

Perceiving the biodiversity of food at chest-height: use of the fleshy fruits of wild trees and shrubs in Saaremaa, Estonia

1. Introduction

Details on the management, harvest and consumption of wild plants constitute an important part of local ethno-ecological knowledge. The food culture of any particular nation depends greatly on the dietary resources available in the given climate, but also on local perceptions of the usefulness of wild plants. Fruits harvested from wild and cultivated trees contribute substantial food energy to human diets all around the world (Pimentel *et al.* 1997) and can be a valuable source for bioactive compounds (Sanchez-Mata *et al.* 2012). Wild fruits are used for food literally everywhere (Turner *et al.* 2011). Several historical (archive-based) studies have reported uses already abandoned in modern Europe (Łuczaj & Szymański 2007; Łuczaj 2008, 2012; Denes *et al.* 2012, Svanberg 2012; Svanberg & Ægisson 2012; Łuczaj *et al.* 2013). Yet, in some European rural areas the tradition of harvesting wild food resources is still alive today (see for example; Tardío *et al.* 2006; Pardo-de-Santayana *et al.* 2007; Mustafa *et al.* 2012; Pieroni *et al.* 2012, 2013; Bellia and Pieroni 2015).

Modern Estonians, and especially those living on islands, tend to picture themselves as a “forest” and “close to nature” nation that should rely greatly on local food resources, including wild food sources. This is to some extent true, even though changes in wild food and medicinal plant consumption have occurred during the last century (Sõukand & Kalle 2011, 2012, 2013; Kalle & Sõukand 2012, 2013). While wild-growing herbaceous plants and semi-shrubs are rather small and often difficult to notice from a distance, trees and shrubs are larger and often stand out from the general “green background”, at least in open areas. Can the latter be considered special distinguishing markers in the personal and communal herbal landscape? (*cf* Sõukand & Kalle 2010a,b). Moreover, during the time of their maturity, fruits are often easily found at human eye level, providing (often colorful) markers for recognition within general species diversity. Due to this visibility, fruits of wild growing trees and bushes form a group that deserves closer attention, as a clear example of the identification of edible plants within a landscape.

Our working hypothesis is that the majority of widespread native edible wild-growing fleshy fruits have been eaten on Saaremaa Island. We suggest that people have a well-established perception of wild fruit taxa and their edibility. This article contributes to the documentation and analysis of the use of wild food plants in Estonia and to the understanding of the significance of the perception of bio-cultural diversity at chest-height.

2. Data and methods

The definition of wild fleshy fruits/pseudofruits of trees and bushes is based on the folk perception of fleshy fruits: in Estonian *puuvili* (tree fruit) for trees and *mari* (berry) for shrubs – fruits whose seeds are surrounded by some (juicy) flesh (hereafter *fruits*). All wild-growing native species are included, as well as cultivated species that have run wild and cultivated ornamental species, which are not grown for food.

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2.1. Research site

Saaremaa, which is the largest island of Estonia (2,673 km², over 30,000 inhabitants), belongs to the West Estonian Archipelago and is located in the Baltic Sea, south of Hiiumaa Island. The island has a mild maritime climate and a wide variety of soil types, which give rise to a rich flora: 1200 vascular plant species, which constitutes almost 80% of the plant species found in Estonia. About 10% of them are rare and thus protected by conservation law. Mixed (and in some areas broad-leaved) forests with rich plant communities cover over 40% of the territory of the island. Wooden meadows and alvars, once very common, are now again cleared and moved with the support of different nature conservation schemes. Figure 1 depicts Saaremaa Island and specific regions expressing differences in the use of fruits.

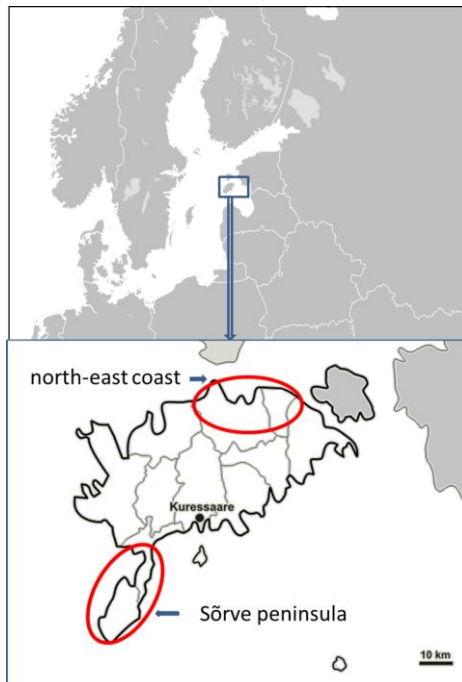


Figure 1. Map of research site with highlighted areas.

2.2. Data collection

The collection of the data on wild fruits was part of a hypothesis-based field study concerning present and recent past uses of medicinal and wild food plants, conducted on the island of Saaremaa in June-August 2014. Face-to-face semi-structured interviews were carried out with 21 males and 29 females born between 1928 and 1952. Only local rural residents who had spent all their conscious childhood on Saaremaa Island were considered for this study. Plants were collected on site or during field walks with the interviewees. The majority of the people were very enthusiastic about their knowledge being recorded; however, few considered it worth anything. The purpose of the study was explained and prior informed consent was obtained from all interviewees.

The voice-recorded interviews as well as their transcripts are stored at the Estonian Folklore Archives of the Estonian Literary Museum. Voucher specimens were collected for wild (and naturalized) plants whenever possible, then dried and identified by the second author, and subsequently deposited at the Estonian University of Life Sciences herbarium.

2.3. Data analysis

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All digitalized responses were entered into a Microsoft Excel spread sheet, and all records regarding the eating of fruits were then extracted. Plant synonyms were unified according to The Plant List (2010). Ethnobotanicity index (percentage of reported useful plants from the respective flora of the area [*sensu* Portères, 1970]) was calculated. Use Reports (UR, Tardio & Pardo de Santayana 2008) referring to fleshy wild fruits were organized according to use variety (snack, jam, juice, wine, etc.), and the frequency of detailed use (DUR, Kalle & Sõukand 2013) was calculated separately from URs. Results of the analysis mentioned above were compared with the qualitative list of the plants eaten in Estonia based on historical data (Kalle and Sõukand 2012) and in 19th century Saaremaa (Luce 1823). Different properties of used vs non-used fruit-bearing trees and bushes native to Estonia were also discussed.

3. Results and discussion

Reported uses of the fruits of 17 vascular plant species belonging to six genera (and three vascular taxa identified on the genus level only) are outlined in Table 1. While the number of fruits used is relatively small, all edible, common and non-toxic native species were consumed (Table 2): of the 23 native taxa of fruit-bearing trees and shrubs growing in Estonia, 11 (48%) were utilized by at least ten percent of the interviewees. Of the remaining 12, two were utilized little, six taxa were more or less toxic and the toxicity of four taxa is not known, but they are sporadic or rare, difficult to differentiate or taste is perceived as unedible. The ethnobotanicity index for all fruits native to Saaremaa is relatively high, at 56.5, while the ethnobotanicity index for common non- or slightly toxic fruits differentiated by people is 88.2.

3.1. Quantitative results

The taxa mentioned in 234 URs corresponded to 6 families and 12 genera, among them:

- The greatest number of taxa (11) belongs to Rosaceae, accounting for more than half (140) of all URs.
- The next most frequently used family was Grossulariaceae (3 species with a total of 34 URs), although the only representative of Cupressaceae *Juniperus communis* alone had a quite similar number of URs (31).
- Four species (*Sorbus aucuparia*, *Juniperus communis*, *Ribes alpinum* and *Prunus padus*) were used by at least 40% of the interviewees.

Fruits were predominantly used fresh (Figure 2) and as snacks (Figure 3).

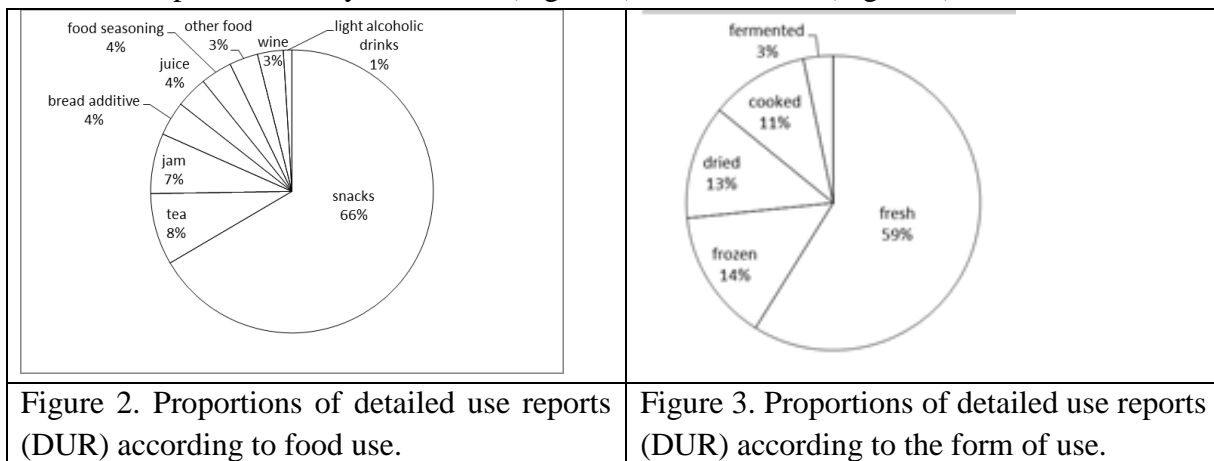


Table 1. Used tree and shrub fruits.

Genera	Species	Local name	UR	Use recorded	D u	Remarks	Hist. use in Estonia	Mentioned in Luce 1823
Adoxaceae	<i>Sambucus nigra</i> L.	must leeder	1	only tasted	rt	taste was not appreciated; cultivated as decorative, rarely runs wild	no	teaches to use flowers, as fruits are rarely ripen
	<i>Viburnum opulus</i> L.	lodjapuu, õispuu, leivamari	7	bread additive (5), (frozen) snacks (2)	ch	bread was remembered to be very tasty	snacks, bread ingredient, jam	teaches to make juice for fermenting
Berberida ceae	<i>Berberis vulgaris</i> L.	paberits, paaburitsud, paburitskad, kukerpuu, barbariss	16	snacks (15), desserts (6), juice (5), jam (2), wine, tea	ch	valued for the taste; historically massively demolished as is intermediate host for <i>Puccinia graminis</i>	snack, tea, additive to desserts, wine	used as surrogate for citron [among city folks]; teaches how to make port wine and vinegar
Cupressac eae	<i>Juniperus communis</i> L.	kadakas	31	snacks (24), spices for food (10), kvass (2), tea, beer, additive to bread	wl	used occasionally; historically important, but in easily becomes dominant in the community	snack, tea, jam, drink, spices for food, beer, kvass, near-beer, additive to fermented birch sap	additive to fermented (pre-boiled) cabbages; teaches eating fruits and using for improving the taste of port wine and beer, making wine and taste additive to cooked poultry
Grossulari aceae	<i>Ribes alpinum</i> L.	mage sõstar, imal sõstar, maamaks, imalmaks, punased metsasõstrad, mage punane sõstar, imal marjapuu	24	snacks (24)	ch	eaten mainly "by the way", when encountered in nature; known for insipid, cloy taste	snacks	only names are listed
	<i>Ribes nigrum</i> L.	must sõstar	5	snacks (5), jam	wl	mainly collected in abandoned gardens, rarely wild; used alongside with	snack, jam	only names are listed, describes various uses of cultivars

						cultivated		
	<i>Ribes uva-crispa</i> L.	tikker, karusmari	5	snacks (5)	ch	collected in abandoned gardens as well as outside the garden; earlier massively run wild	only cultivated: snacks, jam, dessert	no
Rhamnaceae	<i>Frangula alnus</i> Mill.	paakspuu	5	snacks (5)	ch	only tasted, known to be poisonous; taste considered unpleasant	snack	only medicinal use
Rosaceae	<i>Crataegus</i> spp.	viirpuu, türnpuu	4	snacks (4), tea	ch	occasional snacks, now considered unpleasant due to big seed	snack	only medicinal use
	<i>Malus domestica</i> Borkh.	koduõunapuu, aedõunapuu, pärisõunapuu, metsistunud õunapuu	16	snacks (19), jam (7), tea (7), juice, wine	wl	run wild, used alongside with domestic	snack, wine, vinegar, tea, additive to sauerkraut	describes various uses of cultivars
	<i>Malus domestica</i> x <i>M. sylvestris</i>	poolikud(õunad), metsõunad, paradiisipuu, segaõunad	3	snacks (3), juice	ch	used alongside with domestic	no records	no
	<i>Malus sylvestris</i> (L.) Mill.	metsõunapuu, maaõun	19	snacks (frozen) (19)	ch	mainly historical use, collected and left to freeze before eating; becoming rare	snacks	snacks, vinegar
	<i>Prunus domestica</i> L.	kreek, kreegipuu	9	snacks (9), jam (3)	ch	wild are used alongside with cultivated	no records	no
	<i>Prunus padus</i> L.	toomingas	22	snacks (22)	ch	considered poisonous on North-East coast, taste is not appreciated	snacks	snacks

						by many		
<i>Pyrus communis</i> L.	metspirnipuu	1	snacks	wl	run wild, was considered wild by the interviewed	no records	only named	
<i>Pyrus pyraeaster</i> (L.) Burgsd.	metsik pirnipuu	1	compote	rt	tried once, was not satisfied	no records	no	
<i>Rosa</i> spp.	kibuviits, kibusk	16	tea (13), snacks (frozen) (6), jam	wl	highly valued for the taste; seed considered nuisance	snack, tea, jam, syrup, kissel, bread ingredient, coffee, dessert	yes	
<i>Sorbus aucuparia</i> L.	pihla(kas)	40	snacks (38), jam (7), wine (7), juice (4), tea (3)	ch	fresh snack mainly only tasted, used more frozen, those who ate fresh did not like; jam and wine highly appreciated	snack, jam, wine, tea, bread ingredient, kvass	wine, strong alcohol	
<i>Sorbus intermedia</i> (Ehrh.) Pers.	pooppuu	9	snacks (5), additive to bread (5), desserts	ch	bread was remembered as very tasty; fruits known for floury taste	snack, bread ingredient	no	

UR – Use Reports of fruits, n = 50. Hist. use in Estonia are based on Kalle and Sõukand (2012). Du – dominantly used during: ch – childhood, wl – whole life, rt – recent use only.

Table 2. Botanical, ecological and ethobiological characteristics of all fruit-bearing trees and shrubs native to Estonia.

Native taxa	UR	T/S	Heigh (m)	Fruits ripen	Colour of ripen fruits	Taste of fresh fruits	Toxicity	Found in Estonia
<i>Sorbus aucuparia</i> L.	40	T	10	Sept. - Oct.	Red	bitter-sour	Lightly toxic without processing	common
<i>Juniperus communis</i> L.	31	T	1-7(15)	Apr. - Dec.	bluish-black	sweet and spicy	Can be kidney irritant	common
<i>Ribes alpinum</i> L.	24	S	0.5-3	Aug.	Red	sweet and sour	Toxicity not known	common
<i>Prunus padus</i> L.	22	T	15	Aug. - Sept.	Black	constringent	Strong astringent, can be slightly toxic in large quantities	common
<i>Malus sylvestris</i> Mill.	19	T	10	Sept. - Oct.	Green	sour and bitter	Seeds lightly toxic	common in Western-Estonia, rare in the rest of Estonia

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<i>Rosa</i> spp.	16	S	0.5-1.5	Sept.	Red	sour-floury	Toxicity not known	common
<i>Berberis vulgaris</i> L.	16	S	1-3	Sept. - Oct.	bright-red	sour	Rarely causes nausea	common in Western-Estonia, rare in the rest of Estonia, but cultivated in towns
<i>Sorbus intermedia</i> (Ehrh.) Pers.	9	T	10	Sept. - Oct.	reddish-orange	floury	Toxicity not known	common in Western-Estonia
<i>Viburnum opulus</i> L.	7	T	1-3	Sept.	Red	nasty and bitter	Can cause nausea when unprocessed	common
<i>Ribes nigrum</i> L.	5	S	0.5-2	Aug. - Sept.	Black	sweet and sour	Toxicity not known	common, found little on Saaremaa
<i>Frangula alnus</i> Mill.	5	T	6	Sept.	violet-black	bitter-nasty	Toxic when unprocessed	common
<i>Crataegus</i> spp.	4	S	5-15	Sept. - Oct.	Red	saccharine to bitter	Heart stimulant, toxic in large quantities	common in Western-Estonia, rare in the rest of Estonia
<i>Pyrus pyraster</i> (L.) Du Roi	1	T	10-15	Sept. - Oct.	Green	nasty	Toxicity not known	sporadic in Western- and Northern-Estonia
<i>Sorbus rupicola</i> (Syme) Hedl.	0	T	7	Sept.	orange or brownish-red	sloppy	Toxicity not known	found only in Western-Saaremaa and Hiiumaa island, protected by nature conservation law
<i>Prunus spinosa</i> L.	0	T	0.5-3	Sept.	bluish-black	bitter	High in tannins, can be slightly toxic in large quantities	rare even in Western-Saaremaa
<i>Taxus baccata</i> L.	0	T	10-20	Aug. - Sept.	Red	sweet and aromatic	Seeds highly toxic	sporadic in Western-Estonia and islands
<i>Euonymus europaeus</i> L.	0	S	1.5-3	Sept. - Oct.	pinkish-red	bitter	Highly toxic	sporadic
<i>Cornus sanguinea</i> L.	0	S	2	Sept.	bluish-black	nasty (not edible)	Toxicity not known	sporadic in Western- and Northern-Estonia
<i>Rhamnus cathartica</i> L.	0	T	8	Sept. - Oct.	Black	bitter-nasty	Toxic in large quantities	common
<i>Lonicera xylosteum</i> L.	0	S	1-3	Aug. - Sept.	deep-red	bitter	Highly toxic	common
<i>Daphne mezereum</i> L.	0	S	0.3-1.2	Jul.-Aug.	orange-red	extremely nasty	Highly toxic	common
<i>Ribes spicatum</i> Robson	0	S	0.5-3	Aug.	Red	sour	Toxicity not known	not differentiated
<i>Cotoneaster</i> spp.	0	S	0.5-2	Aug. - Oct.	red, blue or black	floury, bitter	Toxic	common in Western- and Northern-Estonia, rare in the rest of Estonia

Species that are not commonly differentiated are presented on the general level. UR – Use Reports of fruits (Table 1), T – tree, S – shrub. The list is composed based on Pogen 1977, Kukk 1999, Kukk and Kull 2005. Toxicity of the plants is described based on (Nielsen 1990, Ehrlen and Eriksson 1993).

3.2. Properties influencing use

The majority of wild fleshy fruits can be seen around human chest level. Hence biodiversity at chest-height has been quite well recognized and culturally acknowledged on Saaremaa through the culturally sustainable consumption of all wild edible fruits available in this domain. The colours of edible fruits vary, with red and black fruits dominating the top of the list. The majority of the fruits ripen in late summer, making fruit-foraging season quite restricted.

3.2.1. Toxicity of the fruits

Quite common among the interviewees was the saying: “we ate only those fruits we knew, all other were *a priori* forbidden to eat.” Several persons mentioned folk generic *ussimarjad* [viper’s berries], referring to red poisonous fruits (like *Lonicera xylosteum* and *Daphne mezereum*, but also variety of herbaceous plants). Knowledge about edibility was acquired mainly from parents, but also from peers. No separate book on the use of wild fruits for food has been published in Estonian. Their use was mentioned only along with recommendations on the use of cultivated trees and shrubs (probably the most influential being Spuhl-Rotalia 1898 and Pogen 1977) and in a few books warning against the use of poisonous berries (Masing 1962; Nielsen 1990).

However, the abovementioned books may have contributed to the awareness of the poisonous properties of some plants, as several interviewees stressed that they ate the fruits in their childhood, but now some of them are considered poisonous. A rather distinct example is that of *Prunus padus*, which is relatively harmless (in small quantities), yet considered poisonous in two separate areas on the north-east coast of Saaremaa Island and Sõrve Peninsula (see Figure 1). On the contrary, the fruits of *Frangula alnus*, widely acknowledged as poisonous, were recalled by a few interviewees as “tasted” in small quantities as a pastime activity (on the way from school or while playing).

3.2.2. Taste

Taste is an important factor: the more interesting and pleasant the taste, the more the plant is reported as eaten. The influence of taste on the perception of fruit consumption is also demonstrated by the high level of awareness of the fact that freezing improves the taste of some fruits (particularly *Sorbus aucuparia*, *Malus sylvestris* and *Viburnum opulus*) and the very different descriptions of their tastes experienced before and after freezing. Therefore the abovementioned fruits are preferably collected after frost or even brought home and stored in the barn (now put directly into the freezer) to be frozen before snacking or processing (cf also Pardo-De-Santayana *et al.* 2005).

However, a few interviewees were unaware of the changes in taste (never mentioned freezing), while one acquired such knowledge regarding *Sorbus aucuparia* only recently. Frozen fruits of *Malus sylvestris* were recalled as a childhood delicacy by the majority of those who claimed to have eaten them. As humans prefer variety in their diet (Johns 1994), but cultivated trees and shrubs were mainly absent from farm gardens until the 1960s, wild fruits were eaten to diversify the palate and satisfy the natural need for fresh foods and vitamins.

3.3. Position of fruits within the regional (food) culture

Fruits were reported in 85% of all DURs on the use of wild fruit-bearing trees and shrubs. The remaining 15% was divided between a wide variety of plant parts (twigs, flowers, resin, leaves, etc.). Hence, fruit-bearing trees are known first and foremost through their fruits. This might be explained by the seasonality in

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the perception of trees in this specific climatic region: unless the fruits are ready for consumption, the trees and bushes constitute a solid green background. For example, people differentiate some species belonging to the genus *Ribes*, which have very similar leaves, by the fruits (and their tastes).

Although small in territory, Saaremaa Island exhibited some more regional peculiarities in addition to the perceived poisonousness of *Prunus padus* in specific territories. In particular, the fruits of *Viburnum opulus*, regarded in other parts of Estonia as “Russian” berry, were commonly used around Sõrve Peninsula (see Figure 1) as a tasty and valued bread additive. The use of *Sorbus intermedia* as a bread additive was also peculiar to this specific region of Saaremaa and unknown elsewhere, although the tree itself is common in landscape gardening all over the island, as the trees of the *Sorbus* family were historically considered sacred and are still cultivated for protection of the household. While direct stigmatizing of wild fruit consumption was not observed (cf. Menendez-Baceta *et al.* 2012), one interviewee stressed that they just snacked on a few fruits of *Prunus padus* at a time, but Russian soldiers “emptied the whole tree at once”. For locals, the eating of fruits as snacks was considered a common pastime activity for kids returning from school and (mainly young) adults wandering around (during daily farm activities).

The interviewees recalled that during their childhood the fruits of wild trees and shrubs were only collected purposefully in rare cases (such as the fruits of *Malus spp.* brought home for freezing). Instead, as they were growing along field edges near stone fences or trenches, the fruits were collected when passing those places during everyday activities. However, some tasks were scheduled in order to obtain a better harvest from the trees; for example, the collecting of tree twigs for winter feeding of domestic animals was scheduled to coincide with the ripening of *Sorbus aucuparia* and *Frangula alnus* fruits, so that the fruits could be gathered for food and medicine. The same applied to the clearing of wooden meadows of *Juniperus communis*; during clearing, some fruiting shrubs (*Viburnum opulus*) and trees (*Sorbus intermedia* and *Malus sylvestris*) were left to grow on the meadows for future harvesting.

3.4. Diachronic continuum and dis-continuum

Compared to the earliest ethnobotanical records of plant use on Saaremaa (Oesel) Island (Luce 1823) the presently collected data is considerably more extensive in both the number of utilized taxa and specific uses. Only the use of three historically consumed species of the local flora were not recorded in present study. Two of them are highly toxic: fruits of the commonly found taxa *Lonicera xylosteum* and *Taxus baccata* (where non-toxic arils were probably eaten), both recorded in Luce (1823) as snacks for children. The third taxon (*Prunus spinosa*) was also recorded in Luce and in our recent study on wild edible plants among people with advanced botanical education (Kalle and Sõukand 2013), but as the taxa is rare on Saaremaa, most likely it was not differentiated on the popular level. In general, recent findings are pretty much in line with the historical uses of the wild fruits recorded all across Estonia, as differences in use were minimal.

Such continuity, however, was future not generally supported, as only five taxa were predominantly reported as used throughout life. Twelve taxa were mainly eaten only in the interviewees’ childhood and only two taxa were “newly discovered”, although their use was marginal and induced by a one-time curiosity. Hence, the diachronic continuity of use evolved into abandonment during the lifetime of one generation. In the authors’ opinion several intertwined social and ecological factors contributed to this outcome, a few of which should be explicitly stressed:

- 1) Decrease of habitats: amelioration, formation of large land plots and the abandonment of small fertile fields have destroyed many of the habitats for wild fruiting trees and bushes, such as partitioning stone fences and small ditches.

- 2) Changes in paths and routes: the extent of daily movement activities of people (working, pursuing a pastime, playing, going to school, etc.) have decreased considerably, which has brought about a reduction in their interaction with nature (and the herbal landscape).
- 3) Decrease in the economic importance of taxa: until the 1990s some wild fruits were purchased by wine industries (*Sorbus aucuparia*) or pharmacies (*Rosa* spp., *Juniperus communis*), and twigs were collected for the winter feeding of domestic animals.
- 4) Cultivation: until the 1960s cultivated trees and shrubs were present in only a limited number of (wealthy) households, so that families collected wild fruits for preservation. Later the need for wild preserves slowly diminished.
- 5) Pollution: currently on Saaremaa Island, regardless of the very low pollution level, people do not collect wild plants near roads; and although the contamination of wild fruits was not explicitly mentioned, the authors observed during several visits that road-side trees and shrubs were full of fruits yet untouched.
- 6) Decrease in harvest: two interviewees have noticed that *Prunus padus* give less harvest (not all fruits ripen); one of them attributed this to the changes accruing in nature and his wife (originated from mainland and hence not included into the sample) attributed this to the massive proliferation of bird-cherry ermine (*Yponomeuta evonymellus*).
- 7) Age-related change to the palate: among the snacks for children were many sour fruits, whereas adults were no longer very keen on eating sour foods. Interviewees explained this as a child's need for sour foods, which disappears with age.
- 8) Vanished need: specific foods (bread, beer) in which fruits were used are no longer made at home.

4. Conclusions

This paper contributes to a better understanding of the (food) cultural importance of wild fleshy fruits in Estonia during the two last centuries and evaluates the factors influencing their consumption. The results show that the majority of native edible fruits of trees and shrubs were eaten quite intensively, both fresh and processed, which demonstrates that in the past the people of Saaremaa were well adapted to the local environment and had a good knowledge of the edibility of the wild fruits found at chest-height. Yet, through reduced access to the fruits' habitat distribution and limited physical activity outside fenced gardens, intensive cultivation of various fruits and perceived pollution, as well as altered practices in the collection of fruit, foods prepared and taste preferences, wild fleshy fruits have changed from a diverse source of food into a marginal snack within the lifetime of one generation. So knowledge of the edibility of fruits is now preserved mainly through occasional snacking, while other food uses are remembered only from childhood.

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