REVIEW ARTICLE

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Donkeys in transition: changing use in a changing world

Jumentos em transição: alterações do seu uso num mundo em mudança

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ABSTRACT

Donkeys have a long history in the development of human societies. Typically referred to as a beast of burden, traditional uses for donkeys have included the transportation of goods and people, use in agricultural and forestry activities, to access water, and provide citizens in low- and middle-income countries a means of making an income for communities. However, the rise of mechanization, the development of modern farming techniques, and the increasing availability of motorized vehicles have led to donkeys and mules becoming redundant from traditional roles in many parts of the world. We provide examples of where donkeys have successfully transitioned from traditional roles to new, non-traditional roles in Europe and North America, and demonstrate that, although the roles and use of donkeys and mules are changing in a rapidly developing world, we can learn lessons from the past and apply them to current challenges. As the need for working equids declines in transport and agriculture, they still hold great value for recreational, therapeutic, and environmentally friendly methods of animal traction.

Keywords: Donkeys. *Equus asinus*. Working equids. Animal traction. Development.

RESUMO

Os jumentos têm uma longa história no desenvolvimento das sociedades humanas. Normalmente referidos como bestas de carga, seus usos tradicionais incluem o transporte de pessoas e bens, atividades agrícolas e florestais, acesso a água, assim como oferecer uma forma de rendimento para comunidades em países de rendimento baixo e médio. No entanto, o aumento da mecanização, o desenvolvimento de técnicas agrícolas modernas e maior disponibilidade de veículos motorizados fizeram com que os jumentos e os muares se tornassem desnecessários nos seus papéis tradicionais em muitas partes do mundo. Neste artigo os autores fornecem exemplos onde os jumentos fizeram a transição, com sucesso, dos papéis tradicionais para novos papéis não tradicionais, tanto na Europa como na América do Norte; e demonstramos que, embora o papel e o uso de jumentos e muares estejam mudando num mundo em rápido desenvolvimento, podemos aprender lições com o passado e aplicá-las aos desafios atuais. À medida que diminui a necessidade de equídeos de trabalho no transporte e na agricultura, eles ainda têm grande valor no que toca a fins recreativos, terapêuticos e ecológicos no uso de tração animal.

Palavras-chave: Jumentos. *Equus asinus*. Equídeos de trabalho. Tração animal. Desenvolvimento.

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Introduction

Animals have been used in agriculture since at least 11,000 BC (Larson et al., 2007), a practice that has evolved to enable humans to have increased production of food and relieve the labor burden (Zeuner, 1963). Despite the recent rise of mechanized farming, and following several agricultural revolutions, in 2006 approximately 50% of the world's agricultural power was still generated by working animals, of which working equids (horses, *Equus caballus*; donkeys, *Equus asinus*, and mules, *Equus asinus* × *Equus caballus* hybrid) represented the majority (Swann, 2006). Although data are scarce on true population figures, the most comprehensive data source from the United Nations Food

and Agriculture Organization (FAO) indicates that there are over 112 million equids (horses, donkeys, and mules) in low- and middle-income countries (LMICs) (Food and Agriculture Organization of the United Nations, 2017) that support the livelihoods of some 600 million people (Valette, 2015).

Although still used in LMICs communities today, donkeys once played a much greater and more central role in millions of communities across the world (Blench & MacDonald, 2000; Camac, 1997; Fernando & Starkey, 2004; Starkey & Fern, 1998; Von Keyserlingk, 1999). Donkeys have lived alongside humans since the animals were domesticated around 10,000 years ago (Bough, 2011). Working donkeys played central roles in the development of early cities and transport systems in Asia and Africa (Kimura et al., 2013; Rossel et al., 2008). Working donkeys have been found buried next to Egyptian kings, which indicates the high level of status donkeys held in those communities (Mitchell, 2018b). There is also indisputable evidence to show that donkeys and mules held high status in the ancient Near East (Mitchell, 2018a; Way, 2010). However, as motorized vehicles and modern farming methods have evolved, donkeys have played a lesser role in traditional societies. This may be a major cause of their declining populations worldwide, as populations of equids are decreasing globally, with the exception of Africa, where they are increasing (Stringer et al., 2015). This growth in the African donkey population can be attributed to the increase in the number of companies trading in agricultural products, and increasing urbanization, whereby working equids are used to transport goods and people. However, there is a decline in equid populations on other continents, and many of these animals are being abandoned.

In this review, we discuss how donkeys have transitioned from high-status animals that carried out important traditional roles such as the transport of goods and people, construction and use in agricultural activities, to low-status, 'unwanted' animals that are abandoned, or how they are now used in new, non-traditional ways, such as for their meat, skin and milk products. We begin with an overview of donkey use in South America and Brazil. We then present a series of three case studies to demonstrate how this process has manifested in different contexts throughout the world. While there are probably thousands of case studies we could have chosen, we selected three from different contexts to provide a broad overview, within the confines of an academic paper. We chose: 1) Brazil, a case study highly relevant to the South American context; 2) Ireland, a unique case of how an animal's value can be impacted by the policy; and 3) Europe, a case study that demonstrates how the use of donkeys in multiple industries has changed in a short period. While other case studies exist, they were outside the scope of this manuscript. We finish with a discussion of the possible unintended consequences of rural development, and consequences to both humans and donkeys following their change of usage and their status transition.

Donkeys in Transition: The South American Context

Donkeys were brought to the American continent in the 16th century during the Spanish colonization (Laguna Sanz, 1991; Rodero Serrano et al., 1992) and Portuguese expedition (McManus et al., 2010; Teresinha, 2018). Centuries after their arrival to the Americas, donkeys, and mules have played a fundamental socio-economic role in activities such as agriculture (packing and plowing), transport of goods, and mining, among others (Carneiro et al., 2018; Cruz-León et al., 2010). While donkey use has declined since the era of mechanization and modern farming practices, the animals are still used in rural areas for traditional roles such as transportation of agricultural products, firewood and water, riding, and, in some urban areas, although to a lesser extent, to pull carts. This situation has been reported in countries like Mexico, Colombia, Venezuela, Bolivia, Ecuador, Peru, and Haiti, among others (Arriaga et al., 2003; Carneiro et al., 2018; Velazquez-Beltran et al., 2002).

In the Americas (North, South, and Central America, combined), the 2008 donkey population stood at 7.1 million, but fell to 6.6 million in 2018, indicating a population decrease of 7% in 10 years. In South America, this decrease was more marked. The 2008 donkey population stood at 3.3 million, but fell to 2.8 million in 2018, indicating a population decrease of 15%. In Brazil, the decline has been the greatest at 30% during the same 10-year period, from 1.13 million donkeys in 2008 to only 822,255 in 2018 (Food and Agriculture Organization of the United Nations, 2017). The three countries in South America with the greatest declines in donkey population are Ecuador, Colombia, and Brazil (70, 60, and 30% reductions, respectively). It is unclear whether these declining populations are linked to the emerging trade in donkeys skins (The Donkey Sanctuary, 2017, 2019a), or reflect increased urbanization and mechanization in these countries, or a combination of both.

More recently, donkeys have been proactively cross-bred with horses to produce mules for traditional activities like the transport and production of agriculture products (i.e., coffee, sugar cane) in the mountain areas of Colombia and Mexico (Herrera Benavides et al., 2018). There has

also been an increase in mule production for recreational activities such as riding (tourism and competitions) or show events, especially in Colombia, Brazil, Peru, and Mexico. Concerning production systems, some countries like Brazil and Mexico have reported interest in developing donkey farms for milk production (Carneiro et al., 2018).

Donkeys also have a role as guardian animals. In Brazil, Mexico, and Uruguay there are reports of livestock producers acquiring donkeys to protect their livestock (i.e., sheep and goats) from feral dogs, or wildlife animals (Burden & Thiemann, 2015; Cutrer, 2018; Smith et al., 2000). In North America, donkeys play the role of companion animals. The Bureau of Land Management (BLM), as part of its population control strategy for feral equids, carries out periodic removal of excess animals (typically defined as those that compete with beef cattle for pasture) and places those animals in private care where they are kept for pleasure and enjoyment. Donkeys have also been recognized as important elements of ecological landscapes, and they have a role to play in the natural management of wild ecosystems. For example, donkeys act as seed-dispersal agents for a range of plants, including *Prosopis*, a genus of tropical or subtropical branching shrubs or trees widespread in arid and semi-arid zones of the Americas with vast economic value (Baes et al., 2002; Sánchez de la Vega & Godínez-Alvarez, 2010; Lundgren et al., 2018).

The Changing Role of Donkeys Around the World: Case Studies

Case study 1: Brazil

Following their arrival in Brazil with Portuguese colonizers in the 16th Century (Almeida, 2009), donkeys (along with mules and horses) played a critical role in regional development (Mitchell, 2018b; Salles et al., 2013). As Mozar de Macedo, a municipal secretary for agriculture once put it: "Since colonial times the entire commercial economy of the northeast [of Brazil] has been based on the use of the donkey as a means of transportation through terrain that is often hostile" (Rohter, 2001, p.4). The critical role that donkeys played in Brazil's development during this time was extensively documented by Antonio Vieira (1919-2003) in his book, "The Donkey, our Brother" (Nosso irmão..., 2019). Donkeys were essentially the sole means by which colonizers developed Brazil in the 16th and 17th centuries. Donkeys were responsible for transporting labor, building materials, and food supplies, and were how infrastructure was developed so that towns were built and areas became more developed. The animals were also used in agriculture for the production of food and the transport of, and access to, water (Mitchell, 2018b).

The breeds of donkeys introduced to Brazil by colonizers were subjected to natural selection in diverse environments such as in northeast Brazil (i.e., Caatinga dry forest; arid, thorny scrubland). Consequently, donkeys in Brazil are now adapted to live in the many different environments in the region (Carneiro et al., 2018; Dias et al., 2019; Salles et al., 2013). There are three main types of donkeys present in Brazil; i) the 'Northeast donkey', highly adapted to the tough and arid conditions of northeast Brazil; ii) the 'Brazilian donkey', descendants of the original donkeys brought from Italy, believed to be of African origin; and iii) the 'Pêga Donkey', bred for use in the Brazilian mining industry, with Iberian origin (Carneiro et al., 2018).

However, donkeys' once-revered status has gradually declined, since, along with the rise of mechanized farming techniques, motorized vehicles, and urban development of many parts of Brazil, the traditional use of donkeys has waned, making them increasingly redundant (Mitchell, 2018b). Moreover, rural development projects initiated by President Luiz Ignacio Lula da Silva (between 2003 and 2010), including road improvements and the installation of piped water, meant that donkeys are no longer needed to transport water in many communities (Gameiro et al., 2020). Consequently, donkeys have been abandoned and left to freely wander on roadsides, prompting major concern over road traffic accidents (Almeida, 2009; Oliviera, 2019; Salles et al., 2013).

Since the 1990s, Brazil has seen the steady abandonment of donkeys and the establishment of free-roaming (and possibly even feral) populations across the northeast (Dias et al., 2019; Gameiro et al., 2020). Brazil is thought to have approximately 800,000 donkeys in the northeast region (Bittencourt, 2018), although it is not known whether these are owned or abandoned donkeys. Only 20% are believed to be used as working animals (Carneiro et al., 2018). Since the number of donkeys on roads in Brazil has been growing since the 1990s, the main concern is the rise in associated car accidents. This is a mounting concern for the authorities in Brazil.

Under Brazilian law, the state is responsible for all animals on roads that do not belong to a private owner, and animal abandonment is a crime, punishable by federal law (n. 9.605/98, article 32; Mariana Gameiro pers. comm.). Legislation has existed since 1995 to empower state authorities to remove animals from roadsides. However, the state of Ceará is currently the only Brazilian state that implements a systematic program of removing animals

from state roads due to the concern with road safety and car accidents. Approximately 7,000 animals are captured every year in the state of Ceará (Oliviera, 2019), with an average of 25 animals per day. Between 2016 and 2019, more than 21,000 donkeys were captured from roads by state authorities in Ceará (Detran-CE, pers. comm.). The authorities are then responsible for providing housing, feed, and care for the captured animals. But managing such large numbers of animals is a difficult task and is problematic for the authorities (Detran-CE, pers. comm.).

The situation is further complicated by the growing global market for donkey meat and skin. In several states in Brazil, donkeys (owned and free-roaming) have been targeted specifically for the meat and skin industry in Brazil (Gameiro et al., 2020). This presents a major social and political problem for Brazilian authorities due to the welfare issues associated with the global skin trade (The Donkey Sanctuary, 2017, 2019a). For some time, the Brazilian authorities have considered the slaughter and exportation of donkey meat and skin as a solution to the issue of donkeys on roads. However, various welfare controversies have generated backlash from the animal welfare community in Brazil (for instance, Geuza Leitão legal actions). These issues have increased in recent years along with the growing and indiscriminate Chinese demand for donkey hides (The Donkey Sanctuary, 2017, 2019a). For the authorities, the global demand for donkey skin has presented a solution to the 'problem' of free-roaming donkeys on roads (Gameiro et al., 2020). A recent report by The Donkey Sanctuary (2019b, p. 12) found that free-roaming populations are being siphoned off and put into unregulated production systems, where donkeys are slaughtered to meet the global demand for their skin. Various welfare and human health issues have been identified with the removal and slaughter of donkeys for their skin. Between 2016 and 2018 in the state of Bahia, there were several breaches of international guidelines on animal transportation, rest and water availability, and unsanitary or illegal slaughterhouse conditions (Gameiro et al., 2020). These issues attracted the attention of global animal welfare charities and public pressure eventually led to the closure of several slaughterhouses in Bahia.

The status of donkeys in Brazil is precarious and inextricably linked to Brazil's rapidly changing economic and global influence. Free-roaming donkeys captured on roads can either be transitioned to temporary facilities such as holding bases or otherwise sent to slaughter. Very few are rehomed or given sanctuary. While there are some initiatives to find other use-values for donkeys in Brazil, for instance by reinstating their traditional role as working animals, or by advocating for their new role as milk-producing animals (Dai et al., 2019), these are likely to be temporary and small-scale options. Furthermore, they may not address the underlying challenges associated with donkey abandonment and the growth of free-roaming donkey populations on and around public roads.

Case study 2: Ireland

The role of donkeys in Ireland has changed significantly since their early introduction to the country. Donkeys have transitioned from being a valuable animal in agriculture to animals whose value is often purely monetary in terms of government subsidies. When these subsidies no longer apply, the donkey loses any value to its owners. Donkeys' traditional roles as part of rural communities have diminished significantly, resulting in their loss of status as 'important', and they have become undervalued, dispensable and, consequently, suffer poor welfare and abandonment. Recorded donkey populations in Ireland have declined from 118,000 in 1847 to fewer than 5,000 in 2017, representing a population decline of 96% (Irish Donkey Society, 2020).

The earliest explicit mention of donkeys in Ireland dates back to 1194, with sporadic mention until 1808, when they became more regularly referenced in literature and recognized as part of the landscape of Ireland (Smyth, 2014). In the early years of their presence, donkeys appear to have been more highly prized as a milk production animal than their physical work ability. From the 1800s, donkeys were used more extensively for pulling and agricultural work and became central to rural livelihoods in Ireland (Swinfen, 1969). Donkeys quickly became known for their ability to carry and pull heavy loads and were considered particularly important for those unable to afford horses (Dutton, 1808; Swinfen, 1969). Despite the decline of equines used on farms between the 1860s and 1891, horses and donkeys were still extensively used for subsistence farming during this time, with numbers of working equines increasing steadily from 1981 until the mid-1940s (Hannan, 1979).

In 1971, less than 25 percent of farm homes in Ireland had piped water and only 26 percent had motor vehicles (Department of Agriculture, Food and the Marine, 1971). Donkeys were still regularly seen clearing rocky fields and bogs, plowing, transporting people and goods, and performing other agricultural roles at this time (Smyth, 2014; Swinfen, 1969). In 1974, Ireland joined the European Union (EU), which led to changes in agricultural policy and increased investment in rural areas. Increased mechanization on farms, including increasing tractor numbers from the 1950s on

(Department of Agriculture, Food and the Marine, 1971), resulted in a steep decline in equines used for agricultural purposes (Hannan, 1979). The traditional role of donkeys became increasingly redundant. Consequently, as demand for working donkeys reduced, they gradually became unnecessary in carrying out their traditional roles, and donkey numbers continued to decline.

While the introduction of mechanization led to an initial decline of donkey use in rural communities in Ireland, in more recent years, various agricultural support schemes have contributed to an increasingly inconsistent landscape for donkey monetary and community value. Agricultural aid schemes (now the 'Areas of Natural Constraints' (ANC) scheme), implemented to support landowners in areas of constraint, were first introduced in 1975. Donkeys qualify as one Livestock Unit (LU) each under these land management schemes. Although donkeys are framed as being of agricultural purpose under these schemes, they do not serve any working function like their previous traditional agricultural roles. Donkeys in Ireland are now mainly kept as pets, or to provide monetary income under these schemes (Collins, 2018). In 2019, over 900 donkeys were registered as LUs in Ireland. The onset of these subsidy schemes increased demand for donkeys, thereby stimulating their breeding and production. Donkeys once again began to increase in financial value, creating a market for them (Collins et al., 2018), with increased breeding developing to fill the supply gap (Collins et al., 2015). However, this resurgence in the demand for donkeys, and their value as an income-earning LU, failed to improve the long-term welfare of donkeys. The scheme created a cycle of overbreeding, increased neglect, and abandonment (Collins et al., 2015).

Breeding supply chains set up at that time continue at present, with the direct purpose of supplying donkeys for ANC schemes (Joseph Collins, pers. comm.). Numerous factors, including donkeys' ability to survive on low-quality nutrition and poor grazing (Burden & Thiemann, 2015), contribute towards donkeys being so popular for ANC schemes while simultaneously exposing them to poor welfare circumstances (Collins, 2018). The increase in donkey popularity under the ANC also contributed to the risk of poor welfare due to low rates of farm inspections and the absence of welfare requirements under the ANC (Collins et al., 2018). In 2012, just 589 farmers were claiming for donkeys on the ANC scheme (Moran, 2017). By 2014, over 2,500 donkeys were registered as LUs (Collins, 2018).

In the financial crisis of 2010, with the downturn in the economic landscape at the end of the Celtic Tiger period (Donovan & Murphy, 2013), there was another significant decrease in donkey value, making the animals more affordable and dispensable. The Irish Society for the Prevention of Cruelty to Animals (ISPCA) pronounced 2013 to be their 'year of the donkey', in a bid to help rescue and home donkeys who had lost their value and been abandoned (ISPCA, 2013). Despite the increasing number of abandoned donkeys and those in states of negative welfare, the ANC scheme continued to register increasing donkey numbers (Collins et al., 2015). In 2015, The Donkey Sanctuary called for a substantial overhaul of the system, including the introduction of improved welfare assessment and mandatory castration for donkeys on the scheme (The Donkey Sanctuary..., 2015). Regardless, the number of donkeys on the scheme increased again in 2016 (Collins, 2018). There were record numbers of donkey abandonments in 2018 (The Donkey Sanctuary, 2019b), and increasing donkey foal relinquishments in 2019, causing further concern about indiscriminate and overbreeding of donkeys.

The next shift in the donkey status in Ireland is currently underway. The permitted use of donkeys as LUs will be phased out from 2020, and donkeys will only be able to make up 50% of the stocking density under any individual owner (Department of Agriculture, Food and the Marine, 2020a). Such changes to the ANC scheme could adversely affect the financial value of donkeys, due to 'restrictions in eligibility and the uncertainty engendered by the prospect of change with the potential for unintended consequences (Collins et al., 2015). The reduction in donkeys accepted as LUs on the scheme is expected to be accompanied by an increase in relinquishments and abandonments (The Donkey Sanctuary..., 2015). This has broad implications for the welfare of individual animals, and the organizations dealing with the consequences of these policy changes.

Although subsidies certainly increased the demand for donkeys following their redundancy after exit from farming, donkey welfare has suffered because of the LU designation under the ANC schemes. Where counties in Ireland have significant ANC activity, donkey abandonments and relinquishments are higher than in counties with less such activity (The Donkey Sanctuary..., 2015). Donkeys under ANC schemes are not protected by regular welfare assessments, and consequences for donkey abandonment are limited as they are often un-passported and their owners untraceable (Collins et al., 2015; Collins, 2018). To be considered part of agricultural activity, animals released onto parcels of land should be cared for under 'normal husbandry and welfare practices throughout the year' (Department of Agriculture, Food and the Marine, 2020b). Despite this, few checks

are carried out. Consequently, high levels of poor donkey welfare exist, with animals abandoned when they are no longer useful for claiming subsidies.

There are lessons to be learned from the experience of donkeys in Ireland. Despite their value in traditional agricultural roles within communities before mechanization, many donkeys have increasingly suffered because of their use under the ANC scheme (despite the label of agricultural use under the scheme) as they reduce in usefulness elsewhere. Although some donkeys live as well-cared-for pets, the majority of donkeys in Ireland are valued for their financial worth in subsidies. People who have donkeys on their land are no longer necessarily part of the donkey-owning community but are people who own donkeys. While this distinction is subtle; it makes a significant difference to the role of the donkey in Ireland. Donkeys have lost their worth within the communities, and there is little accountability for their poor welfare in many circumstances. Thus, as the role of donkeys continues to change in Ireland, they have lost their central role in people's lives and now live on the outskirts of the land rather than working at the heart of the community. The reduction of working donkeys in Ireland has influenced the fundamental nature of the donkey's role in Ireland, with donkeys experiencing relinquishment and abandonment. As a consequence of this change, donkeys are the ultimate sufferers.

Case study 3: native breeds in Europe

Donkeys likely reached Europe with Phoenician traders via the Southern countries, followed by the expansion of the Roman Empire in Europe during the Roman conquests (Camac, 1997). Since that time, donkeys have assumed an important role in Europe as a working force in agriculture, transportation of goods and people, assisting in military operations, and facilitating the production of hybrids. Donkey milk, skin, and meat were used for human consumption and utilization (Kugler et al., 2008), mainly in the south, southwest, and eastern parts of the continent (Camillo et al., 2018).

The extensive use of donkeys and controlled breeding processes led to selective breeding and progressive fixation of phenotypic characteristics; i.e. animals best adapted to the surrounding environment and human needs were selectively bred, a process that, over centuries, has resulted in numerous different populations and breeds (Beja-Pereira & Ferrand, 2005). This is particularly apparent in Europe. Although the current donkey population in Europe accounts for only 1.6% of the total numbers worldwide (Camillo et al., 2018), around 30% of all the recognized breeds of donkeys originated from Europe and the Caucasus region (Kugler et al., 2008).

Technological improvements and motorization of agriculture occurring during the 20th century in Europe, together with the rural exodus of people, greatly reduced the need for equids as animals of draft and burden, leading to a drastic reduction in donkey and mule numbers (Rzekęć et al., 2020). This process was somewhat slower in the southern and eastern European countries due to later industrialization, but these regions soon followed the European trend, particularly in the last three decades (Colli et al., 2013). Such processes affected the European native breeds of donkeys, with the vast majority of the existing breeds now classified as endangered, due to the low number of animals registered in the official studbooks (Camillo et al., 2018).

The European Union recognized the importance of such invaluable genetic resources and created several strategies to support the European Native breeds through the Rural Development Programme, overseen by local breeding associations and by the national genetic resources monitoring program (European Commission, 2019). Although, as Camillo et al. (2018) stated, "the survival of donkey breeds and the possibility of an increase in the number of these animals are related to the economic interest in the donkey and its products", this case study briefly covers those niches where donkeys play an important role: agroforestry activities, production, and social use.

Agroforestry Activities

Animal-powered systems are gradually reappearing as a modern, ecologically- and economically-sound farming practice, with donkeys being used both as pack and traction animals, mainly in the mountain and rural areas. Younger generations are more aware of the environmental impact of human activities, so a collective consciousness about the need to reduce excessive industrialization and mechanization, along with an increased and renewed interest in clean energy and environmental issues, has led some sectors of society to consider the reuse of animal traction as a valid modern source of energy (Rodrigues et al., 2017).

A growing number of farmers in small and medium firms across Europe have already understood the potential of using working donkeys, especially the large European donkey breeds, to achieve their daily work needs. As a result, non-governmental organizations in Europe, mainly under the umbrella of the European Draught Horse Federation (FECTU), increased their formative activities focused on the modern use of donkeys. In 2013, the Institut Français

du Cheval et de l'Equitation (IFCE), in collaboration with Institut National Anes & Mulets and France Anes & Mulets, created the "Ecole Nationale des Anes Maraîchers" (National School of Donkeys used for Gardening) in France to meet the growing demand for organic market gardening with donkeys (L'energie Cheval, 2013).

In forestry activities, horses (and mules to a lesser degree) are preferred to donkeys, due to their larger size and power. But donkeys still play a minor role in mule production, especially in those European countries where mules are still used for agroforestry activities. Spain, France, and Greece are just some examples. If we look to equids in forest management, comparative studies have highlighted both financial and environmental benefits when equids are used for logging activities, when compared with more conventional motorized methods (Miraglia et al., 2006).

Working equids provide sustainability value, strongly supporting the local economies and contributing to the fixation of human population in marginal areas, as well as an ecological value, allowing preservation and improvement of agrobiodiversity. Indeed, equids optimally transform the consumed biomass into working energy output and natural fertilizer (Spugnoli & Dainelli, 2013), contribute to the sustainable management of arable lands, forests, and sensitive areas, avoiding soil degradation (SAVE Foundation, 2013) and helping to provide natural firebreaks by reducing dry vegetation material, diminishing the possibility of forest fires, especially in the countries of southern Europe. Draft animal use also reduces carbon emissions, encourages community self-reliance, and reduces the consumption of external resources (Stringer, 2014). Donkeys may also play an important role as guardian animals for small ruminants, alone or in combination with guardian dogs, against potential predators such as feral dogs or wolves, as proved through different projects in mountain areas in Europe (SAVE Foundation, 2013).

Production

As previously mentioned, donkeys have been used historically for their meat, milk, and skin (Kugler et al., 2008), albeit on a smaller scale when compared to other livestock species. In the late 20th century, donkey milk and by-products began to attract more investors, as well as researchers, due to purported properties and benefits (Cavallarin et al., 2015; Claeys et al., 2014; Gubic et al., 2014). As a result, donkey milk farms have increasingly appeared in Europe over the last 20 to 30 years, mainly in Italy, France, Greece, Croatia, Belgium, Turkey, and Cyprus, with some other smaller projects in Portugal, Spain, and Serbia (Dai et al., 2019). The list of countries corresponds to the Mediterranean area, where there is a high concentration of donkeys in Europe, as well as a high number of native breeds. Donkey milk is mainly used for human nutrition (infant food and for the increasing number of people who are allergic to sheep/cow milk proteins) or as ingredients for the cosmetic industry (Camillo et al., 2018). There are an estimated 270 global donkey milk farms. Italy and France register the vast majority of these farms, ranging from small farms of 5 to 10 animals, to farms containing herds of up to 1000 animals under intensive management systems (Dai et al., 2019).

European native donkey breeds are used for milk production in small scale farms, which effectively increases the value of the final milk product (Gro Azue, 2020; Naturasin, 2020). When looking at official numbers of European native breeds presented by Camillo et al. (2018), data show that European native breed numbers vary between 15 jennies detailed in the Asino di Pantelleria official record (Italy) and 760 jennies in the Burro de Miranda (Portugal). Therefore, the inherent reproduction occurring in these small-scale milk farms is indeed contributing to increase and conserve the total number of animals. Regardless of the specific breed and farm herd size, the use of donkeys as production animals is an ongoing reality in Europe. To ensure that donkeys are included within production-animal related welfare regulations and laws, they must be recognized as production animals alongside other livestock species (Dai et al., 2017; Dai et al., 2019). Regarding meat production, Italy and France are currently the countries with the highest consumption of donkey (and horse) meat in Europe (Paleari et al., 2003). Traditionally, donkey meat was obtained from the slaughter of working animals at the end of their working life. Now the demand is mainly focused on leaner meat. Thus, donkey meat is mainly produced from young animals (Polidori & Vincenzetti, 2013).

Some European donkey breeding associations, who traditionally kept those animals registered in the official studbooks out of the food chain, are currently rethinking this option. This is a consequence of the decline of the traditional breeders, who kept donkeys for working purposes, as part of their traditional rural lifestyle, and the emergence of new breeders, with larger farm herd sizes and a more business-like approach, linked to the breeding process, such that the economic viability of the farm is directly linked to the sale of the foals. The increasing number of milk farms around the Mediterranean countries is contributing to an increased number of foals, and the inclusion of such animals (mainly males) in the food chain may be seen as a

solution to surplus animals (Camillo et al., 2018). As with general livestock production, awareness of donkey welfare during transport and humane slaughtering methods must be an integral part of this process.

During the second decade of the 21st century, a further role for donkeys as production animals re-emerged, through a special interest in donkey skin (The Donkey Sanctuary, 2017, 2019a). Large-scale, global trading in donkey skin (used to produce a traditional Chinese medicine called 'ejiao') has been observed in recent years. The huge demand is a direct result of the increasing wealth and diaspora of the Chinese community, who are the main consumers. This has led to an unprecedented situation worldwide, with donkeys being part of both a regulated and unregulated international trade, mainly in Asia, Africa, and the Americas. This trade is causing major issues regarding donkey supply and welfare and should be seen as a potential, direct cause of transboundary diseases (The Donkey Sanctuary, 2019a). Native European breeds do not appear to be involved in the skin trade market at this stage, but the increasing number of donkeys available described earlier may create the appetite for such a market. Once again, all donkey welfare concerns relating to rearing, transport, and slaughter are of paramount concern within the context of producing donkeys for their skin.

Social Use

In Europe, donkeys are largely involved in social activities and are kept for recreational purposes, such as donkey-facilitated learning programs (onotherapy), also known as donkey-assisted therapy (DAT), tourism, and leisure. The continuous process of selection for working animals that these breeds have experienced over centuries, to select and keep animals with desirable traits for work, e.g., calm behavior, has helped to fix an excellent set of skills in the remaining population that provides a relevant and useful role for these breeds for social use today. In DAT, donkeys have a unique set of physical and behavioral characteristics that facilitate their engagement with people, helping both children and adults with a wide range of emotional, psychological, and cognitive needs (De Rose et al., 2011; Gonzalez-De Cara et al., 2017). The use of donkeys in therapy or learning programs has become increasingly common, with native breeds preferred for such activities in many Southern European countries. Some authors even state that donkeys can be a good alternative for horses in assisted therapies, due to their unique features, such as size, type of hair, and calm and gentle attitude towards people (Borioni et al., 2012). The Donkey Sanctuary in the United Kingdom is probably the most significant example of how donkeys can be successfully used for animal-assisted activities. Established over four decades, the animal-assisted therapy program is now widespread in the UK and Ireland, with several centers dedicated to DAT, and includes school and family programs. The Spanish and Italian subsidiaries of the Donkey Sanctuary UK have also included DAT activities in recent years.

In terms of tourism and leisure, in many mountainous rural parts of Europe, small family businesses offer donkey riding and trekking activities, with donkeys used as pack animals. Such businesses are usually combined with lodges or guest rooms, with the donkeys acting as an attraction for an urban population increasingly seeking new rural activities. France, Belgium, and Switzerland are the main countries where these types of services may be found. In such countries, the growing demand, combined with the need for appropriate harness systems for these animals, has boosted the reappearance of some more traditional professions that were threatened, such as harness makers, and leading to the professionalization of such sectors (Rodrigues et al., 2017).

In some of the Greek islands, donkeys and mules are used on a different scale in tourism activities. For example, the animals are used for tourist rides and transportation, sometimes in difficult conditions, such as the famous steps in Santorini. The number of donkeys has dramatically reduced in Greece in such spots, and mules are now being used, due to their greater working capacity and ability to withstand harsh conditions. Nevertheless, the welfare of the equids involved in such activities should be closely monitored to avoid any situations that may affect their health and welfare (Thiemann & Foxcroft, 2016).

Native European breeds of donkeys face great challenges today across Europe, as a direct result of the loss of functionality as working animals, where these donkeys were once a central piece of a traditional farming system that is now threatened or has already disappeared. Reviving some of the traditional uses of these breeds may be part of the solution and could be included in a broad strategy to preserve their genetic heritage. Every action involving donkeys (and all equids) should always be done respecting their physical limits and dignity, to provide and maintain high standards for health and welfare across all uses, whether that be for agricultural, therapeutic, or leisure activities.

Discussion

Donkeys have played a long and important history in the development of human societies, not only in the Americas

but worldwide (Blench & MacDonald, 2000; Camac, 1997; Fernando & Starkey, 2004; Kugler et al., 2008; Mitchell, 2018a; Swinfen, 1969). Arguably, the Spanish and Portuguese colonization of the South American continent would have been less successful had they not brought donkeys to support them with the hard labor needed to develop new infrastructure and establish agricultural systems. Despite being once so critical to the development of human settlement in this region, however, donkeys and mules no longer hold such an important place in society. These animals hold low status and are part of a major, growing problem of abandoned and free-roaming animals in the region (Gameiro et al., 2020). This causes hundreds of animal deaths and thousands of dollars of damage each year. However, as is the case in Europe, there is a growing trend to recognize the important role that donkeys and mules can play in modern society. Animal traction is environmentally friendly, and during a time of climate change and increasing pollution, offers a real solution to reducing the impact of humans on the environment (Miraglia et al., 2006; Rodrigues et al., 2017; SAVE Foundation, 2013; Stringer, 2014).

The role of working equids is changing across the world. However, as many countries have shown, there is an opportunity for this change. Europe has successfully transitioned donkeys for use as production animals for meat and milk. Northern Europe and North America use donkeys for therapeutic and recreational purposes. Donkeys and mules play positive roles within ecosystems as well. For example, they help to re-wild landscapes, spread seeds, reduce scrub, and prevent bushfires. We have presented a few case studies of how this transitioning use of donkeys can be used for positive outcomes, and we suggest that the lessons learned could be successfully applied in the South American context to manage the growing redundancies of once-working animals in the region.

Conflict of Interest

The authors declare no conflict of interest.

Ethics Statement

This study did not involve animals, nor any experimental procedure, so did not need approval by an ethics committee.

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