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Resilience in the mountains: biocultural refugia of wild food in the Greater Caucasus Range, Azerbaijan

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Abstract: Diversity of Traditional Ecological Knowledge (TEK) created on the edges of culture is the key to the sustainability and resilience of humankind. We recorded wild food TEK among seven autochthonous linguistic communities living on both sides of the Greater Caucasus Range, documenting the use of 72 wild taxa as well as remarkable diversity of both taxa and uses among the communities. The most isolated communities form distinct biocultural refugia for wild food plants and their uses, but the sustainability of such communities is under threat due to depopulation, and their TEK has already entered into decline. While isolation may have been responsible for the preservation of food biocultural refugia, it may no longer be enough for the passive preservation of the food refugia in the study area in the future. More proactive steps have to be taken in order to ensure the sustainability of TEK of the study communities and beyond.

Keywords: biocultural refugia, wild food plants, Azerbaijan, autochthonous languages of Caucasus, Traditional Ecological Knowledge, ethnic and linguistic minorities

Introduction

Diversity of Traditional Ecological Knowledge (TEK) is the key to the sustainability and resilience of humankind within changing climatic and socio-economic conditions. Cultural and linguistic edges create a great diversity of TEK, including that of wild food (Pieroni et al. 2018), yet there are many mechanisms that can limit diversity and erode TEK. Barthel et al. introduced the term *biocultural refugia* to refer to "sources of resilience in the landscape of food production" (2013a). The same authors later suggested that places holding biocultural refugia are important for policy makers and must be considered as part of the solutions addressing global change (Barthel et al. 2013b).

Recent research has shown that centralization has homogenized and eroded plant use in Post-Soviet countries. For example, regional differences in Ukraine are relatively minor despite the separation, distance and linguistic differences (Soukand and Pieroni 2016, Pieroni and Soukand 2017, 2018), in Central Belarus the use of wild food plants has decreased to multifunctional ones (Soukand et al. 2017a), and in the Latgale region of Latvia linguistic and religious differences did not save TEK from homogenization (Mezaka et al 2019 unpublished field results). At the same time, culturally undisturbed regions still hold considerable biocultural richness (Savo et al 2019). Also, quite surprisingly, results from the Republic of Georgia have highlighted the extremely large variety of plant uses in all spheres of life (Bussmann et al. 2016). The South Caucasus, of which Georgia is a part, served as a gateway to Northern Eurasia for the initial spread of animal and plant domestication about 12,000 years ago. In more recent times the region was part of the heavily centralized Soviet Union, the establishment and collapse of which brought food shortages and at the same time, due to forceful relocation of ethnic minorities and collectivization, a significant cut-off of traditional lifestyles. Therefore, this region offers interesting ground for research, as a few recent investigations in the region (Georgia (Bussmann et al., 2016, 2017, 2018; Łuczaj et al. 2017), Armenia (Hovsepyan et al. 2016), Azerbaijan (Pieroni and Soukand 2019) and Dagestan (Kaliszewska and Kołodziejska-Degórska 2015)) have demonstrated that the mountain villages still hold significant biocultural diversity and can be considered a potential biocultural refugia. While a comprehensive volume on the ethnobotany of the Caucasus has already been published (Bussmann 2017), it provides only an overview of the currently and historically most used taxa in the whole region and does not indicate the small-scale regional and ethnic divergences of plant use, due to its summary format.

To date, only one autochthonous linguistic group in Azerbaijan (Udis) has been studied with regard to wild food plants (Pieroni and Soukand 2019), despite the fact that many of them could still hold a high diversity of TEK as they are relatively isolated and have been settled in the region for about a millennium. Azerbaijan has the lowest Global Food Security Index (2018) in Europe which could also signal the potential need to use and maintain the sustainability of wild food resources, as low income often implies more extensive use of wild foods (Stryamets et al. 2015). Therefore, we expect to see diversity of TEK in the region despite the long-lasting influence of the centralization and homogenization practiced during the height of the Soviet Union.

The aims of this study were a) to record the traditional plant foraging among seven autochthonous linguistic communities living on both sides of the Greater Caucasus Range, b) to compare the uses of wild food plants among the communities in order to identify possible differences and define food *plant cultural markers* (*sensu* Pieroni et al. 2015: plants used and mentioned exclusively by one cultural group), c) to discuss the influence of different factors (like linguistic and cultural distance, isolation and separation) on the resilience and sustainability of TEK, and d) to provide recommendations for strengthening the position of TEK in the study communities.

Data and Methods

Study area, communities and the field study

Figure 1. Study area and visited villages.

Ten villages inhabited by seven distinct linguistic groups were visited in November 2017 and October 2018. Visited villages (Figure 1) are situated on both sides of the Eastern Greater Caucasus Range. Of these, Budukh, Khinalug and Kryts communities are situated on the north-eastern side of the range in the Quba-Khachmaz region (hereafter "NW group"), while the other four, Akhvakh, Rutul and two Tsakhur communities, are located in the Shaki-Zaqatala region on the south-western side of the range (hereafter "SE group"). One of the Tsakhur communities has heavily adapted to the Azeri mainstream along the last century, and its members consider themselves Azeris and speak the Azeri language, although they also acknowledge their Tsakhur ancestry; and thus they are referred to as "azerized Tsakhurs".

Both regions border Dagestan. The study communities are autochthonous and the visited villages are located in mountainous areas. All the communities are bilingual and elderly community members, especially those who served in the Soviet army or worked in Russia, speak Russian as a third language. The languages of the communities belong to the Northeast Caucasian language family, apart from the language spoken in Saribas, where the villagers are highly Azerized and speak Azerbaijani (which belongs to the Turkic language family) with some relics from Tsakhur languages. The communities remained endogamic until recent times and are (mainly Sunni) Muslim. The majority of the interviewees were middle-aged or elderly individuals identified by community members (mainly local farmers or shepherds) as knowledge holders; however, in almost all of the communities some younger people were also included in the sample. The villages are located within an altitudinal range of 700 to 2100 meters above sea level, yet the villages situated at lower altitudes have good access to the

higher mountains found in close proximity and within walking distance. Detailed characteristics of the study communities are presented in Table 1.

Table 1. Characteristics of the study communities and interviewed participants.

Ethnic or ethno-religious group	**Akhvakh**	**"Azerized Tsakhur"**	**Budukh**	**Khinalug**	**Kryts**	**Rutul**	**Tsakhur**
Approx. number of inhabitants in Azerbaijan	100	100	1000 (200 speak language)	1000	5 000	30 000	10 000
Level of isolation	Slightly isolated (good road, close to bigger town)	Relatively isolated (separated, now relatively good road)	Highly isolated (very bad mountain and river-bed road)	Relatively isolated (separated, relatively good road)	Highly isolated (very bad mountain road)	Slightly isolated (good road)	Highly isolated (very bad mountain and river-bed road)
Approximate average elevation	700 m	1600 m	1700 m	2100 m	1700 m	1000 m	1100 m
Original language (language family) written or not	Akhvakh (Avar–Andic, Andic) unwritten, home use only	Azerbaijani (Turkic, Western Oghuz), village dialect	Budukh, (Lezgic, Southern Samur) unwritten, all domains	Khinalug, (Lezgic, independent branch) unwritten, all domains	Kryts (Lezgic, Southern Samur) unwritten, all domains	Rutul (Lezgic, Western Samur) written since the 1990s, mainly home use	Tsakhur (Lezgic, Western Samur) written since the 1930s, all domains
Language spoken in the studied villages	Akhvakh and Russian or Azeri	Azerbaijani with some Tshakur words; older men also Russian	Budukh and Azeri mono-lingual in Russian; some bilin-gual in Azeri and Russian	Bilingual Khinalug and Azeri; few men fluent in Russian	Kryts and Azeri, elderly men also Russian	Rutul and Azeri, elderly and educated people fluent in Russian	Tsakhur and Azeri; some elderly people also Russian
Number of study participants	9	10	9	9	10	10	9
% / mean age of women in the sample	56 / 38	33 / 51	44 / 59	33 / 60	30 / 45	30 / 55	44 / 49
% / mean age of men in the sample	44 / 46	67 / 61	56 / 40	67 / 54	70 / 56	70 / 46	56 / 50
Overall mean age	57	56	50	57	50	50	50

Semi-structured interviews were conducted in Russian by the second author, sometimes with the help of a translator. Interviews lasted from 15 to 60 minutes and were followed, if possible, by a field walk with the interviewed person. The interviewees were asked to list and show gathered and consumed wild food plants including vegetables (cooked, fried or fermented) used for preparing *sarma*, wild fruits and other wild plants used in sweet preserves and/or liquors, and wild plants used for recreational herbal teas drunk in the food context without any medicinal purpose (*sensu* Soukand et al 2013) or as snacks. Unusual uses of cultivated plants as well as those that were both cultivated and wild were also recorded. For all listed plant uses, local names and details on

gathering and preparation were obtained.
In each study community only one or two people that were approached refused to be interviewed, mainly due to the lack of time. Interviews were conducted only with people who gave verbal informed consent, and the Code of Ethics of the International Society of Ethnobiology (ISE 2008) was followed.
While nomenclature follows The Plant List database (2018) and the Flora Europaea (Tutin et al 1964), and the family assignments are consistent with the Angiosperm Phylogeny Group (APG) IV (Stevens 2017), plants were identified via the Flora of Azerbaijan (Əsgərov 2016, Grossheim 1949, Karjagin 1950-1961) which uses slightly different nomenclature. If the plant specimen was not available, the taxon was identified based on a full description of the plant and its habitat as well as the local/Azeri/Russian name given by the interviewees. When interviewees did not differentiate taxa at the species level, e.g. referred to different species of a genus with the same name, it was identified at the genus level, even if we collected plant samples for different representatives of the genus (for example *Rumex*, *Allium* and *Mentha*).

Data analysis

All local plant names were transcribed using the rules of Azerbaijani for the languages without an established alphabet, and Azerized Tsakhur and the Roman alphabet for the Khinalug and Rutul languages. Data was transcribed from field notebooks and classified according to taxa and use categories. Emic use categories were used and Use Instances (UI - the emic category of use of a taxon) served as a basis for comparison.
Further, we compared current UIs and taxa recorded for all the study communities to evaluate their food-ethnobotanical distance using proportional Venn diagrams and Jaccard Similarity Indices (JI) following the methodology of González-Tejero et al. (2008): JI = (C/(A+B-C))x100, where A represents the number of taxa/UI in sample A, B is the number of taxa/UI in sample B, and C is the number of taxa/UI common to A and B. For visualization of results we used software developed by BioTuring Inc., San Diego California USA, www.bioturing.com.
For comparison and calculation of JI, some species were considered as one taxon (*Mentha*) whereas others were attributed to two: acidic (referred to as *Rumex acetosa*) and non-acidic (referred to as *Rumex patientia*). In addition, *Allium* spp. represented all *Allium* species apart from *A. ursinum* and *A. rotundum*, which could be accurately identify and thus treated as separate taxa.

Results

We recorded the food use of 65 species and 7 genera (including several possible taxa rarely differentiated at the popular level) representing 27 plant families (Table 2). The most well-represented families were Rosaceae, Asteraceae and Lamiaceae. The largest number of plants (23) were snacked on raw, yet 10 of them were snacked on only in one community and overall only a few people mentioned the use of snacks. Prepared foods dominated the list of emic food categories. *Qutab* (covered pie) is the most popular dish made with wild foods, for which 17 taxa were intensively used. Conceptually similar foods, *grıts* or *khinkali* (type of dumplings), were prepared from six taxa. The leaves of eight taxa were used for wrapping *sarma* and six taxa were a component of *dovğa* (a yogurt soup). Eleven taxa were lactofermented in brine. Sweet preserves constituted another large group, for which 15 taxa were used to prepare sweet preserves and 10 for making kompot. Recreational tea consisted of eight taxa, while four were used only in the Azerized Tsakhur community.

Table 2. Wild food plants recorded among the studied autochthonous communities and their local culinary uses.

Latin name	Local names	Parts used	Uses
Achillea arabica; Asteraceae (AZD18)	Koymaderan^{T}	Leaves	Seasoning for *qutab* and *gırts*^{TT}

Allium rotundum; Amaryllidaceae (AZ23)	Arna[T]	Leaves	*Kətə*[TT]
Allium spp.[#]; Amaryllidaceae	Cincilim[X], Jalıja[S], Jut[K], Lamzu[B], Məsaser[K], Peləi[R], Sipa[T], Şanak [B]	Leaves	Boiled[SS], eaten raw[K] (with bread)[X], fremented in brine[BBB,K,RR,SS], salads[BB], *qutab*[BBB,SS,TT], *dovğa* [BBB]
Allium ursinum[#]; Amaryllidaceae	Haljar[S,T], Ramzil[R]	Leaves	Boiled[R,S], lactofermented in brine[RRR,SSS,TT], salad[R]
Amaranthus retroflexus; Amaranthaceae (GR05, GR19)	Penjar[T,A], Penje[R]	Aerial parts	Boiled[R], fried with eggs[AA,RRR], *qutab*[R,TT]
*Armoracia rusticana***; Brassicaceae (AZ094)	Xren[R,A]	Roots	Seasoning cold dishes[A,R]
		Leaves	Lactofermented in brine[R]
Arctium tomentosum[#]; Asteraceae	Palpatu[K], Pehək[B], Pek[B]	Roots	Spring snack [B,KKK]
Arctostaphylos uva-ursi[#]; Ericaceae	Varanç[K]	Fruits	Kompot[K]
Berberis vulgaris[#]; Berberidaceae	Mirape[X], Sna[S], Siriş[K,X]	Fruits	Added to cooked rice[K], juice[KK,XX], kompot[X], lactofermented in brine[KK], sweet preserves[K,S,X]
Calepina irregularis; Brassicaceae (AZ67)	Kazayax[R]	Leaves	*Qutab*[RRR]
Capsella bursa-pastoris; Brassicaceae (AZ24)	Quşapəyi[K,X,T], Kazaya[T], Tere[K]	Leaves	Q*utab*[KKK,TTT,XXX]
Carum caucasicum[#]; Apiaceae	Çamen[S], Kujur[X], Kurah[K, B]	Seeds	Milled and mixed with salt, used as seasoning for food[BBB,KKK,XXX], sausage seasoning[S]
Castanea sativa; Fagaceae[#]	Shabalıh[S], Tsubıl[A,R]	Nuts	Added to soup with dried meat or other foods[S], fried[R], pilaf[S], snacked on raw or boiled in salted water[A,R,S]
Centaurea sp. (AZ69)	Gangal[R]	Leaves	*Qutab*[R]
Cirsium echinus (AZ57), *C. macrocephalum* (AZ10); Asteraceae	Gangal[S], Kangal[R], Saza[T]	Stems	Pealed and eaten raw[R, S,T]
Cornus mas[#]; Cornaceae	Cumal[R], Kizil[B], Səmel[R], Soğal[T,X] , Soxali[A], Suxal[T]	Fruits	Ace[T], lactofermented in brine[AA,RRR,T], side-dish for very fatty lamb meat[T], sweet preserves[AA,B,R,TT,X], kompot[AA,TT]
Corylus avellana[#]; Betulaceae	Ərək[A], Hek[T], Fistık[R], Funduh[S]	Leaves	*Sarma*[TT], *phkali*[T]
		Nuts	Snack [A,R,S]

Crataegus sp,; Rosaceae (AZD02, AZ30)	Izgil[S], Ələne[A], Kelem[T], Kunini[T], Yemişan[B,T]	Fruits	Sweet preserves[B,TT], kompot[TT] lactofermented in brine[SS], juice[SS], pekmez[S], snack[A]
*Cydonia oblonga**; Rosaceae	Cim[R], Haiva[A], Šim[T]	Leaves	*Sarma*[R,TT]
Daucus carota[#]; Apiaceae	Terhankaç[B]	Roots	Eaten raw[B]
Elaeagnus rhamnoides; Elaeagnaceae (AZ68)	Aktulak[K], Katsi[T], Kilakoholo[B], Kotkolo[B]	Fruits	Juice[B,K], snack[BB,KK], sweet preserves[BB,KK,TT]
Filipendula vulgaris[#]; Rosaceae	Halatai[K], Kində[X]	Tuber Shoots	During food shortages dried, milled and added to bread[K], snack[K,X] *Qutab*[KK]
Fragaria vesca[#]; Rosaceae	Hacanak[A], Çiyələk[K,X]	Fruits	Eaten raw[BB,KK,XX], kompot[K], sweet preserves[A]
Heracleum trachyloma; Apiaceae (AZ66)	Baldrığan[R,S,T], Siyn[T], Sut[R]	Stem	Lactofermented in brine[RRR,SSS,TT], boiled for making drinks[TT], sweet preserves[TT]
Humulus lupulus; Cannabaceae (GR15)	Qulançar[R]	Shoots	Boiled for food[R]
Inula orientalis; Asteraceae (AZD2)	Pəndərçey[S]	Flower pettals	Added to cheese as a garnish[SS]
Juglans regia[#]; Juglandaceae	Goz[S], Hek[T], Hıç[R], Hık[R], Inkxato[A]	Fruits	Snack[A,RRT], sweet preserves of unripe fruits[SSS,TT] , pkhali[TTT]
Malus baccata (AZ51) and *M. orientalis* (AZ65); Rosaceae	Əç[A,R], Çirieç[K,B], Çirməç[X], Çurçumey[T], Çiçemaj[S], Misəmoç[X], Tiçemay[S], Salax[R]	Fruits	Distilled into spirits[T], fermented in brine[RR], kompot [R,T], recreational tea[XX], snack[A,BBB,KKK,SSS,XXX], sweet preserves[T,XX]
Malva parviflora; Malvaceae (AZ29)	Balba[A], Bolba[S], Kostosu[B], Turkaş[X], Parebalba[R], Pareytələx[R], Pəli[R], Tıltıx[R], Tultuka[T]	Leaves Seeds	Boiled with dried meat and onion[R], eaten raw[X], fried with eggs[A], *gırts*[S], *qutab*[RRR,SSS,T], *sarma*[A] Snaked on raw by children[B]
Mentha spp; Lamiaceae [incl. *Mentha × piperita*, and *M. spicata*; (AZ05, AZD03)**, M. aquatica (AZ33), *M. longifolia* (AZ16, AZ27, AZ44)]	Çurki[K], Çurtha[B], Çurti[K], Kaç[K], Laha[X], Nanə [A,R,T], Nuje[T], Reyha[T], Sıdık[R], Yarpəz[S]	Aerial parts	*Dovğa*[BB,KK,RR,TT,X], eaten raw with bread and cheese during hearding[X], food seasoning[K,X], fresh seasoning for salad[TT], pilaff[KK], recreational tea[A,BBB,KKK,RR,S,T,XXX], *qutab*[BBB,KKK,XXX]
Mespilus germanica; Rosaceae (AZ55)	Kidək[B,T], kidik[B,K,R], Kuduke[A], Kumshare[A]	Fruits	Snack[AA,B,K], lactofermented in brine [A,BB,RRR], juice used as seasoning for noodles[B], *pekmez*[KK,T]
*Morus alba***; Moraceae	Tot[T]	Fruits	Distilled into spirits[T], *pekmez*[T], snack[T]

		Leaves	*Sarma*[T]
Oenanthe pimpinelloides; Apiaceae (AZ26)	Baliarpah[X]	Leaves	Mixed with cheese[X], *qutab*[X]
Ornithogalum sp; Asparagaceae (AZ47)	Çag[K] (bulbs), Çek[K], Charghant[K] (aereal part), Çiler[B], Kinde[X]	Tuber	During food shortages was dried and milled into bread or boiled[B,K], snack[BB,KK,XX]
		Leaves	Snack[K]
Papaver orientale[#] and *P. rhoeas* (AZ09); Papaveraceae	Parpari[R]	Seeds	Snack[R]
Pimpinella aromatica; Apiaceae (AZD05)	Yeš[T]	Seeds	Sausage seasoning[T]
Plantago lanceolata; Plantaginaceae (AZ61)	(Surmista) koles[T]	Leaves	Dried and milled, added to flour when making dough[TTT], g*ırts*[TT], *qutab*[TTT]
Plantago major; Plantaginaceae (AZ22)	Bağayarpağe[T,S], Koles[T]	Leaves	Dried and milled, added to flour when making dough[TTT], gırts[TT], *qutab*[SSS,TTT] , recreational tea[S], *sarma*[S]
Prunus cerasifera; Rosaceae (AZ59)	Alça[S], Arig[K,B], Hat[R], Hon[T], quani[A]	Fruits	Ace[T], kompot[T], dried fruits added to soup[B,K], lactofermented in brine[A,R,S], kompot[B,K], side-dish for very fatty lamb meat[T], sweet preserves[BB,KK]
Prunus cerasus[#]; Rosaceae	Acibalı[S]	Fruits	Sweet preserves[S]
Pyrus caucasica; Rosaceae (AZ46)	Armut[S], Çirçeher[B,T], Hır[R], Naxaxo[A]	Fruits	Distilled into spirits[T], kompot[T], snack[A,B,S], sweet preserves[A,T]
Rosa canina and *Rosa* spp.; Rosaceae (AZD01, AZ40, AZ63)	Çimçe[K], Çimke[K], Çimtik[K], Çunu[B,K], Itburnu[X], Kaškala[S,T] , Neçepə[R]	Fruits	Juice[B,K,S,X], kompot[B,K,X], pekmez[S], recreational tea[B,K,SS,TT,X], sweet preserves[B,K,R,S,T,X]
Rubus caucasicus; Rosaceae (AZ64)	Anjina[A], Bəjutkan[S], Boguli[T], Bugürtkan[R,X], Çouxul[R], Kalakke[A]	Fruits	Sweet preserves[A,R,S,T,X]
Rubus idaeus[#]; Rosaceae	Hura[S,T] , Muxale[A], Muruk[A]	Fruits	Sweet preserves[A,S,T]
Rumex acetosa (AZ54) and *R. acetosella* (AZ02); Polygonaceae	Haletin[B], Kusuxulaga[X], Kuzugulag[K,S], Turşag[X], Mai[B], Tsifu[A], Tsurtsum[R]	Leaves	*Dovğa*[XX], *grıts*[SS], *qutab*[A,K,R,S]
Rumex spp.; Polygonaceae [incl. *R. patientia* (AZ21), *R. obtusifolius* (AZ15), *R. crispus* (AZ32), *R. conglomeratus* (AZ43)]	Inçel[X], Inzer[X], Lors[K], Lurs [B], Lıs[R], Kolas[S], Koleç[R], Koles[T]	Leaves, stem	Dried and milled, added to flour when making dough[TTT], pilaff[BBB,KKK,XXX], *qutab*[BBB,KKK,RR,SSS,TTT,XXX], *dovğa*[BBB,KKK,XXX]
Sambucus ebulus; Adoxaceae (AZ58)	Ançili[T], Ənçile[A,S]	Fruits	Distilled into spirits[A,SS,TT], snack[T], sweet preserves[T]

Sorbus caucasica; Rosaceae (AZ72)	Ajalmasə[S]	Fruits	Snack[S]
Stellaria media; Caryophyllaceae (AZ08)	Cincilin[A,R,S,T,X]	Aerial parts	Eaten raw with bread[X], *qutab* [AAA,R,SS,TTT]
Thymus caucasicus (AZD08), *T. collinus* (AZD07), and *T. transcaucasicus* (AZ62); Lamiaceae	Çengal[K,B], Engal[B,K], Kababot[T], Kəliglotu[B,R,T,X], Kəkot[S] Nurs[B]	Aerial parts	*Dovğa*[B], (added to salt mixture for) seasoning[B,K,TT,X], *qutab*[SS,X], recreational tea[BBB,KKK,SS,T,XXX], sausage and meat seasoning[R,SS], snack[K]
Tilia begoniifolia; Malvaceae (GR25)	Çoka[S], Hid[A], Katiande[A]	Leaves	*Sarma* (fresh and fermented)[AA,TT]
		Flowers	Recreational tea[S]
Tragopogon sp.; Asteraceae [incl. *T. graminifolius* (AZ25) and *T. reticulatus* (AZ03)]	Alemink[X], Mhunkai[K], Yohahun[K]	leaves	*Qutab*[K,X], snack[XX]
Trifolium pratense; Fabaceae (AZ73)	Yonça[S]	Flowers	Recreational tea[S]
Tussilago farfara; Asteraceae (AZD12)	Çurki[K], Çurti[K], Dolmajapagə[K], Gaja[S], Tabilgan[R], Tolpaka[K], Ugeyana[T]	leaves	*Gırts*[TT], dried and milled, added to flour when making dough[TTT], fermented in brine[R], *sarma*[KK,RR,S,TT]
Unidentified Asteraceae	Gelbişmek[B]	leaves	Fried[B], *qutab*[B]
Unidentified	Khermay[R]	Leaves	*Qutab*[RR]
Unidentified Apiaceae (white root, otherwise like carrot, sweet and better than real carrot; grows on cultivated fields)	Xnaçur[S]	Roots	Snack[S(in childhood)]
Urtica sp.; Urticaceae (incl *U. dioica* (AZ17))	Cincar[S], Magal[R], Mahar[T], Meç[B,K,X], Miçə[A], Miçlə[A], Mişə[X], Mukal[R]	Shoots	Boiled[BBB,KKK,XXX], fried with onion and eggs[BBB,KKK,SSS,TTT,XXX], *dovğa*[B], *khinkali*[AA], rubbed with salt and eaten (on bread)[KKK,BBB,X,AAA,SS], *qutab*[AA,BBB,KKK,RRR,SSS,TTT,XXX], *pkhali*[T]
		Seeds	Recreational tea[S]
Vaccinium myrtillus; Ericaceae (AZD10)	Gogam[S], Heš[R], Hı[T]	Aerial parts	Recreational tea[R,T]
		Fruits	Snack[R], sweet preserve[S,TT]
Vitis vinifera; Vitaceae**	Aktə[A], Tamıl[R], Tımıl[T], Tomol[T]	Leaves	*Sarma* (fresh and lactofermented) [AAA,RR,TTT]

Abbreviations: Akhvakh ([A]), Azerized Tsakhur from Saribaş village ([S]), Budukh ([B]), Khinalug ([X]), Kryts ([K]), Rutul ([R]), Tsakhur ([T]). Gradient of use: x – 1-2 persons, xx – 3-4 people, xxx – 5 or more people.

*Cultivated taxon (whose recorded folk culinary use is "unusual"); ** both wild and cultivated; [#] taxon identification made through detailed plant descriptions and previosuly recorded folk names.

Dovğa - typical Azeri yogurt-and-herb based soups; *gırts* – Tsakhur name for *khinkali*, which are traditional Georgian dumplings made with various fillings (minced meat, potatoes, cheese, mushrooms and/or herbs); *kətə* - a small open pie traditional for Tsakhurs, made

of dough covered with wild garlic and salt; *kompot* – Slavic beverage (winter preserve) obtained by boiling fruits with a large amount of water (different from the Western European *compote* in the low concentration of sugar); *pekmez*: typical syrup of Ottoman cuisine obtained by condensing diverse fruit juices; pkhali - made from chopped greens or other vegetables mixed with ground onion, garlic, walnuts, and aromatic herbs; *qutab* - typical Azeri thin stuffed (salty) pancake filled with mixtures of aromatic and wild herbs, cheese, or meat.

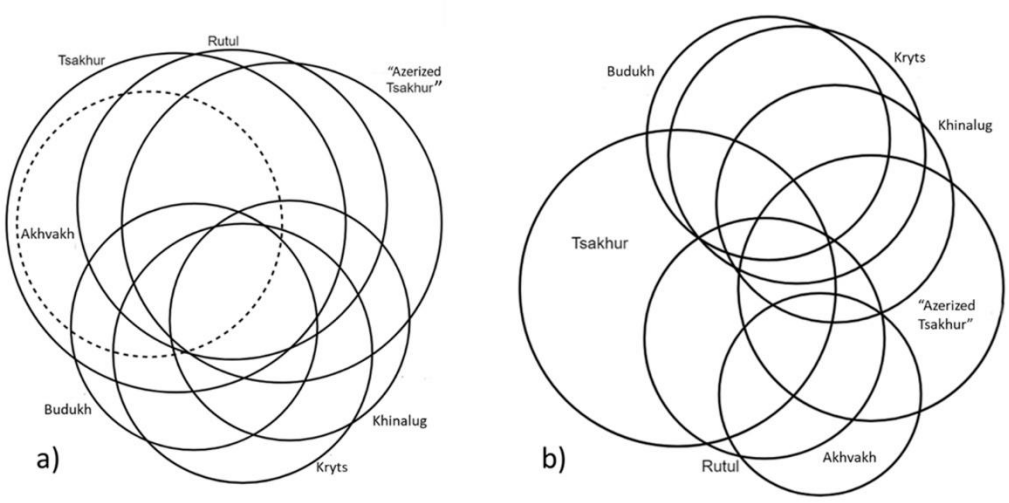
The visual representation of wild food ethnobotanical distances (Figure 2a) demonstrates a clear distinction between the wild food plants used on the two sides of the mountain range. Calculated overlaps among the groups (Table 3) show high similarity between communities on one side of the mountain range. An overlap greater than 50% among the plants used was recorded for Khinalugs and Kryts and also the latter and Budukhs, all of which live on the north-eastern side of the range. Similar values were also observed for Tsakhurs and Azerized Tsakhurs as well as the former group and Rutuls, all residing on the south-western side of the range. Much lower values of JI for taxa were recorded between communities located on opposite sides of the mountain range for which the lowest overlap (below 20%) was recorded between Kryts and Akhvakhs. Overlap from 20% to 30% was recorded between Khinalugs and both Akhvakhs and Tsakhurs as well as between Rutuls and both Kryts and Budukhs.

Table 3. Jaccard Indexes for taxa (lower left corner) and UIs (upper right corner).

JI taxa/ JI UI	Akhvakh	Budukh	Kryts	Rutul	"Azerized Tsakhur"	Tsakhur	Khinalug
Akhvakh	X	12.7	**8.57**	25	17.91	14.94	**9.52**
Budukh	32.25	X	**48.33**	10.67	16.46	13	**34.43**
Kryts	**19.44**	**53.85**	X	**8.64**	15.48	11.32	**40.32**
Rutul	44.44	**28.95**	**27.5**	X	22.97	21.74	**9.46**
"Azerized Tsakhur"	42.1	30.77	29.28	47.62	X	19.8	16.88
Tsakhur	47.5	33.33	28.89	**55.81**	**53.33**	X	13.27
Khinalug	**23.53**	44.44	**57.69**	31.58	33.33	**23.91**	X

The most extreme results are highlighted.

The use of taxa in emic food preparations (expressed in UIs) is more diverse and here the visual representation is not particularly informative (Figure 2b). Jaccard Indexes (Table 3) show low overlap between the recorded uses of the communities situated on opposite sides of the mountain range, being less than 10% between Kryts and both Rutuls and Akhvakhs as well as between Khinalugs and the latter two communities. Only slightly higher values (up to 13%) were recorded for almost all other trans-range comparisons. The only exception was the



relatively higher similarity between uses listed by Azerized Tsakhurs with all cross-range communities, ranging between 15.5% and 16.9%. A high similarity of uses (from 34% to 48%) was recorded only among communities residing on the north-eastern side of the range (NE group), while the overlap of emic uses between the communities on the south-western side of the range (SW group) remained between 15% and 25%.

Figure 2. Best possible fit Venn diagram showing the overlap of taxa (a) and UI (b) for all the study communities.

Table 4. Numerical characteristics of plant use in the study communities.

Parameters/communities	Akhvakh	Budukh	Kryts	Rutul	"Azerized Tsakhur"	Tsakhur	Khinalug
Taxa used	22	19	21	30	32	**37**	**20**
Unique taxa	**0**	1	1	4	4	**5**	1
Taxa used by at least 3 people	**10**	13	18	18	17	**31**	14
UIs	**29**	42	47	41	50	**71**	40
Unique UIs	**4**	7	7	12	18	**25**	10
UIs named by at least 5 people	**4**	**16**	12	8	9	13	12

The lowest and highest results for each parameter are highlighted.

The numerical characteristics of plant use (Table 4) indicate that the communities can in general be divided into two groups based on the number of taxa they mentioned: those using around 20 taxa are situated on one side of the range while those using 30 or more taxa on the other side of the range. The exception here is the Akhvakh community, which used only 22 taxa despite being located on the more "diversified" side of the range. Akhvakhs also differed in other parameters (such as an absence of culturally specific taxa, a low number of UIs and culturally significant UIs, etc.). The other noteworthy community was that of the Tsakhurs, which had the highest total in all parameters apart from UIs named by at least 5 people.

The mapping of the distribution of the use of the most important wild food taxa (named by at least three people) shows that there is only one taxon (*Urtica*) commonly used by all the study communities (Figure 3). Two more taxa were shared by six communities (*Malus* and non-acidic *Rumex*) and four (*Rosa*, *Thymus*, *Mentha* and non-specified *Allium*) were shared by five communities. A few more plants have cross-range uses: *Capsella bursa-pastoris* was used by Khinalugs, Kryts and Tsakhurs; Budukhs and Kryts share the use of *Elaeagnus rhamnoides* and *Prunus cerasifera* with Tsakhurs and the use of *Mespilus germanica* with Akhvakhs; and acetic *Rumex* is common only among Budukhs and Azerized Tsakhurs. The remaining taxa are shared by a maximum of three communities located on the same side of the mountain range.

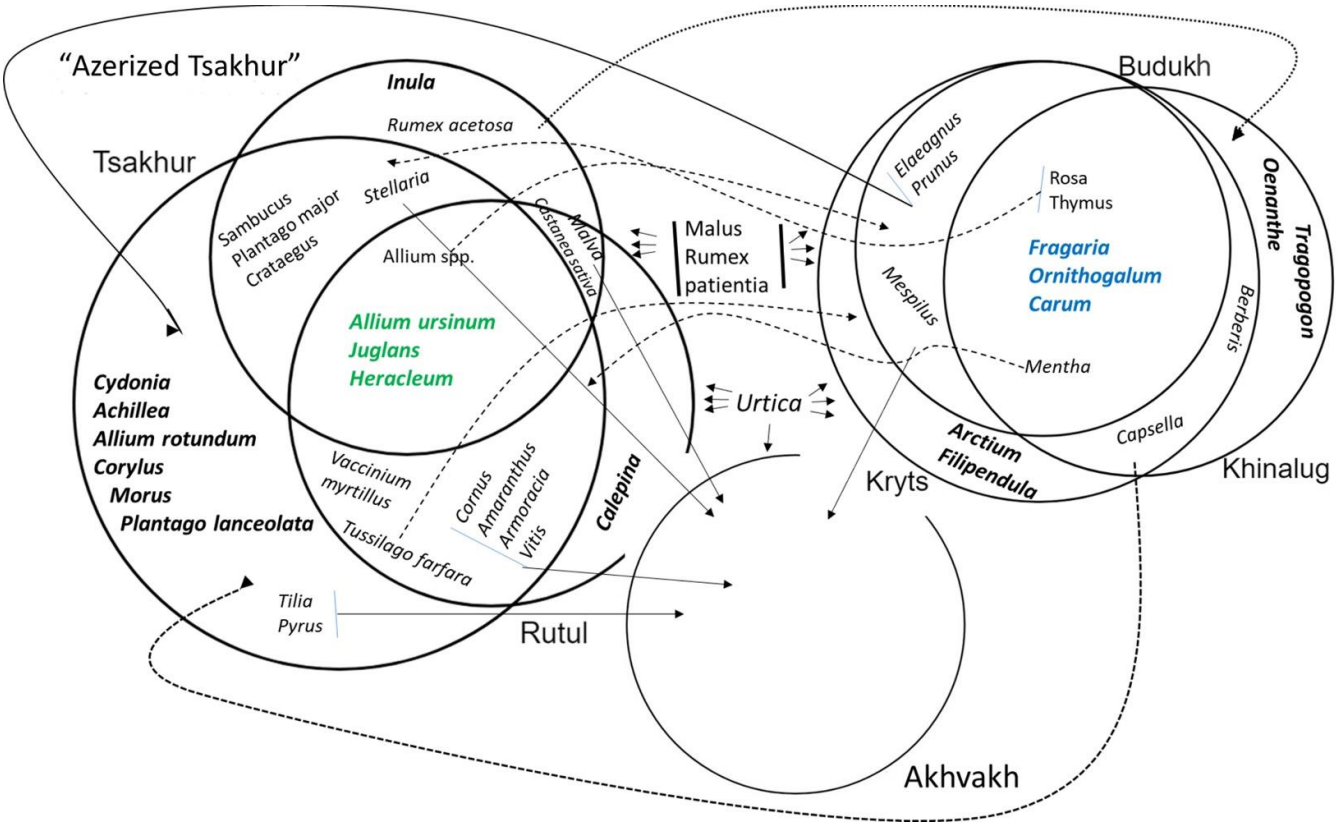


Figure 3. Distribution of the most commonly used taxa (named by at least three people) between the study communities. Highlighted are *cultural markers* for the study communities (bold) and regions (color).

While in the Quba region three taxa (*Carum caucasicum*, *Fragaria vesca* and *Ornithogalum*) are commonly used by all three communities, on the other side of the mountain not a single taxon is shared exclusively by the four communities (except for *Urtica*, which is equally highly used by all the study communities). The Akhvakh community clearly stands out from the others with only ten taxa commonly used and no uniquely used taxa that can be considered a cultural marker.

Discussion

Compared with other available recent research in historically or geographically close regions for which JI has been calculated, the results show remarkable differences between groups divided by mountains. For example, to date the lowest recorded level of overlap in used taxa has been between Assyrians and Muslim Kurds in Iraqi Kurdistan (32%, Pieroni et al 2018), yet high similarity has been found between communities sharing the same side of the mountain range and language group (comparable to the overlap of closely located groups in Ukraine) (Pieroni and Soukand 2018). Although synantropic weeds are linked to horticulture, only one such taxon (*Capsella bursa pastoris*) is used cross-border, while the other one, *Stellaria media*, has been mentioned only on the south-western side of the range. With such examples and only twelve taxa commonly shared between cross-mountain communities, we can confidently say that this part of the mountain range, which has never been on the crossroads of information exchange, indeed acted as a barrier to the distribution of TEK, securing space for biocultural refugia.

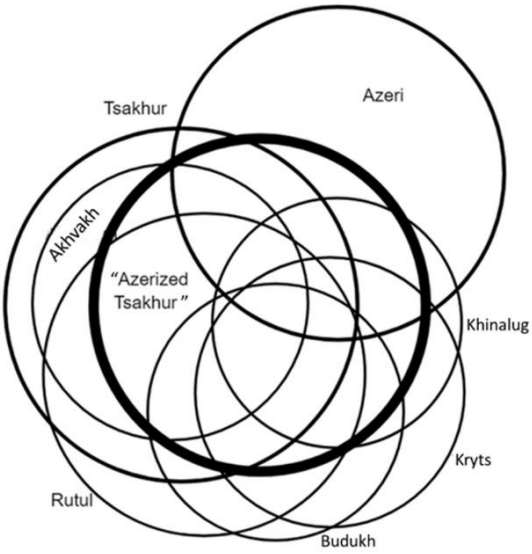


Figure 4. Best possible fit of the overlaps of taxa used by the seven study communities with the uses recorded from the Azeri population (results from Pieroni and Soukand 2019).

Unlike in Ukraine, where wild food has now become merely additive to everyday food or recreational tea (Pieroni and Soukand 2018), autochthonous communities in Azerbaijan keep wild plants as a main component of food (as fillings in pies, lacto-fermented side-dishes, leafy components of soups, etc.). Moreover, just two uses from times of hardship were recorded (tubers of *Filipendula vulgaris* and *Ornitogalum* sp.). Therefore, for the study communities, wild food is neither associated with food shortages nor a taste additive, but rather it is an organic part of life.

Azerized Tsakhurs have still kept some Tsakhur plant names (like *Kaškala* for *Rosa*) and share the largest number of taxa, but not use instances, with Tsakhurs (Table 3). At the same time, Azerized Tsakhurs also share numerous taxa with Azerbaijani communities living on the same side of the mountain range (Figure 4). This raises the question to be addressed in future research: how does assimilation by the dominant culture, in fact, work in the original ecological conditions.

The results show that the researched linguistic communities have different levels of diversity of wild food plant use and this could be related to various factors, including, but not limited to, differences in habitat surrounding the households and everyday activity spaces. However, three factors are perhaps surprising in the context of this research:

- **Geographical and cultural isolation** is not univocally interpretable. The community exhibiting the least diversity in wild food use (Akhvakhs) was located in close proximity to the closest town with a good access road. At the same time, two of the most isolated communities (Tsakhurs and Azerized Tsakhurs) exhibited the most diverse plant knowledge; however, the communities of Kryts and Budukh (both highly isolated) exhibited considerably lower numbers of taxa used.
- **Size of the group** speaking a language seems to be correlated with the diversity of plant use, with the exception of Azerized Tsakhurs who exhibited relatively high plant use diversity while having very few inhabitants in the village. This may be explained by the adaptation of Azeri food traditions alongside Azerization and the recent decrease in the number of inhabitants.
- **Language** as a barrier for understanding: it is possible that the linguistically northern and southern languages were also not intelligible due to limited interaction which had been for centuries the crucial factor determining marriages and exchanges of TEK. This was in place until Azeri became the *lingua franca* and in particular until the Soviet era when continuous contact among ethnicities became the norm.

Collective memory is supported by community interactions (Barthel et al 2013b) which can be productive only on the condition of there being a sufficient number of carriers of that memory. Depopulation is threatening such places of biocultural refugia with extinction. The few younger representatives of the communities that were interviewed were largely knowledgeable about TEK; however, interviewees in all but one community (Rutuls) stressed that young people are leaving their villages in search of jobs or education (for themselves or their

children). Therefore, in the present context, everything that was recorded is very soon to become unlearning debt (*sensu* Kalle and Soukand 2016), no longer living and, more importantly, sustainable TEK.

To save biocultural refugia from sudden and evitable disappearance, forceful and immediate steps should be taken at the policy level of the country with the EU as a possible contributor. While there can be different mechanisms to promote the economic activities of certain areas, the development of regional products based on the sustainable use of local resources and unique local gastronomical knowledge could strengthen communities by providing them the economic means to continue practicing their TEK and to attain a standard of living appropriate for the 21st century. For example, producing and marketing the distinctive cheese with petals of *Inula orientalis* as a local speciality could help the Azerized Tsakhurs to re-introduce pastoral activities which have almost vanished since the fall of the Soviet Union. For Tsakhurs, examples of local specialities could include the mixture of dried leaves of *Rumex* spp., *Plantago* spp. and *Tussilago farfara*, commonly used as an additive to pancake batter or the sweet preserves made from the stems of *Heracleum trachyloma*. It is important to encourage those small linguistic communities to value their TEK and to raise awareness of the importance of their TEK for the sustainability and resilience of humanity.

Conclusion

We can conclude that the majority of the researched mountain communities form distinct biocultural refugia for wild food plants, but the sustainability of such communities is now under threat due to depopulation, and their TEK has already entered the phase of unlearning debt. Therefore, proper care must be taken to encourage those communities to not only continue practicing their TEK, but also develop mechanisms to benefit from that practice through recognized regional products based on plant cultural markers. In parallel, small-scale eco-tourist activities that strongly incorporate TEK need to be developed. This, in turn, should increase the sustainability and resilience of the communities by providing on-site jobs for younger generations which would otherwise leave their community of origin. Only ensuring the transmission of the practical skills of using local plants as food and by creating favorable conditions for youth to remain or return to their villages can prevent this knowledge from dying out quickly.

Isolation is a complex mix of cultural, linguistic and natural factors and may have been responsible for the preservation of food biocultural refugia. However, at the same time, isolation may no longer be enough for the passive preservation of the food refugia in the study area into the future. More proactive steps should be taken in order to ensure the sustainability of those communities. Small-scale eco-tourist activities and small-scale city farmers' markets could reinforce a sense of identity and foster the production of local foods and herbal products. Biocultural refugia can have a future if they stop being just isolated refugia and become open refugia. Purposefully added points in a network of sustainable connections with urban and non-urban consumers will make civil societies aware of the value of biocultural diversity, increase the chance of sustainability and resilience of the existing biocultural refugia, and create a better foundation for the creation of new ones.

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

Ethics: Ethical approval was granted by the Ethical Committee of the University of Gastronomic Sciences.

Herbarium data: The collected voucher specimens are deposited at the Herbarium of the Department of Environmental Sciences, Informatics, and Statistics of the Ca' Foscari University of Venice, Italy (UVV), bearing herbarium numbers UVV.EB.AZ01–73). Dried plant samples were also accepted if offered by the interviewees (deposited with numbers UVV.EB.AZD01-21).

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