# From field to the edge of memory: the ethnobotany and conservation of indigenous wheats in Georgia, the Caucasus

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## Research

## Abstract

*Background*: Wheat is the third most produced crop and provides roughly 20% of the world's calories. Georgia preserves one of the world's oldest and richest traditions of wheat cultivation with over 15 Triticum species historically cultivated, including some dating back to 8000 years ago. But many species, varieties, and practices are either under threat or lost. Early botanical studies identified two distinct centers of indigenous wheat diversity in the country - the northwest and southeast. However, no prior ethnobotanical research has focused specifically on wheats in these regions.

*Methods*: In order to document information about traditional farming practices around these diverse crops, while still in living memory, we conducted ethnobotanical surveys in both centers of diversity, interviewing 93 participants with a mean age of 73 ± 13 years.

*Results*: Most references to wheat cultivation practices pertained to the past. In total, we documented 29 crop types and their mixtures, either currently sown or historically cultivated. Multivariate analyses revealed clear taxonomic dissimilarities between the two centers, distinguishing them based on their associated wheat varieties.

*Conclusions*: Our findings indicate that traditional farming of indigenous wheats has significantly declined in Georgia's primary wheat-growing regions. Nevertheless, certain indigenous varieties and their maslins (e.g., *Triticum carthlicum*) continue to be cultivated in the southeast. Encouragingly, *in situ* conservation initiatives - particularly in northwestern Georgia - have achieved notable success, suggesting that such efforts can be effective. Overall, traditional knowledge of wheat cultivation remains alive, preserving valuable insights into the environmental adaptability and regional suitability of these ancient crops.

*Keywords*: Indigenous wheats, Maslins, *Triticum carthlicum*, *Triticum macha*, *Triticum timopheevii*, Wheat diversity

## Background

Crop diversity plays a key role in ensuring the resilience and adaptability of food systems, particularly under conditions of environmental stress and shifting climate regimes (Gepts 2006; Hajjar *et al*. 2008; Gaudin *et al*. 2015). In many traditional farming systems, this diversity reflects deep ethnobotanical knowledge: farmers distinguish, name, and manage species and landraces based on observable traits, culinary and cultural use values, and performance across environmental variation (Mekbib 2007; Brush 1995). Such varieties are often preferred for their reliability, cultural salience, and contributions to diversified diets, even if their peak yields are lower than those of commercial cultivars (Altieri 1999). Recognizing the ethnobotanical foundations of this diversity is essential for its conservation and contribution to future food security.

Georgia possesses some of the world's oldest and most diverse traditions of wheat cultivation (Pruidze *et al*., 2016). Despite its modest geographic size (approximately 69,500 km²), the country harbors 15 or even 16 of the 20 wheat taxa (Table 1 in the Results). This level of diversity is unmatched even by countries within the Fertile Crescent and Southwest Asia (Mosulishvili, 2021). Among these 15 species, five - *Triticum palaeocolchicum*, *T. carthlicum*, *T. macha*, *T. timopheevii*, and *T. zhukovskyi* - are indigenous to Georgia. During the Neolithic period (at the archeological sites of the lower Kartli region in southeast Georgia: Arukhlo, Khramis Didi Gora, Gadachrili Gora and Shulaveri of the 'Shulaveri - Shomu' Culture (dated back to the 6th millennium BC) local farmers cultivated a large diversity of wheat, which included at least seven domesticated species: *Triticum monococcum, T. diccoccum, T. carthlicum T. durum, T. spelta, T. aestivum, T. compactum,* alongside with other 'founder' crops: barley (*Hordeum vulgare, H. distichum*), flax (*Linum bienne*), lentils (*Lens esculenta*), peas (*Pisum sativum*) and bitter vetch (*Vicia ervilia*) (Mosulishvili *et al*. 2019).

Botanical studies of Georgian wheats date back to the 1920s, with major contributions from Zhukovsky (1924, 1928), Ketskhoveli (1928), Supatashvili (1929), Abesadze (1929), Dekaprelevich & Menabde (1929, 1932), Flaksberger (1935), Lomouri & Supatashvili (1935), Dekaprelevich (1941-1942, 1954), Dekaprelevich & Yashagashvili (1970), Menabde (1940, 1948, 1964, 1969), Dorofeev (1966, 1972, 1979), Gorgidze (1964, 1967, 1977), Bregadze (2004), Pruidze *et al*. (2016), Bedoshvili *et al*. (2019), Mosulishvili *et al*. (2019), and Bussmann *et al*. (2020). In the 1940s sixteen species, 144 varieties, and 150 forms of wheat were registered in Georgia (Menabde 1948). Georgia has been termed a "living wheat museum" (Supatashvili, 1929), where exceptional genomic diversity has been actively cultivated by local farmers until recent times. Indeed, the wheats traditionally cultivated in Georgia collectively represent all known genome combinations within the genus *Triticum* (AA, AABB, AAGG, AAGGAA, AABBDD).

Sources from before the 1980s in Georgia suggest that mixed cropping strategies in Georgia were diverse and widespread, but their current status as a living practice or practice in living memory is unclear. The existence of mixed sowing of wheat and barley appears to have an ancient origin in Georgia (Esakia, Rusishvili, 2000; Mosulishvili *et al*. 2021). Interestingly, wheat, barley, and emmer are fixed together at the Neolithic settlements of the Shulaveri-Shomu culture (the South Caucasus) of the 6th millennium BC. Among the very wide range of mixtures involving wheat attested to before the 1980s are: *Triticum aestivum* and rye (Maisaia, 2009), "*kerdik'a*:" barley and *T. carthlicum* (Naskidashvili *et al*., 2013; Pruidze *et al*. 2016), "*zanduri*:" *T. timopheevi, T. monococcum*, and *T. zhukovskyi* (Maisaia, 2009; Mosulishvili, 2019; Dekaprelevich, 1954; Mosulishvili, 2021), "*macha*:" *T. paleocolchicum* and *T. macha* (Mosulishvili 2021), "Javakheti's *dika*" *T. aestivum* and *T. carthlicum* (Naskidashvili *et al*. 2013), and "Kartli's and Borchalo's *shavpkha*": *T. durum* variety mixtures combined with *T. aestivum.* Similar cereal species mixtures or "maslins" were formerly widespread in Eurasia and northern Africa and may represent an underappreciated climate adaptation strategy (McAlvay *et al*. 2022).

Previous studies identified two principal centers of wheat diversity in Georgia: the northwestern provinces of Lechkhumi, Racha, and Svaneti, and the southeastern provinces of Samtskhe, Javakheti, and adjacent districts of Lower Kartli. To our knowledge, however, no ethnobotanical study has been conducted in these provinces with a specific focus on wheat. The aim of our research was to fill this gap by documenting the traditional knowledge of wheat cultivation still present in these regions. Following the Soviet agricultural reforms of the 1960s and subsequent decades, local landraces and cultivars were largely replaced by maize, potatoes, and commercial wheat varieties (Wegren, 1994). This shift led to a marked decline in the diversity of traditional crops (Akhalkatsi *et al*., 2009, 2010, 2012). Historical sources provide limited detail regarding the advantages and drawbacks of the mixtures, their cultivation, their history, and their place in culture.

Our objective was therefore to assess the current state of traditional knowledge related to wheat cultivation in the wake of these significant socio-economic changes - first under Soviet policy and later following the collapse of the USSR. The study aimed to document the existing ethnobotanical knowledge associated with wheat farming in these regions.

## Materials and Methods

### Study area

The study was conducted across two primary centers of wheat diversity in Georgia: the northwestern provinces of Lechkhumi, Racha, and Svaneti, and the southeastern provinces of Samtskhe-Javakheti and Lower Kartli. These regions differ in climate (Elizbarashvili *et al*. 2025), topography, vegetation (Nakhutsrishvili 2012), ethnolinguistic composition (Yemelianova and Broers, eds. 2020), and associated crop practices (Kikvidze 2020, Chapter 2; Bussmann *et al*. 2024). The northwestern provinces are located along the southern slopes of the Greater Caucasus mountains and experience a humid subtropical climate with higher precipitation and milder winters. For example, Tsageri (Lechkhumi) has a mean annual temperature of 9°C and receives ~1815 mm of precipitation. By contrast, southeastern provinces such as Akhaltsikhe (Samtskhe) are situated on the volcanic and semi-arid plateaus of the Lesser Caucasus, with cooler temperatures (mean annual 7°C) and lower precipitation (~1659 mm).

The northwest is inhabited primarily by ethnic Georgians belonging to various highland subgroups, including Lechkhumians, Rachans, and Svans. In the southeast, the population is more mixed: Samtskhe-Javakheti is home to Meskhetian Georgians as well as Armenian and Greek communities.

### Ethnobotanical interviews

Between 2022 and 2023, we conducted 93 interviews, targeting a gender-balanced sample of participants engaged in farming across the target regions. Semi-structured interviews were used following the oral free prior informed consent of participants, who were selected through snowball sampling (Bussmann 2019). All interviews were conducted in participants' homes and gardens by native Georgian speakers.

Species nomenclature follows the traditional *sensu stricto* classification system outlined by Dorofeev (1979). Collection permits were issued by the Institute of Botany, Ilia State University, Tbilisi. In the text, non-wheat crops are referred to by their common names, while wheat taxa are presented using scientific nomenclature.

### Data analysis

Data were organized in Excel spreadsheets, forming a composite matrix with participants as rows and plant-related variables as columns, including date, location, age, and gender. Species composition similarity among plant groups was analyzed using non-metric multidimensional scaling (nMDS). To examine the distribution of wheats among the regions, data were pooled by province and examined using Principal Component Analysis (PCA) and Cluster Analysis based on the UPGMA algorithm and Bray-Curtis's dissimilarity index. The same matrix was also visualized as a bipartite network chart.

To assess the extant nature of crops being mentioned, we calculated the percentage of participants who referred to grains currently cultivated *versus* those who spoke of them exclusively in the past tense. This index was calculated for each crop.
All analyses were performed using PAST version 4.17

## Results

### Participant characteristics

We interviewed a total of 93 participants, comprising 61 men and 32 women. Their mean age was 73 ± 13 years, with a strong skew toward older individuals (Skewness = - 0.69). The youngest participant was 36 years old, and the oldest was 92.

### Crops and crop mixtures documented

Our records included data on 29 crops and crop mixtures, either currently cultivated or historically sown (Table 1). The most frequently mentioned crops were Makha *Triticum macha*, Doli *T. aestivum*, barley, Chelta Zanduri *T. timopheevii*, Dik'a *T. carthlicum*, Ch'vavi (rye), Simindi (maize), Seli (flax), and Khulugo (awnless cultivars of *T. aestivum*). The maslin of *T. carthlicum* and barley, *kerdik'a,* was also frequently recorded.

### Past and present cultivation practices

The overall "presentness" of the indigenous wheat cultivation was low: only 18.2% of participants referred to current practices, while 81.8% spoke exclusively of past cultivation. Crops mentioned in the present tense included *T. aestivum*, *T. carthlicum*, *T. macha*, barley, *T. dicoccum*, *T. durum*, *T. durum* var. *apilicum*, *T. timopheevii*, rye, maize, and oat. Maslins such as *kerdik'a*, barley with oats, and *T. carthlicum* with *T. aestivum* were also noted as currently cultivated. All other crops - including local cultivars of common wheat and flax - were recalled only in reference to the past.

Participant gender did not significantly influence the distribution of crop practices across provinces. However, age and presentness showed associations with nMDS ordination coordinates (Figure 1). The analysis linked *T. aestivum*, flax, *kerdik'a* maslin, rye, and *T. carthlicum* with the southeastern provinces of Javakheti and Samtskhe. In contrast, *T. timopheevii*, *T. zhukovskyi*, *T. macha*, local awnless cultivars of *Triticum aestivum* L., maize, and barley were more closely associated with the northwestern provinces of Lechkhumi, Racha, and Svaneti. Lower Kartli showed affinities with Racha but occupied an intermediate position between the eastern and western Georgian provinces.

Table 1. Frequency distribution of crops recorded during the survey. Local names (1st column), scientific names (2nd column) and frequency of occurrence in the records (3rd column) are given along with code names used in figures (only those with frequency > 5, 4th column).

| Local name | Name | Frequency | Code |
|---|---|---|---|
| **Makha** | *Triticum macha* Dekapr. & Menabde | 36 | Mkh |
| **Doli** | *Triticum aestivum* L. | 34 | Dol |
| **Keri** | *Hordeum vulgare* L. | 21 | Bar |
| **Zanduri** | *Triticum zhukovskyi* Menabde & Ericzjan | 19 | Znd |
| **Dik'a** | *Triticum carthlicum* Nevski | 15 | Dik |
| **Ch'vavi** | *Secale cereale* L. awnless | 10 | Rye |
| **Simindi** | *Zea mays* L. | 8 | Mai |
| **Seli** | *Linum usitatissimum* L. | 5 | Flx |
| **Khulugo** | *Triticum aestivum* L. local awnless cultivars | 5 | Khl |
| **Asli** | *Triticum dicoccum* Schrank ex Schübl. | 3 | |
| **Tavtukhi** | *Triticum durum* Desf. | 3 | |
| **Ipkli** | *Triticum aestivum* L. local awned cultivars | 3 | |
| **Ugrekheli** | *Vicia ervilia* (L.) Willd. | 3 | |
| **Ghomi** | *Setaria italica* (L.) P. Beauv. | 3 | |
| **Shavfkha** | *Triticum durum* var. *apilicum* Koern. | 3 | |
| **Tsertsvi** | *Vicia faba* L. | 3 | |
| **Barda** | *Lathyrus oleraceus* Lam. (= *Pisum sativum* L.) | 2 | |
| **Shvria** | *Avena sativa* L. | 2 | |
| **Gvats'a zanduri** | *Triticum monococcum* L. | 1 | |
| **Chelt'a zanduri** | *Triticum timopheevi* (Zhuk.) Zhuk. | 1 | |
| **Tsertsvela** | *Vicia narbonensis* L. | 1 | |
| | **Mixtures** | | |
| ***Kerdik'a*** | *Hordeum + T. carthlicum* | 34 | Krd |
| | *Hordeum + Lathyrus* | 4 | |
| | *Hordeum + Avena* | 4 | |
| | *Hordeum + Secale* | 3 | |
| | *T. carthlicum + T. aestivum* | 1 | |
| | *T. aestivum + T. carthlicum* | 1 | |
| | *T. aestivum + Vicia faba* | 1 | |
| | *T. aestivum + Secale* | 1 | |

**Geographic patterns of crop distribution**

Principal Component Analysis (PCA) corroborated the findings of the nMDS ordination, further clarifying the division of crop associations between eastern and western Georgian provinces, with Lower Kartli occupying an intermediate position (Figure 2). A two-way cluster analysis (Figure 3) revealed a similar distribution pattern, while providing finer detail on the specific crops contributing to inter-provincial differences. *Triticum aestivum* and *kerdik'a* were especially characteristic of the eastern provinces of Samtskhe and Javakheti, whereas *T. macha* and *T. timopheevii* distinguished the western provinces, particularly Lechkhumi.

The relationships between crops and provinces were also visualized as a bipartite network (Figure 4). Barley and rye exhibited the highest number of connections across provinces, indicating their widespread cultivation. Lechkhumi, Racha, and Samtskhe showed the greatest number of crop associations. Flax and maize were each linked to a single province - Samtskhe and Lechkhumi, respectively. *Triticum carthlicum* and *kerdik'a* were associated with the eastern provinces of Samtskhe and Javakheti, while *T. macha* and *T. timopheevii* were linked to the western provinces of Lechkhumi and Racha.

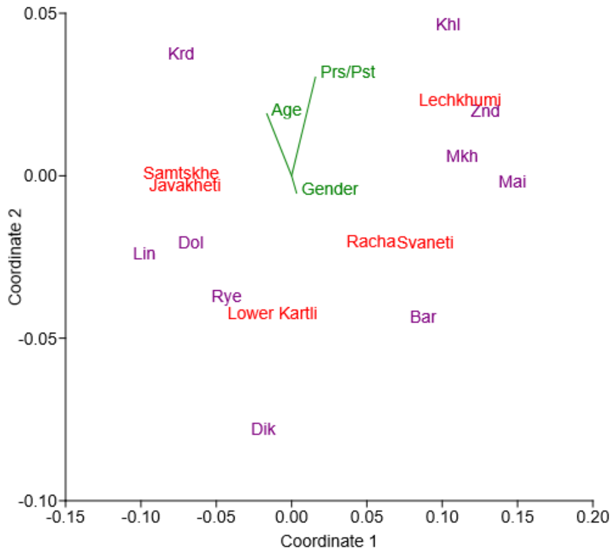


Figure 1. Non-Metric Multidimensional Scaling of crop distribution among the provinces as related to respondent age, gender and crop presentness. Stress = 0.0198, coordinates 1 and 2 explained 62.9% and 12.2% of variation in data, respectively. "Prs/Pst" refers to the "presentness" (Materials and Methods)

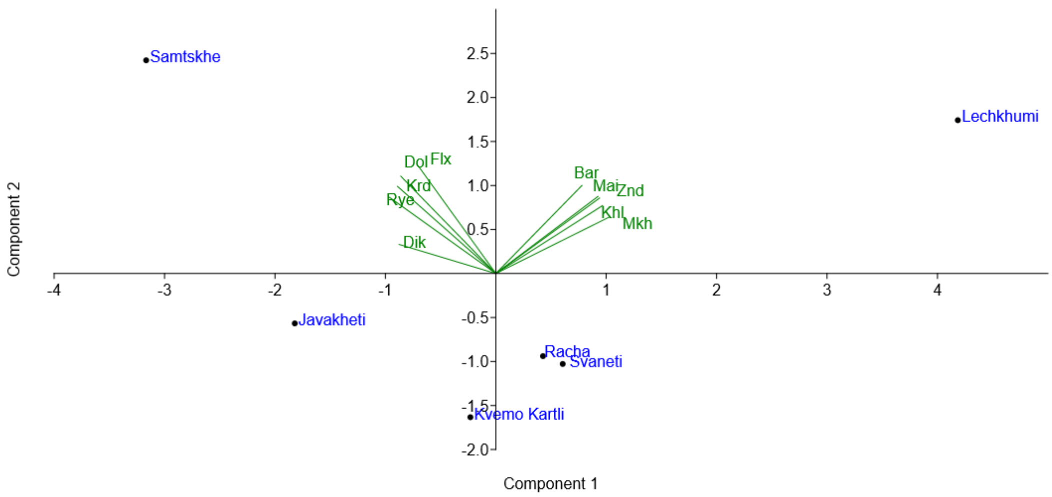


Figure 2. PCA analysis of the distribution of traditional crops among Georgian provinces. Eigenvalues of the PCA coordinates 1 and 2 were 6.29 and 2.77, respectively. Together they explained over 90% of variation in the data (62.9% and 27.7% respectively by PCA coordinates 1 and 2).

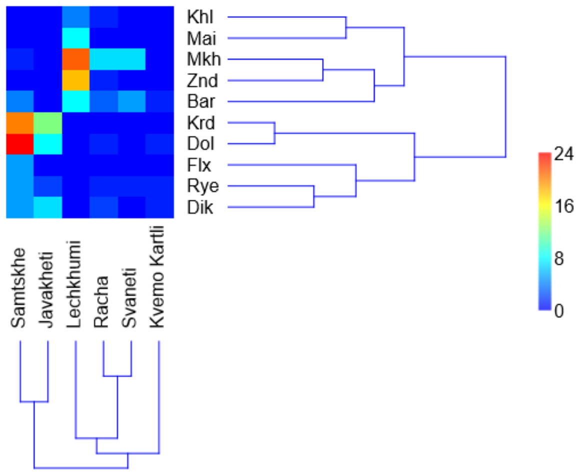


Figure 3. Cluster analysis of the distribution of traditional crops among Georgian provinces

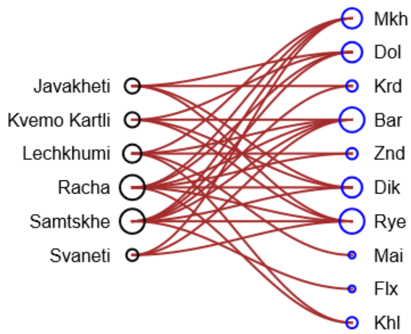


Figure 4. The distribution of wheats over the regions presented as a bipartite network. The nodes are scaled by the number of edges.

**Farmer knowledge and foodways**

Finally, we recorded several qualitative observations that, while not included in the quantitative analyses, offer valuable insights into traditional knowledge surrounding indigenous wheats and maslins.

Sixteen participants emphasized the exceptional taste of bread made from traditional wheat varieties, noting that its aroma was so distinctive that neighbors from across the village could smell the freshly baked loaves. “In the past, until the 1970s, when bread was baked, its aroma could be smelled from 2-3 kilometers away” (residents of village Bardnala, Lechkhumi). Seven participants specifically praised the bread made from *kerdik’a* maslin for its flavor and fragrance. One man, Manuchar Sarsevanidze recalled stories from his great-grandmother (who lived to 110, born in 1888 and passed away in 1999) and his grandfather (who died at 80 in 2000) that in Gomareti (Lower Kartli), *kerdik’a* was cultivated. The bread had an excellent taste, and its aroma could be smelled at the edge of the village when baking. Similarly, the maslins in the northeastern provinces - makha and zanduri - were frequently praised by participants, especially for the culinary qualities of their bread: “You could smell that bread was being baked from 2-3 km away”; “When bread was baking in one village, other villages could smell it”; “Makha and zanduri bread kept well; it didn’t go stale or hard”; “It was a famous bread - very tasty - you could smell it from 1-2 km away”; “Bread made from zanduri flour was dark and very tasty, but makha bread was even tastier and gave better harvests too. Makha bread smelled delicious and could be smelled from the far end of the village”; “The baked bread was very tasty and was prepared for festivities”.

In addition to culinary qualities, six participants highlighted agronomic advantages of *kerdik’a*, describing it as more productive and resilient to seasonal weather fluctuations than any cereal grown alone. Farmers also stated that the mixture reduced lodging (“barley kept *dika* from falling over”) and it increased the tillering of *T. carthlicum* planted with barley, with many farmers stating that the yield of *dika* was higher when grown with barley than grown alone. Farmers also mentioned reduced weeds in the mixture and increased total yields.

Practically all interviewed residents were able to identify specific plots of land traditionally used for wheat cultivation and often linked local toponyms to wheat farming. For example, “Naq’anevi” derives from *q’ana*, the Georgian word for cropland, and “Napurali” from *p’uri*, meaning bread.

It should be noted that, among the species still actively cultivated, *Triticum carthlicum* - locally known as Dik’a wheat - remains prominent, along with *Doli*, a local cultivar of *T. aestivum*. *T. carthlicum* is typically sown in spring and serves as the principal component of the maslin *kerdik’a*, which continues to be grown in southeastern Georgia.

## Discussion

**Erosion and persistence of traditional grain crops and associated knowledge**

Our survey indicates that traditional knowledge related to wheat cultivation persists: although only about 18% of all participants practiced wheat cultivation, the rest held historical knowledge. The documented knowledge is concentrated among older community members, with most references to indigenous wheats in the past tense. This demographic skew of knowledge-holders underscores the urgency of documentation and suggests that this knowledge is in a transitional phase: still retained in collective memory, but at risk of being lost with generational succession, because cultivation is largely not practiced. Similar patterns of knowledge erosion have been reported in other centers of crop diversity following agricultural modernization and market integration (Brush 1995; Zimmerer 1996; Khoury *et al*. 2022), but these transformations can be complex (Bellon and Hellin 2011) and in some cases traditional practices persist (Perales *et al*. 2003)

Following the economic reforms of the 1960s and subsequent transformations, indigenous wheats and other traditional crops in the northwestern regions of Georgia have been increasingly replaced by maize (Kikvidze 2020, p.63) - a trend confirmed by our survey, in which maize was frequently mentioned. In contrast, flax (*Linum usitatissimum*) often recalled during interviews, was exclusively referred to in the past tense, with no current cultivation reported. Shavpkha and Tavtukhi (local varieties of *T. durum*) were only mentioned once and in the past tense by the residents of Sadmeli, Racha, but they are sown in Eastern Georgia (Kartli, Kakheti).

Despite this trend, several indigenous wheat species continue to be cultivated, albeit by a small number of farmers. This persistence may be attributed to the efforts of research institutions and non-profit organizations that are conducting research and conservation projects focused on indigenous wheats within the territory of Georgia. Notably, researchers affiliated with the Menabde Collection at the Institute of Botany, Ilia State University, the Tsilkani base of the Scientific-Research Center of Agriculture, and the Biological Farming Association of Georgia (Elkana) have played key roles in raising awareness and promoting *in situ* conservation of indigenous wheats. Currently, *in situ* conservation projects involve up to 10 participants who agreed to allocate special plots and cultivate indigenous wheats traditionally grown in their locality, following a campaign and seminar organized in local schools by the mentioned organizations and individuals. Also, these institutions allocated plots from their experimental facilities and lands for *ex situ* conservation of all indigenous wheats of Georgia.

**Regional differentiation and environmental adaptation**

The multivariate analyses (nMDS, PCA, and cluster) show a strong northwest-southeast differentiation in crops used. Southeastern provinces (Samtskhe, Javakheti, Lower Kartli) are characterized by *T. carthlicum*, *T. aestivum*, and kerdik’a mixtures, reflecting adaptation to colder, drier conditions and a longer tradition of spring sowing. By contrast, northwestern provinces (Lechkhumi, Racha, Svaneti) are distinguished by *T. macha*, *T. timopheevii*, and *T. zhukovskyi*, species better suited to wetter, warmer highland environments. These species often also occurred in mixture. For example the *zanduri* mixture included *T. timopheevii*, *T. monococcum*, and the allopolyploid *T. zhukovskyi*, which arose from the crossing of the other two species in the mixture. *T. macha* was often grown in a mixture called *macha* with *T. paleocolchicum.* These patterns parallel early 20th-century botanical surveys (e.g., Menabde 1940; Lomouri & Supatashvili 1935). These earlier surveys also attested to variety or cultivar mixtures of wheat, though these were not recorded in our interviews.

**Agronomic and cultural value**

In addition to the potential value of advantageous traits in indigenous wheats in Georgia, traditional knowledge surrounding maslins (mixtures of cereal species) may help inform resilient cereal cropping practices (McAlvay *et al*. 2022). These mixtures have rapidly declined in use in recent centuries for a variety of reasons, including marketability, mechanizability, and political reasons (McAlvay *et al*. 2022). In our interviews, kerdik'a (*T. carthlicum* and barley) emerged as both culturally salient and agronomically advantageous. In addition to praising the bread made from the mixture, respondents described higher and more stable yields compared to monocultures. These findings align with broader literature on the yield stability and risk-buffering roles of cereal mixtures (Woldeamlak *et al*. 2008; Halstead and Jones 1989, McAlvay *et al*. 2022).

**Implications for conservation**

The regional distinctiveness of wheat species grown in Georgia has implications for conservation strategies. *In situ* efforts should prioritize continued cultivation of species in their adaptive agroecological contexts - e.g., *T. macha* and *T. timopheevii* in the northwest, *T. carthlicum* in the southeast - while promoting seed exchange networks and markets for heritage wheat products. *Ex situ* collections should capture representative germplasm from both centers of diversity, ensuring that genetic material is linked to its associated knowledge, cultivation methods, and environmental conditions. In recent decades, while Georgian farmers, the Ministry of Agriculture, and academic researchers have become interested in revitalizing indigenous Georgian wheats for their agronomic and culinary properties, efforts so far have focused on distribution of certified single-species lots of seed for monocultural planting. Restoring mixed cropping practices may provide locally-adapted benefits. Participants in the *in situ* conservation programs (see above) maintain and manage their own seed banks and often exchange seeds. This practice can be considered an informal Community Seed Bank (CSB).

## Conclusions

Traditional wheat farming and the cultivation of indigenous wheats have notably declined in Georgia's primary wheat-growing regions. Nonetheless, certain indigenous species - particularly *Triticum carthlicum* and its associated maslins - continue to be cultivated in southeastern provinces. Encouragingly, *in situ* conservation initiatives, especially in northwestern Georgia, have achieved measurable success, indicating that such efforts can be effective in preserving agrobiodiversity.

Overall, traditional knowledge of wheat cultivation remains alive and retains valuable insights into the environmental adaptability and regional suitability of these ancient crops. We recommend that this knowledge be actively integrated into conservation strategies to support the continued cultivation and protection of Georgia's indigenous wheat varieties.

Georgia's wheat heritage represents a unique combination of genetic resources, agronomic practices, and cultural traditions that have developed over millennia in one of the world's most significant centers of wheat diversity. Our study shows that while a small number of the indigenous wheats and their maslins (such as kerdik'a, macha, and zanduri) continue to be cultivated widely, the knowledge associated with their management is concentrated among the oldest members of rural communities. This pattern signals an advanced stage of knowledge erosion, in which the crops themselves and their associated management practices are at risk of disappearing within a generation.

The regional differentiation between the northwest and southeast due to contrasting climates, topographies, and cultural histories, underscores the need for geographically targeted conservation approaches. *In situ* strategies should prioritize supporting farmers who still grow these wheats in their adaptive environments, while *ex situ* collections should capture germplasm linked to the ecological and cultural background from which it originates.

By recording the ethnobotanical knowledge on indigenous wheats of Georgia while it remains in living memory, this study provides a foundation for conservation actions that treat the indigenous wheats of Georgia not only as genetic resources, but components of cultural heritage. The survival of this heritage will depend on integrating traditional knowledge with conservation science, promoting market and policy opportunities for heritage wheat cultivation, and thinking strategically about engaging younger generations in the cultivation of these crops. Without coordinated action, this link between Georgia's ancient agricultural heritage and the world's food-secure future may be permanently broken.

## Declarations

**List of abbreviations:** Not applicable

**Ethics approval and consent to participate:** All participants provided free prior informed consent before the interviews. This project followed International Society of Ethnobiology Code of Ethics, Plant collection permits were obtained from the Institute of Botany, Ilia State University, Tbilisi.

**Consent for publication:** Not applicable

**Availability of data and materials:** Available from the corresponding author

**Competing interests:** The authors declare no competing interests

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**Author contributions:** ZK and MM initiated and organized the study, contributed to the updating, analyzed the data and wrote the manuscript with the contributions of AM, RWB, NYPZ and AGP. MM and AM organized and conducted the fieldwork with the participation of NT. IM and GC edited the data.

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