]). In historical data, there is no information on making alcohol drinks: "People in Zaonezh'e did not know how to make hoppy drinks of grain, birch sap and aspen bark" [49]; in fact, even wine shops were very few, vodka was seldom sold, and drunkenness was absent [64,74]. In the past, very few herbal plants were used but for flour and tea substitutes—in fact, these are only *Allium*, *Heracleum*, *Pteridium*, *Rumex*, and *Urtica*.

The list of berries used in Karelia, however, did not change for the most part, although in the past they were processed and stored in different and fewer ways. Old techniques are applied to new products: "Karelians use *kissel* a lot: oat and pea *kissel* has been known for a long time, and milk and berry ones were introduced during the Soviet era because of the availability of sugar" [53] (p. 133). At least since the 19th century, local people have collected berries not only for themselves but also for selling in the nearest towns: "In addition to kitchen gardening and fishing, old women-schismatics [Russian Orthodox Old Believers] from Pertozero collect berries, such as raspberries, cloudberries, bilberries (*V. myrtillus*) and cowberries, as well as mushrooms; most of the berries and mushrooms collected are sold to residents of Sumskoi Posad. In recent years raspberries have been sold by schismatics at a rather high price, one might say, i.e., at the St. Petersburg price; so, in the summer of 1909, fresh raspberries were sold at 20 kopecks per pound, while cowberries and cloudberries were sold at 5 to 5.5 kopecks per pound" [61], (p. 15). Some sources provide information about the ways in which to store berries to be sold: "Among berries, fresh bilberries (rarely dried), cranberries and cowberries were harvested for sale. The latter, crushed in barrels with water, were sold to the town, sometimes with soaked wild apples" [50], (p. 106). The extent of the process is underlined by the size of the containers mentioned for the berries: "Cloudberries, soaked in barrels and tubs, were sold to resellers. Fresh bilberries were also bought by them without limitation" [62], (p. 187).

### 3.1.2. The Importance of the Name

To evaluate the level of phytonymic knowledge among our Karelian informants, we compared the list of plant names given by our informants in Russian and Karelian with the ones presented in several dictionaries of the Karelian language [75–80]. The list of berry names includes 20 in Russian interviews, 12 in Karelian ones, and 19 in the various dictionaries. The ratio for herbal plants is 34:5:29 (but many Russian plant names were named by only one person). In addition, 10 berry names are presented in all six dictionaries while for herbal plants it is only three, which also indirectly indicates the popularity of berries.

For some berries, we were able to record two or three Karelian names, as our respondents speak various dialects of that language. Overall, we had the impression that berry names are retained more by our informants than any other group of phytonyms. They remember mushroom names less, and herb names are remembered least of all: "What's the name of this plant? [We say *pizhma*] So do we. [And in Karelian?] I don't know in Karelian. I know all berries names, but not all for flowers" (F, Karelian, b. 1951). One of the informants (F, Karelian, b. 1941) gave the name *juomoi* for *Rubus saxatilis*, although this is really the name of *Vaccinium uliginosum*. Another interviewee gave the Karelian name of *Pinus sylvestris*, i.e., *pedäi*, to *Populus tremula* (F, Karelian, b. 1951). An elderly woman explained her diminishing knowledge of Karelian as a result of living with Russians since the age of fourteen and her marriage to a Russian man (F, Karelian, b. 1927).

In the Russian dialect spoken in Karelia, both *Rumex* and *Oxalis acetosella* may have the name *kislitsa*, based on the sour taste of the two plants (Rus. *kislyi*), as well as *shchavel'*, which is also used for both plants. *Oxalis acetosella* has an especially long list of names which seem to have genesis in children's culture. The only plant which has special names for soft ripe berries and hard unripe berries in both languages is *Rubus chamaemorus*.

Sometimes, the plant name was not remembered, yet the person was able to describe it accurately enough for robust identification. For example, we identified *Eriophorum vaginatum* as a childhood snack of a Karelian woman born in 1968: "There are those, they grow in the marshland, plants with white tassels. There are many, many in the swamp . . . we went to the cinema in the village, and always ate those white ones. Seemed so delicious to us! (...) They are kind of one into another, these little things ... Yes, a blade of grass—you pull it out, and we always ate these tips. They are kind of tasteless, but tasty anyway".

#### 3.1.3. Food Medicine

To understand the importance of berries to the people of Karelia, it is important to consider, in parallel, their use as medicine: "Again, for the whole *artel'* [a group of workers] one must take—one simply can't live without it—a barrel of soaked cloudberries; without cloudberries scurvy will lead to death" [47], (pp. 76–77). Raspberries and blueberries [*V. ulginosum*] were dried, and then, as well as cranberries, used for medicinal purposes [22]. Our informants also mentioned *Rubus idaeus* as a means of fighting cold: "My mother always cut the tops of raspberry, twigs with berries, dried them . . . and then, when she was ill, she brewed these in the tea-pot and drank it as raspberry tea. [Just for taste or as a medicine?] Well, anyway phytoaspirin remains. This fragrance" (F, Karelian, b. 1968); "Raspberry contains natural aspirin" (F, Russian, b. 1948). Other berries were also named as a means to treat various illnesses: "[And high temperature?] Cranberries" (F, Fin/Kar, b. 1941); "Earlier, I remember, my grandmother always crushed cowberries for us. When we had sore throat. And now I make juice for my grandchildren. When there is already a patch there in the throat, tonsillitis, and this acidity—it kills all the germs. I warm it and pour into their mouths. To coat. And then they don't eat anything for a while. And it goes away very fast" (F, Karelian, b. 1963). After various cold ailments, the second most common problem mentioned was intestinal disorders: "Dried bilberries—for diarrhea. Dries it on the stove" (F, Russian, b. 1938). The same attitude was transferred to cultural plants cultivated in gardens: "Aronia, chokeberry. It also lowers blood pressure, but it increases blood viscosity" (F, Russian, b. 1948); and "I like to harvest viburnum for cough" (F, Russian, b. 1952). It seems that habitual consumption in some cases is thought to have prophylaxis properties: "We should eat berries [bilberries], just fresh berries, they said, for vision" (F, Russian, b. 1967).

### *3.2. Comparison of Current Use with Suggested Wild Food Plants Available in the Region*

It is possible to compare the situation today with the officially proposed list of edible plants of Karelia [81] (Figure 7). Fruit-yielding plants are used in full (14 out of 14). More than that, during the interviews we encountered plants not listed in the book in question: *Lonicera caerulea*, *Arctostaphylos uva-ursi* and *Vicia cracca* were mentioned only once, whereas collecting *Rubus nessensis*, *Empetrum nigrum*, and *Prunus padus* seems to be common practice. Among the plants recommended for salads only half are used (nine out of 18). Inhabitants of Karelia use nine additional plants, not present in [81], including *Atriplex patula*, *Achillea millefolium*, *Betula* spp., *Stellaria media*, *Trifolium* sp., *Plantago* spp., *Elymus repens*, *Polygonum aviculare*, and *Alchemilla vulgaris*. Still, all of them apart from *Stellaria* were mentioned only once, and in most cases by the same woman who quite actively uses wild edible and medicinal plants. Among the recommended beverage plants, 14 of 19 are used, which includes berries, leaves, and roots, primarily for making *kissel* and *mors*, but also for making tea and coffee substitutes. *Crataegus chlorocarpa*, *Hypericum* spp., and *Betula* spp. (the last as fresh sap, but also to make *kvass*) are also used. Aromatic and spicy plants are not numerous in Karelia, yet still less than half of these are used (three out of seven). Only one of our informants used *Barbarea vulgaris* and *Achillea millefolium*, which are not mentioned in the book.

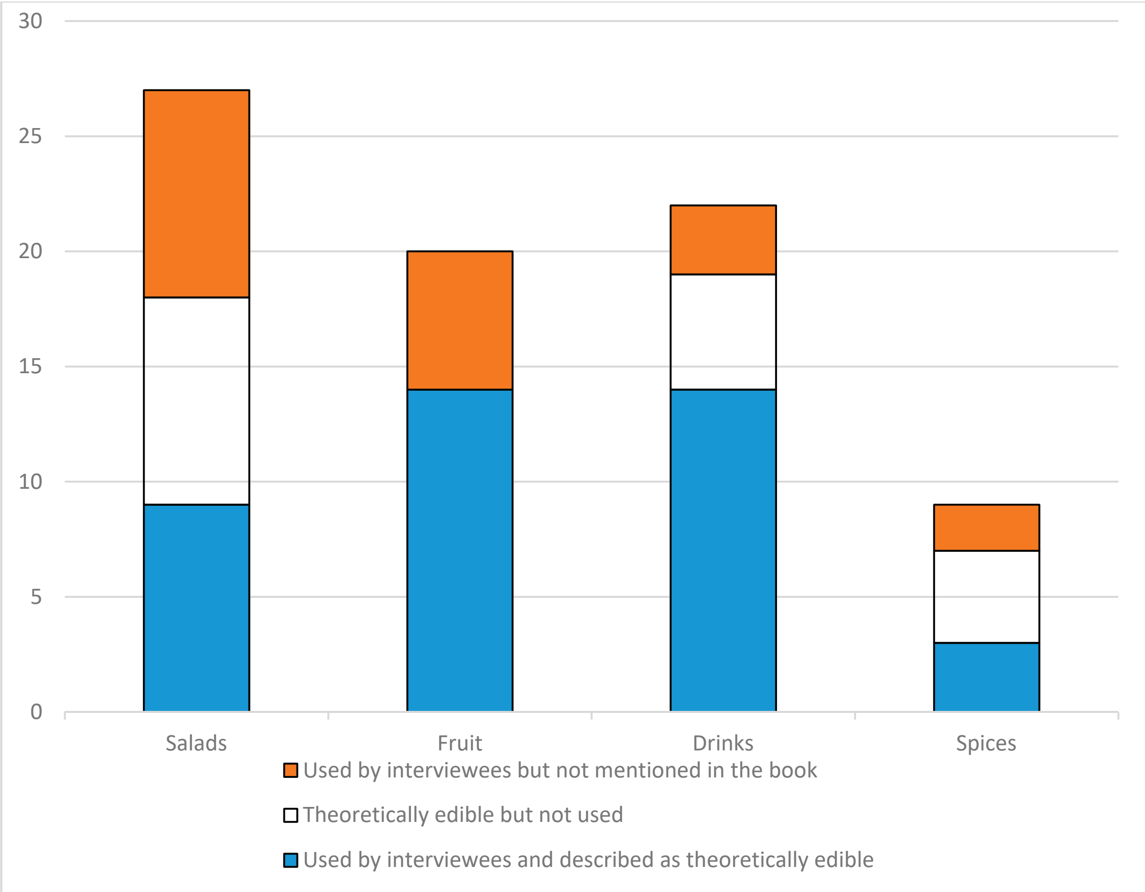


**Figure 7.** Categories in which theoretically edible wild plants can be used according to [81] and the proportion of the plants recommended in his study against the ones used by our interviewees.

As we can observe, today all kinds of fruit plants named in the book are used, while salad plants, beverage plants, and spices are underused. It is difficult to judge from only one book, but it appears that here we witness the same tendency toward the maximum use of berries while greens and spices are neglected.

In [55], four groups of wild edible plants in Russia are distinguished: (1) plants harvested and used continuously; (2) plants widely used before but (nearly) forgotten now; (3) plants picked up in spring by children; and (4) plants used during times of war and crop failures. Most of the WEPs mentioned by our respondents correspond to group 1; group 2, based on the above definition, was not mentioned; plants from group 3 are much less numerous than those of group 1; while plants from group 4 were mentioned only by elderly people in reference to memories (their own or those of their parents) about the war and evacuations.

Procurement Offices

Another aspect of human-forest relations is that of picking up wild edibles for the procurement office (Rus. *zagotkontora*). By handing over berries, mushrooms, herbs, and bark, people could get not only money but also the right to buy certain goods that were in short supply: "Well, there were procurement offices. There we handed them over—and there were goods. And even imported ones. Finnish goods. Tea, coffee... First of all, berries. Cowberries, bilberries, cloudberries. Blueberries were taken, but they were very few" (F, Karelian, b. 1954). Practically everyone was involved in the business: "Handed over berries, mushrooms, cowberries. Everything was in shortage—clothes, food. One could buy clothes with coupons. We bought imported Finnish clothes. Previously, berries were expensive; it was possible to hand over a lot. <...> I lived in a forest village, and the whole village worked in a timber industry enterprise. And everyone handed them over" (F, Belorussian, b. 1965). The sum of money received for forest products could be rather impressive: "Then real goods, not Chinese fakes, were sold. Japanese electronics, cars. We bought our first car in the procurement office. Had to harvest 500 kg of berries" (F, Russian, b. 1957). The need to collect a large quantity of berries could result in over-harvesting, especially while using special devices for the easy picking of many berries at once (Rus. *kombain*) which was prohibited; however, we saw wooden analogues of such devices made about 100–150 years ago in a local museum (Figure 8). The coupons received for berries and other wild plants sometimes became the object of bargaining: "Or sometimes in a shop, but with a coupon. Suppose, I hand them over for 100 rubles—they give you goods for 10 rubles. For example, the children were small, we could not buy tights. To buy two pairs of tights, it was necessary to hand over a bucket of bilberries. They gave money for it. My husband really didn't like to collect bilberries, but for four pairs of tights we had to collect. Then these coupons were even outbid by people. People hand them over, who don't need [the goods], and you pay" (F, Karelian, b. 1954).

**Figure 8.** Wooden 'kombains' in Ethnographic museum of rune singers, Kalevala.

In addition, they could hand over the wild edibles they did not use themselves: "We dried berries, I remember, and handed them over ... we needed to buy school textbooks, so we dried and handed them over. But we didn't use rowan berries" (F, Karelian, b. 1944). In recent years the state offices have been replaced by private harvesters, *ivan-chaj* producers, etc.: "I lived in Kostomuksha before moving here, there was an entrepreneur who took berries and processed them for preserves, juices. And now there is "Iagoda Karelii" [Berry of Karelia]. The whole production is established, and berries are accepted from the population. There, in Kostomuksha" (F, Belorussian, b. 1965). One more way to profit from forest products is to be hired as a berry receiving inspector; this seasonal job is advertised every year (Figure 9).

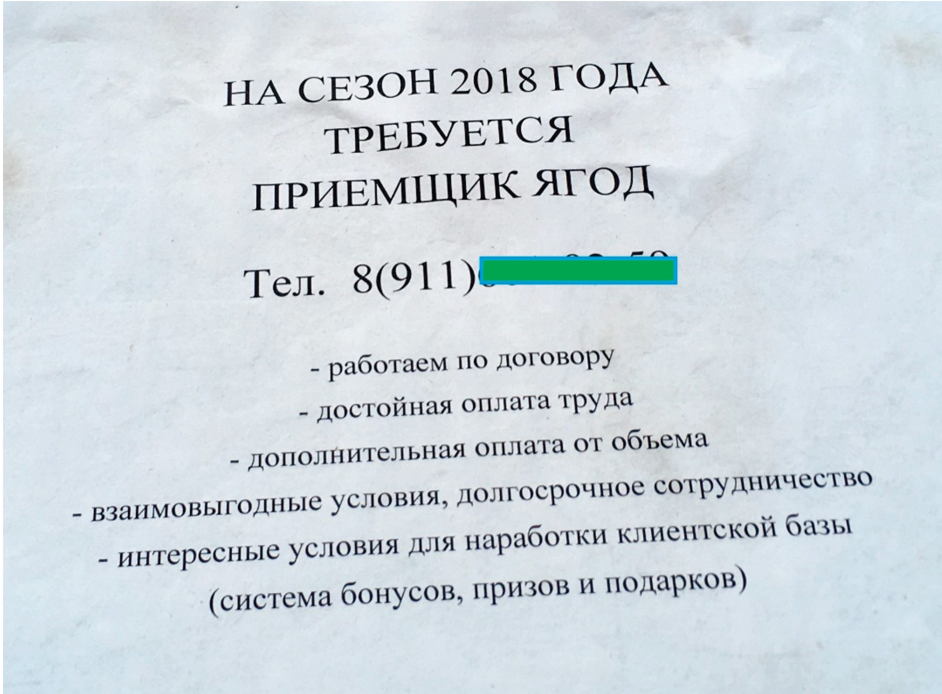


**Figure 9.** An advertisement about a berry receiving inspector job vacancy for 2018 season, Kalevala. Translation: 'For the season of 2018 a berry receiving inspector job position is open. Tel. xxx-xx-xx. -job contract, -decent salary; -additional payment in function of volume; -mutually beneficial conditions, long-term collaboration; -attractive conditions for the customer base (a system of bonuses, prizes and gifts)'.

'Iagoda Karelii' mentioned by the respondent is the first company in Russia to completely process forest berries, from cleaning and sorting to producing fillings, jams, and confitures [82]. Recently, direct investment from Swedish, Finnish and Norwegian companies has become a stimulus for the development of procurement in Karelia. This is due to the proximity of the region to the western borders of Russia and relatively cheap Russian raw materials market. In Karelia, there are about 40 companies collecting wild plants and delivering them to the countries of Northern Europe. All of them work under the condition of full funding from Western partners. Still, the processing of wild-grown berries is not developed in the region: most operators in this market collect berries and export them "as is" [83]. In shops, one can buy jams and other products made from the same berries which have been harvested for centuries (Figure 10).


**Figure 10.** Cranberry, raspberry and black currant jams sold in a convenience store, Petrozavodsk.

## 4. Conclusions

As farmers in a risky agricultural zone, the inhabitants of Karelia developed their own type of minimalism, different from, for example, the minimalism of Northern nomads [84]. For centuries, the lack of bread was covered by bread substitutes such as cambium and nutritious wetland plants found in nature, and the lack of fruit and vegetables by berries. In Karelia, changes in traditional culture, usually perceived as the loss of traditional ecological knowledge and plant uses, have actually resulted in the expansion of both the range of plants used (as salad herbs, spices) and the methods of their processing (e.g., smoking, making jam and compotes) and storage (freezing). The only group of plants that has been irretrievably lost is flour additives, which were no longer needed after the problems with bread disappeared. Berries, however, did not disappear after fruit became readily available, and they started to be used in new ways (jams, jellies, smoothies, etc.). This may be explained by both their free availability and their dual role as food and medicinal plants, as well as their being a source of vitamins, especially in winter. Furthermore, in the Russian Empire, in the Soviet Union, and more recently in the Russian Federation, the harvesting of berries was and still is a way to earn extra money and/or obtain deficient goods.

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*foods*

*Article*

# Dining Tables Divided by a Border: The Effect of Socio-Political Scenarios on Local Ecological Knowledge of Romanians Living in Ukrainian and Romanian Bukovina

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**Abstract:** Local cuisine is an important reservoir of local ecological knowledge shaped by a variety of socio-cultural, economic, and ecological factors. The aim was to document and compare the current use of wild and semi-cultivated plant food taxa by Romanians living in Romania and Ukraine. These two groups share similar ecological conditions and historically belonged to the same province, but were divided in the 1940s by the creation of a state border. We conducted 60 semi-structured interviews with rural residents. The contemporary use of 46 taxa (plus 5 cultivated taxa with uncommon uses), belonging to 20 families, for food consumption were recorded. Romanians in Romanian Bukovina used 27 taxa belonging to 15 families, while in Ukraine they used 40 taxa belonging to 18 families. Jams, sarmale, homemade beer, and the homemade alcoholic drink "socată" are used more by Romanians in Southern Bukovina, while tea, soups, and birch sap are used more in Northern Bukovina. We discuss the strong influence of socio-political scenarios on the use of wild food plants. Cross-ethnic marriages, as well as markets and women's networks, i.e., "neighbors do so", may have had a great impact on changes in wild food use. In addition, rapid changes in lifestyle (open work market and social migration) are other explanations for the abandonment of wild edible plants.

**Keywords:** cultural landscapes; marginal rural areas; non-wood forest products; rural livelihoods; wild plants; wild food

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## 1. Introduction

The way people prepare their food is an important expression of local culture that is also shaped by the surrounding environment and historical background [1]. Indeed, different cultures often develop different recipes and the use of different ingredients. The underlying ecological knowledge is in fact shaped by a number of factors including socio-cultural aspects, like religion [2], language [3], politics including governance systems [4–6], and economic features [7]. Such knowledge is not static, but rather dynamic as it evolves over time according to changes in the abovementioned factors. For instance, a change in lifestyle (influenced by economic shifts) was found to change the perceptions and the use of wild food plants [8–10] by changing motivations such as the desire for quality food and the pleasure of gathering wild plants [11], and also as a consequence of the disappearance of an agrarian lifestyle [12]. Wild food plants play an essential role in traditional cuisines across Europe [13], not to mention their economic value, especially in marginal rural areas in countries undergoing economic and governance transition [14]. The study of wild food plants in multicultural contexts has only been partially researched among migrant communities (e.g., [15]) and among coexistent ethnic groups (e.g., [16]), yet this is of vital importance not only to understand past food habit trajectories [17], but also to foresee possible future scenarios. To explore the trajectories of wild food plant consumption, Bukovina is an ideal case study due to its multiculturalism and complex historical background. This region, now split between Romania and Ukraine, is a hotspot of cultural diversity as it was home to several minority groups, including Jewish, Polish, German, and Hungarian people [18]. During the Austro–Hungarian Empire, Bukovina was a land of immigration with people coming from different contexts (e.g., [19,20]). Such complex human ecology, along with the peculiar landscape consisting of the Carpathian Mountains as well as hilly and plains areas, resulted in a varied and rich food heritage. However, more recent political events have also resulted in consistent emigration from both Romanian and Ukrainian Bukovina to other European contexts as well as urban centers of the respective countries. Such a phenomenon may have contributed to changes in the current consumption of wild food plants, yet only one recent investigation has demonstrated the influence of globalization on the use of wild plants in terms of social mobility [21]. In Ukraine, only a handful of publications have addressed current or past uses of wild food plants (e.g., Western Ukraine [7,22,23], Bukovina [4–6], and Northern Ukraine [24], in addition to a historical analysis of the use of plants [25] and a questionnaire among specialists working in the country [26]). In Romania, there have been ethnobotanical studies on the use of wild food ([24] and reference therein) [27], focusing on different ethnic groups (e.g., Hungarians [28,29], Italians [30], Polish [31], Tatars and Romanians [32], and Hutsuls and Ukrainians [4,33]). Yet, there have been no studies on the use of wild plants for food by the Romanian diaspora or Romanian ethnic groups living in other countries.

Within this multifaceted and intriguing context, the Ukrainian–Romanian border area of Bukovina has been settled by, among others, Romanians, Ukrainians, and Hutsuls (a Ukrainian ethnic minority living predominantly in Hutsulshyna and mountainous areas of Bukovina [34–36]), which have shared a complex history and socio-economic scenario, but different governance systems [4]. A few studies on the influence of the border in Bukovina with regard to the use of wild plants have been published [4–6,37]. However, the rich biocultural diversity of border areas due to different cultures, ethnos, religions, rituals and multiplex geopolitical and socio-economic conditions in a relatively small space [38] requires more research [39]. This is even more important in the current era of globalization and the homogenization of cultures, languages and natural resource use [40–42], as biocultural diversity is dynamic, involving both ecological and cultural relationships, changing the use of wild plants due to a variety of external factors [42].

During the COVID-19 crisis, with the various logistical problems and unstable situation with regard to the food supply and food security, wild food has developed a new important role as a safety-net. Therefore, study of the contemporary use of wild plants for culinary purposes, and the driving forces increasing or decreasing their use, is a timely endeavor. In this new reality, knowledge of the plants that surround us could be vital, especially in marginal rural areas. In the past, the use of wild foods has played various roles, and those roles are changing [11,12].

Within this multicultural border, we propose here a cross-border study to document and compare the current and past uses of wild and semi-cultivated plant food taxa by Romanians that live in similar ecological conditions and historically belonged to the same province, but were divided between two countries (Romania and Ukraine) in the 1940s. Moreover, we aimed to compare the uses of wild taxa among Romanians living on both sides of the border with other ethnic groups (e.g., Hutsuls).

Our hypothesis is that the different political scenarios of the two countries (Romania and Ukraine) have led to different socio-economic phenomena (e.g., emigration, seasonal work abroad, intense contact and cohabitation with neighbors through cross-ethnic marriage, and the influence of other food cultures (via markets and mass media)) which have affected the use of wild plants for culinary purposes in the historically unified region of Bukovina. It would be logical to expect that Romanians living on both sides of the border use similar wild food plants as they share the same language and, since 2015, can freely move across the border. Yet, even with an "untrained eye" one can see that Romanians living under the same environmental conditions, in the same historical province, but on opposite sides of the border, have different wild food plant uses. However, the question remains: to what extent do the living conditions of the country and the social interconnections that exist there influence local cuisine and wild food use?

## 2. Materials and Methods

### 2.1. Study Areas

Bukovina province has long been inhabited by Ukrainians and Romanians. It is believed that the name derives from the fact that the region was covered by natural beech (*Fagus sylvatica*) forest: in Ukrainian " y"—buk means beech tree (the word has a German root) and "Bukovina" means the beech land [43].

A complex history under different governance systems, e.g., the Turkish Empire, Moldavian Kingdom, Austro–Hungarian Empire (1774–1918), Kingdom of Romania (1918–1940), and then division into Southern and Northern Bukovina between Romania and the Soviet Union, respectively, have influenced population structure and distinctive natural resource use [18]. Therefore, in the study region, the population predominantly consisted of Hutsuls in the mountainous part of Bukovina [35] as well as Romanians and Ukrainians (the latter inhabiting the lowlands of Northern Bukovina). The multicultural population of Bukovina was formed under the Austro–Hungarian law freeing local inhabitants from taxes for 30 years, which led to the growth of the population, from 80 thousand in 1800 to 850 thousand at the beginning of the 20th century, via migrants from other overpopulated regions of the Austro–Hungarian Empire, such as Ukrainians, Germans, Polish people, Jewish people, Hungarians, Roma people, etc. [18,34]. Bukovina was characterized by ethno-political stability, as there were no cross-ethnic conflicts [18]. The division of Bukovina between Romania and the Soviet Union in 1940 led to changes in the multicultural population structure, especially in Northern Bukovina. Soviet governors initiated depopulation and forcibly sent Romanians, Germans and Polish people away [44]. In Southern Bukovina, Jewish people were deported and Hungarians and Germans moved out [45]. Rich Ukrainians were sent to Siberia and, later, the Romanians who stayed in Northern Bukovina (in the territory of the Soviet Union) did not have the opportunity to migrate to Romania. There are historical data that many Romanians were killed while trying to escape from the Soviet Union [44,45].

The study was conducted in a lowland area of Northern Bukovina, Ukraine and the uplands of Southern Bukovina, Romania (Figure 1).


**Figure 1.** Study areas in Ukraine (Northern Bukovina) and Romania (Southern Bukovina).

After Romania joined the European Union (2007) the economic situation improved and crossing the border to purchase consumer goods became popular [46]. In 2015, the

Romanian and Ukrainian governments signed an agreement on "small cross-border movement" [47]. This allows residents of Romania and Ukraine who permanently live in the 35–50 km border zone to cross the border without obtaining a visa. People have to apply for a card, which is issued once every two years, and then they can cross into the other country, but not outside the 35–50 km small movement zone. There is a list of villages on both sides that are included in this agreement, and our study villages appear on this list. This agreement allows Romanians living in Ukraine to freely travel to visit their relatives and vice versa [46]. This also includes economic benefits for both areas as residents now commute and buy cheaper or better groceries on both sides of the border. In June 2018, Ukraine signed an agreement with the European Union establishing no-visa entry for Ukrainian residents possessing biometric passports to member states of the Schengen area.

Our participatory observation in Northern Bukovina in 2018–2019 revealed a large number of cars with foreign plates (from Romania, Great Britain, Germany, and others). As was explained by locals, to officially register a car in Ukraine costs a lot of money, sometimes more than the price of the car, so locals use foreign license plates. This also helps to travel abroad, because for a Ukrainian registered car you need to buy insurance. Economic development in the area is seen in brand new houses built close to old ones with wooden roofs (see Figures 2 and 3). Even though it is still Northern Bukovina, the Hutsul area of Putyla [4] is much poorer with a worse infrastructure compared with the region of Storozenetskyi and Gluboka where Romanians and Ukrainians live.


**Figure 2.** The local landscape in Northern (**A**,**D**) and Southern (**B**,**C**) Bukovina. Photos by: (**A**) S. Nagachevskyi, summer 2018; (**B**–**D**) N. Stryamets, summer 2019.

Every household engaged in small-scale family farming, including both animal breeding (mainly cows, chickens, ducks, and goats, and rarely sheep) and vegetable gardens for home consumption (mainly corn, cabbage, potatoes, onions, garlic, beetroot, beans, and carrots, as well as many other crops).

**Figure 3.** A Romanian house with wooden roof (**left**) and a newly built house in the same village for which the advertisement says "For sale" (**right**), in Northern Bukovina. Photos by N. Stryamets, August 2018.

*2.2. Northern Bukovina, Ukraine and Southern Bukovina, Romania*

Northern Bukovina corresponds to the southern–eastern part of Chernivci region (except Hotynchshyna). The landscape consists of agricultural fields and some beech forests (Table 1). The Glybotskyi and Storozenetskyi region is situated in the foothills of the Carpathian Mountains and is located in the Prut-Sirets interfluve. The highest peak is 475 m a.s.l.

**Table 1.** The environmental and socio-economic characteristics of the study areas [48–51].

| Characteristic | Northern Bukovina (Lowlands) | Southern Bukovina (Straja) |
|---|---|---|
| Climate type | Dfb | Dfb |
| Annual precipitation | 601 mm | 673 mm |
| Altitude | 350 m a.s.l. | 520 m a.s.l. |
| Average temperature | −5 °C January<br>19.6 °C July | −5 °C January<br>17.6 °C July |
| Population density | 110 people/km$^2$ | 111 people/km$^2$ |
| Forest cover | 37% | 63% |

Romanians live in villages close to the Romanian border, in the regions of Glybozkij, Gerzaivskyi and Storozenetskyi, which are dominated by a rural population. Based on the last country census in 2001, there are 114,555 Romanians living in Chernivci Region (an increase from the 84,800 people in 1970). There are 76 Romanian schools (financed by the Ukrainian state) and 13 mixed schools that teach in both Ukrainian and Romanian. There are also 12 local newspapers in the Romanian language as well as three bilingual newspapers (Romanian and Ukrainian). In addition, there are 10 non-governmental Romanian national cultural organizations in Chernivci Region.

The visited villages included Krasnoijsk, Chudej, Jizivci, Stara Krasnoshora, Nova Krasnoshora, and Prosika, populated mostly by Romanians, in Ukraine (Figure 1) and Straja in Romania.

Romanians reside in the lowlands of Southern Bukovina, which nearly corresponds to present-day Suceava County with around 635,000 inhabitants (Table 1).

In the municipality of Straja, where we conducted the study, most of the approximately 5000 inhabitants are particularly devoted to mountain agriculture, organized in small-scale farming activities including both animal breeding and crop cultivation.

After joining the European Union, the government of Romania has welcomed the issuing of a Romanian passport if someone meets the required criteria (proof that you have a Romanian relative, know some of the Romanian language, etc.). Respondents from the Ukrainian side explained that with the help of that passport they can freely travel to other European countries for seasonal or permanent employment, where salaries are much higher.

*2.3. Data Collection*

Fieldwork was carried out in the summers of 2018 and 2019. This study is part of the broader research project "Ethnobotany of Divided Generations" which, using the same method for data collection, aims to compare ethnobotanical knowledge of groups divided by the creation of a border during or after the Soviet time. The sample comprised 30 people from each side of the border, chosen pseudo-randomly, sometimes using snowball and convenient sampling methods. People were approached in streets, gardens, and fields, as well as in public places like libraries, bus stops, and markets. Oral informed consent was obtained prior to each interview. The respondents were given full freedom to talk about the subject. Only people permanently living in the study area were interviewed. Sixty interviews were conducted mainly in Romanian, but also in Russian or Ukrainian, depending on the preference of the interviewee. Participatory observation was performed during the summer of 2018. Most of the interviews in both Southern and Northern Bukovina were conducted with the help of a field assistant and facilitator, native in Romanian (for Southern Bukovina) and in the local Romanian dialect (for Northern Bukovina), who asked the questions, listened to responses, and posed follow-up questions, as Romanian is not the native language of the authors. The face-to-face interviews lasted from 20 minutes to 2 h. This study is part of a larger research project, in which questions on the use of wild plants were grouped into food, medicine, ritual and other uses modules. The food module consisted of questions specifying the use of wild plants for tea, soups, salads, main dishes and desserts, as well as any information the interviewee wanted to share about wild taxa use for culinary purposes. Oral consent was obtained prior to each interview, in which the aim of the project and the anonymous status of the interviewee were explained, as well as the condition that they could stop and withdraw all data and information at any stage of the interview. We strictly followed the ethical guidelines prescribed by the International Society of Ethnobiology [52], and the study protocol was approved by the Ethical Committee of Ca' Foscari University of Venice.

During the interviews herbarium voucher specimens were collected. The Ukrainian voucher specimens are stored in the Nature Reserve "Roztochya" UAV with codes NB001-NB289 and the Romanian voucher specimens at Ca' Foscari University of Venice UVV bearing codes SB001-SB094. The mentioned taxa were collected and then identified according to the local flora [53]. Taxonomic identification, botanical nomenclature, and family assignments followed the Flora Europaea [54], The Plant List database [55], and Angiosperm Phylogeny Group IV [56].

Participatory observation at local markets, shops, restaurants and near houses was performed, focusing on the wild food plants and products made from various wild parts and fruits that are sold. Participatory observations at local markets (on specific days of the week, so-called "market days") and selling locations (e.g., on the side of the road) were carried out in order to identify supply and demand of wild products in both study areas. While conducting interviews, we also made observations of home gardens and the vegetables planted by households.

*2.4. Data Analysis*

The gathered data were organized as Detailed Use Reports (DUR), where each interviewee mentioned the use of a plant and mode of preparation (e.g., dried blueberries leaves used for tea or the leaves of horseradish as a seasoning for fermented foods) documented into the Excel spreadsheet. The spreadsheet includes informant code, language of the interview, Latin name, taxonomic family, local name (Ukrainian names were transliterated using the system adopted by the [57]; Russian names were transliterated following the general transcription rules, with the use of the webpage www.calc.ru, time of use (always, in the past, recently abandoned, recently adopted), food use, mode of preparation, source of knowledge, and comments. For all calculations only wild and semi-wild taxa were used, while unusual uses of cultivated taxa are reported only in Table 3 and the discussion.

Following the methodology of González-Tejero et al. [58], we calculated the Jaccard similarity index as:

$$JI = C \times 100/(A + B - C) \tag{1}$$

where A is the number of recorded species in study area 1, B is the number of species recorded in study area 2, and C is the number of species common to both study areas 1 and 2.

An index value close to 100 indicates that the plant uses of the two groups are very similar, while a value close to 0 indicates that the groups are very different.

The respondents were selected using convenient sampling, in which they were approached in gardens and yards, during hay making, or at local markets. Only two people refused to speak with us, and so response rate was high; everyone else was friendly and willing to discuss wild food issues and their life experiences.

In Northern and Southern Bukovina 60 interviews were conducted (see Table 2).

**Table 2.** Socio-economic data of the interviewees.

| Characteristic | Northern Bukovina | Southern Bukovina |
|---|---|---|
| Number of interviews | 30 | 30 |
| Average age of the interviewees | 63 | 61 |
| Eldest interviewee | Born 1930 | Born 1928 |
| Youngest interviewee | Born 1983 | Born 1987 |
| Gender distribution | 24 female (80%), 6 male (20%) | 24 female (80%), 6 male (20%) |
| Education level | 45% primary education<br>37% secondary education<br>8% basic education<br>5% specialist education<br>5% higher education | 50% primary education<br>40.1% secondary education<br>6.6%, higher education<br>3.3% basic education |
| Religion | Orthodox, Baptist | Orthodox |
| Language spoken by parents | Romanian (with some dialect words), Ukrainian | Romanian |

In the Ukrainian study areas, Romanian is the official language in schools, while students study the Ukrainian language some hours every week. In the regional (Oblast) government offices, Ukrainian is used as the primary language, while in local village councils Romanian is spoken. In the street, Romanian and local Romanian dialects are used. As there are Ukrainians living in those villages or married to Romanians, Ukrainian with a mixture of Romanized words is used.

Furthermore, we classified the used plants into two categories based on their level of wildness: wild plants—taxa that grow spontaneously in the surrounding environment without human intervention (e.g., *Vaccinium myrtillus*); semi-cultivated plants—taxa that grow without direct human intervention, but were once planted in gardens (e.g., *Armoracia rusticana*).

Additionally, we compared our results with the wild food plant uses collected by the authors using the same interview structure among Hutsuls in the mountainous area of Bukovina in Ukraine and Romania [6].

To process the data statistically, on the request of the academic editor, we first ran a boxplot to graphically check the data. We observed that use categories of Romanians living in Ukraine are more scattered than those of Romanians living in Romania. Therefore, in order to test the observed difference between the two groups we performed a Wilcoxon test on use categories reported by Romanians living in Ukraine and in Romania. We set $\alpha = 0.05$. In addition, we verified significance with a Kruskal–Wallis test using the same significance level. Both analyses were conducted using R software R (version 3.6.1).

*2.5. Factor of Informant Consensus*

The Factor of informant consensus (FIC) was calculated as the number of use citations in each category (Nur) minus the number of species used (Nt), divided by the number of use citations in each category minus one [59].

$$\text{FIC} = (\text{Nur} - \text{Nt})/(\text{Nur} - 1) \quad (2)$$

The high values (near 1) indicate that the majority of respondents propose a low number of taxa for cooking in this food category, while low values (near 0) indicate the respondents' disagreement about taxa used for certain food categories.

## 3. Results and Discussion

*3.1. Caveats of the Study*

Before discussing the results of the study we want to mention some caveats which may affect our interpretation and were considered in the following discussion. As the research is qualitative, the statistical analysis showed the following results: we performed a Wilcoxon test and a Kruskal–Wallis test, and both analyses revealed that there is no significant difference between the use categories of the two groups of Romanians living across the border. Indeed, the *p*-value for the Wilcoxon test was 0.16 and 0.092 for the Kruskal–Wallis test. Assuming that the null hypothesis for both tests was the equivalence of distributions of two groups, and given that the *p*-values are higher than 0.05, we accept the null hypothesis. We conclude that the two groups of Romanians do not present a statistically significant difference in the use of plant categories. However, we consider that the present differences, even though statistically non-significant, are important from a cultural perspective and we further focus on qualitative methods that are better suited for the analysis of cultural phenomena.

*3.2. Contemporary Use of Wild Food Plants*

In the wild food domain, Romanians living in Bukovina used 46 plant taxa (plus five cultivated taxa with uncommon uses) belonging to 20 families (see Table 3). The most used plant taxa, incorporating both sides of the border, were *Rubus idaeus* (73.3% of interviewees), *Armoracia rusticana* (50%), *Urtica dioica* (46.7%), *Rubus* spp. including *Rubus fruticosus* (45%), *Fagus sylvatica* (40%), and *Fragaria vesca* (35%).

Romanian interviewees in Romania reported 27 taxa belonging to 15 families, plus five cultivated taxa with uncommon uses, used for food. In Ukraine, Romanians named 40 taxa belonging to 18 families plus four cultivated taxa. Cultivated taxa, such as the wood of *Prunus avium*, *P. cerasus*, *P. domestica*, and *Malus domestica*, were used for smoking meat and *Vitis vinifera* leaves were used for making sarmale, which are uncommon uses, and thus we included them in the study.

In both areas of Bukovina, the Rosaceae family was the most used with 95 DUR and 101 DUR, respectively. Romanians in Ukraine used more families, including the following that were distinctive: Betulaceae (7 DUR), Boraginaceae (2 DUR), Hypericaceae (9 DUR), Plantaginaceae (1 DUR). Only Romanians in Romania used Vitaceae (2 DUR), Papaveraceae (5 DUR), and Cannabaceae (4 DUR).

Twenty-one taxa were common to both groups (see Figure 4), including *Rubus* spp., *Rubus idaeus*, *Rosa rugosa*, *Rosa centifolia*, *Quercus* spp., *Carum carvi*, *Fagus sylvatica*, *Fragaria vesca*, *Tussilago farfara*, *Urtica dioica*, *Vaccinium vitis-idaea*, *Vaccinium myrtillus*, *Thymus vulgaris*, and *Sambucus nigrum* (see Figure 5).

In Northern Bukovina, interviewees reported 19 taxa not named by Romanians in Romania (see Table 3), with more than twice the number of uses. These taxa included *Achillea millefolium*, *Crataegus* spp., *Hypericum* spp., *Matricaria chamomilla*, *Betula* spp. (*Betula pendula* and *Betula pubescens* which locals use as "birch sap"), and *Rumex acetosa*.

**Table 3.** Use of wild plants for food by Romanians on both sides of the border (Romanian #, Russian @, Ukrainian $, and * Hutsul dialect used by interviewees to name plants).

| Latin Name, Family/Voucher Specimen | Local Name | Parts Used | Preparation | UA R | R R |
|---|---|---|---|---|---|
| *Achillea millefolium* L. Asteraceae, NB070, NB117 | Tcec@ (Tysiachelystnyk), Coada-șoarecului #, epe$ e@ (derevyi belyi) Coada-șoricelului # | Aerial parts | Tea | 9 | |
| *Arctium lappa* L., Asteraceae, NB149 | yx $ (Lopukh) | Roots | Coffee | 1 | |
| *Arctostaphylos uva-ursi* (L.) Ericaceae | Urșana # | Fruits | Fresh snack | 2 | |
| *Armoracia rusticana* P.Gaertn., B.Mey. and Scherb. Brassicaceae, NB028, NB212 SB031 | Hrean #, xp@ (Khryn), xpi$ (Khrin) | Roots | Seasoning (beetroots) | 8 | |
| | | | Souse | 1 | |
| | | | Salad with meat | | 1 |
| | | | Mustard | | 2 |
| | | | Fresh snack as a starter | 2 | 1 |
| | | | Salad with beetroots | 2 | 14 |
| | | | For pickled cucumbers | 2 | |
| | | Leaves | For fermented cucumbers | 3 | |
| | | | Murătură | 1 | 4 |
| | | | Sarmale | | 1 |
| *Arnica montana* L. Asteraceae | Arnica # | Flowers | Tea | 2 | |
| *Artemisia absinthium* L. Asteraceae NB051 | Pelin # | Aerial parts | Tea | 1 | |
| *Artemisia dracunculus* L. Asteraceae SB015, SB029 | Tarhon # | Aerial parts | Borshch | | 1 |
| *Atriplex hortensis* L. Amaranthaceae NB088 SB004, SB018 | Lobodă # | Aerial parts | Borshch | | 1 |
| | | | Sarmale | | 10 |
| | | | Soup | | 1 |
| *Betula* spp. Betulaceae NB041, NB115 | epea $ (bereza), Mesteacăn # | Sap | Alcoholic drink | 1 | |
| | | Sap | Drink | 4 | |
| | | | Fermented for winter | 1 | |
| | | Leaves | Tea | 1 | |
| *Carpinus betulus* L. Betulaceae | Carpen # | Wood | Smoked meat | 1 | |
| *Carum carvi* L. Apiaceae NB037 SB007 | Săcărică #, Chimion # | Aerial parts | Tea | 3 | |
| | | Seeds | Rachiu | | 2 |
| | | | Seasoning | 1 | 2 |
| *Crataegus monogyna* Jacq. Rosaceae | Mălăieș # | Fruits | Raw | 1 | |
| *Crataegus* spp. Rosaceae NB066 | p@ (boyarishnik) | Fruits | Tea | 2 | |
| *Equicetum* spp. Equisetaceae | Barba ursului # | Roots | Tea | 1 | |

**Table 3.** *Cont.*

| Latin Name, Family/Voucher Specimen | Local Name | Parts Used | Preparation | UA R | R R |
|---|---|---|---|---|---|
| *Fagus sylvatica* L. Fagaceae NB168 SB060 | φa# (fag), fag # | Wood | Smoked meat | 5 | 19 |
| *Fragaria vesca* L., Rosaceae, NB004 SB094 | Frăguța # ea, @ (zemlyanyka), frag # | Fruits | Compote | 2 | 1 |
| | | | Dessert | 2 | |
| | | | Jam | 5 | 7 |
| | | | Fresh snack and with cream | 1 | 5 |
| | | | Snack | 1 | |
| | | | Tea | 4 | |
| | | | Syrup | | 1 |
| *Humulus lupulus* L. Cannabaceae NB182 SB081 | Hamei # | Flowers | Beer | | 3 |
| *Hypericum* spp. Hypericaceae, NB185 | ipi$ (Zvirobii) ep@ (zveroboi), ip@,$ (zviroboj), Pojárniță # | Aerial parts | Tea | 9 | |
| *Malus domestica* L. Rosaceae, SB038 | Măr # | Wood | Smoked meat | 1 | 2 |
| *Matricaria chamomilla* L. Asteraceae NB164 | Paa $ (Romashka) Romaniț #, Romaniță # | Aerial parts | Tea | 14 | |
| *Mentha* spp. Lamiaceae NB080, NB079, NB172 | Menta #, Mintă ciuparata # Mintă # | Aerial parts | Tea | 6 | |
| *Mentha longifolia* (L.) L. Lamiaceae | Izmă # | Aerial parts | Tea | | 1 |
| *Plantago major* L. Plantaginaceae NB077 | Pătlagină # | Leaves | Salad | 1 | |
| | | Roots | Tea | 1 | |
| *Papaver rhoeas* L. Papaveraceae SB044a, b, c | Mac # | Seeds | Cake | | 5 |
| *Prunus avium* (L.) L. Rosaceae SB059 | Cireș #, epe$ (chereshnia), Cireșe # | Wood | Smoked meat | 5 | 9 |
| *Prunus cerasus* L. Rosaceae SB045 | B$ (Vyshnia), Vișine # | Wood | Smoked meat | 4 | 4 |
| *Prunus domestica* L. Rosaceae | Perje #, Perj # Ca $ (slyva) | Wood | Smoked meat | 4 | 8 |
| *Pyrus pyraster* (L.) Burgsd. Rosaceae | Prăsad # | Fruits | Dried | 1 | |
| *Quercus* spp. Fagaceae SB056 | y$ (dub), Stejar # | Leaves | Preservative (Murătură) | 1 | |
| | | | For fermented cucumbers | 4 | 1 |
| | | | For pickled cucumbers and tomatoes | 2 | |
| *Robinia pseudoacacia* L. Leguminosae, SB041 | Salcâm # | Flowers | Recreational tea | | 3 |
| | | | Dessert | | 1 |

**Table 3.** *Cont.*

| Latin Name, Family/Voucher Specimen | Local Name | Parts Used | Preparation | UA R | R R |
|---|---|---|---|---|---|
| *Rosa* spp. (including *Rosa canina* L.), Rosaceae NB083 | Mălăieș # | Fruits | Juice | 2 | |
| | | | Jam | 2 | |
| | | | Tea | 1 | |
| *Rosa* spp. (including *Rosa rugosa*), Rosaceae SB023 | Pa (roza) $, trandafir # | Flowers | Syrup | 2 | |
| | | | Jam | 4 | 10 |
| | | | Tea | | 3 |
| *Rubus idaeus* L. Rosaceae SB009, SB071, NB082 | Zmiură #, Zmeură # Maa $ (malyna) | Leaves | Dried | 1 | |
| | | Aerial parts | Tea | | 2 |
| | | Fruits | Cake | 2 | |
| | | | Juice | 2 | 4 |
| | | | Compote | 7 | 14 |
| | | | Frozen | 1 | |
| | | | Raw | 2 | 2 |
| | | | Jam | 14 | 15 |
| | | | Preserve | 2 | |
| | | | Syrup | 1 | 6 |
| | | | Tea | 5 | |
| | | | Uzvar | 1 | |
| *Rubus* spp. (including *Rubus fructicosus* L.) Rosaceae NB001, NB062, NB63 SB073 | epa @ (chernyka), Mur #, Mur din padure #, Ojana $ Zmeură neagră # | Fruits | Compote | 2 | 4 |
| | | | Fresh | 7 | |
| | | | Jam | 6 | 10 |
| | | | Juice | 1 | 5 |
| | | | Marmalade with sugar | 1 | |
| | | | Syrup | | 2 |
| *Rumex acetosa* L. NB081 Polygonaceae | Măcriș-acru #, Măcriș # | Leaves | Soup | 3 | |
| | | | Borshch | 4 | |
| *Rumex* spp. Polygonaceae SB076 | ia (shiva) $ Stejă # Ștevie # | Leaves | Soup | 1 | |
| | | | Borshch | 2 | |
| | | | Sarmale | 2 | 2 |
| *Sambucus nigra* L. Adoxaceae SB084 | Ochio lupului # Soc # | Fruits | Jam | 3 | |
| | | | Socată | | 7 |
| | | | Beer | | 1 |
| | | | Juice | | 3 |
| | | | Tea | 1 | 2 |
| *Symphytum officinale* L. Boraginaceae | Tătănească # | Roots | Tea | 1 | |

**Table 3.** *Cont.*

| Latin Name, Family/Voucher Specimen | Local Name | Parts Used | Preparation | UA R | R R |
|---|---|---|---|---|---|
| *Taraxacum campylodes* G.E.Haglund, Asteraceae NB083, SB063 | Kyaa $ (kulbaba) Păpădie # Curul găiini # | Roots | Coffee | 1 | |
| | | Leaves | Salad | 5 | |
| | | | Jam | 1 | |
| | | Flowers | Tea | 1 | |
| | | | Jam | | 2 |
| *Syringa vulgaris* L. Oleaceae | y i$ (busok bilyi) | Flowers | Tea | 1 | |
| *Thymus serpyllum* L. Lamiaceae SB001 | Cimbrișor # | Aerial parts | Tea | 2 | 1 |
| *Thymus* spp. *Thymus vulgaris* L., Lamiaceae SB090 | Cimbrișor #, Cimbru # | Aerial parts | Soup | 1 | |
| | | | Tea | 1 | 1 |
| | | | Seasoning | | 11 |
| *Tilia* spp. (including *Tilia cordata* Mill.) Malvaceae, SB017 | Tei #, a $ (lipa) | Flowers | Tea | 8 | 1 |
| *Trifolium* spp., Leguminosae NB076, NB102 | Trifoi # | Aerial parts | Tea | 3 | |
| *Tussilago farfara* L. Asteraceae NB118 SB065, SB085, NB072 | a ayxa $ (maty y machukha), podbal #, a# (podbal), mati-maciuha $ | Aerial parts | Sarmale | 13 | 8 |
| | | | Tea | 2 | |
| | | | Galuște | | 1 |
| | | | Rolls | 2 | 2 |
| *Urtica dioica* L. Urticaceae SB088, NB152 | Kpa $ (kropyva), paa @ (krapiva), Urzica # | Aerial parts | Borshch | 4 | 2 |
| | | Young aerial parts | Omelets | 1 | |
| | | Leaves | Salad | 2 | |
| | | | Scrambled eggs | 1 | |
| | | | Tea | 1 | |
| | | | Soup | 15 | 4 |
| | | | Stew | 2 | |
| | | | Puree | | 1 |
| *Vaccinium myrtillus* L. Ericaceae, NB060, SB006 | Aφ* (afyny), cernika @, aφ* (afynu), afină # | Fruits | Jam | 3 | 13 |
| | | | Preserved with sugar | 2 | |
| | | | Afinătă | | 2 |
| | | | Fresh | 2 | |
| | | | Juice | | 3 |
| | | | Compote | | 5 |
| *Vaccinium vitis-idaea* L. Ericaceae, NB061, SB010 | * (gogdzy), Merișor # | Fruits | Fresh | 2 | |
| | | | Jam | | 2 |
| | | | Tea | 1 | |
| *Viburnum opulus* L. Adoxaceae NB157 | Kaa $ (kalyna), calină # | Fruits | Raw with sugar | 2 | |
| | | | Tea | | 2 |
| *Vitis vinifera* L. Vitaceae | Vie # | Leaves | Sarmale | | 2 |

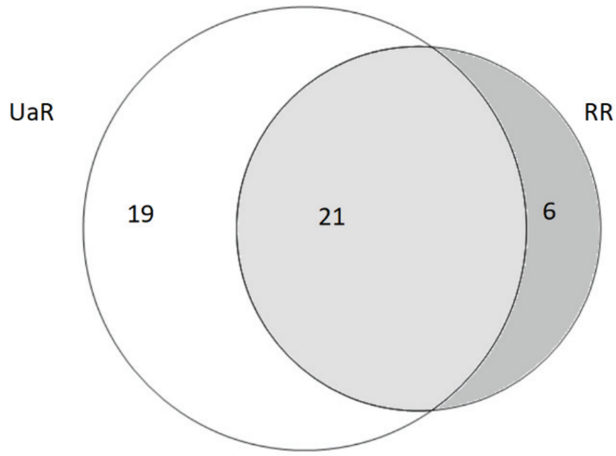


**Figure 4.** Venn diagram of overlap of wild taxa used in both study areas (UaR—Romanians in Northern Bukovina, RR—Romanians in Southern Bukovina).

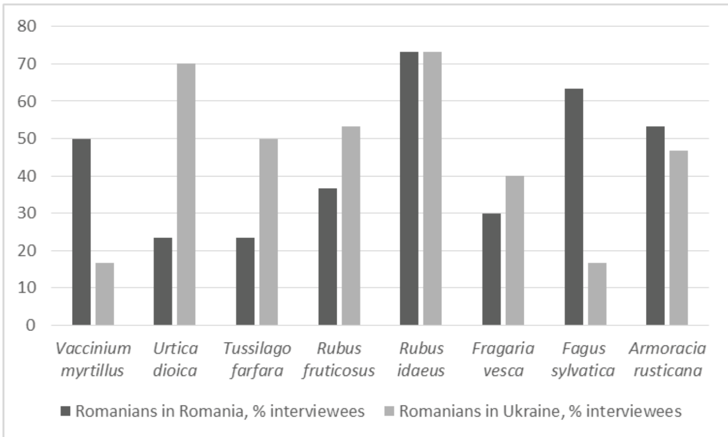


**Figure 5.** Taxa reported by the majority of interviewees.

Five taxa were used only in Southern Bukovina: *Atriplex hortensis*, *Humulus lupulus*, *Robinia pseudoacacia*, *Papaver rhoeas*, and *Vitis vinifera*.

More than 70% of interviewees in both areas used *Rubus idaeus* (Figure 5), while *Fagus sylvatica* and *Urtica dioica* were used on both sides of the border but with different intensity. *Fagus sylvatica* was used four times more often in Southern Bukovina, whereas *Urtica dioica* was used three times more often in Northern Bukovina.

The division of used plant parts in Southern Bukovina was the following: fruits (119 DUR), aerial parts (63 DUR) including leaves (29 DUR), flowers (22 DUR) and petals (13 DUR), roots (22 DUR), and wood (18 DUR). In Northern Bukovina the division of used plant parts was as follows: aerial parts (125 DUR) including leaves (47 DUR), fruits (110 DUR), flowers (16 DUR), roots (21 DUR), and wood (5 DUR). Comparison shows that the most commonly used plant parts were fruits by Romanians in Romania and aerial parts by Romanians in Ukraine.

Seventeen taxa in Southern Bukovina and 26 taxa in Northern Bukovina were used by at least 10% of interviewees, with 13 shared taxa.

Figure 6 shows the most important differences between the two samples: teas, fermented preparations, and fresh snack consumption are quite prevalent among Romanians in Ukraine, while Romanians in Romania favor wild food plant-based jams, compotes, syrups, and sarmale, as well as smoking meat.

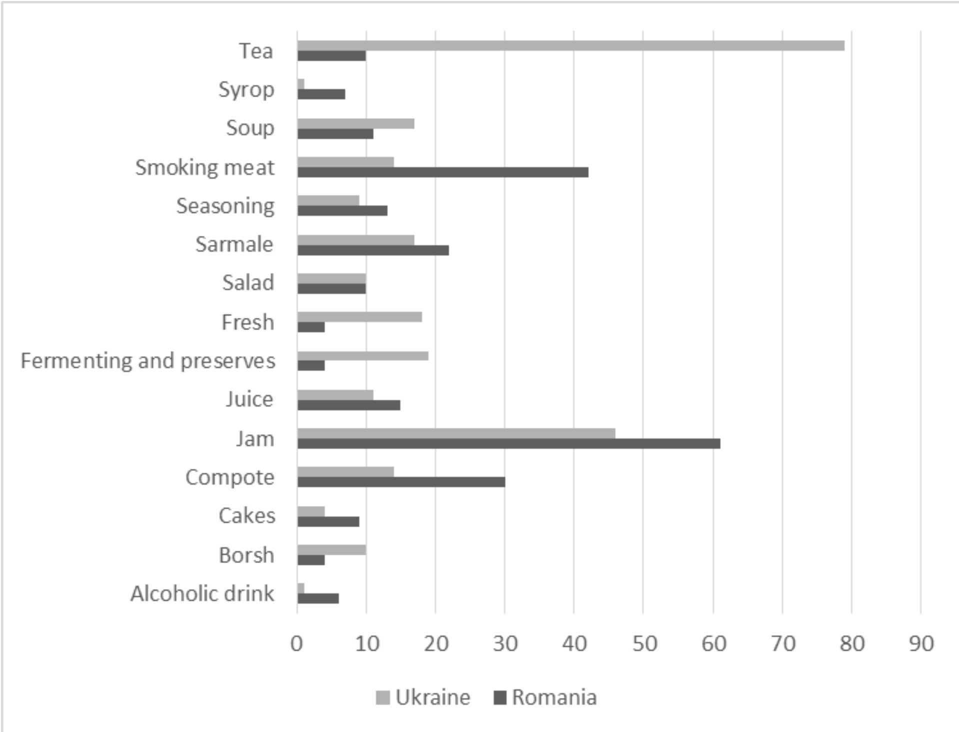


**Figure 6.** The most used food categories (with at least four Detailed Use Reports (DUR)).

This picture largely corresponds to the national cuisines of the respective countries [60–63], which seem to have greatly influenced the two divergent trajectories of Romanians during the past century. The predominance of lacto-fermentations among Ukrainians is possibly linked to old Slavic customs, while the prevalence teas may have been introduced via the promotion of popular teas spread through popular literature in the former Soviet Union during the Communist era [64].

In Romania, sarmale, jams, compotes, and syrups represent quintessential elements of Romanian cuisine, which historically was greatly influenced by the Ottomans. The prevalent custom of smoking meat at home in Romanian Bukovina may be linked to the persistence of this custom, which has not been weakened by food industrialization, as may have happened in Ukraine during the administration of the USSR food system. The "deficit" (a word that corresponds to the lack of high-demand products in markets, e.g., meat or sugar, during Soviet times) of meat may have contributed to a decline in the custom of smoking it among Romanians in Ukrainian Bukovina.

In Northern Bukovina the most prevalent wild food preparation was tea, while in Southern Bukovina it was jam (see Figure 6). Winter preserves, both fermented and marinated, were also highlighted. Spring soups made with four wild taxa (including *Urtica dioica* and *Rumex* spp.) were mentioned as well. Birch sap as a beverage was only named by Romanians in Ukraine because it was considered medicinal by Romanians in Romania. Salads made with wild plants were named by ten interviewees on each side of the border.

In Southern Bukovina, the fruits of *Rubus idaeus*, *Rubus* spp., *Vaccinium myrtillus*, and *Fragaria vesca*, were used for jam, as were the flowers of *Rosa rugosa*, *Rosa centifolia*, and *Taraxacum campylodes*.

The leaves of *Tussilago farfara*, *Atriplex hortensis*, *Rumex* spp., *Brassica oleracea*, *Vitis vinifera*, and *Armoracia rusticana* are used for making sarmale (from the Romanian "sarmale"; this dish consists of ground meat with rice or corn rolled in different types of the leaves, e.g., cabbage or beetroot). Sarmale was a popular preparation use of wild taxa for food. Romanian interviewees in Ukraine called this dish "găluște", but they used fewer taxa, only the leaves of *Tussilago farfara* and *Rumex* spp.

For soups, Romanians in Romania used the young leaves of *Urtica dioica* and *Atriplex hortensis* in springtime. Romanians in Ukraine used more species for making soups, including *Urtica dioica*, *Rumex acetosa*, *Rumex* spp., and *Thymus* spp. as seasoning. *Urtica dioica* was named in both areas as an early spring food, used for making borshch (typically the term "borshch" is used to refer to a soup with meat, cabbage, carrots, potatoes, tomatoes, and beetroot with sour cream, which should be red in color). Another variety called "green borshch" is made with carrots, potatoes, boiled eggs, sour cream, and different green plants like *Urtica dioica* or *Rumex acetosa*, (thus the color of the soup is green). In Ukrainian Bukovina, *Urtica dioica* was used for stew with sour cream, in omelets and scrambled eggs, and for frying with eggs: "Nettle, in the spring, when it is young and small, we boil it and stir fry it and eat it" explained a Romanian woman born in 1939. Interviewees highlighted that they use nettle leaves only in early spring when they are tender. Fried young sprouts with sour cream were also mentioned as a "vitamin food" during spring time.

In both areas, *Armoracia rusticana* was the most popular fresh root that was used for salads with beetroot and as a seasoning for pickles and fermenting winter preserves (Figure 7). Romanians in Northern Bukovina used the young leaves of *Urtica dioica*, *Plantago major*, and *Taraxacum campylodes* for salads, whereas Southern Bukovinians only used *Armoracia rusticana*. It was referred to as semi-cultivated because it grows everywhere, including home gardens.


**Figure 7.** (**A**) Use of a variety of wild taxa leaves and roots (*Quercus* spp., *Armoracia rusticana*) and cultivated taxa (*Allium sativum*, *Anethum graveolens*, *Ribes nigrum*) for fermenting cucumbers; (**B**) home-smoked sausage and ham, which was smoked using the wood of *Fagus sylvatica*, *Prunus domestica*, and *Malus domestica*, sampled during a field interview. Photos by N. Stryamets: (**A**) Northern Bukovina, July 2018; (**B**) Southern Bukovina, July 2019.

The dominant use of wild food for salads was that of grated roots of *Armoracia rusticana*, which was named by 47% of Romanians in Romania.

### 3.3. Wild and Cultivated Plants for Smoking

*Fagus sylvatica* was used in both areas for smoking meat. The wood of *Prunus avium* (9 DUR), *Malus domestica* (2 DUR), *Prunus cerasus* (4 DUR), and *Prunus domestica* (8 DUR) was also used for smoking meat by Romanians in Romania. Meat smoking was explained as a way "for meat to last long", because when you raise your own pigs, you have to be able to store the meat. In earlier times, when freezers were not available, smoking was an important preservation practice for local livelihoods.

In Northern Bukovina, besides *Fagus sylvatica*, the wood of *Carpinus betulus* was used for smoking meat. In addition, in both areas of Bukovina, fruit trees branches were mentioned as "adding taste and color", which was explained as: when you prune trees in your garden in the autumn and spring, you keep the branches for smoking purposes. As in Southern Bukovina, the wood of *Prunus avium* (5 DUR), *Malus domestica* (1 DUR), *Prunus cerasus* (4 DUR), and *Prunus domestica* (4 DUR) was also used for smoking meat in Northern Bukovina. The wood of cherry trees gives a reddish color to the meat, and the more cherry wood you burn, the deeper the color of red you achieve, explained a retired interviewee. Smoking was mentioned as an important practice for the long preservation of pork meat. In Southern Bukovina, only one interviewee mentioned the practice of cheese smoking. Smoking practices and the use of both wild and cultivated taxa were not mentioned by researchers either in Romania [4,33] or Ukraine [7,24]. Historical sources show that this practice of preserving meat was popular among inhabitants of the Carpathian Mountains [34,43].

### *3.4. Plant-Based Beverages*

Alcoholic beverages were only mentioned in Southern Bukovina. This included rachiu, which is prepared with *Carum carvi* and home-distilled alcohol (see Figure 7). Aromatized alcohol drinks were also popular. The fruits of *Rubus idaeus* and *Vaccinium vitis-idaea* macerated in alcohol were mentioned by Romanians in Romania. In addition, the fruits of *Vaccinium myrtillus* were used for an alcoholic drink called "afinătă" (from the Romanian afină—blueberry), which added colored and aroma to the alcohol. Four interviewees also mentioned homemade beer, which was made from the flowers of *Humulus lupulus* or sometimes the flowers of *Sambucus nigra*.

Syrups made from *Rubus idaeus*, *Fragaria vesca*, *Rosa rugosa* or *Rosa centifolia*, and *Rubus fructicosus* were mentioned by Romanians in Southern Bukovina. Their use was intended for weekly fasting days: "Usually when you fast on Wednesdays and Fridays you eat raspberry syrup with bread", explained a man born in 1965. In both study areas, Romanians fasted on Wednesdays and Fridays and during four fasting periods throughout the year. Meat and dairy products are not allowed to be eaten on those days, and thus syrups and jams made from wild fruits are consumed by locals. The use of food plants for fasting, rituals and ceremonies needs to be more thoroughly studied.

In Southern Bukovina, the fruits of *Rubus idaeus*, *Rubus* spp., and *Vaccinium myrtillus*, and the flowers of *Sambucus nigra* were used for juice preparations. Interviewees also explained that the flowers of *Sambucus nigra* are used for making a fermented drink called "socată" (from the Romanian word 'soc'—*Sambucus nigra*). The flowers of *Sambucus nigra* are collected, and then 10 flower inflorescences, 1 kg of sugar and a lemon are added to 10 l of warm water and a teaspoon of dry yeast; after one day this mixture is bottled and stored in a cool place. The dried flowers also were named as suitable for preparing "homemade beer". The beer is lacto-fermented and may contain a small amount of alcohol. The same use was described in Roztochya (Western Ukraine), but it is called "sparkling drink" [7].

### *3.5. Homogeneity and Inhomogeneity of Wild Plants Use for Food Preparations*

As the analysis of Factor of Informant Consensus reveals (Table 4), in Southern Bukovina among Romanians consistently used the same taxa for smoking of meat, seasoning and sarmale, while for tea and borshch more diversity was used. In Northern Bukovina, Romanians homogeneously use plants for jam and fermentation, while there was disagreement, meaning they made a not homogenous use of plant taxa, for alcoholic drinks, syrup and fresh food.

**Table 4.** Factor of informant consensus. (FIC—factor of informant consensus).

| Food Categories | Romania, Number of Uses | Number of Taxa | FIC | Ukraine, Number of Uses | Number of Taxa | FIC |
|---|---|---|---|---|---|---|
| Alcoholic drink | 6 | 4 | 0.4 | 1 | 1 | 0 |
| Borshch | 4 | 3 | 0.3333 | 10 | 3 | 0.7778 |
| Cakes | 9 | 3 | 0.75 | 4 | 2 | 0.6667 |
| Compote | 30 | 5 | 0.8621 | 14 | 3 | 0.8462 |
| Jam | 61 | 8 | 0.8833 | 46 | 6 | 0.8889 |
| Juice | 15 | 6 | 0.6429 | 11 | 5 | 0.6 |
| Fermenting and preserves | 4 | 2 | 0.6667 | 19 | 3 | 0.8889 |
| Fresh snack | 4 | 2 | 0.6667 | 18 | 8 | 0.5882 |
| Salad | 10 | 1 | 1 | 10 | 4 | 0.6667 |
| Sarmale | 22 | 5 | 0.8095 | 17 | 3 | 0.875 |
| Seasoning | 13 | 2 | 0.9167 | 9 | 2 | 0.875 |
| Smoking meat | 42 | 3 | 0.9512 | 14 | 4 | 0.7692 |
| Soup | 11 | 2 | 0.9 | 17 | 3 | 0.875 |
| Syrup | 7 | 3 | 0.6667 | 1 | 1 | 0 |
| Tea | 10 | 5 | 0.5556 | 79 | 15 | 0.8205 |

### 3.6. Past Uses of Wild Food Plants

In Romania, interviewees explained that in the past more forest products were used, mainly to generate income. In Northern Bukovina, their function as a food substitute for "deficit" products was mentioned, e.g., coffee was difficult to buy and so locals made coffee at home from the roots of *Arctium lappa* and *Taraxacum campylodes*. The decline in the use of wild plants for food was mentioned in both areas of Bukovina. Two interviewees in Northern Bukovina mentioned that in the past their grandparents used the leaves of *Urtica dioica* for making tea and soup. Likewise, tea made from *Achillea millefolium* and *Matricaria chamomilla* were named by 10% and 6% of interviewees, respectively, as past uses, again by their grandparents.

Compote and jam prepared from *Vaccinium myrtillus* and *Rubus idaeus* were mentioned as recently abandoned food practices by one interviewee in Southern Bukovina. Six percent of interviewees named jam made from *Rosa rugosa* as a recently abandoned practice. Smoking meat with the wood of *Fagus sylvatica* was also mentioned by one person as a recently abandoned practice. Romanians in Romania did not mention past uses of wild food plants. Participatory observation in both study areas indicated that restaurants currently offer dishes with wild mushrooms and forest fruits, and they even sell dried wild forest fruits. In Southern Bukovina, local restaurants serve wild mushroom sauce, and desserts with wild forest fruits (blueberries and raspberries) were offered on the menu. In Northern Bukovina, a variety of forest fruits and plants were sold at local markets. In small local restaurants, tea made from forest fruits and plants was served, while blueberries were added to desserts, which in the description indicated that they were "forest" blueberries.

The use of wild food in our study populations plays a food supply role, as well as a culturally important role. For example, in Southern Bukovina wild foods were used to help generate income in the past and they are currently important in everyday cuisine.

### 3.7. Wild Edible Forest Plants

In both groups of Romanians, wild forest taxa were the most used, including *Rubus idaeus* (Romanians in Northern Bukovina (UaR) 40 and Romanians in Southern Bukovina

(RR) 43 DUR), *Rubus* spp. (UaR 19 and RR 21 DUR) including *Rubus fructicosus* and *Rubus caesius*, *Vaccinium myrtillus* (UaR 7 and RR 23 DUR), *Fragaria vesca* (UaR 15 and RR 15 DUR), *Vaccinium vitis-idaea* (UaR 2 and RR 3 DUR), *Fagus sylvatica* (UaR 5 and RR 19 DUR), and *Urtica dioica* (UaR 26 and RR 7 DUR) (see Figure 6 and Table 3). These results are unusual as the local landscape of the region consists predominantly of flat lowlands with agricultural fields (Figure 2), and thus the distance to the forest and the fact that "most of the forests are situated in the mountains" were not seen as an obstacle. "We buy blueberries, raspberries and a variety of mushrooms at the market because those products grow in the forest up in the mountains", highlighted a Romanian woman from Northern Bukovina born in 1966. Our findings, therefore, show that forest products and forest taxa still play an important role in local ecological knowledge (LEK), which is consistent with Pieroni and Sõukand [24].

"We use forest berries [fruits]: blueberries, raspberries, blackberries, but they grow in the Carpathians, and you have to go far to harvest them", explained a young Romanian woman from Northern Bukovina born in 1983.

The better economic situation in the region is now allowing locals to buy forest products instead of collecting them themselves: "Before we were going to harvest blueberries, we started to go to the forest at 3 am; it was so hard and so time-consuming to collect blueberries. Now we buy them at the market", explained a Romanian woman born in 1947 in Northern Bukovina. "This year a friend brought me birch sap because it is too far to go to get it in the forest", stated a retired woman from Northern Bukovina. "We buy forest mushrooms and berries, they are tasty", asserted a retired Romanian woman in Ukraine. Romanians in Romania explained that in the past they used the forest fruits *Vaccinium myrtillus*, *Fragaria vesca*, and *Vaccinium vitis-idaea* to generate additional income in times of scarcity and economic crisis. However, nowadays they buy forest berries at the market or in shops.

Romanians in Ukraine also mentioned purchasing wild forest fruits, but mostly because "they grow far away in the mountains and one has to have time to harvest them", so it is much more convenient to buy them at the market.

Participatory observation at local markets revealed the sale of home-made dairy products and forest products (wild blueberries, mushrooms) in Northern Bukovina, while in Southern Bukovina it was mostly produced goods. The reason for this difference could be that in Romanian Bukovina milk collection from homes is still present (which was observed during fieldwork), so there is no need to process and sell milk yourself. Legislation in Ukraine allows the selling of forest products by locals, but there is currently discussion on banning the sale of dairy products by locals [65]. By law in Ukraine, the harvesting of forest products with commercial purposes has to be carried out with a special permit, which is a tax-based payment to local forest enterprises; however, this is not widely practiced due to bureaucratic complexity [14]. More active enforcement of this legislation may influence the use of wild forest products due to a reduction in the number of collectors and an increase in prices (to offset the additional cost of the permit). In Romania, the collection of forest products is free of charge for personal consumption, while it requires authorization for commercial purposes (according to article 58 of the Forest Code).

In both study areas wild plants including forest products continue to be used in daily cuisine, while in Southern Bukovina interviewees explained that those products also played a role in income generation in the past. Therefore, nowadays, in both areas the purchase of wild forest products was mentioned much more often than collecting them in the wild. This economic influence on wild product use is consistent with the findings of Stryamets [22], in Småland, Sweden, where locals buy rather than collect non-wood forest products (NWFPs). So here, economic factors have highly influenced the use of forest products: first locals actively used them and sold them for additional income, but as the economic situation has improved, people have stopped selling them as they have money to buy them at local markets. This is the first step toward losing this LEK as children do not learn how and where to collect them; the next step involves people stopping cooking them (if these products are not available in shops). The situation in Swedish Småland demonstrates that LEK has been eroded because of the healthy economic situation [7,22] and the consequent loss of the practice of foraging for NWFPs. One interviewee from Southern Bukovina explained that border creation reduced his opportunities to go to the forest, because most of the historical forest of Straja now belongs to Northern Bukovina; however, forest cover in Southern Bukovina is 63% compared to 37% in Northern Bukovina.

### *3.8. A Childhood Delicacy: The Past to Present Fashion of Dainty Foods*

Rose syrup and jam made from the flower petals, minus the white part, of *Rosa rugosa* and *Rosa centifolia* were considered delicacies and used on special occasions. "In the past we used a specific rose for sweets and it was a delicacy; only respectable people made sweets with green walnuts and sweets with roses; they were for guests [Means that sweets with roses were used for only special occasions for guests]. I know that my mother made syrup and jams and locked them up [to be used only on special occasions and kept away from children]; they also made sherbet. The little ones went to the forest for raspberries and sold them in the town center to have money to buy school supplies, uniforms", explained a Romanian woman born in 1957. In the Ukrainian part of Bukovina, rose jam was used for religious celebrations as an additive to cakes and doughnuts. "We also prepare raw jam with rose flowers; what tasty buns you get with it! They are delicious", highlighted a Romanian woman from Ukraine, born in 1953. Nowadays, for confectionery purposes, one can buy rose syrup in specialty shops, for UAH 2700 (80 Euro) per kg, and the syrup is used in fashionable restaurants and by elite cakes producers. Historical Ottoman influence introduced a few elements which can still be found among Romanians living in Bukovina. One recipe is rose jam made with the petals of *Rosa rugosa* and *Rosa centifolia*. This recipe can also be found among other groups that were under Ottoman control, such as Hungarians [66] and Bosniacs [67]. Interestingly, this product was almost exclusively mentioned by Romanians in Romania. In addition, tea is also sometimes made from the petals of these roses. Both jam and tea can also be found in shops in Romania.

Another Ottoman element is sarma [68], which is locally called sarmale (mainly in Southern Bukovina) and găluşte (mainly in Northern Bukovina). This dish consists of meat and rice wrapped in leaves. For this purpose, the leaves of *Tussilago farfara*, *Atriplex hortensis*, *Rumex* spp. *Brassica oleracea*, *Vitis vinifera*, and *Armoracia rusticana* were used. One interviewee used horseradish leaves: "I make sarmale with horseradish [*Armoracia rusticana*], and loboda [*Atriplex hortensis*]. [Horseradish leaf] is placed between sweet-leafed cabbage rolls. We also do it with grape leaves", highlighted a Romanian woman born in 1955. All the mentioned taxa are common plants for this preparation; however, they were not previously reported in Romania [68].

The fact that homemade alcoholic drinks were mentioned in Southern Bukovina but not in Northern Bukovina may be the result of Soviet propaganda and punishment for preparing moonshine and homemade alcohol. However, alcoholic tinctures with a variety of forest fruits were used for medicinal purposes by Hutsuls in Bukovina [6].

### *3.9. Comparison with Hutsuls*

Comparison with Hutsuls living in Bukovina reveals that 19 taxa are used by all four groups (see Figure 8). Hutsuls in Ukraine and Romania use the same taxa as Romanians in Ukraine for recreational tea: *Arnica montana*, *Matricaria chamomilla*, and *Achillea millefolium*. Hutsuls in Romania and Ukraine and Romanians in Romania, however, use *Viburnum opulus* and *Humulus lupulus* for this purpose (see Figure 8).

The use of *Plantago major* as a tea has also been documented among Hutsuls in Ukraine, but not among Boykos [7]. Cross-border comparison of wild plant uses shows that *Equisetum* spp., *Acer* spp., *Aronia melanocarpa* (Michx.) Elliott, *Picea abies* (L.) H. Karst., *Sorbus aucuparia* L., and *Chenopodium album* L. were used only by Hutsuls.

Cross-cultural analysis in Ukraine reveals 29 shared wild taxa, whilst five of them (*Arctium lappa*, *Plantago major*, *Crataegus monogyna*, *Trifolium* spp., and *Betula* spp.) are specific for Northern, but not Southern Bukovina. In Romania, cross-cultural analysis of food plants used by Romanians and Hutsuls in Southern Bukovina reveals the use of 22 shared taxa.

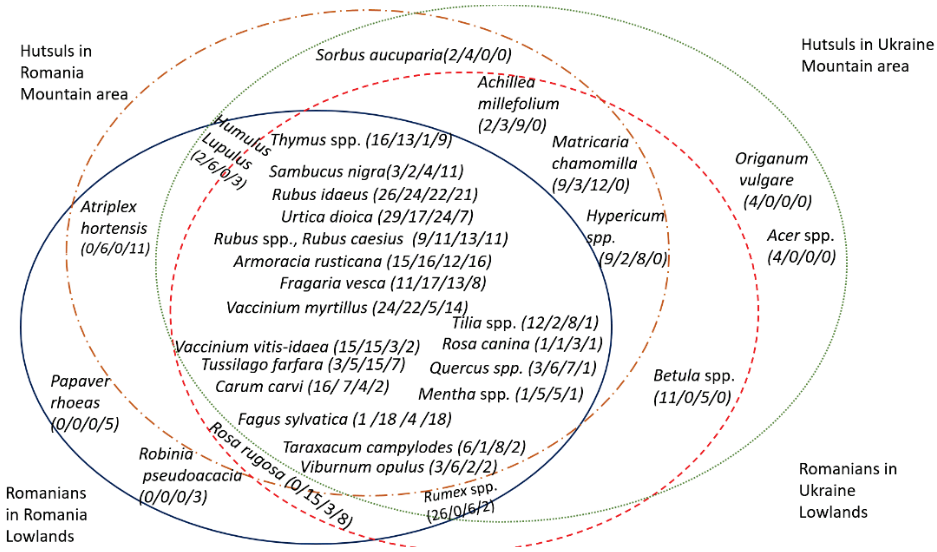


**Figure 8.** Wild food taxa used by the four groups (mentioned by at least three interviewees). The numbers in brackets correspond to interviewees that named the plant taxa (A/B/C/D), where A (dotted green circle)—Ukrainian Hutsuls, B (dotted and dashed brown circle)—Hutsuls in Romania, C (dashed red cycle)—Romanians in Northern Bukovina Ukraine, D (solid blue circle)—Romanians in Southern Bukovina. In the central part of the figure the taxa used by all four groups are represented.

The Jaccard similarity index (JI) calculated for Romanians on the two sides of the border is 45.65. The JI for taxa named by at least 10% of interviewees is 43.33. Comparison with other studies [4,6] shows that the calculated similarity index with regard to wild taxa used for food within the Hutsul ethnic group across the border is 55 when considering all taxa and 44 when considering only those taxa mentioned by at least 10% of interviewees (Table 4).

Hutsuls and Romanians living in Romania share 22 taxa (including cultivated ones) used for food, with a JI of 53.66.

In Ukrainian Bukovina, both Hutsuls and Romanians use a greater diversity of taxa, whereas Romanian Bukovina Hutsuls and Romanians use fewer taxa but with greater intensity (based on DUR) (Figure 9).

The calculation of JI without cultivated taxa revealed even more similarity (Table 5) in uses within a country: JI for Romanians and Hutsuls in Romania is 61.11, and for Romanians and Hutsuls living in Northern Bukovina it is 52 (data on wild plant taxa used for food by Hutsuls is from [6]).

**Table 5.** Comparison of Jaccard similarity indexes (JI) for wild food plants used in Bukovina.

| Group | Romanians in Ukraine and Romania, JI | Romanians and Hutsuls in Romania, JI | Hutsuls and Romanians in Ukraine, JI | Hutsuls in Ukraine and Romania, JI [6,8] |
|---|---|---|---|---|
| All food uses | 45.65 | 61.11 | 52 | 55/42.5 |

The homogenization of LEK among Romanians living in Ukraine and Hutsuls, which live in different environments but within same country, may have been due to Soviet influences as discussed by Pieroni and Sõukand [5], e.g., propaganda of wild plant use at schools as the availability of local foods was inadequate. An older Romanian interviewee, who was born in Ukraine in 1953 and worked at the library, explained that she and a school biology teacher have made an excursion path into the forest for two km where they explain to children the medicinal and food plants that growth there. "It feels so good when kids go there and ask about the plants and collect plants. It is so important to teach kids", explained the retired librarian.

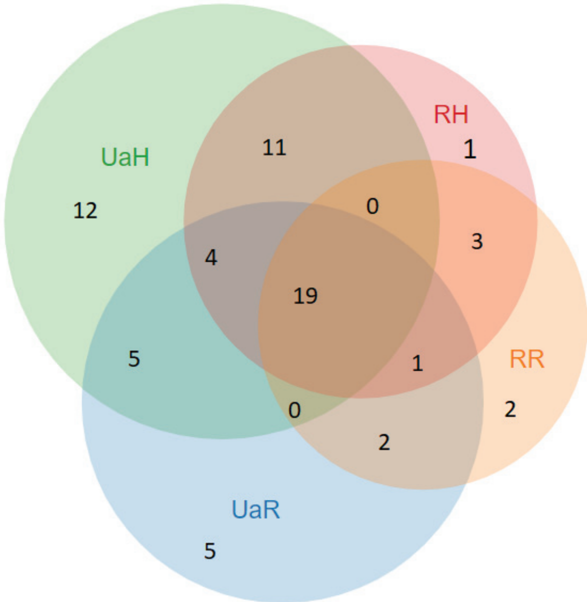


**Figure 9.** Venn diagram of the comparison of food taxa uses by the four groups. (RH—Hutsuls in Romanian Bukovina, RR—Romanians in Romanian Bukovina, UaH—Hutsuls in Ukrainian Bukovina, UaR—Romanians in Ukrainian Bukovina).

Figure 10 shows, in particular, the prevalence of *Achillea*, *Betula*, *Matricaria*, *Taraxacum*, *Tilia*, *Tussilago*, and *Viburnum* spp. food uses among Romanians in Ukraine and of *Atriplex*, *Rosa*, *Sambucus*, and *Thymus* spp., as well as of *Vaccinium myrtillus*, among Romanians in Romania.

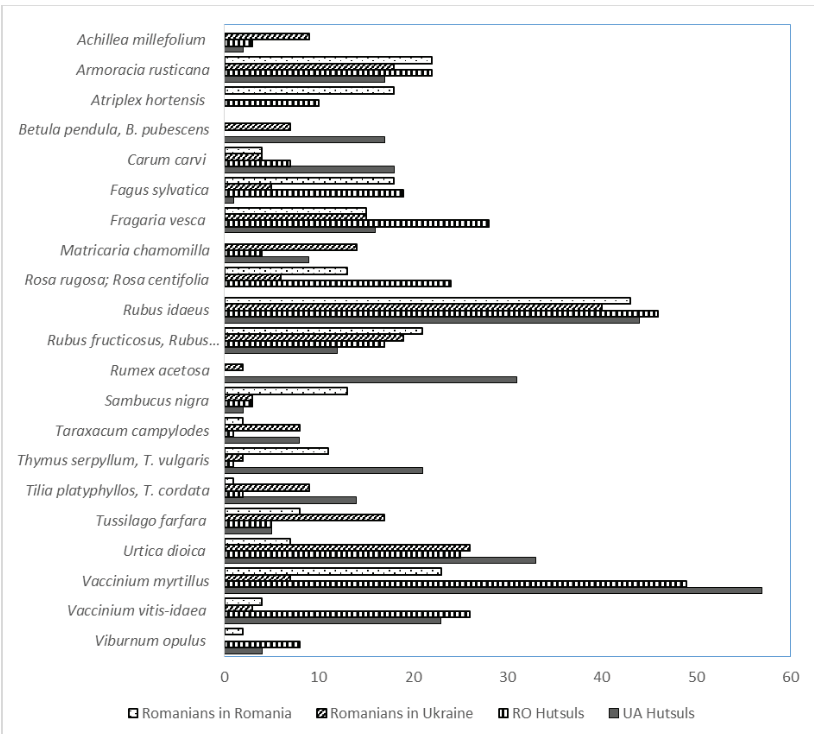


**Figure 10.** Number of uses of the most used taxa by the four groups (more than 10 DUR).

These remarkable differences correspond again, following the pattern we outlined for plant preparations, to the most prototypical wild food plants occurring in the foodscapes of Ukraine and Romania: *Betula*, *Taraxacum*, *Tilia*, and *Viburnum* are particularly crucial plants in the Eastern Slavic and wider post-Soviet wild food domain [33,69–71], while *Atriplex*, *Thymus*, and *Vaccinium* spp. are salient ingredients of the Romanian foodscape [32,37]. These data show again how the wild foodscapes of Romanians have been diversely influenced in the past century by national cuisines on both sides of the border, possibly via intense contact and cohabitation with neighbors (Ukrainians in Ukraine and Romanians in Romania, respectively), facilitated by intermarriages and the celebration of an atheistic, non-religious ethos which Communism provided.

### *3.10. Attitudes and Perceptions*

Cross-border Bukovina is very diverse and multifarious. Nice lawns with magnolias and decorative trees neighbor yards with home gardens growing a variety of crops; a huge jeep car is followed by horses. In a local pizza place a young woman buys pizza for the family dinner (instead of cooking it herself which is the more common and much cheaper practice in rural areas, e.g., for the price of three pizzas one can feed the family for a week), while in the next house we see home-baked bread and a cow kept for milk for the children. The interviewees explained that most of the young people are abroad for seasonal work. Women or grandparents stay at home to take care of the kids. Visually, the differences in the level of income are seen very clearly, with expansive home and fence decoration and a wooden roof house close by.

### *3.11. "There Is No One to Cook for" in Southern Bukovina*

The demographical situation in both Southern and Northern Bukovina regions over the past several years has changed dramatically—the younger generation has moved to the cities or richer areas of the European Union. Elderly individuals are the ones who remain in the region. There are a few current trends: (1) the younger generation sends back money to build houses; (2) the men of the household leave for seasonal jobs and then return; and (3) younger individuals move out and never come back. During our interviews we noted all of these trends. Some people, including several middle-aged men who worked in Germany, explained that they have tried "the hard living in a foreign land" and will eat "bread and water", but they would never go back. Others explained that because there is nowhere to work in Bukovina they (or at least someone from their family) have to go for seasonal work to earn money. There were cases in which children were left with grandparents, while parents went abroad and "talked with and educated kids via the Internet", but they physically did not see them for years. We also observed the huge newly built houses in the area that stand empty (see Figures 3 and 4). All this trend has influenced the use of wild plants for food. The youngsters have left on their own, there is a missing chain (parents are abroad and it is not possible to learn the way of wild plant use via the internet) in the transmission of knowledge. Economic influence also reduces the need to collect wild plants and the last trend the absence of children close to grandparents. A Romanian woman, born in 1947, explained that because there are no younger children or grandchildren left with her, she has no one to cook wild foods for any more: "I have bought one liter of blueberries. Now I live alone, and I have no one to cook for. Before I was cooking a lot; now my kids left, so I don't need so much for myself".

### *3.12. "Like in Italy" in Northern Bukovina*

In Northern Bukovina besides the emigration trend, we observed how the influence of experience local's gain abroad was transmitted to local cuisine. Meanwhile, the locals sometimes perceived the wild food plants as "famine food or poor food". A woman born in 1928 explained that there was no Holodomor (the artificial famine) like in other parts of Ukraine, so they do not use many wild plants for food. This indicates that there is a view of wild plants as famine foods, which is in line with previous studies [7,10].

"This is păpădie (*Taraxacum campylodes*), we use it for salads, like in Italy", explained a Romanian woman born in Ukraine in 1966. "I spent 8 years working in Italy; I just came back. I buy tea, I don't collect it", declared a 54-year-old man from Northern Bukovina.

"I have tea from Italy, I don't drink tea from local herbs", stated an older Romanian woman in Northern Bukovina. "We are not poor to drink herbal tea", explained a retired Romanian woman. Nowadays some respondents see wild food as a famine or peasant food, which is in agreement with many findings from contemporary Europe [10,28].

Two interviewees explained that they do not collect *Origanum vulgare* nor buy bay leaves (*Laurus nobilis*) because they obtain them from Italy.

Among Romanians in Ukraine, a widespread response was that they buy tea, instead of collect it from nature: "We don't make other teas, the majority we buy. There are big and small packages, I think they are called gruzinskii", explained a Romanian woman born in Ukraine in 1939. One pensioner, a Romanian women living in Ukraine, asserted that "we are not poor, we have tea and coffee from Italy", so there is a view of wild food as "poor" food, in contrast to food coming from abroad (considered elitist, which has Soviet roots when products from abroad could only be found in specific shops in capital cities, and those who could afford them were seen as wealthy).

Globalization and the homogenization of cultures, languages and natural resource use is a trend nowadays [40,41].

In addition, in both of our study populations, results show that an open work market has negatively influenced wild food use, including its abandonment and decline, due to:

1. The emigration (both seasonal and permanent) of young and middle-aged individuals from border areas to other European countries. New knowledge and practices of wild plant use as a result of traveling and working abroad, e.g., "Salad like in Italy", and "I don't collect herbs from here [the surrounding environment], I have tea from Italy".
2. The idea of "no one to cook for", which involves a reduction in the use of wild foods due to depopulation of rural border areas by younger generations, leaving only pensioners in the region. This is about unwillingness to invest time in elaborate recipes (or hard-to-find ingredients) because of the lack of loved ones to motivate such an effort.
3. The decline in the use of wild plants because of replacement by mass market products, e.g., "I have *Origanum* from Italy; I don't collect it anymore".
4. The valorization of forest products and higher income level which allows people to buy forest products instead of harvesting them from the wild, e.g., "We buy blueberries".

Our results demonstrate the use of wild plants was as a part of cultural identity and self-actualization. It is shown with the childhood memories, or use of wild plants for specific, time-requiring dishes (e.g., smoking meat).

Living in same ecological conditions, but with different socio-economic scenarios, we discover differences in the use of wild foods by the same ethnic group (Figure 11). Problems with infrastructure and the lack of job opportunities in Ukrainian Bukovina compel locals to be more dependent on available wild food resources, while in Southern Bukovina the income-generating function of wild foods is confined to the past. The use of wild plants that are strongly associated with local cultural identity and are present in local culinary traditions [72], the maintenance of wild taxa used as childhood treats, and specific local culinary recipes (e.g., smoking meat, afinată, socată, sarmale and green borshch) are less likely to disappear from local cuisines. However, our results demonstrate the strong influence of an open work market and social migration on the use of wild plants. Rapid changes in lifestyle and habits are one explanation for the abandonment of wild food use, which is consistent with Serrasolses et al. [72].

The majority of food taxa used by Romanians in Ukraine, especially for making tea, can also be used for medicinal purposes. This food–medicinal continuum when comparing the two groups was also observed in Sõukand and Pieroni [6].


**Figure 11.** The dining table of Romanians divided by a border, showing the main differences. Drawings by S. Stryamets.

In Bukovina, 51 taxa (46 wild taxa plus 5 cultivated taxa with uncommon uses) were used for food, compared to 40 taxa recorded by Sõukand and Pieroni [4]. This number, however, is lower than the 70 taxa recorded in Polissya Region [24], yet higher than in Roztochya with 26 taxa [7], or the 44 taxa used in Maramureș [33].

Romanians in Ukraine used four wild taxa (*Urtica dioica*, *Rumex acetosa*, *Rumex* spp., and *Thymus* spp.) for soup preparations, while Romanians in Romania used only two taxa (*Urtica dioica* and *Atriplex hortensis*). In other parts of Ukraine the number of plants use for "green" soup reaches 21 taxa [26]. In Southern Bukovina, *Atriplex hortensis* is not seen as wild because it grows in gardens, similar to that of *Rumex acetosa* in the area of Roztochya, where this taxon grows in yards and gardens [22].

Birch sap was widely used in Northern Bukovina as a refreshing drink and also fermented for winter time. It is popular in other parts of Ukraine and Eastern Europe as well [5,71], and thus could have a Soviet origin.

The flowers of *Robinia pseudoacacia* were mentioned as a famine food during times of scarcity in Polissya Region [24]. The possible attenuation in use of *Atriplex hortensis* by Romanians in Northern Bukovina may be related to the fact that it is seen as a famine food [73]. The prevalent use of recreational tea by Romanians in Ukraine could have Soviet roots, as teatime and herbals tea were promoted during this era. Sweets being the dominant preparation mode in Southern Bukovina may be explained in a couple of ways: the "deficit" of sugar during economic crises and sweets being seen as rich people's food, and the Turkish influence of using jams and sweets. The difference in the use of winter preserves and fermenting may be due to the unstable economic situation in Northern Bukovina, which forces people to have their own food security system for winter time and times of uncertainty.

The taste of wild foods was also one of the factors influencing the use of plants, e.g., jam made from *Rosa rugosa* is considered to be a delicacy, and nowadays there is a trend toward the valorization of products made from *Rosa rugosa* in both areas of Bukovina. Studies have demonstrated that taste is culturally developed [74]. Therefore, in our case taste was not the main factor influencing wild food use [72].

The use of wild foods not only serves nutritional and safety-net functions [75], but it is a source of self-actualization and contributes to well-being [42], e.g., "I cook as my mom and grandma used to cook, using wild herbs". Complex human-nature relationships are formed with the use of wild foods growing in the surrounding landscape, creating a unique local cuisine. However, socio-economic and governance systems have produced differences in uses by the same ethnos in the same environment. An improved economic situation leads to a decline in the use of wild taxa for food, as well as harvesting practices (purchasing food items at the market instead of collecting them from the surrounding landscape) and cooking practices, e.g., "it is hard to cook and there is no one to cook for".

Differences across the border are remarkable: along with the use of 21 shared taxa, we recorded 25 different wild food taxa. The most remarkable differences between the two sides were related to mode of preparation. We suggest that those differences are the result of the influence of intense contact and cohabitation with neighbors (Romanians on the Southern Bukovina side and Ukrainians on the Northern Bukovina side). In Romania, Bukovinians were part of a larger group and did not have to preserve any ethnic belonging and cultural identity. While in Northern Bukovina, Romanians had to somehow integrate with Ukrainians, yet remain Romanian in order to save their cultural identity. In Northern Bukovina, interviewees mentioned that their children were studying in Ukrainian universities; even though schools in the region are Romanian, they study Ukrainian and some teachers are Ukrainian. The peaceful coexistence of these two ethnic groups has resulted in intermarriages and close connections. Interviewees also highlighted Moldova as a state with a similar language (they use Romanian with a Cyrillic alphabet) and education in Moldavian institutes during Soviet times.

Therefore, the factors possibly influencing local cuisine and the use of wild food plants include:

1. The border that has divided Bukovina for the last 80 years has resulted in different socio-political scenarios and thus in different food behaviors and the use of wild plants in local cuisine. Long-standing borders have had a tangible effect in shaping divergent wild plant foodscapes, since the respective national states of Northern and Southern Bukovina, and possibly different neighbors, have shaped the Romanian dining table in different ways.
2. Intermarriage and neighbor influence. At least three interviewees in Northern Bukovina explained that they were married to a Ukrainian, which may have influenced their food behavior: "I cook green borshch as Ukrainians do" and "My daughter-in-law is Ukrainian, from Kolomyya; she cooks 12 dishes for Christmas Eve, and she teaches me". Another male interviewee stated: "In the neighboring Novoselecjk region they ferment apples and melons, but we don't".
3. Economic differences: in order to smoke meat one has to be able to afford it, and during Soviet times meat was "deficit", while during the economic crisis between 1990 and 2000 rural individuals could not afford it. In contrast, herbal teas are easily affordable, and among Romanians it was twice as popular in Northern Bukovina as in Southern Bukovina. The use of birch sap clearly has Soviet roots as it was promoted as a "healthy and tasty drink". Winter preserves, as a way to survive during economic crises, are still popular in Northern Bukovina as a food security practice.
4. Market influence: Romanians live in close proximity to other ethnic groups with whom they interact at local markets; for example, participatory observation in Northern Bukovina has revealed the possible exchange of culinary experiences at "babushka" markets [65].
5. The media: local newspapers and television food shows may also influence local cuisine, as recipes for different dishes have been published in the local press.

The latest UN report [76] highlighted that in terms of global food issues locally grown foods and the use of wild foods from local landscapes are the answer to the challenges that humankind currently faces. That is why documenting and discussing LEK on wild food use is a crucial and timely endeavor.

## 4. Conclusions

Contemporary use of wild taxa by Romanians in Bukovina Region was diverse and different across the border. Romanians in Romania use fewer taxa in a less intensive way, while Romanians in Ukraine use more diverse species and have more diverse uses, including those that support food security in winter time. In the wild food domain, Romanians living in Bukovina used 46 plant taxa (plus 5 cultivated taxa with uncommon uses). Despite the flat landscape with extensive agricultural fields, Romanians on both sides of the border used forest taxa the most as wild food.

The limitation of the study is that the two groups of Romanians do not present a statistically significant difference in the use of plant categories, therefore the qualitative results of this study represent the contemporary use of wild plant taxa for food purposes, showing 566 DURs.

Limitations of the study: in both case study areas the women were the dominating (80%) interviewees; therefore we consider this division as relevant to these conditions (in the gender strictly of the older generation the women dominated) and qualitative methods. As in both areas the help of the field assistant was used, some small details of the interviews might be lost in the translation.

Our results show that the use of wild food plants in Bukovina is more similar between ethnic groups (Hutsuls) within the same country (Romania or Ukraine) than within groups across the border (Romanians living in Romania and Ukraine), which supports the main hypothesis of the DiGe (Divided Generations project) that socio-political scenarios influence the use of wild foods. Indeed, cross-border studies can greatly contribute to enhance our understanding of the impacts of political (and consequently social and economic for instance) contexts on the local ecological knowledge. This can be crucial to shape effective policies according to the perceptions and management of local resources adapted to different political contexts. Such policies can be especially important in areas rich of biological and/or cultural diversity, which therefore would require context-based conservation and valorization policies.

The 80 years spent living under different governance systems has resulted in different ways of using wild plants in daily cuisine. The use of food plants by Romanians is more markedly shaped by intermarriage and neighbor influence (through media and local markets), as well as the recent phenomenon of globalization/open work market, as a result making use of some plants similar to those found in countries where interviewees worked (e.g., Italy). The improved economic situation (the possibility of buying produced food instead of collecting it in the wild) and the availability of industrially produced goods have also influenced current uses, e.g., decrease in the use of wild plants in everyday cuisine. Depopulation of rural areas and a growing disconnect with nature has also significantly influenced the decline in the skills and practices of wild plant use. In addition, the valorization of forest products and a higher income level allows for buying forest products instead of harvesting them from the wild.

This research gives the opportunity to understand the dynamic structure of local cuisine, influences by the socio-political scenarios, globalization, intermarriage and co-existing of different cultures, and media influence, market flow of products as well as the economic situation which allows limitation of wild plants use. Based on these results, the prognoses of more disconnection with nature, less wild plants use for everyday cuisine could be reached. Therefore, the internal global crises events, e.g., the COVID-19 pandemic or issues with food supply in the remote areas might increase the wild plant use for food.

Complex human–nature relationships are formed with the use of wild foods growing in the surrounding landscape, creating a unique local cuisine. There is a need for further research into how socio-political scenarios under conditions of globalization, in terms of the flow of people, investment, market product and knowledge, influence LEK and food habit changes, focusing on biocultural values and dynamics of local cuisine.

The use of wild food as a self-actualization and contribution to well-being also requires future studies. Further research is needed to explain food uses for cultural purposes; for example, religious celebrations. Another issue that was frequently mentioned by locals and seen as an important culinary practice, and thus needs more thorough analysis and consideration, including cross-border comparison, is food habits connected to ceremonies and ritual behaviors.

In the framework of recent debates on the significance of wild food plants, especially during the Covid-19 crisis, current research is vital in terms of the application of LEK and understanding the driving forces of wild plant use. The next issue that demands research is home-grown foods as a food security measure. During the participatory observations and during interviews, locals named the food gardens close to homes as an important source of both supplementary food and "healthy self-growing food". The use of wild foods as ethnomedicine for humans and for animals is another important subject for our future research.

**Author Contributions:** R.S. and N.S. designed the study, N.S. and G.M. conducted the fieldwork, A.P. structured the study, I.K. has input to structure and discussion, N.S. analyzed the data and drafted the manuscript with contributions from all the authors. All authors approved the final manuscript. All authors have read and agreed to the published version of the manuscript.

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**Informed Consent Statement:** Oral informed consent was obtained from all subjects involved in the study.

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## Abbreviations

| | |
|---|---|
| NWFPs | Non-wood forest products |
| LEK | Local Ecological Knowledge |
| DUR | Detailed use report |
| JI | Jaccard similarity index |
| RR | Romanians in Romanian Bukovina |
| UAR | Romanians in Ukrainian Bukovina |
| UAH | Hutsuls in Ukrainian Bukovina |
| RH | Hutsuls in Romanian Bukovina |

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*foods*

MDPI

*Article*

# Shared but Threatened: The Heritage of Wild Food Plant Gathering among Different Linguistic and Religious Groups in the Ishkoman and Yasin Valleys, North Pakistan

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**Abstract:** A wild food ethnobotanical field study was conducted in the Ishkoman and Yasin valleys, located in the Hindukush Mountain Range of Gilgit-Baltistan, northern Pakistan. These valleys are inhabited by diverse, often marginalized, linguistic and religious groups. The field survey was conducted via one hundred and eighty semistructured interviews to record data in nine villages. Forty gathered wild food botanical and mycological taxa were recorded and identified. Comparative analysis among the different linguistic and religious groups revealed that the gathered wild food plants were homogenously used. This may be attributed to the sociocultural context of the study area, where most of the population professes the Ismaili Shia Islamic faith, and to the historical stratifications of different populations along the centuries, which may have determined complex adaptation processes and exchange of possibly distinct pre-existing food customs. A few wild plants had very rarely or never been previously reported as food resources in Pakistan, including *Artemisia annua*, *Hedysarum falconeri*, *Iris hookeriana*, *Lepidium didymium* and *Saussurea lappa*. Additionally, the recorded local knowledge is under threat and we analyzed possible factors that have caused this change. The recorded biocultural heritage could, however, represent a crucial driver, if properly revitalized, for assuring the food security of the local communities and also for further developing ecotourism and associated sustainable gastronomic initiatives in the area.

**Keywords:** ethnobotany; ethnobiology; local ecological knowledge; local food knowledge; Gilgit-Baltistan

## 1. Introduction

Food systems and their elements and relationships are subject to constant modifications by wider processes of change linked to regional and global trends. Moreover, with the natural environment being the basis of food production, food systems should always be understood as coupled social-ecological systems [1]. Mountain communities are considered particularly vulnerable to food insecurity, and their vulnerability is sometimes assumed to be increasing because of difficult conditions for agricultural production, social and political marginalization, and the negative impacts of climate change. A number of ethnographic studies have pointed out that food systems in mountains are fragile, dynamic and multifaceted, relying on diverse farm and off-farm sources of livelihood while being subject to manifold social, economic, political and ecological changes [2–5].

Wild food plants (WFPs) have provided a key source of food to humans since prehistoric times, although their importance in the human diet has diminished, first with agricultural expansion and later more dramatically with industrialization and urbanization processes [6]. While traditional/local ecological knowledge (LEK) identifies the complex body of understanding/knowledge, practices and beliefs (UKPB) that human societies have developed in inextricable relationships with their natural environment, and which is dynamic and coevolving with social and ecological changes [7], we believe that traditional/local food knowledge (LFK) refers to the UKPBs related to the environmental foodscape (agroecosystems where ingredients are produced), as well as the culinary practices/skills, the local recipes, and the social contexts of food consumption within a given community.

Both LEK and LFK, therefore, represent an integral part of sustainable and sovereign local food systems that need to be dynamically preserved; however, for a few decades, global environmental and socioeconomic changes, and especially food industrialization, commodification and globalization have had a negative impact on LEK and LFK, which are often considered vanishing and somehow eroded, since they are often perceived as part of a fading, orally-transmitted, local biocultural heritage. Nevertheless, since environmental and social relationships are constantly changing, LEK and LFK are actually not static but should be more correctly seen as a mutating complex that are continuously renegotiated [8,9].

Over the last decade, ethnobiologists have documented LEK on gathering and consuming WFPs in very different regions of the world ([10–14], and references therein), in order to provide concrete tools for fostering sustainable trajectories of rural development, or even sometimes for contributing to food security [15–23]. More recently, especially in Europe and the Middle East, an interesting trajectory of ethnobotanical research has concerned the cross-cultural comparison of wild food plants used among various ethnic and religious groups or among diasporas [24–30]. This emerging area may provide reflections concerning the ways though which cultural factors influence the transmission, evolution and change of plant ingredient use in traditional cuisines.

Pakistan boasts various kinds of natural resources, but the country still experiences food shortages. According to a report of the global hunger index (GHI), the country is facing serious food security issues [31]. In recent years, various biophysical and socioeconomic factors have led to a depletion of natural resources across the Hindukush Himalayan region. This has resulted in a significant loss of ecosystem services, particularly in terms of soil nutrients, water and biomass, and the resultant decline in food productivity [32]. Gilgit-Baltistan (Northern Pakistan) represent a multicultural and multilingual reservoir, which is inhabited by various marginalized linguistic minorities [33] that have a close attachment to natural resources for their livelihood, largely based on small-scale horticultural and pastoralist activities. It is relevant to mention that in northern areas of Pakistan, the completion of the Karakoram Highway in 1979 has had an impact on the local communities [34–36] and there has been considerable economical change, which has led to the diversification of livelihoods. However, at the same time, there are several communities residing at higher elevations that still today can be reached only by foot, and have little reliance on markets to supply food. Therefore WFPs play a crucial role in these peripheral communities [37,38] and surrounding regions as well [39,40]. In recent decades, the rapid processes of "modernization" and changing lifestyle of mountain communities have led many locals to embrace the western-style way of food procurement via large-scale markets, and this phenomenon has been and still is detrimental to LEK and LFK on WFPs [26]. Moreover, the local perception of the effects of climate change already seems to be considerable in Gilgit-Baltistan [41], while its specific effect on LEK is still understudied.

The overarching aim of this research was therefore to document these threatened local knowledge systems related to WFPs, and to provide stakeholders a possibly useful baseline of data for revitalizing them. We specifically investigated the impact that linguistic and religious affiliations have on the gathering and consumption of WFPs in two remote valleys of Northern Pakistan. The objectives of the study were therefore: (a) to record traditional wild food plant uses among different linguistic and religious communities living in the Ishkoman Valley and the Yasin Valley; (b) to compare the same data with the pre-existing food ethnobotanical surveys conducted in Northern Pakistan and (c) to better understand the diachronic dynamics of change of LEK and LFK linked to WFPs in order to possibly promote this heritage in sustainable rural development programs.

## 2. Materials and Methods

### 2.1. Study Area and Communities

The study area is situated in the mountainous territory that is part of the Western Ghizar (or Ghizer) District in Gilgit-Baltistan, Northern Pakistan. The Ghizar District represents the westernmost part of the Gilgit-Baltistan region of Pakistan and is a crossroads between Gilgit and Chitral via the Shandur Pass, and also to China and Tajikistan via the Broghil Pass through the Ishkomen Valley. Ghizer District belongs to the Western Himalayan floristic region [42] (Figure 1) and has a humid continental climate (subtype Dwb) according to the Köppen classification [43]. The district is the home of four major linguistic groups: Shina, Kho, Burusho and Wakhi [44].

**Figure 1.** Landscape of the study area (an east-west view) with a wheat crop field. at Chatorkand, Ishkoman Valley, July 2019.

#### 2.1.1. Ishkoman Valley

The Ishkoman Valley is located in the transition zone between the Hindukush and Karakoram mountain ranges. In a historical perspective, Ishkoman figured as a regional political entity between the principalities of Hunza in the west and Yasin in the east. The northern boundary is contiguous with the Afghan controlled part of Wakhan. During the 20th century, the average growth rate of the population in Ishkoman steadily increased at a rate of 3% per year. Shina-speaking residents claim to be descendants of immigrants from Darel and Yasin, while additional migrants arrived from neighboring regions introducing other languages. In the central part of the valley, Khowar-speaking families from Ghizer, Turkho and Laspur (Chitral) took residence. In 1883, the ruler of Wakhan, Mir Ali Mardan Shah, fled his principality and took refuge under the protection of the Mehtar of Chitral. Mehtar Aman-ul-Mulk allocated barren tracts of land in the Karambar side valley to a growing group of Wakhi refugees [45]. In 1906, the total population of Ishkoman consisted of 1220 people, of which 390 claimed to be Khowar (32%), 377 Shina speakers (31%) and 453 Wakhi (37%) [46]. Wakhi habitations were clustered in Karambar. Shina speakers dominated the oldest settled parts of the upper Ishkoman River in addition to both banks of the lower valley where the Ishkoman borders Punial, a Shina speaking area. The Kho occupied the central fertile lands of Pakora, Chatorkhand and Dain. The three original settlement centers of importance continue to be the domain of Wakhi, Shina and Khowar speakers, while younger migrant groups have altered this pattern [44].

2.1.2. Yasin Valley

Yasin valley is one of two valleys located in the middle of the western-central part of the mountainous belt of Northern Pakistan. Linguistic field research has found that the valley has remained the home of the speakers of the isolated Burushaski language [33,47–49]. Jettmar [50,51] asserted that there is evidence proving that the Burusho people descend from an archaic stratum of migrants or even the original inhabitants and that in later times Shina superseded and replaced Burusho in the Hunza and Yasin valleys. Researchers have claimed that it is highly likely that the arrival of Indic languages to the area started with the ancestors of present-day Kho and Shina speakers about a millennium ago and resulted in the occupation of the lower parts of the valleys; Gilgit and Chitral became their political centers from which further settlements spread into adjacent valleys. Previous research studies have shown that intra-montane migration was undertaken in order to search for cultivable land and grazing pastures. Significant migration within the mountain belt has taken place during the present century. New settlements were established in previously unoccupied territory either on barren terraces through irrigation or by converting temporary pasture settlements into permanent villages [44]. The literature indicates that for long periods Ghizer was under Chitrali rule, resulting in the migration of Kho people into the area from Chitral [44].

*2.2. Field Study*

A field ethnobotanical study was carried out from June to July 2019 in 9 mountain villages (Figure 2) in the Yasin and Ishkoman valleys of Gilgit-Baltistan, North Pakistan.

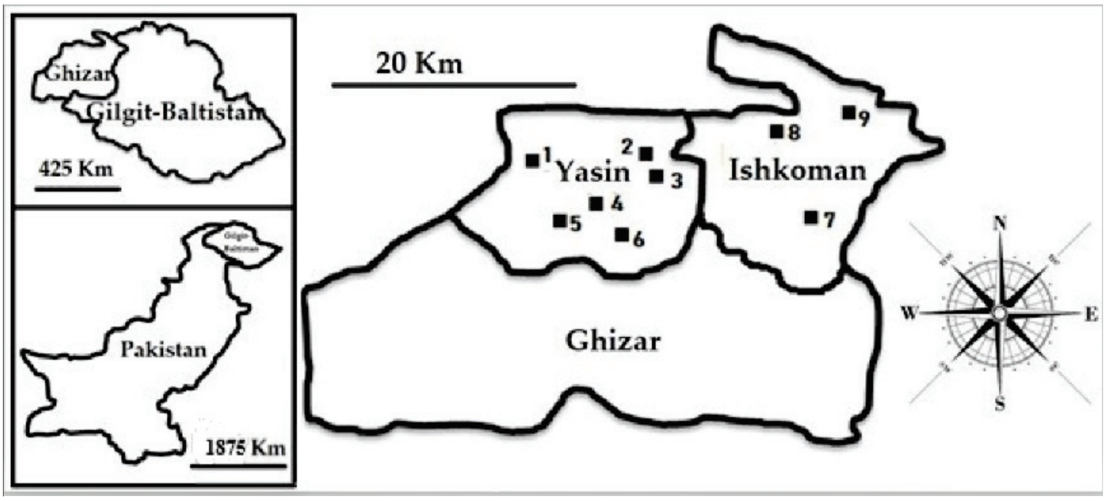


**Figure 2.** Map of the study area and visited villages: 1. Barkolti; 2. Sandi; 3. Ghojalti; 4. Sultan Abad; 5. Thawoos; 6. Yasin Khas; 7. Chatorkand; 8. Ishkoman Khas and 9. Imit.

Information was gathered from different linguistic and religious groups that were dispersed in different villages across the valleys. Study participants, which were recruited through the snowball technique, were selected among middle-aged and elderly inhabitants (range: 52–69 years old), including farmers, shepherds and housewives who were considered possible knowledge holders. From each of the studied groups, twenty participants were selected for interviews, including both male and female community members.

Table 1 provides a brief summary of the characteristics of the visited villages and the considered sample.

**Table 1.** Characteristics of the visited mountain villages and studied communities.

| Language | Village | Elevation (Metres Above Sea Level) | Approx. Number of Inhabitants | Number of Interviewees (Male/Female) | Islamic Faith | Arrival in the Area | Subsistence Activities |
|---|---|---|---|---|---|---|---|
| | | | | Yasin Valley | | | |
| Burushaski | Barkolti | 2462 | 12,000 | 5/5 | Sunni | Autochthonous | Horticulturalism and pastoralism |
| | | | | - | Ismaili | | |
| | Ghojalti | 2415 | 9000 | - | Sunni | | |
| | | | | 5 | Ismaili | | |
| | Sandi | 2395 | 7000 | - | Sunni | | |
| | | | | 3/2 | Ismaili | | |
| | Sultan Abad | 2405 | 3000 | - | Sunni | | |
| | | | | 3/6 | Ismaili | | |
| | Thawoos | 2397 | 4000 | 3/2 | Sunni | | |
| | | | | 1/1 | Ismaili | | |
| | Yasin Khaas | 2371 | 7000 | 3/2 | Sunni | | |
| | | | | - | Ismaili | | |
| Khowar | Barkolti | 2462 | 12,000 | - | Sunni | Arrived in the 17th century from Chitral, North-West Pakistan | Horticulturalism and pastoralism |
| | | | | - | Ismaili | | |
| | Ghojalti | 2415 | 9000 | - | Sunni | | |
| | | | | - | Ismaili | | |
| | Sandi | 2395 | 7000 | 2/1 | Sunni | | |
| | | | | 2/2 | Ismaili | | |
| | Sultan Abad | 2405 | 3000 | 1/2 | Sunni | | |
| | | | | 5/3 | Ismaili | | |
| | Thawoos | 2397 | 4000 | 2/2 | Sunni | | |
| | | | | 4/4 | Ismaili | | |
| | Yasin Khaas | 2371 | 7000 | 7/3 | Sunni | | |
| | | | | - | Ismaili | | |
| | | | | Ishkoman Valley | | | |
| Khowar | Chatorkhand | 2092 | 6000 | 13/7 | Sunni | Arrived in the 17th century from Chitral, North-West Pakistan | Horticulturalism and pastoralism |
| | | | | 10/10 | Ismaili | | |
| Shina | Ishkoman Khaas | 2092 | 3000 | 15/5 | Sunni | Arrived from other areas of Gilgit-Baltistan (North Pakistan) in the late 18th century | Mainly horticulturalism |
| | | | | 12/8 | Ismaili | | |
| Wakhi | Imit | 2391 | 3500 | - | Sunni | Migrated into the area from Wakhan Corridor (North-East Afghanistan) during the 19th century | Pastoralism and horticulturalism |
| | | | | 12/8 | Ismaili | | |

Prior to each interview, verbal consent was obtained from the participants and the Code of Ethics adopted by the International Society of Ethnobiology [52] was followed. Semistructured interviews were conducted both in the Urdu language, as well as in the local language (with the help of a local translator). The interviews were focused on gathered and consumed wild food plants used as cooked vegetables, raw in salads, as snacks, as seasoning or for recreational teas. Specific questions were also asked concerning wild plants possibly used in dairy products or in lactic fermented foods, as well as the consumption of edible mushrooms. Moreover, we recorded information on some cultivated species, which locals considered "wild" or whose culinary use was unusual. For each of the free listed plants recorded during the study, the local name, gathering period and local food uses were documented. Additionally, qualitative ethnographic information was gathered via open-ended questions and participant observation. The quoted wild food taxa were then collected from the study area (Figure 3).


**Figure 3.** (**A**): A few flowering specimens collected for the herbarium; (**B**): *Morchella esculenta* hanging by a string at a local shop in Imit village and (**C**): *Rheum* sp.

Collected plant taxa were identified by the third author using the Flora of Pakistan [53–56], and voucher specimens were deposited at the Herbarium of the Department of Botany, University of Swat, Khyber Pakhtunkhwa, Pakistan. Identification of the few wild plants for which it was not possible to collect vouchers was made on the basis of the folk name and detailed plant description only. Nomenclature followed The Plant List database [57] for each plant taxon and the Index Fungorum [58] for the mushroom taxon, while plant family assignments were consistent with the Angiosperm Phylogeny Website [59].

*2.3. Data Analysis*

Ethnobotanical taxa and their uses were compared among different community groups through proportional Venn diagrams, which were drafted using free software (http://bioinformatics.psb.ugent.be/webtools/Venn/). Data analysis was also carried out by calculating the Jaccard index (for each pair of considered communities), used for gauging the similarity and diversity of sample sets, following the application that González-Tejero et al. [60] designed for the use of this ecological index in the ethnobotanical domain. Moreover, for national data comparison, a detailed literature survey on the ethnobotany of wild food plants of Pakistan and Pamir was also conducted [26,37–40,61–75].

## 3. Results

### 3.1. Food System of the Studied Communities

The traditional food system of the studied communities was based on ingredients obtained from seasonal crops, as well as dairy products and the meat of sheep, cow and goat, as these communities have historically been attached to small-scale horticulture and livestock rearing. Almost every household in the study area had a small piece of land where the family cultivated different crops and vegetables. Cultivated crops contributed to the management of the traditional food system, which primarily consisted of consuming corn, wheat, buckwheat, pearl millet, barley and potatoes. Some important vegetables grown by locals in their home gardens or fields included cabbage, cucumbers, tomatoes, turnips, carrots, radishes, amaranth and lettuce. In the past, primary orchard foodstuffs, such as apricots and mulberry, were also supplemented with grains like barley, foxtail millet, buckwheat, fava bean and amaranth. Apart from these products, the most culturally salient customs of the people living in the area, and for which they are famous, are the frequent culinary uses of potato and rye. Different homemade food products were preserved and used at different times throughout the year. Some important dishes recorded in the study area include: Dawdoo, which is a famous noodle soup used especially in winter (Figure 4), Makoti (wheat flour combined with ground nuts and almonds and then cooked together), Terbat (wheat flour mixed with walnuts, almonds, and vegetable oil), Gyal (prepared by mixing wheat flour with butter and eggs), Chahn (wheat grain cooked with meat), Bappa (cooked wheat flour), Paqo (cooked wheat flour), Brat tiki (made by mixing wheat flour with butter and eggs), Chalpak (made by mixing local herbs with dough and oil), Mul (wheat flour combined with butter and then cooked), Molida (wheat flour mixed with milk and butter), Bayo-Cha or Trup Cha (salty tea mixed with milk) and Sharbat (wheat flour mixed with butter and then cooked).

**Figure 4.** Traditional noodle soup known as Dawdoo, prepared in winter (photo courtesy of Asad Rahman).

All the above mentioned traditional dishes contained ingredients or products obtained from local small scale family-run horticultural and pastoralist activities, while the consumption of wild plants was considerable for those families living in the most isolated locations of the valleys.

### 3.2. Wild Food Plant Uses

The survey recorded forty plant and fungal taxa, which were used in the traditional food system across the two valleys (Table 2).

**Table 2.** Gathered wild food plants recorded in the study area.

| Botanical Taxon; Family; Botanical Voucher Specimen Code | Recorded Local Names | Parts Used | Recorded Local Food Uses | Religious and Linguistic Communities in Which the Food Use Was Recorded | | | | | | | | | Previously Reported in Pakistan |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | IBY | IKI | IKY | ISI | IWI | SBY | SKI | SKY | SSI | |
| *Allium fedtschenkoanum* Regel; Amaryllidaceae; SWAT005487 | Gasho [B]<br>Kasch [K]<br>Karghapyaz [W]<br>Khasho [S]<br>Teshto [K] | Aerial parts | Cooked | + | + | + | + | + | + | + | + | + | Yes |
| *Allium carolinianum* DC.; Amaryllidaceae | Latruk [K]<br>Lanturk [W]<br>Khasch [B,S] | Aerial parts | Cooked | + | + | + | + | + | + | + | + | + | Yes |
| *Amaranthus cruentus* L.; Amaranthaceae; SWAT005512 | Bardoomhoi [B]<br>Kruishakh [K, S]<br>Lolosha [S]<br>Sakarghaz [W] | Leaves | Cooked | + | + | + | + | + | + | + | + | + | Yes |
| *Artemisia annua* L.; Asteraceae; SWAT005779 | Kakasho [B, S]<br>Khalkhalich [K]<br>Khulkhulo [K]<br>Stwirg [W] | Aerial parts | Cooked in *Dawdoo* | + | + | + | + | + | + | + | | | No |
| *Berberis parkeriana* C.K. Schneid.; Berberidaceae; SWAT005491 | Chong [K]<br>Chikoring [S]<br>Ishkor [W]<br>Ishkoring [B]<br>Ishkorash [B]<br>Ishkoring [K]<br>Karaqoot [W]<br>Zolag [W] | Fruits | Raw snack | + | + | + | + | + | + | + | + | | No |
| *Bergenia stracheyi* (Hook. F. and Thomson) Engl.; Saxifragaceae | Beesapur [K]<br>Bushk [W]<br>Geesapur [K]<br>Geesapur [B]<br>Geesapur [S]<br>Sapur [W] | Roots | Tea | + | + | + | + | + | + | + | + | + | Yes |
| *Brassica rapa* L.; Brassicaceae; SWAT005807, SWAT005520 | Charrsham [S]<br>Chiroogh [W]<br>Malharo [B]<br>Malharo [K] | Leaves | Cooked | + | + | + | + | + | + | + | + | | Yes |
| *Capparis spinosa* L.; Capparaceae; SWAT005794 | Chopur [B]<br>Kapur [W]<br>Kaveer [K]<br>Kaveer [S] | Flowers | Cooked | + | + | + | + | + | + | + | + | + | Yes |
| *Carum carvi* L.; Apiaceae; SWAT005486 | Hojooj [B]<br>Hojooj [K]<br>Hojooj [S]<br>Zeera [W] | Seeds | Seasoning | + | + | + | + | + | + | + | + | + | Yes |
| | | | Tea | + | + | + | + | + | + | + | + | + | |

**Table 2.** *Cont.*

| Botanical Taxon; Family; Botanical Voucher Specimen Code | Recorded Local Names | Parts Used | Recorded Local Food Uses | Religious and Linguistic Communities in Which the Food Use Was Recorded | | | | | | | | | Previously Reported in Pakistan |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | IBY | IKI | IKY | ISI | IWI | SBY | SKI | SKY | SSI | |
| *Chenopodium album* L.; Amaranthaceae; SWAT005509, SWAT005499 | Konah [S]<br>Konakh [K]<br>Konakh [B]<br>Shileet [W] | Aerial parts | Cooked | + | + | + | + | + | + | + | + | + | Yes |
| *Cotoneaster nummularius* Fish. and Mey.; Rosaceae; SWAT005485 | Dodool [S]<br>Dundal [B]<br>Mikeen [K] | Fruits | Snack | + | + | + | + | + | + | + | + | + | Yes |
| *Echinops echinatus* Roxb.; Asteraceae; SWAT005490 | Chacheer [S]<br>Chancheer [B]<br>Chancheerak [K]<br>Kankeer [W]<br>Kareer [W] | Roots | Snack | + | + | + | + | + | + | + | + | + | No |
| *Elaeagnus angustifolia* L.; Elaeagnaceae; SWAT005806, SWAT005808 | Ginahoor [B]<br>Gunair [S]<br>Sisk [W]<br>Sonjoor [K] | Bark | Tea | + | + | + | + | + | + | + | + | + | Yes |
| | | Flowers | Seasoning | + | + | + | | | + | + | + | | |
| | | Fruits | Snack | + | + | + | + | + | + | + | + | + | |
| *Eremurus himalaicus* Baker; Xanthorrhoeaceae | Laqa [K, S]<br>Laqa [B]<br>Laqanz [K]<br>Laqo [S] | Aerial parts | Cooked | + | + | + | + | + | + | + | + | + | Yes |
| *Hedysarum falconeri* Baker; Leguminosae | Shavoo [K]<br>Shingalo [B] | Bark | Tea | + | | + | | | + | | + | | Yes |
| | | Shoots | Snack | + | | + | | | + | | + | | |
| *Helianthus tuberosus* L.; Asteraceae; SWAT005476 | Jangli Kachalo [K, S]<br>Jangli Kachalo [B] | Tubers | Snack | + | + | + | + | + | + | + | + | | No |
| *Iris hookeriana* Foster; Iridaceae; SWAT005478 | Shato [K]<br>Sosan [B, K]<br>Sosan [W, S] | Aerial parts | Cooked | + | | + | + | + | + | + | + | + | No |
| *Lepidium didymium* L.; Brassicaceae | Holominazk i [B]<br>Khodong [K]<br>Shadoi [W]<br>Shadong [K]<br>Shadong [K]<br>Shadoging [S] | Aerial parts | Cooked | + | | + | + | + | + | + | + | + | No |
| *Lepyrodiclis holosteoides* (C.A. Mey.) Fenzl ex Fisch. and C.A. Mey.; Caryophyllaceae | Balghar [B]<br>Birghal [K, S]<br>Yarkwoosh [W] | Aerial parts | Cooked | + | + | + | + | + | + | + | + | + | Yes |
| *Medicago sativa* L.; Fabaceae; SWAT005797, SWAT005795 | Ishpit [B] | Aerial parts | Cooked | + | | | | | | | | | Yes |
| *Mentha longifolia* (L.) L.; Lamiaceae; SWAT005792, SWAT005790 | Ben [K]<br>Phalaling [B]<br>Phaleel [S]<br>Wadan [W] | Aerial parts | Salad | + | + | + | + | + | + | + | + | + | Yes |

**Table 2.** *Cont.*

| Botanical Taxon; Family; Botanical Voucher Specimen Code | Recorded Local Names | Parts Used | Recorded Local Food Uses | Religious and Linguistic Communities in Which the Food Use Was Recorded | | | | | | | | | Previously Reported in Pakistan |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | IBY | IKI | IKY | ISI | IWI | SBY | SKI | SKY | SSI | |
| *Morchella esculenta* (L.) Pers.; Morchellaceae | Shalkhot [W]<br>Shoto [B, K]<br>Shoot [S] | Aerial parts | Cooked | + | + | + | + | + | + | + | + | + | Yes |
| *Portulaca quadrifida* L.; Portulacaceae | Pichili [W, S]<br>Pichiling [K, B] | Aerial parts | Cooked | + | + | + | + | + | + | + | + | + | Yes |
| *Rheum maximowiczii* Royle; Polygonaceae | Chotal [S]<br>Naik [W]<br>Shpaar [K]<br>Zeekap [B, K]<br>Zeekap [K, S]<br>Zeepak [S] | Stalks | Snack | + | + | + | + | + | + | + | + | + | Yes |
| *Rheum* sp.; Polygonaceae | Chotool [S]<br>Kakool [K, B]<br>Naik [W], | Young shoots | Snack | + | + | + | + | + | + | + | + | + | Yes |
| *Ribes alpestre* Wall.ex. Decne.; Grossulariaceae; SWAT005775 | Chilazum [W]<br>Ishkorash [B]<br>Shatoo [K]<br>Shatoo [B]<br>Shatoo [K, S] | Fruits | Snack | + | | | + | + | + | | + | + | Yes |
| *Ribes* sp.; Grossulariaceae; SWAT005774 | Ginat [W]<br>Inaat [W] | Fruits | Snack | | | | | + | | | | | Yes |
| *Rosa webbiana* Wall. ex Royle; Rosaceae; SWAT005502 | Chareer [W]<br>Goshalgoo [S]<br>Shawo [B]<br>Shinai [S],<br>Shingai [S]<br>Throni [K] | Bark | Tea | + | + | + | + | + | + | + | + | + | Yes |
| | | Flowers | Tea | + | + | + | + | + | + | + | + | + | |
| | | | Seasoning | + | + | + | + | + | + | + | + | + | |
| *Rubus fruticosus* G.N. Jones; Rosaceae | Tikbaranj [B]<br>Chootimirach [K]<br>Marach [K]<br>Marooch [K] | Fruits | Snack | + | + | | | | | + | + | | Yes |
| *Rumex dentatus* L.; Polygonaceae; SWAT005468 | Sirkonzoor [K] | Leaves | Cooked | | + | + | | | | + | + | | Yes |
| *Saussurea lappa* (Decne.) C.B. Clarke; Asteraceae | Minal [B, K, S] | Aerial parts | Additive in the home-made processes of yogurt and butter production | + | + | + | | | + | + | + | | No |
| *Salvia nubicola* Wall. ex Sweet; Lamiaceae; SWAT005761 | Paltasho [B] | Shoots | Snack | + | | | | | | | | | Yes |
| *Silene conoidea* L.; Caryophyllaceae; SWAT005481, SWAT005514 | Hapupar [B, K, S] | Aerial parts | Cooked | + | + | + | + | | + | + | + | | Yes |

**Table 2.** *Cont.*

| Botanical Taxon; Family; Botanical Voucher Specimen Code | Recorded Local Names | Parts Used | Recorded Local Food Uses | Religious and Linguistic Communities in Which the Food Use Was Recorded | | | | | | | | | Previously Reported in Pakistan |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | IBY | IKI | IKY | ISI | IWI | SBY | SKI | SKY | SSI | |
| *Silene vulgaris* (Moench) Garcke; Caryophyllaceae; SWAT005475 | Tumtak [K, S] | Aerial parts | Cooked | | + | | + | | | + | + | + | Yes |
| *Sorbus* sp.; Rosaceae | Tar bhalt [B]<br>Lalmi Palough [K] | Fruits | Snack | + | | | | | | | + | | Yes |
| *Taraxacum campylodes* G.E. Haglund; Asteraceae | Ishkanacho [B, K, S]<br>Papas [W] | Leaves | Cooked and salad | + | + | + | + | + | + | + | + | + | Yes |
| *Thymus linearis* Benth.; Lamiaceae | Jambilak [W]<br>Krotum [S]<br>Sew [K]<br>Tumoor [B, K]<br>Tumooru [S] | Aerial parts | Tea and seasoning | + | + | + | + | + | + | + | + | + | Yes |
| *Tulipa* sp.; Liliaceae | Cheeram [K]<br>Chirongo [B] | Bulbs | Snack | + | | + | | | + | | + | | Yes |
| *Urtica dioica* L.; Urticaceae; SWAT005479, SWAT005501 | Drozono [K]<br>Ghashoshing [B, K]<br>Joomi [S]<br>Zoomi [S] | Leaves | Cooked | + | + | + | + | | + | + | + | + | Yes |
| *Vicia sativa* L.; Fabaceae; SWAT005798, SWAT005799 | Barawo [B, K, S] | Aerial parts | Cooked | + | + | + | + | | | + | + | | Yes |
| Unidentified taxon | Navoohar [B, K, S] | Aerial parts | Cooked | + | | + | + | | + | | + | | |

[B]: Folk name recorded among Burusho people; [K]: folk name recorded among Kho people; [S]: folk name recorded among Shina people; [W]: folk name recorded among Wakhi people; IBY: food use recorded among Ismaili Burusho in the Yasin Valley; IKI: food use recorded among Ismaili Kho in the Ishkoman Valley; IKY: food use recorded among Ismaili Kho in the Yasin Valley; ISI: food use recorded among Ismaili Shina in the Ishkoman Valley; IWI: food use recorded among Ismaili Wakhis in the Ishkoman Valley; SBY: food use recorded among Sunni Burusho in the Yasin Valley; SKI: food use recorded among Sunni Kho in the Ishkoman Valley; SKY: food use recorded among Sunni Kho in the Yasin Valley; SSI: food use recorded among Sunni Shina in the Ishkoman Valley; +: food use quoted by less than 50% of the study participants; **+**: food use quoted by 50% or more of the study participants; *Dawdoo:* noodle soup traditionally consumed in the winter season.

Among the thirty-nine reported botanical taxa, thirty-eight were taxonomically identified. The recorded taxa also included one fungal taxon. In addition, the plant taxa included a few cultivated food plants that were considered by locals to be "wild", and/or they were used in unusual ways (these taxa are also included in Table 2). In the same table we also indicated the most quoted taxa for each considered religious and ethnic group. Among the recorded wild food plants, twenty-one taxa were cooked and consumed as vegetables. Some of the most frequently used plant species cooked as vegetables were *Allium carolinianum*, *Allium fedtschenkoanum*, *Amaranthus cruentus*, *Artemisia annua*, *Capparis spinosa*, *Eremurus himalaicus*, *Iris hookeriana*, *Lepidium didymium*, *Lepyrodiclis holosteoides*, *Taraxacum campylodes* and *Urtica dioica*.

Furthermore, thirteen taxa were consumed raw as snacks and a few plants were used in recreational herbal teas and as seasonings. Wild plant taxa used in herbal drinks or seasonings that were frequently mentioned included the seeds of *Carum carvi,* the bark of *Elaeagnus angustifolia* and the aerial parts of *Thymus linearis*. Wild food plants from the study area, which were rarely quoted included: *Medicago sativa, Ribes* spp., *Rubus fruticosus, Rumex dentatus*, *Saussurea lappa*, *Silene conoidea*, *Silene vulgaris*, *Sorbus* sp. and *Tulipa* sp. It is worth mentioning that only two plants, namely *Allium carolinianum* and *Allium fedtschenkoanum*, were frequently quoted by all the investigated groups.

During the course of the ethnobotanical survey, local communities did not mention any wild plants used in fermentation. Study participants stated that there are certain plants that were mainly collected during the late spring, including *Allium carolinianum, Allium fedtschenkoanum, Bergenia stracheyi, Capparis spinosa, Carum carvi, Eremurus himalaicus*, *Rheum* spp. and *Thymus linearis*. Some of the study participants also mentioned that *Capparis spinosa*, which could usually be found near houses in villages where it was mostly gathered by women and children, was also sold in the market as it was an important medicinal plant. Study participants described certain plant species, which were collected in the mountains when needed for mainly medicinal purposes. An important spot for the collection of wild plants is represented by pastures located at higher elevations to which animals are taken to graze (called "Nalla"). Some wild food plants are collected there and later brought home (Figure 5).

**Figure 5.** Locals and the first author after having gathered wild food plants in *Nalla*.

After a detailed literature survey, we found some food uses of certain plant taxa, which were quite new and have not been mentioned, to the best of our knowledge, in any previous wild food ethnobotanical reports in Pakistan and surrounding Pamir areas. These plants included: *Artemisia annua*, *Berberis parkeriana*, *Hedysarum falconeri*, *Iris hookeriana*, *Lepidium didymium* and *Saussurea lappa*.

### 3.3. Cross Cultural Analyses

In the Yasin Valley, comparative assessment of wild plant uses among Ismaili Kho, Sunni Kho, Ismaili Burusho and Sunni Burusho indicated that the largest number of plant taxa was reported by Sunni Kho, and a large majority of wild food plant taxa were shared, apart from a few, minor divergences (Figure 6A). The greatest similarity was observed between Ismaili Kho and Sunni Burusho for recorded wild food plant uses.

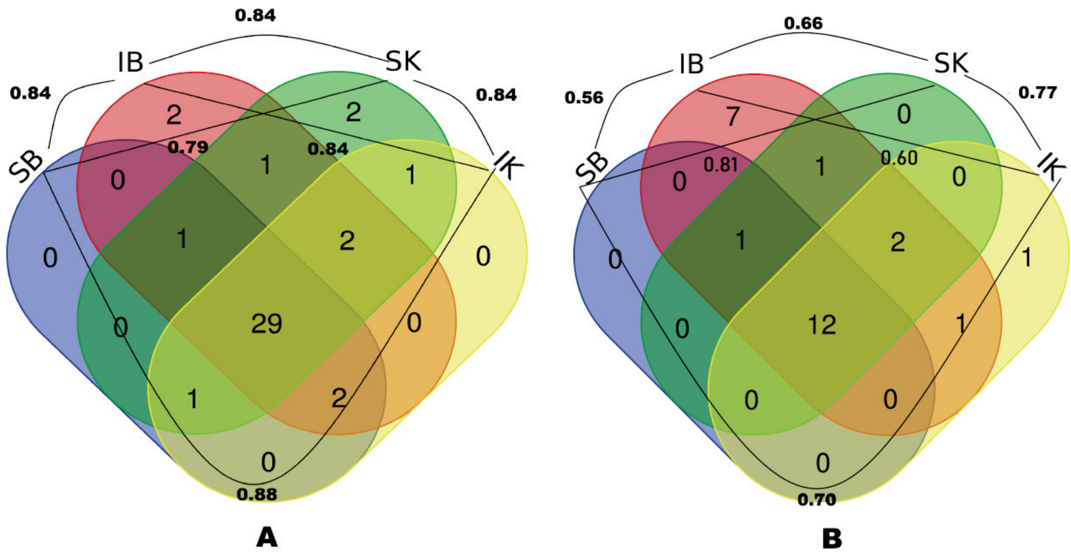


**Figure 6.** Venn diagrams showing the Jaccard indexes and overlap of (**A**) overall recorded wild food plants and (**B**) the most frequently reported wild food plants (quoted by more than 50% of the informants) among the four studied groups (IB: Ismaili Burusho, IK: Ismaili Kho, SB: Sunni Burusho, SK: Sunni Kho) in the Yasin Valley.

In order to specify more precisely the effect of language and religion on traditional knowledge of wild plant uses, we also compared the most frequently quoted plants among the groups. It was noted that half of the frequently reported taxa were common to all the studied groups and the majority of these plants were reported by Ismaili Burusho (Figure 6B).

In the Ishkoman Valley, cross-cultural comparison of wild food plant uses among Ismaili Kho, Sunni Kho, Ismaili Shina, Sunni Shina and Ismaili Wakhi demonstrated that of the total reported taxa half were common among the groups (Figure 7A).

The largest number of wild plant taxa was reported by Sunni Kho, while Sunni Shina reported the lowest number of wild food taxa. The greatest similarity was observed between Ismaili Kho and Sunni Kho, whereas the least similarity was recorded between (a) Sunni Kho and Sunni Shina, and (b) Ismaili Kho and Ismaili Wakhi. Furthermore, in the valley, approximately one third of the frequently quoted plant taxa were used by all the studied groups (Figure 7B). Similarly, we also found great overlap of wild food taxa reported from both valleys, and approximately 90% of the plant uses were the same (Figure 8).

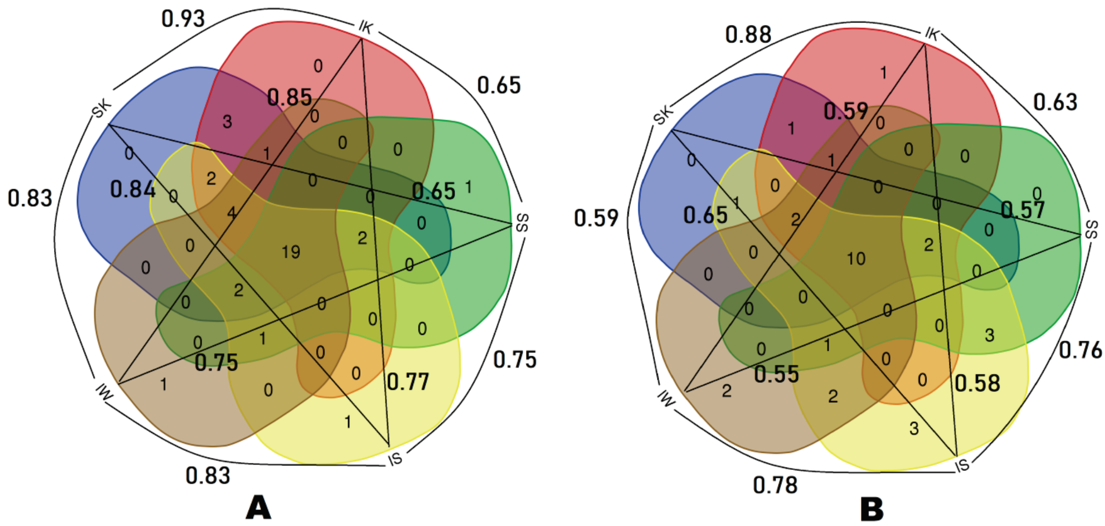


**Figure 7.** Venn diagrams showing Jaccard indexes and the overlap of (**A**) overall recorded wild food plants and (**B**) the most frequently reported wild food plants (quoted by more than 50% of the informants) among the five studied groups (IK: Ismaili Kho, IS: Ismaili Shina, IW: Ismaili Wakhi, SK: Sunni Kho, SS: Sunni Shina) in the Ishkoman Valley.

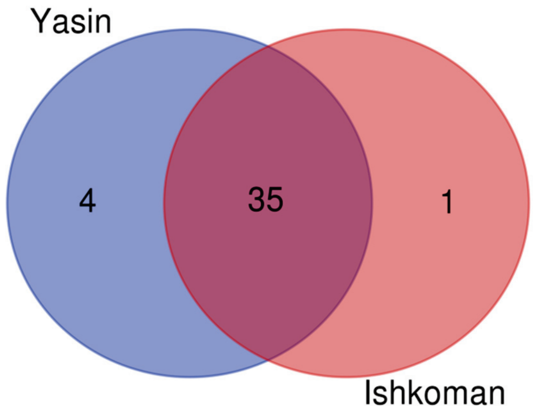


**Figure 8.** Venn diagram showing the overlap among the studied groups in both valleys for the recorded wild food plants.

## 4. Discussion

### *4.1. Ismailism and Its Cultural Pluralism: A Homogenizing Factor for LEK and LFK?*

The cross-cultural ethnobotanical analysis has shown that remarkable commonalities among the selected studied groups and the overlapping pattern of wild plant uses confirms some form of cross-interaction among communities, which shared the same environmental and sociocultural space for a few centuries. Our main finding suggests that the heritages of LEK and LFK concerning WFPs of the considered groups have not remained distinct and this could be due to intense social exchanges, which possibly the dominant Ismailism in the area could have allowed across history [76]. Moreover, in other works we have suggested that intermarriages between different cultural groups may lead to the homogenization of traditional knowledge, since most LEK and LFK are shaped by transmission passing from one female generation to the next [23–25,30]. In order to better evaluate the impact of this variable on the transmission of this knowledge system, we also qualitatively addressed kinship relationships among individuals of the studied groups. While study participants confirmed that—as nearly everywhere in the world—the transmission of LEK and LFK systems regarding food plants (and especially wild vegetables) passes mainly from mothers to daughters, they did not openly recognize the presence of endogamic rules. We often noticed the presence of intermarriages among the different cultural groups; for example, during the field research in the Ismaili community we found that a Burusho man married a Kho woman and a Shina woman married a Kho man. However, it was not uncommon to observe Sunnis that intermarried with locals having perhaps a different language but sharing the same faith. We also found families in which some members belonged to the Ismaili faith of Islam while others converted to the Sunni faith. These observations suggest a possible trend among Sunnis, which contradicts the historical cultural pluralism forged over centuries by Ismailism.

However, study participants confirmed us in their narratives that knowledge on WFPs goes beyond linguistic and religious boundaries and they have the perception that they all follow the same food patterns. During the survey, participants did not report any WFPs, which were exclusively consumed during specific food events or religious festivities of individual communities.

It is worth mentioning that among all the studied groups, Burusho was the only autochthonous linguistic group in the area, which is considered an isolated language group; Burushaski speakers used some WPFs that were very frequently reported within their group and hardly used by the other groups. This confirms the peculiar position of this group within the study area, where historically diverse invaders pushed the Burusho into the most remote and highest areas of the valley. Burushaski speakers were originally isolated, and yet the fact that they share qualitatively (but not quantitatively and in their frequency) the same wild food plants gathered by the other groups shows that after the arrival of other groups into the area they possibly generated complex cultural adaptation and negotiation processes. The crucial role of these negotiations among diverse ethnic pastoralist groups in the mountains of NW Pakistan was superbly described by Fredrick Barth (1928–2016) half a century ago [77].

Kassam has analyzed how adaptation is fundamentally linked to indigenous cultural values and local wisdom, and despite the fact that local communities in the neighboring Pamir Mountains have been subjected to dramatic changes within the last century (colonization, the Cold War, penetration of the market system, civil war and, lastly, dramatic climate change), their survival and continued existence speaks to their amazing capacity to adapt, demonstrating cultural and ecological pluralism, and highlighting the importance of "keeping all the parts" [78,79].

On the other hand, in another study we pointed out that selective convergence in wild food ethnobotanical knowledge could occur between ethnic groups during periods of food insecurity, and may leave a lasting mark on the body of orally transmitted LEK and LFK [28]. This could have also happened in the study area considered here.

Moreover, LEK and LFK may have been influenced by a specific linguistic adaptation as well. For instance, it was observed that the local names of certain WPFs are common to all the different communities: *Capparis spinosa* is known as Kaveer by the Kho and Shina, *Carum carvi* is referred to as Hojooj by the Burusho, Kho and Shina, *Chenopodium album* is called Konakh by both the Burusho and Kho and *Eremurus himalaicus* was described as Laqa by the Burusho, Kho and Shina. This linguistic adaptation was possibly linked to a broader cultural adaptation that minority groups underwent toward the majority groups or the groups speaking the lingua franca (Kho in our study area, [49]).

### *4.2. Dynamics of Change of Local Knowledge: Nalla and Its Vanishing Role*

LEK and LFK regarding WFPs has gone through remarkable changes in the past few decades, not only in terms of the frequency of gathering, but also generational dynamics in WFP gathering. For instance, participants frequently mentioned that in the past wild garlic (*Allium fedtschenkoanum* and *A. carolinianum*) was used in traditional cooking instead of onions bought from the market, but now no one uses this ingredient on a daily basis anymore. Similarly, *Urtica dioica* was formerly used as a common vegetable, but study participants claimed that the plant is no longer used very often in this manner. Participants also frequently claimed that the consumption of wild food plants has reduced with the passage of time due to certain factors including the availability of cultivated vegetables both from the market and fields. Some participants mentioned that most of the wild plants are not available near houses or within the village. In the study area, especially in the Yasin Valley, the Burusho community retains extensive knowledge of wild food plants. People living in Nalla, which still represent the core environment of the original pastoralist socioecological system, have broad skills in recognizing and gathering WFPs, but there is also a threat to this knowledge as they have begun to move down to the plain areas of the valleys in search of jobs and business opportunities. The majority of the visited local communities no longer pay attention to their wild food resources, apart from those community members still living in Nalla during the summer.

One of the study participants (71-year-old man) from the Yasin Valley mentioned his views using these words:

> "My father and grandfather used wild food plants in the old days when we were children and we also used the mountain, taking our animals to graze over there. When I was young I could walk and I was able to go to the mountains but now I can't climb them. As you ask about the degradation of wild food plants, I am not sure whether wild food plants are increasing or decreasing. I am old and my legs don't allow me to go there and see over there. Our younger generation is not interested in such cultural things because they have facilities and can get a modern education in cities. But I think that wild plants are still available in Nalla, but who among us is going to Nalla? Of course no one goes there because we don't need wild food plants anymore and the consumption of wild food plants is a story of former times when my father and forefather were poor and wild plants were easily available".

During the survey we also observed that some locals gathered WPFs at different locations across the region (Figure 5) because they also recognize their medicinal value and thus their practical and economic importance. Some locals mentioned that previously these plants were collected for food purposes but now they were collected for mainly medicinal use only; this was the case, for example, for *Allium carolinianum, Capparis spinosa* and *Bergenia stracheyi*.

*Allium carolinianum* is generally preferred by elderly people for treating joint pain. *Capparis spinosa*, which is found near the houses within villages, is frequently gathered in order to obtain an extract from its flowers; this extract, which was found in many homes, is famous for treating liver problems, as well as diabetes, hepatitis, cough, cold, fever and malaria. Similarly, in some households we also found the dried rhizomes of *Bergenia stracheyi*. Participants used to prepare an herbal tea of these rhizomes, but now they mainly utilized them for gastric problems. Local inhabitants also go to *Nalla* to gather these wild food plants for medicinal purposes and if they find them easily then the plants are cooked and eaten as a meal as well. During the course of the study, we recorded an interesting local perception about a wild plant, which is well known in mountain areas of Central Asia as an important, but threatened medicinal plant: *Saussurea lappa*, which is locally known as "Minal". Participants reported that in the past this plant was added to milk or yogurt in order to increase the amount of fat in yogurt or butter, respectively; this species was only been used within some specific families locally known as "Khandani Khalaq". It was believed that if a household used Minal this would have automatically reduced the amount of butter in the nearby houses, which was morally unacceptable and not allowed from a religious point of view. This suggests how certain food taboos in the study area may have been associated to the use of rare natural resources such as *Saussurea*. Similar patterns were recently observed in the gathering of ritual plants in Benin [80] and were especially well described by Alpina Begossi in her pioneering work on the coevolutive significance of fishing rare species in Brazil [81].

Moreover, in the study area locals mentioned that now Minal is used only for medicinal purposes in the Ghizar region and in other areas of Gilgit-Baltistan, as also well described in recent ethnobotanical literature [67].

This shift from of WFPs into the medicinal domain may have different reasons: the gathering of wild medicinal represents a good source of cash, while the resilience of folk medicinal practices seems to find wider social acceptance than that of WFPs, which often represent symbols of economic marginalization.

### 4.3. Strategies for the Future: Revitalizing the Wild Food Cultural Heritage and Nalla

In the study area, transformation of subsistence economies has led to market dependency, which has greatly affected local food systems. Due to this change, local knowledge systems are facing critical problems, which in turn are posing biocultural conservation problems and need critical attention from stakeholders. People living in Nalla still retain an important portion of LEK, but this heritage is threatened, since the Nalla-centered socioecological system is vanishing as a result of the increasing migration to the plain areas of the valleys for employment. In order to dynamically preserve the biocultural heritage and foodscape and to empower local subsistence economies, it is urgent that measures be put in place in order to revitalize Nalla. Policy makers and various stakeholders should also pay attention to the issue of how local knowledge systems, especially those circulating around Nalla, could be promoted and further transmitted. For fostering the resilience of LEK, it may be necessary to incorporate it into the existing school curricula with the help of traditional knowledge holders. This would not only possibly further transform LEK, but would also increase awareness of the need to preserve the local natural resources and especially the complex socioecological systems attached to it.

Revitalizing and increasing the appreciation for local wild plant resources could have a positive impact on the promotion of sustainable rural development. The entire area could become a hotspot of ecotourism, improving the economic condition of the local people by honoring their local culture. Ecotourism in the region could also alleviate the social isolation of some local groups and provide additional awareness of their traditional food cultural heritage, which could help to prevent the further erosion of LEK. However, promoting wild species could also have a negative impact on available genetic resources (over-exploitation) and therefore it would be crucial to frame this strategy within the larger picture of environmental education. Designing community-centered biocultural diversity conservation projects based on LEK could possibly generate better outcomes than traditional biodiversity conservation strategies. Nalla could become the center of these bio-cultural initiatives, in which local communities could engage with urban civil societies and visitors to also foster virtuous social exchange and internal social cohesion. It would be equally interesting to examine how younger generations of the area re-articulate this knowledge related to wild plant taxa as younger individuals are more exposed to "modernization" and are less interested in maintaining this biocultural heritage.

### 4.4. Food Security in Rural Areas of Pakistan: Quo Vadis?

In mountainous areas of Pakistan, as in other developing areas, livelihoods were based mainly on subsistence horticulture, livestock rearing and the use of common pastures, rangeland and forests. However, in recent times, governmental wheat subsidies and facilitated access to city markets have led to a profound transformation of livelihoods and farming systems, as in other communities of the region [34]. Until the 1980s, farming was mainly subsistence-oriented and modern technologies were largely absent, with dominant crops being wheat, barley, millets, buckwheat, maize, alfalfa and apricots. Over the last four decades, new technologies have been adopted, traditional crops have been replaced by potatoes and other cash crops, and small-scale family agriculture has lost its prominent importance in the diversified livelihoods of the village population [82]. Obviously these changes have also improved access to food supplies beyond local production. However, the aforementioned socioeconomic changes have led to a loss of food sovereignty as well, i.e., the self-sufficiency of local communities has decreased, posing new risks related to market dependency and also environmental hazards [83,84]. For instance, in Gilgit-Baltistan, a recent historic event has been critical for subsequent changes in local food systems: the catastrophic Attabad landslide in 2010 cut off a large populated area from access to down country Pakistan and posed serious economic threats for local communities across the area. This raises the question of whether the developments since the 1970s have actually reduced the ability of local food systems to cope with emerging economic, political and environmental risks and challenges [85]. Ultimately, food security issues in mountainous and rural areas of Pakistan still largely need to be addressed from a broader perspective, since food vulnerability is not only a matter concerning agroecosystems, supply chains, and even the resilience of LEK and LFK regarding WFPs. In particular, food insecurity in Pakistan also involves a complex interplay in which diverse factors are determinant: environmental change and degradation, cultural changes, gender issues (i.e., the still largely invisible social and economic role of women [86]), as well as the overall governance of food policies and economies at both the regional and national level [87,88].

## 5. Conclusions

The field study conducted among the different linguistic and religious groups living in the Ishkoman and Yasin valleys revealed a considerable, but possibly eroded, LEK and LFK concerning the folk use of wild botanical and mycological taxa. The finding showed that the studied groups of both valleys are currently mainly attached to horticultural food ingredients and dairy coming from livestock rearing, yet only partially still rely on wild food plant taxa. More than half of the wild food plant reports referred to vegetables that are cooked, while snacks roughly represented one third of the recorded botanicals. Comparative analysis of wild plant uses among the different groups in the two valleys showed no significant variation among the diverse visited groups. The conducted literature review demonstrated that some wild food plant taxa recorded in the current field study were not reported in any previous ethnobotanical food studies from the region. It is important to note that in this study there were some plant taxa recorded with past uses, while others switched from being food species to medicinal species. This study addressed also the complex transformations LEK and LFK systems underwent during the past decades and the possible strategies that are needed for revitalizing the complex wild food biocultural heritage, as well as for better implementing the future food security in mountain areas of Pakistan.

Further cross-cultural and possibly cross-temporal food ethnographic studies among different groups living in other areas of the Hindukush range could be vital for contributing to a better understanding of the dynamics of change in ethnobotanical knowledge and foodways in disadvantaged mountain areas.

**Author Contributions:** A.P. designed the theoretical framework of the research, and, together with M.A.A., planned the methodology and the field study. M.A.A. carried out the field study. Z.U. identified the ethnobotanical taxa. A.P. and M.A.A. analyzed the data and provided the cultural interpretation of the findings. M.A.A. drafted the first version of the manuscript, which was later commented on by A.M.A. and thoroughly revised and finalized by A.P. All authors have read and agreed to the published version of the manuscript.

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foods

*Article*

# Gathered Wild Food Plants among Diverse Religious Groups in Jhelum District, Punjab, Pakistan

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**Abstract:** Recent ethnobotanical studies have raised the hypothesis that religious affiliation can, in certain circumstances, influence the evolution of the use of wild food plants, given that it shapes kinship relations and vertical transmission of traditional/local environmental knowledge. The local population living in Jhelum District, Punjab, Pakistan comprises very diverse religious and linguistic groups. A field study about the uses of wild food plants was conducted in the district. This field survey included 120 semi-structured interviews in 27 villages, focusing on six religious groups (Sunni and Shia Muslims, Christians, Hindus, Sikhs, and Ahmadis). We documented a total of 77 wild food plants and one mushroom species which were used by the local population mainly as cooked vegetables and raw snacks. The cross-religious comparison among six groups showed a high homogeneity of use among two Muslim groups (Shias and Sunnis), while the other four religious groups showed less extensive, yet diverse uses, staying within the variety of taxa used by Islamic groups. No specific plant cultural markers (i.e., plants gathered only by one community) could be identified, although there were a limited number of group-specific uses of the shared plants. Moreover, the field study showed erosion of the knowledge among the non-Muslim groups, which were more engaged in urban occupations and possibly underwent stronger cultural adaption to a modern lifestyle. The recorded traditional knowledge could be used to guide future development programs aimed at fostering food security and the valorization of the local bio-cultural heritage.

**Keywords:** ethnobotany; wild food plants; traditional food; religious diversity; bio-cultural heritage; local resources

## 1. Introduction

Wild food plants have remained an important ingredient of traditional food basket systems especially in remote communities around the globe [1]. However, due to dramatic socio-cultural shifts local communities are facing and global climate change, dependence on wild food plants has drastically decreased in many areas. Food industrialization and globalization have severely impacted traditional food systems, especially in rural communities [2]. Consequently, traditional/local environmental knowledge (TEK) linked to wild food plants is becoming more and more endangered, and in some places of the world, it has already disappeared [3]. In recent decades, scientists have recorded several complex TEK systems associated to wild food plants, especially in marginalized areas. However, very few ethnobotanical field studies have focused on the cross-cultural and cross-regional comparison of TEK associated to wild food plants, despite the fact that cultural diversity shapes TEK [4–9].

In many regions of the world, inhabitants of rural areas depend on wild plants as food [10] and a large number of wild plant species occurring in a great variety of habitats are consumed [11,12]. Recent works have addressed the role that religious affiliation may play in shaping folk wild food plant uses and cuisines, since this factor shapes in many areas of the world kinship relations and the vertical transmission of plant and gastronomic knowledge [13–15]. However, all over the world wild plants have been more frequently consumed in the past [10]. There are over 20,000 species of wild edible plants in the world, yet fewer than 20 cultivated species now provide 90% of our main staples [16].

The collection and culinary use of wild plants for food are part of the bio-cultural heritage of local communities and therefore can foster their future sustainability [17,18]. During the last decades, a large number of publications have documented the ethnobotany of wild food plants, but only sporadically scholars have tried to articulate the evaluation of socio-cultural and economic factors possibly influencing foraging [19–32]; simultaneously, research on specific domains of the plant foodscape, such as that of fermentation of local plants (sometimes wild) is exponentially growing [33–45].

Pakistan comprises remarkable natural resources, and a large variety of religious faiths and linguistic communities using a wide range of wild food plants [46]. Many rural communities in Pakistan live closely attached to their natural resources [47] and wild food plants are often consumed for food [48]. A few comparative studies have very recently addressed the cross-cultural dimension of wild food plants gathering and use in Pakistan, and highlighted the role of diverse linguistic and religious groups [49–51].

In order to further evaluate this trajectory, the current study focused on six religious groups (Sunni and Shia Muslims, Christians, Hindus, Sikhs, and Ahmadis—also named Qadiani in official Pakistani documents, despite this term is considered sometime derogatory by the community), speaking eleven different languages (Urdu, Punjabi, Phtohari, Gojri, Pahari, Hindko, Saraiki, Sindhi, Pashto, Kashmiri, and Hindi) in Jhelum District, Punjab, NE Pakistan.

The main aim of our research was to record local knowledge related to wild food plants and also to provide baseline documentation to help local stakeholders revitalizing their food traditions. We particularly explored the impact of religious and linguistic affiliation on the gathering, utilization and consumption of wild food plants in 27 villages in Jhelum district, Punjab, Pakistan, hypothesizing that there could be some differences between different faiths.

The specific research objectives of this study were:

- to explore and record the diversity of wild food plants gathered in Jhelum,
- to evaluate the local food and possible traditional perceptions,
- to compare the mentioned wild food plants among the six selected religious faith groups in order to possibly understand cross-cultural similarities and differences and to better understand the cultural context supporting the use of wild food plants found in Jhelum district.

## 2. Materials and Methods

### *2.1. Study Area*

The study area of Jhelum district is located North of the river Jhelum and is bordered by Rawalpindi district in the North, Sargodha and Gujrat districts in the South, Azad Jammu and Kashmir in the East, and Chakwal district in the West [52,53]. The population of the district is 1.22 million, and 71% of the population lives in rural areas, while the remaining 29% are urban [54]. The climatic conditions are semi-arid, warm-subtropical, characterized by warm summers and severe winters. Jhelum is a semi-mountainous area (Figure 1), with a mean annual rainfall of 880 mm. The annual average temperature reaches 23.6 °C. Jhelum is home to the world's second largest salt mine (Khewra) covering about 1000 ha [53,55]. The people of Jhelum have a diverse culture with distinct modes of life, traditions, and beliefs [56]. The ethnic groups of the area show a strong connection to wild plants which often have cultural and medicinal significance [57].


**Figure 1.** Diverse landscapes of Jhelum study area, NE Pakistan; (**a**–**d**): landscape depicting leading plant species associations (indicator species: *Acacia modesta*, *Acacia nilotica*, *Prosopis juliflora*, *Ziziphus numularia*, *Justicia adhatoda* and *Dodonea viscosa*); (**e**–**g**): exposed sedimentary bedrock stratification (age: Pre-Cambrian to Pliocene; composition: limestone, sandstone, shale, and dolomite) and sandy loam textured soil; (**h**): rangeland for livestock grazing.

The study was conducted in 27 remote villages (Figure 2), all of which contained rivers, mountains, forests, salt mines, and valleys. Some typical and important attributes including landscapes, vegetation, geology and soil, and rangeland are shown in Figure 1.

*2.2. Field Study*

The ethnobotanical field research was conducted from March to November 2020. Study participants were selected through snowball sampling focusing on middle-aged and elderly inhabitants (range: 40–90 years old), especially farmers, herders, and housewives. Selected interviewees belonged to different religious faiths and different language groups. Twenty participants (men and women) from each religious group were selected and participated in the survey. The characteristics of the study participants from the 27 visited villages and their different socio-cultural and economic attributes are reported in Table 1.

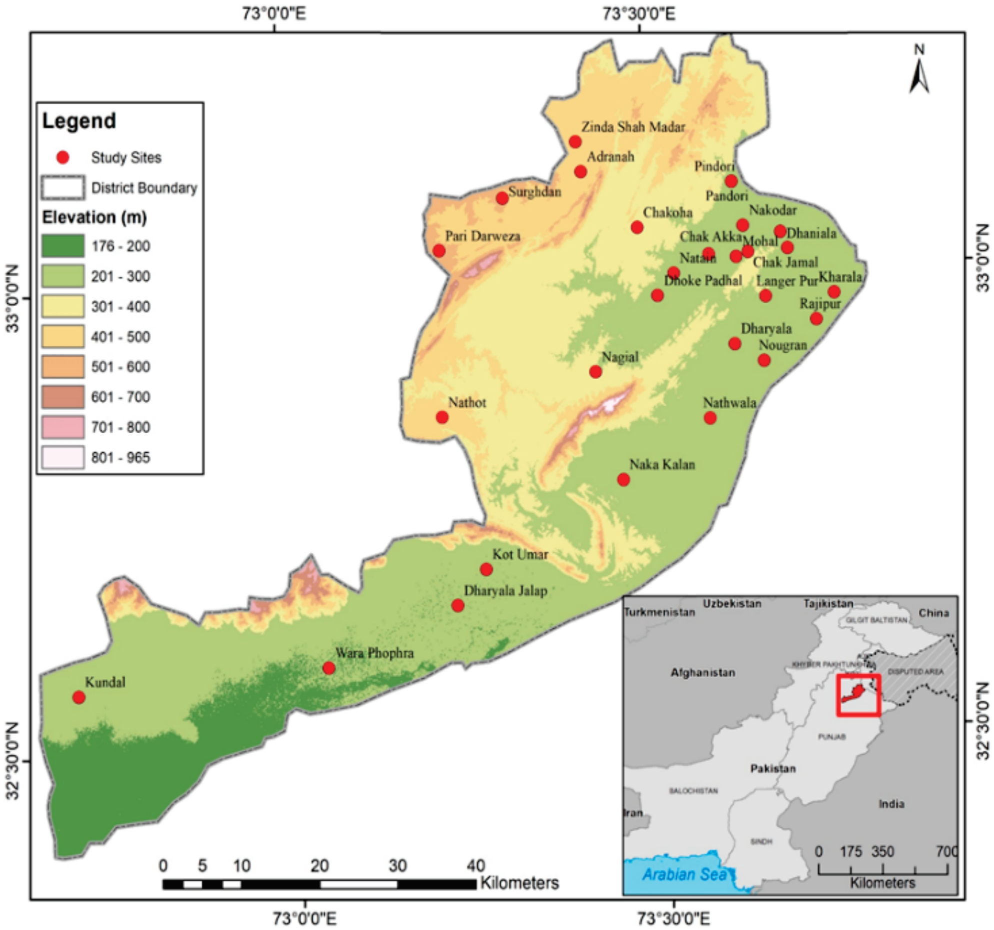


**Figure 2.** The map of the study area displaying the studied sites/village locations.

Prior to starting an interview, oral informed consent was obtained, and the Code of Ethics of the International Society of Ethnobiology [58] was followed. Semi-structured interviews were conducted in the national language, Urdu, and some local languages (Punjabi, Saraiki, Pothohari, Gojri, Hinko, Pahari, Kashmiri, Sindhi, and Hindi) with the help of translators. The information collected focused on the gathering and consumption patterns of wild plants as cooked vegetables, raw snacks, salads, herbal drinks, recreational herbal teas, jams, and for fermentation following Kujawska and Łuczaj [59]. Particular questions were focused on the use of wild plants in daily food habits or in food fermentation, and the consumption of edible wild food plants [49]. Local names of collected taxa were recorded in eleven different local languages.

During the interviews qualitative ethnographic data was documented following Termote et al. [60]. The recorded wild food plants were collected from the study area and were identified using the Flora of Pakistan [61–63]. After correct identification, each taxon was given a voucher specimen number and deposited in the Herbarium of the Department of Botany, University of Gujrat, Punjab, Pakistan. For nomenclature, the Plant List database [64] was followed for plants, and the Index Fungorum [65] for the single recorded mushroom taxon. The plant family nomenclature follows the Angiosperm Phylogeny Group [66].

**Table 1.** Characteristics of the study participants.

| Religious Group | Sunnis | Shias | Hindus | Sikhs | Christians | Ahmadis |
|---|---|---|---|---|---|---|
| Brief historical sketch | Islam arrived in the 8th century, the majority converted to Sunni Islam during in the 11th–16th centuries; minor fractions migrated from Middle Eastern and African countries | The majority converted to Shia Islam during the 16th–18th centuries; minor fractions migrated from the Middle East | Autochthonous | Converted around the 15th century | Emerged with British colonialism in the 18th and 19th centuries | Converted in the 19th century |
| Approx. number of inhabitants in Jhelum District, Pakistan (2020) | 1.01 million | 0.21 million | 2000 | 5000 | 7000 | 6000 |
| Study villages | Dhoke Padhal, Dharyala, Chakoha, Mohal, Natain, Zinda Shah Madar, Surghdan, | Chak Jamal, Kundal, Pindori, Nathot | Chak Akka, Nathwala, Nakodar, Pari Darweza | Dhaniala, Nougran, Adranah | Nagial, Kot Umar, Dharyala Jalap | Naka Kalan, Rajipur, Kharala, Wara Phophra, Langer Pur |
| Spoken languages | Pothwari, Kashmiri, Pashto | Saraiki, Pahari, Pothwari | Hindku, Hindi, Sindhi | Punjabi, Gojri | English, Urdu | Urdu |
| Inter-marriages | Rarely exogamic with Shia | Rarely exogamic with Sunni | Endogamic | Strictly endogamic | Endogamic | Strictly endogamic |
| Main occupations | Forestry and farming | Forestry and farming | Farming and urban occupations | Pastoralism and urban occupations | Horticulturalism and urban occupations | Horticulturalism |
| Estimated average socio-economic status of the study participants | Middle | Middle | Low | Low | Low | Middle low |
| Number of study participants | 20 | 20 | 20 | 20 | 20 | 20 |
| Percent of female participants | 30% | 25% | 25% | 45% | 45% | 30% |
| Overall mean age of the study participants | 47 | 53 | 64 | 66 | 59 | 69 |

### 2.3. Data Analysis

The documented data was stored in two main binary data spreadsheets (1. Species gathered for any use; 2. Species gathered for specific use) across the six local religious communities and compared through Venn diagrams and pairwise Jaccard's dissimilarity using the R Statistical Package [67–69].

The Jaccard Index (JI) was calculated as:

$$J(X, Y) = |X \cap Y| / |X \cup Y|$$

X = Individual set of plant usages documented by group X

Y = Individual set of plant usages documented by group Y

By using JI, Jaccard's distance (JD) was calculated as:

$$D(X,Y) = 1 - J(X,Y)$$

Moreover, a qualitative comparison with other studies on wild food plants carried out in Pakistan [49–52,70–72] was conducted.

## 3. Results and Discussion

### 3.1. Reported Wild Food Plants and Their Uses

A total of seventy-eight taxa (77 vascular plants and one mushroom) were gathered and consumed in different ways in the study area (Table 2). The most commonly used wild food plant species were native, with the exception of *Agave americana*, *Amaranthus spinosus*, *Sonchus oleraceus*, *Tephrosia purpurea*, *Trigonella corniculata*, *Salvia moorcroftiana*, *Salvia nubicola*, *Solanum incanum*, *Chenopodium album*, and *Portulaca quadrifida*, which were grown as herbs or grew wild as weeds in anthropogenically disturbed locations. A total of nine different typologies of food preparations were identified: chutneys (a family of spicy condiments and sauces prototypical of South Asian cuisines); cooked vegetables; fermented preparations; herbal drinks (plant material infused in cold water); herbal teas (plant material infused in hot water); jams; raw snacks (consumed singly, mostly in the field at the collection site); salads (raw plants consumed at the dining table as a starter and/or in conjunction with other food items); and seasoning/spices.

**Table 2.** Recorded wild food plants and their local uses.

| Plant Species, Family, and Voucher Specimen Number | Local Names | Parts Used | Gathering Area and Season | Local Culinary Uses and Quotation Frequency | Frequency of Consumption |
|---|---|---|---|---|---|
| *Acacia modesta* Wall.;<br>Leguminosae;<br>827/MM//2020 | Pholai[UR, PN, PT, HN]<br>Pali[PH, GJ]<br>Jangli Kiker[SR]<br>Palosa[PS]<br>Angrezi Babur[SN]<br>Kiker Kul[KM] | Gum,<br>Leaves | DL, FO, HS, RS, SP, WP; March–April | Fermentation[HN**, SI*]<br>Jam[SH*, SN] | Very common[SH]<br>Common[HN]<br>Rare[SN]<br>Very rare[SI] |
| *Acacia nilotica* (L.) Delile;<br>Leguminosae;<br>783/MM//2020 | Kikar[UR, PN, PT, HN, HI]<br>Kikr[SR, PH, GJ, KM]<br>Kikhar[PS]<br>Sindhi Babur[SN] | Gum,<br>Pods | DL, FO, HS, RS, SP, WP; March–April | Fermentation[SH**, QA*]<br>Jam[SI**, SN] | Very common[SH]<br>Common[QA]<br>Rare[SN]<br>Very rare[SI] |

**Table 2.** *Cont.*

| Plant Species, Family, and Voucher Specimen Number | Local Names | Parts Used | Gathering Area and Season | Local Culinary Uses and Quotation Frequency | Frequency of Consumption |
|---|---|---|---|---|---|
| *Aerva javanica* (Burm. f.) Juss. ex Schult.; Amaranthaceae; 544/MM//2020 | Boen[UR]<br>Thoo[PN]<br>Boi[PT, PH, GJ, KM]<br>Niki Boien[SR]<br>Shorakai[PS]<br>Sparokai[PS]<br>Booh[SN]<br>Safed Bui[HI] | Flowers, Leaves, Seeds | DL, FO, GR, HS, SP, SL, WP; February–April | Cooking[CR**, QA*, SH, SN**] | Very common[SH]<br>Common[SN]<br>Rare[CR]<br>Very rare[QA] |
| *Agave americana* L.; Asparagaceae; 675/MM//2020 | Jangli Kwar Gandal[UR]<br>Laphra[PN, PH, GJ]<br>Kanwar Phara[SR]<br>Desi Kwar Gandal[PT]<br>Kamal Gand[KM]<br>Keuro[SN]<br>Zargira[PS]<br>Kamal Cactus[HN]<br>Bin Katora[HI] | Leaves | AL, DL, FO, GL, GR, RS, SP, WP; August–September | Cooking[SN, SH, HN*, QA **] | Very common[SH]<br>Common[SN]<br>Rare[QA]<br>Very rare[HN] |
| *Allium carolinianum* DC.; Amaryllidaceae; 409/MM//2020 | Jangli Pyaz[UR, KM, HN]<br>Jangli Ganda[PN, PT, GJ]<br>Jangli Wasal[SR]<br>Khokhai[PS] | Bulbs | DL, FO, GL, SP, SH; August–September | Cooking[CR*, SN*]<br>Salad[QA*, SH*] | Very common[SN]<br>Common[CR]<br>Rare[SH]<br>Very rare[QA] |
| *Amaranthus spinosus* L.; Amaranthaceae; 787/MM//2020 | Cholai[UR]<br>Konjel[PN]<br>Surkh Gunahr[PH, PT]<br>Batto[SR]<br>Ghinyar[GJ, KM]<br>Chalvery[HN]<br>Sarmay[PS]<br>Kalga[SN]<br>Gulee[KM]<br>Ganhar[HN]<br>Kanta Chaulai[HI] | Leaves | AL, GL, HS, RS, SL, SH, WP; August–September | Cooking[CR*, SH***, SI**, SN] | Very common[SN]<br>Common[SI]<br>Rare[CR]<br>Very rare[SH] |
| *Amaranthus viridis* L.; Amaranthaceae; 878/MM//2020 | Jangli Choolai[UR]<br>Tandla[PT, GJ, PH]<br>Tandula[SR]<br>Tanduli[PN]<br>Lutur[SN]<br>Saag[PS]<br>Ranzaka[PS]<br>Ganyar[HN]<br>Ganar[KM] | Leaves | AL, GL, HS, RS, SL, SH, WP; August–September | Cooking[QA*, SH, SI**, SN] | Very common[SN]<br>Common[SI]<br>Rare[SH]<br>Very rare[QA] |
| *Boerhavia repens* L.; Nyctaginaceae; 816/MM//2020 | Looni Booti[UR]<br>Lornki[PN, PT]<br>Lorank[SR]<br>Bakhro[SN] | Leaves | AL, FO, GL, GR, HS, RS, SH, WP; August–September | Cooking[SN**, SH, SI**, CR**] | Very common[SN]<br>Common[SH]<br>Rare[CR]<br>Very rare[SI] |
| *Cannabis sativa* L.; Cannabaceae; 669/MM//2020 | Bhang[UR, SN, SR, GJ, PH, KM]<br>Pang[PN, PT, HN]<br>Kamm[PS] | Leaves, Seeds | AL, GL, GR, RS, SH, WP, WL; March–April | Herbal drink[SN, SH*, SI**, QA] | Very common[SN]<br>Common[SH]<br>Rare[QA]<br>Very rare[SI] |

**Table 2.** *Cont.*

| Plant Species, Family, and Voucher Specimen Number | Local Names | Parts Used | Gathering Area and Season | Local Culinary Uses and Quotation Frequency | Frequency of Consumption |
|---|---|---|---|---|---|
| *Capparis decidua* (Forssk.) Edgew.; Capparaceae; 532/MM//2020 | Karir$^{UR}$<br>Pichu$^{UR}$<br>Karinha$^{PN, GJ}$<br>Kari$^{SR}$<br>Kareenh$^{PT, PH, KM}$<br>Kareer$^{HN}$<br>Dela$^{GJ, KM}$<br>Kreeta$^{PT}$<br>Kareenh$^{SR}$<br>Kira$^{PS}$<br>Jaba$^{PS}$<br>Kirar$^{SN}$<br>KairHI | Fruits | DL, FO, GR, HS, SP; August-September | Fermentation$^{SN**}$<br>Jam$^{SH*}$<br>Raw snacks$^{SI**, CR*}$ | Very common$^{SH}$<br>Common$^{SN}$<br>Rare$^{CR}$<br>Very rare $^{SI}$ |
| *Caragana ambigua* Stocks.; Leguminosae; 409/MM//2020 | Jangli Phali$^{UR, PN, PT, GJ}$<br>Baiphli$^{SR}$<br>Zaray$^{PS}$ | Flowers, Pods | RS, SL, SH, WP; June–July | Cooking$^{CR*}$<br>Raw snacks$^{SN*, SI}$<br>Salad$^{HN**}$ | Very common$^{SN}$<br>Common$^{SI}$<br>Rare$^{CR}$<br>Very rare$^{HN}$ |
| *Chenopodium album* L.; Amaranthaceae; 748/MM//2020 | Jangli Bathoo$^{UR}$<br>Desi Bathoo$^{PN, PT, PH, GJ}$<br>Desi Battoon$^{SR}$<br>Surma$^{PS}$<br>Sormi$^{PS}$<br>Spin Soba$^{PS}$<br>Buthia$^{PS}$<br>Udharam$^{HN}$<br>Chil$^{SN}$<br>Bathwa$^{KM}$<br>Goyalo$^{HI}$ | Branches, Leaves | AL, FO, GL, GR, HS, RS, SL, SH, WP; March–April, August–September | Cooking$^{SN**, SI***, CR*, SH**}$ | Very common$^{SN}$<br>Common$^{SI}$<br>Rare$^{CR}$<br>Very rare$^{SH}$ |
| *Chenopodium murale* L.; Amaranthaceae; 805/MM//2020 | Karnd$^{UR, PH, GJ, KM}$<br>Karwa Bathoo$^{PN}$<br>Bathoo$^{PT}$<br>Kora Batoon$^{SR}$<br>Thor Surma$^{PS}$<br>Lulur$^{SN}$<br>Kurund$^{HN}$<br>Goyalo$^{HI}$ | Branches, Leaves | FO, GL, GR, HS, RS, SL; March–April | Cooking$^{SN, SH**, CR*, QA}$ | Very common$^{SI}$<br>Common$^{SN}$<br>Rare$^{SH}$<br>Very rare$^{QA}$ |
| *Chenopodium vulvaria* L.; Amaranthaceae; 611/MM//2020 | Sufaid Bathoo$^{UR, KM}$<br>Jangli Batoon$^{PN, PT, PH}$<br>Chitta Batoon$^{SR}$<br>Lulur$^{SN}$<br>Kurund$^{HN}$<br>Goyalo$^{HI}$ | Branches, Leaves | AL, DL, RS; March–April, August–September | Cooking$^{SN*, SH, SI*, QA*}$ | Very common$^{SI}$<br>Common$^{SN}$<br>Rare$^{SH}$<br>Very rare$^{QA}$ |
| *Cirsium arvense* (L.) Scop.; Asteraceae; 761/MM//2020 | Leeh$^{UR}$<br>Lehi$^{PN, PT}$<br>Leh$^{PH}$<br>Liah$^{GJ}$<br>Wanvahri$^{SR}$<br>Da Khwarak Azghai$^{PS}$<br>Kandiara$^{SN}$<br>Kund$^{KM}$ | Stems | DL, FO, GL, GR, HS, SP, SH, WP; March–April | Raw snacks$^{SN*, SH***, HN*, QA*}$ | Very common$^{SH}$<br>Common$^{QA}$<br>Rare$^{HN}$<br>Very rare$^{SN}$ |

**Table 2.** *Cont.*

| Plant Species, Family, and Voucher Specimen Number | Local Names | Parts Used | Gathering Area and Season | Local Culinary Uses and Quotation Frequency | Frequency of Consumption |
|---|---|---|---|---|---|
| *Citrullus colocynthis* (L.) Schrad.; Cucurbitaceae; 638/MM//2020 | Tumma[UR]<br>Kaud<br>Tumbha[PN, GJ, PH]<br>Kor Tumma[PT, SR, KM]<br>Pirpandyan[PS]<br>Marghone[PS]<br>Tarha Marha[PS]<br>Andrain[PS]<br>Hanzal[PS]<br>Trooh[SN]<br>Indrayan[HI] | Fruits | AL, DL, FO, GL, GR, HS, RS, SP, SL, SH, WP; May–June | Fermentation[CR***]<br>Jam[SI**]<br>Spice[SN*, SH***] | Very common[SI]<br>Common[SN]<br>Rare[CR]<br>Very rare[SH] |
| *Commelina benghalensis* L.; Commelinaceae; 795/MM//2020 | Kani[PN, SR]<br>Jawarzaal[PS]<br>Chura[KM] | Leaves | FO, GL, HS, RS, SL, SH, WP, WL; March–April | Cooking[SN, SH*, SI***, QA**] | Very common[SH]<br>Common[SN]<br>Rare[SI]<br>Very rare[QA] |
| *Convolvulus arvensis* L.; Convolvulaceae; 728/MM//2020 | Lehi[UR]<br>Lehli[PN, GJ]<br>Hiran Kahri[PT, PH]<br>Vanvaihre[SR]<br>Parvaty[PS]<br>Naaro[SN]<br>Speaker Booti[HN]<br>Hirapadi[KM] | Leaves | AL, FO, GL, GR, RS, SH, WL; March–April | Cooking[SH, SI**, CR**, QA] | Very common[SH]<br>Common[QA]<br>Rare[CR]<br>Very rare[SI] |
| *Corchorus depressus* (L.) Stocks; Malvaceae; 591/MM//2020 | Bahu Phali[UR]<br>Baephli[SR]<br>Munderi[SN] | Whole plant | DL, GR, HS, MS, SP, SL; March–April | Herbal drink[SN, SI***, CR**, QA*] | Very common[SI]<br>Common[QA]<br>Rare[SN]<br>Very rare[CR] |
| *Corchorus tridens* L.; Malvaceae; 417/MM//2020 | Phali[UR, PN, PT, GJ, KM]<br>Dadi[SR] | Pods | GL, GR, HS, MS; March–May | Herbal drink[SN, SH*, SI*, QA*] | Very common[SH]<br>Common[QA]<br>Rare[SN]<br>Very rare[SI] |
| *Cucumis melo* L.; Cucurbitaceae; 527/MM//2020 | Chibar[UR, PN]<br>Chibbarh[SR]<br>Chibhar[PH, PT, GJ, KM]<br>Mitero[SN] | Fruits | AL, GL; June–July | Chutney[SN***]<br>Fermentation[QA**]<br>Jam[SI*]<br>Raw snacks[HN***]<br>Salad[SN***] | Very common[SI]<br>Common[HN]<br>Rare[QA]<br>Very rare[SN] |
| *Digera muricata* (L.) Mart.; Amaranthaceae; 694/MM//2020 | Tandla[UR]<br>Tandoli[PT, GJ, PH]<br>Leswa[KM]<br>Tandala[PN]<br>Mareeri Saag[SR]<br>Athi[HN]<br>Tartara[PS]<br>Nazam Hoora[PS]<br>Lulur[SN]<br>Chanchali[HI]<br>Lahsuva[HI] | Branches, Leaves | FO, GL, GR, HS, RS, SH, WP, WL; August–September | Cooking[SI*, CR**, SN*, QA] | Very common[SI]<br>Common[SN]<br>Rare[CR]<br>Very rare[QA] |

**Table 2.** *Cont.*

| Plant Species, Family, and Voucher Specimen Number | Local Names | Parts Used | Gathering Area and Season | Local Culinary Uses and Quotation Frequency | Frequency of Consumption |
|---|---|---|---|---|---|
| *Dysphania ambrosioides* (L.) Mosyakin & Clemants; Amaranthaceae; 856/MM//2020 | Desi Bathoo[UR]<br>Bathoo[PN, PT]<br>Jangli Battoon[SR]<br>Babre Nagdi[PS]<br>Bathu[GJ, PH]<br>Bathwa[HN, KM] | Branches, Leaves | AL, DL, FO, GL, GR, HS, RS, SL, SH, WP; August–September | Cooking[SH**, CR**, SN*, QA**] | Very common[SH]<br>Common[SN]<br>Rare[CR]<br>Very rare[QA] |
| *Fagonia indica* Burm. f.; Zygophyllaceae; 842/MM//2020 | Jamahon[UR, PN, PT]<br>Damanh[PN, KM, GJ]<br>Jawanh Booti[SR]<br>Dramaho[SN] | Whole plant | DL, FO, GR, HS, RS, SP, SL; July–August | Herbal drink[SN*, SH, SI**, QA] | Very common[SH]<br>Common[SI]<br>Rare[QA]<br>Very rare[SN] |
| *Galium aparine* L.; Rubiaceae; 589/MM//2020 | Wanwair[PN, PT, GJ]<br>Wanwair Booti[SR, PH]<br>Cochna[PS]<br>Lahndra[KM] | Leaves | AL, FO, GL, GR, HS, RS, SL, SH, WP; June–July | Herbal Drink[SN**, SI, CR, QA] | Very common[SI]<br>Common[QA]<br>Rare[SN]<br>Very rare[CR] |
| *Gisekia pharnaceoides* L.; Gisekiaceae; 644/MM//2020 | Balu Ka Sag[UR]<br>Jangli Sag[PN, PT, SR] | Leaves | AL, FO, GL, GR, RS, SP, SH, WP; July–August | Cooking[SN*, SH**, SI**, CR**] | Very common[CR]<br>Common[SH]<br>Rare[SN]<br>Very rare[SI] |
| *Indigofera hochstetteri* Baker.; Leguminosae; 499/MM//2020 | Kano[UR]<br>Raari[PN, PT, GJ, PH]<br>Mareeri[SR]<br>Zind[KM]<br>Jhill[SN] | Flowers, Seeds | GL, GR, HS, MS; August–October | Jam[SH, SI*, CR*, QA] | Very common[SI]<br>Common[QA]<br>Rare[SH]<br>Very rare[CR] |
| *Lathyrus aphaca* L.; Leguminosae; 844/MM//2020 | Jangli Matter[UR, PN, PT]<br>Jangli Mattri[SR]<br>Marghayo Hpay[PS]<br>Kukarmany[PS]<br>Jangli Phali[KM] | Pods | AL, FO, GL, RS, SH, WP, WL; September–October | Fermentation[HN**, SI***]<br>Raw snacks[QA**, SH***] | Very common[SH]<br>Common[QA]<br>Rare[HN]<br>Very rare[SI] |
| *Lathyrus sativus* L.; Leguminosae; 572/MM//2020 | Jangli Matter[UR, PN, PT]<br>Jangli Mattri[SR]<br>Marghayo Hpay[PS]<br>Kukarmany[PS]<br>Jangli Matar[SN] | Pods | AL, FO, GL, HS, RS, WP, WL; March–April | Cooking[CR**, SN**]<br>Raw snacks[SH*, SI**] | Very common[SN]<br>Common[SH]<br>Rare[CR]<br>Very rare[SI] |
| *Launaea procumbens* (Roxb.) Ramayya & Rajagopal; Asteraceae; 821/MM//2020 | Dodak[UR, PN]<br>Bhathala[PT]<br>Hund[PH, GJ, KM]<br>Dodhk[SR]<br>Sondrashi[PS]<br>Alakoo[PS]<br>Bhattar[SN] | Leaves | AL, FO, GL, GR, RS, SH, WP, WL; March–April | Raw snacks[SN***, SI*, CR**, QA] | Very common[SI]<br>Common[SN]<br>Rare[QA]<br>Very rare[CR] |
| *Lepidium apetalum* Willd.; Brassicaceae; 505/MM//2020 | Jangli Khoob Kalan[UR]<br>Bashky[PS, PH, PT]<br>Desi Halyun[SR]<br>Burchan[HN]<br>Hanon[PS]<br>Harf[PS]<br>Haleem[PS] | Leaves | FO, GL, HS, MS, SH, WP, WL; July–August | Cooking[SN, CR**, HN*, QA**] | Very common[SN]<br>Common[CR]<br>Rare[QA]<br>Very rare[HN] |

**Table 2.** *Cont.*

| Plant Species, Family, and Voucher Specimen Number | Local Names | Parts Used | Gathering Area and Season | Local Culinary Uses and Quotation Frequency | Frequency of Consumption |
|---|---|---|---|---|---|
| *Lepidium draba* L.; Brassicaceae; 459/MM//2020 | Senna[UR] Suchi Senna[PN, PH, GJ, PT] Koori Sana[SR] Ghora Wal[SN] Dadhwal[SN] | Leaves, Seeds | DL, FO, GR; April–July | Raw snacks[QA*, SI*] Salad[HN*, SN*] | Very common[SN] Common[QA] Rare[HN] Very rare[SI] |
| *Malva neglecta* Wallr.; Malvaceae; 665/MM//2020 | Sitara Sunchal[PN, SR] Tikalay[PS] Jungali Soxal[KM] Sonchal[UR, HN, PT, PH] Khubasi[HI] | Leaves | AL, DL, FO, GL, GR, RS, SH, WP, WL; March–April | Cooking[SN**, SH***, SI*, QA*] | Very common[SI] Common[QA] Rare[SN] Very rare[SH] |
| *Malva parviflora* L.; Malvaceae; 510/MM//2020 | Jangli Sonchal[UR, PN, PT, HN] Jungali Soxal[KM] Jangli Khubasi[HI] | Fruits | AL, DL, FO, GL, GR, RS, SH, WP, WL; March–April | Cooking[SH, QA*] Herbal tea[CR*, SN**] | Very common[SH] Common[QA] Rare[CR] Very rare[SN] |
| *Malva sylvestris* L.; Malvaceae; 564/MM//2020 | Jamni Phool[UR] Methrai[PN, PS, SR] Khawazamary[PS] Samchal[PT, PH, KM] Khabazi[HN] | Leaves | RS, SH; April–May | Cooking[SH**, SI***, QA, SN**] | Very common[SN] Common[SI] Rare[SH] Very rare[QA] |
| *Mentha arvensis* L.; Lamiaceae; 693/MM//2020 | Podina[UR, PN, PT, PH] Podna[SR] Shinshobai[PS] Podina[GJ, HN] | Leaves | AL, GL; March–April, August–September | Chutney[SH***, SN***, SI**] Cooking[SH*, SN**, SI**, CR*] Herbal tea[HN**, SI**] Spice[CR**, SH*, SN*] | Very common[HN] Common[CR, SI] Rare[SI] Very rare[SH] |
| *Mentha longifolia* (L.) L.; Lamiaceae; 698/MM//2020 | Jangli Podina[UR, PN, KM] Chita Podna[SR, HN, PT, PH] Vaylanai[PS] Shinshobai[PS] Bareena[SN] | Leaves | FO, GL, HS, SL, SH, WL; May–June, August–September | Chutney[SN**, SH**] Cooking[SN*, SH*] Herbal tea[SI***, CR**] Spice[CR*, SI**, QA**] | Very common[SI] Common[CR] Rare[QA] Very rare[SN] |
| *Mentha pulegium* L.; Lamiaceae; 659/MM//2020 | Jamni Podina[UR, PN, PT, PH] Desi Podna[SR] Pudina[KM] | Leaves | AL, FO, GL, HS, RS, SL, SH, WL; March–April, August–September | Chutney[HN*, SI**] Herbal tea[QA**, SN**] | Very common[HN] Common[SN] Rare[SI] Very rare[QA] |
| *Mentha royleana* Wall. ex Benth.; Lamiaceae; 631/MM//2020 | Sofaid Podina[UR, PN, PT, PH] Chitta Podna[SR, HN] Jangli Podina[KM] | Leaves | AL, FO, GL, HS, RS, SL, SH, WL; March–April | Chutney[SH**, SN*] Cooking[SH*, SN*] Herbal tea[CR***, HN*] | Very common[SN] Common[SH] Rare[HN] Very rare[CR] |
| *Olea europaea* subsp. *cuspidata* (Wall. & G. Don) Cif.; Oleaceae; 746/MM//2020 | Kahou[UR, PN, PT] Kao[GJ, KM, PH, SR] Shwawan[PS] Khuna[PS] Kaow[HN] Kaho[HN] | Fruits | AL; August–September | Raw snacks[QA**, SH**, SI*, HN*] | Very common[SH] Common[SI] Rare[QA] Very rare[HN] |

**Table 2.** *Cont.*

| Plant Species, Family, and Voucher Specimen Number | Local Names | Parts Used | Gathering Area and Season | Local Culinary Uses and Quotation Frequency | Frequency of Consumption |
|---|---|---|---|---|---|
| *Opuntia dillenii* (Ker Gawl.) Haw.; Cactaceae; 699/MM//2020 | Khashi$^{UR}$<br>Thor$^{PH, GJ, KM}$<br>Peeli Saroon$^{PN}$<br>Peela Saroon$^{PT}$<br>Peela Rayea$^{SR}$<br>Woraki$^{PS}$<br>Shersham$^{PS}$<br>Hoob Sublan$^{PS}$<br>Hakseer$^{PS}$ | Leaves | AL, GL, HS, RS, SH, WP; March–April | Cooking$^{SN**, SH*, HN*, QA}$ | Very common$^{HN}$<br>Common$^{SH}$<br>Rare$^{QA}$<br>Very rare $^{SN}$ |
| *Oxalis corniculata* L.; Oxalidaceae; 732/MM//2020 | Peeli Booti$^{UR}$<br>Choti lonak$^{PN}$<br>Lonak$^{SR}$<br>Therwashka$^{PS}$<br>Bibi Shaftala$^{PS}$<br>Tarookay$^{PS}$<br>Khati Buti$^{HN}$<br>Khati$^{KM}$ | Leaves | AL, FO, GL, GR, HS, RS, SH, WP, WL; February–March | Chutney$^{CR**, QA*}$<br>Cooking$^{SI**, SN**}$ | Very common$^{CR}$<br>Common$^{SI}$<br>Rare$^{QA}$<br>Very rare$^{SN}$ |
| *Phoenix sylvestris* (L.) Roxb.; Arecaceae; 501/MM//2020 | Jangli Khajoor$^{UR, PN, PT, HN}$<br>Desi Khajoor$^{GJ, PH, KM}$<br>Pind$^{SR}$<br>Chotti Khagoor$^{PS}$<br>Khaji$^{SN}$<br>Khajur$^{HI}$ | Fruits | AL, DL, GL, RS; June–July | Jam$^{QA*}$<br>Raw snacks$^{SN*, HN, SH}$ | Very common$^{SH}$<br>Common$^{SN}$<br>Rare$^{HN}$<br>Very rare$^{QA}$ |
| *Physalis divaricata* D. Don; Solanaceae; 569/MM//2020 | Jungli Berry$^{UR}$<br>Jangli Tamator$^{PN, SR}$<br>Hundusi$^{GJ, PT, PH, KM}$<br>Band Malkhovj$^{PS}$<br>Delhuu$^{SN}$ | Fruits | FO, GL, HS, SL, SH, WP; August–September | Raw Snacks$^{SN*, SI*, HN**, QA**}$ | Very common$^{SI}$<br>Common$^{QA}$<br>Rare$^{HN}$<br>Very rare$^{SN}$ |
| *Pistia stratiotes* L.; Araceae; 515/MM//2020 | Jall Khumbi$^{UR, HI, KM}$<br>Jall Shamkala$^{GJ, PT, PH}$<br>Nargis$^{PN, PT}$<br>Jaru$^{SN}$ | Leaves | WP; March–April | Cooking$^{SN*, SH, SI***}$<br>Salad$^{QA*}$ | Very common$^{SN}$<br>Common$^{SI}$<br>Rare$^{SH}$<br>Very rare$^{QA}$ |
| *Polygonum plebeium* R.Br.; Polygonaceae; 531/MM//2020 | Gorakh Pan$^{UR}$<br>Droonk$^{PN}$<br>Bandoki$^{PS}$<br>Gull Srah$^{PS}$<br>Khowar$^{SN}$<br>Chimati Saag$^{HI}$ | Stems | AL, FO, GL, GR, HS, MS, RS, SL, SH, WP, WL; March–April | Cooking$^{SN**, SI**, CR*, HN}$ | Very common$^{SI}$<br>Common$^{CR}$<br>Rare$^{HN}$<br>Very rare$^{SN}$ |
| *Portulaca oleracea* L.; Portulacaceae; 865/MM//2020 | Kulfa Lonak$^{UR, PN}$<br>Lorniki Booti$^{PT, GJ, KM}$<br>Lorni Booti$^{SR}$<br>Varhori$^{PS}$<br>Loonk$^{SN}$<br>Khurfa$^{HN}$ | Leaves, Stems | FO, GL, HS, RS, SH, WP, WL; August–September | Cooking$^{SN**, SH*, HN*, QA**}$ | Very common$^{SH}$<br>Common$^{HN}$<br>Rare$^{SN}$<br>Very rare$^{QA}$ |

**Table 2.** *Cont.*

| Plant Species, Family, and Voucher Specimen Number | Local Names | Parts Used | Gathering Area and Season | Local Culinary Uses and Quotation Frequency | Frequency of Consumption |
|---|---|---|---|---|---|
| *Portulaca quadrifida* L.; Portulacaceae; 753/MM//2020 | Lornak Booti[UR, PN]<br>Loranki[PT, GJ, PH]<br>Lonak[SR]<br>Wakhorai[PS]<br>Pakharai[PS]<br>Loonk[SN]<br>Lunak[KM]<br>Kolfa[HN] | Leaves, Stems | FO, GL, GR, HS, MS, RS, SL, SH, WP; August–September | Cooking[SH**, SN*, CR*, QA] | Very common[CR]<br>Common[SN]<br>Rare[SH]<br>Very rare[QA] |
| *Prosopis cineraria* (L.) Druce; Leguminosae; 745/MM//2020 | Jand[UR, PN, PT, PH, KM]<br>Jandi[SR]<br>Kandi[SN]<br>Jangli Matar[KM]<br>Jhand[HI]<br>Khejri[HI] | Gum, Pods | DL, FO, GR, HS, RS, SP, SL, WP; August–September | Fermentation[SN*, CR**]<br>Jam[QA**, SH*] | Very common[QA]<br>Common[SH]<br>Rare[CR]<br>Very rare[SN] |
| *Prosopis juliflora* (Sw.) DC.; Leguminosae; 547/MM//2020 | Kikar[UR]<br>Phari Kikar[PN, PT, GJ, KM, SR]<br>Sindhi Kikar[PH]<br>Kikar[PS]<br>Angrezi Babur[SN]<br>Velayti Kikar[HN]<br>Jungli Kikar[HI] | Gum, Pods | AL, FO, GR, HS, RS, WP; August–September | Fermentation[SI, HN*, CR]<br>Jam[SH**, SN*] | Very common[SH]<br>Common[SN]<br>Rare[HN]<br>Very rare[SI, CR] |
| *Rhynchosia minima* (L.) DC.; Leguminosae; 855/MM//2020 | Jangli Lobia[UR, PN, PH, KM]<br>Jangli Arwan[PT]<br>Herdal[SR] | Pods | AL, FO, HS, RS, WP, WL; March–April | Cooking[SN, SH*, SI**, CR] | Very common[CR]<br>Common[SI]<br>Rare[SN]<br>Very rare[SH] |
| *Rumex dentatus* L.; Polygonaceae; 812/MM//2020 | Khatkal[PN, PT, PH, KM]<br>Jangli Palak[UR, GJ, SR]<br>Sarkari Palak[PS]<br>Zamda[PS]<br>Jangli Palak[SN]<br>Hullah[HN]<br>Ola[HN] | Leaves | AL, FO, GL, HS, RS, SL, SH, WP, WL; March–April | Cooking[SN**, SH**, SI**, HN] | Very common[SI]<br>Common[HN]<br>Rare[SH]<br>Very rare[SN] |
| *Salvadora oleoides* Decne.; Salvadoraceae; 690/MM//2020 | Jall[UR]<br>Van[GJ, KM]<br>Jhal[PT, PH]<br>Pilu[PN,SR]<br>Khabbar[PS]<br>Khabar[SN]<br>Kallijari[HN] | Fruits | DL, FO, GR, HS, SP, WP; August–September | Chutney[HN*, CR*]<br>Fermentation[SH*, SN**]<br>Jam[SH*, HN*, CR*] | Very common[SH]<br>Common[SN]<br>Rare[CR]<br>Very rare[HN] |
| *Salvadora persica* L.; Salvadoraceae; 747/MM//2020 | Pelo[UR, SR, GJ]<br>Khabar[SN]<br>Pilu[PN, PT, PH, KM]<br>Diyar[SN]<br>Kallijari[HN]<br>Jaal[HI] | Fruits | DL, GR, RS, SP, SL, WP; August–September | Fermentation[SH*, SN*]<br>Jam[SI*, HN**] | Very common[SH]<br>Common[SN]<br>Rare[SI]<br>Very rare[HN] |

**Table 2.** *Cont.*

| Plant Species, Family, and Voucher Specimen Number | Local Names | Parts Used | Gathering Area and Season | Local Culinary Uses and Quotation Frequency | Frequency of Consumption |
|---|---|---|---|---|---|
| Salvia moorcroftiana Wall. ex Benth.; Lamiaceae; 530/MM//2020 | Tokham Belaga[UR]<br>Lapra[PN]<br>Belangoo[SR]<br>Dersai[PS]<br>Sidrai[PS]<br>Jungle Tamookh[KM]<br>Shwanko[SN]<br>Kallijari[HN]<br>Khesari Daal[HI] | Stems | FO, HS, SL, SH, WP; May–June | Raw snacks[SN***, SH, QA **, CR*] | Very common[SH]<br>Common[QA]<br>Rare[CR]<br>Very rare[SN] |
| *Salvia nubicola* Wall. ex Sweet; Lamiaceae; 841/MM//2020 | Hernar[PN]<br>Darshool[PS]<br>Kallijari[HN]<br>Khesari Daal[HI] | Leaves | FO, HS, RS, SH, WP, WL; August–September | Cooking[SH**, SI*, HN***, QA] | Very common[SI]<br>Common[SH]<br>Rare[HN]<br>Very rare[QA] |
| *Senna italica* Mill.; Leguminosae; 479/MM//2020 | Ghora Wal[SN] | Seeds | GL, GR, HS, MS, RS; April–June | Raw snacks[SN*, SH*, SI, QA**] | Very common[SN]<br>Common[QA]<br>Rare[SH]<br>Very rare[SI] |
| *Senna occidentalis* (L.) Link; Leguminosae; 576/MM//2020 | Lobia[UR, PN, GJ, KM]<br>Desi Arwan[SR, PT, PH]<br>Ghora Wal[SN] | Pods | AL, FO, HS, RS, WP, WL; March–April | Cooking[SN**, SH, CR*, QA] | Very common[CR]<br>Common[SN]<br>Rare[QA]<br>Very rare[SH] |
| *Sisymbrium irio* L.; Brassicaceae; 750/MM//2020 | Khud-e-Kalan[KM]<br>Khashi[UR, PN, PT, PH]<br>Peeli Booti[SR]<br>Woraki[PS]<br>Shersham[PS]<br>Hoob Sublan[PS]<br>Hakseer[PS]<br>Khubkalan[HN]<br>Khakasi[HN] | Leaves | AL, GL, HS, RS, SH, WP; March–April | Cooking[SN, SH**, SI***, HN**] | Very common[SI]<br>Common[SN]<br>Rare[HN]<br>Very rare[SH] |
| *Solanum americanum* Mill.; Solanaceae; 636/MM//2020 | Makao[UR]<br>Kainch Mainch[PN]<br>Katch Match[PT]<br>Mohkri[PH, GJ, KM]<br>Karveloon[SR]<br>Kach machao[PS]<br>Malkhovj[PS]<br>Malgabai[PS] | Fruits | AL, FO, GL, GR, HS, RS, SH, WP; June–July | Chutney[SI*, SH]<br>Herbal drink[SN**, SI]<br>Raw snacks[HN*, SH, SI*, SN**] | Very common[SH]<br>Common[SI]<br>Rare[HN]<br>Very rare[SN] |
| *Solanum incanum* L.; Solanaceae; 727/MM//2020 | Jangli Khashi[UR]<br>Jangli Baingan[PN, PT]<br>Mahokari[PS]<br>Kori Wal[SR]<br>Mahora[SN] | Fruits | FO, GL, HS, SH, WP; June–July | Chutney[SH, SN*]<br>Raw snacks[QA**, HN**] | Very common[SH]<br>Common[QA]<br>Rare[HN]<br>Very rare[SN] |
| *Solanum surattense* Burm. f.; Solanaceae; 758/MM//2020 | Neeli Khurd Katai[UR]<br>Choti Kandiari[PN]<br>Mahori[PT, GJ, PH, KM]<br>Kandiari Walh[SR]<br>Markondaye[PS]<br>Speenazghai[PS]<br>Kanderi[SN]<br>Mohkree[HN] | Fruits | DL, FO, GR, HS, MS, RS, SP, SL; October–November | Raw Snacks[SN, CR*, HN*, QA*] | Very common[HN]<br>Common[QA]<br>Rare[CR]<br>Very rare[SN] |

**Table 2.** *Cont.*

| Plant Species, Family, and Voucher Specimen Number | Local Names | Parts Used | Gathering Area and Season | Local Culinary Uses and Quotation Frequency | Frequency of Consumption |
|---|---|---|---|---|---|
| *Solanum villosum* Mill.; Solanaceae; 415/MM//2020 | Mako[UR, SN]<br>Kaach<br>Mach[PN, PT, GJ, KM]<br>Karveloon[SR] | Fruits | GL, GR, HS, MS; March–May | Chutney[SI*, HN*]<br>Raw snacks[SH**, SN**] | Very common[SI]<br>Common[SH]<br>Rare[SN]<br>Very rare[HN] |
| *Sonchus asper* (L.) Hill; Asteraceae; 666/MM//2020 | Bhattal[UR]<br>Malai Booti[PN]<br>Dodhi[PT, PH, GJ]<br>Dodhak[SR]<br>Soon Latti[PS]<br>Kasni[SN]<br>Dodal[KM] | Leaves | DL, FO, GL, HS, RS, SL, SH; March–April | Cooking[SH**, HN***, SN] | Very common[SH]<br>Common[SN]<br>Very rare[HN] |
| *Sonchus oleraceus* (L.) L.; Asteraceae; 713/MM//2020 | Bhattal[UR]<br>Malai Booti[PN]<br>Dodhak[PT]<br>Peeli Dodhak[SR]<br>Tarizha[PS]<br>Soon Dodak[PS]<br>Kasni[SN] | Leaves | AL, FO, GR, RS, SH; March–April | Cooking[SN*, SI**, HN***, QA**] | Very common[SI]<br>Common[QA]<br>Rare[HN]<br>Very rare[SN] |
| *Stellaria media* (L.) Vill.; Caryophyllaceae; 796/MM//2020 | Kangni Booti[UR]<br>Phoolan Cheeri[PN]<br>Cheeri Pta[PT]<br>Stalli[PH, GJ, KM]<br>Chitti Booti[SR]<br>Vilaghori[PS]<br>Badsha Saba[PS]<br>Bin Batorhi[PS]<br>Buch-Bucha[HI] | Leaves | AL, FO, GL, HS, MS, RS, SL, SH, WP; March–April | Cooking[SN***, SH**]<br>Herbal tea[CR**, SI] | Very common[SH]<br>Common[SN]<br>Rare[CR]<br>Very rare[SI] |
| *Tephrosia purpurea* (L.) Pers.; Leguminosae; 429/MM//2020 | Bansa-Bansu[PN, PT, PH, GJ, KM]<br>Sarphooka[PS]<br>Haldri[SR]<br>Maheero[SN]<br>Ban Nil[HI] | Pods | GL, GR, HS; March–May | Cooking[SN**, SH*, SI, QA*] | Very common[SI]<br>Common[SH]<br>Rare[QA]<br>Very rare[SN] |
| *Tribulus terrestris* L.; Zygophyllaceae; 539/MM//2020 | Pakhra[PS, PT, KM]<br>Bhakhra[UR, SR]<br>Bakhro[SN]<br>Melai[PS]<br>Ghokru[HN] | Fruits | DL, FO, GL, GR, HS, MS, RS, SP, SL, SH, WP; August–September | Herbal tea[SN*, SH, SI**, HN*] | Very common[SH]<br>Common[SI]<br>Rare[HN]<br>Very rare[SN] |
| *Trigonella anguina* Delile; Leguminosae; 568/MM//2020 | Jangli Meethre[UR, PN, PT,GJ, SR]<br>Jungle Math[KM] | Leaves, Seeds | AL, DL, FO, GL, GR, HS, RS, SH, WP, WL; March–April | Fermentation[SH**, HN*, SI*]<br>Raw snacks[SN] | Very common[SH]<br>Common[HN]<br>Rare[SN]<br>Very rare[SI] |
| *Trigonella corniculata* Sibth. & Sm.; Leguminosae; 615/MM//2020 | Meethre[UR, PN, PT,GJ, SR]<br>Jungle Math[KM] | Leaves, Seeds | AL; March–April | Fermentation[QA*, CR, SN*, SH*] | Very common[CR]<br>Common[QA]<br>Rare[SN]<br>Very rare[SH] |
| *Veronica anagallis-aquatica* L.; Plantaginaceae; 834/MM//2020 | Hazar Dani[UR]<br>Obo Saba[PS] | Leaves | AL, FO, GL, HS, RS, SH, WP; March–April | Cooking[SN***, SH, SI*, QA*] | Very common[QA]<br>Common[SI]<br>Rare[SH]<br>Very rare[SN] |

**Table 2.** *Cont.*

| Plant Species, Family, and Voucher Specimen Number | Local Names | Parts Used | Gathering Area and Season | Local Culinary Uses and Quotation Frequency | Frequency of Consumption |
|---|---|---|---|---|---|
| *Vicia sativa* L.; Leguminosae; 767/MM//2020 | Jangli Lobia$^{UR}$<br>Jangli Rewari$^{PN, GJ}$<br>Jangli Rawan$^{SR}$<br>Mutri$^{KM, PT, PH}$<br>Pervatha$^{PS}$<br>Chilow$^{PS}$ | Pods | AL, FO, GL, HS, SL, SH, WP, WL; March–April | Cooking$^{SN**, SH*, SI**, CR**}$ | Very common$^{SN}$<br>Common$^{SH}$<br>Rare$^{CR}$<br>Very rare$^{SI}$ |
| *Withania coagulans* (Stocks) Dunal; Solanaceae; 741/MM//2020 | Paneer$^{UR}$<br>Jangly Chana$^{PT}$<br>Akri$^{PN, PH, SR}$<br>Khamzora$^{PS}$<br>Ashwgandhas$^{SN}$<br>Asgandh Nagori$^{SN}$ | Leaves, Fruits | DL, FO, GL, SP, SH; March–April | Herbal drink$^{SN, SH, SI*, CR}$ | Very common$^{SH}$<br>Common$^{SI}$<br>Rare$^{CR}$<br>Very rare$^{SN}$ |
| *Ziziphus jujuba* Mill.; Rhamnaceae; 726/MM//2020 | Bairi$^{UR, PN}$<br>Seo Bair$^{PT, SR}$<br>Jand Beri$^{PH, GJ}$<br>Bera$^{PS}$<br>Moti Ber$^{PS}$<br>Karkanra$^{PS}$<br>Ber$^{SN}$<br>Ber$^{KM}$ | Fruits | DL, FO, GL, GR, HS, RS, SP; August–September | Raw snacks$^{SN**, HN***, SI**, SH**}$ | Very common$^{SI}$<br>Common$^{HN}$<br>Rare$^{SN}$<br>Very rare$^{SH}$ |
| *Ziziphus nummularia* (Burm. f.) Wight & Arn.; Rhamnaceae; 612/MM//2020 | Jangli Bairi$^{UR, PN, GJ}$<br>Kathy Beer$^{PT, SR}$<br>Karkanr$^{PS}$<br>Chotti Ber$^{PS}$<br>Anane$^{PS}$<br>Bada Bera$^{PS}$<br>Jhangugli Ber$^{SN}$<br>Jahri Ber$^{HN}$ | Fruits | FO, GL, HS, RS, SP; April–May | Raw snacks$^{SN**, HN***, CR**, SH**}$ | Very common$^{SH}$<br>Common$^{HN}$<br>Rare$^{SN}$<br>Very rare$^{CR}$ |
| *Ziziphus oxyphylla* Edgew.; Rhamnaceae; 409/MM//2020 | Surkh Bair$^{UR, PN}$<br>Saib Bair$^{SR, PH, PT, GJ}$<br>Heilaneiy$^{PS}$<br>Phitni$^{HN}$ | Fruits | FO, GL, HS, RS, SP; April–May | Raw snacks$^{SN*, SH*, SI***, CR*}$ | Very common$^{SI}$<br>Common$^{CR}$<br>Rare$^{SN}$<br>Very rare$^{SH}$ |
| *Ziziphus spina-christi* (L.) Desf.; Rhamnaceae; 413/MM//2020 | Jangli Bair$^{UR}$<br>Jhar Beri$^{PN, PT, GJ, KM}$<br>Jangali Bair$^{SR}$<br>Ber$^{SN}$ | Fruits | GL, GR, HS, MS, RS; March–June | Raw snacks$^{SN*, SI*, SH*, CR*}$ | Very common$^{CR}$<br>Common$^{SH}$<br>Rare$^{SN}$<br>Very rare$^{SI}$ |
| *Coprinus comatus* (O.F. Müll.) Pers.; Agaricaceae; 400/MM//2020 | Khumbhi$^{UR, PN, PT, GJ, SR}$<br>Guchi$^{PS}$<br>Klikichok$^{PS}$ | Arial parts | GL, GR, HS; August–September | Cooking$^{SN*, SH, SI*, HN**}$ | Very common$^{SI}$<br>Common$^{SH}$<br>Rare$^{SN}$<br>Very rare$^{HN}$ |

Gathering areas: AL: arable land, DL: dry land, FO: forest, GL: grassland, GR: graveyard, HS: hilly slopes, MS: mountain summits, RS: roadside, SP: sandy places, SL: scrubland, SH: shady places, WP: paste places, WL: wet land; Local Languages: UR: Urdu, PN: Punjabi, PT: Pothwari, PH, Pahari, GJ, Gojri, HN: Hindko, SR: Saraiki, SN: Sindhi, PS: Pashto, KS: Kashmiri, HI: Hindi; Religious faith: SN: Sunnis, SH: Shias, SI: Sikhs, HN: Hindus, CR: Christians, QA: Ahmadis (Qadiani); Quotation frequency in percent: 1–25% = without asterisk, 26–50% = *, 51–75% = **, 76–100% = ***.

The most commonly quoted wild food plants and the typologies of their food preparations are reported in Figure 3.

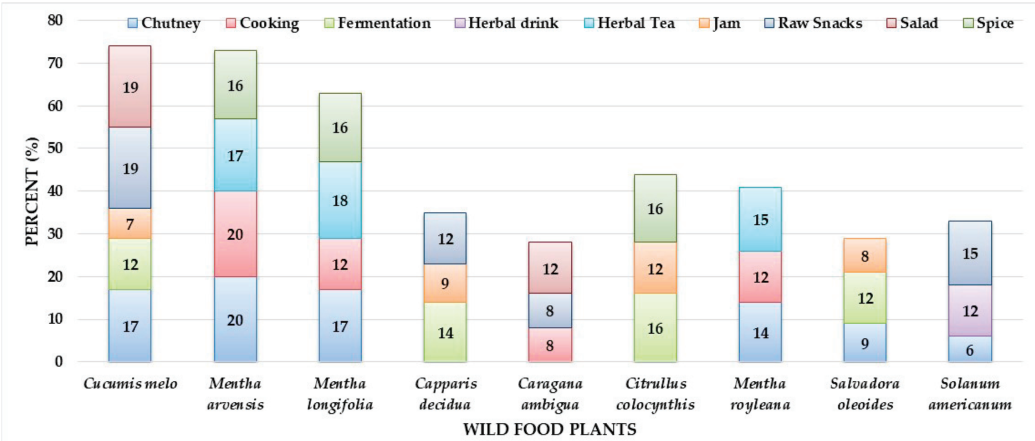


**Figure 3.** Most commonly used wild food plants and their uses.

The most important site for the gathering of wild food plants were grasslands, found sometimes at high elevations, where people normally bring animals for grazing. Summer herders were the most knowledgeable ethnobotanical informants and this show the importance of the link between resilience of wild food plant knowledge and the survival of pastoralist activities. However, the transmission of ethnobotanical practices from elders to the younger generation is continuously decreasing due to the generation gap and fast changing lifestyle. With the modernization of life, the younger generation is moving towards cities for education and business opportunities, which is one of the major reasons for the decline of TEK described in many ethnobotanical studies.

Some important wild food plants (Figure 4) and dishes prepared by the visited communities were available for photographing (Figure 5). Traditional culinary processing included cooking the plants as vegetables (43 mentions), followed by raw snacks (33), confirming what documented in other ethnobotanical studies too [73–75]. Raw snacks were eaten especially by transhumant herders, and it has been shown that herding develops specific linkages between humans and their surrounding ecosystem [76–79]. Herding is also linked to the use of particular types of wild food plants: for example, in Iraq and Kurdistan shepherds consumed more raw snacks than nearby horticulturists [9,76]. Moreover, pastures have been documented as very important gathering habitats of wild food plants [80,81].

Leaves were the most used plant part (38 times used), especially in salads, herbal teas, herbal drinks, as raw snacks, in chutneys, and as cooked vegetables. One third of the reported plants (27 taxa) were only gathered during the spring season.

It was noted that sweet fruits in particular were consumed as raw snacks especially by local communities with a herding lifestyle. Thirty wild food plants were consumed as raw snacks by all religious faith groups, especially *Capparis decidua*, *Caragana ambigua, Cucumis melo*, *Lathyrus aphaca*, *Lathyrus sativus*, *Phoenix sylvestris*, *Salvadora persica*, *Solanum americanum*, *Solanum incanum*, *Solanum villosum*, *Ziziphus jujube*, *Ziziphus nummularia*, *Ziziphus oxyphylla*, and *Ziziphus spina-christi*, many also earlier reported by Sõukand and Kalle [82]. Although *Solanum americanum* was recognized as containing toxic alkaloids [83], especially in its fruit [84], informants used fruits as raw snacks without reporting any toxic effects. Similarly, some other important food preparations in the study area were herbal drinks, salads and chutney (Figure 5).

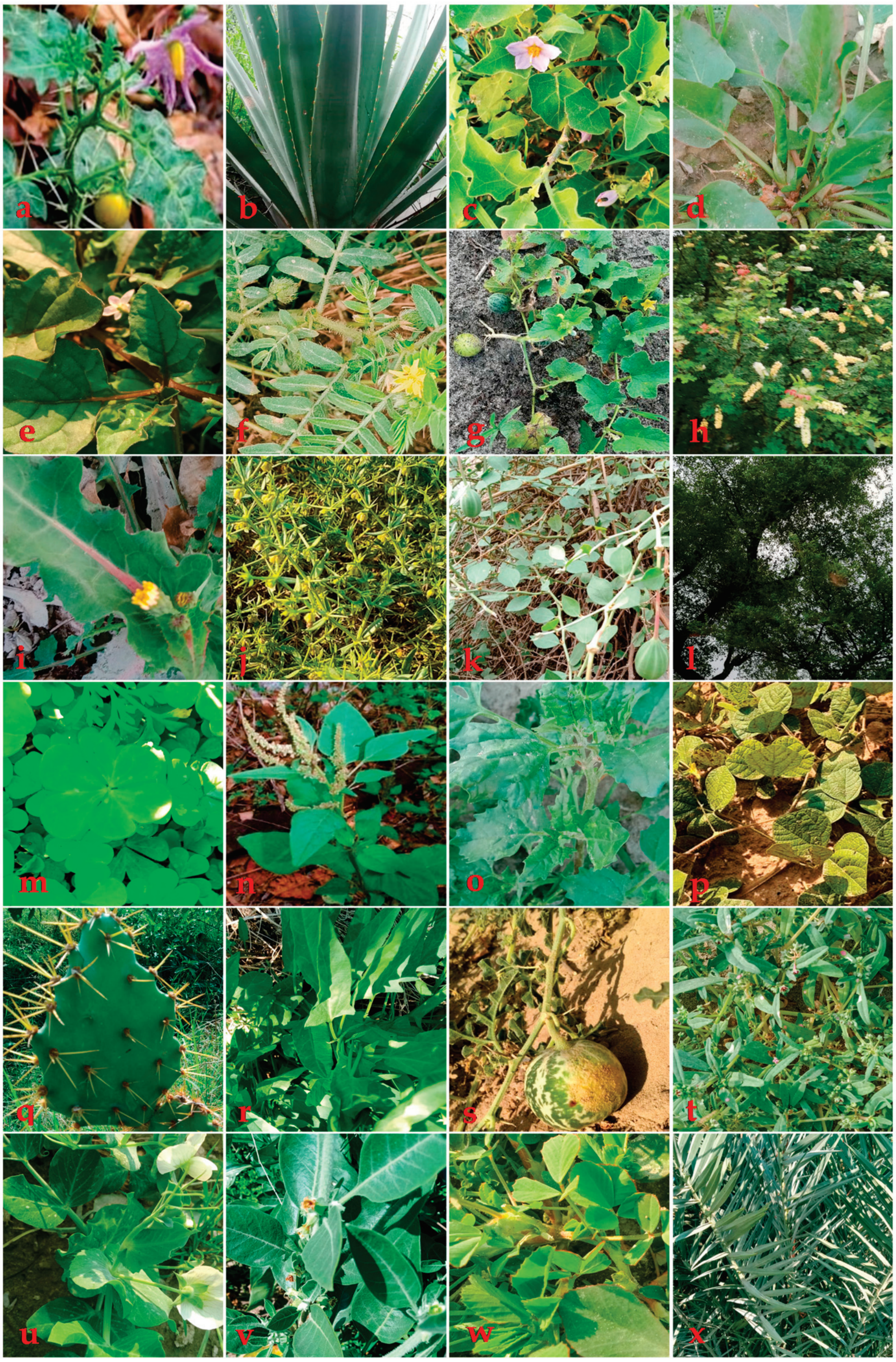


**Figure 4.** Some examples of wild food plants of Jhelum district: (**a**) *Solanum surattense*; (**b**) *Agave americana*; (**c**) *Solanum incanum*; (**d**) *Rumex dentatus*; (**e**) *Solanum americanum*; (**f**) *Tribulus terrestris*; (**g**) *Cucumis melo*; (**h**) *Acacia modesta*; (**i**) *Sonchus asper*; (**j**) *Fagonia indica*; (**k**) *Capparis decidua*; (**l**) *Ziziphus jujuba*; (**m**) *Oxalis corniculata*; (**n**) *Amaranthus spinosus*; (**o**) *Chenopodium murale*; (**p**) *Rhynchosia minima*; (**q**) *Opuntia dillenii*; (**r**) *Convolvulus arvensis*; (**s**) *Citrullus colocynthis*; (**t**) *Gisekia pharnaceoides*; (**u**) *Lathyrus sativus*; (**v**) *Withania coagulans*; (**w**) *Trigonella corniculata*; (**x**) *Phoenix sylvestris*.


**Figure 5.** Traditional culinary uses of wild food plants by different linguistic and religious communities reported from the study area: (**a**) mixture of black pepper and *Mentha royleana*; (**b**) mixture of chilies and *Mentha pulegium*; (**c**) powdered *Citrullus colocynthis*; (**d**) powedered *Mentha arvensis* in yogurt; (**e**) bread made with rice flour with *Opuntia dillenii* pulp; (**f**) rice cooked with *Amaranthus viridis* seeds and *Cucumis melo* as salad; (**g**) herbal drink made with *Cannabis sativa*; (**h**) jam made by *Prosopis cineraria* fruits.

On a global scale, it has been found that folk knowledge has been decreasing, mostly due to modern lifestyle changes and urbanization [50,71,85–90]. Gathering wild food plants is linked to local biodiversity and especially local cultural practices [91] and in our field study wild plant knowledge among younger informants was limited, similar to what was found in many other studies, for example, Kalle and Sõukand [92].

### 3.2. Cross-Religious Comparison

Cross-religious comparison of the used wild food plants (Figure 6) shows a remarkable homogeneity and the absence of any plant cultural markers (i.e., plants used by one group only); at the same time, however, not a single taxa is used by all the six considered groups and the majority of recorded wild food plants are used by three to four groups.

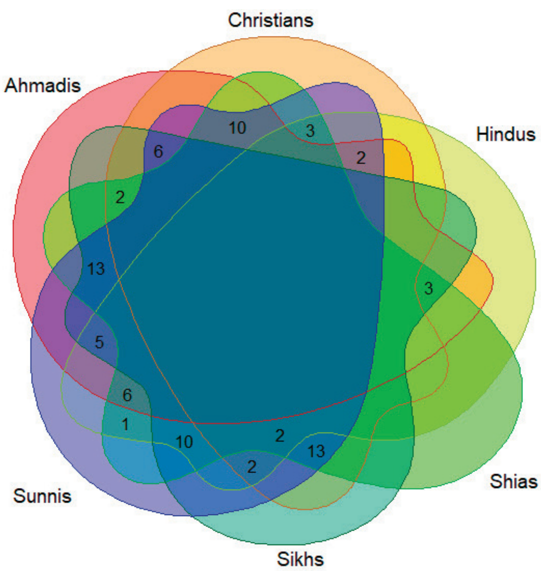


**Figure 6.** Venn diagram showing the overlaps of the recorded wild food plants among the six considered groups.

However, the Jaccard's distance heat map (Figure 7) shows high dissimilarity between some groups. While both Muslim groups, Shias and Sunnis, appeared to be closest in their selection of the wild food plants, Hindus and Christians are the most distant.

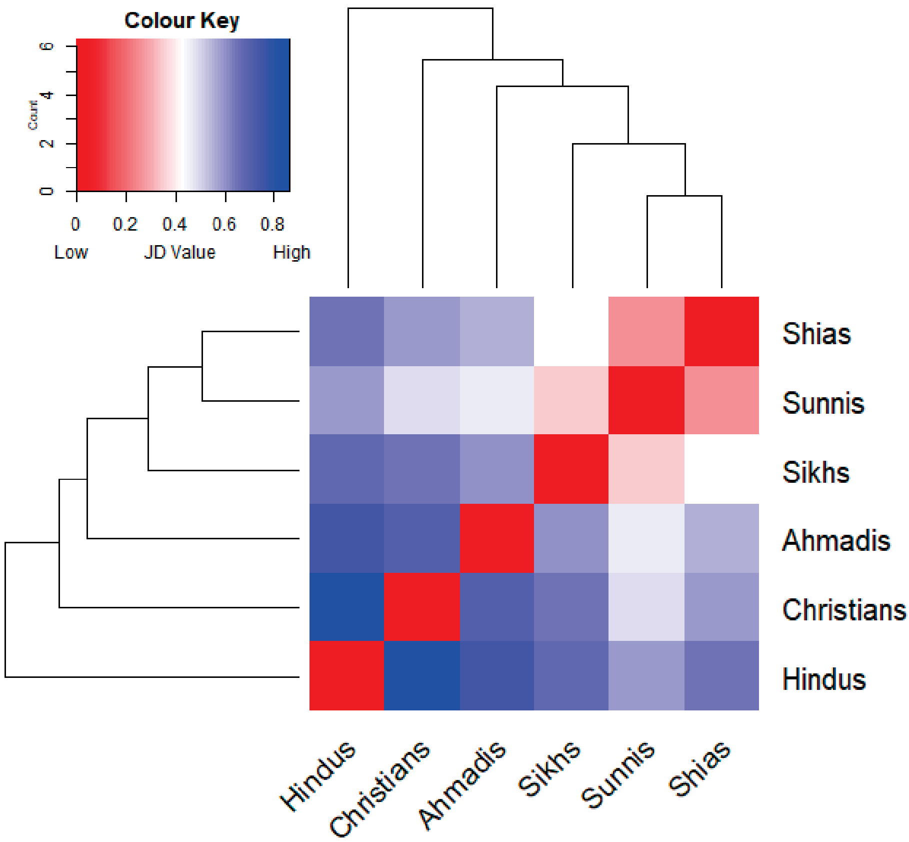


**Figure 7.** Hierarchical clustering tree coupled with heat map depicting Jaccard Dissimilarity Indices calculated by comparing the wild food plants quoted by the six considered groups.

The heat map (Figure 7) allows us to distinguish two easily comparable clusters within the six religious groups: a subgroup of Shias, Sunnis, and Sikhs, which used the highest number of plants (from 56 to 73) and a subgroup using far fewer taxa (Christians, Hindus, and Ahmadis (from 34 to 47). Bearing in mind that Shias and Sunnis together used all 78 listed taxa, there is a clear pattern of dissimilarity among the second subgroup (Figure 8).

Sunnis, using a slightly higher number of taxa than Shias, had more similarities with all the other groups. This could be due to the fact that the Sunni faith is the dominant one in the study area.

Figure 9 shows the comparison among the six groups in terms of specific food uses of the recorded wild food plants; the diagram shows a high diversity as well as a few specific cultural markers.

The similarity heat maps on the typology of wild plants food uses (Figure 10) demonstrates similar tendencies, outlining even greater differences between Christians and Ahmadis compared to Hindus, and also showing more divergences even among Sunnis and Shias. This suggests that there is a higher similarity in the used wild food plants than the way taxa are actually consumed in the study area; moreover, each considered group retains unique wild food plant utilizations.

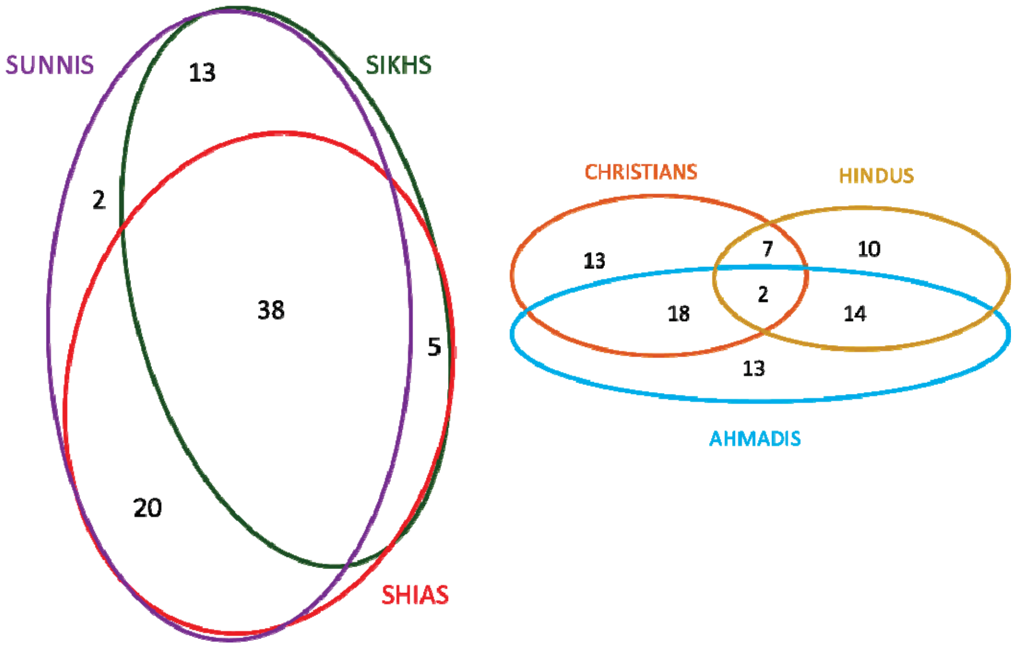


**Figure 8.** Intuitive best fit Venn diagrams comparing the recorded wild food plants among the six religious groups divided into two clusters.

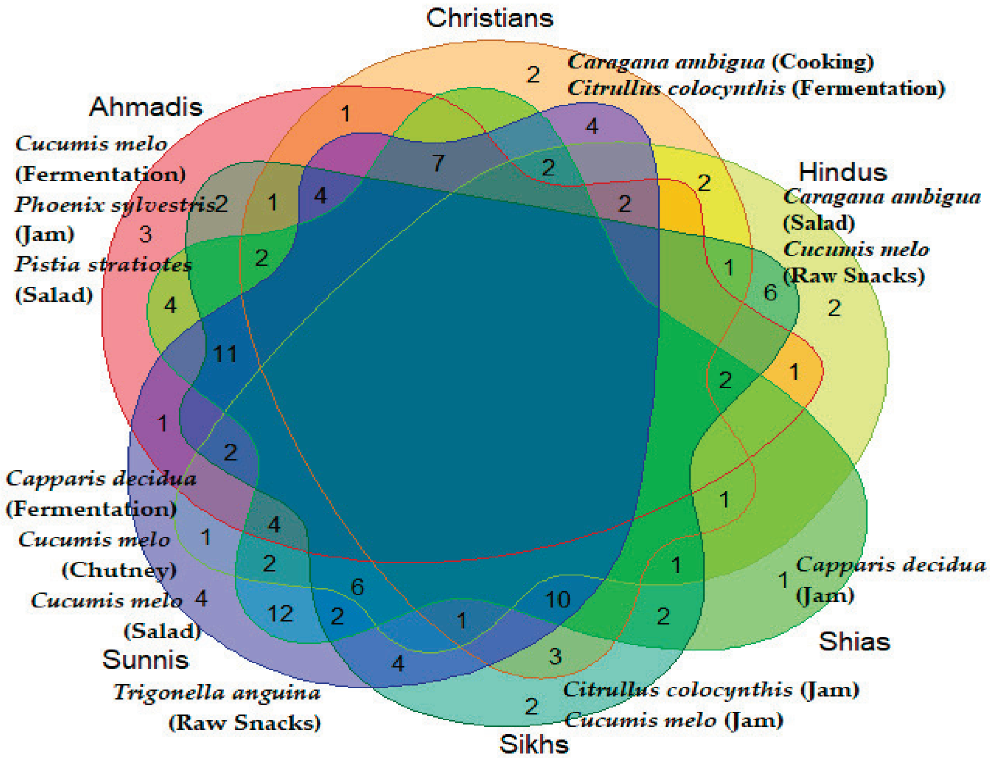


**Figure 9.** Venn diagram showing the number of overlaps of the recorded wild food plant uses among the studied religious groups; the diagram shows also the food uses uniquely recorded within each group.

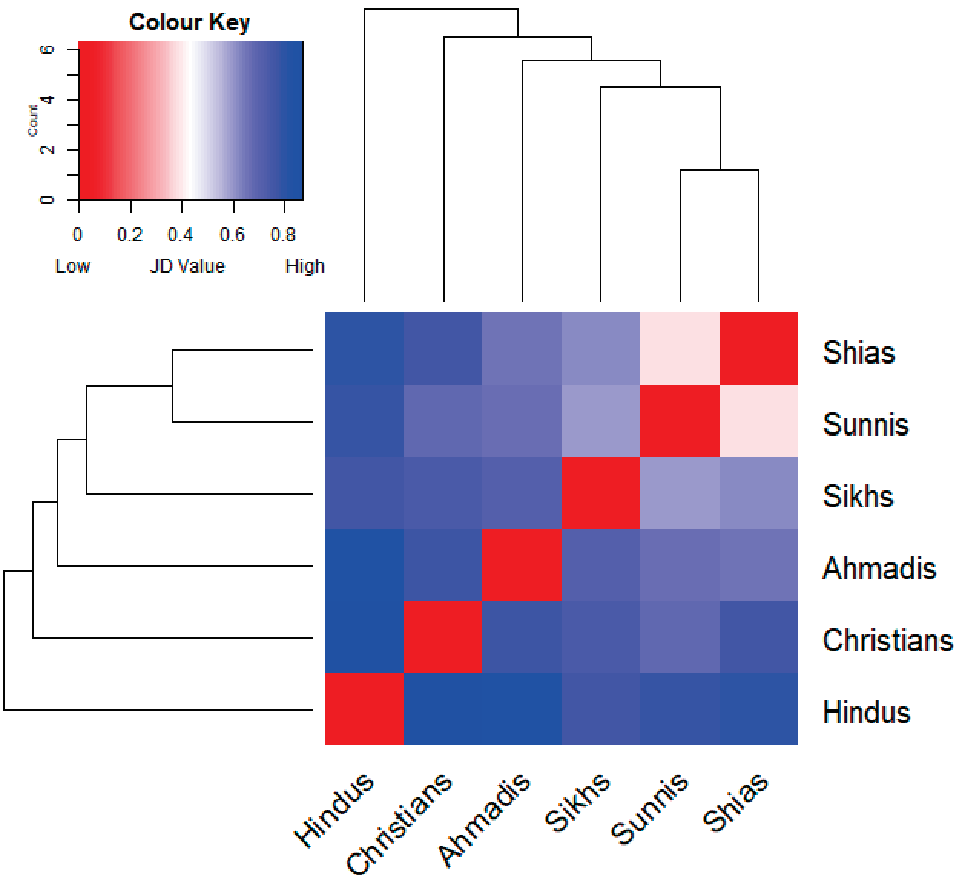


**Figure 10.** Hierarchical clustering tree coupled with heat map depicting Jaccard Dissimilarity Indices calculated by comparing the actual food utilizations of the recorded wild food plants among the six considered groups.

While our results show remarkable social and cultural exchanges between the different religious groups (sharing the same repertoire of plants), we can also see clear differences among the ways local food plants are actually used. This may to be linked to the different exposure the diverse religious groups have to traditional rural lifestyles and to nature. Nowadays, only Shias, Sunnis and Ahmadis have for example retained traditional livelihood practices (farming), while the local community members belonging to the three other faiths (Christians, Hindus, and Sikhs) are partially employed in city jobs, and some of them even practice as professional herbalists. The different relationships to farming that shape the differences in wild food plants-centered TEK among the groups may also be due to diverse levels of land access and land ownership.

While members of the different religions in the study area generally do not intermarry, they very regularly interact in urban settings and this, over centuries, may have contributed to a homogenization of TEK and cultural adaptation to the dominant groups.

The study participants confirmed that the use of wild plant species as daily food has significantly decreased, as well as the use of wild food plants on special occasions and religious festivities. This may be due to the fact that study participants perceive nowadays foraging (collecting wild food plants) as very time consuming, while cultivated plants are relatively easy to purchase in the immediate vicinity, and especially in bulk if and when required on special occasions. These trends may further lead to rapid TEK erosion in the near future, and further ethnobotanical works documenting local uses of wild food plants could be crucial for the food security and the preservation of the bio-cultural heritage of rural communities [93,94].

Food taboos restricting the consumption of some plants and fruits under certain conditions have been described from many regions of the world, involving followers of various religions including Hindus [95]. Similarly, in this study, some Hindus participants reported that the fruits of *Ziziphus oxyphylla* and *Ziziphus jujuba* were gathered only in mountain areas, hilly slopes and scrubland in time of need as famine foods only. Hence, the Hindus, but others possibly as well, follow the specific rules in what they consume, especially like when pregnant or menstruating. Food taboos might influence the uses of certain wild plants with regard to seasons or a consumer's health condition, gender or age [95]. The participants pointed out a few other idiosyncratic food uses of wild plants within specific groups as well; these uses mostly included *medicinal foods*, i.e., food preparations considered consumed for counteracting specific diseases or health conditions, or ritual uses linked to specific cultural beliefs. For example, the gum of *Acacia modesta* and *Acacia nilotica* is added in "halwa" (a local sweet prepared by using clarified butter and wheat bran), and recommended to women after childbirth to avoid general weakness and back pains among the Muslim participants. Similarly, Sikhs conveyed that a limited dosage (about 250–300 mL) of a herbal drink made with *Cannabis sativa* can induce activeness; the informants claimed that their ancestors use the same preparation during battles in the 19th and 20th century. The herbal tea prepared by using fruits of *Tribulus terrestris* is drunk by Hindu women in order to improve lactation. Finally, Muslims add leaves of *Ziziphus jujuba* and *Ziziphus numularia* in boiling water, and use them for bathing dead persons, as they perceive that would delay their decomposition until burial. The rest of documented wild edible plant species as food in this study may applicable to all gender, religion and age groups equally, and no associated food taboo is mentioned by any participant.

### *3.3. Comparison with the Pakistani Food Ethnobotanical Literature*

The comprehensive comparison with the Pakistani wild food ethnobotanical literature [49–52,70–72] of Pakistan showed that a remarkable number of species were documented as wild food plants, for the first time, in the study regions: *Acacia modesta, Acacia nilotica, Agave americana, Boerhavia repens, Capparis decidua, Chenopodium murale, Chenopodium vulvaria, Coprinus comatus, Corchorus depressus, Corchorus tridens, Cucumis melo, Dysphania ambrosioides, Fagonia indica, Gisekia pharnaceoides, Indigofera hochstetteri, Lathyrus sativus, Lepidium apetalum, Mentha arvensis, Mentha pulegium, Olea europaea, Phoenix sylvestris, Pistia stratiotes, Prosopis cineraria, Prosopis juliflora, Rhynchosia minima, Salvadora oleoides, Salvadora persica, Senna italica, Senna occidentalis, Solanum incanum, Tephrosia purpurea, Tribulus terrestris, Trigonella anguina, Trigonella corniculata,* and *Withania coagulans*.

Despite the fact that in our study three quarters of the wild food plants were reported also in other areas of northern Pakistan [50,52], pairwise Jaccard's distance between our findings and those arising from field studies recently conducted in various regions of Pakistan shows little similarity and a very large diversification of wild food plant uses within the country (Figure 11). This may be explained by the very diverse geography and natural environments, as well as a remarkable cultural diversity, which ultimately and most importantly affect the diversity of food customs of the country.

Based on a comprehensive literature review, we found that some wild food plant species recorded in the current study have rarely been documented as food ingredients elsewhere in Pakistan and its neighboring countries. These include *Aerva javanica*, *Agave americana*, *Amaranthus spinosus*, *Boerhavia repens*, *Caragana ambigua*, *Commelina benghalensis*, *Convolvulus arvensis*, *Corchorus depressus*, *Corchorus tridens*, *Gisekia pharnaceoides*, *Indigofera hochstetteri*, *Lathyrus aphaca*, *Lepidium apetalum*, *Mentha royleana*, *Opuntia dillenii*, *Oxalis corniculata*, *Physalis divaricata*, *Pistia stratiotes*, *Polygonum plebeium*, *Rhynchosia minima*, *Trigonella anguina*, *Trigonella corniculata*, and *Veronica anagallis-aquatica.*

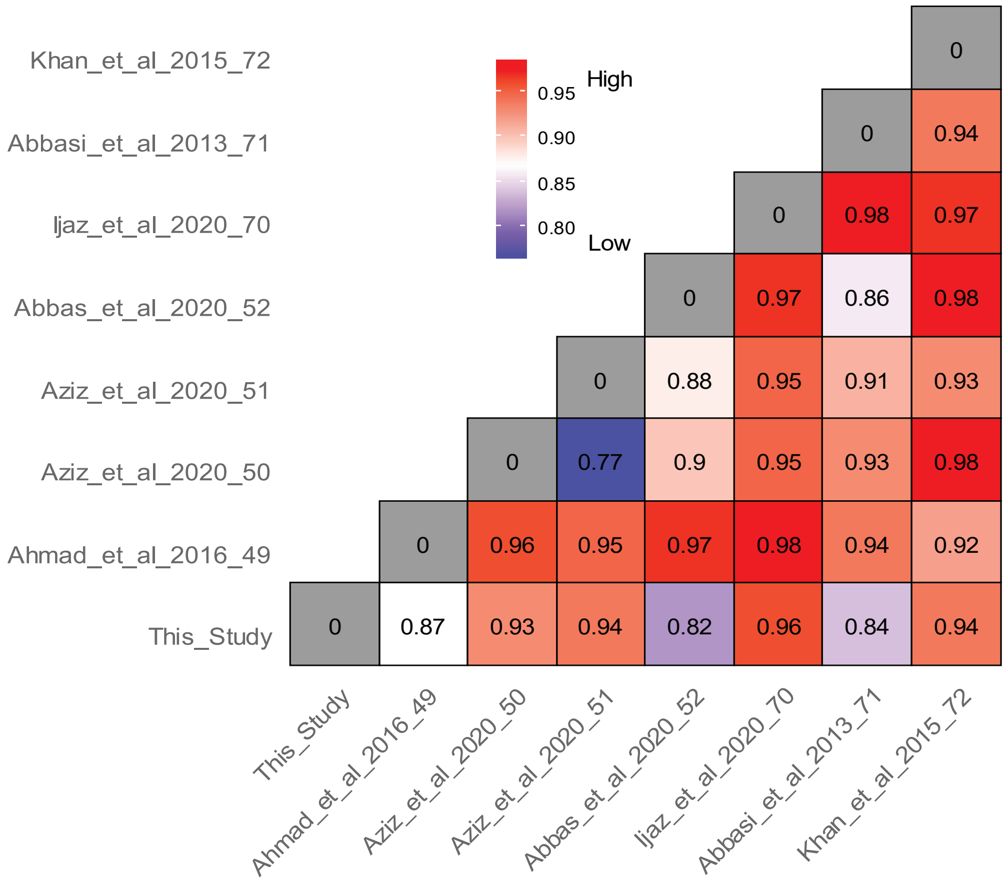


**Figure 11.** Pairwise Jaccard Dissimilarity Indices calculated by comparing the current study with other wild food ethnobotanical field works previously conducted in Pakistan.

## 4. Conclusions

Our study reported seventy-seven plant taxa and one mushroom used as cultural foods among six different religions. The cross-religious comparison showed high overlap in the used taxa between Shias and Sunnis, who together used all listed taxa in the study region and contributed the most detailed information about specific, commonly used wild food plants. Comparison of the other four religious groups showed much less overlap between the groups and greater variation in the numbers of used plants. Urban Hindus and Christians used the least number of plants, followed by rural Sikhs and urban Ahmadis. A comparative analysis with the wild food plant literature of Pakistan showed a high diversification of wild plant uses in the study region, due to both environmental and cultural factors. This study also concluded that there is relatively higher homogeneity in use of plant species as food compared to method (preparations) of use of the same among the religious groups. Therefore, if one religious group prepares herbal drink of a plant species, the other might prefer to prepare jam of the same, depicting possession of unique recipes.

The inherited cultural knowledge of wild food plants of Hindus, Sikhs, Christians, and Ahmadis, in particular, faces the greatest challenges, as these groups have apparently undergone cultural adaptation to an urban, "modern" lifestyle. The present study may provide a foundation for the promotion of eco-tourism and for supporting sustainable development programs. Several of the recorded wild food plants are still sold in local markets (e.g., *Capparis*, *Mentha*, *Olea*, *Phoenix*, *Rhynchosia*, *Salvadora*, *Salvia*, *Senna*, *Solanum*, *Trigonella*, *Vicia*, and *Ziziphus* spp.) and this could represent the basis of wild food plant-centered local projects, aiming to revitalize TEK and generate small-scale economies providing some cash-income for rural communities.

**Author Contributions:** Conceptualization, M.S.A., A.P., and M.M.; methodology, A.P. and M.S.A.; validation, K.H.B. and S.K.C.; formal analysis, A.M.K. and R.S.; investigation, M.M.; resources, M.M., R.S., M.A.A., and A.P.; data curation, M.M.; writing—original draft preparation, M.M. and M.S.A.; writing—review and editing, A.M.K., R.W.B., A.P., and R.S.; supervision, M.S.A. and K.H.B. All authors have read and agreed to the published version of the manuscript.

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**Institutional Review Board Statement:** The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Institutional Review Board (or Ethics Committee) of Department of Botany, University of Gujrat, Pakistan (protocol code 2019-12A; date of approval Wednesday, 16 January 2019)

**Informed Consent Statement:** Prior informed consent was verbally obtained from all the study participants and Code of Ethics of the International Society of Ethnobiology (http://www.ethnobiology.net/what-we-do/core-programs/ise-ethics-program/code-of-ethics/, accessed on 6 March 2020) was strictly followed.

**Data Availability Statement:** The data presented in this study are available on request from the corresponding author. The data are not publicly available due to avoid any inter-controversies among the studied religious groups.

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**Conflicts of Interest:** The authors declare that they have no conflict of interest.

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# Tangsa and Wancho of North-East India Use Animals not only as Food and Medicine but also as Additional Cultural Attributes

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**Abstract:** Cultural and ritual uses of animals beyond those for food and medicine should not be dismissed if we wish to understand the pressure that wildlife is under. We documented such uses for the Tangsa and Wancho tribals of Eastern Arunachal Pradesh (India). Group discussions with assembled members of 10 accessible villages in each of the tribal areas were carried out in 2015 and 2016. Vernacular names of culturally important species were noted and details of hunting practices were recorded. The different uses of animals and their parts during rituals and festivals and their significance in decorations and adornments, in supernatural beliefs and in connection with tribal folklore (stories) are documented. Folklore helps us understand why some species are hunted and consumed while others for no apparent reason are killed or simply ignored. Similarities as well as differences between the two tribes were recorded and possible reasons for the differences are given. The roles that the government as well as the tribal leaders play to halt or slow down the erosion and gradual disappearance of traditions that define the two cultures without losing already rare and endangered species are highlighted.

**Keywords:** common knowledge; traditional wisdom; North-East Indian tribals; Arunachal Pradesh; ethnobiology

## 1. Introduction

The Earth faces a biodiversity crisis, with current rates of species extinction that are between 1000 and 10,000 times higher than the background rate [1]. Conservation actions are a key part of responses to try to halt or minimize the loss of biodiversity [2]. Yet conflicts can emerge between the conservation of biodiversity and the uses of wildlife by people. It can be particularly difficult to resolve such conflicts where they relate to the traditional uses of wildlife by indigenous peoples, as the cultural practices of such peoples are often not well understood by conservationists or by government agencies tasked with conserving wildlife [3–6]. There is therefore a need to understand the uses of animals, including ritual and cultural uses beyond food and medicine, by tribes living in biodiversity hotspots. Such local knowledge, as well as being important cultural knowledge in its own right, is often overlooked by conservation.

Cultural knowledge is based on traditions. Frequently also referred to as common sense [7], cultural knowledge is the cumulative body of awareness and understanding of practices and beliefs held by local people. It involves adaptations to environmental circumstances, having stood the test of time, is handed down through generations by way of cultural transmission and is an important component of the cultural identity of tribal communities around the world [8–13].

Given the dearth of knowledge of the traditional roles that animals play beyond those as food and medicine [14,15], and in order to understand the pressure that wildlife is under, every bit of information still available must be welcomed. It is for this reason (and the fact that the first author of this paper is a Tangsa herself) that we chose to work with these two tribes of Arunachal Pradesh, a region of North-East India considered a global biodiversity hotspot [16]. Arunachal Pradesh is famous for its high levels of ecological, geographic and ethnic diversity, and the state is home to a variety of traditional communities with 26 major and 110 sub-tribes [6,17–20].

Tangsa and Wancho still have a close relationship with the animals of the region be it through the people's awareness of the dangers that some species pose or through activities like trapping and hunting. This relationship has only been given some attention by Dutta [18] and Dutta and Bhattacharjya [20]. On the other hand, Tangsa history, community structure, social interactions, style of dwellings, etc., were covered by Rao [21] and Morang [22], while the marriage system of the Wancho was studied by Ralongham [23].

An earlier investigation on these tribes had revealed that 63 animal species were hunted for their medicinal value and their meat [24]. However, animals and their parts also play important roles for barter and in rituals, religious beliefs, myths and mysticism, the manufacture of goods, decorations and clothing, in stories, song and dance, etc., and in this paper we therefore report that at least 39 animal species among the Tangsa and 38 among the Wancho are associated with tribal traditional knowledge and can be considered of cultural value. This paper will examine if there is a conflict between, on the one hand, the need to keep cultural traditions alive and on the other, to make sure that wild species used for traditional purposes will not become extinct due to the pressure they are under given the roles they play in the local traditions.

## 2. Material and Methods

### 2.1. The Tangsa Tribe

Known for its picturesque hills, Changlang, bounded by the districts of Tinsukia (Assam and Arunachal Pradesh) in the north, Tirap in the west and Myanmar in the southeast, is home to the Tangsa. With an area of 4662 km$^2$ the district lies between 26°40′ N–27°40′ N latitudes and 95°11′ E–97°11′ E longitudes and has a majorly Tangsa population of 148,226. Some other tribes, including Singpho, Tutsa, Lisu (Yobin) and Deori also call the district home. Tangsas have a high number of subtribes, namely Muklom, Longchang, Mossang, Jugli, Kimsing, Tikhak, Ronrang, Mungrey, Lungphi, Longri, Havi, Ponthai, Sangwal, Yungkuk, Sakieng and Thamphang. The subtribes reside together and maintain peace and harmony by sharing traditional practices, but they differ slightly in terms of dialect and some attitudes. This study includes information from the Mossang, Muklom, Longchang, Jugli, Tikhak and Kimsing, whose villages were accessible at the time of this study.

Climatic conditions vary from place to place due to the district's topography. The altitude ranges from 200 to 4500 m, with lower elevations and the valleys experiencing hot and humid June–August conditions and the settlements in the hills enjoying more moderate weather. January is the coldest month and the average minimum and maximum temperatures throughout the district are 13 °C and 22 °C, respectively. August is the hottest month during which temperatures may occasionally exceed 30 °C. Annual precipitation is 3800–4866 mm with a maximum during June–October. The Tangsa depend about 80% on agriculture for their livelihoods. Shifting cultivation is traditionally practiced, although people have started to adopt wet cultivation technology.

### 2.2. The Wancho Tribe

The Wancho people inhabit the Longding district within a 27°012′ N and 27°132′ N latitude and a 95°16′ E to 95°20′ E longitude, bounded by the Tirap district of Arunachal Pradesh in the east, Nagaland in the west, Assam to the north and Myanmar in the south. The district has a population of around 70,000. The literacy rate of Longding inhabitants is 68.50%. Economically backward with numerous school dropouts and poor healthcare facilities, the Wancho had fought hard for a separate district, which was granted by the Government of Arunachal Pradesh on March 19th, 2012.

The district is majorly inhabited by the Wancho, who practiced head-hunting until 1991. Nocte and Konyak Naga (also former headhunters) occupy some areas of the district. Owing to the district's large and diverse geography, Wancho have developed complex social norms, beliefs and practices. Being followers of animism, the society was engrossed by myths, superstitions, tattoo customs and rituals, but since being influenced by Christian missionaries, they have begun to condemn head-hunting and some rituals that accompanied traditional festivals and events. Governed by the council of chieftains in which the King is the Head, traditions of gun-making, woodcarving, bead-making and facial tattooing still exist. Slash-and-burn cultivation known as "*jhum*" is practiced in the mountainous regions.

### 2.3. Field Survey Descriptions

Field surveys were conducted from May 2015 to March 2016 among the Tangsa and Wancho in their respective districts, i.e., Changlang and Longding in the North-East Indian state of Arunachal Pradesh (26°28′ and 29°30′ N latitude 13 and 90°30′ and 97°30′ E). The region has few roads and many villages are only reachable on foot or at certain times of the year. Ten accessible villages were visited in each of the two tribal areas. The number of households in the Changlang district varied from 30 to 60 per village but was higher with around 100 to 200 per village in the Longding district. Surveys were based on 1–2 h long group discussions and information gathered from semi-structured interviews combined with free conversations at each village headman's house (i.e., the "Gaon burha").

During the interviews, animal photographs were shown to twenty approximately 45- to 70-year old villagers, (the majority being men in keeping with the custom that they are the leaders). Additionally, at least two households inhabited by village elders (aged 80–90: people often do not know their ages) and their families were visited in the two districts. Recommendations by headmen or village elders to visit certain persons were sometimes followed in line with the "snowball method" [25]. Headmen were chosen as initial contacts because of their status, influence and knowledge of their areas' residents.

The interviewed people were asked simple questions on whether the animals shown to them in photographs and videos were hunted for food or were involved in rituals, treating diseases, decorating garments, aspects of folklore and anything else deemed important. When animals or their parts were involved, we requested that the specimens be shown to us for identification with illustrated guides [26–28]. When this was unsuccessful, photographs of the specimens were later shown to experts or compared with material held in the university collection. Due to the study area's remoteness and the fact that some animals represented protected species, voucher specimens were not collected.

Vernacular names of the animals were recorded, but as the locals had limited knowledge of Hindi or English, Assamese as the *lingua franca* was frequently used. Younger people could often communicate with us in English. Since one of us (Salomi Jugli) was a Tangsa, questions could be asked in Tangsa, which facilitated collecting information from members of that tribe. Knowledge of the animals and their uses pass from generation to generation, but now some traditions are declining.

## 3. Results

### 3.1. Animals Associated with Indigenous Hunting Systems of Animals and Commercialization

With a preference for non-domesticated species, the Tangsa and Wancho use a variety of invertebrate as well as vertebrate animals therapeutically and as a source of protein. One exception are vultures (*Gyps* spp.), which are considered taboo by members of both tribes and regarded as dirty and unpalatable. Moreover, there is the fear that they could conceivably have incorporated human remains into their body and they are, therefore, ignored.

All of the tribal communities of North-East India employ various kinds of hunting tools and use different strategies to obtain their prey. Animal traps are constructed using materials like bamboo, tree branches and leaves, but firearms have become increasingly popular. Tribal people may, according to

Indian law, possess firearms to defend themselves when attacked by a wild animal, but the Wancho in particular, as our informants stated, use guns more for hunting than for self-defence.

Hunting and fishing by a group of male villagers are still common Wancho practices. In connection with predictions by experienced hunters for possible successes in hunting, fishing and honey collections, special rituals are performed. These frequently involve an inspection of the inner organs, such as heart, liver, gallbladder and spleen of sacrificed animals. Decisions whether to take a banana, broom or betel leaves along to pack and wrap the anticipated catch in, also depend on the predictions.

### *3.2. Animals Associated with Traditional Uses and Socio-Cultural Aspects*

Many similarities between the Tangsa and Wancho exist regarding traditional and cultural uses of animals. For instance, the fur of a bear and the teeth of wild boars may be attached to local headwear by members of both tribes, and while shoulder bands made of goat hair (dyed locally) are usually worn by males during festivals, porcupine quills are the females' hair accessories in both tribes. Quills also find use in weaving dresses, designed by Tangsa women, while hornbill feathers are attached to head bands of both male and female Wancho but only male Tangsa dancers. Skulls and jaws of animals like deer, buffalo, mithun (*Bos frontalis*) and the beaks of hornbills are used by both tribes to decorate the houses of expert hunters to indicate the latter's prowess and superiority.

#### 3.2.1. Tangsa Customs

Members of the Tangsa tribe use the feathers of jungle fowl, domesticated hens and roosters as accessories on head bands worn by males and females. The teeth of big cats like *Panthera tigris, Neofelis nebulosa* and *Panthera pardus* are hung on the sheath of local machetes (dao) called '*Jang*' to indicate superiority and strength, while the neighbouring Monpa tribals decorate their dao with the skins and furs of wild goats [5]. Only village heads, local priests and the elderly of a village used to carry machetes with these accessories, but now any rich person may own a decorated machete. The teeth of wild or domesticated boars are used as the trigger in bows ('*dahkau*') to dislodge arrows ('*dahsaan*').

The traditional Tangsa drum "*nong*" is played by men during a festival called "*moh-mol*" or, rarely, on other occasions. Anyone, even by mistake, who plays the drum during non-occasions is thought to invite bad luck and receives a hefty fine, which is decided by village elders and imposed on the family of the one who played. Deer hide is the preferred raw material for the local drumhead, but recently monkey, cow, buffalo, or goat skins, e.g., *Capricornis sumatraensis* and *Capra indicus*, may be used when deerskin is unavailable. Dried skins of buffalo, cow and deer are used as carpets; buffalo skins also served as shields called '*laak*'. Deer antlers are worn as headgear by men. The tradition to present freshwater fish to relatives and close friends for weddings lives on among some Tangsa subtribes.

Items considered valuable, possessing special powers or representing a connection with deceased relatives are passed on from generation to generation. However, accessories used by males, e.g., daos, shields, headgear or by females like feathers, beads and armbands are inherited by sons and daughters, respectively. Bows and arrows are male items like drums, although exceptions regarding the latter exist (Table 1).

**Table 1.** Traditional knowledge associated with the Tangsa tribe.

| | | 1. Mammalia | | | |
|---|---|---|---|---|---|
| **Sl.** | **Scientific Name** | **Common Name** | **Local Name** | **Parts Used** | **Purpose and Traditional Use** |
| 1 | *Ursus thibetanus*, *Melursus ursinus* | Asiatic black bear, Sloth bear | Chabbaang | Hair, gall bladder | *Decoration:* Used for traditional hats and for making shoulder bands worn by men during festivals.<br>*Utilty:* Knives used for cutting bamboo for house construction are rubbed with a piece of dried bear gall bladder, soaked in water. This helps to avoid the bamboo being attacked/damaged by pests. |
| 2 | *1) Macaca assamensis*, *2) Macaca mulatta*, *3) Trachypithichus pileatus* | 1) Assamese macaque, 2) Rhesus macaque, 3) Capped langur | 1) Wii till 2) Woi 3) Raq | Hair | *Magic*: Hair used on traditional hat worn by male and for preventing evil spirit causing bad omen. |
| 3 | *Hoolock leuconedys* | Hoolock gibbon | Thukbai | | *Magic*: Gibbons cause bad omens (accidents, unnatural deaths). Whenever an incident happens, villagers go and hunt a gibbon, kill it, cut its body into pieces and throw them away. It is believed that the spirit of the dead person has been taken away by the monkey. |
| 4 | *Manis pentadactyla* | Chinese Pangolin | Bitsai | Scale | *Magic*: Believed that out of its many scales some would consist of imaginary pictures featuring deer, maidens, temples (used for worshiping) etc. Such scales are considered highly valuable and kept as treasures. The rest are sold.<br>*Food*: The animal is killed for meat and the scales are traded to neighbour states and countries like Nagaland, Assam and Burma. |
| 5 | *Vulpes bengalensis* | Fox | Makakoi | Flesh, Blood | *Bad food*: Only few people consume its flesh, as some consider it as unclean as foxes feed on carcass.<br>*Magic*: If blood is consumed no black magic can harm the consumer. |

**Table 1.** *Cont.*

| | | | | | |
|---|---|---|---|---|---|
| 6 | *1) Canis lupusfam.*<br>*2) Capra hircus* | 1) Dog<br>2) Goat | 1) Heeh,<br>2) Kekai | Head | *Magic*: To appease a bad omen or evil spirit the head of dog or goat is severed and kept in front of the house; the body is buried near or in front of the owner's house's stairs; an event called "*Khulek*". |
| 7 | *Canis lupus fam.* | Dog | Heeh | | *Sacrifice:* During pregnancy or before birth or for a healthy delivery a dog is taken to the forest and tied only to a Bunyan tree (*Min chung*) and sacrificed with continuous chanting. |
| 8 | *Capra hircus* | Goat | Kekai | Hair from beard | *Decoration*: Hair from the goat's chin (most preferred) is used for making shoulder bands worn by men during festivals. |
| 9 | *Sus scrofa domesticus* | Domestic pig | Wak | Liver | *Magic*: For performing predictions; fortune telling before harvest and cultivation. |
| 10 | *Sus scrofa* | Wild boar | Wakngi | Teeth | *Decoration*: Teeth used for the men's traditional cap for decoration and as a symbol of male power and strength. |
| 11 | *Hystrix* sp. | Porcupine | Wihaang | Spines | *Decoration*: Spines are worn by women on their head for beautification and as hair accessories during festivals.<br>*Magic*: Used for performing black magic by some tribals.<br>*Utility*: Spines are used for weaving local costumes, mainly for putting designs on them. |
| 12 | *Cynopterus sphinx* | Bat | Phaksak | | *Poor food*: Only consumed by adults (mostly males) with most of the population believing its taste to be unpleasant and linked to bad omens. |
| 13 | *Nycticebus* spp. | Slow Loris | Rangchuwi | | *Magic*: In the past, it was believed that seeing this animal itself causes a bad omen, following the owner when leaving an earlier home and moving to the new house. |

**Table 1.** *Cont.*

| | | | | | |
|---|---|---|---|---|---|
| 14 | *1) Panthera tigris,*<br>2) *Neofelis nebulosa,*<br>*3) Pantherapardus* | Cat family:<br>1) Tiger<br>2) Clouded leopard<br>3) Common leopard | 1) Chaah<br>2) Pulkhu Chaah | Teeth | *Exalted species*: Some subtribes (e.g., like Jugli) do not eat bornbills and tigers as they consider them to be "Kings" (royal). It is believed that the tiger's soul or spirit is related to humans and a person would soon die too. The cause of the death of the tiger, any marks on its body when hurt, would be seen as the exact place on the dead person.<br>*Magic*: When someone kills any cat family member, a feast for all villagers with rituals to prevent a bad omen is given by sub-tribes Muklom, Tikhak and Longchang, as it is believed that the soul of a *Shamma* (priest) dwells in the tiger. Teeth (canines) are presented as a gift to the maternal uncle. The incisors are presented to village heads/elders like Gaon bura. Bones and skin are sold at the market.<br>*Decoration*: Teeth of all cat family members are attached to swords of important elders, village heads like *Gaon bura*, village judges like '*Walang*' etc. Teeth signify male power and symbolize good luck. |
| 15 | *Bos bubalus* | Buffalo | Loi | Head, Skin | *Sacrifice*: Buffaloes are sacrificed whenever there is an epidemic (spread of disease or any evil spirit)<br>*Decoration*: The head is used for decorative purposes.<br>*Utility*: The dried skin is used for shield called '*Laak*', but also for making drums played at festivals or for making carpets to sit on. |
| 16 | 1)*Cervus uni*<br>2) *Axis porcinus* | 1) Sambar deer<br>2) Hog deer | Chok/Khihoi<br>Nalang | Skin | *Utility*: The dried skin is used for making drums (the thinner the better) and also for making carpets to sit on. Deer skins are the most preferred for making drums. |

**Table 1.** *Cont.*

| | | | | | |
|---|---|---|---|---|---|
| 17 | *Bos indicus* | Cow | Maan | Skin | *Utility*: The dried skin is used for making drums and carpets. |
| 18 | *Sciurus* sp. | Squirrel | Chanchaang | Tail | *Decoration & utility*: Dried tails are used for decorative purposes and for making key chains/holders. |
| | | | **2. Aves** | | |
| **Sl.** | **Scientific Name** | **Common Name** | **Local Name** | **Parts Used** | **Purpose and Traditional Use** |
| 1 | *Hornbills:*<br>*1) Buceros bicornis*<br>*2) Aceros nepalensis*<br>*3) A. undulates*<br>*4) Anthracoceros albirostris* | 1) Great hornbill<br>2) Necked hornbill<br>3) Weathered hornbill<br>4) Pied hornbill | 1) Wuraang<br>2) Wujung<br>3) Wungip<br>4) Wukengkap | Feathers (mostly tail), beak | *Decoration*: Tail feathers (*alap*) from male hornbills (especially the Great Hornbill) are considered most beautiful (with variable colours); used on hats worn by the first dancer who leads the dance troop (*Lamshal waa*) during festivals. However nowadays all male dancers wear it. Beaks are used for decorative purpose.<br>*Magic:* Hornbills, considered "Kings" (royal), are usually not eaten. People feared to bring them home as they were considered to possess ill-causing spirits (the "evil spirit" called *"Wuraang thang")* causing bad omens and deadly diseases. Moreover, it was believed that when a sick hornbill was killed, the person who killed or touched it would infected with the disease.<br>*Magic:* Few subtribes hunted them, but then only when seen in pairs; it was believed to be a sin to kill a bird that was single. If only one was seen, it meant it was a male and a female was with the nest and the young; thus males must not be killed to keep female's and young's company. Only 3 eggs are were thought to be laid: one for Earth, one for Heaven (God), one for the young. |

**Table 1.** *Cont.*

| | | | | | |
|---|---|---|---|---|---|
| 2 | *Spilornis cheela* | Crested serpent eagle | Laang | | *Magic*: Not edible, as considered to possess the spirit of a dead person. (If a person dies a few days later vultures are seen gliding in the sky and the eagle is believed to be the dead person's spirit (*jakhang*). Family members place some food and sprinkle water outside the main entrance of the house, as an offering to the spirit).<br>Few sub-tribes consume it, but then only older males do. |
| 3 | *Gallus domsticus* | Domestic chicken | Wuu | Liver | *Magic*: Used during performing rituals to bring back a lost spirit considered to be the spirit taken away by a ghost.<br>*Magic*: For fortune telling before harvest and cultivation. |
| 4 | *Polyplectron bicalcaratum* | Grey peacock pheasant | Wupoi | Wings, feathers | *Food & Decoration*: Killed for food, but wings and feathers used for decoration due to their colourful appearance. |
| 5 | *Gyps* spp. | Vultures | | Not used | *Taboo:* Unpalatable and dirty |

**Table 1.** *Cont.*

| 3. Reptilia | | | | | |
|---|---|---|---|---|---|
| **Sl.** | **Scientific Name** | **Common Name** | **Local Name** | **Parts Used** | **Purpose and Traditional Use** |
| 1 | *1) Python reticulatus*<br>*2) Python molurus* | 1) Reticulated Python<br>2) Indian python | Paujung | Skin | *Food & Magic*: The flesh must be consumed either boiled or fried. When roasted, it is believed that the skin colour of the person who eats it, would change into snakeskin with time and age.<br>*Taboo*: Not consumed by pregnant and lactating women as it is believed that the child feeding on breast milk would develop an allergy or skin problem. In case of pregnant women, it is thought that the child would be born with their tongue sticking out, constantly salivating and drooling.<br>*Decoration*: The dried skin is used for decorative purpose. |
| 2 | *Varanus* sp. | Monitor lizard | Paupot | | *Magic*: It is feared that when bitten, a person dies because of the poison. However, there is the belief that the person might survive if s/he (in disguise) reaches the river before the lizard as it is thought the lizard goes to the river after it has bitten a person. If the lizard reaches the water (river) first, the person would die. |
| 3 | *Testudo* sp. | Tortoise | Kongsharang | Shell | *Taboo*: Pregnant women do not eat this reptile fearing their babies might never walk properly or may experience a delay in walking.<br>*Magic*: The dried shell is hung outside the entrance door of the house in order to drive away any evil spirit or bad omens. |

**Table 1.** *Cont.*

| | | **4. Amphibia** | | | |
|---|---|---|---|---|---|
| **Sl.** | **Scientific Name** | **Common Name** | **Local Name** | **Parts Used** | **Purpose and Traditional Use** |
| 1 | *Unknown* sp. | Frog | Likkai | Forelimb | *Taboo*: The forelimbs of a frog that are mostly found during late August (they come in groups) are used in the form of a necklace to protect both adults and children from evil spirits.<br>*Magic*: Also believed that when eaten, the man who consumes the frog's forelimbs will not die quickly (as frogs come in groups). |
| 2 | *Bufo* sp. | Toad | Lugmaanchai | | *Taboo*: Toads are not consumed as they are considered to be poisonous and when eaten the person dies instantly. Also it is noted that it is not even eaten by other animals. |

**Table 1.** *Cont.*

| Sl. | Scientific Name | Common Name | Local Name | Parts Used | Purpose and Traditional Use |
|---|---|---|---|---|---|
| | | | **5. Pisces** | | |
| **Sl.** | **Scientific Name** | **Common Name** | **Local Name** | **Parts Used** | **Purpose and Traditional Use** |
| 1 | *Labeo* sp. | Cyprinid | Ngah | | *Social purpose*: Common fresh water fishes are presented as a custom to invite relatives and close friends to special occasions like marriage by the Lungchang sub-tribes. |
| | | | **6. Insecta** | | |
| **Sl.** | **Scientific Name** | **Common Name** | **Local Name** | **Parts Used** | **Purpose and Traditional Use** |
| 1 | unidentified sp. | Cicada | Wajong | | *Utility:* This insect with its first sound announces the beginning of the sowing of rice.<br>*Magic* & Health: In the past some subtribes believed that consuming this insect could cause headache.<br>*Magic & Health*: The insect's sound is believed by some to be a sign of the start of sickness/fever, so that the villagers throw some plant leaves backward as a belief to avoid sickness/fever. |
| 2 | Mantodea | Praying Mantis | Rawehpaanpah | | *Food & Health*: Nymphs/eggs but not adults are eaten because the latter are believed to possess worms inside their stomach. |
| 3 | *Odontotermes* sp. | Termite | Phinphoi | | *Food & Health*: Only the nymphs are consumed. Adults when eaten are linked with a person's swollen stomach and death. |
| 6 | *1) Apis cerana*<br>*2) Apis mellifera*<br>*3) Apis dorsata*<br>*4) Apis florea*<br>*5) Apis andreniformis* | Honey bees | 1) Nyahkaai<br>2) Nyahkhing<br>3) Nyahkaan<br>4) Nyahbi<br>5) Minmoi/Tangu | Honeycomb | *Magic*: The empty honeycombs of any honey-producing bees are hung on the entrance door with a belief to cast away evil spirits. |
| 7 | *Xylocopa* sp. | Carpenter bee | Bintin | Sting | *Taboo & avoided*: This bee is rare and avoided because its sting causes diseases like swelling of skin, wounds, pus, etc. |

**Table 1.** *Cont.*

| | | 7. Crustacea: Malacostraca | | | |
|---|---|---|---|---|---|
| **Sl.** | **Scientific Name** | **Common Name** | **Local Name** | **Parts Used** | **Traditional Knowledge** |
| 1 | *Maydelliathelphusa lugubris* | Freshwater crab | Khaan | | *Taboo & health*: It is believed that crab food can cause malaria. Crabs are therefore completely avoided by some subtribes. |

### 3.2.2. Wancho Customs

Among the Wancho, teeth and nails of bears are worn as ornaments (necklaces) by males. Skins of any monkey species may be used in making baskets and hats for males during festivals (as Monpa tribals do) [5]. Squirrel tails worn by male dancers, who may also wear deer antler earrings, are tied to small baskets attached to their waist. The squirrel tail hanging from the basket around the waist (or attached to the hats) indicates masculinity and is considered beautiful. Mithun (*Bos frontalis*) skin was traditionally used for making defensive shields, as the hide was considered especially tough and even bulletproof. Goat hair, painted red and black with local dyes obtained from a variety of plants, is used on hats and swords worn by male dancers during festivals.

Beeswax known as '*nah*' helps to fuse rope strands and finds applications in the manufacture of the local muscial instrument known as '*patwazah*'. Without beeswax the sound produced by the instrument lacks its characteristic soft resonance that is so loved by the locals. People believe that the wax smoothens rope and bamboo and helps create a more melodious sound. The wax of a bee, known as '*Nyahsa*' is used in connection with ornaments and to attach items made of metal (i.e., mostly copper and sometimes iron), bent into desired shapes, e.g., during the manufacture of guns.

A tradition of family members and relatives is communal fishing whenever a boy is born. The one who names the child is presented with the day's catch. Community fishing is also executed during times when crops are collected from the nursery and are separated accordingly. The meat of soft-boiled snakehead fish identified as *Channa* sp. (possibly being *Channa melanostigma*: [29]) is given to infants of both genders just before starting them on solid food at 5–6 months of age. Nowadays this practice is being followed by increasingly fewer mothers (Table 2).

**Table 2.** Traditional knowledge associated with the Wancho tribe.

| Sl. | Scientific Name | Common Name | Local Name | Parts Used | Purpose and Traditional Use |
|---|---|---|---|---|---|
| | | | **1. Mammalia** | | |
| 1 | *Ursus thibetanus*, *Melursus ursinus* | Asiatic Black bear, Sloth bear | Chapnu | Hair, tooth, nails | *Utilty*: The fur is used for making traditional hats worn by male during festivals.<br>*Decoration*: Teeth and nails used as ornament by males.<br>*Gift & trophy*: One half portion of the hair (mainly from the head region that covers the ears) is presented to the king and the other half is kept by the owner of the slain bear. |
| 2 | 1) *Macaca assamensis*, 2) *Macaca mulatta*, 3) *Trachypithichus pileatus* | 1) Assamese macaque 2) Rhesus macaque 3) Capped langur | Mainak | Skin | *Utilty*: The skin is used for making caps and baskets that are worn during dancing by the males during festivals. |
| 3 | *Manis pentadactyla* | Pangolin | Hahbut | | *Trade & barter*: Scales collected from a pangolin are sold to residents of the neighbouring states and countries. |
| 4 | *Canis lupus familiaris* | Dog | He | | *Social purpose*: Dogs are exchanged as gifts, to pay fines etc. but only within people sharing the same surname or subtribe.<br>*Food & health*: Earlier eaten only by lower caste people, but presently preferred by all with the meat being considered medicinal.<br>*Magic & health*: A dog is sacrificed by the oldest man of the community in the presence of all the villagers during an outbreak of an epidemic like measles, small pox, diarrhoea etc. The fresh blood is then touched by the villagers, (both sick and healthy), as it is believed that by doing this they would be healed from the diseases.<br>*Ritual food*: Marriages of kings and queens from different villages are consummated by sacrificing a dog. The sacrifice is done by the king's eldest brother (signifying the first-born son) by beheading it in a single blow. The newly married queen enters her in-laws' house by stepping over the spilled blood on the ground. |

**Table 2.** *Cont.*

| | | | | | |
|---|---|---|---|---|---|
| 5 | *Hystrix* sp. | Porcupine | Adi/Azi | Spines | *Decoration*: Spines used by women as local earring and by ladies as hair accessories during festivals.<br>*Utility*: Used as forks to eat meat during festivals. |
| 6 | *Nycticebus* spp. | Slow Loris | Awai | | *Magic*: Not eaten; hunted and killed if sighted, as it is believed to cause bad omens. |
| 7 | All Cat family<br>1) *Panthera tigris*<br>2) *Neofelis nebulosa*<br>3) *Panthera pardus* | 1) Tiger,<br>2) Clouded leopard<br>3) Common leopard | Chahnu | | *Taboo:* Not consumed as it is seen to be an incarnation of a King's soul. Seeing tigers is considered rare for the same reason. Killing of any of the cat family is a serious issue among the villagers (they do not want to kill but have to for safety). Young and old alike would weave small local baskets and carry them to the forest to seek forgiveness from the gods of the Kings (as the great cats are the strongest of all animals in the forest) by singing and dancing. The whole village are considered to be guilty of the crime of killing the animal, which is why everyone participates in the ritual. |
| 8 | *Bos bubalus* | Buffalo | Loi | Head/Skull | *Decoration*: For decorative purposes and to exhibit superiority. |
| 9 | *Sciurus* sp. | Squirrel | Heeh | Tail | *Decoration*: Used for decorative purpose. On the first day of the Oriya festival, male dancers wear the squirrel tail tied to a hat or local basket, worn around the waist. Smaller squirrel tails are tied to children's baskets too. |

**Table 2.** *Cont.*

| | | | | | |
|---|---|---|---|---|---|
| 10 | 1) *Cervus uni*<br>2) *Axis porcinus* | 1) Sambar deer<br>2) Hog deer | Maikhi/Chok | Antlers | *Decoration*: Antlers used as decorations and adornment. Earrings made from antlers worn by males as ornamets.<br>*Social:* The first person to accurately fire the bullet gets the right thigh of the animal. The 2nd person to hit or arrive at the spot, gets the shoulder portion; followed by third with the back portion. The head is always presented to the king of the village (all this is followed only during community hunting and not in individual hunting). |
| 11 | *Talpa* sp. | Mole | Thupha | | Sighting this animal is believed to be a bad omen and leads to the abandonment of executing further plans or work. |
| 12 | *Sus scrofa* | Wild Boar | Myla | Teeth | - The teeth are fixed to hats and worn by males during festivals.<br>- Teeth are used for decorative purposes. |
| 13 | *Bos frontalis* | Mithun | Ngaa | - Head/Skull<br>- Skin | - The head/skull is hung outside the house for decoration and as a symbol of superiority/strength.<br>- After drying the skin is used as a shield and for defence during fights with the enemy; it is even used as a bulletproof shield. |
| 16 | *Capra hircus* | Goat | Zon | Hair | - The hair is painted red and black using locally made dyes. This painted hair is used as shoulder bands and on hats worn by males. Also tied to swords used for dancing during festivals.<br>- Earlier, members of the high-class section of the tribe did not eat goat, but now they do. |

**Table 2.** *Cont.*

| | | 2. Aves | | | |
|---|---|---|---|---|---|
| **Sl.** | **Scientific Name** | **Common Name** | **Local Name** | **Parts Used** | **Traditional Knowledge** |
| 1 | *Hornbills:*<br>*1) Buceros bicornis*<br>*2) Aceros nepalensis*<br>*3) A. undulates*<br>*4) Anthracoceros albirostris* | 1) Great hornbill<br>2) Necked hornbill<br>3) Weathered hornbill<br>4) Pied hornbill | Ozang | Feathers (mostly tail), Beak | - The feathers are used as decoration in traditional hats, both by male and female dancers during festivals. The tail feathers of the great hornbill are more favoured than others.<br>- The beak is also used for decorative purposes. |
| 2 | *Spilornis cheela* | Crested serpent eagle | Ola | | This bird is considered to possess the spirit of a dead person and s therefore protected and neither hunted nor consumed. |
| 3 | *Bubo nipalensis,*<br>*B. bubo* | Owl | Akhuh | | - Consumed only by the elderly people.<br>- Considered the decider of day and night. |
| 4 | *Dicrurus paradiseus* | Greater racket-tailed drongo | Waah | Feathers | - The feathers are used in traditional hats<br>- Not edible. The bird chirps during dusk and dawn so people believe it to be the morning and night announcer. The chirps are taken as an indication of time to return from the fields in the evening, as it would get dark soon. |
| 5 | *Dicrurus macrocercus* | black drongo | Jajoi | | It is believed this bird informs the people of the presence of fish in the stream and alerts them whether or not it's worthwhile to go fishing. |
| 6 | *Corvus splendens* | Crow | Okha | | Not consumed as it is considered a sweeper/ scavenger and thus dirty. |

**Table 2.** *Cont.*

| | | | | | |
|---|---|---|---|---|---|
| **3. Reptilia** | | | | | |
| **Sl.** | **Scientific Name** | **Common Name** | **Local Name** | **Parts Used** | **Traditional Knowledge** |
| 1 | *1) Python reticulatus*<br>*2) Python molurus* | 1) Reticulated Python<br>2) Indian python | Punu | | - Hunters should not have eaten until a ritual is performed by a local priest, which is done by removing and using the horn-like outgrowth in the abdomen of the snake. The ritual is concluded by hanging the head of the snake outside the house of the priest (and let it wither away with time). The consequence of not performing the ritual is believed to lead to a cursed life of the hunter.<br>- The snake is killed upon sight or the curse is believed to double or cause bad omens.<br>- The horn-shaped outgrowth is believed to be poisonous and the reason for the withering away of the canopy over which the snake crawled.<br>- Sighting a python could lead to the death of the person, and therefore the python must be killed and cut in two and thrown away to survive the sighting. It is then followed with rituals and feasting. |
| 2 | *Naja* sp. | Cobra | Pucham | | The soul of people is believed to dwell in this snake and killing it would welcome curses and an eventual death of the person. |
| **4. Amphibia** | | | | | |
| **Sl.** | **Scientific Name** | **Common Name** | **Local Name** | **Parts Used** | **Traditional Knowledge** |
| 1 | Anura (Hylidae) | Green Frog | Luk | Whole Body | Eaten before performing rituals during festival. |

**Table 2.** *Cont.*

| | | | | | |
|---|---|---|---|---|---|
| | | | **5. Pisces** | | |
| **Sl.** | **Scientific Name** | **Common Name** | **Local Name** | **Parts Used** | **Traditional Knowledge** |
| 1 | *Labeo* sp. | Cyprinid | Nyah | | - When a boy child is born, the family members and relatives (mostly males) go fishing. The person who names the child gets the maximum share of the caught fish.<br>- Fishing is also done during the time of collection and separation of rice samplings from the nursery. |
| 2 | *Channa* sp. | Snakehead fish | Nyah | | This fish is fed to infants just before starting the consumption of solid food. |
| | | | **6. Insecta** | | |
| **Sl.** | **Scientific Name** | **Common Name** | **Local Name** | **Parts Used** | **Traditional Knowledge** |
| 1 | *Odontotermes* sp. | Termite | Khunkhah | Termite mound | - Urinating or excreting on the termite mound (*Hahpho*) is believed to cause swelling of the private parts and buttocks.<br>- Contacting the mud from the mound should be avoided and should never be used to build a fireplace in the house. |

**Table 2.** *Cont.*

| | | | | | |
|---|---|---|---|---|---|
| 2 | *1) Apis cerana*<br>*2) Apis mellifera*<br>*3) Apis dorsata*<br>*4) Apis florea*<br>*5) Apis andreniformis* | Honey bee | 1) Nyaakat<br>2) Nyaakat<br>3) Nyaakat<br>4) Nyahsa<br>5) Nyahsa | Bee wax | - The presence of a beehive should be informed to the king and then the family, relatives and the villagers. A local prediction is performed using leaves (e.g., banana, betel leaf etc.) before collecting the honey to know the yield (size of honeycomb and quantity of honey and brood inside). Extraction is not performed if the yield is predicted to be low.<br>- Messenger of love. The bee is believed to be the spirit of a lover and its buzzing conveying love.<br>- Wax is used as a coat by rubbing it on local musical instruments, especially the mouth instrument called '*Patwazah*' made of bamboo and rope to produce a better sound from the instrument.<br>- Beeswax is used for joining copper materials and some iron materials too, mostly to shape the barrel of a gun to a desired curvature, but also for making ornaments. |
| 3 | Orthoptera | Any grasshoppers and crickets | Okuk | | - Freshly caught from rice fields used in rituals: e.g., during Oriya festival and while planting *Colocasia* (taro) eaten in the belief of protecting the plant from the insect and for the healthy growth of the plant.<br>- The insects are collected from the field and the rituals are performed by a priest to ensure healthy cultivation of rice, millets, colocasia etc. |

### 3.3. Animals Associated with Indigenous Beliefs, Myth, Rituals and Customs, Cosmologies, Stories and Songs

The notion that diseases are caused by evil spirits, and therefore can be cured only by appeasing the evil spirits by means of an animal sacrifice is still prevalent in North-East India. Domesticated animals like fowl, pigs and dogs are easily available and are sacrificed in the hope to appease the evil spirits. Hoolock gibbons are considered bad omens by the Tangsa and any unexpected death of a family member is blamed on them. If there are unnatural deaths due to an accident or during childbirth, the villagers hunt down a hoolock gibbon and cut its meat into pieces for the relatives of the deceased, but not to be consumed by them but to be thrown away in the jungle, thereby cursing the monkey for having caused the unexpected death (Table 1).

In Tangsa villages, only the head of a dog or a goat, dried shells of tortoises and honeycomb refuse are frequently seen at the entrance of a house to cast away evil spirits and bad omens. At the onset of labour during childbirth, a dog, later to be sacrificed, may be taken into the forest and tied to a banyan tree. It is believed that this helps the delivery. Similarly, a bunch of monkey hair (any species) is tied to the entrance of the house or attached to the ceiling or beams inside to prevent evil spirits from lodging in the house and giving the family a bad omen, sabotaging its future or causing illness and distress (Table 1).

Pigs and hens often have their livers used in fortune telling and predicting the yield of harvests. Fortune tellers never reveal how they deduce the future from, for example, the liver's colour, shape and texture. Their final conclusion depends on what their senses tell them with onlookers unable to comprehend how they make the predictions. Liver, gallbladder, heart and spleen used in this haruspex (i.e., interpretations of omens through inspections of sacrificial animals' entrails) are consumed together with the meat of the sacrificed animal. Buffaloes are only sacrificed during major epidemics and their meat would, of course, be consumed while their skulls would be used for decorations. To ward off evil spirits that attack children and sickly adults, a necklace of frogs' forelimbs is worn by the weak individual (Table 1).

Amongst the Wancho, dogs are important and sacrificed, e.g., when a king from one village marries a queen from another. The dog is beheaded with a machete in a single blow, a task usually performed by the king's eldest brother (signifying the first-born). The queen then takes the first few steps into the in-law's house by stepping into the dog's blood on the ground. Upon that the dog's meat is prepared for consumption by the newly-weds and their relatives. The dog's significance among the Wancho is also evident from the age-old custom of exchanging dogs as gifts among members with similar surnames. Contrary to the Tangsa, Wancho elders prescribe dog sacrifices also at times of epidemics. All the villagers will touch the sacrificed animal's blood, as it is thought to possess healing powers and to prevent diseases. The meat will be consumed (Table 2).

Following community hunting, a killed animal's head and thighs, considered the most important parts, go to people of high standing while the remainder will be available to all villagers. In connection with an individual's hunt, the person who shoots the animal is entitled to have the right of the thighs; the one to hit the animal thereafter or to arrive at the spot it was shot, gets the shoulder or hip portion, while the third gets the back. The head is always presented to the village's king or headman. Members of the tribe believe one should never encounter a python, but if accidentally someone does run into one, the python must be killed by that very person who encountered the snake lest that person be cursed indefinitely. To render a curse ineffective, a priest may perform a variety of rituals (Table 2).

Orthopterans (e.g., grasshoppers, crickets, etc.) are collected twice: just before the planting of the *Colocasia* (known as "taro") at the beginning of February and during the Oriah festival in March or April. The ritual, which involves chanting, sacrificing and consuming insects, is performed in order to protect this plant, its edible tuber and other cultivated crops like rice, millet and maize from harmful insects Table 2).

Traditional songs and stories are preserved and transmitted orally from one generation to another, a process which heavily involves the elderly of the village. Since there are no written records of the stories or the songs and their origins to save them, scientific documentations, videos or audio recordings are required. It should be mentioned, however, that a script for Wancho was recently invented and the first book in Wancho was published by Losu [30]. Songs and stories about animals reflect the importance that the locals attach to species that play roles in their cosmology as a source of food or danger, good or evil. As such, the local folklore can therefore help to shed some light on the various reasons why some species are hunted and consumed while others are killed and not used in any way, or why some are simply ignored.

3.3.1. Stories of the Tangsa

1) *Story 1: The Origin of the Flying Lizard (Junglep)*

Known as '*Junglep*', the name refers to a lizard, whose sound is heard during the months of March and April. During sacrificial rituals (called '*Khaatang*') and head-hunting, female members of the family serve rice beer to male members while the males reciprocate by distributing meat to the females. According to the story of *Junglep*, a teenage orphaned girl, had nobody she could serve rice beer to or receive any meat from in return. The grief of being alone made her cry "*Junghong le, Wahong Le*"—(no elders, father or brothers). She eventually succumbed to her grief and turned into a *Junglep*.

2) *Story 2: Transformation of a Man into a Tiger (Chaah)*

People of the village where this story is being told believe in a "shape-shifting spirit" called "*Namphi*" (or *Aphi*), which can transform itself into a tiger. This is the story of two friends, with one of them disappearing night after night from his bed, making the other suspicious. Getting increasingly worried, the friend decided to find out the reason for his companion's absences. Searching everywhere for his companion without finding him, he found a container with fresh tiger teeth and claws. He then understood that his friend was a normal human by day and a tiger by night and decided to kill his shape-shifting friend. He put hot charcoal and ashes into the container to destroy the tiger's teeth and claws, thereby killing the shape-shifter.

Another story about a shape-shifter and a tiger involves a wandering businessman who starts quarrelling with a person of a village he is visiting for some business matter. The person gets furious and warns him that he will teach him a lesson. The businessman on his way back to his own village encounters a tiger. The tiger threatens and thereafter haunts but does not kill the man. The man gets seriously ill after reaching home. After that incident, the villagers conclude that the tiger was not a real animal, but a shape-shifting spirit of the man from the other village with whom he quarrelled.

3) *Story 3: Dog (Heeh) and Pig (Wak) Story: Why Pigs Are Reared and Fed Separately and Dogs Get Just Leftovers*

Once a master had a dog and a pig. Both helped their master in every possible way, but one day the master sent both of them to plough the field. The pig obediently ploughed the field the whole day, but the dog only slept. In the evening, when they were returning home, they had to cross a bridge. The pig having pointed toes could not cross the bridge and had to go down into the water to cross the river while the dog crossed the bridge. Thus, the dog reached home early and told the master that he worked hard the whole day while the pig slept and did nothing. The pig overheard the dog's lies, confronted him, and told the master the truth. Upon that, the dog got mad and bit the pig, which infuriated the master so that he beat the dog. He then cooked food for the pig but did not bother to prepare any food for the dog. This is why people in the villages still rear pigs and cook their food separately while dogs are fed leftovers of meals served to humans.

4) *Black Bird (Black Drongo) and Rat Story: How the Bird Got Its Beautiful Tail Feathers Shortened*

The black drongo bird used to have very beautiful long and thick tail feathers of which it was very proud. Every day the bird would sit on the highest branch of a bamboo plant and flaunt its tail. The other forest animals loathed this behaviour and decided to teach the bird a lesson. A small bamboo rat decided to take the challenge. When, as usual, the bird sat on the bamboo showing off its tail feathers, the rat climbed up to the bird. Not being noticed, the rat then carefully started biting off the bird's tail feathers. Thus, the bird's tail was shortened and to this very day, the black drongo bird has a short tail. To see this boastful braggart taught a lesson made the other animals very happy.

3.3.2. Stories of the Wancho

***1)*** *Story 1: Tiger (Sahnuh) and Cicada (Nyu): How Humans Learnt to Make Fire*

Originally humans and animals lived peacefully together and the tiger was the only one who knew how to make fire but would not share that knowledge. The cicada is considered a mythical creature with eyes on its belly. Once the tiger and the cicada, known by the Wancho as "*nyu*", were keeping company. For some reason, the tiger had to make fire and, not wanting to disclose how he did it, asked the cicada to close its eyes. The cicada complied and started to wrap its arms and legs around its belly to cover its eyes. Not realizing that cicadas have eyes on their bellies, the tiger scolded the cicada and demanded that it cover its head, thinking that the cicada's eyes must be there. The cicada, however, watching the tiger make fire learnt the technique and then conveyed that knowledge to the humans. That was how the world learnt how to make fire (*wuju*).

***2)*** *Story 2: Owl (Akhuh): The Day and Night Decider and the Origin of the Owl's Flat Head*

An argument once started between nocturnal and diurnal animals. Diurnal animals claimed there was only daylight throughout a day and darkness. The nocturnal animals took the opposite view, saying there was only darkness in a day. Then came the owl and announced that both light (day) and dark (night) were in a day. The animals agreed that the owl should become the day and night decider. However, they were annoyed with the owl because had it arrived earlier, they needn't have had an argument. They decided upon a punishment and agreed that hitting the owl on the head and singing "why did you not come earlier to teach us, so that our fight would not have happened?" ("*Akhuh thele thele amih saman ngui hait*") would be the appropriate punishment. The beatings on the head of the owl then the flattened this bird's head.

***3)*** *Story 3: Crab (Saan) and Frog (Luk): How the Crab Got Its Colour and the Frog Lost Its Backbone*

The frog and the crab were ploughing the field. The crab brought boiled colocasia (=taro) for lunch. The colocasia became cold by noon, and so the crab decided to warm it up by putting it on the fire. When the crab went near the fire to retrieve it, the crab's body turned red in colour due to the heat. Seeing the crab becoming red, the frog could not stop laughing and laughed so hard that he bent his backbone. Since then, crabs have a red body and frogs lack a straight backbone.

***4)*** *Story 4: Mongoose and Blackbird: How the Bird Got Its Tail Feathers Thinned and the Mongoose Got Sharp Teeth and a Long Mouth*

Using its mouth, a mongoose once took hold of a blackbird's tail. The bird, in order to get rid of the mongoose, started flying upward. However, the adamant mongoose did not let go and was dragged up into the air by the bird. The struggling of the bird eventually made the mongoose lose its hold and therefore, to this day, the bird's tail is thin along the base and normal at the tip, while the mongoose's teeth in its elongated mouth are sharp and pointed.

***5)*** *Story 5: The Origin of the Monkey*

Ages ago, there lived a couple who adopted an orphan as their son. They asked their son to take care of their paddy field in the jungle. Being alone, the son enjoyed his freedom and played and slept but did not bother looking after the field. One day, the parents conveyed the message to return to their son through a neighbour, who had his own paddy field nearby. The neighbour, however, told the son that his parents want him to stay in the jungle and never to return. So the parents waited for their son to arrive in vain. They conveyed the same message again through their neighbour and also sent their son some food. Yet again, the neighbour misled the son into thinking his parents were waiting to beat and kill him. Consequently, the son decided not to return home. The father then decided to go to the field with some food himself to make his son come back. On reaching the field, he called his son, but the son got so frightened that he ran deeper into the jungle. His father was shocked and followed him. He requested him to come to him and have some food, but the son still thought his father had come to beat him for not taking care of the field. His father showed him the special meal he had cooked, but the son climbed a tree and shouted to his father that he had enough to eat what he liked best, namely the young leaves of the bamboo. The boy then disappeared into the jungle to turn into a monkey and never to return.

*Song 1: Honey Bees: the messengers of love*

"Nahkat peele jangpong thaiba

Zole taahpo kah ho le lah hai"

***Narration***: Whenever you are sitting alone and a honeybee flies buzzing around you, you must never kill it, as it is believed to be the spirit of a loved one who is thinking of you.

*Song 2: Cicada*

"Sacchi sahpu ngu nu din sammai"

***Narration:*** This line says about the cicada that, although its stomach is always empty, it still has a beautiful and sweet singing voice. In the early days when traditional methods were used for cultivating paddy, the yield was low and would often not even last until the next harvest. Just before the harvest season, when people had nothing in their stores to eat, it was the time when cicadas began to sing. The starving villagers took inspiration from the cicada's singing, for even on an empty stomach it never ceased to sing. People likewise thought they should not stop working if their stomachs were empty.

## 4. Discussion

### *4.1. Traditional Knowledge: Looking Back on the Way Forward*

A study like this based on a limited number of interviews with a fraction of the population can only "scratch the surface" of what would constitute the totality of tribal lore regarding animals that the Wancho and Tangsa encounter in their respective areas. Given, however, the speed with which traditional beliefs and age-old practices disappear, any bit of information still available is precious and worth reporting.

There are, of course, efforts by community leaders, scholars and the government to slow down this erosion and gradual disappearance of tribal traditions, but if such efforts do prove successful, new problems may arise. As the tribal population increases and members of the tribes continue to follow their traditional practices related to wild animals, species already vulnerable and threatened by extinction may not survive into the future. It is this dilemma that anthropologists, animal conservationists, law-makers and policing bodies have to grapple with.

The general concern regarding traditional uses of animals is therefore twofold. If we do not have in place encouragements and perhaps even rewards to retain local traditions, we will lose them and once lost, they would be almost impossible to revive. On the other hand, cultural purposes revolving around the exploitation of certain animals and the impact such practices can have, need to be addressed. This study has revealed only some instances that would require judicial intervention as there was no immediate threat to most of the animals (other than the large carnivores, the hoolock gibbon, slow loris and pangolin) used by the tribes. In fact, it is in the interest of the tribal people that their ritually important species continue to be available (with the exception of a few like the pythons which are loathed and considered dangerous to individuals and the community: but see the next paragraph).

### 4.2. Living in Harmony with the Animals: An Achievable Goal?

The emphasis on maintaining their rituals and customs, their beliefs, myths, etc., could be a guarantor for the tribals' protection of various species, working against needless animal killings. In this context, traps constructed by using materials like bamboo, tree branches, leaves, and stones as described in [31,32] are far superior to the indiscriminate use of firearms in order to obtain terrestrial species or the use of fine nets of polyamide fibres like nylon to snare aquatic or aerial organisms. However, traditional beliefs can also be helpful to protect certain species. To mention a few examples: eagles, considered endangered, are believed by the Tangsa to possess the spirits of dead people and are never harmed. Pregnant and lactating Tangsa females avoid pythons and tortoises lest their babies stick out their tongue, be incessantly salivating and requiring prolonged feeding on breast milk to avoid allergies or skin problems. It is also believed that consumption of tortoise meat by pregnant females may cause their babies to walk awkwardly and although the shells of tortoises are sometimes used to ward off evil from a house, tortoise populations are not in danger of being overexploited by the locals. Regarding crabs, the Tangsa are advised to consume them seldomly and then only in small quantities, as the consumption could lead to malaria. Some Tangsa believe that to hunt hornbills unless seen in pairs is a sin and that three eggs should never be collected together. Hornbills are said to lay only three eggs; one each for the heavens, the earth and a hatchling.

The Wancho also consider eagles to possess the spirits of the dead and their consumption is taboo. Crows are avoided as they are considered dirt sweepers and vultures, including the critically endangered *Gyps indicus*, are not hunted, but mainly ignored because they are seen as unclean. Moles and slow lorises are animals whose reputations are entirely negative and even the sight of them is a bad omen. Although they may sometimes be killed, more often they are simply avoided as it is an effort to hunt them down. Cobras are believed to possess the souls of people and if killed, they will haunt and ultimately destroy the person who harmed the snake. The Wancho avoid urinating or defaecating onto a termite's mound, locally called '*hahpho*', as it could cause problems like swelling of the genitals and buttocks. One should not touch the mound and has to ensure that the mud from the nest is not exposed to the mud used for making the fireplace. Although there is definitely no need to protect the termites, beliefs such as these (and almost certainly many unrecorded more) were strictly adhered to in the past but have undergone some relaxation. The present generation, for example, does collect and relish termites, especially during their swarming phase.

Bee honey and brood are collected systematically. When a hive is found, the village king is informed and family members and some villagers accompany the person who located the hive to retrieve it. However, they need to listen to some predictions first to help them estimate the size of the hive, the quantity of the honey and its brood. As the brood and quantity of the honey matter to safeguard the resource, any attempts of extraction are abandoned if the yield is predicted to be small. The proficient utilization of honeybee products also differs. Beeswax has several purposes for the Wancho but not the Tangsa. Insects generally, and crickets and grasshoppers in particular, play a bigger cultural role for the Wancho than they do for the Tangsa [33] and this is reflected in some of their folktales and stories.

### 4.3. What Do the Differences Mean to a Biodiversity under Threat?

Several aspects regarding cultural practices and traditions unite the two tribes, but obviously some differences exist, especially in connection with the killing of species belonging to the cat family (i.e., tiger, leopard, etc.). Where, on the one hand, some Tangsa participate in merry-making and feasting following such kills, the Wancho tribals consider such killings unfortunate and become seriously concerned, making the villagers perform various rituals after such killings. Another difference concerns the hoolock gibbons. For the Tangsa, even to set eyes on one is thought to have serious consequences for the person who saw the gibbon. For the latter, already an endangered species, the consequences could be even worse as it may be killed to avert any harm coming to the person who saw it. The Wancho know no such repercussion regarding the hoolock gibbon, but kill the slow loris, which, however, are of little interest to the Tangsa. Obviously, there are threats to some already vulnerable species and the pangolin is one of those species under particular pressures: it is used for trade and barter by both tribes, and moreover for food by the Tangsa.

To stop the needless killings, one needs to understand the reasons why the animals are killed. If it is for food, alternatives could possibly be provided by domestic species. Opportunities to earn money other than by selling wildlife should reduce the pressure on the traded animal species. Animal parts, and this includes feathers, used for decoration and adornment can be replaced by equally beautiful artificial objects, and when it comes to the use of species in magic and rituals, the best option is to make people understand that they will lose their ritually important species if they don't protect them and make sure there are always sufficient younger individuals to replace those removed from the population. Tribal people need to understand that biodiversity matters; that is, that it helps to stabilize the environment they call "home" and the younger generation can teach the older one.

Luckily, local leaders and elders are still widely respected individuals and to empower such local leaders by letting them feel that they are the guardians of their region's flora and fauna and thereby have a responsibility to make sure that unnecessary killings do not take place, can be very helpful. This means, of course, that the leaders and elders themselves have to understand that some of the older beliefs like the hoolock gibbons' bad omens are no longer acceptable and that the harmless pangolin (and the income derived from the sale of its scales) will disappear if there are no restrictions to curb its exploitation. Laws and regulations have to be put in place, but law enforcement is weak in the remote areas, which is why those that are influential in the community need to be convinced that some of the older beliefs should not be upheld any longer and that alternatives to the use of wildlife in rituals can be found: some domestic species could, for example, be used and some like dogs and chickens are indeed already used.

The examples given in the previous section in connection with the attitudes towards certain animal species show differences between the tribes, especially regarding the endangered cat species and hoolock gibbons. Although climate and environmental features as well as faunal composition seem similar between the two regions, there could be differences regarding the abundance and occurrence of certain species. It is, however, also possible that cultural dissimilarities and attitudes have evolved between the tribes to deliberately separate the two populations from each other in ways that food and other taboos are distinct between neigbouring ethnic groups [34]. Contacts with missionaries and western ideas may also have varied between the tribes and led to separate attitudes towards species in their respective regions.

Although both tribes rely on predictions (made by respected local experts, who frequently use animals or animal parts) before going to collect wildlife or go hunting, the practice has now almost disappeared among the Tangsa, largely due to the influence of Christianity, but still operates among the Wancho. Likewise, the practice of "community hunting": it is nowadays only still common among the Wanchos. The Tangsa may very occasionally go "community hunting", but group hunting (involving a few people) and individual hunting are nowadays more common activities and possibly less damaging to the wildlife than if whole crowds of people were going on a hunt all together. It is encouraging that the stories retold in this essay do not generally describe hunts or depict the animals as foes and enemies of humans but greet them as partners. The stories may not be identical but they are a reflection of how the members of the two tribes interpret Nature and her creatures. The connection with the animals of the region is something that is shared by the stories of both tribes and this demonstrates that the species mentioned in the stories are important representatives of the wildlife of the region—and hopefully will remain to be so in the future as well.

The Government is lending a helping hand to promote and educate tribal people of Arunachal Pradesh to preserve the cultural uses of their animals without losing the region's biodiversity or threatened and vulnerable species. Tribal leaders do generally support the government's efforts, but their powers to influence and/or control the behaviour of their people will inevitably steadily get weaker. Ultimately, the tribal people of the region themselves need to find a compromise between, on the one hand, accepting an increasingly more modern "Western" lifestyle and on the other, retaining their local customs that define their tribes' respective cultural uniqueness.

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*Article*

# Wild Food Plants and Trends in Their Use: From Knowledge and Perceptions to Drivers of Change in West Sumatra, Indonesia

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**Abstract:** Wild food plants (WFPs) are often highly nutritious but under-consumed at the same time. This study aimed to document the diversity of WFPs, and assess perceptions, attitudes, and drivers of change in their consumption among Minangkabau and Mandailing women farmers in West Sumatra. We applied a mixed-method approach consisting of interviews with 200 women and focus group discussions with 68 participants. The study documented 106 WFPs (85 species), and Minangkabau were found to steward richer traditional knowledge than Mandailing. Although both communities perceived WFPs positively, consumption has declined over the last generation. The main reasons perceived by respondents were due to the decreased availability of WFPs and changes in lifestyle. The contemporary barriers to consuming WFPs were low availability, time constraints, and a limited knowledge of their nutritional value. The key motivations for their use were that they are free and "unpolluted" natural foods. The main drivers of change were socio-economic factors and changes in agriculture and markets. However, the persistence of a strong culture appears to slow dietary changes. The communities, government and NGOs should work together to optimize the use of this food biodiversity in a sustainable way. This integrated approach could improve nutrition while conserving biological and cultural diversity.

**Keywords:** wild edible plants; indigenous foods; agrobiodiversity; nutrition and diets; food systems; food environment; local knowledge; ethnobotany

## 1. Introduction

Although the current global food system is believed to be capable of providing enough calories for the world, there are still around two billion people who experience hunger or do not have access to a nutritious diet [1]. An increasing number of countries experience the double burden of malnutrition, where undernutrition coexists with overweight, obesity and other diet-related diseases [2]. Recent studies have demonstrated that food systems are failing to deliver a healthy diet and are inequitable and environmentally unsustainable [3,4]. Global trade and markets play an omnipresent role in influencing human dietary and lifestyle habits, and among Indigenous and vulnerable communities, tend to increase the consumption of highly processed foods of poor nutrient value [5]. For these many reasons, traditional landscapes, cultures and foodways are increasingly homogenized, and many communities are undergoing a nutritional transition negatively affecting their health [6,7].

Wild food plants (WFPs) have been part of diets and traditional food systems throughout human history, providing important nutrients and bioactive compounds. Ancestral and contemporary traditional diets are known to offer valuable health benefits [8]. There are also suggestions that humans and their genome are adapted to the diet and environment from past times and that contemporary diets and lifestyles are not optimal for the human genome [9]. The Western dietary pattern is characterized by a high consumption of ultra-processed foods, which also seems to push the human gut microbiome to produce negative health outcomes and inflammation [10]. WFPs are traditional foods that tend to be richer in micronutrients than cultivated crops [11,12]. This offers the potential for alleviating micronutrient deficiencies in some contexts such as among rural and Indigenous communities [13,14]. WFPs also represent bioactive functional foods that could contribute to healthy diets and immunity to a variety of illnesses [15,16]. Among Indigenous communities, a higher use of wild foods has been linked with greater food security [17]. WFPs are embedded in traditional food knowledge, which represents an integral part of local and sovereign food systems [18].

Despite their potential benefits, WFPs have been overlooked and excluded from most formal education, policies and research or development programs. The barriers to a greater use of WFPs were reviewed by [19], with the main ones being a lack of information, statistics, market infrastructure, research and policies. Moreover, food and agriculture sectors have neglected wild species in favor of cash crops and starchy staples [20]. In terms of research, documentation of WFPs is challenging and numerous assessments and "production diversity" studies fail to capture them as they are uncultivated and stewarded in the social memory of communities. Quantifying their contribution to diets is also limited by a severe lack of food composition data [13]. In addition, their free availability in nature has resulted in low economic valuation, which further reduces their visibility and promotion despite their nutritional, health, social and ecological benefits [21].

Currently, numerous drivers are accelerating the decline in biodiversity and the use of WFPs, such as changes in land-use, climate change, agriculture intensification, overharvesting, socio-economic change, expansion of markets and the loss of local knowledge [20,22].

In Indonesia, one of the most bioculturally diverse countries in the world, foods and diets vary along with geographical, socio-economic and cultural diversity [23]. Food in Indonesia has a high socio-cultural value [24]. Despite its gastronomical richness and significant economic growth, malnutrition in Indonesia remains a major problem [25]. In 2018, the national prevalence of stunted children under 5 years was 29.9%, and anemia reached 48.9% of pregnant women [26]. The problem is multi-faceted [27], but in terms of diet, the main issue appears to be an extreme dependence on rice and a low intake of nutritious foods such as fruits and vegetables [23]. According to the same authors, Indonesians should substitute refined rice with a wider variety of staple foods; increase intake of traditional fruits and vegetables; increase consumption of proteins and fats, especially among those who are undernourished; and curb processed foods rich in added sugars and oils. As shown by the PROSEA (Plant Resources of South East Asia: http://proseanet.org/prosea/) series, Indonesia is rich in wild and cultivated foods, but the country is losing its forests and biodiversity at a tremendous rate [28] and little is known about changes in WFPs.

In West Sumatra, local communities maintain a relatively diverse diet with a prevalence of traditional foods [29,30]. But the quality of the diet was found to be rather low, mainly due to a monotonous diet and a high intake of saturated fatty acids [31]. There is also a high incidence of diet-related problems, such as coronary heart disease and anemia [30]. A previous survey showed that rural West Sumatra is rich in wild and cultivated food plants which could improve the diet [29]. But many of these plant foods are under-consumed. Our understanding of the barriers, motivations and reasons for changes in the use of these foods is limited in Indonesia, resulting in a lack of action to address this issue. Here we present a case study in West Sumatra as an attempt to understand the reasons behind the change in WFP use in the context of a traditional food system.

The objectives of this study were: (1) to document and assess the local knowledge on WFPs of the Minangkabau and Mandailing communities; (2) to understand the perceptions and attitudes on WFPs; and (3) to explain the reasons for changes in the use of WFPs along with the drivers of these changes.

## 2. Materials and Methods

### *2.1. Study Area*

West Sumatra province lies in the range of the Bukit Barisan Mountains, with the western part aligned with the Indian Ocean. The province has an area size of about 42,297.30 km$^2$ divided into 12 regencies [32]. The region falls in the tropical wet climate zone with rainy and dry seasons. The montane rainforests receive rainfall, which averages more than 2500 mm/year [33]. The area is rich in plant and animal biodiversity, with iconic species being tigers, orangutans, gibbons, or the Rafflesia plant, Andalas tree (*Morus macroura*), or endemic orchids. Tropical forests that in the past dominated the area are restricted to mostly protected areas and only a few customary forests, "hutan adat". The province is dominated by a mosaic landscape which has been maintained by traditional land management based on the strong relationship between the Minangkabau people and their land. The core of local land-use systems is based on the cultivation of wet rice and agroforestry systems dominated by trees [34]. Rice fields are situated close to settlements as they need intensive care and water management. Forestland and mixed agroforestry systems are situated in hilly areas where the lower soil fertility and the more frequent erosion is more suitable for growing trees than annual plants [35]. The most important lowland crops are rice, coconut and chili, while hill slopes are dominated by cocoa, rubber, coffee, durian, cinnamon, clove tree, and numerous other fruit or multipurpose trees. Our study area is located in the Pasaman regency, which is isolated, landlocked and has a high cover of forests (Figure 1). The selected regency has the highest rate of stunted children in the province, reaching 41% [36].

### *2.2. Study Communities*

From a cultural perspective, the region is dominated by the Minangkabau ethnic group and to a lesser extent by the Mandailing ethnic group, which is more populous in North Sumatra [37]. The study area was located at a cultural crossroad in the north of West Sumatra and included both ethnic groups. The Minang people are Muslims and are the largest matrilineal society in the world [38]. In this matrilineal society, where women inherit the land and assets, they also play an important role in transmitting knowledge within the clan. In the Minangkabau food system, women play a crucial role in agricultural production and in the processing and preserving of food [39]. The Minangkabau have a rich knowledge and a natural philosophy related to agriculture and resource management, with concepts such as customary forests, protected waters, traditional agroforestry, planting trees after marriage and mutual cooperation [35,40].

Mandailing people had initially been a Batak sub-ethnic grow and were Christians until the 19th century when they converted to Islam and started to adopt elements of Minangkabau culture. In contrast to the Minang culture, they adhere to the patrilineal heritage system, and maintain their Mandailing language. The Mandailing community is often described as a hardworking agricultural society with indigenous traditions and community governance [37]. Their way of life is also very much tied to the land and particularly the paddy fields. Both communities are clan-based, where clans as social units play an essential role in socio-cultural issues and in the management of natural resources.

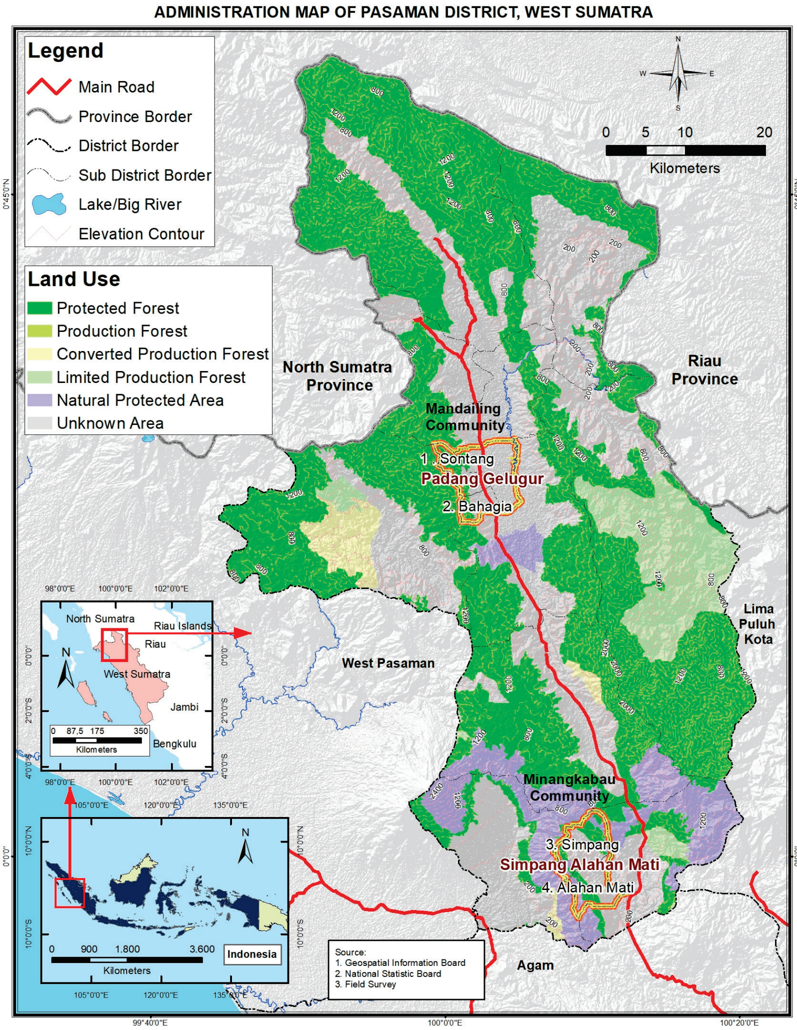


**Figure 1.** Map of the study area.

## 2.3. Study Ethics, Approach and Sampling

This study is a part of the broader Food, Agrobiodiversity and Diet (FAD) project which aimed to improve the food and nutrition security of the Minangkabau and Mandailing communities in the Pasaman regency by promoting the use of agrobiodiversity and traditional foods. The project was approved by the Indonesian Ministry of Research, Technology, and Higher Education (RISTEK). The methodology was further reviewed by the ethical committee of the University of Indonesia (UI) in Jakarta, and ethical clearance was obtained (No. protocol 18-03-0291). The research followed the Code of Ethics of the International Society of Ethnobiology and all informants were familiarized with the research objectives, methods and expected results. The free prior informed consent was obtained in a written form from all the individual respondents or their spouses. The data were interpreted anonymously. The project was aligned with the goals and policy of the Indonesian National Medium Term Development Plan (RPJMN) 2015–2019, in particular with a key strategy (c) to improve the quality and nutritional value of the Indonesian diet.

Having improved nutrition as an ultimate goal, our sampling targeted women at reproductive age (15–49 years old), as women represent a group vulnerable to malnutrition [41]. A stratified random sampling of cocoa farmers involved in the SCPP (Sustainable Cocoa Production Programme implemented in the study area by Swisscontact Indonesia) program was applied. We interviewed 200 women individually (100 women from each ethnic group). In addition, in-depth qualitative data were obtained through four focus group discussions (FGD) with 68 knowledgeable women participants. The sampling of FGD respondents was done purposively to select knowledgeable and active participants. Key farmers, husbands and children were allowed to join and complement the discussions whenever suitable and whenever accepted by the women participants. The Mandailing respondents were selected from the Padang Gelugur sub-district (Sontang and Bahagia villages) and Minangkabau respondents from the Simpang Alahan Mati sub-district (Simpang and Alahan Mati villages), as shown in Figure 1. The selection of these locations followed a recommendation of the local staff from SCPP, and it was based on the feasibility of the fieldwork, preserved landscape, and a need to improve the people's nutritional status.

### *2.4. Individual Interviews and Plant Identification*

Individual semi-structured interviews using questionnaires were conducted by trained data enumerators supervised by the principal investigator. The interviews started with capturing socio-economic characteristics, including questions for Progress out of Poverty Index for Indonesia [42]. These were followed by ethnobiological and anthropological methods including freelisting [43]. A Likert scale was used to record perceptions [44] and attitude statements [45]. The attitude statements were designed a priori with the local partners to fit the study context and objectives. In addition to interviews, the food system practices were documented via participant observation and by informal open-ended discussions. For ethnobiological plant inventory, often a husband contributed to the discussion of plant identity or took part in "Walks in the woods" to seek specimens [43]. Whenever possible, plant specimens were photo-documented and collected for later identification. Although the communities perceived mushrooms as wild vegetables, we excluded mushrooms in the study due to their limited availability during the fieldwork. Plant species were pre-identified in the field and determined taxonomically by botanists from the Faculty of Biology at Andalas University in Padang. The herbarium specimens were deposited in the herbarium of Andalas University (ANDA).

### *2.5. Focus Group Discussions*

Qualitative in-depth data on trends and changes in the plant use patterns were obtained through four focus group discussions (1 FGD per 1 village). In total, 68 women took part, sometimes accompanied by husbands or heads of farmer groups. A trained facilitator led the discussions following an open-ended questionnaire, while assistants took notes. Besides general questions and answers, we applied two main participatory exercises: seasonal crop calendars [46] and 4-cell analysis (Figure 2) [47]. The latter was the principal method of collecting data on changes in the use of WFPs along with motivations and barriers. Firstly, we prepared individual cards for each WFP, and women assessed the concurrent use of WFPs by sorting cards into four cells representing the different extents of plant use. Then we discussed contemporary barriers and motivations. Secondly, we asked women to re-organize the cards to show how the situation was in the past (around 20 years ago). After reshuffling, we asked the reasons for the change in use. With the women's permission, the discussions were recorded by an audio recorder.

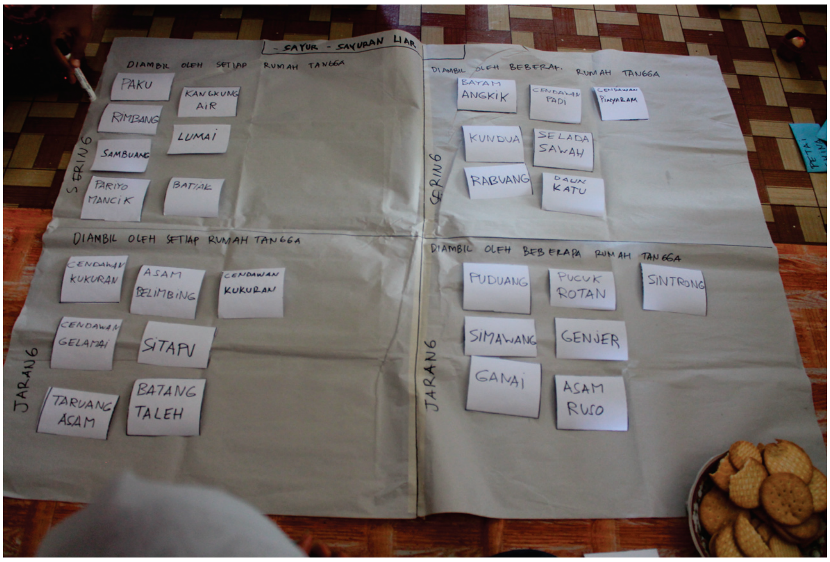


**Figure 2.** Participatory group assessment of changes in diversity and use of wild food plants through the 4-cell analysis method (Simpang village, June 2018).

### *2.6. Data Management and Analysis*

After data cleaning, the individual and quantitative data were analyzed initially by functions and pivot tables in Microsoft Excel, followed by the descriptive and inference statistics performed in the IBM SPSS program version 22 (IBM Corp., Armonk, NY, USA). The comparison of means between the ethnic groups was made by the Mann–Whitney U test. The relationships between knowledge of WFPs and socio-ecological characteristics were assessed by multiple linear regression to identify the predictors of traditional knowledge on WFPs. The relationship of plant parts used with the extent of their use was visualized by an Alluvial diagram using RAWGraphs [48], while the importance of land-use systems as sources of WFPs was analyzed by Chord diagram in the R programming language (EthnobotanyR package [49]).

The qualitative data, such as the reasons for changes in the use of WFPs, were coded and categorized into emerging themes through inductive thematic analysis [50]. We opted for a posteriori inductive approach as it can better represent local views [51] and as the current food system framework does not align well with the context of consumers who are simultaneously also food producers or collectors. However, after categorizing the reasons into emerged themes, we followed the ecological framework on what people eat, developed by [52] to determine whether the reasons are related to personal factors, social environment, physical environment or macro-level. The changes in the use of WFPs were then discussed in the context of the systemic drivers [22]. The coding was conducted using the software ATLAS.ti version 7.5.18 (Scientific Software Development GmbH, Berlin, Germany).

WFPs were categorized into the food groups of dietary diversity [41]. The reason for following this grouping was that the overall project aimed to improve dietary diversity, and therefore it followed the nutritionally validated food groups. Nevertheless, the locally perceived categories were captured too.

## 3. Results

### *3.1. Contextualizing WFPs in the Minangkabau and Mandailing Food Systems*

The traditional food system of the studied communities is strongly linked with rice production and with agroforestry gardens (Figure 3). Almost every household had these two principal land-use systems, which are used for their own food production as well as for income generation, with a highly varied ratio of subsistence to market orientation between the households. Food crops are also grown in home gardens (kitchen gardens) and occasionally in field plots and other lands not used for rice production. Crop diversity is generally high, and around half of the households raised farm animals, mostly chickens, and more rarely duck, fish or goat. Natural habitats such as forests, rivers, and streams are used to a smaller extent to acquire wild foods, mostly WFPs and various types of fish. The diet is dominated by a high intake of rice, accompanied by a small amount of vegetables and meat, mostly fresh or dried fish. Fruits are consumed irregularly and with high variation due to seasonality. The traditional foods contain lots of spices (mostly chili, onion and garlic) and many include coconut milk. WFPs are consumed to a small extent and rather spontaneously (based on our unpublished dietary assessment). In terms of food preparation, wild vegetables are consumed cooked, either stir-fried or boiled, whereas wild fruits are primarily consumed raw. WFPs are collected from both natural and managed lands, as well as purchased in traditional markets, where more and more households are purchasing foods. Considering the transition of food environments [53], the area can be characterized as an agrarian society with trade, as the main food environment is composed of wild and cultivated food environments and with regular informal markets composed mainly of wet markets and kiosks. Although the communities still prefer and consume traditional foods, the availability and consumption of fried snacks and ultra-processed foods is increasing.

**Figure 3.** Traditional landscape in the study area (rice field in Simpang village on the left; cocoa agroforestry in Sontang village on the right, July 2017).

### 3.2. Natural Food Environments as the Main Source of Wild Food Plants

Cocoa agroforests were the major sources of WFPs, where 74 WFPs were found. This is noteworthy as agroforests are managed lands showing that some amount of human disturbance can result in a greater diversity of useful plants than in purely wild habitats (see also [54,55]). After agroforests, the lands which were richest in WFPs were forests (40 species), fields (33 species) and home gardens (30 species). In contrast, aquatic environments (9 species) and rice fields (7 species) were less diverse, with only a few wild vegetables found. Figure 4 visualizes the biodiversity of WFPs in particular food groups across all the land-uses. We can see that agroforests are the most diverse and that WFPs from agroforests contribute to the following food groups: other fruits, other vegetables, and leafy vegetables; and to a lesser extent nuts and seeds, pulses and starchy staples. In view of food environment typology [53], local agroforests and other land-uses are not single but complex food environments, as they are a source of both wild and cultivated foods. Overall, the existence of WFPs is intertwined with local knowledge, traditional agriculture and landscape management.

### 3.3. Diversity of Wild Food Plants and Comparison of Knowledge between the Ethnic Groups

The communities in Pasaman steward traditional knowledge on 106 WFPs, corresponding to 85 species, 65 genera and 37 botanical families (Table S1). The best-represented botanical families were Leguminosae (10 WFPs), Moraceae (7 WFPs) and Solanaceae, Araceae and Arecaceae (all by 6 WFPs). Concerning plant parts, the most prevalently used were fruits (48%, including unripe fruits used as vegetables), leaves (25%, including young shoots or tender leaf stems), seeds (10%), stems/shoots (11%, including palm hearts of 2 palm species), tubers (5%) and lastly flowers (2%). Figure 5 shows the plant parts used according to their extent of use. It can be seen that the most of WFPs are used for their fruits and leaves, which likely do not threated the survival of the plants. Use of underground organs would be more harmful [56], but in the study area, tubers of a few common species are used minimally or in the past. Figure 5 also demonstrates that the majority of households use WFPs rarely, some are not used anymore, and only a few of preferred WFPs are used frequently.

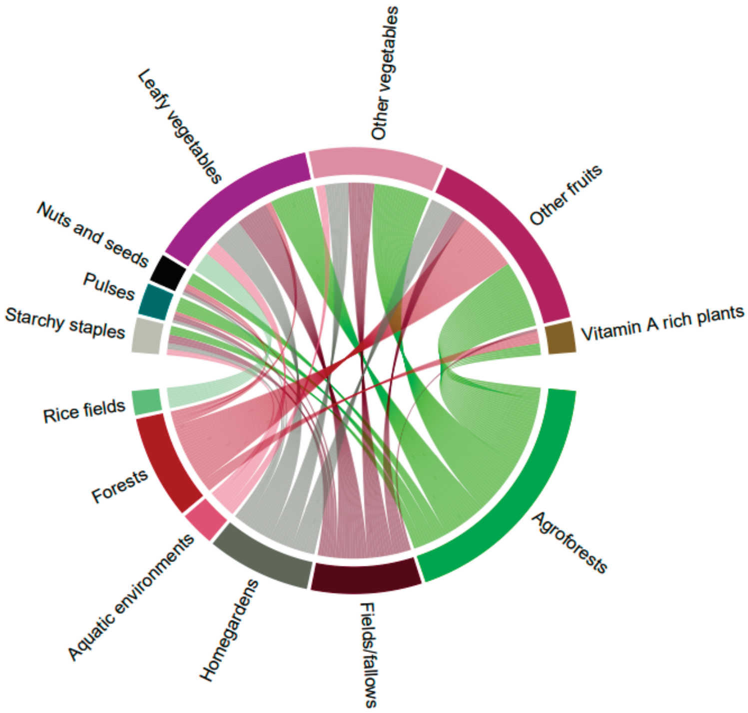


**Figure 4.** Land uses as sources of wild food plants in particular food groups (the thicker the stream, the more types of wild food plants are found in that land use).

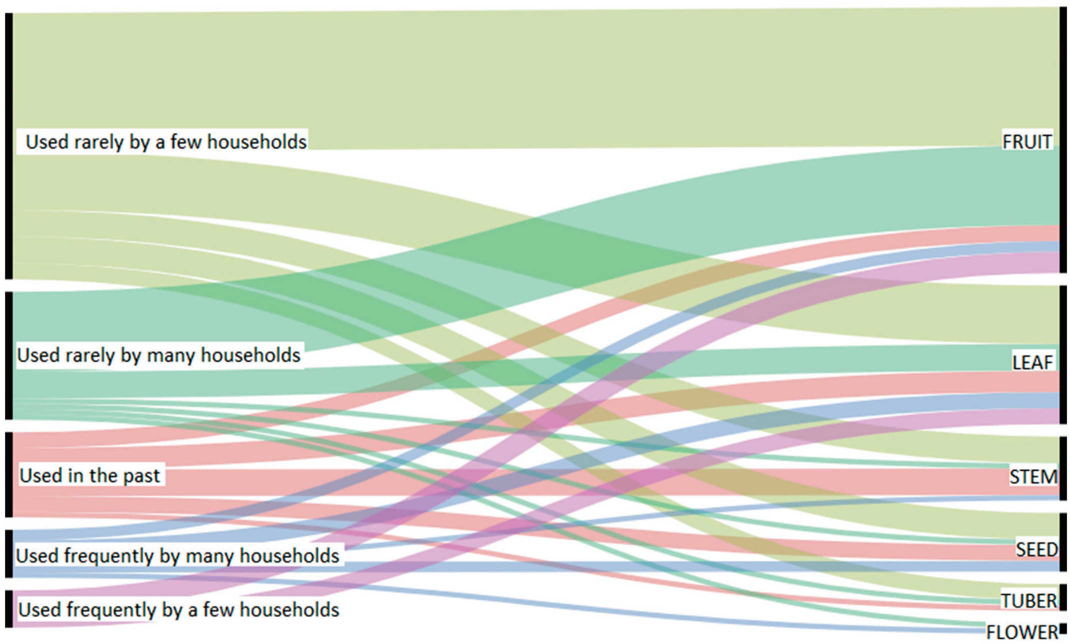


**Figure 5.** Plant parts used according to their extent of use (the thicker the stream, the more types of wild food plants).

The distribution of WFPs across the food groups demonstrated that the most diverse were other fruits (30 WFPs), followed by other vegetables (29 WFPs), leafy vegetables (27 WFPs), pulses (6 WFPs), nuts and seeds (5 WFPs), vitamin A-rich plants (5 WFPs) and lastly starchy staples with 4 WFPs. Comparison of traditional WFP knowledge between ethnic groups showed that Minangkabau women were familiar with 93 WFPs compared to 83 WFPs known by Mandailing women (Table 1). On average, Minang and Mandailing women listed 14.0 ± 6.9 and 10.2 ± 5.3 WFP species respectively. The difference in knowledge is statistically significant ($Z = -4.145$; $p = 0.000$). Minangkabau were found to know 23 unique food plants which do not occur in the Mandailing area, whereas the Mandailing community had only 13 unique food plants. Overall, two-thirds of WFP diversity (67% = 70 WFPs) overlapped and were common to both ethnic groups. We ran multiple linear regressions to determine the predictors of traditional WFP knowledge, but none of our social or ecological variables significantly predicted the knowledge of WFPs ($p > 0.05$). In the final model, all the variables together gave a weak correlation of $r = 0.260$, and they predicted the knowledge only by 7% ($R^2 = 0.07$). However, as mentioned above, Minang women knew a significantly higher number of WFPs, which is likely related to the greater remoteness of Minang villages from the main road. In addition, the Minang are the dominant and are the ancestral group of West Sumatra, whereas the Mandailing arrived from North Sumatra more recently.

**Table 1.** Comparison of wild food plant diversity between Minangkabau and Mandailing ethnic groups.

| Food Group | Total No. of WFPs | No. of WFPs in Minangkabau | No. of WFPs in Mandailing | No. of WFPs Unique to Minangkabau | No. of WFPs Unique to Mandailing | No. of WFPs Overlapping in Both |
|---|---|---|---|---|---|---|
| Starchy staples | 4 | 4 | 3 | 1 | 0 | 3 |
| Leafy vegetables | 27 | 22 | 23 | 4 | 7 | 16 |
| Other vegetables | 29 | 25 | 22 | 7 | 4 | 18 |
| Pulses | 6 | 5 | 5 | 1 | 1 | 4 |
| Nuts and seeds | 5 | 4 | 4 | 1 | 1 | 3 |
| Vitamin A rich plants | 5 | 5 | 4 | 1 | 0 | 4 |
| Other fruits | 30 | 30 | 22 | 8 | 0 | 22 |
| Total | 106 | 93 | 83 | 23 | 13 | 70 |

WFPs = wild food plants.

### *3.4. Perceptions and Attitudes Towards Wild Food Plants*

Perceptions and attitudes are principal drivers of human behavior. We assessed attitudes towards wild and cultivated food plants using “barrier analysis statements” [45], adjusted to the study context and aims. A level of the agreement is given in Figure 6. The strongest agreement came with the statement “I would eat more wild foods if I knew their nutrition and health benefits”. This is followed by strong agreement with the statement “wild foods are rich in vitamins and minerals” and “Consumption of wild foods is good for health”. The strongest disagreement was found for the statement “Wild food plants are associated with lower social status”. From these attitudes, we can deduce that the majority of women perceived WFPs positively. They also assumed that WFPs are nutritious and healthy, but during group discussions, they mentioned a lack of information about their health benefits. Eliminating this knowledge gap would likely improve perception and consumption.

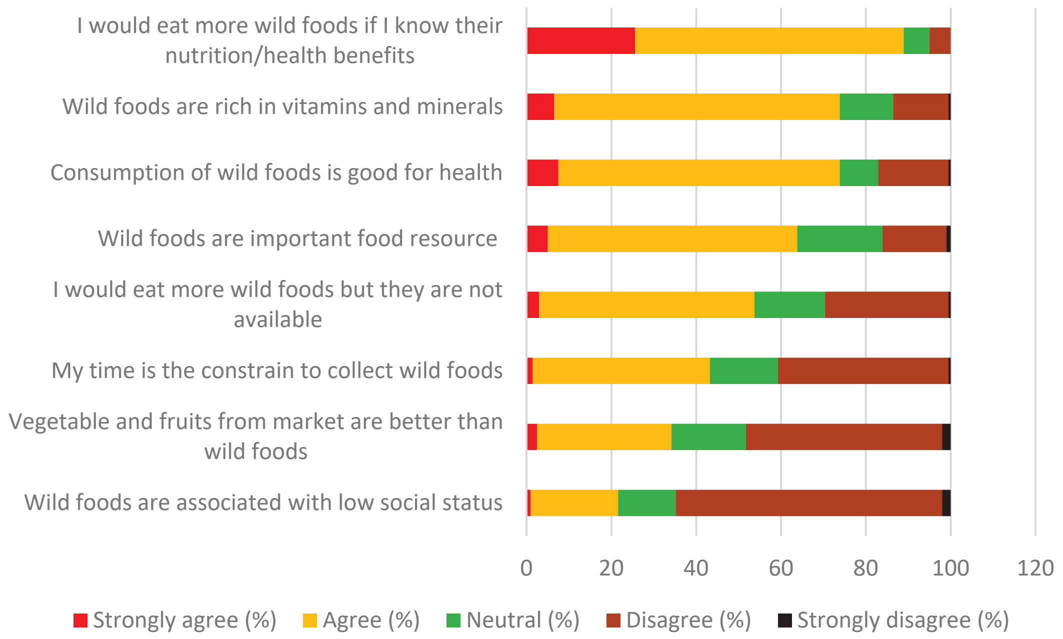


**Figure 6.** Attitudes of women towards consuming wild food plants.

Using a similar method, but with a simplified 3-option scale, we compared the perception of WFPs versus commercial food plants from markets. The answers of 95% of women clearly showed that WFPs have a lower market value. On the other hand, the majority of women perceived WFPs to be tastier than the purchased plants (tastier = 63%, same = 24%, less tasty = 13%). Lastly, when asked about the image/prestige of wild and marketed plants, 47% of women considered them equal, 33% considered WFPs to be more prestigious and 20% considered them less prestigious. Overall, we can conclude that WFPs are perceived positively, but have a low economic value.

To draw a full picture, we further let women list specific reasons for continuing the consumption of WFPs. What we found is that the most prevalent motivations were that WFPs are obtained for free or at a low cost (45%); that they are natural and unpolluted by agricultural chemicals (44%); and that some are still available and easy to obtain (32%) (Figure 7). While the economic factor (available for free) was of parallel importance for both ethnic groups, the importance of the availability was more prevalent among Mandailing women, while the aspect of being an unpolluted natural food was listed more by Minang women.

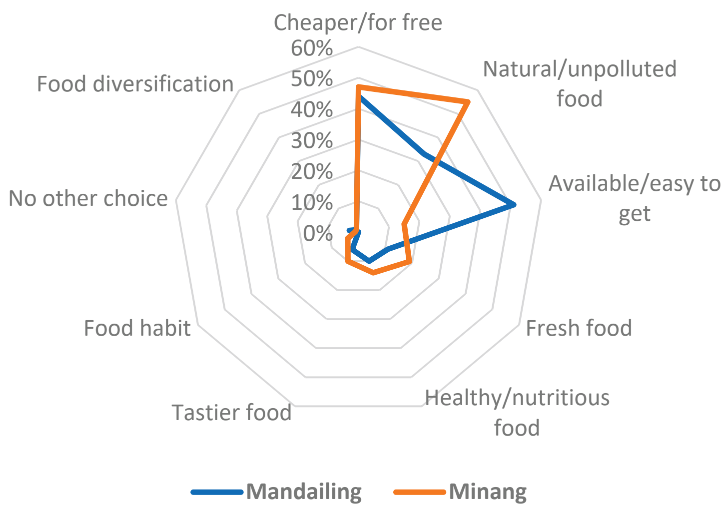


**Figure 7.** Motivations for consuming wild food plants (% of women).

### 3.5. Trends in the Use of Wild Food Plants and Drivers of Change

In general, the results showed that the collection and consumption of WFPs has declined over the last generation. The reasons for the changes, as well as the barriers and motivations for contemporary use of WFPs, were categorized into the following six themes: (i) availability; (ii) livelihood and lifestyle; (iii) food, consumption, health; (iv) income, marketing, economy; (v) multifunctionality/processing; and (vi) knowledge and skills. Thematically categorized motivations and barriers to the current use of wild vegetables, along with reasons for a greater use of wild vegetables in the past, are given in Table 2.

**Table 2.** Barriers, motivations and reasons for the changes in the use of wild vegetables.

| Theme | Reasons for Using Wild Vegetables More in the Past | Reasons for Underutilizing Selected Wild Vegetables Currently (Barriers) | Reasons for a Greater Use of Selected Wild Vegetables Currently (Motivations) |
|---|---|---|---|
| Availability | Easy to get (Mi, Ma)<br>Still plenty of them (Mi)<br>There were no other vegetables (Mi, Ma)<br>Abundant forests (Mi, Ma)<br>Spacious gardens (Mi)<br>Collect their own (Ma) | Competitiveness (Mi, Ma)<br>Not available in the market (Mi)<br>Hard to get (Mi, Ma)<br>Limited land (Mi)<br>Not much available (Ma) | Can be obtained in the forest (Mi)<br>Can be shared (Mi)<br>There are no other vegetables (Mi)<br>Land area available (Mi)<br>Easy to get (Ma)<br>At close range (Ma) |
| Livelihood and lifestyle | Community collection (Mi)<br>People were gardening more (Mi)<br>People were often going to the forest (Ma)<br>Many enthusiasts (Ma) | Reduced interest (Mi)<br>Not everyone likes it (Ma) | Many enthusiasts (Mi, Ma) |
| Food, consumption, health | People liked them (Mi)<br>Food was needed every day (Ma)<br>Healthy (Ma) | Taste disliked (Mi, Ma)<br>Not consumed much (Ma) | People like them (Mi, Ma)<br>These are required and eaten regularly (Mi, Ma)<br>Rich in nutrients (Ma) |
| Income, marketing, economy | They are free (Mi, Ma) | | No need to buy (Mi, Ma)<br>Good economic value (Mi)<br>Source of income (Mi) |
| Multifunctionality/ processing | Easy to grow (Mi)<br>Easy processing (Mi)<br>Traditional processing (Ma) | Need good care (Mi)<br>Processing is not easy (Mi) | Good benefits (Mi)<br>Multiple benefits (Ma) |
| Knowledge and skills | | Don't know the taste (Mi)<br>Don't know that they can be consumed (Mi)<br>Don't know how to cook them (Ma) | |

Mi = Minangkabau; Ma = Mandailing.

The motivations and barriers to the contemporary use of wild fruits, along with reasons for a greater use of them in the past, are given in Table 3.

**Table 3.** Barriers, motivations and reasons for the changes in the use of wild fruits.

| Theme | Reasons for Using Wild Fruits More in the Past | Reasons for Underutilizing Selected Wild Fruits Currently (Barriers) | Reasons for Greater Use of Selected Wild Fruits Currently (Motivations) |
|---|---|---|---|
| Availability | There were no other fruits (Mi, Ma)<br>Seasonal (Mi, Ma)<br>Many were available (Mi, Ma)<br>Easy to collect or grow (Mi, Ma)<br>People did not spray chemicals (Ma)<br>Land was available (Ma) | Rare or extinct (Mi, Ma)<br>Grow in the forest (Mi)<br>They are only seasonal (Mi, Ma)<br>Depends on the land (Mi)<br>Hard to get (Mi, Ma)<br>Decreasing from spraying agrichemicals (Ma)<br>Not in the market (Ma)<br>Difficult to cultivate (Ma) | There are no other fruits (Mi, Ma)<br>Can be collected on your own (Mi)<br>Easy to collect (Ma)<br>Still plentiful (Ma) |
| Livelihood and lifestyle | People often went to the forest (Mi) | Not a big interest (Mi)<br>People are busy and lack of time (Ma) | Many enthusiasts (Mi) |
| Food, consumption, health | People liked the taste (Mi, Ma)<br>Natural and healthy (Ma) | Not so tasty (Mi)<br>Taste preferences have changed (Ma) | They are tasty (Mi)<br>Eaten every day (Mi)<br>They are needed (Mi)<br>Many people like it (Ma)<br>Kids like them (Ma) |
| Income, marketing, economy | Can be sold (Mi)<br>Cheap to purchase (Mi, Ma)<br>No need to buy (Ma) | | Can be sold (Mi)<br>No need to buy (Ma) |
| Multifunctionality/ processing | | Used also as a medicine (Mi) | Can be cooked according to taste (Mi) |
| Knowledge and skills | | Don't know how to cultivate them (Mi)<br>We don't know them (Mi) | |

Mi = Minangkabau; Ma = Mandailing.

We grouped all the reasons related to both wild vegetables and fruits according to the emerged themes (called factors onwards). Each factor contains a paragraph on changes in the use of WFPs compared to the past, followed by information on contemporary barriers and motivations. The last paragraph discusses the changes on the ecological framework on what people eat [52] and attempts to identify the broader systemic drivers of changes. The findings are enriched by quotations from the respondents.

### 3.5.1. Factors of Availability

Changes in the availability of WFPs were the most prevalent explanations for their decreased use. The most common reason was that WFPs were more abundant and easier to get in the past. Women further disclosed that in earlier times, the area was more forested and that people did not spray agricultural chemicals, which are now eradicating many WFPs and wild vegetables in particular. In addition, both gardens and landscapes were more spacious and more wild vegetables and fruits occurred there naturally.

Currently, some WFPs are underutilized because they are not very available. Moreover, they are not so common in the markets, while other food options can be purchased or grown. Some wild fruits are now very rare or even extinct, and their presence is further undermined by spraying agricultural chemicals and removing shade trees. Lower availability of land has also become an issue.

However, some WFP species are still widely utilized, and availability plays a crucial role for the persistence in their use. Women mentioned specific motivations related to availability, such as that WFPs can be collected easily and on your own. Or that some WFPs are still plentiful in nearby lands, while others are only available further in the forest. Some women also mentioned that WFPs could be shared with other people. A few women explained that they are used to eating them when there are no other vegetables or fruits, especially in the lean season.

The general decrease in the availability of WFPs can be attributed to the changes in the physical environment, which according to the responses, is caused mainly by the overuse of external inputs and changes in land management.

Minangkabau woman in Simpang village: "In the past, there were more forests, and people were collecting wild fruits and vegetables more. Now people use chemicals in the fields and wild food plants are gone".

Mandailing woman in Sontang village: "Older people are more used to the taste of wild food plants from the past, well we like them too, the main issue is that they became rare and far".

#### 3.5.2. Livelihood and Lifestyle Factors

Changes in livelihoods and lifestyles were also found to be common reasons for abandoning the use of WFPs. In the past, people were gathering plants more collectively and they were going to forests more frequently for non-timber forest products. Besides, more people were gardening and there were also more enthusiasts using WFPs.

Currently, there is a reduced interest in some WFPs. People are now busier and there is not as much time as in the past. In addition, tastes started to change, especially with the younger generations and their less natural way of life.

Despite the generally negative impact of lifestyle changes on the use of WFPs, some people are still enthusiastic about WFPs and eat them quite regularly.

The lifestyle changes and convenience issues affecting the use of WFPs are happening at the individual (personal), social, and macro-level on the ecological framework on what people eat. They are likely driven by modern trends and changing socio-economic needs.

Mandailing woman in Sontang village: "Before people used to eat more wild food plants as there were less cultivated crops. Now more fruits and vegetables are being cultivated, traded and preferred in general."

#### 3.5.3. Factors Related to Food, Consumption and Health

Women explained that the taste of WFPs were perceived to be better in the past. People also valued natural food and the health benefits of WFPs more. Some women mentioned that WFPs were common foods needed every day.

Currently, many WFPs are not consumed much as their taste is less preferred and they have become foods that people eat occasionally. Sometimes, older people might like them more, but in general, people are consuming more cultivated plants and purchased foods.

However, there are large differences in the extent of using different species, and some WFPs are still eaten regularly as they are considered tasty, natural and healthy foods. Regarding wild fruits, it appears that they are more popular among children. Wild vegetables are perceived by women to be healthy and rich in nutrients.

The changes in use related to food, consumption and health belong to the personal factors and physical food environment in the ecological framework. Based on the responses, the changes in this theme appear to be driven mainly by changes in the markets and agriculture production.

Minangkabau woman in Alahan Mati village: "I continue eating wild food plants because they are rich in vitamins, tasty, and they do not contain pesticides".

#### 3.5.4. Economic Factors

Many people stated that WFPs were cheap or free, which was even more important in the past. In the past, more people were also engaged in selling WFPs. Economic factors appear not to have changed the use of WFPs dramatically, and some women continue to sell or buy them, however, the number of people engaged in this is lower. Nowadays, cultivated plants and food products are being sold and bought more.

Women still value the fact that WFPs are free (this was the most frequent motivation listed by 45% women individually). Some women noted that several of these plants have an economic value and are still a source of income.

The discussed economic factors such as expenditures and income are related to the personal factors as well as to physical environment (markets). The current trend of selling and buying more cultivated plants or processed foods is also likely driven by changes in the markets, agricultural production, and a better livelihood opportunity.

Mandailing woman in Sontang village: "In the past, people did not need to buy fruits and vegetables on the market, but now it is easier to buy them rather than go to the forest".

Minang woman in Simpang village: "Wild edibles are good because they are available and fresh natural food which is for free".

#### 3.5.5. Factors Related to Processing/Multifunctionality

In the past, women were more used to traditional processing and the cooking of wild foods. Nowadays, some women still appreciate that WFPs can be processed and used according to taste and occasion. But generally, collecting and processing WFPs is considered more demanding, less convenient, and is done less frequently. Buying and cooking food ingredients purchased at the local market is considered to be more convenient and it is becoming more common.

Interestingly, women pointed out that some species are used more because of their multiple benefits and also their medicinal value in some cases.

The changes in this theme are mostly related to convenience and skills which are belonging to the personal factors on the ecological framework. The reduced processing and cooking of WFPs is driven largely by changing lifestyles and markets.

Minangkabau woman in the Alahan Mati village: "The process of preparing and cooking wild vegetables takes a long time".

#### 3.5.6. Factors Related to Knowledge and Skills

A generation ago, people had a richer knowledge of WFPs. Currently, while the common WFPs are known to everyone, some women are not familiar with the taste of some less common WFPs and others do not even know that certain WFPs are edible.

A further barrier is the lack of knowledge on how to cook these traditional foods. Another reason mentioned by farmers was missing knowledge of how to cultivate wild plants. From these points we can see first that there is a loss of traditional knowledge on diversity and uses of some WFPs; second, that there is lack of knowledge on improved management, the domestication of these wild resources and little innovation of cooking or processing methods.

The issues with limited knowledge and skills can be considered personal factors. The weaker traditional knowledge seems to be caused by lack of its transmission driven by changes in lifestyles and food environment, whereas the lack of modern knowledge can be associated with gaps in the education system and a lack of relevant policies and innovations in science and technology.

Group of Minangkabau women: "We don't know how to cultivate or manage some less common wild species, and only a few women know how to cook them".

## 4. Discussion

### *4.1. Comparison of Wild Food Plants Diversity with Other Regions*

The total number of 106 WFPs (85 species) documented represents a relatively high diversity. A recent study in a Mandailing community in North Sumatra showed that 106 food plant species are being used, including wild and cultivated ones [57]. Further in North Sumatra, Batak Toba people from Peadungdung village were found to use 44 species [58]. Towards the east of Indonesia, only 22 WFPs species were found to be used in Sasak cuisine on Lombok island [59], while in Bali, 86 species are used [60]. Ninety WFPs, a similar number as in our study, was found by Ogle and colleagues in the Mekong Delta in Vietnam [61] and also by Chauhan et al. [54] in the drier environment of Indian Gujarat. A diversity of 90–100 species of wild foods has been identified as an average for Asian and African agricultural and forager communities [20]. However, there are exceptions, such as in Meghalaya state of North-East India, where Sawian et al. [62] found 249 species in the markets of the Khasi tribe. In Thailand, Cruz-Garcia and Price [55] found from 87 to 252 WFP species. Kang et al. [63] found 185 WFP species from the Chinese Han. The overall diversity of WFPs in the study area is thus comparable to other regions, besides parts of India and tropical Thailand and China, where local communities tend to use greater diversity. The present study documented some lesser-known local food plants such as *Elateriospermum tapos* Blume, *Plukenetia corniculata* Sm., *Hornstedtia conica* Ridl., *Hornstedtia elongata* (Teijsm. and Binn.) K. Schum. or *Salacca sumatrana* Becc.

### *4.2. Local Perceptions and Attitudes on Wild Food Plants*

The studied communities do not strictly divide between wild or cultivated plants, and in daily life, they call food plants by their vernacular names without further distinguishing. Sometimes they distinguish between traditional and modern food plants, where they use the term "local" for indigenous food plants and "modern/from the market" for the exotic and commercialized plants. Most respondents did not consider WFPs as "food of the poor", a notion that has often developed in some regions [64] or "famine food" [65]. Minang and Mandailing communities perceived WFPs generally positively, appreciating the fact that they are a freely available, tasty, healthy and unpolluted food (people are concerned by heavy use of agrichemicals applied in commercial agriculture, and this to some extent, enhances the perception of local food plants). Other studies also noted positive attitudes towards WFPs. In both rural and urban Japan, WFPs were labelled as being a tasty, healthy and safe food [66]. WFPs were also perceived positively and as healthy elsewhere [67–69]. However, similar to other areas [54,70,71], the "change of taste" has started to occur among younger generations who interact less with nature and are more exposed to markets and more processed foods. As exotic species penetrate markets, in many places, traditional species become undervalued [20]. The increasing availability of processed and ultra-processed foods can result in a dietary transition with reduced dietary quality and rising rates of diet-related health problems [7]. It is also possible that dietary diversity can increase with markets, but this depends on affordability and food choices [72].

### *4.3. What Are the Reasons for the Decreased Use of Wild Food Plants?*

Most of the available studies from various regions have found that socio-cultural factors are the main drivers of the reduced consumption of WFPs [70,73–75]. Here we find that instead, reduced availability was the most common factor limiting the consumption of WFPs in West Sumatra. This is similar to findings by Chauhan et al. [54], in Indian Gujarat and by Sõukand in rural Estonia [69].

Łuczaj et al. [64] showed that both social and ecological factors have reduced the use of wild plants in the European context (mainly the reduced contact with nature, and massive changes in agriculture and ecosystems). Apart from the biocultural refugia in mountainous areas or in the Mediterranean region, Europe has experienced a gradual disappearance of WFPs from diets [76]. The global trends and multiple factors are changing the use of wild plants across the world [20], including Africa (e.g., [13]) and America (e.g., [77]). Meanwhile, in Asia, the use of WFPs and particularly wild leafy vegetables appear more persistent [76]. The use of wild plants tends to persist among Indigenous communities [5]. In the studied sites in West Sumatra, although changes in lifestyle and perceptions have played a role in the reduced consumption of WFPs, they appear not to be the major drivers, as the traditional culture is still strong in the region. People still value and prefer their traditional foods, and diets are changing less dramatically in the region [78]. In this context, we found that changes in the availability of WFPs caused by agriculture intensification is the most important factor driving reductions in consumption. An increased use of chemical pesticides is known to eliminate not only pests and weeds, but overall field biodiversity too, including edible plants and animals [79]. Our respondents recalled a major decline in the diversity of edible weeds, fish and crustaceans in rice fields as they are now managed chemically by most of the farmers. Opportunities to earn more income along with supportive programs and markets drive this intensification of production.

Besides reduced availability, other reasons for not consuming WFPs were limited knowledge about their nutrition and health benefits, time involved to collect and prepare these foods and the lower economic value of these resources. Limited information on nutrient composition of wild foods is a well-known challenge [11,80] and more research, investment and mainstreaming are needed. Time constraints and convenience are related to lifestyle and livelihood changes [52], while the issue of the remoteness of wild foods was found in other countries too [69,70,81]. The low economic value of WFPs is common in other regions (e.g., [21]), but it does not appear as a main driver of change in the study area.

FAO [22] identified the most widespread threats to WFP use as overexploitation, habitat alteration, pollution, land-use change and deforestation. Some of these issues might also be factors here, but were not perceived by respondents.

### 4.4. What Motivates People to Continue Consumption of Wild Food Plants?

Understanding the motivations of human behavior can enable us to design more effective solutions to achieve the needed changes. More studies have looked at the reasons for the decrease in WFPs, as opposed to the actual motivations for their continued consumption. This is likely due to the global downward trend in the use of WFPs. Despite the overall decreasing trend, some studies in Himachal Pradesh [70], North-Eastern Thailand [82], Estonia [69] and the Catalan Pyrenees and Balearic Islands of Spain [75] found the taste of WFPs to be the primary motivation for their continued consumption. In more industrialized countries or regions, the motivations for the use of WFPs have moved towards recreation or seeking innovative food trends [74,83,84], whereas, in more traditional and indigenous territories, wild resources play a more critical dietary, economic and cultural role [5]. In the area studied, the primary motivations for the use of WFPs were that they were freely available and that they are considered unpolluted natural foods (see Figure 7 for all the motivations). Nevertheless, we found substantial differences in the characteristics and use of individual plant species, where some WFPs are used more than others because of their higher availability, better taste, larger size, easier management or collection and their multiple uses or economic value. Indeed, a whole range of factors determines whether the particular species is better utilized, underutilized or abandoned. Future interventions may need to consider these differences and prioritize locally preferred species with a higher potential for wider use.

### 4.5. Need for an Integrated Approach for Sustainable Use of Wild Food Plants

Public health policy across many countries tends to operate within a model of food security and nutrition that discounts the biodiversity and traditional food practices of the communities [85]. Moreover, other policies and sectors have overlooked these existing resources, which means missed opportunities and eventually the implementation of more costly or less sustainable interventions. Numerous scientists and international conventions have recognized the importance or potential of WFPs for food and nutrition, e.g., Global Strategy for Plant Conservation of the Convention on Biological Diversity (CBD), the International Treaty on Plant Genetic Resources for Food and Agriculture, or the Second Global Plan of Action for Plant Genetic Resources for Food and Agriculture. Now more action should be taken at the national and local levels.

What needs to be recognized is that WFPs have to be sustained in a participatory manner with local communities and their evolving intercultural knowledge. This inclusive approach of food biodiversity conservation through local knowledge and practices allows the continuous evolution and adaptation to socio-ecological change [86,87]. To guide countries and different stakeholders in developing plans and strategies related to WFPs, Borelli et al. [88] proposed an integrated approach for using and conserving WFPs. That approach calls for and guides the many stakeholders and actors to take action to ensure that WFPs are used sustainably and maintained for future generations.

The sustainability of use is an important aspect that needs to be considered where wild plants are being used and particularly when they are being promoted. Overharvesting or using whole plants or certain plant parts such as roots can have strong implications for the existence of these resources and should be avoided [56]. In the study area, rather than overharvesting, there is a general trend of decline in intensity of WFP use. The availability of WFPs is decreasing due to broader drivers such as land and agriculture intensification.

In the context of scaling sustainable use of WFPs in Indonesia, the country could build on the previous work of PROSEA (http://proseanet.org/prosea/), existing food, ethnobiological and biodiversity studies, and conduct food mapping or barrier analysis where knowledge gaps exist. This should include an innovative action bringing the knowledge to the broader public and supporting actions at the local level. Figure 8 shows an example of illustration developed by the FAD project to raise awareness on WFPs. The project also produced a policy brief and a community guidebook on food plants for nutrition and health [89] (which can be requested from the first author). Examples of follow-up actions could be to integrate traditional and modern knowledge of WFPs into programs of education, tourism, certification schemes, community health workers "posyandu", women groups and extension services. The government and stakeholders could support and incentivize local actions related to agrobiodiversity demo plots, home gardens, school gardening, food festivals, culinary tourism, rural-urban supply chains, traditional product development, community forestry and agroecological production.

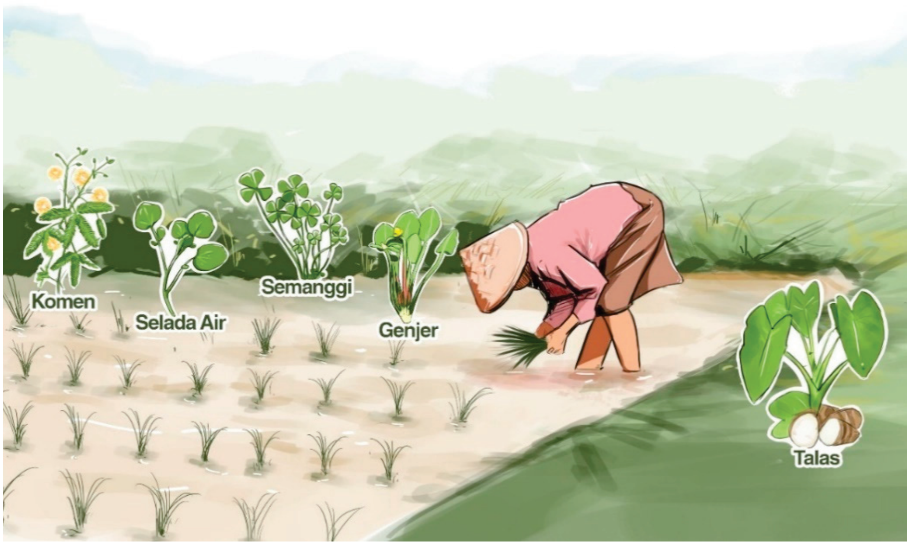


**Figure 8.** Illustration of wild vegetables naturally occurring in the organically managed rice field (adapted from the community guidebook by Pawera et al. [89]).

## 5. Conclusions

Identifying interventions to improve diet and nutrition in Indonesia is one of the key issues for contemporary research and development in the country. Mainstream research and development, however, have been overlooking the potential of agrobiodiversity and WFPs, even though they could contribute to diversifying diets and provide functional foods, particularly to marginalized and vulnerable communities. The locations in this study were found to be still relatively rich in WFPs due to the persistence of traditional land-use systems and strong local culture. However, consumption of WFPs has declined over the last generation, despite the overall positive perception of these foods. The reasons for this decline were foremost their decreased availability (mainly due to agriculture intensification at the farm level) and changes in perceptions and lifestyle. The main overall drivers of change appear to be socio-economic factors, agriculture intensification and changing markets. On the ecological framework on what people eat [52], most of the changes relate to the personal factors and the physical food environment. The main contemporary barriers to consuming WFPs were their low availability, time constraints and the limited knowledge of their nutritional benefits. In contrast, the key motivations for their continued use were that they are freely available, are natural foods free of chemicals, and that some species are still abundant.

The findings inform us what barriers and motivations can be acted upon to counteract underutilization and loss of this food biodiversity. This study found large differences in use and valuation of individual species, and a whole range of factors affecting whether the species is utilized, underutilized or abandoned. The fact that the local communities perceive WFPs positively offers an important opportunity for their successful promotion. This should be supported by actions for increasing their availability and raising awareness to fill the knowledge gap about their benefits. Both traditional and modern knowledge of these foods could be integrated into agriculture, food, nutrition, health, tourism, social and education programs in the area. There is a need for communities, government and NGOs to come together to undertake creative action to optimize the use of WFPs in an inclusive and sustainable way. This integrated approach of "conservation through use" could improve nutrition and health while conserving biodiversity and traditional knowledge.

**Supplementary Materials:** The following are available online at http://www.mdpi.com/2304-8158/9/9/1240/s1, Table S1: Wild food plants used by Minangkabau and Mandailing women in Pasaman regency, West Sumatra, Indonesia.

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*foods*

*Article*

# An Exploratory Study on the Diverse Uses and Benefits of Locally-Sourced Fruit Species in Three Villages of Mpumalanga Province, South Africa

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**Abstract:** Globally, the potential of indigenous and neglected fruit species is continuously being recognized. In the current study, we explored the uses and benefits of locally available fruit species among the Mapulana people in Bushbuckridge Local Municipality. An ethno-botanical survey was conducted using in-depth interviews to record the names of the fruit species, their uses, seasonal availability, and occurrence in three villages, namely, Mokhololine, Motlamogatsane, and Rooiboklaagte B. Forty-one (41) participants aged 23 to 89 years old, identified by community members as knowledgeable on the utilization of fruit species, were interviewed. The frequency of citation (FC), use value (UV), and use report (UR) of the locally sourced fruit species were determined. The study revealed thirty-one (31) indigenous/naturalized plants belonging to 17 families with Anacardiaceae (four species) and Rubiaceae (three species) as the dominant ones. Approximately 48% of the 31 plants had FC of 100%, suggesting their high popularity in the study area. The identified plants had diverse uses that were categorized into six (6) groups and mainly dominated by food (59%) and medicine (34%). *Strychnos madagascariensis* had the highest (0.56) UV while *Berchemia discolor*, *Parinari capensis*, *Parinari curatellifolia,* and *Sclerocarya birrea* had the highest (6) URs. Overall, these locally sourced fruit species still play a significant role in the daily lives of the Mapulana people. The identified fruit species have the potential to be considered as alternative sources to meet the dietary requirements and health needs, especially in rural communities.

**Keywords:** beverages; bio-economy; conservation; food security; indigenous knowledge; wild edible plants

## 1. Introduction

Globally, food and nutritional insecurity remain among the biggest concerns facing humans, as recently highlighted by Willett et al. [1]. Likewise, food deficiency and insecurity remain a major challenge in many rural communities, especially in developing countries [2–4]. Since time immemorial, local communities have relied on diverse native plant species because they are easily accessed from their immediate environment. It is undeniable that the indigenous fruits contribute to food security, especially in developing countries [5,6]. Particularly, sub-Saharan Africa is endowed with numerous indigenous fruit species that can be explored and incorporated into the diets to solve nutrition-related concerns [4,7,8].

Local communities continue to utilize and consume indigenous edible fruits for food and medicine as well as fulfilling the socio-cultural needs and livelihood of the people [6,9–11]. Particularly, it may be a supplementary income or the major income for the household [12,13]. As part of the benefit associated with indigenous fruit trees, they are well adapted to local environmental conditions and often withstand abiotic and biotic stresses better than introduced plants [6,10]. Furthermore, Awodoyin et al. [14] stated that encouraging the domestication and protection of indigenous fruit trees in the agro-ecosystem may provide highly sustainable systems that maintain soil productivity, micronutrients, and biodiversity. This can enhance food productivity, adaptation, and mitigation to climate change. As a result, Cemansky [13] articulated the need for concerted research effort and policies to mitigate the ongoing decline of indigenous fruit trees.

Exploring the potential of indigenous fruit trees for sustainable livelihoods of humans remains a research priority in several parts of the world [1,4,11,15]. In South Africa, many local communities in the different provinces, especially Mpumalanga, acknowledge the value of plant biodiversity as an integral part of their culture for survival and general welfare [16,17]. Similarly, there is a growing awareness of the importance of indigenous plants, especially fruits, for food security and health-promoting value [4,8,18]. Given the high occurrence and diversity of indigenous (native or wild) fruits in many South African communities, they remain an affordable and potential source of meeting the daily nutritional requirement especially for the essential vitamins and minerals [18,19]. However, the indigenous knowledge on these plants is diminishing due to urban migration as well as the high preference for exotic fruits. This has created a knowledge transmission gap between the old and youthful generations [20,21]. Exploring indigenous knowledge on the uses of native plants provide the basis to pursue their preservation and promotion locally, nationally, and internationally [8,22,23]. Moreover, these plants and their associated products have the potential to contribute toward achieving the Malabo Declaration goals 2025 and United Nations Sustainable Development Goals (SDG) Agenda 2030 such as zero hunger and no poverty, as well as good health and well-being. Thus, the current study explored the indigenous knowledge on the diverse uses and benefits of locally sourced fruits (wild/indigenous and naturalized) among the Mapulana people in Bushbuckridge Local Municipality. The following research questions guided the study:

- Which locally sourced fruit trees are found among the Mapulana people in Bushbuckridge Local Municipality?
- How do Mapulana people use and benefit from the wild fruit trees in their locality?

## 2. Materials and Methods

### 2.1. Study Area

The study was conducted in Setlhare Tribal Council in Bushbuckridge Local Municipality, Ehlanzeni District of South Africa. The Ehlanzeni District is situated in the northeast of Mpumalanga Province, demarcated by Mozambique and Swaziland, and covers a surface of 27,895.47 km$^2$. Rural areas make up the most of Bushbuckridge region, with small rural villages containing 29% of the populace and dense rural villages represent 61% [24]. It has 34 wards and more than 135 villages, with an estimated of 509,964 people, who are predominantly (99.5%) black Africans, based on data from Stats SA [24]. The Mapulana people found in the three selected villages are descendants of the Northern Sotho ethnic group of Lebowa [25].

As highlighted by Shackleton et al. [12], Bushbuckridge has the mean annual rainfall of approximately 1200 mm in the west and diminishing to 550 mm in the east. The area has no frost and the mean annual temperature is approximately 22 °C [21]. The primary crops cultivated consist of groundnuts, maize, and various beans. A majority of households harvest various resources such as fruits, firewood, thatch grass, mushrooms, and reeds from their immediate surroundings [12]. The area is often negatively impacted by challenges such as dry spells, veld fires, and non-ecofriendly cultivating practices [21,24]. For the current study, three (3) villages, namely, Mokhololine (24°40′45.96″ S and 30°51′18.98″ E), Motlamogatsane (24°38′22.02″ S and 31°1′21.22″ E), and Rooiboklaagte B (24°39′42.12″ S and 31°3′32.04″ S) were sampled due to their long history of dependence on locally sourced fruits (Figure 1).

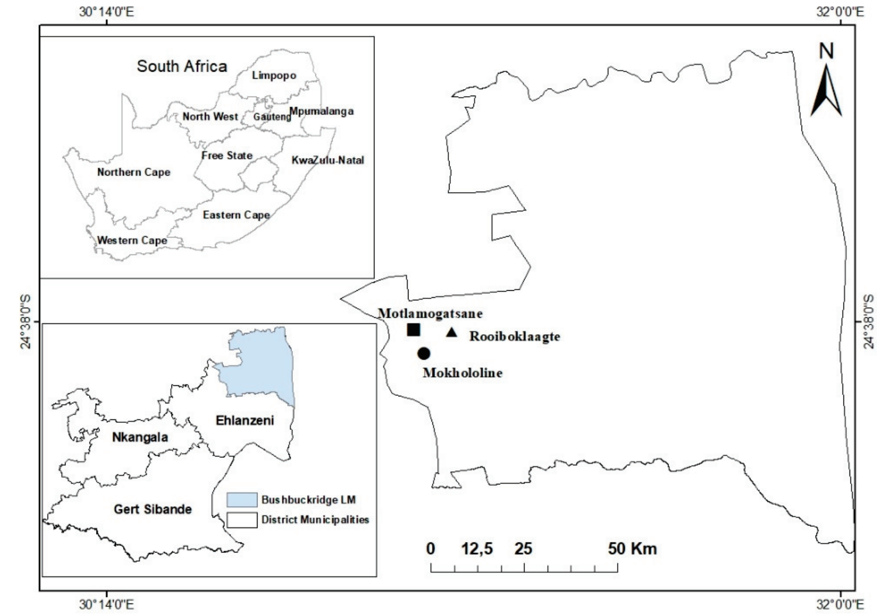


**Figure 1.** Location of Mokhololine, Motlamogatsane, and Rooiboklaagte B in Bushbuckridge Local Municipality (LM), Ehlanzeni District, Mpumalanga Province, South Africa.

### 2.2. Ethno-Botanical Survey

The ethno-botanical information on plants was collected from December 2018 to January 2019. The information was collected using in-depth interview guides where details such as the names, uses, and the availability of the fruit trees were recorded. The interview sessions were conducted in Sepulana (Northern Sotho sublanguage) with the assistance of a field assistant who is fluent in both English and Sepulana. A total of 41 participants were interviewed from the three (3) selected villages. The identification and recruitment of participants were done in consultation with the traditional leader of the selected communities. The plants mentioned by the participants were collected with the help of the research assistant during the field walks. Thereafter, voucher specimens were prepared and deposited at the S.D. Phalatse Herbarium, North-West University, Mahikeng Campus (UNWH) and the National Herbarium, Pretoria (PRE), South Africa.

### 2.3. Data Analysis

To determine the importance of the locally sourced fruit trees in the study area, we applied two (2) ethno-botanical indices including frequency of citations (FC) and use value (UV), based on the description by Tardío and Pardo de Santayana [26].

2.3.1. Frequency of Citation

The percentage of participants claiming the use of a particular fruit tree was calculated as follows:

$$FC = \left(\frac{Np}{N}\right) \times 100 \quad (1)$$

where *Np* is the number of citations for a particular fruit tree, and *N* is the total number of participants in the study.

2.3.2. Use Values (UV)

The use value is an ethno-botanical index that shows the relative importance of plant species known locally based on the number of recorded uses for each species. It was calculated by following the formula given by Logan [27].

$$Use\ value\ (UV) = \sum \frac{Ui}{N} \quad (2)$$

where *UV* stands for use value and "*Ui*" refers to the total number of uses per species while "n" is the number of participants who reported on the plant species.

2.3.3. Use Categories and Use Report (UR)

The uses for the different plants were categorized following the guideline by Cook [28]. All the uses as reported by the participants were classified into one of the 13 levels provided in the guideline.

### *2.4. Ethical Approval*

The study was approved (NWU-00601-18-A9) by the Faculty of Natural and Agricultural Sciences (FNAS) Research Ethics Committee, North-West University (NWU). Permission to access the study areas was provided by the Setlhare Tribal Authority of Bushbuckridge Local Municipality and written consent was obtained from all participants prior to the interviews. The permit to collect plants was granted under the National Forest Act, Act No. 84 of 1998 by the Department of Agriculture, Fish and Forestry, South Africa.

## 3. Results and Discussion

### *3.1. Demographic Characteristics of the Participants*

A total of 41 participants with diverse demographic characteristics was involved in the current study (Table 1). Among the 41 individuals, 24% were self-employed in the study area. The participants knowledgeable on the utilization of plant species ranged from 23 to 89 years. The participants were categorized into three groups, namely, young (aged 18–35: n = 9), middle-aged (aged 36–64: n = 13), and elderly (aged > 64: n = 19). The majority (58.5%) of the participants were female. The youth, who contributed approximately 22% of the participants, had little enthusiasm for indigenous knowledge on the utilization of fruit species. As a result, there is a risk of knowledge loss if nothing is done to motivate and engage the youthful generation about the use of fruit species. Magwede et al. [20] emphasized the need for the preservation of indigenous knowledge that runs the risk of being lost due to the adoption of modern lifestyles. For instance, youthful individuals are influenced by globalization and, consequently, not keen on learning and participating in ethno-medicinal and cultural activities [29].

**Table 1.** Demographic characteristics of the participants in three (3) villages of Bushbuckridge Local Municipality, Mpumalanga province, South Africa.

| Feature | Frequency (n) | Percentage (%) |
|---|---|---|
| | Age groups | |
| 20–35 | 9 | 22 |
| 36–64 | 13 | 32 |
| >64 | 19 | 46 |
| | Gender | |
| Male | 17 | 41 |
| Female | 24 | 59 |
| | Formal educational level | |
| None | 7 | 17 |
| Primary | 4 | 10 |
| Secondary | 24 | 58 |
| Tertiary | 6 | 15 |
| | Work status | |
| Employed | 5 | 12.2 |
| Unemployed | 5 | 12.2 |
| Self-employed | 10 | 24.4 |
| Retired | 21 | 51.2 |

### 3.2. Inventory and Uses of Locally Sourced Fruits in the Study Area

A total of 31 plant species with multiple uses was identified in the current study (Table 2). The importance of fruit trees/shrubs among local communities has been documented in countries such as Namibia [11], Zimbabwe [30], Ethiopia [31], India [32,33], Estonia [34], and Indonesia [35]. These aforementioned studies suggest that local communities often rely on locally sourced plants for diverse uses and as a source of livelihood. As indicated in Table 2, 100% FC were recorded for 15 fruit species (e.g., *Annona senegalensis*, *Carissa edulis*, *Diospyros mespiliformis*, *Flueggea virosa*, *Sclerocarya birrea*, *Ximenia caffra*), which suggests their popularity among the participants. Interestingly, *Sclerocarya birrea* and *Diospyros mespiliformis* were identified among the four top plants with the highest priority (based on the high number of citations among participants) in Namibia by Cheikhyoussef and Embashu [11]. On the other hand, six of the fruits (*Berchemia discolor*, *Searsia pendulina*, *Berchemia zeyheri*, *Bridelia micrantha*, *Strychnos madagascariensis,* and *Ximenia americana*) had the lowest FC (<40%) in the current study.

In a recent study, Mashile et al. [21] demonstrated the increasing importance and popularity of fruit species in 15 villages located in three (Bushbuckridge, Mbombela, and Thaba Chweu) local municipalities in Mpumalanga Province. Although the majority (about 84%) of the fruit species in the current study were recently reported [21], five species, namely, *Canthium inerme*, *Macrotyloma maranguense*, *Searsia pendulina*, *Syzygium intermedium,* and *Trichilia emetica* were indicated for the first time in the study area. It was also evidenced that the type of fruits in the study area is different than other parts of South Africa where similar ethno-botanical surveys for indigenous food/fruit have been conducted. For instance, 28 indigenous fruits were documented among the contemporary Khoe-San descendants on the south coast of the western Cape Province [36]. However, none of these fruits was mentioned in our study among the Mapulana of Mpumalanga Province. Welcome and van Wyk [7] demonstrated the diverse patterns in the utilization of indigenous plants for food type among the different ethnic groups in southern Africa.

**Table 2.** An inventory of locally sourced fruit species among three villages in Bushbuckridge Local Municipality, Mpumalanga Province, South Africa. Use value (UV), frequency of citation (FC), and use report (UR).

| Scientific Name and Voucher No | Family | Local Name (Sepulana) | Plant Part(s) | Uses and Significance among Participants | No of Use Category | No of Use Report (UR) | FC (%) | UV |
|---|---|---|---|---|---|---|---|---|
| *Annona senegalensis* Pers KNS 10 | Annonaceae | Matllepo | Fruit, leaves, roots | Food (edible fruit), vertebrate poison (snake repellent), medicine (cosmetics and sexually transmitted infections/diseases), | 3 | 4 | 100 | 0.098 |
| *Berchemia discolor* (Klotzsch) Hemsl KNS 31 | Rhamnaceae | Digokgoma | Fruit, bark, roots | Food (edible fruit, porridge and alcoholic beverage), fuel (firewood), medicine (wounds, bleeding gums) | 3 | 6 | 36.5 | 0.401 |
| *Berchemia zeyheri* (Sond.) Grubov KNS 20 | Rhamnaceae | Dinee | Fruit, roots | Food (edible fruit), medicine (headache) | 2 | 2 | 24 | 0.203 |
| *Bridelia micrantha* (Hochst.) Baill. KNS 1 | Phyllantaceae | Ditsere | Fruit, bark | Food (edible fruit), medicine (diarrhoea, headache, sore eyes and tooth-ache) | 2 | 5 | 24 | 0.508 |
| *Canthium inerme* (L.f.) Kuntze KNS 8 | Rubiaceae | Mmitswa | Fruit, branches | Food (edible fruit), material (construction) | 2 | 2 | 100 | 0.049 |
| *Carissa edulis* Vahl. KNS 12 | Apocynaceae | Dithokolo | Fruit, roots | Food (edible fruit and beverage/wine), social use (misfortunes), medicine (body pains) | 3 | 4 | 100 | 0.098 |
| *Diospyros mespiliformis* Hochst. ex A.DC. KNS 5 | Ebenaceae | Ditsoma | Fruit, branches | Food (edible fruit), material (wooden spoon), medicine (epilepsy) | 3 | 3 | 100 | 0.073 |
| *Englerophytum magalismontanum* (Sond.) T.D. Penn. KNS 9 | Sapotaceae | Ditlhatjwa tsa tlhaga | Fruit | Food (edible fruit, jam, syrup and beverage/wine) | 1 | 4 | 51 | 0.191 |
| *Euclea divinorum* Hiern KNS 22 | Ebenaceae | Motlakolane | Fruit | Food (edible fruit) | 1 | 1 | 73 | 0.033 |

**Table 2.** *Cont.*

| Scientific Name and Voucher No | Family | Local Name (Sepulana) | Plant Part(s) | Uses and Significance among Participants | No of Use Category | No of Use Report (UR) | FC (%) | UV |
|---|---|---|---|---|---|---|---|---|
| *Ficus sur* Forssk. KNS 3 | Moraceae | Mago | Fruit, bark | Food (edible fruit and jam), medicine (chest problems) | 2 | 3 | 70.3 | 0.104 |
| *Ficus thonningii* Blume KNS 23 | Moraceae | Mokumo (Dikumo) | Fruit | Food (edible fruit and jam) | 1 | 2 | 46 | 0.106 |
| *Flueggea virosa* (Roxb. Ex Willd.) Royle subsp. *virosa* KNS 7 | Phyllanthaceae | Motlhalabu (Ditlhalabu) | Fruit, bark | Food (edible fruit), medicine (chest problems) | 2 | 2 | 100 | 0.049 |
| *Grewia flavescens* Juss KNS 27 | Malvaceae | Dipharatshwena | Fruit | Food (edible fruit, beverage/juice) | 1 | 2 | 51 | 0.096 |
| *Lannea edulis* (Sond.) Engl. KNS 11 | Anacardiaceae | Diphiroku | Fruit, branches | Food (edible fruit), material (wooden spoon) | 2 | 2 | 100 | 0.049 |
| *Lannea schweinfurthii* Engl. KNS 29 | Anacardiaceae | Marulanopsane | Fruit, branches | Food (edible fruit), material (wooden spoon) | 2 | 2 | 46 | 0.106 |
| *Lantana rugosa* Thunb. KNS 34 | Verbenaceae | Molutoane | Fruit, leaves, roots | Food (edible fruit), medicine (fever and diarrhoea) | 2 | 3 | 100 | 0.073 |
| *Macrotyloma maranguense* (Taub.) Verdc KNS 6 | Leguminosae (Fabaceae) | Mokorola kgogo (Mokorolakgogo) | Fruit | Food (edible fruit) | 1 | 1 | 100 | 0.024 |
| *Mimusops zeyheri* Sond. KNS 19 | Sapotaceae | Mmupudu | Fruit | Food (edible fruit) | 1 | 1 | 100 | 0.024 |
| *Parinari curatellifolia* Planch. ex Benth KNS 2 | Chrysobalanaceae | Dipola | Fruit, roots | Food (edible fruit, soft porridge and syrup), medicine (pneumonia, sore eyes and ear problems) | 2 | 6 | 51 | 0.287 |
| *Parinari capensis* Harv. KNS 30 | Chrysobalanaceae | Dimola | Fruit, roots | Food (edible fruit, soft porridge and syrup), medicine (ear problem and sore eyes) | 2 | 6 | 51 | 0.287 |
| *Sclerocarya birrea* (A.Rich.) Hochst. subsp. *caffra* (Sond.) KNS 28 | Anacardiaceae | Morula | Fruit, seeds, bark | Food (edible fruit, jam, nuts and beverage/wine), medicine (sexually transmitted infections/diseases and diarrhoea) | 2 | 6 | 100 | 0.146 |

**Table 2.** *Cont.*

| Scientific Name and Voucher No | Family | Local Name (Sepulana) | Plant Part(s) | Uses and Significance among Participants | No of Use Category | No of Use Report (UR) | FC (%) | UV |
|---|---|---|---|---|---|---|---|---|
| *Searsia pendulina* (Jacq.) Moffett KNS 25 | Anacardiaceae | Botlhotlho | Fruit | Food (edible fruit, alcoholic beverage) | 1 | 2 | 36.5 | 0.134 |
| *Strychnos madagascariensis* Poir. KNS 17 | Loganiaceae | Magwagwa | Fruit, leaves, roots | Food (edible fruit and sweets), medicine (poison and wounds) | 2 | 5 | 21.9 | 0.557 |
| *Strychnos spinosa* Lam. KNS 21 | Loganiaceae | Mashala | Fruit, leaves, roots | Food (edible fruit), medicine (poison) | 2 | 2 | 73 | 0.067 |
| *Syzygium cordatum* Hochst. ex Krauss KNS 18 | Myrtaceae | Ditlho tsa tlhaga | Fruit, roots | Food (edible fruit, alcoholic beverage), medicine (tuberculosis) | 2 | 3 | 100 | 0.073 |
| *Syzygium intermedium* Engl. & Brehmer KNS 4 | Myrtaceae | Ditlho | Fruit | Food (edible fruit) | 1 | 1 | 100 | 0.024 |
| *Trichilia emetica* Vahl subsp. *emetica* KNS 13 | Meliaceae | Mogotlho | Fruit, bark, roots | Food (edible fruit, dried fruit, beverage/juice), medicine (kidney problems) | 2 | 4 | 48.7 | 0.200 |
| *Vangueria infausta* Burch. KNS 16 | Rubiaceae | Mabilo | Fruit, bark, roots | Food (edible fruit, dried fruit, alcoholic beverage), medicine (sexually transmitted infections/diseases and tooth-ache) | 2 | 5 | 100 | 0.122 |
| *Vangueria pygmaea* Schltr. KNS 15 | Rubiaceae | Mmilofasane Mabilofasane | Fruit, bark, leaves | Food (edible fruit, dried fruit, alcoholic beverage), medicine (sexually transmitted infections/diseases) | 2 | 4 | 100 | 0.098 |
| *Ximenia americana* L. KNS 24 | Olacaceae | Ditsadi | Fruit, bark, roots | Food (edible fruit), medicine (wounds and constipation) | 2 | 3 | 21.9 | 0.334 |
| *Ximenia caffra* Sond. KNS 14 | Olacaceae | Dichidi | Fruit, leaves | Food (edible fruit and jam), medicine (diarrhoea, infertility, fever) | 2 | 5 | 100 | 0.122 |

In the current study, the top three fruit species in terms of UV were *Strychnos madagascariensis* (0.56), *Bridelia micrantha* (0.51), and *Berchemia discolour* (0.4). These aforementioned fruit species had the most common uses among a sizable number of participants. On the other hand, *Macrotyloma maranguense*, *Mimusops zeyheri,* and *Syzygium intermedium* had the least UV of 0.02, suggesting limited knowledge on their utilization among the participants. Currently, these aforementioned species are only consumed as edible fruit in the study area.

Diverse uses of the fruit species were evident in the study area. For instance, the consumption of all the fruits was common as a source of nutrient and energy. Plants such as *Annonas senegalensis*, *Trichilia emetica*, *Parinari capensis,* and *Ximenia caffra* are popular species used for different health conditions in the study area. Branches from plants such as *Diospyros mespiliformis*, *Lannea edulis,* and *Lannea schweinfurthii* are used for the production of wooden spoons as a useful utensil among the households. The use of species such as *Sclerocarya birrea*, *Pirinari capensis*, *Strychnos madagascariensis,* and *Vangueria infausta* for the production of different beverages (wine and juice), porridge, jam, juice, and sweets was common among the participants. In recent times, an increased awareness of the importance of indigenous plants for new product development and numerous new products have been demonstrated [8].

Despite the diverse uses for the identified fruit species, only six (food, materials, fuel, social uses, vertebrate poison, and medicine) out of the 13 categories were covered based on the guideline by Cook [28]. The utilization of indigenous plants is often low due to inadequate knowledge of their potential and existing undesirable traits as well as the inherent challenges associated with their production [4,14,23]. Nevertheless, many fruit species play an important role by contributing to the welfare and livelihoods of households in many South African rural communities [21,37]. Many wild, edible plants are important sources of vitamins and other nutrients for the indigenous communities [8,14,38].

### *3.3. Distribution of Plants Based on Families and Parts*

In total, the identified plants were from 17 families with Anacardiaceae and Rubiaceae as the most dominant ones (Figure 2). Most of these 17 families are widespread and often used as wild foods in southern Africa [7]. The current results are similar to the study by Maroyi [30], whereby Anacardiaceae had the highest number of wild, edible plants in the Nhema communal area, Midlands Province, Zimbabwe. Likewise, Anacardiaceae and Rhamnaceae were the most dominant families for the 52 fruit plants documented across 15 villages located in Ehlanzeni district municipality of Mpumalanga Province, South Africa. On the other hand, Dejene et al. [31] reported families such as Malvaceae and Moraceae as common plant families of wild, edible fruit tree species in lowland areas of Ethiopia. Furthermore, the families occurring in the current study are similar to those reported by Mashile et al. [21]. Particularly, the Sapotaceae are considered as important fruit trees frequently used among communities in Mpumalanga Province, South Africa [21].

The current survey revealed that six (6) plant parts were used for diverse purposes (Figure 3). The four most frequently used parts were fruit (49%), roots (20%), bark (14%), and leaves (9%). This was similar to other studies [30,32], where plant parts such as fruit and leaves were among the most common plant parts. Based on the extensive analysis of the food plants of southern Africa by Welcome and van Wyk [7], fruits and leaves were identified as the most important plant parts used as food for most of the cultural groups. In the current study, the high incidence of root and bark is linked to the use of such plants for therapeutic purpose among the participants. Likewise, the roots were the most popular plant parts recorded for the cumulative for the indigenous fruit trees in Ohangwena and Oshikoto regions of Namibia [11].

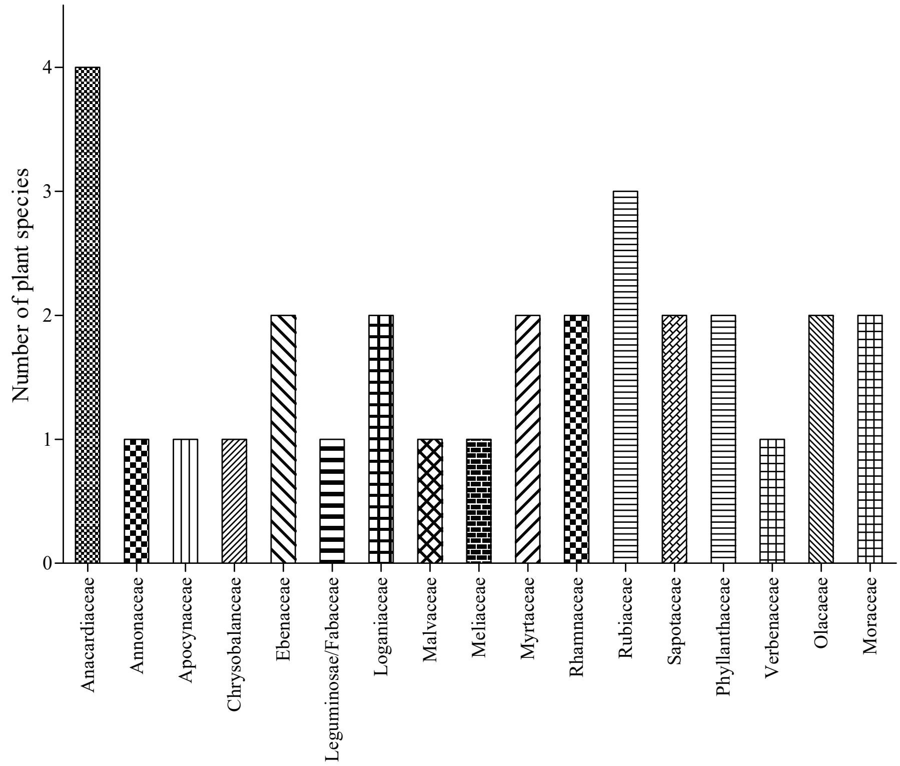


**Figure 2.** Families of fruit species identified in three villages of Bushbuckridge Local Municipality, Mpumalanga province, South Africa.

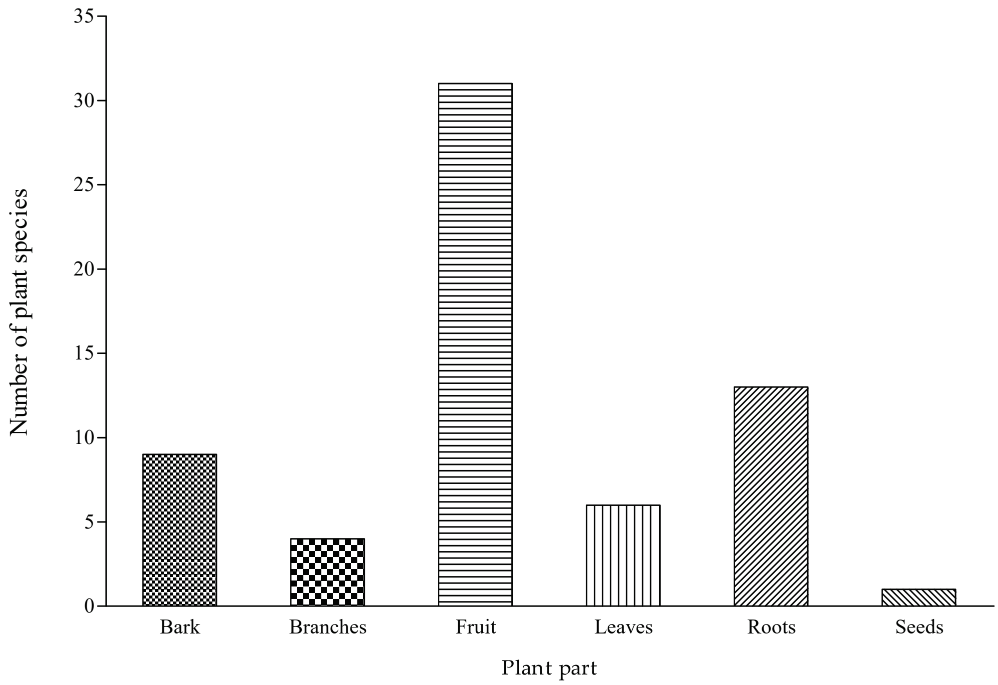


**Figure 3.** Plant parts of fruit trees used for different purposes in the three villages of Bushbuckridge Local Municipality, Mpumalanga province, South Africa.

*3.4. Category of Uses for the Fruit Species among the Local Communities*

Wild plants form an important part of the human diet with a significant number of plant species known to be edible [7]. In South Africa, the diverse uses of indigenous fruits among rural households have been extensively documented [5,16,20,21]. Social values held by the different communities have a significant effect on the manner in which wild, edible plants are consumed and conserved by the indigenous communities [39]. In the current study, the majority of these fruit species were considered as food (59%) and medicine (34%) while a few (7%) were utilized for other purposes such as fuel, material, vertebrate poison, and social uses (Figure 4). Generally, indigenous fruit species have been part of their diet whenever they are available, especially during their fruiting seasons [39]. Suwardi et al. [40] articulated that the locals tend to use certain parts of edible fruits to support some daily living requirements. Particularly, edible fruit trees may serve as an alternative food supply for households during food shortage [41]. As indicated by the participants, most of these fruit species have been part of their diet for a long time. The identified by-products derived from the locally sourced fruit species are prepared using diverse methods. For instance, the nuts found in the kernel of *Sclerocarya birrea* are sun-dried and ground into a powder to make a traditional snack called "*Lekoma*". The fresh fruits are peeled off and eaten in a fresh state. Likewise, *Vangueria infausta* is sun-dried and eaten as snack bites. However, Mapulana does not use only the abovementioned species to make the "*Lekoma*" traditional snack; other plant species such as *Strychnos madagascariensis* are ground, sun-dried, and eaten in powder form [21].

As reported by Shackleton et al. [12], the wild fruits in the Bushbuckridge savanna region have diverse uses. For instance, *Sclerocarya birrea* is used for beverage, cleansers, and cooking oil. Fruits such as *Carissa edulis*, *Vangueria infausta*, *Vangueria pygmaea,* and *Sclerocarya birrea* are traditionally eaten as snacks and household-fermented beverages [5,20,21]. Among the 31 fruit species documented in the study area, the majority (>60%) are identified as popular and used as beverage-making species in villages of South Africa [8,20]. In South Africa, *Sclerocarya birrea* are gathered by rural communities for nourishment and making marula, a customary matured drink [21]. In the study area, it is known as "Borula" and is popular during the summer season. In Ethiopia, edible fruit trees such as *Carissa edulis* and *Ximenia americana* are often consumed as a supplementary diet [31].

Even though many indigenous/wild fruits are highly desired as food and dietary supplements [1,42], their therapeutic properties have been recognized. For instance, in northern Namibia, 76% of the 25 indigenous fruit trees had different uses in traditional medicine [11]. A significant proportion of the fruit species mentioned by the participants was utilized as remedies against 22 different ailments. Some of these fruit species possess medicinal purposes, as demonstrated in a previous study [43]. Plant species with the highest number of medicinal uses included *Bridelia micrantha, Strychnos madagascariensis,* and *Vangueria infausta*. The abovementioned plants were highly ranked and regarded as the most important for the treatment of various diseases such as sexually transmitted infections/diseases (e.g., syphilis and gonorrhea), snakebites, and excessively irritated bowel movements [17]. In this study, the knowledge holders mentioned that the role of wild fruits in treating diseases is crucial in the community. According to Tshikalange et al. [17] and Van Wyk and Gericke [44], numerous sicknesses and conditions such as tuberculosis, flu, toothache, snakebite, syphilis, gonorrhea, epilepsy, infertility, headache, and diarrhea are often treated with fruit species. In addition, the participants stated an example of treating gonorrhea and syphilis with a concoction of *Flueggea virosa, Sclerocarya birrea, Vangueria infausta,* and *Vangueria pygmaea.* The traditional health practitioner soaks and boils the plant parts in warm water for a particular period and demonstrated as an effective herbal remedy for the aforementioned condition.

The study also revealed the value of the fruit species in mitigating and boosting the health issues of community members. For instance, the majority of male participants highlighted the importance of frequently drinking a few glasses of brewed marula. For instance, the fruit can boost sex drive. As such, men are encouraged to drink the marula alcoholic beverage. Moreover, participants affirmed that they advise patients to feed on wild fruits so that they would obtain essential energy and nutrients. Likewise, Mogale et al. [45] highlighted the medicinal use of indigenous fruits in Central Sekhukhune, Limpopo province.

*3.5. Seasonal Availability and Occurrence of Fruits in the Study Area*

Generally, most fruit species are accessible in the summer, i.e., hot-dry season, which is often associated with the scarcity of food supplies (Table 3). For some of the plants, the fruiting period indicated by the participants aligns with the existing evidence in the literature [5,46–51]. On the other hand, the extended fruiting duration reported for plants such as *Englerophytum magalismontanum*, *Ficus sur,* and *Ficus thonningii* was in contrast to shorter duration reported in literature (Table 3). Fruit harvesting seasons for fruits are known to slightly vary across different locations [31]. Studies have demonstrated that fruit harvesting from the wild and semi-domesticated trees that grow on farms can improve rural employment [10–13]. Particularly, the processing of indigenous fruits into jams and juices during the fruiting season may generate extra income [10]. In Africa, fruit species play an important role during the dry season and at the beginning of the rainy season in many local communities [12]. In the study area, the participants alluded to the availability of locally sourced fruits as species-specific (Table 3). As mentioned by one of the participants, "*We get them all seasons from summer, winter, autumn, and spring. Their occurrences may differ according to seasons. Like, the rainy season has its own blossom of wild fruits.*" For example, *Ficus sur* are available all year round while others occur in a specific season. An interesting finding of the current study was that some fruits are utilized as hunger quenchers and harvested during months of low agricultural productivity. The participants reported that some fruit species are commonly harvested during periods of food shortages, these included *Annona senegalensis, Carissa edulis, Diospyros mespiliformis, Ximenia caffra, Mimusops zeyheri,* and *Sclerocarya birrea*.

Maroyi [30] highlighted that fruiting seasons of wild, edible plants vary and the consumption alters with other species in terms of appearances. Based on the response from the participants, every season provides a constant supply of food resources for the community. As a result, many rural communities depend on wild, edible plants and related resources for their sustenance, especially in times of food shortage [4,12,21,30]. Winter collection coincides with the time of resting, festivities, migrations and displacements, working on new homes and redesign of old ones, visits to family members and companions, and numerous exercises that are just conceivable when individuals are briefly liberated from farming activities. Particularly, people in the indigenous communities have sufficient opportunity to walk and gather the indigenous fruits, given that they are free from agricultural activities [52].

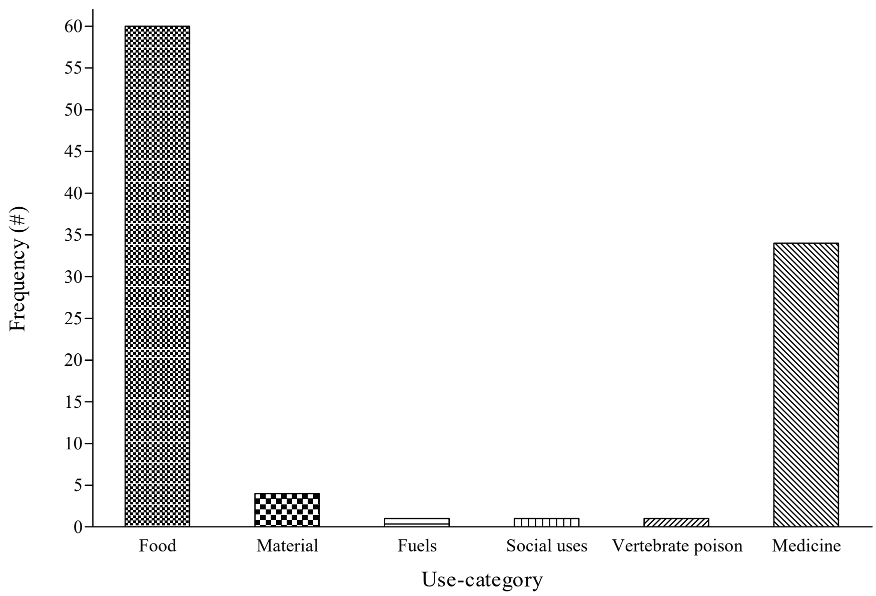


**Figure 4.** Distribution of use category of fruit species identified in three local communities of Bushbuckridge Local Municipality, Mpumalanga province, South Africa. # denotes number of mentions. Use category was based on the guideline prepared by Cook [28].

**Table 3.** Seasonal availability (W = winter, Sp = spring, Su = summer, A = autumn), occurrence, and ecological traits of fruit species in three villages in Bushbuckridge Local Municipality, Mpumalanga province, South Africa. SATN = South Africa. $ Life-form number provided in bracket is based on National List of Indigenous Trees (https://www.treetags.co.za/national-list-of-indigenous-trees/). # Colors of ripe fruit were similar to the description by Mashile et al. [21]

| Scientific Name | Availability | Occurrence | $ Life-Form | # Colour Of Ripe Fruit | Fruiting Period | Source |
|---|---|---|---|---|---|---|
| *Annona senegalensis* | Su | Common | Shrub (105) | Yellow | Dec–Mar [6] | Wild |
| *Berchemia discolor* | Su | Common | Tree (449) | Yellow | Jan–May [53] | Wild |
| *Berchemia zeyheri* | Su, A | Common | Tree (450) | Red | Jan–May [53] | Wild |
| *Bridelia micrantha* | W | Common | Tree (324) | Black | Oct–Dec [53] | Wild |
| *Canthium inerme* | Sp, Su | Common | Shrub (708) | Brown | Oct–Apr [54] | Wild |
| *Carissa edulis* | Sp, Su | Common | Shrub (604.4) | Black | Sept–Dec [55] | Wild |
| *Diospyros mespiliformis* | Sp, Su | Common | Tree (606) | Brown | Apr–Sep [46] | Wild |
| *Englerophytum magalismontanum* | W, Su, A | Common | Tree (581) | Red | Dec–Feb [47] | Wild |
| *Euclea divinorum* | Sp, Su | Common | Shrub (595) | Black | Dec–Mar [54] | Wild |
| *Ficus sur* | W, Sp, Su, A | Common | Tree (50) | Red | Sept–Mar [54] | Wild |
| *Ficus thonningii* | W, Sp, Su, A | Common | Tree | Red | Oct–Dec [46] | Wild |
| *Flueggea virosa* | Sp, Su | Common | Shrub (309) | White | Dec–Mar [54] | Wild |
| *Grewia flavescens* | Su | Common | Shrub (459.2) | Brown | Dec–Mar [54] | Wild |
| *Lannea edulis* | Su | Common | Shrub | Black | Oct–Dec [46] | Wild |
| *Lannea schweinfurthii* | Su | Common | Tree (363) | Yellow | Nov–Mar [54] | Wild |
| *Lantana rugosa* | Sp, Su | Common | Shrub | Purple | Sep–May [48] | Domesticated |
| *Macrotyloma maranguense* | Su | Common | Shrub | Yellowish or pinkish-brown | Sep–May [48] | Domesticated |
| *Mimusops zeyheri* | Su | Common | Tree (581) | Yellow | Apr–Sep [54] | Wild |
| *Parinari capensis* | W, Sp | Common | Tree | Brown | Oct–Jan [54] | Wild |
| *Parinari curatellifolia* | Sp | Common | Shrub (146) | Brown | Oct–Nov [6] | Wild |

**Table 3.** *Cont.*

| Scientific Name | Availability | Occurrence | $ Life-Form | # Colour Of Ripe Fruit | Fruiting Period | Source |
|---|---|---|---|---|---|---|
| *Sclerocarya birrea* | Su | Common | Tree (360) | Yellow | Feb–Jun [54] | Wild |
| *Searsia pendulina* | W, A | Common | Tree (396) | Black | Dec–May [54] | Wild |
| *Strychnos madagascariensis* | Su | Common | Tree (626) | Yellow | Sept–Feb [49] | Wild |
| *Strychnos spinosa* | Sp, Su | Common | Tree (629) | Yellow | Sept–Feb [49] | Wild |
| *Syzygium cordatum* | Sp, Su | Common | Tree (551) | Deep purple | Nov–Mar [6] | Wild |
| *Syzygium intermedium* | A | Common | Tree (556.1) | Red | Dec–Apr [54] | Domesticated |
| *Trichilia emetica* | Su, A | Common | Tree (301) | Red to brown | Jan–May [54] | Wild |
| *Vangueria infausta* | Su, A | Common | Tree (702) | Brown | Jan–May [50] | Wild |
| *Vangueria pygmaea* | Sp, Su | Common | Tree | Black | Feb–Apr [6] | Wild |
| *Ximenia americana* | Sp, Su | Common | Shrub (101.5) | Orange | Jan–May [54] | Wild |
| *Ximenia caffra* | Sp, Su | Common | Shrub (103) | Red | Aug–Oct [54] | Wild |

### 3.6. Implication of Current Findings for Food and Nutritional Security

As a result of the increasing negative effect of unhealthy food on the health and well-being of humans as well as the severe impact on the environment, the importance and urgent need to collectively transform diets and food production cannot be overemphasized [1,4]. Interestingly, these challenges may be mitigated using the recently proposed reference diet that highly resonates with traditional eating pattern [1]. Furthermore, indigenous and traditional plants, especially fruits, remain essential in the diversification of food in order to enhance food and nutrition security globally [4,42]. Even though the abundance of indigenous plants, especially fruits, is generally well acknowledged in sub-Saharan Africa, the documentation of their uses and associated local knowledge remain inadequate [4,13,23]. This is further worsened by the potential loss of valuable local fruit trees due to diverse threats, particularly habitat loss arising from anthropogenic factors [11,51]. The current findings established the rich, indigenous knowledge of local fruit species among participants in the study area. It was also evident (as all the identified plants are often consumed) that these fruits' species contribute to the food and nutrition security among the participants. Furthermore, these fruits are readily available and accessible to the participants in the study area. Although the many indigenous fruits are often neglected and not well known beyond their immediate environment, increasing awareness and potential exploration for the development of new food and beverage products have been recognized in recent times [8]. This trend is expected to continue given the inherent values, attributes, and traits associated with many indigenous plants [1,4,23].

## 4. Conclusions

The current findings highlight the diverse indigenous knowledge and continuous importance of fruit species among the participants in the study area. Relative to previous work done in Bushbuckridge, four plants (*Canthium inerme*, *Macrotyloma maranguense*, *Searsia penduline,* and *Syzygium intermedium*) are reported in the study area for the first time, to the best of our knowledge. An estimated 48% of the documented fruit species (e.g., *Annona senegalensis*, *Canthium inerme,* and *Sclerocarya birrea*) were well known (FC = 100%) by all the participants. The reported uses for the plants were categorized as food (59%), medicine (34%), material (4%), fuel (1%), social uses (1%), and vertebrate poison (1%). Particularly, *Brechemia discolor*, *Parinari capensis*, *Parinari curatellifolia,* and *Sclerocarya birrea* were considered as the most valuable fruit species based on their high UR. *Strychnos madagascariensis*, *Bridelia micrantha,* and *Berchemia discolor* had the highest (0.4–0.56) UV and regarded as fruit species with the most diverse uses among the participants. The majority of the fruit species are available during summer and mainly sourced from the wild. Overall, these fruit species have the potential to add value in the food production industry, economy, and well-being of people in the local communities. Thus, they can help in addressing some of the United Nations Sustainable Development Goals (UN SDGs) such as Nos. 1, 2, and 3, which focus on no poverty, zero hunger, and good health and well-being, respectively.

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