

THE IMPORTANCE OF NATIVE GOAT BREEDS FOR PRESERVING BIODIVERSITY, DEVELOPING HIGH-QUALITY FOOD MARKET AND INCREASING THE PROFITABILITY OF PRODUCTION – AN EXAMPLE OF THE RESTORATION AND BREEDING OF THE CARPATHIAN GOAT IN POLAND

Aldona Kawęcka

National Research Institute of Animal Production, Department of Sheep and Goat Breeding,
32-083 Balice near Kraków

Abstract

The restoration of and reintroduction of breeding farms for the native Carpathian goat are critical for biodiversity nowadays, while also enhancing the economic efficiency of farms that breed these animals. Breeding the species offers an opportunity to establish a market for distinctive goat products, including organic ones, with exceptional flavour and nutritional value as well as health-promoting properties. Interest in the breed, as well as financial assistance available from the Rural Development Programme and, beginning in 2023, from the project 'Conservation of endangered animal resources in agriculture' (CAP 2023-2027), have made the Carpathian goat one of Poland's fastest-growing populations. The restoration of the native Carpathian goat in Poland demonstrates how breeding efforts combined with promotional activities and scientific research may reclaim a breed's importance for agricultural biodiversity, regional heritage and the revival of local businesses.

Keywords: native breeds, Carpathian goat, restoration, biodiversity, goat products

The situation of goat farming in Poland

In Poland, goat breeding and husbandry are not economically significant. They do, however, fill a critical market niche for high-quality food, organic farming, and agrotourism. Currently, there are around 54,000 goats in Poland, raised on 2.6% of livestock farms and 1.2% of all farms (Molik and Garstka, 2022). Apart from the larger dairy operations in the central part of the country, goats in Poland are raised in small herds on small farms, with a focus on organic agriculture or agrotourism. These farms provide their own unique dairy products as well as, increasingly, meat products from young male goats. Raising native goat breeds has gained traction in recent years, giving momentum to the development of local markets for goat products and associated services.

Carpathian goat – breed restoration

The revival of goat husbandry in the second half of the 1980s and following the political transformation after 1990 was based mostly on imported noble breeds. Traditional goat breeds, which were once common in Poland, were gradually replaced by animals with superior production values and eventually died out. Farming came to be dominated by the Saanen and

Alpine goats, as well as refined domestic breeds, including refined white goat and refined coloured goat.

Actions taken by the National Research Institute of Animal Production (henceforth 'IZ PIB') in Balice to restore the population of the Carpathian goat, which was thought to be extinct, and to reintroduce the breed to its original habitat, namely the Polish Carpathians, allowed its unique genotype to be reproduced in present-day breeding farm conditions (Sikora and Kawęcka, 2019). The restoration process of the Carpathian goat breed began in 2005, when five animals were discovered and purchased, resulting in the creation of a herd. The female goats and bucks, together with their kids, were placed on a farm located in Rymanów, which is owned by the PIB's Experimental Institute (henceforth 'ZD PIB'). The herd consisted of 6 mature female goats, 4 female kids, 2 bucks, and 2 male kids at the time of establishment. ZD PIB breeding material enabled the formation of further herds. A programme for the conservation of genetic resources of the Carpathian goat breed was created in 2009. The programme's objective was to restore a goat population of 500 mother goats, which was accomplished 14 years later. In 2010, the Polish Minister of Agriculture and Rural Development commissioned the IZ PIB to keep livestock records for the Carpathian goat herd.

Carpathian goats are part of indigenous populations that have adapted well to harsh environmental conditions, in this instance the mountains and hills. This is attributable to traits such as toughness and good health, combined with strong fertility, prolificacy, careful offspring rearing, longevity, and flexible forage selection. Carpathian goats have a white, mid-length coat with an occasional downy undercoat that divides on the back and falls evenly on both sides of the body (<http://www.bioroznorodnosc.izoo.krakow.pl/kozy>).

Other native Polish goat breeds have also been successfully reintroduced into farm breeding: the Sandomierz goat and Kazimierz goat, whose herd records are kept by the University of Life Sciences in Lublin and the Warsaw University of Life Sciences, respectively. Since 2020, the IZ PIB has introduced conservation programmes for these breeds (Kawęcka et al., 2021).

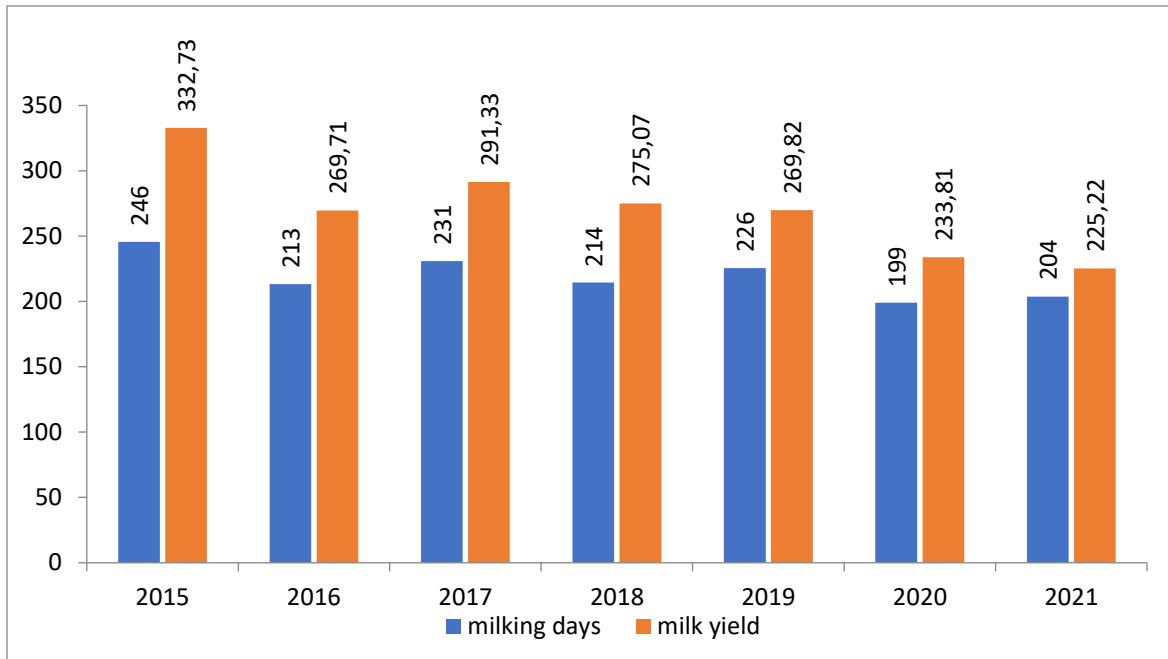
Genetic conservation programme

The breed conservation programme, which has been in place since 2015, aims to stabilise and conserve the distinctive genotype of goat breeds, increase population size, and maintain genetic diversity. The Carpathian goat genetic resources conservation programme is carried out in the animal's native habitat (the Carpathian Mountains and Hills), as well as on agrotourism and organic farms all over Poland (<http://www.bioroznorodnosc.izoo.krakow.pl/kozy>).

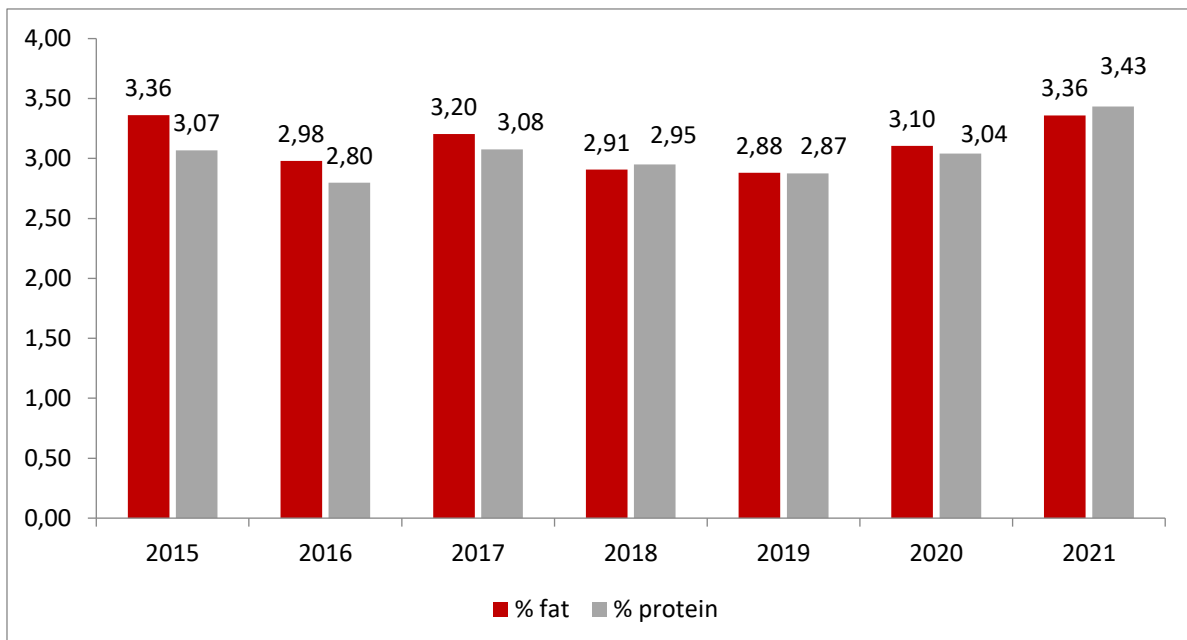
The programme is implemented by the breeder (herd owner), the Polish Sheep Breeding Association as well as herd record keepers and herd value assessors in conjunction with the IZ PIB. That last institution is responsible for protection of genetic resources of breed animals and record keeping. The owner's participation in the programme is voluntary. Husbandry in the case of goat populations should try to preserve their distinct traits. The performance evaluation includes a review of breeding performance and milk quality for compliance with current requirements. The evaluation of goat milk means determining the volume of milk produced by the goat during lactation as well as the amount of protein and fat contained in the milk based on monthly trial milking performed by the assessor.

Carpathian goats covered by the dairy performance audit currently account for 70% of Poland's estimated goat population (Kawęcka et al., 2022a). The collected data allows researchers to track changes in milk production in the Carpathian goat population. Over the previous 6 years, the milking duration of the examined herds has shortened with milk yield decreasing from 332.7 kg to 225.2 kg per lactation (Figure 1). This was linked to the arrival of several new herds with young female goats. The results confirm that young goats had lower

milk production and often greater component content than goats in later lactations (Ibrahim and Jalil, 2022). The protein content % was greater than in 2015. The rising trend was also noted for fat content in milk (Figure 2).

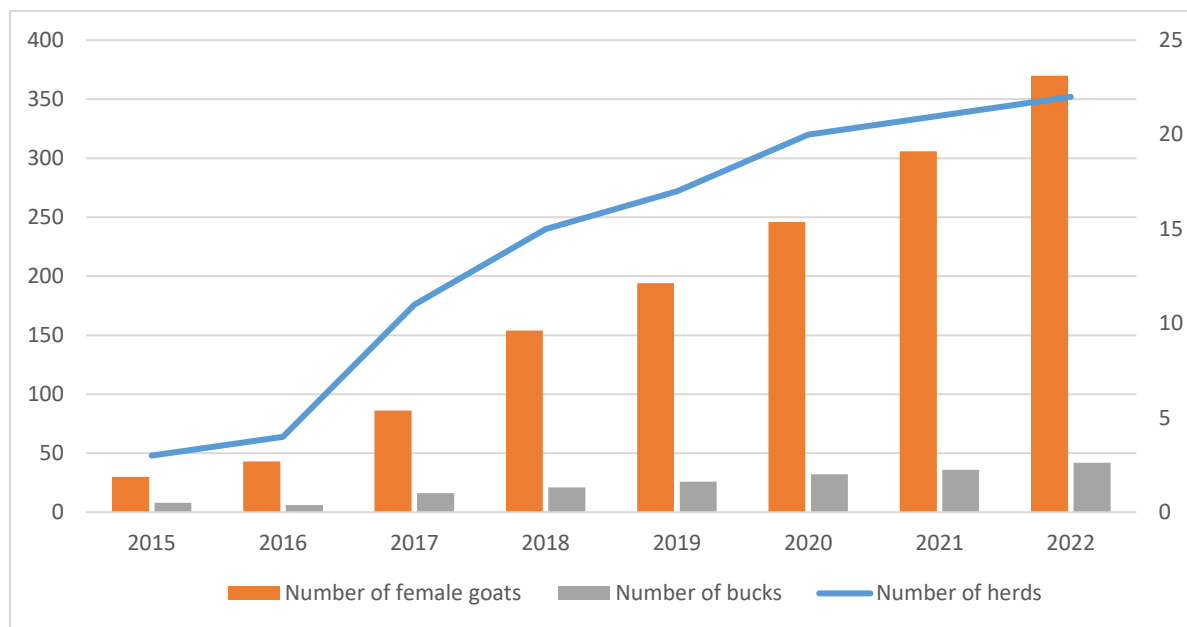


Rys. 1. Średnia roczna wydajność mleczna i długość trwania doju dla kóz karpackich w latach 2015 - 2021
Fig. 1. Average annual milk yield and duration of milking for Carpathian goats in 2015-2021



Rys. 2. Średnia roczna zawartość procentowa [%] w mleku kóz karpackich w latach 2015 - 2021
Fig. 2. Average annual percentage of fat and protein [%] in the milk of Carpathian goats in 2015-2021

The interest in raising the breed and the financial support from the Rural Development Programme, beginning in 2015, as well as from the project ‘Preservation of endangered animal resources in agriculture,’ available as of 2023, under the Common Agricultural Policy 2023-2027, have made the Carpathian goat one of the fastest growing livestock populations in Poland (Figure 3).



Rys. 3. Zmiany liczebności pogłowia kóz karpacczych w trakcie realizacji programów ochrony zasobów genetycznych rasy

Fig. 3. Changes in the population numbers of Carpathian goats during the implementation of programs to protect the breed's genetic resources

The role of breed as an element of animal biodiversity

Carpathian goats are a vital part of biodiversity, and their breeding is consistent with the structure of small farms in Natura 2000 reserves and areas where natural conditions are not conducive to intensive livestock breeding (mountain areas, protected areas, marginal areas, organic and agrotourism farms), where Carpathian goats can supplement primary livestock production or provide an alternative to peri-agricultural activities (Sikora, 2022). EU rural policy promotes efforts aimed at preserving biodiversity, such as native goat breeds. Indigenous breeds are part of the cultural history of many places due to their great adaptability to unique conditions, their association with traditional goods with distinctive qualities, and the way they are utilised (D'Oronzio et al., 2022). Many countries engage in development activities in the context of native goat breeds. The small population of *cilentana* goats from the Italian province of Salerno (Iommelli et al., 2022) is a case in point, demonstrating the importance of local breeds in Mediterranean nations. The extensive livestock-keeping system of the breed allows for the exploitation of abandoned land and sustainable breeding, resulting in high-quality products. Furthermore, rearing and breeding *cilentana* goats provides a significant source of income for rural communities, as well as biodiversity protection and the preservation of local occupations with historical traditions. Di Trana et al. (2015) offers instances of how local breeds might add value to a conventional or traditional product. *Caiotta* and *ricotta* cheeses manufactured from *girgentana* milk, for example, have a specific fatty acid composition, nutritional index, and sensory qualities when compared to cheeses made from the milk of other breeds.

The market for goat products

The establishment of a market for traditional and regional products directly related to local breeds is an essential part of conservation breeding. Dairy (mostly cheese) and cured meats derived from certain breeds are available in Western European countries. Products from indigenous breeds are also manufactured in Poland. The Polish Ministry of Agriculture and Rural Development keeps the List of Traditional Products with close to 2,000 items, 125 of which are cheeses and dairy products (<https://www.gov.pl/web/rolnictwo/lista-produktow-tradycyjnych12>). The List includes items whose distinct traits, attributes, or quality arise from the employment of traditional (at least 25-year-old) manufacturing processes. A product applying for inclusion on the List should be an element of the local community's identity and form part of the cultural heritage of the region from which it originates. The largest group of listed products are goat milk cheeses (Table 1), including from Carpathian goat milk.

In Poland, the goat meat market is basically non-existent, and the commodity is scarce. The low demand for goat meat is mostly due to Polish eating habits and the country's lack of a tradition of consuming this sort of meat. Indeed, consumption of goat meat is restricted to larger urban centres and can be traced to a tiny number of gourmet restaurants that specialise in Middle Eastern cuisine. The majority of goats in Poland are kept for milk only. The population of meat goats, such as the Boer breed, is small, resulting in a limited number of farms that specialise in raising slaughter goats (Kawęcka and Pasternak, 2020).

Table 1. Polish traditional goat's milk products

Województwo Voivodeship	Produkt Product	Rok wpisu Year of entry
dolnośląskie	Łomnicki goat cheese	2010
	Zgorzelec cheese*	2008
kujawsko-pomorskie	Mikanów goat cheese	2013
lubuskie	Maturing goat cheese	2016
	Zamkowy goat cheese	2013
	Goat milk cottage cheese	2016
	Goat curd cheese	2016
łódzkie	Eufaminów goat curd cheese	2009
	Drużbino dried goat cheese	2011
mazowieckie	Dried goat cottage cheese	2013
	Cegłowo goat cottage cheese	2012
	Milk goat cheese	2018
	Jakubowo goat cheese	2017
podkarpackie	Goat curd**	2005
	Goat curd**	2015
	Bieszczady maturing goat cheese	2014
	Podkarpacki white and smoked goat cheese**	2006
	White or smoked 'Wallachian' goat's cheese	2005
	'Wallachian' goat cheese from the Wisłok Valley	2019
świętokrzyskie	Goat cheese from Machory	2014
	Zagajnik goat cheese	2015
wielkopolskie	Witoldziński goat cheese	2017

*also produced from sheep's and cow's milk; **from the milk of Carpathian goats

The growing interest in all-purpose breeds (milk, meat, hides), such as the native Carpathian goat, and in high-quality food offer an opportunity to exploit this niche market. Goat meat products are an interesting culinary proposition for goat-breeding agrotourism farms that has the potential to boost their economic efficiency. Popular products include sausages or rolls made from or with goat meat. Ranchers and producers also offer pâtés as well as (kid) goat meat in the form of roasts and stews (Sikora, 2022).

Research on Carpathian goats

Research on Carpathian goats has been an important component of the breed's development, determining the genetic structure of the reconstituted population, as well as the suitability of these animals for breeding under different living conditions and the influence of environmental factors on the quality of the products obtained, including their composition and technological and health-promoting properties. A large portion of the research has focused on goat meat. The goal of the study at the IZ PIB was to establish how the quality of carcasses and meat of the native Carpathian compares against other goat breeds and species depending on the slaughter date. The study also looked at volatile chemicals. Carpathian goat meat was found to be more tender than Saanen goat meat, with a higher content of certain amino acids, and its fat was distinguished by a higher content of monounsaturated acids and more favourable indices, on which the health-promoting properties of a product depend (Migdał et al., 2021).

Goat meat is rich in numerous volatile compounds formed from their precursors – amino acids and fatty acids – and directly responsible for taste and odour parameters. Gas chromatography/mass spectrometry (HS-SPME-GC/MS) analysis found that goat meat contained 93 volatile compounds. Their profile can be analysed for different animal products depending on the species, breed, region, housing system and nutrition. This can also help to prove product authenticity (Gašior et al., 2018; Kawęcka et al., 2022b). An analysis of the effect of slaughter age on meat quality in Carpathian kids (Kawęcka and Pasternak, 2022b) has found significant differences with regard to physicochemical parameters, fatty acid profile and organoleptic properties. The meat of older kids was distinguished by a darker colour and a slightly higher pH, a higher concentration of hypocholesterolemic fatty acids (DFA) and a more favourable hypo- to hypercholesterolemic ratio (DFA/OFA). Roasted meat from Carpathian kids scored high in the organoleptic evaluation, and meat from older animals slaughtered at 12 months of age was also rated highly and described as 'very good' contrary to widespread opinion in Polish society that meat from uncastrated young male goats had a characteristically unpleasant odour. It should be noted that meat from older goats was rated highly, confirming previous results obtained by other authors (Pieniak-Lendzion et al., 2003).

Research has demonstrated that, being a product of indigenous origin, Carpathian kid meat is of excellent quality. This should convince consumers about its exceptional nutritional value, health-promoting properties and culinary potential.

Agrotourism, ecology and other forms of local business

Indigenous goats and the products derived from them can also play an important role in agrotourism: domestic and foreign tourists can visit local communities to see and photograph animals. Traditional handicraft or clothes-making techniques would be a valuable adjunct to the marketing of native breeds and their associated products (Monau et al., 2020). A poll conducted among Croatian consumers to gauge their perception of the potential of goat products for agrotourism has shown that the respondents would be more willing to visit farms with local goat breeds, selling farm-produced goods. Almost half of respondents thought products from indigenous breeds were of higher quality than those from other breeds (Prpi et al., 2022).

Carpathian goats are popular on organic and agrotourism farms. This serves a popularising and promotional purposes, while also educating people of a wide range of age about the animals and their region of origin. Farms, which are frequently located in tourist areas with infrastructure for hiking and cycling, provide not only accommodation but also food, which is as natural and unprocessed as possible. They are also an opportunity for tourists of a wide range of ages to have direct exposure to animals and nature. Agrotourists can learn about local customs and participate in activities and workshops centred on preserving traditions, such

as making goat cheese. Many agritourism farms are members of the National Network of Educational Homesteads, whose mission is to raise awareness about the farming profession and disseminate knowledge about food origins, diversify non-agricultural activities in rural areas, and preserve the rural cultural heritage. During the workshops, the hosts demonstrate the agricultural face of the countryside as a source of food, as well as share their hobbies, teaching the visitors to make folk trinkets and educating them about local life.

Organic goods (high-quality food with excellent health and nutritional properties) have grown in popularity among consumers in recent years. The conditions for the growth of organic farming are particularly advantageous in Poland. The country's farm size structure is marked by considerable fragmentation and a large amount of manual labour, making it feasible to turn them into huge organic farms with minimum effort. Organic livestock production, by definition, should take place under natural conditions, with pastures serving as the primary source of nutrition for ruminants. As a result, local breeds of sheep and goats are best suited to being kept on organic farms since these have avoided intensification of production that is incompatible with organic principles (Sikora, 2022).

Public awareness and promotion

Raising awareness about the benefits of preserving animal genetic diversity and the popularisation of the use of animal raw materials from indigenous conservation breeds for the production of regional, organic products on small farms offers great opportunities for breeders to improve the profitability of their production or diversify their income. To this end, a variety of promotional events are organised, including conferences, exhibition, fairs, study trips, training courses, seminars, expert networks, culinary workshops, and publications. Animal exhibitions and thematic fairs and events, held as part of local and national events, are an effective way of promoting native breeds and the goods derived from them. For many years, the IZ PIB has organised regional and national exhibitions of native breeds in Poland, with its primary objective being the presentation of animals from species covered by genetic resource protection programmes, tours by experts on genetic resource protection and the agri-environmental programme. It has also disseminated knowledge about native breeds through publications such as albums, leaflets, brochures, posters, promotional materials, catalogues, and books. The IZ PIB website has news on the promotion of the Carpathian goat breed (<https://kozykarpackie.izoo.krakow.pl>).

The IZ PIB has established its own method of certifying local breeds, including goats and their derivative products, as yet another promotional device. This campaign aims to highlight the importance of Poland's native breeds, their role in environmental and landscape restoration, and the potential of their genetic resources. The campaign also tries to identify products with superior nutritional and health-promoting value. The 'Native Breed' logo was created as a collective logo as well as a separate logo for each indigenous breed, including the Carpathian goat, and serves as the foundation for the promotion of indigenous farm animal breeds as well as products obtained from them (<http://ksb.izoo.krakow.pl/site/certification>). Ranchers of native breeds participating in the project, breeder-processors, and processing businesses manufacturing goods from these breeds have the right to mark their products with the logo under an agreement with the IZ PIB Institute. The Institute keeps a register of certification programme participants, a dedicated website dedicated, and runs a Logo information campaign (Radomski et al., 2019).

Summary

Native goat breeds are an essential element of livestock biodiversity, and their rearing has grown in popularity in recent years. This offers an opportunity to expand the market for increasingly popular goat products and support local businesses. It is critical for environmental efforts to continually raise awareness about native breeds and their alternative uses, as well as their importance for local communities by conserving their cultural heritage and creating local products. These efforts should be supplemented by research to assure product quality and authenticity. The native Carpathian goat breed in Poland is an example of how breeding effort combined with promotional activities and scientific study may restore the breed's relevance for biodiversity, regional history, and economic development.

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