

# Appreciating working cattle worldwide, their cultural heritage and future importance

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## Abstract

Over 10,000 years, draft cattle technologies spread worldwide, creating diverse breeds, yokes, implements, carts, machinery, management techniques and cultural associations. People selected draft cattle for characteristics appropriate for agricultural and transport work and other operations. Numerous technologies were developed for harnessing, tillage and transport. These evolved to suit farming systems and socio-economic circumstances, with localised design compromises relating to size, shape, performance and environmental conditions. People developed techniques and rituals relating to working animal age, sex, appearance, team size and operators (generally men). Adapted equipment and techniques became traditional, embellished with folk art designs, colours, accessories and rituals.

The importance of draft cattle in agriculture and transport became embedded in cultural heritages and portrayed in songs, stories, toys, textiles, carvings, ceramics, coins, statues, paintings, books and (in recent years) on bank notes, stamps, photos, films and social media.

The historic importance of draft cattle is widely appreciated, but the 'old-fashioned' perception needs improving. Despite being labour-intensive and slow, draft cattle remain important in many farming systems in Asia, Africa and Latin America and have modern niche roles elsewhere. Where feed is limiting, smallholder farmers may switch to cow traction.

Draft cattle use can continue where there is labour and an enabling environment with support services (needing a critical mass of users). National and local policies, strategies and networks are required to ensure an enabling environment for draft cattle, so they remain an ecologically friendly and sustainable multipurpose power resource suitable for women and men in modern agricultural enterprises worldwide.

## Kurzfassung

Über einen Zeitraum von 10.000 Jahren verbreiteten sich Technologien für Zugrinder weltweit und führten zur Entstehung vielfältiger Rassen, Joche, Geräte, Karren, Maschinen, Managementtechniken und kultureller Assoziationen. Die Menschen wählten Zugrinder aufgrund ihrer Eignung für landwirtschaftliche Arbeiten, Transportaufgaben und andere Tätigkeiten aus. Es wurden zahlreiche Technologien für das Anspannen, die Bodenbearbeitung und den Transport entwickelt. Diese entwickelten sich entsprechend den landwirtschaftlichen Systemen und sozioökonomischen Gegebenheiten weiter, wobei lokale Kompromisse hinsichtlich Größe, Form, Leistung und Umweltbedingungen eingegangen wurden. Die Menschen entwickelten Techniken und Rituale in Bezug auf das Alter, das Geschlecht, das Aussehen und die Größe der Arbeitsgruppen der Tiere sowie die Bediener (in der Regel Männer). Angepasste Ausrüstung und Techniken wurden zur Tradition und mit volkstümlichen Kunstmotiven, Farben, Accessoires und Rituale verziert.

Die Bedeutung von Zugrindern in der Landwirtschaft und im Transportwesen wurde Teil des kulturellen Erbes und in Liedern, Geschichten, Spielzeug, Textilien, Schnitzereien, Keramiken, Münzen, Statuen, Gemälden, Büchern und (in jüngerer Zeit) auf Banknoten, Briefmarken, Fotos, Filmen und in sozialen Medien dargestellt.

Die historische Bedeutung von Zugrindern wird weithin geschätzt, aber die „altmodische“ Wahrnehmung muss verbessert werden. Obwohl sie arbeitsintensiv und langsam sind, spielen Zugrinder in vielen landwirtschaftlichen Systemen in Asien, Afrika und Lateinamerika nach wie vor eine wichtige Rolle und haben anderswo moderne Nischenfunktionen. Wo Futter knapp ist, können Kleinbauern auf Kuhzugkraft umsteigen.

Der Einsatz von Zugrindern kann dort fortgesetzt werden, wo Arbeitskräfte und ein förderliches Umfeld mit unterstützenden Dienstleistungen vorhanden sind (wobei eine kritische Masse an Nutzern erforderlich ist). Nationale und lokale Politiken, Strategien und Netzwerke sind erforderlich, um ein förderliches Umfeld für Zugrinder zu gewährleisten, damit sie eine umweltfreundliche und nachhaltige Mehrzweck-Kraftquelle bleiben, die für Frauen und Männer in modernen landwirtschaftlichen Betrieben weltweit geeignet ist.



## Résumé

Au cours des dernières 10.000 années, les techniques d'utilisation des bovins de trait se sont répandues dans le monde entier, donnant naissance à diverses races, jougs, outils, charrettes, machines, techniques de gestion et associations culturelles. Les gens sélectionnaient les bovins de trait en fonction de leurs caractéristiques adaptées aux travaux agricoles et au transport, ainsi qu'à d'autres activités. De nombreuses techniques ont été mises au point pour le harnachement, le labour et le transport. Celles-ci ont évolué pour s'adapter aux systèmes agricoles et aux circonstances socio-économiques, avec des compromis locaux en matière de conception liés à la taille, à la forme, aux performances et aux conditions environnementales. Diverses populations ont développé des techniques et des rituels liés à l'âge, au sexe, à l'apparence, à la taille de l'attelage et aux opérateurs (généralement des hommes) des animaux de trait. Les équipements et les techniques adaptées sont devenus traditionnels, embellis par des motifs, des couleurs, des accessoires et des rituels issus de l'art populaire.

L'importance des bœufs de trait dans l'agriculture et le transport s'est ancrée dans le patrimoine culturel et a été représentée dans des chansons, des contes, des jouets, des textiles, des sculptures, des céramiques, des pièces de monnaie, des statues, des peintures, des livres et (ces dernières années) sur des billets de banque, des timbres, dans des photos, des films et les réseaux sociaux.

L'importance historique des bovins de trait est largement reconnue, mais la perception « démodée » dont ils font l'objet doit être améliorée. Bien qu'ils nécessitent beaucoup de main-d'œuvre et soient lents, les bœufs de trait restent importants dans de nombreux systèmes agricoles en Asie, en Afrique et en Amérique latine, et occupent un créneau particulier ailleurs aujourd'hui. Lorsque les ressources alimentaires pour les animaux sont limitées, les petits exploitants agricoles peuvent se tourner vers l'utilisation des vaches pour le travail.

L'utilisation des bovins de trait peut se poursuivre là où il existe une main-d'œuvre et un environnement favorable avec des services d'appui (nécessitant une masse critique d'utilisateurs). Des politiques, des stratégies et des réseaux nationaux et locaux sont nécessaires pour garantir un environnement favorable aux bovins de trait, afin qu'ils restent une ressource énergétique polyvalente, écologique et durable, adaptée aux femmes et aux hommes dans les entreprises agricoles modernes du monde entier.

## Resumen

A lo largo de 10.000 años, las tecnologías relacionadas con el ganado de tiro se extendieron por todo el mundo, dando lugar a diversas razas, yugos, aperos, carros, maquinaria, técnicas de gestión y asociaciones culturales. Las personas seleccionaban sus bueyes y sus vacas de tiro por sus características apropiadas para las labores agrícolas, de transporte y otras actividades. Se desarrollaron numerosas tecnologías para el enganche, el cultivo del terreno y el transporte. Estas evolucionaron para adaptarse a los sistemas agrícolas y a las circunstancias socioeconómicas, con compromisos de diseño localizados en relación con el tamaño, la forma, el rendimiento y las condiciones ambientales. Las personas desarrollaron técnicas y rituales relacionados con la edad, el sexo, la apariencia, el tamaño del grupo de los animales de trabajo y los operadores (generalmente hombres). Los equipos y las técnicas adaptados se convirtieron en tradición y se decoraban con diseños de arte popular, colores, accesorios y rituales.

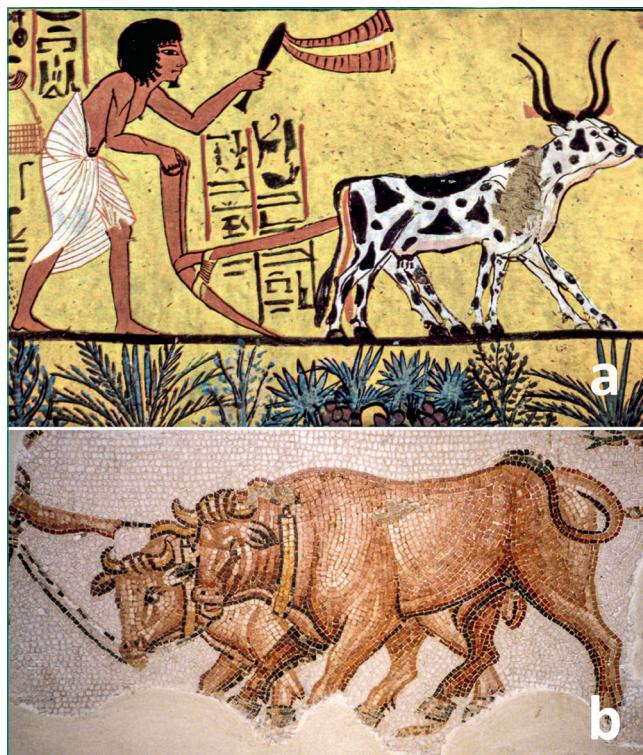
La importancia de la tracción bovina en la agricultura y el transporte se integró en el patrimonio cultural y se representaba en canciones, cuentos, juguetes, textiles, tallas, cerámicas, monedas, estatuas, pinturas, libros y (en los últimos años) en billetes, sellos, fotografías, películas y redes sociales.

La importancia histórica del uso de bueyes de tiro es ampliamente apreciada, pero es necesario mejorar la percepción «antiquada» que se tiene de él. A pesar de ser laborioso y lento, el ganado de tiro sigue siendo importante en muchos sistemas agrícolas de Asia, África y América Latina, y tiene funciones modernas específicas en otros lugares. Cuando el pienso escasea, los pequeños agricultores pueden recurrir al empleo de vacas para la tracción.

El uso de ganado de tiro puede continuar cuando hay mano de obra y un entorno propicio con servicios de apoyo (que requieren una masa crítica de usuarios). Se necesitan políticas nacionales y locales, estrategias y redes para garantizar un entorno propicio para el ganado de tiro, de modo que siga siendo un recurso energético, ecológico y sostenible con múltiples usos, adecuado para mujeres y hombres en las empresas agrícolas modernas en todo el mundo.

## Historical perspective

Cattle were probably domesticated about 10,000 years ago in Mesopotamia and were subsequently used for meat, milk, transport and agriculture. Draft cattle technology gradually spread through the Levant and into South Asia, North and Northeast Africa and Europe<sup>1</sup>. As will be mentioned and illustrated later, the use of yoked draft cattle for ploughing was clearly displayed in ancient Egyptian art, including stone carvings, models, wall art and on papyrus, some dating back over 4000 years<sup>2</sup> (see **Fig. 1**). By 2000 years ago, draft cattle were widely used in appropriate environments in much of Asia, north and northeast Africa and Europe. Draft cattle technology for agriculture and transport was much later transferred to the Americas (around 500 years ago)<sup>3</sup>. In Sub-Saharan Africa, the use of cattle as riding and pack animals dates back millennia and there was a long history of using cattle for some post-harvest operations in northeast Africa and into the Sahel<sup>4</sup>. The use of draft cattle for cart transport and soil tillage in Sub-Saharan Africa and Madagascar was introduced in colonial times, commencing about 370 years ago in South Africa<sup>5</sup>. In many sub-Saharan African countries, the use of draft cattle only became widespread in the twentieth century, and that is also true for various farming systems in Latin America, South Asia and the Pacific.



**Fig. 1** Ancient depictions of the use of draft cows and draft bulls. a) Mural of a man ploughing with two cows in the tomb of Sennudem in Egypt, c. 1200 BCE (York Project). b) Pair of draft bulls portrayed in a mosaic in Roman Tunisia, c. 150 CE (P. Starkey).

1 Pitt et al. 2018.

2 Rossiter 1984.

3 Starkey 2022.

4 Mudamburi/Starkey 2022.

5 Starkey 2000.

## Diverse draft animals

While draft cattle are the oldest and most numerous working animals, it is important to note that over time, other species have been found to be better adapted to particular conditions, operations and economic circumstances. After the domestication of horses, their speed made them preferable for many transport operations, including military ones. Donkeys became important for pack transport in mountainous regions and arid climates. For centuries in Europe, oxen were the default animal power source for small-scale farming, but horses became increasingly popular on larger farms in times of peace. In the nineteenth century, as farms and farm equipment increased in size, horses largely replaced oxen on large farms in Northern Europe<sup>6</sup> and North America. Certain other work animal species have filled important niche roles in particular environments, notably camelids (dromedaries in warm deserts, Bactrian camels in cool deserts and llamas in the Andes) and other bovids (water buffaloes in rice-farming systems, yaks around the Himalayas, banteng in Indonesia and goats in many countries). Elephants, reindeer and dogs have also played transport roles in specific situations. Wherever they are used, there are strong cultural associations with all types of working animal, and these are often portrayed and celebrated as cultural heritage. However, for thousands of years, cattle have been the most numerous draft animals, and the most important for smallholder farmers.

### Diverse draft cattle: *Bos taurus* and *Bos indicus*

There are two main species of cattle. The first domestication of aurochs probably occurred in West Asia around 10,500 years ago and led to the development of the humpless *Bos taurus* cattle that spread into Europe and North Africa. Some are likely to have migrated with people to West Africa<sup>7</sup>, as there are some small breeds of humpless cattle, including the N'Dama, that are resistant to trypanosomiasis (see **Fig. 14**). Humped cattle or zebus are likely to have evolved from a different strain of aurochs domesticated in the Indus valley around 8,500 years ago<sup>8</sup>. These are thought to have spread with human migrations into much of southern Asia and into northeast Africa, and onto much of sub-Saharan Africa. The zebu cattle are considered better adapted to hot climates, while taurine cattle can cope with cold conditions. Both species have been locally selected for certain characteristics, leading to distinct breeds. Certain breeds, including the Charolais (*Bos taurus*), were selected for their large size and strength for work. Similarly, many Indian breeds of cattle, including the Hallikar and Kangayam (*Bos indicus*) have been selected over the generations for their draft work.

Cattle were introduced into the Americas around 500 years ago, and into Australia and the Pacific about 250 years ago. While many of the initial introductions were with *Bos taurus* animals, there were also introductions of zebus, and much crossbreeding over the years. In general, due to their availability, zebus are the preferred draft cattle in south Asia and most of Africa, while in Europe and North America, taurines remain predominant. In Latin America there is a wide variety of draft cattle, including zebus, taurines and crossbreds.

6 Collins 2010.

7 Pitt et al. 2018.

8 Ibid.



### Diverse draft cattle: bulls, oxen and cows

In English (and several other languages) the word 'ox' means a working bovid and/or a castrated male. Historically, most working cattle have been castrated bulls. This has been logical as cows produce a surplus of male animals (only a small number of intact males are needed for breeding) and castration makes bulls more docile. However, intact bulls can be used for work, and this can be seen in several countries including Chad, Nigeria and Honduras. Some portrayals of working cattle in Roman times indicate that intact bulls were used (see *Fig. 1*) and it has been suggested that the castration of animals was not common in the middle east around that time<sup>9</sup>. It appears clear from murals and papyri that cows were used as draft animals in ancient Egypt (see *Fig. 1*). Around the world, there are smallholder farmers who use cows for work (see *Fig. 2*). Provided the work is relatively light and intermittent, draft cows can produce milk and remain fertile<sup>10</sup>. If feed resources are in short supply, it may not be worth maintaining oxen for intermittent work: the feed can go to working cows that can produce calves and milk as well as provide draft power (and meat and manure). Working cows have been important in Europe, North Africa, Indonesia and the altiplano of Bolivia and in particular circumstances in many countries including Cuba and Kenya. In Germany, it was reported that in 1934 there were 2.4 million working cows (about 25% of all dairy cows)<sup>11</sup>. The number of working cows was slightly greater than the number of draft horses and eight times the number of work oxen. An interesting case of an 'exception that proves the rule' could be seen in Portugal towards the end of the twentieth century. Most working cattle in the country at that time were dairy cows, used by smallholder farmers for some tillage and transport work. There were also some teams of draft cattle used to launch fishing boats and pull in fishing nets. These were used twice a day, throughout the year and oxen were the clear choice for this regular, income-generating, heavy work (see *title Fig.*).



**Fig. 2** Examples of using draft cows. a). Cow traction in Morocco, with yokes fitted with traditional fly-control extensions. b). Cows levelling rice field in Indonesia. c). Cows ploughing in the altiplano of Bolivia. d). Milking a draft cow during a break from field work in the Dominican Republic (all: P. Starkey).

### Diverse harnessing systems

Working cattle have generally been harnessed with wooden yokes. The yokes may be tied to horns (horn/head yokes) or they may rest on the ridge of the back between the shoulder blades known as the withers (withers yokes). With zebu oxen the withers is just in front of the

9 Cabanac/Bonniot-Cabanac 2006.

10 Simalenga/Pearson 2003.

11 Kropp 2024.



**Fig. 3** Examples of withers yokes and horn/head yokes for use with one or two animals (P. Starkey).

hump. The term 'neck yoke' has been used in various documents to describe both types of yoke, and also bow yokes<sup>12</sup>, and so this terminology is no longer clear and is best avoided. Yokes can be double or single. Pairs of yoked draft cattle can be hitched in teams of four, six, eight or more animals. Teams of animals can be used for heavy ploughing (see *Fig. 7*) and for pulling large loads (see *Fig. 11*).

While head/horn yokes are tied to the animal, withers yokes rest on the withers and are generally loosely secured to the animal with a rope, strap, staves, bow or subframe. The spacing of the animals can be determined by the curved shaping of the yoke or by vertical staves or U-shaped bows. Different yoke sizes are required for various operations, with short yokes being used for ploughing and longer yokes used for transport, ridging and inter-row weeding.

There are advantages and disadvantages of the various types of yoke and frequently there are strongly-held views about the best yokes. The double withers yoke allows animals to move their heads easily and seems

more natural. The double head/horn yoke restricts the animals' head movements, which can be an advantage if the animals are not docile. The secure connections to the animals also aid braking, which can be beneficial particularly for transport and logging operations. The bows and staves of withers yokes can allow the animals to push with their shoulders, and this is said to increase their efficiency.

Other, less common harnessing systems include withers yokes made from leather or cloth, forehead yokes and collars. Collars can be 'full', as often used with draft horses, or just three-pads and wooden hames (as shown in *Fig. 14*). An unusual and rare harnessing system is the 'belly' yoke of north Africa designed to allow animals of different species to work together. The 'belly yoke' is based on two single withers yokes each attached to a swingle-tree beneath the walking animals.

Numerous designs of yokes have been developed and become part of the local heritage (see *Fig. 3*). A specially

12 Conroy 2004.

curated exhibition of yokes from around the world was held at the Lauresham Open-Air Laboratory at Lorsch in Germany in 2024, with an attractive and informative catalogue produced to complement it<sup>13</sup>. That exhibition illustrated very many yoke designs, often made with great skill and artistic talent. Many yokes are embellished with carved designs, added not for practical reasons but to celebrate their creativity and cultural heritage<sup>14</sup>.

## Diverse operations for draft cattle

The earliest uses of draft cattle might have been for simple transport operations (possibly pack transport and dragging loads, perhaps with simple sledges) and for soil tillage with simple wooden implements that evolved into ard ploughs fitted with metal points or shares. Primary tillage and transport have been the main tasks of draft cattle for the past two millennia. Early ploughs were symmetrical ards, with long beams attached to the yoke (see *Fig. 1* and *9*). Many variations of basic long-beamed ard ploughs can be found in use around the world today<sup>15</sup>. They are widely used where cattle are employed for primary tillage in south Asia, north and northeast Africa and in Latin America, where they were introduced by Spanish and Portuguese colonialists (see *Fig. 2*). The reasons for their long-standing popularity and success include their simplicity for village-level construction and repair, and their ease of transport to the field. Wooden mouldboard ploughs that invert the soil were developed in Europe in the mediaeval period (see *Fig. 7*)<sup>16</sup>. Following the industrial revolution, factory-made mouldboard ploughs became common in Europe and North America and were introduced into sub-Saharan Africa. Mouldboard ploughs can be used for making ridges and earthing up, but symmetrical ridgers, with two mouldboards, were developed to improve performance.

Wheeled carts became increasingly important for carrying heavy loads. Ox carts were crucial for land transport in the Roman period<sup>17</sup>. Two-wheeled carts were, and remain, the main transport devices pulled by draft cattle, as they are relatively simple to make, use and maintain. Four-wheeled wagons are more expensive and complicated (with steering mechanisms) but they can carry larger and heavier loads, and are suitable for commercial use as well as for caravans, baggage trains and wagon trains. In many countries, resource-poor, smallholder farmers use simple sledges, often made from V-shaped tree-branches that can be dragged by draft cattle. Sledges are very cheap to make, and simple to use, but they scrape on the ground and can cause erosion, causing them to be banned in some countries<sup>18</sup>. Oxen can be ridden and/or used for pack transport (see *Fig. 4*). While that form of transport is used by pastoralists in Africa and Asia (and also in a few other countries, including the Dominican Republic), this is relatively uncommon as equids are generally better suited for riding and packing.

Secondary tillage using simple harrows has been widespread for millennia, and in their simplest form harrows are simply tree branches that are pulled across land

13 Kropp 2024.

14 Smerdel 2024.

15 Haudricourt/Delamarre 1955.

16 Ibid.

17 Raepsaet 2002.

18 Starkey 2000.

to break up clods and make a seedbed. In the nineteenth century, various designs of steel harrows were developed to replace the traditional wooden frames, and some models included spring tines or discs. Tine weeding with draft cattle appears to have been relatively recent, following the mechanisation of row planting.

In South Asia and East Asia, implements were developed to allow irrigated rice production, with animal-drawn ploughs, harrows and levellers. This technology was spread to appropriate locations worldwide.

An early use of draft cattle was for post-harvest operations, including threshing, by trampling and/or pulling a sledge or a roller. Threshing was illustrated in Ancient Egyptian murals and papyri<sup>19</sup> and mentioned in Semitic religious texts and Greek and Roman writings. Working cattle (and other livestock) were used to turn mills to grind corn and to extract oil. Draft cattle were also used to raise water from wells, by pulling ropes or by turning wheel. The spiral *saqiya* mechanism for raising water seems to have originated about 2300 years ago in the Nile valley and for over two millennia was important for irrigating fields. Such water-raising and post-harvest operations are still undertaken in some countries, although such uses of draft cattle are declining<sup>20</sup>.

It is likely that some of the earliest uses of draft cattle were to drag timber, and this has continued in many situations where draft cattle are maintained. There have been some commercial forestry enterprises that have used oxen for logging, including in Chile, Costa Rica, Mexico, India, Myanmar and Malawi<sup>21</sup>. Selective logging with draft animals is seen as a modern solution to forest degradation, and a range of implements have been designed including skids and sulkies<sup>22</sup> (wheeled arches, see *Fig. 4*). Small-scale logging with draft cattle remains important in some localities, including for smallholder farmers in North America and Europe (including France).

The diversity and range of the types of implements and machines developed for use with draft cattle is huge. However, even more remarkable are the countless variations on each operational theme, developed by local adaptations that became typical of particular localities, and so part of their cultural heritage. Ard ploughs and ox carts, for example, have a few basic principles, but these have allowed so many variations in how they are built, how they perform and what they look like. The boat-shaped ox cart shown in *Fig. 4* is only found in one area of Turkey, and other designs of carts have become typical of other areas. All these designs, embellishments and traditional practices add to the worldwide cultural heritage of draft cattle operations.

19 Stead 1986.

20 Lowe 1986.

21 Hedman 1991.

22 Cordero 1988.



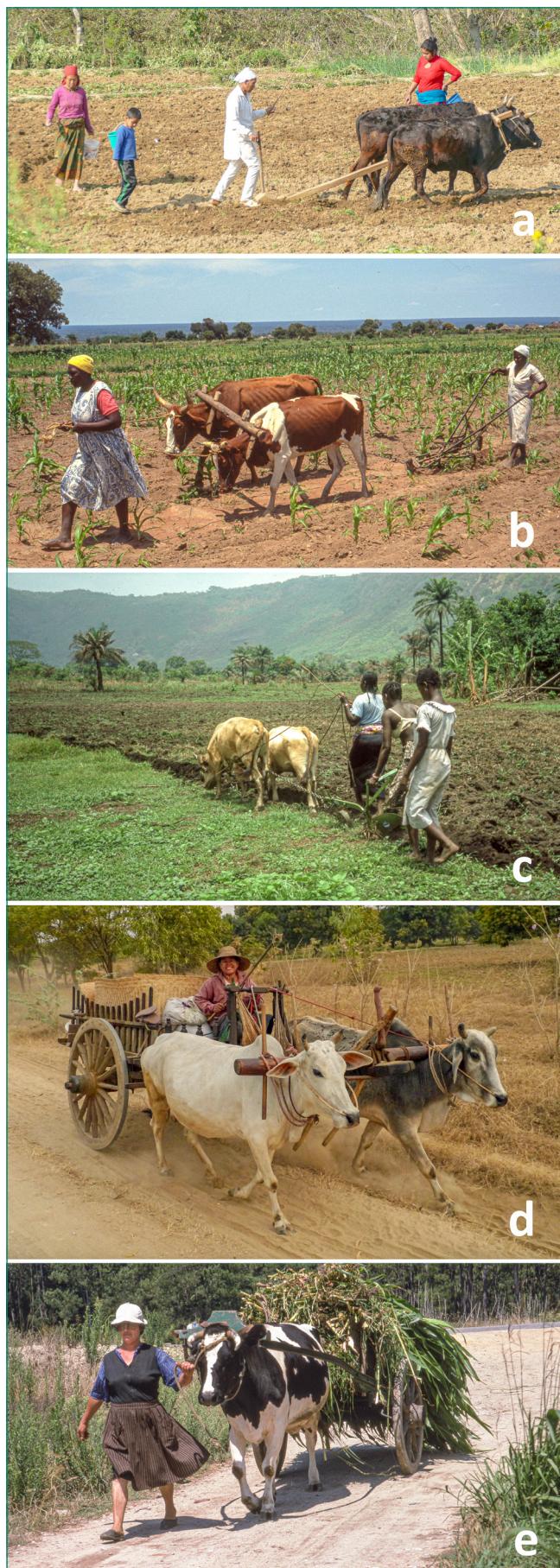
**Fig. 4** Examples the diversity of operations that can be performed by draft cattle. a). Man with two draft cows ploughing in Egypt with a wooden ard. b). Man weeding cotton with oxen using a wide withers yoke in Zimbabwe. c). Men using pack oxen to carry goods to market in Sri Lanka. d). Man loading traditional cart in Turkey. e). Oxen turning a 'trapiche' sugar-cane mill in Honduras. f). Oxen logging with a sulkies in France (all: P. Starkey).

## Women and draft cattle

In much of the world, working with draft cattle has tended to be a job for men. The author estimates he has taken tens of thousands of photos of draft cattle working in over 60 countries worldwide, and he estimates that in over 95% of these photos, men have been in control of the animals and the equipment. Due to his interest in gender issues with draft cattle, the author has been collecting photographed examples of women in control of draft cattle, and these have only occurred on perhaps 100-200 occasions (out of more than ten thousand photo opportunities). On the other hand, there are numerous photos of women assisting with draft cattle operations, for example leading the work animals or planting seeds behind a plough (see **Fig. 5**). Women are also frequently passengers in ox carts or wagons. In contrast, in the author's photos of donkeys in use for carrying, riding or cultivating, women or children are much more frequently in control, perhaps in as many as half of all photographed occasions in 50 countries. Naturally, those roughly estimated figures are purely indicative, but they do illustrate some differences in the traditional roles of men and women in controlling work animals.

In most countries in the world, traditional roles and ownership relating to cattle have meant that men have generally been responsible for working with draft cattle in both field and transport operations. This generally was the case whether farmers were working with their own animals or paying workers to do the operations. On small-holder operations, where labour is short, men and women may work together with the draft cattle, but it is frequently the men who control the technologies (such as the tillage implements). However, in recent years, women have increasingly been responsible for working with draft cattle, sometimes because men worked away from their farm and were unavailable when the operations were required (see **Fig. 5**). Historically, this was also the case, notably when men left their farms during times of war. That women can work well with draft cattle is not in any doubt, and the gendered allocation of tasks has been an attribute of societies and cultures, and this may be changing, albeit slowly.





**Fig. 5** Examples of women working with draft cattle. a). Man ploughing with draft cattle in Nepal, as women follow with seeds and fertiliser. b). Women in Zimbabwe weeding with draft cows, as men away in distant jobs. c). Members of a women's association ploughing

with N'Dama cattle in Sierra Leone. d). Woman returning from market in an ox cart in Myanmar. e). Woman controlling a cow pulling a cart with forage from a family smallholding in Portugal (all: P. Starkey).

### Adaptation and optimisation

From the moment a draft animal technology is tried in an area (whether by invention or copying from someone else), it is likely to be gradually modified by individual users to better fit their circumstances. This is the beginning of local optimisation. Equipment, techniques and practices gradually change to be appropriate to the local animals and resources. Similarly, the draft cattle are gradually modified, by individual training and by genetic selection and breeding to be appropriate to the work (and other outputs) required of them.

For example, if the initial design of a plough appears heavy, some people may make a lighter plough. If a plough appears liable to break, some people may make stronger ones. Different farmers or blacksmiths may change the angle of attack of the ploughshare, and on a mouldboard plough change the size and curvature of the mouldboard. Yokes may be made lighter or stronger, more or less curved and their length may be varied too.

Some farmers may move from using two animals to using just one, or vice versa. Some may start to train their animals at a young age. Some may sell their working cattle after one or two seasons, while others keep them for many years. Some may use cows for work, while others use bulls or oxen.

Neighbours may copy the more successful of the various management techniques and harnessing and implement options. The result is that the methods and technology gradually evolve in every area, and draft cattle systems diverge.

The result is that within countries, provinces and districts there are unique systems of utilisation associated with particular areas. Whether it be breed of cattle, type and design of yoke or choice and characteristics of implement, there is a great overall diversity, with local areas of relative homogeneity, that people in that area consider to be their normal, traditional practices.

The differences in draft cattle technologies between provinces and regions will be mainly due to the local adaptation and optimisation of utilisation systems appropriate to the local circumstances. However, some differences may also represent technological drift, as imperfect copies gradually lead to changes over time and space. Similar situations occur in biological populations of plants and animals that gradually diverge across their ranges, partly as a result of local adaptation to the environments, and partly due to genetic drift.

### Optimisation rather than maximisation

It is important to understand the concept that farmers tend to optimise their draft cattle systems to their local ecosystem(s), available resources and socio-economic circumstances. There have been many researchers who have developed 'better' technologies that maximise certain benefits. For example, ploughs that invert more soil, animals that are larger and stronger or collars that appear to provide a more efficient angle of pull. The researchers have often suggested they have 'perfected' the technologies, only to find that farmers have rejected them. For example,

much time was spent developing and promoting multipurpose wheeled toolcarriers<sup>23</sup>, pulled by draft cattle, which were found to be excellent on research stations, but were seldom adopted by smallholder farmers, who preferred a range of lighter and simpler implements (see *Fig. 6*). While researchers were concentrating on productivity in large fields, the farmers had to consider many more parameters as they generally worked on smaller plots with smaller animals. A large animal may be stronger, but it is also likely to be more costly, require more food and represent a greater financial risk should it die or be stolen. An ox may be stronger, but a cow can give calves and milk besides work. A steel mouldboard plough may be better at soil inversion, but it is heavier to carry to a distant field. A multipurpose implement is a clever concept, but it tends to be heavier and if something fails, all implement options are lost at the same time. A collar-based harnessing system may be efficient, but a wooden yoke may be much cheaper and simpler. Researchers working with farmers to improve their operations need to share the holistic approaches used by farmers and understand that all choices tend to be based on compromises between performance, cost, convenience, risk and other factors.



**Fig. 6** Draft oxen pulling wheeled toolcarriers on research sites. a). Ridging on research station in India (International Crops Research Institute for the Semi-Arid Tropics). b). Testing minimum-tillage planter in Nicaragua c). Earthing up maize in Cuba (both: P. Starkey).

23 Starkey 1988.

## Local traditions and loyalty to these

Whether due to intentional local adaptations or the result of technological drift, the local people that have grown up with a particular technology around them, regard this as traditional and are often very proud of their traditions. They will often praise their own system in comparison with diverging systems in neighbouring areas. A good example relates to yoking systems in France. As noted before, there are two main types of yokes for working cattle. The horn/head yoke fits on the neck just behind the head and is tied to the horns. The withers yoke fits at the other end of the neck, above the withers, close to the shoulders. In much of the world, these two types of yoke seldom overlap, with withers yokes being common in most of Asia and much of Africa, and horn/head yokes being dominant in Latin America and parts of West Africa. In France, there is a chimera of distribution, with many departments having their own traditional yokes that is one of the two types and perhaps very different from those of the neighbouring departments. Despite the close proximity of the two types throughout most of France, neither type has led to the displacement of the other. Both types are strongly defended by their users, as better than those in neighbouring departments. From the technical point of view, this is not surprising, as attempts to show the clear advantages of one type of yoke have seldom achieved a clear overall advantage in terms of training, animal welfare, work efficiency and simplicity in manufacture and use (although most have shown the inefficiencies of poorly fitted yokes)<sup>24</sup>. The lesson from the yoke diversity of France is that farmers appreciate, and are loyal to, their traditional designs, and the potential advantages of the other yokes (claimed by the farmers in their neighbouring departments) have not been sufficient to reject their traditional designs.

## Traditional designs and folk art

The boundary between traditional designs and folk art is blurred. If part of a design is attractive but unnecessary, it is clearly art. Yet the traditional, functional designs made by artisans may also be considered as folk art. Many of the technological features of the harnessing systems, implements and carts used by working cattle are clearly part of local folk art and cultural heritage. Extra carving on yokes is very common, as is painting of carts in traditional colours and designs. The coats of the animals may be fashioned creatively, and the tassels of the fly protectors may be intricate and typical of a particular region. In addition, on special days of the year, such as the start of the planting season or the beginning of harvesting, or at the time of religious festivals or important local events, additional drapes, tassels and flags may adorn the working cattle and their implements or carts. Such items are technologically superfluous, but culturally and psychologically important for the farmers and their communities.

In some cases, the benefits of the folk art appear to outweigh the technological efficiency. Examples of this are the wonderfully carved and painted yokes used in parts of Portugal, including by the ox handlers that pull in fishing nets and boats (see *Fig. 3*).

24 Starkey 1989.





**Fig. 7** Illustration of ploughing with a team of four oxen from the mediaeval British Luttrell Psalter, c. 1330 CE (Copyright: British Library Board, Add. 42130, f. 170).



**Fig. 8** Painting on a traditional beehive featuring ploughing and harrowing using oxen fitted with collars, Slovenia, 1897 (Slovene Ethnographic Museum).

These yokes are beautiful, with intricate carving and painting of tall panels on top of the yoke beam. They are further adorned by horse-hair plumes. However, the yoke appears to be ergonomically poor, being much heavier than necessary (due to the carved panel) and insufficiently curved to fit the necks of the oxen comfortably. It seems that the importance of the folk art to the people has taken precedence over functional simplicity and the ergonomic comfort of the animals.

### Portraying and embedding cultural heritage

Since the domestication of cattle and their employment for work, people have portrayed their uses in many different art forms, including songs and stories, drawings and paintings (using different materials and techniques), stone and wood carvings, metal work, ceramics and other forms of art. Models have been made as ornaments, funerary objects, toys, presents and souvenirs. The roles of working cattle have been described, authorised, proscribed and/or illustrated in manuscripts, laws, texts and books. For example, the biblical book of Deuteronomy dating back to the 7th century BCE, proscribed the muzzling of oxen when they were used for threshing<sup>25</sup>. In Ethiopia, the Orthodox Church prohibits the use of oxen on certain days, and in Nepal, where oxen are widely

used, they are not generally worked in the Kathmandu Valley, that is sacred to Lord Shiva.

In general, the portrayal of animal power has been seen as a positive part of the cultural heritage. On Graeco-Roman coins the person working with the animals was often a ruler or other dignitary. This was related to the ceremony marking the foundation of a city, where a dignitary controls a yoked bull and a cow pulling an ard plough to create a furrow marking the initial city boundary<sup>26</sup>. However, the technological accuracy of the designs portrayed can be debateable. On Roman coins the draft animals often appear to be oxen<sup>27</sup>. The writers, artists, sculptors and designers were not necessarily well-informed about (or interested in) specific technical details and so their creations may not correspond exactly to the reality of what they were trying to convey. This creates a dilemma for modern interpretations of historical depictions. Evidence from recent inaccuracies of draft cattle utilisation depicted on bank notes (see **Fig. 11**) and stamps, suggests that care must be taken when commenting on specific details in historical representations of working cattle. For example, in the mediaeval Luttrell Psalter depiction of four oxen pulling a plough, the horn of one of the rear oxen appears to be on the wrong side of its yoke (**Fig. 7**).

<sup>25</sup> Deuteronomy 25:4.

<sup>26</sup> Rykwert 1976.

<sup>27</sup> Jellonek 2022.

## Paintings

For centuries, the importance of working cattle has been portrayed in many types of artwork including drawings, paintings and carvings, and more recently in photographs and films. Some of the oldest and clearest drawings and paintings come from the tombs of ancient Egypt, where they have been painted on walls and included in illustrated papyri, including versions of the Book of the Dead<sup>28</sup>. In such wall paintings and papyri, many dating from around 1000 BCE, the use of cattle is clearly seen for ploughing and threshing and cows are seen providing milk. While the ancient Egyptian artists did not master perspective, they clearly show pairs of animals, yoked and pulling ard ploughs not dissimilar to those seen in modern Egypt (see *Fig. 4*). Interestingly, many working cattle appear to be cows (with small udders and four teats, see *Fig. 1*), with masculine anatomy not as clear. This is not surprising, as cows have frequently been used for ploughing in irrigated farming systems, and cows are still used for ploughing in Egypt today (*Fig. 4*).

In mediaeval Europe, the illustrators of manuscripts would sometimes include agricultural scenes. The fourteenth century portrayal of a wooden mouldboard plough pulled by a team of four oxen shown in the Luttrell Psalter has become well known (*Fig. 7*).

In the past millennium, numerous artists have used watercolours or oil-based paints to portray working cattle, with their roles in transport and primary tillage particularly common. In addition to paintings on paper and canvas, working cattle have also been painted on animal skins and wooden panels. In Slovenia, there has been a long tradition of decorating bee-hive panels, and among the many designs, have been working cattle (*Fig. 8*). Some of the paintings of working animals have been more entertaining than accurate.

## Stone, ceramics and bronzes

For thousands of years, people have been portraying the importance of working animals through marks and paintings on stone and pottery, the carving of stone and wood, the creation of statues made from bronze and the decoration of tiles and mosaics. The ancient Egyptians carved bas-relief images of working cattle<sup>29</sup>. There are Greek pots with pictures of oxen ploughing<sup>30</sup> and Roman mosaics portraying working cattle, including working bulls (see *Fig. 1*). More recently, in the early twentieth century, blue ceramic tiles were used in São Bento railway station in Porto to portray some of the history and cultural heritage of Portugal, including depictions of oxen pulling carts. In West Africa, bronze has been used to create three-dimensional art, including the depiction of draft cattle (see *Fig. 9*).

## Models

For millennia, the importance of working animals has been portrayed in models including works of art, technical models, toys and souvenirs. Models of two cattle ploughing have been found in Egyptian tombs dating from about 1850 BCE (*Fig. 9*)<sup>31</sup>. These reinforce in three

dimensions the Egyptian paintings of this era, although the sex of the animals is not clear. Models of working cattle, local carts and wagons have been produced for centuries in many countries as toys, souvenirs and works of art. These models acknowledge the cultural heritage of the local designs, which may differ from those of neighbouring areas and countries.



**Fig. 9** Examples of models of draft cattle. a) Ancient Egyptian wooden model of man ploughing with two yoked cattle, c. 1850 BCE (British Museum). b) Recent bronze model of man cultivating with draft oxen in Burkina Faso. c) Recent wooden model of oxen with painted yoke pulling traditionally painted cart in Costa Rica (both: P. Starkey).

## Currencies

As already discussed, working cattle have been portrayed on ancient coins. Examples include a silver Greek coin from Tarsus minted around 425–400 BCE that shows a pair of yoked cattle being worked with an ard plough (*Fig. 10*). As noted above, a ‘foundation scene’ with yoked pairs of draft cattle pulling ard ploughs was commonly depicted on Roman coins, notably in the period 100 BCE to 100 CE (*Fig. 10*). Oxen have subsequently been portrayed on coins in several countries including the Dominican Republic, Egypt, Ethiopia, Nepal and Vatican City (*Fig. 10*).

28 Rossiter 1984.

29 Haudricourt/Delamarre 1955.

30 Ibid.

31 Andrews 2000.





**Fig. 10** Examples of coins featuring draft cattle. a) Silver Greek coin, c. 410 BCE. b) Silver Roman denarius c. 27 BCE (both: British Museum). c) Ethiopia one-santim coin, 1977. d) Nepal two-rupee coin, 2006 (both: P. Starkey).

Since the widespread use of bank notes as day-to-day currencies, several countries have portrayed working cattle<sup>32</sup>. Examples include Algeria, Bangladesh, Cambodia, China, Ethiopia, Guinea, Mongolia, Mozambique, Rwanda and South Africa (see **Fig. 11**). It is interesting to note that 'oxen' is now the name of a cryptocurrency.

As mentioned earlier, artistic representations may not be technically accurate. This appears to be the case in some bank notes, that do not realistically reflect the actual use of working cattle in that country. For example, the 50 Franc note of Guinea Conakry in 1985 shows two large, humped oxen, with a withers yoke pulling a wooden-beamed plough (**Fig. 11**). This image is very different from the work oxen seen in Guinea at this time, as they were dwarf, humpless N'Dama cattle, fitted with head/horn yokes and pulling steel ploughs by chains (similar to **Fig. 5** and **Fig. 14**). It is likely the currency image was inspired by the work oxen and implements used in Cuba (with which Guinea was closely associated at the time). In another example of probable inaccuracy, a 500 taka note issued in 2011 in Bangladesh showed agricultural scenes with four yoked oxen working in a field. The original design may have been based on a photo of two-pairs of animals walking close together while levelling a field (although no implements are shown). In the printed design, the artist has provided a single, four-animal yoke with no staves or ties, which is clearly unusual (**Fig. 11**).



**Fig. 11** Examples of bank notes featuring draft cattle. a) Ethiopia, b) Cambodia, c) Guinea (showing Latin American animals and implement), d) Bangladesh (showing unlikely 4-animal yoke), e) Mozambique, f) Rwanda g) Mongolia (all: P. Starkey).

### Postage stamps

The first postage stamps were produced in the UK in 1840, and the first designs with animals were produced in Canada in 1851. There was then a proliferation of designs featuring various aspects of the cultural heritage of the issuing countries. In 1899, Cuba created stamps portraying two oxen pulling a wooden-beamed plough. In 1942, Panama issued a stamp showing a pair of oxen fitted with a head/horn yoke pulling a cart loaded with wood. In the 1940s and 1950s, some countries, including the USA and New Zealand, included oxen in the designs of stamps commemorating significant centenaries. By

the 1960s, many countries produced thematic issues of stamps and some of these included oxen in the context of local agriculture, transport, paintings, traditions and festivals. Some of these are illustrated in **Fig. 12**.



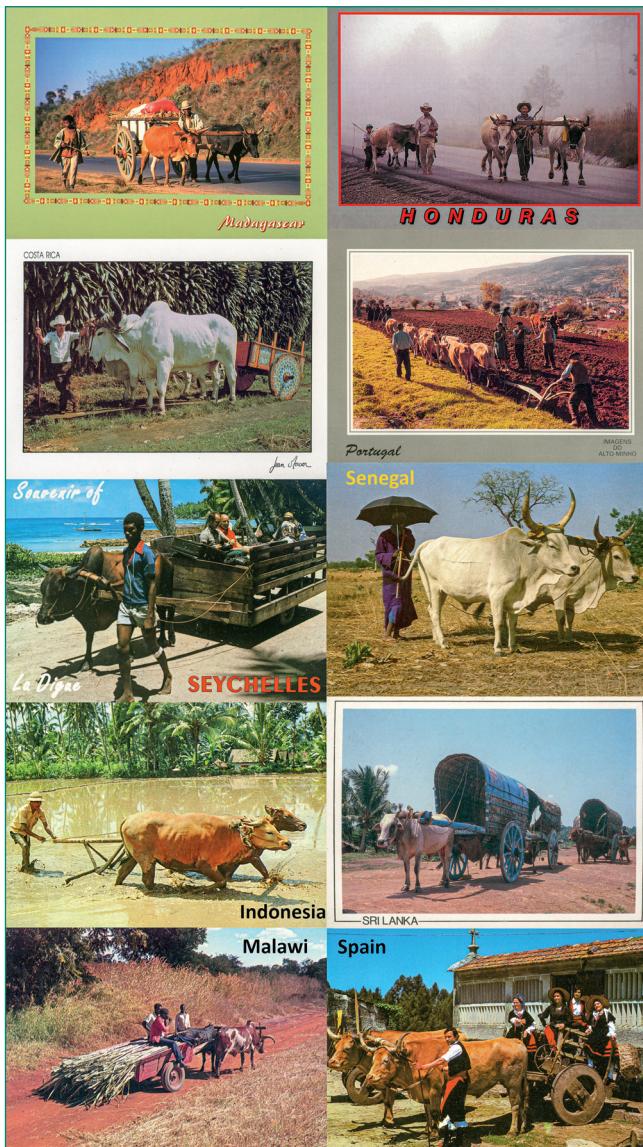
**Fig. 12** Examples of postage stamps featuring draft cattle (P. Starkey).

## Postcards

Postcards started being used as a rapid means of simple and low-cost communication in the second half of the nineteenth century<sup>33</sup>. In the twentieth century, picture postcards based on photographs become popular, and significant markets developed for tourist postcards designed to be kept as souvenirs and to be sent to friends and relatives. Favourite subjects included beautiful scenes, historic buildings, wildlife and the local cultural heritage. In many countries, working cattle, often pulling traditional carts, were considered part of the local heritage.

33 Staff 1966.

tage to be highlighted and were included in tourist postcards. Some examples are illustrated in *Fig. 13*.



**Fig. 13** Examples of postcards featuring draft cattle (P. Starkey).

## Demonstrating cultural heritage and modern uses

Worldwide, people tend to be proud of their cultural heritage, including the use of draft cattle. Historic uses of draft cattle and associated folk art are generally appreciated and sharing these can be popular, whether in museums, festivals, exhibitions or demonstrations.

The heritage of working cattle is frequently displayed in museums, particularly agricultural and open-air museums. Museum displays may include collections of yokes, tillage implements, carts and wagons. The displays may be accompanied by drawings, paintings or photographs illustrating how the draft cattle were worked, and there may be references to the local cultural heritage of traditions, including carving of yokes and the painting of carts and wagons.



The Museum of English Rural Life, at the University of Reading, has a large display (and an on-line exhibition) of local designs of carts and wagons from many different counties of England<sup>34</sup>. While work oxen had been the main source of farm power in ancient and mediaeval times, they were gradually replaced by horses, and so the carts and wagons currently displayed would have mainly been pulled by draft horses<sup>35</sup>.

With increasing urbanisation, and large populations of people that have limited contacts with, or knowledge of, agriculture, the contents of museums relating to draft cattle may seem to have distant connections to urban people, whether in space or time. The problem of connections is greatest in highly industrialised and mechanised countries and in large cities, anywhere in the world. However, even in countries without massive urbanisation, museums can seem separated from the rural technologies they display. For example, in October 2023, at the Folk Heritage Museum in Kawangjanga, Bhutan, there was a good collection of traditional equipment used with draft cattle including yokes, ploughs, harrows, muzzles and pack saddles. However, the local museum staff had little knowledge about the uses of these items in its collection, even though similar technology would have been in use in the local rural area.

The words 'heritage' and 'museum' convey a retrospective approach, which is entirely natural. However, in many countries, draft cattle are part of the present and will be part of the future. Therefore, in addition to celebrating the past, there is a need to publicise the on-going and future value of animal power, through agricultural shows and traditional fairs, exhibitions, demonstrations and networking events. Museums (especially agricultural, rural life, folk and open-air museums) can play an important role in this, provided they are in contact with people and organisations currently engaged in promoting and using animal power.

Two good examples of demonstrating both past and present uses of draft cattle took place in Europe recently. In March 2024, the Lauresham Open Air Laboratory (and now also the Centre for Draft Cattle Research and Education) in Kloster Lorsch, Germany, hosted an international conference on draft cattle. At this event, and also at the subsequent open day for visitors, the displays included demonstrations of mediaeval draft cattle technologies in action, for which the experimental archaeology laboratory is famous<sup>36</sup>. However, they also included practical demonstrations of modern animal power equipment and diverse operations using oxen, including training techniques, logging and the preparation of raised beds (see *Fig. 14*). The local and international visitors were also able to see a curated exhibition of yokes and related photos showing current draft cattle uses in many parts of the world<sup>37</sup>.

In May 2024, the French farmer Philippe Kuhlmann invited farmers and interested persons to a three-day event on his farm, with numerous demonstrations by work oxen and cows (from many different farms) of tillage and logging operations, and the use of different yokes and har-

nesses. There were exhibitions of past and present yokes and harnesses and various traditional and recently-developed equipment (see *Fig. 14*). The event culminated in a procession of many different draft cattle through the local town at the time of a traditional fair. This event highlighted the potential and benefits of networks of practitioners and ways in which they can not only share information among themselves, but also involve other interested professionals and the general public.



**Fig. 14** Draft cattle networking events and demonstrations a) Demonstrating N'Dama draft cattle in Guinea, organised by a local network. b) Demonstration of a single ox pulling a modern Kassine disc-ridger at a world draft cattle symposium in Lorsch, Germany. c) Participants preparing draft cattle at a networking event hosted by Philippe Kuhlmann in Châtelus-Malvaleix, France (all: P. Starkey).

Similar types of demonstration and networking events are also likely to be undertaken at other open-air museums, living history farms and agricultural shows and these can demonstrate and publicise both draft cattle heritage and modern applications. Such links between the past and the present can be important, as the use of draft cattle is increasingly being perceived as a part of history, particularly by young people in urban areas who may not be familiar with current uses. Urban people seldom see draft cattle in use, and the images they do see on social media, television and films and in publications, generally relate to historic situations. Where images of draft cattle are shown in the contemporary world, they may be associated with resource-poor farmers in difficult situations. In these cases, the messages being conveyed are seldom those of positive 'cultural heritage' since the

34 MERL 2025.

35 Collins 2010.

36 Kropp 2022.

37 Kropp 2024.



**Fig. 15** Examples of artisanal support services needed for draft cattle. a). Demonstration of French yoke making. b). Yoke making in Guinea. c). Cartwheel making in Madagascar. d). Shoeing a draft ox in France (all: P. Starkey).

draft cattle appear to be associated with poverty and lack of modernisation<sup>38</sup>. Indeed, the word ‘backward’ has been used to describe certain areas in India where the use of draft cattle is common and ‘backward’ was used to describe areas where oxen were still being used in Britain and France<sup>39</sup>. In the setting of a West African university, a suggestion to promote work oxen was ridiculed by some academic staff as ‘a U-turn back to the stone age’. While such words might not be common, young people growing up in urban environments are likely to succumb to the old-fashioned images associated with draft cattle and assume that working cattle are predominantly historical. They need to be informed that using draft cattle can be a sustainable and environment-friendly technology that is still relevant. Working cattle can be ‘modern’ and highly appropriate for many different farming situations. Therefore, the sharing of draft cattle information in the media, exhibitions and museums should aim to improve societal perceptions to allow the continued use of draft cattle in appropriate ways.

## Future of draft cattle: need for support services

Users of draft cattle need certain services to enable them to operate effectively. They need artisans or manufacturers who can supply and repair the technical hardware: yokes and harnesses, carts, wagons and a variety of soil tillage and other implements. They need sources of suitable animals and perhaps assistance with training the animals. The animals may need veterinary and health services, nutritional supplies and possibly farriers familiar with cattle. In some situations, farmers may need specialised financial services, able to provide appropriate credit and perhaps insurance. In rural villages where the use of draft cattle is common, some of these support services are likely to be available from other farmers, and people will be learning from each other, sharing experiences and assisting with equipment adjustments and repairs. The various services needed by draft cattle users depend on there being a ‘critical mass’ of working animals to justify the provision of the service. This is particularly true of commercial services, whether artisanal or retail, that need regular sources of income to sustain them.

38 Starkey 2011.

39 Liebowitz 1992.

Where draft cattle are being introduced (as is happening in parts of sub-Saharan Africa), it is important that such services are made available from the outset, and a critical mass of users is developed as soon as possible to ensure the essential services are sustainable. This requirement should influence any organisations supporting the introduction of draft cattle technologies. From the point of view of overcoming disadvantage and spreading the benefits widely, it may seem appropriate to introduce small numbers of work animals to disadvantaged people in remote villages. However, to ensure the rapid development of a critical mass of support services, it may be better to initially concentrate on introducing the technology to relatively resource-rich farmers, in good farming land, close to active markets where suppliers and artisans can base their services. Once the local support services have developed within an area, it will be much easier to spread the benefits to the more disadvantaged farmers and the remoter areas. In the author's experience: the idea of testing twenty ox carts in twenty different isolated villages seemed appropriate but actually led to twenty ox carts with unrepaired punctures. When ten ox carts were concentrated in and around one important village, a local artisan started a puncture-repair service.

Where the use of draft cattle is declining, as it is currently in many parts of the world, including much of southern Asia, southern Europe and North Africa, it is important that a critical mass of users is preserved to justify the support services. As the numbers of working animals decline, the artisans responsible for making the carts, carving the yokes and repairing the ploughshares find their traditional work is drying up. They may diversify into other activities or move to an urban setting where work is more abundant. Networks of users may need to be established to keep in touch with the smaller number of people with the knowledge and skills to support draft cattle farmers. Fortunately, the widespread use of mobile phones and social media does facilitate support services meeting farmers' needs in larger catchment areas. However, the cohesion of the systems may be strained, and procedures for passing on skills and services to a new generation of providers may be difficult to achieve.

## Need for policies, strategies and networking

Whether the use of draft cattle is increasing, decreasing or stable, there is likely to be a need for national or local policies and strategies to ensure there is an enabling environment for the users of draft cattle and their various support services. Unfortunately, due to the lack of inclusion of animal power issues in modern agricultural, veterinary and forestry degree courses, and in school curricula, few decision makers involved in developing policies and strategies will have great understanding of the issues involved in draft cattle use. This means that in most countries there will be a need for awareness raising to ensure relevant issues are addressed. One of the ways of doing this is through networking.

A network is a group of individuals or organisations who, on a voluntary basis, exchange information and/or undertake joint activities and who organise themselves in such a way that their individual autonomy remains intact<sup>40</sup>.

40 Starkey 1998.

Networking involves making contacts and encouraging reciprocal information exchange and voluntary collaboration. Networks should encourage and facilitate people's participation and actions and link individuals and organisations living or working in different circumstances (or in different 'silos'). Networks can help people and organisations to exchange novel information and experiences and stimulate collaboration and new understanding that may be missing from people's own limited professional vision. Given the general lack of understanding about draft cattle among national decision-makers, national (and international) networks are important for exchanging information relating to draft cattle, publicising issues and promoting strategies<sup>41</sup>.

In Europe, there are strong national and international networks linking people concerned with the use of draft horses, notably FECTU (Fédération Européenne du Cheval de Trait pour la promotion de son Utilisation). In France, are many people and organisations involved in networking<sup>42</sup>, and there are two networks linking the users of draft cattle: l'Association Attelages Bovins d'aujourd'hui and l'Association Française des Meneurs de Bovins. Both link current users of draft cattle and support services (including people making yokes) and organise professional meetings and publicity-generating local displays. The Global Draft Cattle Network was recently formed as an outcome of an international symposium on draft cattle held in March 2024 in Lorsch, Germany. Its secretariat is currently based in the Centre for Draft Cattle Research and Education hosted by the Lauresham Open-Air Laboratory, Lorsch, Germany. Two other networks based in the USA, with some interest in draft cattle, are the Draft Animal-Power Network (DAPNet) and the Association for Living History, Farm and Agricultural Museums (ALHFAM). The Netherlands-base EXARC.net, a network concerned with experimental archaeology, is interested in current draft cattle usage as a means to understand historic uses of working cattle.

In the period 1985–2005 there were several animal traction networks in Africa and Latin America that supported research, training and policy development issues relating to draft cattle (and other working animals). Networking was particularly important at that time, as there were small numbers of people in different countries working on draft cattle promotion and technologies. Multidisciplinary networking workshops, visits and publications increased understanding and morale, reduced duplication, provided peer recognition and involved ministries, NGOs and donor representatives, facilitating a critical mass for advocacy and actions. The networking activities were mainly funded by bilateral and international donor organisations and the resulting publications remain available on-line as valuable and highly relevant resources<sup>43</sup>. The formal networking activities generally stopped early in the twenty-first century due lack of donor funding, but some informal networking continues to this day.

One major change in the past twenty years has been the increased understanding of the importance of envi-

41 Ibid.

42 Griffin-Kremer 2022.

43 Starkey/Ndiamé 1988; Starkey/Faye 1990; Sylvander/Mpande 1992; Lawrence et al. 1993; Starkey et al. 1994; Starkey/Simalenga 1998; Kaumbutho/Simalenga 1999; Starkey/Kaumbutho 1999; Kaumbutho et al. 2000.

ronmental resilience and sustainability, and the availability of funding for initiatives linked to climate change and low-input, sustainable agriculture. This offers scope for policy and strategy work relating to draft cattle to be approached (and funded) from perspectives of climate-resilience and ecological sustainability. Existing networks promoting such approaches might be a useful entry point for networking activities relating to draft cattle.

With positive, enabling environments draft cattle can remain an ecologically friendly and sustainable multipurpose power resource for suitable modern agricultural enterprises in many countries around the world. Draft cattle can be part of the many solutions required to overcome environmental, climatic and societal issues.

## Conclusions

Draft cattle have been important in human civilisations for 10,000 years and remain so today in various regions, environments and socio-economic circumstances. This history has led to a great diversity of working animals, implements, techniques, management systems and related folk art. It represents a wonderful cultural heritage for the world, individual countries and local regions. This has been celebrated in writings, art, sculptures, models, photographs and films, and has also been portrayed on coins, banknotes, postage stamps and other day-to-day items. Past examples of artisanal work and technologies have been exhibited in museums.

Draft cattle are not only historical as they are also used today and will be in the future. It is therefore important to not only preserve the diverse beauty of old technologies, but also to understand the significance of the different designs and variations and the techniques used to employ them. Where possible, this will require discussions with, and deep understanding of, existing and past users to appreciate their points of view and their observations on systems of utilisation. Sharing this knowledge, as well as the technologies, will provide a resource for current and future users of draft cattle and increase public appreciation of the on-going heritage.

With draft cattle use low or declining in many countries there is a need to ensure equipment supplies and support services can remain viable to ensure the continuation of ecologically sustainable draft cattle technologies. Networks and networking events can be important in sharing knowledge and creating a critical mass to influence policies and encourage the inclusion of draft cattle technologies in resilience strategies relating to climate change. This will help ensure the public appreciates the wonderful heritage of draft cattle, as well as enable women and men to adopt, use and further develop the draft cattle technologies and systems that have proven invaluable for so long.

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