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# Undertaking the Full Circle

The working horse's utility in the first half of the twentieth century

Luise Elsässer

**The use of horsepower remained a significant energy source for Western European economies until the 1950s. Horsepower was needed for everything and by everybody in one way or another. If working horses were an industrial and agricultural energy source of the nineteenth and early twentieth centuries, then the horses' carcasses were its by-product. The end of a working horse's life eventually brought usage full circle, as the remains were fed back into economic circulation. This paper looks at the different uses of horsepower and its disappearance, using the example of England. The use of horsepower was socially and culturally coded, while the animals served as raw material, commodity, working power, and food, from its breeding to its disposal.**

**T**he invention of James Watt's coal-powered steam engine, patented in 1769, meant nothing less than that one machine could do the work of at least three horses. The steam engine is only one example of a range of changes in the use of energy supplies that occurred from the mid-eighteenth century onwards. Coal exploitation and the consumption of other fossil fuels significantly altered how

the economy and everyday life were powered.<sup>1</sup> For example, European inland shipping transformed in the early nineteenth century. In 1812, the first steamboat appeared on the river Clyde, and in 1820 on the Rhone and the Seine; the Rhine was traversed by steamboats from 1816, making redundant the horses that had pulled the boats along rivers and canals on well-trodden paths. Trains doubled the speed of inland travel and replaced the horse-drawn coach cross-country network; however, the railway did not necessarily challenge human reliance on the horse. Because trains and ships could only transport freight between terminal points, horses were used for everything and by everybody to reach their destination. Hence, the need for horsepower did not peak in the eighteenth century but at the turn of the twentieth century. Yet, at the same moment around 1900, new technologies had already started to make the working horse redundant. Nevertheless, the car and other motorised vehicles on roads did not begin to challenge the horse seriously before the 1920s. Even then, it took another thirty years to supersede the horse in both urban and rural spaces. The horses' gradual disappearance left behind deep socio-cultural, political, and economic traces. The shift to motor vehicles fundamentally changed the soundscapes, landscapes, and smells of the human environment and economic life.

The disappearance of the horse as a working animal and energy source was an extremely rapid one in some places and areas of use, but a very slow process in others. First, horses lost their role as traction power in the passenger transport sectors of urban spaces, while remaining a significant source of energy in agriculture, short-distance haulage, and warfare until the mid-twentieth century. There were differences between countries too. For instance, in Finland, the agricultural horse population peaked in the 1950s, when they were used in the logging industry. In Britain, the disappearance of the horse took approximately 200 years altogether and spanned all spheres of life and all ranks of society. This shows that the horse was not a remnant of the pre-mechanical age.

**The horses' gradual disappearance left behind deep socio-cultural, political, and economic traces. The shift to motor vehicles fundamentally changed the soundscapes, landscapes, and smells of the human environment and economic life.**

Historians have been concerned with the human use of horses since the 1960s. In his inaugural lecture at the University of London in 1968, F. Michael Thompson chose to put the horse centre stage. He suggested that, for all its novelty, the Victorian era was still “at heart a horse-drawn society” and argued that as a practical and commercial means of locomotion the horse was expensive and inefficient, and thus limited social and economic developments.<sup>2</sup> However, this assessment clouds the complexity of reasons why society relied on horsepower well into the twentieth century and how it fell into disuse.

Other historians have since followed Thompson's example and explored the horse's role in human society. Out of a long list of scholarship, several studies in particular are worth noting. Clay McShane and Joel Tarr analysed animal influence in North American cities and their intimate relationship with humans, urbanisation, industrialisation, and change. They argue persuasively that the presentation of horses as backwards is too simplistic because horses were an integral part of industrialisation and urbanisation.<sup>3</sup> Similarly, Ann Norton Greene offered a wonderful study that examined the changing role of horses as energy sources in industrialising the American economy in the nineteenth and early twentieth centuries.<sup>4</sup> Thomas Almeroth-Williams provided an analysis of the contribution that horses, and also cattle, sheep, dogs, and pigs, made in Georgian London.<sup>5</sup>

In German language historiography, Ulrich Raulff, for example, asked in 2015 how historians could have overlooked the impact of the horse on culture, art, literature, and society, and described the end of what he called

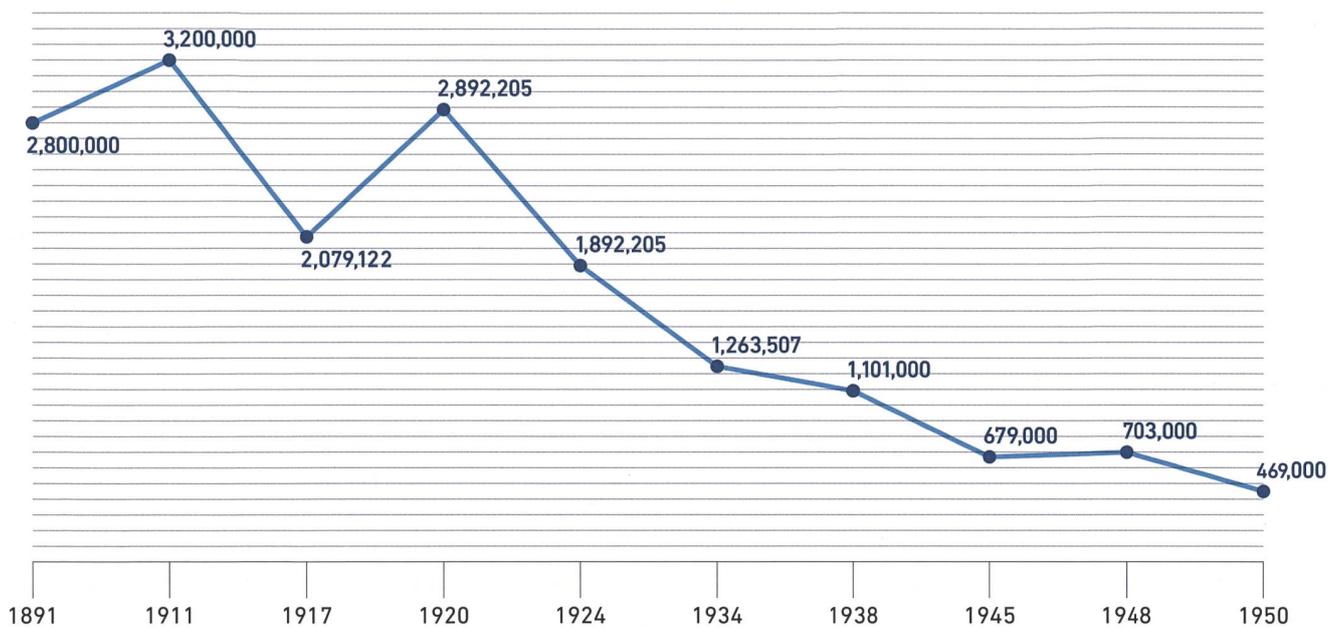
“the centaurian pact”.<sup>6</sup> Daniel Roche researched French equestrian culture and the bond between human beings and the horse between the sixteenth and nineteenth centuries.<sup>7</sup> Linking to Roche's work, Monica Mattfeld and Kristen Guest presented an edited volume in 2019 that argues that horses are deeply linked to ideas and practices of modernity, which they trace back the seventeenth and eighteenth centuries.<sup>8</sup> In ‘The Age of the Horse’, Susanna Forrest offered a broad panorama of the relationship between humans and horses as well as human uses of horses around the world.<sup>9</sup>

All these studies highlight the diversity of horse histories. Yet, they also remain focussed on the period between the sixteenth and nineteenth centuries and rarely peek into the use of horsepower in the twentieth century. A recent exception is Felicity McWilliams's PhD thesis on the introduction of tractors on British farms between 1920 and 1970. Farmers, she shows, constantly evaluated the utility of horses against tractors, and actively decided between the two technologies. Hence, she introduced the horse as a living technology to acknowledge the animal's human-engineered origins through selective breeding and not primarily as a power resource.<sup>10</sup>

In contrast, this paper proposes that horses be regarded not as a technology but as an animal resource, as this allows us to study how society used, re-used, dealt with, traded, and “recycled” horses across places and time.<sup>11</sup> This has implications for an awareness of the material basis of the economy that relies on accessibility to natural resources. Until the 1950s, horsepower was needed as an energy resource to run or manoeuvre many technologies, such as ploughs, locomotives, buses, or carts. Considering horsepower as a raw material also allows one to take a broad perspective that draws together different uses of this energy source and its recyclability into food and other products.

**In 1901, the human–horse ratio was about one working horse every thirteenth person. In 1931, there was only one horse for every fortieth person.**

In the remainder of the article, the multiple uses of horsepower between late-nineteenth- and mid-twentieth-century Great Britain, and England more particularly, will be highlighted. This geographic focus is chosen because of the depth of primary sources available. More generally, Britain offers an interesting case study for two main reasons. Firstly, although Britain was an industrial pioneer, horses did not disappear earlier than elsewhere in the Western world. On the contrary, the US-American agricultural sector, for example, was faster to adopt tractors than British farmers. Secondly, in contrast to other continental



1 The horse population of the UK in total, 1891–1950.

European powers, the British government never introduced a centralised breeding system governed by the state. Therefore, the following illuminates the use and disuse of horses in a range of industries. After a brief chronological overview of the disappearance of horsepower, the use and dis-use of horses in agriculture will be explored, before analysing the use of horsepower in mining, the railway industry, and urban employment of horsepower. Insights into the recycling process of horses as well as a brief discussion of the consumption of horse-meat conclude the article.

### Chronology of a decline

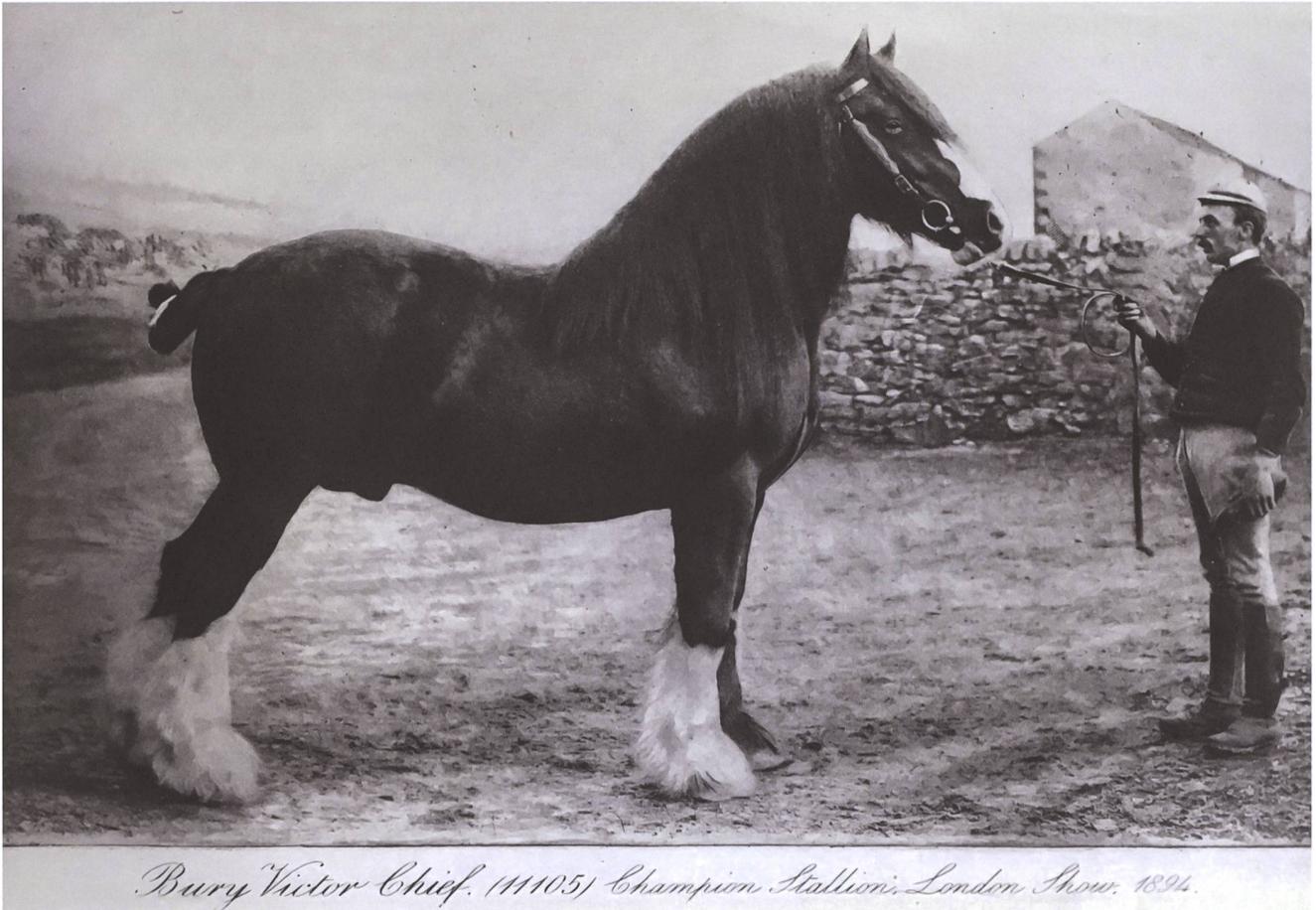
To gain an idea about the longevity of the horse it is useful to look at the chronology of its decline. Even though data for the period is a little sketchy because the returns were voluntary and it is unclear what class of horse they contain, it shows the numerical importance of horses, and also helps to pinpoint when the need for horsepower decreased. What can be observed is that the overall horse population increased from 2.8 million in 1891 to 3.2 million in 1901 and declined to 3 million in 1911. In the inter-war years, the use of horsepower declined gradually as

petrol-powered vehicles became more widely available. Eventually the horse population reached a figure of roughly half a million in 1950. To grasp what this data means, it is perhaps helpful to set it out in relation to the human population. In 1901, the human–horse ratio was about one working horse every thirteenth person. In 1931, there was only one horse for every fortieth person.<sup>12</sup>

Horses used for working purposes had a different build than what we might know from watching horse sports today. They were often strong, stocky, and heavy horses that could pull heavy loads. In Britain, typical breeds of working horses were the Scottish Clydesdale, the English Shire horse (Figure 2), or the Cleveland, but also small breeds, like the Shetland pony, had their uses.

### Horsepower in agriculture

Most farmers bred horses according to what they needed and sold on surplus animals. Until the mid-twentieth century, horsepower played a significant role in British agriculture. Horses were needed as an energy source for most agricultural machinery, such as mowers, tedders, swathe turners for tossing and turning the hay, stacking machines, and elevators. Horses were more reliable and



2 The Shire horse stallion Bury Victor Chief and his owner, photographed in 1894 for volume 15 of 'The Shire Horse Stud Book'.

adapted more easily to their environment, and often it was a conscious choice by farmers to use a horse, even though tractors became available in larger numbers in the 1920s.<sup>13</sup>

Only a minority of farms, so-called studs, specialised in the production of horsepower as their main commodity. The Shire horse breeder James Forshaw, for instance, established his family-run business in the early 1870s. For three generations the Forshaws bred Shires in Nottinghamshire and their horsepower was acclaimed across the United Kingdom as well as internationally. During the peak of the horse-powered economy, the breeding of pure-bred horses was a prestigious business that facilitated upward social mobility and social mixing, and opened the doors to upper-class circles of British society. In 1953, the last two working horses left the farm for slaughter, and in 1971, the farm had to be sold entirely. Richard Forshaw burned the stud books and sale papers of the Forshaw Shire horse stud a few days later.<sup>14</sup>

From 1914, the business benefitted from government funds paid in support for heavy horse breeding to secure supplies during World War I. After the war, fossil fuel-powered vehicles made inroads and threatened Forshaw's business. Defying the downward trend of

their commodity, Forshaw, like other horse owners, adopted a rhetoric of the perceived superiority of horsepower over motor power. He argued that horses were better equipped for the farm economy because they themselves and their remains could be fully integrated into the agricultural cycle. Horses ate straw and roots, which were disposable products, and they produced natural fertiliser.

**Ultimately, in economic terms, tractors yielded more profits and horsepower fell into disuse.**

Eventually, the decision to adopt tractors depended not only on the technology available or on economic concerns, but also on the size and utilisation of the agricultural holding. Dairy production, for example, was less energy intensive than arable farming, which means that less horsepower or motor power was required. Political factors were significant too. In the 1930s, the potential of another war brought a boom to farming to make the country more self-sufficient (the UK relied on food im-

ports to feed its population to a large extent). Edith Whetham established, for example, that the government invested around 250 million pounds in plant and machinery between 1948 and 1952.<sup>15</sup> With increasing levels of mechanisation, tractors also slowly became cheaper. Ultimately, in economic terms, tractors yielded more profits and horsepower fell into disuse.

### Horses in mining

Until the 1970s, horses were used as source of energy by the coal mining industry. At its peak in 1914, the industry employed about 70,000 pit ponies and horses underground.<sup>16</sup> Horses were used to haul the coal to the shaft bottom, where the coal was loaded in cages and brought up to the surface by steam power or, rarely, by electricity. Because of the low roofs of the underground roadway system, the preference was for small ponies, for instance Shetland ponies or imported Icelandic ponies. The horses were lowered into the mine shaft using the coal cages or ropes. Once in the pits, the animals were stabled underground and would stay there for extended period of times. Many horses went blind or would acquire injuries through rubbing their bodies open against the low ceilings and narrow pathways. Public pressure, especially petitions from the Pit Ponies' Protection Society, caused the government to introduce legislation in 1887 to regulate the use of pit ponies underground.<sup>17</sup> Charities, such as the Pit Ponies' Protection Society, intervened on humanitarian grounds. However, their successes in forcing legislation often had little effect on the ground. In *The Times* in 1911, the author of a letter to the editor lamented that only six inspectors had been appointed to carry out the controls in some 3,000 coal mines in the UK.<sup>18</sup>

Although levels of mechanisation increased in mines, ponies were still required for shorter haulages for which they remained in use until the late twentieth century because it was difficult to install mechanised haulage in the narrow sideroads. In 1972, the National Coal Board still employed some 600 ponies underground.<sup>19</sup> The decline of horsepower in mining had to do with the introduction of mechanised haulage and new technologies. However, it also went hand in hand with the general decline of the industry as coal was increasingly replaced by other energy suppliers, such as natural gas and oil, throughout the twentieth century.

### Shunting horses

The early-nineteenth-century railroad gentlemen's prognosis "that, by superseding the employment of horses in public conveyance, and in the regular carriage of goods, the adaption of [the steam-engine] will enable 1,000,000 horses to be dispensed with", turned out to be a little bit premature.<sup>20</sup> The British Railway only retired its last shunting horse, Charlie, in 1967.<sup>21</sup>

Railway companies owned some horses but mostly hired horsepower from livery stables, jobmasters – the nineteenth-century equivalents of Hertz or Avis – which allowed them to be more flexible and respond to in- or decreases in demand more swiftly.<sup>22</sup> Horsepower was required at most stations to move rail waggons and locomotives into position, to transport freight from the station to its destination, and to convey goods from the factories to the station for their onward transport or from ports to depots or railway stations.

Bryan Holden estimates that railway companies in Britain together owned 27,826 horses in 1913.<sup>23</sup> Given that most horsepower was hired, the likely real number in use must have been much higher. From the 1930s, their replacement progressed relatively quickly as horsepower was replaced with tractors to save hiring and feeding costs. For instance, at the station in Lowestoft in Suffolk, the London North Eastern Railway let seven out of 15 men go and replaced all 13 horses with four tractors in 1933. This decision saved the company about 315 pounds per year.<sup>24</sup>

### Horses in road transport and cities

In road traffic, horses were used for passenger and commercial transport. They were also vital for public services like the fire brigade, the police, or ambulances. Motor power began to challenge the dominance of horsepower in the 1880s. With growing (horse-drawn) traffic, congestion, noise, accidents, poor hygiene, drunken carriage drivers, and manure became frequently cited problems and legislation slowly made the use of horses difficult. In Berlin, for instance, horse cabs were banned in 1912. In Britain, steps to keep horses off the urban streets were only taken in the 1930s when horse-drawn vehicles were banned from major roads during peak hours.

**A team of two horses usually pulled the weight of eight to twelve tons.  
A single horse could be loaded with five to seven tons.**

Across the country, the disappearance of horsepower produced social frictions and inequalities. A diversity of individual actors, businesses, and institutions, not least a powerful state, shaped the disappearance of horsepower and the shift in the use of energy sources towards fossil fuels. The most impressive employment of horses in terms of numbers was London.

Besides privately owned horse transport, London recorded about 3,000 cab proprietors in 1893.<sup>25</sup> A cab required two horses to go for about six to seven hours a day with the drivers working more than double these hours to groom and feed the horses. London bus horses counted about 40,000 at the same time.<sup>26</sup> However, by 1924, 98 per



3 "Waiting.....", the monument to the Liverpool working horse, commemorates the importance of carters and their horses for the city's economy.

cent of London passenger transport was mechanised because motor buses and cars allowed for a larger radius of operation. This process created a highly competitive climate among different transport operating companies, in which larger ones with more capital power emerged as winners.

Nevertheless, heavy draught power remained in use until the 1950s. Breweries and carting companies continued to use horses alongside motor vehicles because horsepower remained more economical for short-distance deliveries.<sup>27</sup> Even today, many breweries use horses as a marketing tool. Carting firms hired out horsepower to railway or shipping companies to transport the goods from the ships to the warehouses, railway stations, or other local businesses. A team of two horses usually pulled the weight of eight to twelve tons. A single horse could be loaded with five to seven tons.<sup>28</sup> The Great Depression in the 1930s dampened the enthusiasm of businesses to switch to fossil fuel-powered vehicles and they carefully calculated the cost-benefit of horsepower versus motor power. The purchasing cost of a horse in 1930 was 50–75 pounds; a horse-drawn vehicle was 70–100 pounds. A lorry, depending on size and power, had an initial cost of 160–800 pounds.<sup>29</sup> Even though the initial cost was about

the same, the running costs could differ and influenced the decision to replace horses. However, other factors such as the horse's versatility and adaptability also influenced this decision.

For the carters, as an example of one profession that made a living from work with horses, the eventual shift to petrol-powered lorries after World War II was a sudden event that touched on the very fabric of their cultural lives. They often had strong social bonds to their horses and were emotionally attached to them. One Liverpool carter remarked: "Ah it was great with the horses, it's different, I don't know... with a motor it's not the same, you can't have the same love for a motor as you could with a horse."<sup>30</sup>

Even though the carters felt differently about it, the replacement of horses with motor vehicles was a long process depending on the type of horse, its utility, and economic calculations. Thus, working horses influenced the urban environment well into the twentieth century. Urban spaces were spaces full of people but until the mid-century, they were also built around the presence of animal power. The contribution of the carters and their horses to Liverpool's economy is now commemorated by a life-size monument of a working horse at the quayside in the port city.

### The horses' remains

Horsepower was completely recyclable, and its products were fed back into economic circulation. Worn-out horses were sold to knackers who destroyed the animals and recycled their remains. The hide was used to cover large boardroom tables. It could be turned into boots, whips, saddles, or the roof of a carriage. The bones were turned into knife handles or buttons. When boiled, they could also be used to make oil for candles. The horse's fat was used to fire lamps. Their intestines were used as sausage skins, while the tendons and hooves were manufactured into glue. Hair and mane found use in fishing lines, violin bows, or in the furniture industry where they served as stuffing for sofas or mattresses.

In Britain, horse meat was sold as dog and cat food and was not regarded as human food.<sup>31</sup> It is impossible to say, however, how much horsemeat entered the human diet "in the oblivion of sausage meat".<sup>32</sup>

**In Britain, horse meat was  
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not regarded as human food.**

It was also a known fact that knackers sold cheap cuts of horsemeat on the side to the poor. Hence, it was also a sign of social status not to have to eat horsemeat. While the acceptance of hippophagy increased in many continental European countries during the nineteenth and twentieth centuries, it remained a socially stigmatised practice in Britain.<sup>33</sup> However, the taboo was somewhat broken after World War II. Because of increasing levels of mechanisation there was an over-supply of horses. "Figures show that in 1948, [...], about 85,000 horses were killed for food in Great Britain, compared with 17,000 in 1938. The figure for 1952 was 63,000."<sup>34</sup>

After the war, the economy was eager to replace horsepower with fossil-fuelled machinery at a large scale and horse dealers found a profitable market in the sale of horses for slaughter.<sup>35</sup> Additionally, because of food rationing (meat was rationed until 1954), hippophagy became a temporary practice.

The government introduced regulative measures in 1941 by fixing a maximum price for the sale of horsemeat. Retailers were allowed to sell horseflesh at a maximum price of one shilling a pound. Considering the weight of a horse, at this price profit from selling horsemeat could only be made if the value of the horse was above thirty pounds. However, Trevor Handoll of the *News Chronicle* reported in August 1948 that dealers made 120 pounds on a single horse for which they had paid sixty pounds on a farm. Handoll stated that meat was so sought after that horsemeat made three shillings a pound, concealed as venison on the black market – and not for the one shilling a pound for horsemeat – to avoid food rations.<sup>36</sup>

Some scientific voices, also from within the government, tolerated this market as a source of protein for the population.<sup>37</sup> However, not the whole country had turned into hippophagists, and the public outcry was significant. Many expressed their irritation about the ongoing slaughter of horses by referring to the national self-perception of the British as a horse-loving nation and what they perceived as moral and immoral behaviour. Especially the press became a channel in which opposition to hippophagy was voiced.<sup>38</sup> Some took to more direct action and threw a clog at a lorry transporting horses for slaughter.<sup>39</sup>

Ultimately, hippophagy in Britain was a temporary practice. Repugnance went across society and as soon as the surplus stock of horsepower was absorbed and the food rations ended, horsemeat disappeared from the diet. This shows that horses are attributed certain human feelings that are not extended to other meat-producing animals, such as pigs, cattle, or sheep. Thus, the practice of hippophagy had implications for national identity formation processes.

### Conclusion

What this article was hopefully able to show is that the use of "old" energy resources did not come to an end with the first industrial revolution of the eighteenth century. Indeed, horsepower formed an essential power source until the mid-twentieth century as there were many economic but also practical reasons for the continued use of horsepower. Horses were an economic necessity and their remains entirely integrable into the economy.

## About the author

### Luise Elsässer, PhD



After obtaining her undergraduate degree in history at the University of Konstanz in 2016, Luise Elsässer obtained her MSc from the University of Edinburgh in 2017, specialising in colonial sports history. The same year, she started her doctoral studies at the European University Institute in Florence. Her thesis looks at the process from the peak of horsepower to its demise between 1870 and 1950. The work engages with access to, and the distribution and disappearance of, the horse as a significant organic energy source. With a strong focus on social and cultural implications, the thesis's ambition is to deliver a comprehensive understanding of the energy transition from horsepower to fossil fuel-powered vehicles.

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Verwandter Artikel im Ferrum-Archiv:  
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Logistik der Westfront im Ersten Weltkrieg  
von Kurt Möser in Ferrum 88/2016

## Annotations

- 1 These changes were also accompanied by innovation; see, for instance, Edward A. Wrigley, *Energy and the English Industrial Revolution*, Cambridge 2010.
- 2 F. Michael Thompson, *Victorian England: The Horse-Drawn Society. An Inaugural Lecture*, October 1968, Bedford College, University of London 1970, p. 8.
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- 8 Kristen Guest and Monica Mattfeld (eds.), *Equestrian Cultures: Horses, Human Society, and the Discourse of Modernity*, Chicago / London 2019.
- 9 Susanna Forrest, *The Age of the Horse: An Equine Journey through Human History*, London 2016. See for the role of horses in modernity, Kristen Guest and Monica Mattfeld (eds.), *Equestrian Cultures: Horses, Human Society, and the Discourse of Modernity*, Chicago / London 2019.
- 10 Felicity McWilliams, *Equine Machines: Horses and Tractors on British Farms c 1920–1970*, King's College, London, PhD thesis, 2019.
- 11 McWilliams (see n. 10), p. 29; Norton Greene (see n. 4), p. 2–4. The term "recycling" only emerged at the beginning of the 1970s in connection with resources. However, it is assumed here that we see a recycling society up until the 1950s.
- 12 See for human population of England, Wales, Scotland, and Ireland: [www.ons.gov.uk](http://www.ons.gov.uk) (Accessed on 12 February 2021).

- 13 McWilliams (see n. 10); Alun Howkins, *The Death of Rural England: A Social History of the Countryside since 1900*, London 2003, for example, claims mechanisation was a linear approach to the adoption of technology.
- 14 Fredrick Forshaw (born 1947) to Keith Chivers, 5 January 1990, in: *The Museum of English Rural Life [MERL], D CHIV A1/2/2, The Forshaws 2*.
- 15 Edith Whetham, *The Agricultural Expansion Programme, 1947–51*, in: *Journal of Agricultural Economics* (1955), p. 313–319, here: p. 317.
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- 17 *Coal Mines Regulation Act, 1887*.
- 18 John Galsworthy, *Inspection of Pit Ponies*, *The Times*, 10 December 1912, p. 4.
- 19 *Scheme to Feed 600 Pit Ponies*, *The Times*, 12 January 1972, p. 2.
- 20 J. R. McCulloch, *Dictionary of Commerce*, London 1834, p. II, 654.
- 21 *Shunting Horse*, Produced by British Pathé. UK, 23 August 1964. See also a note about Charlie's retirement in Somerset: *Picture Gallery*, *Times*, 21 February 1967, p. 1.
- 22 A livery stable keeper rents out space where horses can be kept or lets horses out for hire. A jobmaster is a man or woman who lets out horses and carriages by the job or for a limited time. See for the web of railway-employed horse contractors: *The National Archives [TNA], RAIL 252/1636, Agreement between Great Western Railway Company and Clifford Scribbin Snow (haulier, Swindon) for three horses*, 1 October 1910–31 July 1922; TNA, RAIL 267/39, *London Horse Establishment. Great Western Railway Company: Special Reports, 1877*; TNA, RAIL 267/64, *Cost of Horse Shunting. Report by Mr H. Lambert. Great Western Railway Company: Special Reports, 1880*.
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- 27 See, for example, Edward N. Clark, *The Cart Horse on the Quay: The Story of the Liverpool Cart Horses*, Garstang 1989; Thomas Almeroth-Williams, *The Brewery Horse and the Importance of Equine Power in Hanoverian London*, in: *Urban History* 40:3 (2013), p. 416–41.
- 28 Clark 1989, p. 19.
- 29 TNA, MAF, 52/59, *The Horse as a National Economic Factor, the Encouragement of Horse-Breeding; Memoranda by Major-General Sir John Moore; Licensing Statistics (1928–53)*, 22a.
- 30 *Museum of Liverpool, Albert Hilton. Interview Transcript*.
- 31 Gordon 1893, p. 183–90; See *Slaughter of Animals Act 1933*, in, TNA, MAF 52/65, *Export of Working Horses to Continent*.
- 32 Gordon 1893, p. 89.
- 33 Forrest 2016, p. 231.
- 34 *Parliamentary Correspondent, Horse Killing Industry*, *The Times*, 21 August 1953, p. 6. It is hard to arrive at reliable statistics but it can be assumed that hundreds of thousands of horses were slaughtered for human consumption between 1945 and 1954.
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