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Sustainability Aspects of the Hungarian Horse Industry

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The importance and use of horses have changed throughout the history. Nowadays, horses are sharers of different equestrian competitions and provide recreation possibilities via sport and hobby, take part in therapeutic processes, produce highly valuable milk, and meet and stock pharmaceutics, while for many people, it's like a pet or companion animal. Hence, the horse industry contributes significantly to social goods and is an interesting economic sector for EU regional sustainable growth. Although there are no definitive statistics, horses have many environmental and economic advantages, but the fragmentation of the sector and the lack of synthetic knowledge about their impacts do not enable the promotion of these assets and their effective inclusion in management practices and the local/national and global/EU policies. The situation in Hungary is very similar. This paper led to the identification of some "green assets" like grazing, domestic biodiversity, land use, tourism, and work fields where horses show unique environmental and economic advantages compared to other agricultural productions. The study deduced the vital need to extend the current knowledge of the environmental and economic benefits of horses to strengthen sustainable aspects of the Hungarian horse industry, with a focus on a historical state-owned stud farm.

1. Introduction

The horse industry in the European Union is of economic importance to all countries. In the past, horses were vital in agriculture, transport, and the military, and today, in the modern world, they can represent a leisure or sporting activity, a way of life, or a working companion (Vial and Evans, 2015).
Horses in Europe, and especially in Hungary, represent a part of our history. In different parts of Europe, different breeds have evolved depending on environmental conditions and the intended use of the breed. Nowadays, the national borders between European countries have become less important in the horse world. We are homogenous concerning the same type of horse activities and mainly sport horse breeds represented all over the continent. However, while there are similarities, there are also many differences, including the degree of state involvement in the horse industry, the favourite choice of horse sports or how the betting on horses is organised. Thus, the horse industry in Europe is more varied (Liljenstolpe, 2009).
The European equine industry has a role to play in the achievement of the biodiversity strategy. Horses are not only production animals. They also provide ecosystem services, especially for land uses and biodiversity preservation in different ways.
According to O'Neill et al. (2018) the aim of sustainability is to achieve, within planetary boundaries, a good life for all people now and in the future. "Sustainability" is often used to mean that public policies should place equal emphasis on economic, social equity, and environmental outcomes. This definition has been called the three pillars of sustainability, the three-legged stool of sustainability, or the "triple bottom line" (Willard, 2010; Gottlieb et al., 2020). Agricultural development seems like a policy strategy that can achieve all these three objectives simultaneously. Profitable farms generate income and jobs while at the same time preserving landscapes, scenic views, and at least some form of wildlife habitat. The increased interest in sustainability over the last few decades in Europe has coincided with a new approach to local and regional economic development.
Herein, this paper aims to extend the current knowledge of sustainability aspects of the Hungarian horse industry, where horses show unique environmental and economic advantages compared to other agricultural productions, with a focus on a historical, state-owned Hungarian stud farm.

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2. Methodology

Although there are no definitive statistics, horses have many environmental and economic advantages. However, the fragmentation of the sector and the lack of synthetic knowledge about their impacts do not enable the promotion of these assets and their effective inclusion in management practices and the local/national and global/EU policies. The situation in Hungary is very similar.
In 2020, the European Horse Network (EHN) identified five main environmental assets of the equine industry, named “green assets” as follows: 1. Grazing, 2. Domestic biodiversity, 3. Land use, 4. Tourism and 5. Work. In this study, the Hungarian horse industry will be described according to these points, focusing on the ecological (environmental, biological, genetic, etc.), economic, human and historical considerations. Moreover, unique traits and size of the population of the traditional (genetically preserved) Hungarian horse breeds are submitted with the case study of Bábolna National Stud Farm.

3. Discussion and results

Today’s ecological wake-up calls and the importance of sustainable development encourage stakeholders to promote the environmental assets of the agricultural sector. The different activities involving horses meet the ongoing reforms and policies of the EU, “greening” the Common Agriculture Policy focuses on the need to balance agriculture with environmental and rural development. The equine industry is part of the agricultural sector, but it differs from that in many cases. Horses are involved in a multiplicity of activities, from conservation grazing to agricultural traction and production to racing, equestrian competition, or outdoor tourism. These equine uses participate in the maintenance of societal and economic heritages, but they also have unique environmental impacts. From this point of view, horses are of particular interest and relevance because of the longevity, intensity, and significance of our shared relations (Birke et al., 2010).

3.1 Grazing

Horses have a unique impact on the land. Their morphology, physiology and behaviour are different from other species. Horse grazing presents certain advantages. Double rows of incisive allow the animal to graze at ground level and intake easily digestible proteins of young seedlings. As compared to bovines, the absence of rumen limits methane emission, which is a dangerous greenhouse gas. As a consequence of the absence of a rumen, the intake volume is not limited by the time of rumination nor the size of the rumen. Horses can swallow more than cattle and be less impacted by the nutritional quality of the food. Horses seem to prefer young grass and move more easily towards less palatable species than cattle in case of food shortage.
Horses can be used in complementary with other species for an optimal recovery of grasslands and a good preservation of biodiversity. This method is called mixed grazing, and it is a sustainable agricultural practice. Scientific studies like those by Bigot et al. (2015) on farm sustainability and López et al. (2019) on foraging behaviour demonstrate the positive impacts of mixed grazing: better nutritional value of the grasslands, better control of shrubs, and a decrease in parasitism.

3.2 Domestic biodiversity

Genetic homogenisation of populations, breed specialisation to maintain competitiveness and commercial lack of interest cause the decline of both versatile breeds and breeds that are less competitive. Yet, the larger the genetic diversity within a species is, the better its resilience is in coping with environmental changes (Alderson et al., 2005). There has already been a decline in breeds which are locally adapted to habitats with rough or specific constraints.

Table 1: Population size of the traditional Hungarian horse breeds in the year 2022 (Federation of Hungarian Horse Breeders, 2023)

Breed	Stallion	Mare	**Total**
Shagya-Arabian*	72	886	**958**
Lipizzan	85	1,278	**1,363**
Nonius	82	1,265	**1,347**
Furioso-North Star	69	615	**684**
Gidran	35	512	**547**
Kisbér	74	1,215	**1,289**
Hucul**	86	644	**730**
Hungarian Coldblood	198	1,257	**1,455**
Total	**701**	**7,672**	**8,373**

*with the purebred Arabians, **with other small horses

Horses are able to conserve biodiversity in two different ways. Firstly, grazing has already been discussed. Secondly, local and/or hardy breeds seem to fit the environmental conditions of the habitat they come from and are often used to preserve them. This use of local breeds as land managers is a way to maintain their population and promote their conservation.
Approximately 180 local equine and donkey breeds are registered in the FAO database in Europe. Half of these are at risk, and 15 % are extinct. In Hungary, there are 8 traditional horse breeds, and all of these are at risk. The size of the population can be seen in Table 1.

The Shagya-Arabian

The Shagya-Arabian breed was developed on the stud farms of historical Hungary: Bábolna, Mezőhegyes and Radautz. Thanks to its expansion primarily in Europe, it has been bred in a dozen of countries based on closed stud books. Despite their wither height, some individuals are able to produce incredible results in show jumping and dressage. Heavier individuals are suited for driving. The endurance of the Shagya-Arabian horse is excellent, as well. Due to its characteristics and long life, the breed is very popular among hobby riders and drivers, particularly among young horsemen. Shagya-Arabians possess a combination of qualities that are not found in either of the breeds. Thanks to strict selection criteria and purebred breeding, the above-mentioned qualities are inherited reliably.

The Lipizzan

The Lipizzan is a classical representative of the Baroque style. It is noted for its noble head, sometimes with a slightly convex profile. The movement is impressive, high, and secure. The Lipizzan horse is late maturing, long-living, healthy, enduring, intelligent and friendly. It makes an excellent partner for its human mate. It learns easily, works willingly, is very supple, hard, resistant, and not very demanding. In Hungary, Lipizzans are primarily used in driving, while in Vienna (Austria), they are used in classical dressage at the Spanish Riding School.

The Nonius

The Nonius breed, derived from the Anglo-Norman stallion called Nonius Senior, is unique among the breeds throughout the world in terms of general impression and type. Heavy body weight, hard constitution, willingness and ability to work are all traits inherited from the ancestors used for artillery jobs. Considering its genetics, the Nonius breed is a Thoroughbred crossbred, the heaviest among the draught type warm blood breeds. The main characteristic of the Nonius is its convex profile. Nonius horses are calm, and able to achieve lasting performance. They served as proof of their stamina, endurance and excellent movement at endurance driving competitions of former years. Their willingness to work is unique. Nonius horses are all-purpose animals of the family: they can be used for both riding and driving. The most excellent ones are internationally successful at driving events.

The Furioso-North Star

Similarly to other traditional Hungarian horse breeds, the Furioso-North Star was developed at the Mezőhegyes State Stud Farm. By the 1840s, the Thoroughbred had become the most important enhancer breed in Hungarian horse breeding. Of the stallions involved, two excelled because of the superior quality of their offspring: Furioso and North Star. These two stallions found two lines that supplemented each other very well in the breeding. In two decades, a heavier riding horse, also useful as a medium carriage horse type, emerged that was clearly distinct from other horses and met the requirements of private breeding demands as well. It was called the Mezőhegyes crossbred, later the Furioso-North Star breed.

The Gidran

The Gidran was developed at the Mezőhegyes State Stud Farm as a result of classic line breeding for riding. Thanks to the consistent breeding, at the turn of the 20th century, the Gidran became a leading Anglo-Arabian breed in the Austro-Hungarian Empire in all the countries of the Danube Basin. After World War I, almost all the Gidrans were transported to Romania by the occupying Romanian troops. The Mezőhegyes State Stud Farm did its best to recreate the lost population of the highly useful Gidran breed. As a result of the efforts, three lines (A, B, C) were developed, and the breed's sports achievements reached the heights experienced during its days of glory.

The Kisbér

Today, Kisbér horses have a high percentage of Thoroughbred genes and meet the requirements of modern sport horses besides preserving traditional breeding and genetic values. The Kisbér was named after the town Kisbér in Komárom County, Hungary. In 1853, Emperor Franz Joseph I ordered a new stud to be established

here for military use, relying on existing imperial stud farms and private studs having horses of good quality. The carefully selected breeding stock was bred with Thoroughbred stallions with correct constitutions and excellent performances through generations. To improve homogeneity and increase body weight, only crossbred stallions from the best Thoroughbreds were used in breeding. Some Mezőhegyes crossbred horses (Furioso-North Star) were also involved in order to increase body weight. Breeding mare candidates were first tested at fox hunts. The result was a crossbred breed closely related to Thoroughbred horses with primary use in riding, but the individuals are calmer and somewhat heavier, willing to work, have an elegant appearance, and have a firm constitution. In 1942, three Trakehner stallions were imported to improve movement and use. Nowadays, the breeding goal is to produce horses able to meet the requirements demanded of sport horses.

The Hucul

The Hucul is a unique breed that differs from all other breeds in its general impression and way of living. It emerged mainly as a result of natural selection. The primitive character of the Hucul horse is conspicuous by its small stature, its heavy and bony yet nicely shaped head, thick muzzle, undemanding character and great resistance. Despite their small stature, Huculs do not seem to be underdeveloped horses. A fully grown animal's height at the withers is 137-143 cm. Typically, Huculs' colours are several varieties of bay, but black and grullo also occur. Bay or grullo animals often have dorsal stripes, and zebra stripes on the legs also occur. Sometimes, transverse shoulder strips can also be found.

The Hungarian Coldblood

The Hungarian Coldblood has a firmer constitution, less demanding and more nimble than the Western European Coldbloods. Hungarian Coldblood horses have a calm temperament and mature fast. They are excellent workers, good-natured and easy to handle. Traditionally, they have been reliable and friendly work fellows of farmers that learned fast and did not require special livestock skills. For this reason, it has recently become popular as a leisure animal as well.

3.3 Land use

The horse industry uses land not only through grazing and forage crops but also through equestrian facilities such as racecourses, studs, farms, riding schools or trails. Unlike other animal industries, horses are spread all around the territory, in suburban, rural and environmentally sensitive areas. In suburban areas, facilities holding horses are mainly riding schools and livery yards.

Equine grazing enhances transitional areas that are abandoned by agriculture and not yet subsumed by urbanisation. Thus, horses maintain a form of agriculture in those areas, seen as a tool for "soft urbanisation" and acting as a spatial and functional link between residential areas and agriculture (Saastamoinen et al. 2017). Moreover, mixed grazing, as we already have discussed, assists in optimising the grazing management of other herbivores.

Mountains, wetlands and swamps are considered as so-called sensitive areas. Horses can enhance non-arable areas that are difficult to maintain through mechanisation, as well as sensitive territories that might be subject to shrub invasion. Thus, equine grazing optimises pasture management and contributes to the reduction of land abandonment in sensitive areas.

The area required to produce the yearly feed for a horse varies between 0.5 and 2.5 hectares. So, we can conclude that 1 horse is equal to 1 ha. In Hungary, this means that 55,000 horses need approximately 55,000 ha of land and not necessarily valuable agricultural land.

3.4 Tourism

Equestrian tourism concerns all outdoor activities with horses (and donkeys) outside of the residential area. According to Pickel-Chevalier (2015), equine tourism has a larger definition than equestrian tourism: "A movement in free time that takes place outside the temporality and spatiality of everyday life, whose activities are related to equestrian practice (mounted, harnessed or supported by a pack equine) or an activity surrounding a horse through visits or events. The equine and horse riding can be the main motivation or a secondary activity of the visit.".

Diverse stakeholders are involved in equine tourism: from riding schools to event sites, from local shopkeepers to riders, from visitors to trainers, etc. Their impact on the environment is difficult to quantify, but in many countries, quality labels are being developed. The „horse-shoe" system in Hungary, for example, rewards human, environmental and animal welfare guarantees for stables and equestrian competitions.

The socio-economic and environmental impacts of equestrian events are hot topics. Anyway, equestrian tourism is a sustainable form of leisure that also helps the environment. It has similar but sometimes more severe environmental impacts to other users of trails, such as hikers or bikers, regarding soil erosion, loss of organic litter and loss of vegetation. However, it differs from these at least in two ways: equine manure leads to the

nitrification of soils and rivers but also to the enrichment of nutrient-poor soils and spread of seeds through fur, manure or equipment (of the horse or the rider) enriches poor soils in plant diversity, but may lead to the spreading of invasive species in protected areas.
Equestrian tourism creates and maintains trails that are useful to other users. It also contributes to the preservation of some sensitive areas.
The public demand for typical local outdoor activities offered by equestrian tourism provides a role for local or traditional breeds and, thus, their sustainability.

3.5 Working horses

A working horse provides energy that can be substituted by other sources of energy, other machines or types of travel. Horses work in several sectors all over Europe: agriculture (field crops, vineyards, market gardening), forestry (skidding), tourist transport and public services (school transport, garbage collection). In natural areas, horses degrade soil less than machines and frighten less fauna (Maijala, 1999).
Worldwide, there are ten times more animals used as a source of draught power than tractors. In developed countries, 26 % of land is managed thanks to animal traction, especially in sensitive areas (and 52 % in developing countries). The energy needed to feed a working horse is up to 60 % renewable because they eat plants, growing thanks to photosynthesis (9 % if using a tractor powered by oil).
Soil compaction is the most severe form of degradation in conventional agriculture. A motorised machine creates a continuous path and leads to deep soil compaction, while a horse creates an intermittent path and causes superficial compaction.
Manure produced by horses directly fertilises soils, avoiding the use of chemical fertilisers and reducing the emission of N_2O in the atmosphere. Moreover, equine grazing maintains grasslands, being carbon sinks.
As interest in carbon neutrality has increased worldwide, efforts are being made to introduce various eco-friendly modes of transportation (Ku et al., 2022), especially trams (Choi et al., 2022). When compared to motorised machines, the use of a horse could be more profitable, especially on shorter distances. Many policies have been drawn to enhance transport sustainability and reduce its emissions. According to a Life-Cycle Assessment model that examined a 1-km long drive, for the emission of 1 kg $eqCO_2$, a machine carried 80 kg of wood, whereas a horse carried 311 kg. In cities, the use of horses allows for a decrease in the carbon footprint for some public services. Moreover, they are seen as ‘city pacification’ agents.
Working horses can graze on non-arable zones, avoiding competition with lands intended for human food production. However, this is different from the case of biofuels. This solution not only presents economic advantages, but also supports local breed conservation, as local breeds are well adapted to local environmental conditions.

4. Case study: Bábolna National Stud Farm

Because of the increasing demand for high-quality soldier horses, Hungary’s second oldest, world-class stud was founded in 1789 as the Royal Bábolna Stud. Since 1816, only Arabian stallions have been standing at the Royal Bábolna Stud. After World War II, the social and economic conditions did not favour horse breeding in Hungary. Many of the valuable Arabian horses from Bábolna were taken to breeders in Western Europe. While the Bábolna Stud tried to look for a new direction in the breeding of purebred Arabian from the late 1960s, the Bábolna Arabian breed – which was named the Shagya-Arabian – conquered the lovers of Arabian horses in Europe and around the world. The stud started to bloom again over the past two to three decades.
The pile of the Arabian Stud at Bábolna is historical: the stud yard was built in the beginning of the 1700s, and it is surrounded by an impressive building complex with stables, a castle, the Heroes’ Gate, the Chamber Hall and the Riding Hall. The originally single-storey mansion was burned down by the troops of Napoleon arriving in Bábolna after the battle of Győr in 1809. After this, the building complex was renovated and was completed in 1860. The 15 m wide and 44 m long riding arena is used for daily work and horse shows. Not only are horses learning between the thick walls, but hundreds of riders have also mastered the art of riding, which they demonstrate at shows and competitions. However, one of the oldest riding halls in the country does not only offer opportunities for horse lovers, but it is also suitable for big events. There is a collection of carriages and coaches, and the exhibition at the Horse Museum shows the history of the Stud over more than two hundred years in the building of the former Officers’ Casino.
The Arabian Stud at Bábolna has approximately 250 horses (stallions, mares and foals), most of them are Shagya–Arabians and purebred Arabians (Table 2). There are about 10 geldings for the everyday coachwork, and they provide reproduction, etc., service for about 20 guest horses, mainly during the breeding season. The Stud farm maintains 80 hectares of pastures and approximately 175 hectares of meadows that absolutely fit the data in the literature. The staff consists of approximately 83 persons in three locations. They organise different events like sports competitions and shows throughout the year. Besides, plenty of tourists visit the traditional buildings and the exhibitions because of their historic past and sustainable present.

Table 2: Breeding stock of the Arabian Stud at Bábolna National Stud Farm

Breed	Stallion	Broadmare	Yearling*	Foal*	**Total**
Shagya-Arabian	14	37	35+44	9+15	**154**
Purebred Arabian	4	20	15+18	1+2	**60**
Anglo-Arabian	0	0	4+1	0	**5**
Total	**18**	**57**	**54+63**	**10+17**	**219**

*colt and filly (Source: Bábolna National Stud Farm)

5. Conclusions

Horses are involved in various activities, from conservation grazing to agricultural traction and production to racing, equestrian competition, breed conservation or outdoor tourism. These equine uses participate in the maintenance of societal and economic heritages, but they also have unique environmental impacts not only in urban but in rural areas, as well. In this study, the 8 traditional Hungarian horse breeds were also presented, coming out at 15 % of the total horse population of Hungary, and all of these are at risk. According to the data in the literature, horses need approximately 55,000 hectares of land and provide working places or jobs for about 15,000-20,000 people in Hungary, mainly not in agricultural production but in education and research, public and governmental organisations, etc. Finally, the activity of the Arabian Stud of Bábolna National Stud Farm was described where approximately 250 horses, mainly Shagya–Arabians can be found. The stud operates on approximately 255 ha of grasslands. The staff consists of approximately 85 persons who organise various events like sports competitions and shows many times a year. Besides, plenty of tourists visit the historical buildings and the exhibitions. These indicators absolutely range with the data of literature. The Bábolna National Stud Farm is such a special historic place in the world's culture of mankind and horse breeding that visualises its colourful past through its unique Shagya-Arabian horses and multiplies its sustainable present.

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