Ethnobotany of Mountain Regions: Far Eastern Europe

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The Caucasus

The Caucasus is generally regarded as the area situated between the Black and Caspian seas, including parts of Southern Russia, Georgia, Armenia, Azerbaijan, and small parts of Turkey and Iran, and comprises the largest mountain system treated in this volume. The Greater Caucasus harbors Europe's highest mountain, Mt. Elbrus,

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Fig. 1 Main chain of the Greater Caucasus seen from the Lesser Caucasus. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

with 5642 m in the western part of the Greater Caucasus (Fig. 1). The North Caucasus (Ciscaucasia) includes parts of Georgia (especially in Khevsureti, Pshavi, and Tusheti) as well as parts of the Republics of Kabardino-Balkaria, Karachay-Cherkessia, Ingushetia, North Ossetia, Chechnya and Dagestan of the Russian Federation, and the Southern (Trans) Caucasus. The Lesser Caucasus comprises parts of Georgia, Armenia, Azerbaijan, and small parts of Turkey and Iran (Fig. 2) (Bussmann 2017; Bussmann et al. 2016a, b, c, d, 2017a, b, 2018).

Geology

The Caucasus started in the Alpine geosyncline in the late Oligocene Epoch, and the region thus reflects the same structural characteristics as the younger mountains of Europe. Therefore, the Greater Caucasus Mountains are mainly composed of Cretaceous and Jurassic rocks with the Paleozoic and Precambrian rocks in the higher regions. Structurally it represents a great anticline uplifted at the margin of the Alpine geosyncline about 25 million years ago and subsequently altered by fresh cycles of erosion and uplift. Hard, crystalline, metamorphosed rocks such as schists and gneisses, as well as pre-Jurassic granites, are characteristic of the western part, while softer, Early and Middle Jurassic clayey schists and sandstones characterize the eastern part. The foot of the Greater Caucasus is built of younger limestones, sandstones, and marls. By contrast, the Lesser Caucasus Mountains are formed predominantly of the Paleogene rocks interspersed by the Jurassic and Cretaceous rocks. The youngest geological structures are represented by the vast volcanic

Fig. 2 Central Lesser Caucasus at Tabatskuri Lake. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

plateaus in the southern part of the range (Bussmann 2017; Bussmann et al. 2016a, b, c, d, 2017a, b, 2018).

Two main plain areas divided the Caucasus ranges – the plains of Colchis and Kura-Aras are also linked to the Alpine geosyncline; the former is related to the formation of the Black Sea and the latter to that of the Caspian. The Colchis plains are mainly represented by deposits broken here and there at the foot of the mountains by the protrusions of slightly older sedimentary rocks. Younger rock also underlies the Kura-Aras Lowland. Overall, three tectonic units can be distinguished by the degree of dislocation of the Earth's crust: (1) fold system of the Greater Caucasus, (2) the Transcaucasian intermountain area, and (3) the fold system of the Lesser Caucasus. Each of these tectonic units can be further subdivided into finer units (Bussmann 2017; Bussmann et al. 2016a, b, c, d, 2017a, b, 2018).

Terrain

The Caucasus' terrain is extremely complex with steep climatic gradients. Four main units of terrain can be distinguished: (1) mountains of the greater Caucasus (Fig. 3); (2) the intermountain plains between the Greater and Lesser Caucasus mountains (Fig. 4); (3) the mountains of the Lesser Caucasus (Fig. 5); and (4) the volcanic plateau of the Southern Georgia and Northern Armenia (Fig. 6). These primary units can be further subdivided into secondary ones (below).

The mountains of the Greater Caucasus contain many ranges, gorges, and depressions. The following secondary units can be distinguished: (1) the main watershed of

Fig. 3 Greater Caucasus, Racha, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Fig. 4 Inner mountain area in Imereti, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Fig. 5 Lesser Caucasus at Bakuriani, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Fig. 6 Volcanic plateau in Central Lesser Caucasus. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Fig. 7 Greater Caucasus chain seen from Telavi, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

the Greater Caucasus with peaks over 5000 m (Elbrus, Shkhara, Babis Mta, Chanchakhi, etc.); (2) the ranges south to the main range of the Greater Caucasus running either north to south or east to west (the ranges of Gagra, Bzipi, Chkhalta, Kodori, Shdavleri, Tsalgami, Svaneti, Egrisi, Lechkhumi, Shoda, Kedeli, Racha, Java, Avlevi, Kakheti, etc.) with peaks over 4000 m (e.g., the peak of Lahili elevated to 4010 m) (Fig. 7); and (3) the ranges north to the main range of the Greater Caucasus running either north to south or east to west (the ranges of Khokhi, Piriketi, Kuro, Shavani, Khevsureti, Tusheti, etc.) (Figs. 8 and 9), one of the highest peaks of Georgia, Mkinvartsveri, or Kazbegi (5033 m) (Fig. 10) that is located on the Khokhi range (Bussmann 2017; Bussmann et al. 2016a, b, c, d, 2017a, b, 2018).

The intermountain plains. There are two major intermountain plains between the Greater and Lesser Caucasus mountains: those of Colchis (the Western Georgian plains) and Iveria (the Eastern Georgian plains). The terrain of both is rather hilly. The Colchis plains consist of the Colchis lowlands and hilly zones adjacent from north and south. The elevation is 200 m in average, although it can reach 1000–1200 m here or there. The plains of Iveria consist of the Shida (Inner) Kartli, Kvemo (Lower) Kartli, and Alazani or Inner Kakheti valleys. Basically, the elevation ranges 200–800 m, while in the hilly zone, the elevation range can rise up to 500–1500 m. The highest range is Gombori reaching 2000 m (Bussmann 2017; Bussmann et al. 2016a, b, c, d, 2017a, b, 2018).

The mountains of the Lesser Caucasus. The mountains of the Lesser Caucasus are considerably lower than those of the Greater Caucasus. The highest peaks here rarely

Fig. 8 Greater Northern Caucasus, Khevsureti, Chechen-Georgian border. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Fig. 9 Greater Caucasus chain Gudamakari Valley, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Fig. 10 Greater Caucasus around Kazbegi, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Fig. 11 Lesser Caucasus Landscape, Bakuriani, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Fig. 12 Lesser Caucasus Landscape, Bakuriani, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

exceed 3000 m asl (Mepistskaro, Kheva, Shaviklde, Kanis Mta, Arsiani). The mountains of the Lesser Caucasus are represented by the ranges running east to west (Shavsheti, Meskheti, Trialeti, and Loki) and the range of Arsiani that runs rather diagonally, the Khrami Mountains Middle Knot and the Akhaltsikhe depression (Figs. 11 and 12) (Bussmann 2017; Bussmann et al. 2016a, b, c, d, 2017a, b, 2018).

The volcanic plateaus of Southern Georgia and Northern Armenia. These plateaus are featured by their vastness and elevation (1300–2200 m). The terrain is characterized by the sequence of the central volcanoes and lava warping, as well as lava plateaus with the trace of ancient glaciations and eroded canyons. The peaks of some ranges (Erusheti, Nialiskuri, Samsari, and Javakheti) elevate as high as 2950–3300 m. The following units can be distinguished: (1) the range of Erusheti, (2) Javakheti Plateau, (3) the ranges of Samsari and Javakheti, (4) Tsalka Plateau depression, and (4) Khrami Lava Plateau (Bussmann 2017; Bussmann et al. 2016a, b, c, d, 2017a, b, 2018).

Climate

The Caucasus climate is determined by its location within a warm temperate zone between the Black and Caspian seas and the complexity of its terrain in which mountain ranges and their orientation play an important part. In the Black Sea

region, the climate of the coastal zone is warm: the mean temperature is 4–7 °C in January and 22–23 °C in July. Precipitation is abundant (1500–2000 mm annually), especially in the southern part. At the same time, the Greater Caucasus mountains bar cold air from the north, while warm and moist air from the Black Sea spreads easily into the coastal lowlands from the west till the range of Likhi, which partly impedes further westward movement of the warm and moist airwaves. In the mountains weather conditions change to cool and wet quite steeply with increasing elevation, and above 2100 m, the environment becomes subalpine and alpine; permanent snow and ice are found above 3600 m. Overall, climatically the following provinces can be distinguished: (1) the Western Great Caucasus with humid warm climate; (2) the Eastern Greater Caucasus with continental warm to maritime intermediary climate; (3) the Colchis plains with hyper-humid warm climate where the influence of the Black Sea is most prominent; (4) the plains of Shida Kartli with moderately dry warm climate; (5) the plains of Kvemo Kartli with dry warm climate; (6) Iori Plateau with dry continental climate; (7) the Inner Kakheti with moderately humid warm climate; (8) Meskheti (Samtskhe) with dry continental climate; and (9) Javakheti with continental climate (Bussmann 2017; Bussmann et al. 2016a, b, c, d, 2017a, b, 2018).

Plant Use History

The territory of the modern-day Caucasus has been continuously inhabited since the early Stone Age, and agriculture was developed during the early Neolithic era (Javakhishvili 1987). The Georgian name "Sakartvelo" for the "Republic of Georgia" reflects this, being semantically linked to Greek (γεωργία) meaning "agriculture" (Javakhishvili 1987). Human occupation however started in the Early Pleistocene. The 1.7-Myr-old hominid fossils of Dmanisi in Southern Georgia are the earliest known hominid site outside of Africa (Finlayson 2005; Gabunia and Vekua 1995; Gabunia et al. 2000). This specimen has been classified as Late Middle Paleolithic and Early Upper Neanderthal, and modern human occupation are well documented (Adler and Bar-Oz 2009). Upper Paleolithic fossils of Dzudzuana Cave include remnants of wool (*Capra caucasica*) and dyed fibers of wild flax (*Linum usitatissimum* L.) dated to ~36–34 Ka BP (Adler and Bar-Oz 2009; Bussmann 2017; Bussmann et al. 2016a, b, c, d, 2017a, b, c, d, 2018).

The Caucasus is counted as one of the global biodiversity hotspots (Schatz et al. 2009). Botanical exploration of the Caucasus has a long history, yielding good recent treatments of the area's vegetation, e.g., for Georgia (Nakhutsrishvili 1999). As such, the region has long been the center point of botanical exploration, with the National Herbarium of Georgia in Tbilisi and Bakuriani Alpine Botanical Garden serving as a hub. The visitor's log of the garden reads like a "Who is who" of the twentieth-century botany (Fig. 13).

The Caucasus has been occupied since early human history and in the Northern Caucasus in particular shows an interwoven settlement history with traces of many

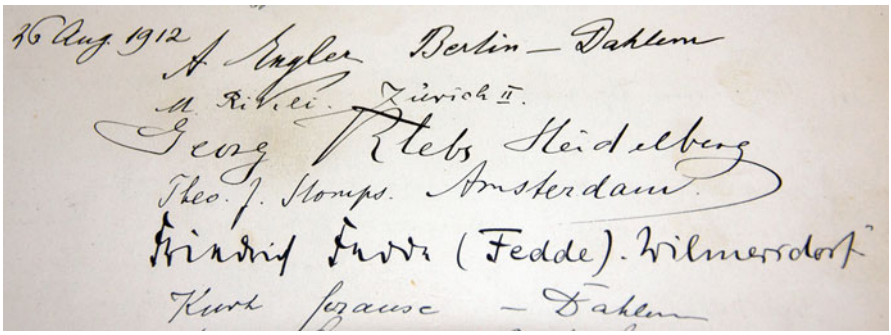

Fig. 13 Visitor log Alpine Botanical Garden, Bakuriani, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Fig. 14 Ushguli, Svaneti, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

cultures and high mountain villages with typical architecture, e.g., in Svaneti (Fig. 14), Tusheti (Figs. 15 and 16), Pshavi (Fig. 17) or Khevsureti (Fig. 18).

Georgia counts as one of the oldest Christian regions, adopting Christianity around 320 CE. A great example for early church construction is Gergeti Trinity Church, built in the fourteenth century, located at 2170 m at the base of Mount Kazbegi (5047 m), overlooking the narrow valley leading from Georgia to Ingushetia (Fig. 19). However, ancestral shrines are still very common in many regions of the Caucasus, indicating the cultural connections between many peoples of the region (Fig. 20).

Fig. 15 Tusheti, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Fig. 16 Tusheti, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

The architecture found in the Northern Caucasus range clearly indicated ethnic links, e.g., Ingush style towers in Tusheti (Figs. 21 and 22), remnants of traditional Georgian watchtowers (Fig. 23), or Chechen style villages, e.g., Shatli in Georgia (Fig. 24).

Fig. 17 Gudamakari valley, Pshavi, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Fig. 18 Roshka, Khevsureti Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

The archaeological findings from Neolithic and Early Bronze periods are rich with plant fossils and seeds of both wild species and local landraces, and agricultural implements, e.g., threshing sleds (Figs. 25 and 26), have been maintained until

Fig. 19 Gergeti Trinity Church, Kazbegi, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Fig. 20 Ancestral shrine, Tusheti, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Fig. 21 Ingush architecture towers in Dartlo, Tusheti, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Fig. 22 Ingush architecture towers, Girevi, Tusheti, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Fig. 23 Georgian style watchtower ruin, Khevsureti, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Fig. 24 Chechen-Dagestani style architecture, Shatli, Khevsureti, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Fig. 25 Threshing sled, Museum of Ethnography, Tbilisi, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

recently. Similar implements can be found all the way from the Caucasus through Georgia, the Eastern Mediterranean to Spain, indicating the close links of the Caucasico-Mediterranean Agricultural Complex, where seeds were traded together with agricultural know-how.

Seven species of cultivated wheat – *Triticum aestivum* L., *T. carthlicum* Nevski, *T. compactum* Host, *T. dicoccum* Schrank, *T. macha* Dekapr. & Menabde, *T. monococcum* L., *T. spelta* L., one wild relative, *Aegilops cylindrica* Host., as well as millet – *Panicum milliaceum* L., barley – *Hordeum vulgare* L., Italian millet – *Setaria italica* L.) P. Beauv., oats – *Avena sativa* L., wild lentil – *Lens ervoides* (Brignolidi & Brunhoff) Grande, and pea – *Pisum sativum* L. have been discovered in Arukhlo, dating back to the 6th – 2nd millennium BC (Melikishvili 1970). The earliest grapevine seeds indicating cultivation were excavated in Southern Georgia and date to ~8.000 years BP (Ramishvili 1988). Due to its long tradition, agriculture in Georgia is characterized by a great diversity of landraces and endemic species of crops. These show a high level of adaptation to local climatic conditions and often-high

Fig. 26 Threshing sled, Museum of Ethnography, Tbilisi, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

disease resistance. Early research documented this great variety (Akhalkatsi et al. 2012; Dekaprelevich and Menabde 1929; Ketskhoveli 1928, 1957; Ketskhoveli et al. 1960; Menabde 1938, 1948), but a rapid loss of local cultivars of cereals, legumes, and flax began in the 1950s with the Soviet agricultural reform (Akhalkatsi 2009; Akhalkatsi et al. 2010). Despite the long cultural history, recent studies on cultivated plants are rather scarce (e.g., Bussmann 2017; Bussmann et al. 2016a, b, c, d, 2017a, b, c, d, 2018; Pistrick et al. 2009; Zhizhizlashvili and Berishvili 1980).

Grapes – *Vitis vinifera* L. (Vitaceae) – show genetic diversity in the region, with about 600 varieties known only from Georgia (Javakhishvili 1987; Ketskhoveli et al. 1960; Ramishvili 1988; This et al. 2006), and in most regions the population takes great pride to produce their own wine and share it with visitors. Hardly any house in the Georgian lowlands is without at least some grapes in its garden or backyard. Today, 41 cultivars of grapevine are used as commercial varieties (Bedoshvili 2008), and good wine is readily available, but the history of grape cultivation and winemaking goes back millennia (Figs. 27 and 28). Like in other parts of Europe,

Fig. 27 Wine grapes, Imereti, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Caucasian grapes were devastated by the *Phylloxera vastatrix* (Planchon) Signoret, and after the infestation in the 1860s, most Georgian grape varieties are now grafted on rootstocks of American grapes resistant to *Phylloxera*.

Wheat – *Triticum* L. (Poaceae): In the 1940s, 16 species, 144 varieties, and 150 forms of wheat were registered in Georgia alone (Menabde 1948). This diversity has however greatly diminished, and most species had already disappeared by the 1960s, when introduced cultivars were favored in Soviet kolkhoz systems. At present, none of these species are sown in Georgian commercial agriculture. Pistrick et al. (2009) report some traditional varieties of bread wheat in Tusheti, Meskheti, Javakheti, and Svaneti.

Barley – *Hordeum vulgare* L. (Poaceae) – is also an ancient agricultural crop in the region and had particular importance in beer production, as well a function in religious rituals and traditional medicine (Badr et al. 2000; Javakhishvili 1987).

Caucasian rye – *Secale cereale* L. (Poaceae) – used to be cultivated in the high mountain regions (1800–2200 m) and entered into bread and beer production, although barley was preferred for beer.

Legumes, especially peas (*Pisum sativum* L.), lentils (*Lens cornicularis* L.), chick-peas (*Cicer arietinum* L.), and faba beans (*Vicia faba* L.), are still commonly grown in home gardens, and green pea (*Pisum sativum*) is thought to have originated in the Southern Caucasus. Traditional vegetables like garden lettuce (*Lactuca sativa* L.), beans (*Phaseolus vulgaris* L.), sweet basil (*Ocimum basilicum* L.), peppermint (*Mentha x piperita* L.), onions (*Allium cepa* L.), sugar beets (*Beta vulgaris* L.), spinach (*Spinacia oleracea* L.), carrots (*Daucus carota* L.), radishes (*Raphanus sativus* L.),

Fig. 28 Wine grape ornament on Mtskheta Cathedral, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

turnips (*Brassica rapa* subsp. *rapa* L.), Welsh onion (*Allium fistulosum* L.), amaranth (*Amaranthus viridis* L.), goosefoot (*Chenopodium album* L.), leeks (*Allium ampeloprasum* L.), and garlic (*Allium sativum* L.) are still very common throughout the region, and herbs like parsley (*Petroselinum crispum* (Mill.) Fuss.), coriander (*Coriandrum sativum* L.), tarragon (*Artemisia dracunculus* L.), savory (*Satureja hortensis* L.), garden cress (*Lepidium sativum* L.), dill (*Anethum graveolens* L.), fennel

Fig. 29 Home garden, Racha, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

(*Foeniculum vulgare* Mill.), celery (*Apium dulce* Mill.), *Allium fistulosum* L., *Brassica rapa* L. subsp. *rapifera* Metzger, *Lathyrus sativus* L., *Linum usitatissimum* L., *Medicago sativa* L., *Onobrychis transcaucasica* Grossh., *Pisum arvense* L., and *Trigonella caerulea* (L.) Ser. are cultivated almost everywhere. In addition, introduced species like zucchini (*Cucurbita pepo* L.), cucumber (*Cucumis sativus* L.), eggplant (*Solanum melongena* L.), marigold (*Tagetes patula* L.), watermelon (*Citrullus lanatus* (Thunb.) Matsum. & Nakai), sunflower (*Helianthus annuus* L.), tomato (*Solanum lycopersicum* (Mill.) Wettst.), pepper (*Capsicum annuum* L.), potato (*Solanum tuberosum* L.), and maize (*Zea mays* L.) were found to be popular ingredients of local cuisine.

Nicotiana rustica has been cultivated for a long time and is found in most regions, including high mountain areas. *N. tabacum* was only introduced during the Soviet period for commercial use.

A large number of additional species are traditionally also grown in home gardens (Figs. 29 and 30), e.g., sour plum (*Prunus cerasifera* var. *divaricata*) is commonly used as sauce with meat, rose hips (*Rosa canina* L.) are often used for tea and to make jam, and *Staphylea pinnata* L. (Bladdernut) inflorescences are a favorite pickle (Bussmann 2017; Bussmann et al. 2016a, b, c, d, 2017a, b, c, d, 2018). However, the species-rich home gardens in the region are not necessarily an indication of an old tradition – small plots are essentially an artifact of Soviet occupation, where people were only allowed to cultivate very small personal plots.

Food plays a major role in Caucasus culture and is the core of local hospitality (Figs. 31, 32, and 33).

Fig. 30 Home garden, Khevsureti, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Fig. 31 Ethnobotanical Interview, Barisakho, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Fig. 32 Ethnobotanical Interview, Roshka, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Fig. 33 Ethnobotanical Interview, Roshka, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Fig. 34 *Allium victorialis* pickle, Barisakho, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Many wild foods are pickled for winter use, e.g., *Allium victorialis* (Fig. 34) or *Heracleum* sp. (Fig. 35), and in spring many herbs are used for vegetable pies (Pkhali, Fig. 36).

Threats to Diversity

The process of genetic erosion of ancient crop varieties was originally of little concern for the mountain areas especially of the Northern Greater Caucasus, e.g., the Georgian Dagestani border (Fig. 37), which until the 1990s acted as a depository of ancient crops.

Nowadays the main reason for genetic erosion of ancient crop varieties is the demographic decline in mountain regions due to harsh economic conditions and lack of modern infrastructure (Nakhutsrishvili et al. 2009). The shift from ancient cultivars to modern high-yielding crops such as maize and potato, which took place in the

Fig. 35 *Heracleum* sp. pickle, Tabatskhuri, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

lowland areas much earlier, began in mountain villages in particular of Georgia after the end of Soviet occupation, when local inhabitants who had been forced to the lowlands returned to their original villages. However, in general many villages at high altitudes in the Caucasus were abandoned under pressure during Soviet occupation (Fig. 38), and while in the south some families have returned at least for the summer, many villages were completely abandoned in the 1980s and remain in ruins. In occupied villages old household utensils like butter barrels are often to be found in storage, but not used anymore. In most areas agricultural terraces are abandoned (Figs. 39 and 40) (Bussmann 2017; Bussmann et al. 2016a, b, c, d, 2017a, b, 2018).

Small bridges are still made from wood, but many other wooden household items like beautiful bed headboards are simply discarded. Some implements, e.g., snowshoes or brooms, are still maintained. Agricultural tools such as hay rakes are a common sight in abandoned barns, but more sought afar items like ox-drawn threshing sledges could only be found in museums. While sheep were produced

Fig. 36 Collecting herbs for Phkhali, Bakuriani, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Fig. 37 Northern Caucasus, Dagestani border, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Fig. 38 Abandoned village, Kazbegi, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Fig. 39 Abandoned terraces, Shenako, Tusheti, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Fig. 40 Abandoned terraces, Tusheti, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

on a large scale during Soviet times, leading to widespread overgrazing, nowadays only a few scattered herds remain, connecting the different regions of the Greater and Lesser Caucasus (Figs. 41, 42, and 43).

Traditional wool items are getting more and more difficult to find. Sadly, in our own research, we could hardly find grain cultivation anywhere, although old landraces of wheat and barley were formerly preferred to prepare bread and beer for religious rituals, and many abandoned terraces indicate where grain was formerly grown. Many old barns still contain clay-lined grain storage baskets made from *Salix* sp., which quite often contain old grains (Figs. 44 and 45). However, no grain has been grown in the region for decades. Now villagers buy wheat to distil alcohol or to bake bread or buy commercial beer making mixtures to brew their own beer, while the huge original copper beer vats, made in Dagestan, serve nowadays at most as decoration (Figs. 46, 47, and 48), like traditional wedding dresses that are kept as memory (Fig. 49) (Bussmann 2017; Bussmann et al. 2016a, b, c, d, 2017a, b, 2018).

The National Botanical Garden in Tbilisi runs a large seed bank and in situ growing program for rare local species and varieties of *Triticum*, *Panicum*, and *Sorghum*, and some material is grown at the Ethnographic Museum in Tbilisi, where *Sorghum* is grown and dried and gruel with *Prunus* sauce is available to visitors (Fig. 50) (Bussmann et al. 2014, 2016a, b, c, d, 2017a, b).

Fig. 41 Azeri shepherds with their flocks, Samtskhe, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Fig. 42 Sheep, Northern Caucasus, Khevsureti, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Fig. 43 Sheep, Northern Caucasus, Khevsureti, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Fig. 44 Wheat, harvested in the 1980s, Khevsureti, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Fig. 45 Traditional wheat storage container, Khevsureti, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Flora and Vegetation

The Caucasus region contains an amazing variety of vascular plants, with about 6300 described species (Gagnidze et al. 2002). The number of endemic taxa known for the Caucasus region is set at 2791 (Schatz et al. 2009).

The botanical exploration of the Caucasus started in the seventeenth century. Jean-Baptiste Chardin (1686) described the gardens in Tiflis, Georgia, as well as the surrounding areas as result of a journey in 1672–1673. Joseph Delaporte published similar impressions in 1768 (Gogolishvili and Skhiereli 1986). Botanist Joseph Pitton de Tournefort published a large treatment of the Caucasus flora and vegetation in 1717. Johann Christian Buxbaum published a five-volume treatment of the region in 1728–1740. The first real flora of the Caucasus region was however prepared by Adolf Marschall von Bieberstein (1808–1819). In the twentieth century, most of the Caucasus region formed part of the former Soviet Union and botanically well studied

Fig. 46 Traditional copper beer vats made in Dagestan. Khevsureti, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

Fig. 47 Traditional copper beer vats made in Dagestan. Khevsureti, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

in that time (Grossheim 1928–1934, 1939–1967; Takhtajan 2003–2012). A large number of detailed treatments of the Caucasus flora were compiled by Alexander Grossheim, who published the most complete flora of the Caucasus (1928–1934). Starting in the 1940s, Grossheim produced also a series of volumes on human plant use for Armenia, Azerbaijan, and Georgia (Grossheim 1942, 1943, 1946, 1949,

Fig. 48 Traditional copper beer vats made in Dagestan. Khevsureti, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

1952). Especially his *Manual of the Caucasian Plants* (Grossheim 1949) is still a standard reference today. Nakhutsrishvili (1999) produced the most comprehensive vegetation description for the Caucasus.

The high biodiversity in the Caucasus is found in a wide variety of vegetation types. A large portion of the region is covered by broad-leaved and coniferous forests (Galushko 1978–1981; Doluchanov 1989; Nakhutsrishvili 1999; Zazanishvili et al. 1999, 2000). In the northern Caucasus, forests are mostly found in the western part, while moving further east forested areas are more and more restricted to areas along streams, and in Dagestan, steppe and shrub formations are prevalent (Livinskaya and Murtazaliev 2009). The forest cover was estimated to be 36% in Georgia (Doluchanov 1989), and forest cover has diminished from 35% to 11% in Azerbaijan (Schatz et al. 2009). However, usage change, especially a reduction of sheep in the Northern Caucasus, as led the timberline to extend upward in many areas (Bussmann et al. 2014, 2016a, b, c, d, 2017a, b).

What most characterizes Caucasian forests is their taxonomic richness. Broad-leaved and coniferous forests are typically composed of a large number of tree species. Almost half of the forested area in the Greater Caucasus range is covered by *Fagus orientalis* Lipsky (Fagaceae). Other dominant tree species are *Abies nordmanniana* (Steven) Spach and *Picea orientalis* (L.) Peterm. (both Pinaceae), as well as a variety of oaks (Menitzky 2005). *Quercus castaneifolia* C. A. Mey. and *Quercus iberica* Steven are found in the whole Caucasus region, while *Quercus hartwissiana* Steven is restricted to the humid Colchic forests on the eastern slopes

Fig. 49 Traditional Khevsur wedding dress, Juhta, Khevsureti, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

of the Black Sea. Many forest areas also include *Fagus orientalis* Lipsky and *Castanea sativa* Mill. (both Fagaceae), the latter however heavily impacted by Chestnut blight and dying back in large areas. In some areas, *Zelkova carpinifolia* (Pall.) K. Koch) forms dense stands, and *Alnus barbata* C. A. Mey. is common in wet areas. The Colchis broad-leaved forests along the Black Sea coast represented Pleistocene refugia. Evergreen relicts are well represented in the Caucasus. Representative woody taxa are *Alnus barbata* C. A. Mey, and *Tilia begoniifolia* Steven (Tiliaceae). When comparing the Colchis Caucasian forests and mid-European forests, Rikli (1943) found that the number of species in the Colchis forests was almost twice as high as those in European forests. Many relics such as *Betula medwediewii* Regel (Betulaceae), *Betula megrelica* Sosn, *Quercus pontica* K. Koch, *Rhamnus imeretina* Booth, Petz. & Kircn. (Rhamnaceae), and *Corylus colchica* Albov (Betulaceae) are still widely used by the local population and face current threats (Bussmann et al. 2014, 2016a, b, c, d, 2017a, b; Nakhutsrishvili 1999, 2012).

Fig. 50 Traditional porridge made from *Panicum*, Ethnographic Museum Tbilisi, Georgia. (Photo R.W. Bussmann & N.Y. Paniagua-Zambrana)

In the Lesser Caucasus, mixed forests occur from 550 to 2300 m. Species of oaks such as *Quercus iberica* Steven and *Quercus petraea* L. ex Liebl. (Fagaceae) are common and occur together with *Carpinus betulus* L. (Betulaceae), wild species of apple (*Malus* L.), and pears (*Pyrus* L.) (Rosaceae). *Quercus macranthera* Fisch. & C. A. Mey. is common from 1800 to 2600 m on southern slopes, and *Fagus orientalis* Lipsky (both Fagaceae) is found on northern slopes (Nakhutsrishvili 1999, 2012).

In Eastern Georgia, Southern Armenia, and Azerbaijan, *Juniperus* sp., especially *Juniperus foetidissima* Willd. and *Juniperus oblonga* M. Bieb. (Cupressaceae), are an important component of the vegetation. Other woody taxa, like *Cotinus coggygria* Scop. (Anacardiaceae), various species of *Celtis* L. (Ulmaceae), ash, *Sorbus aucuparia* L., are common (Nakhutsrishvili 2012).

Subalpine meadows in the Caucasus are highly diverse and harbor many endemic species. One example in the western Caucasus is *Woronowia speciosa* (Albov) Juz. (Rosaceae), an endemic monotypic genus. Due to overgrazing, the relict plant community characterized by *Woronowia speciosa* has been widely replaced by grass communities dominated by *Nardus* L. (Poaceae). Among the endemic genera that grow in subalpine meadows is *Agasyllis latifolia* (M. Bieb.) Boiss. (Apiaceae). Other endemic genera include *Grossheimia* Sosn. & Takht. (Asteraceae) with six species (Schatz et al. 2009).

The alpine zone of the Caucasus region usually extends from elevations of 2400–3000 m, while in the Southeastern Caucasus, it reaches from 3200 m. Endemic

small rosette plants like *Pseudobetckea caucasica* (Boiss.) Lincz. (Valerianaceae), which has its closest relatives in the Andes, can be found in the alpine zone close to the sow line.

Some genera are especially numerous in the Caucasus, among them *Campanula* L. (Campanulaceae) with at least 70 endemic species, *Silene* L. (Caryophyaceae) with 70 species, *Veronica* L. (Scrophulariaceae) with 66 species, and *Heracleum* L. (Apiaceae) with 30 species (Schatz et al. 2009).

The Mountain Regions of Northern Iran

Location and Geology

The Iranian highlands extend about 3000 km from northwest to southeast through the dry areas of the northern zone and separate the North African-Arabian from the Turanian-Central Asian desert area. Similar to Asia Minor, it is surrounded by an inner highland interrupted by depressions and sub-basins.

In the north, the Elburs mountain range is an extension of the Lesser Caucasus and borders with the highest volcanic elevation, the Dema. By contrast, in the eastern part, east of Ziriat, as well as in the plain and mountains of Gorgan (5604 m), to the Caspian Sea, several parallel mountain chains run to the southeastern to the Zagros Mountains on the southern Iranian border, which also exceed 3000 m. The rivers mostly flow into the Tigris or the Persian Gulf. Mountain ranges in the interior of the country divide the land into mostly fluvial depressions and basins, which are either filled with weathering debris or enriched with saline clays by the constant influx of rivers within this dry space, which has led to extensive salt deserts (e.g., Dasht-e Kavir). Originally parts of Elburs were covered with glaciers, but these have by now mostly disappeared due to the impact of climate change.

Vegetation

The elevation division in the Elburs mountains corresponds on the southern slope significantly to the Turkmenian mountain ranges of the Kopet Dag. In the southern foothills of the Elburs mountains, the vegetation takes on a desert-like character. In the lower part of the mountain range, the mountain slopes are occupied by *Juniperus* and *Amygdalus* steppes with *Amygdalus spartioides*, *A. scoparia*, *A. horrida*, *A. reuteri*, *A. eburnea*, *A. spinosissima*, *Pistacia mutica*, *P. khinjuk and P. vera*, rose species (*Rosa*), *Lonicera persica*, *Berberis integerrima*, and cherries (*Cerasus microcarpa* and *Cerasus prostrata*).

In contrast, the northern flank of the Elburs receives much more humidity and is characterized by a completely different vegetation with open hyrcanian deciduous forests in the lower parts, dominated by *Quercus castaneifolia*, *Carpinus betulus*, *Castanea sativa*, *Zelkova carpinifolia*, species of *Acer*, *Ulmus minor*, *Albizia julibrissin*, *Parrotia persica*, and *Juglans regia*, with a large number of climbers

like *Vitis vinifera*, *Hedera helix*, *Smilax excelsa*, and *Periploca graeca*. In the undergrowth, humidity-loving species like *Punica granatum*, *Paliurus aculeatus*, *Buxus hyrcana*, *Prunus laurocerasus*, and *Ilex spinigera* dominate.

The montane zone from about 700 to 2400 m, especially on the northern slopes of Elburs, is dominated by hyrcanian/Caspian deciduous montane forests and dominated by Oriental beech (*Fagus orientalis*), hornbeam (*Carpinus betulus*), maple species (*Acer insigne*, *A. hyrcanum*), yew (*Taxus baccata*), cherry laurel (*Prunus laurocerasus*), and with species like *Galium odoratum* in the undergrowth. In the eastern, drier part, *Quercus macranthera* replaces *Fagus* and *Carpinus*, followed by a subalpine belt with conifers, including *Abies nordmanniana*, *A. bornmuelleriana*, *Picea orientalis*, *Acer hyrcanum*, and *A. monspessulanum*.

The alpine vegetation is very distinct from European and Caucasian areas and characterized by a lack of dwarf shrubs and alpine pastures, which are replaced by cushion plants, especially *Pedicularis*, *Veronica*, *Potentilla*, *Gypsophila*, and *Saxifraga* species.

The Ural

Location and Geology

The Ural represents a very old, eroded mountain range, stretching over 2000 km in north-south direction, from 68 °N to 51 °S, encompassing a large range of climatic and ecological zones, with elevations from around 500 m in the middle section, and the highest peaks of 1894 m in the north, and 1638 m in the south.

The Polar Urals extend for about 385 km from Mount Konstantinov Kamen in the north to the Khulga River in the south, with an area of about 25,000 km^2 and a maximum elevation of 1499 m. The mountains of the Polar Ural have exposed rock with sharp ridges. The Subpolar Urals are higher and much wider extending 225 km south to the Shchugor River and include the highest peaks of the range: Mount Narodnaya with 1895 m, Mt. Karpinsky (1878 m), and Mt. Manaraga (1662 m). Its ridges are sawtooth shaped and dissected by river valleys. The Northern Ural reached elevations of up to 1200 m and extends 560 km to the Usa River. Intensive weathering has produced large areas of eroded rock. The Middle Ural, extending south to the Ufa river, represents the lowest portion of the mountain range, with the highest peak Basegi only reaching 994 m. The Southern Ural is much more complex and reaches a maximum elevation of 1638 m at Mt. Yamantau.

The Ural is one of the worlds' oldest mountain ranges, with an age of up to 300 million years. The range was formed by a collision of the eastern Laurasian plate with the Kazakh plate, which now underlies most of Western Siberia and Kazakhstan. However, unlike most other mountain ranges, the Ural has undergone little extensional collapse. The Ural shows a large diversity of metamorphic rock in its folding systems. The west is generally formed by sandstone, limestone, and dolomite, and features pronounce karstic elements, with many caves, while the Eastern

parts show a basaltic structure. Due to its geologic structure, the Urals are rich in minerals, ores, coal, oils, and gas.

Climate

Due to the large north-south extension of the Ural, it is impossible to generalize on climatic conditions. However, the vegetation period in the forest-free areas is short everywhere. The mountain range receives relatively high precipitations, up to around 800 mm annually. The climate of the Urals is generally continental. The areas west of the Ural Mountains are 1–2 °C warmer in winter than the eastern regions due to warming westerly winds, whereas the eastern slopes are chilled by Siberian air masses. The average January temperatures increase in the western areas from −20 °C in the Polar areas to −15 °C in the Southern Urals, and temperatures in July are around 10 °C and 20 °C, respectively. The highest precipitation around 800 mm occurs in the Northern Urals with up to 10 m snow. The eastern areas receive around 500–600 mm in the north and 300–400 mm in the south, with generally wet summers and dry winters.

Vegetation

The vegetation distribution in the Ural shows great asymmetry, with much wetter western parts. The northernmost slopes are characterized by forest-free tundra vegetation up to around 500 m, with the upper parts covered by cold polar desert vegetation, while the lower and more southern parts are characterized by forest tundra associations, especially with *Larix sukaczewii*, *Picea obovata*, and *Betula tortuosa*, interspersed with *Betula nana* scrub.

Slightly further south, the vegetation changes to a sequence of two forest zones – gymnosperm dominated foothills, mostly dominated by *Picea obovata* and *Betula pubescens*, and Ericaceae dominated undergrowth, especially with *Ledum palustre*, *Vaccinium myrtillus*, and *Empetrum nigrum*. On well-drained soils especially on the eastern slopes, such communities are replaced by *Pinus sibirica*, *Pinus sylvestris*, and *Abies sibirica*. The forests of the southwestern Ural are characterized by a mix of *Tilia cordata*, *Acer platanoides*, *Ulmus scabra*, and *Ulmus glabra*, with a species-rich herbal and grassy undergrowth up to about 750 m.

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