Cattle

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Cattle—colloquially **cows**[note 1]—are the most common type of large domesticated ungulates. They are a prominent modern member of the subfamily Bovinae, are the most widespread species of the genus *Bos*, and are most commonly classified collectively as ***Bos taurus***. Cattle are raised as livestock for meat (beef and veal), as dairy animals for milk and other dairy products, and as draft animals (oxen or bullocks that pull carts, plows and other implements). Other products include leather and dung for manure or fuel. In some regions, such as parts of India, cattle have significant religious meaning. From as few as 80 progenitors domesticated in southeast Turkey about 10,500 years ago,[1] according to an estimate from 2011, there are 1.4 billion cattle in the world.[2] In 2009, cattle became one of the first livestock animals to have a fully mapped genome.[3] Some consider cattle the oldest form of wealth, and cattle raiding consequently one of the earliest forms of theft.

Contents

Cattle

A Swiss Braunvieh cow wearing a cowbell

Conservation status

Domesticated

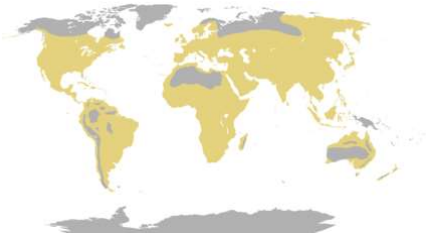
Scientific classification

Kingdom:	Animalia
Phylum:	Chordata
Class:	Mammalia
Order:	Artiodactyla
Family:	Bovidae
Subfamily:	Bovinae
Genus:	*Bos*
Species:	***B. taurus***

Binomial name

Bos taurus

Linnaeus, 1758



Bovine range

Synonyms

- *Bos primigenius*
- *Bos indicus*

Taxonomy

Cattle were originally identified as three separate species: *Bos taurus*, the European or "taurine" cattle (including similar types from Africa and Asia); *Bos indicus*, the zebu; and the extinct *Bos primigenius*, the aurochs. The aurochs is ancestral to both zebu and taurine cattle. These have been reclassified as one species, *Bos taurus*, with three subspecies: *Bos taurus primigenius*, *Bos taurus indicus*, and *Bos taurus taurus*.[4][5]

Complicating the matter is the ability of cattle to interbreed with other closely related species. Hybrid individuals and even breeds exist, not only between taurine cattle and zebu (such as the sanga cattle, *Bos taurus africanus*), but also between one or both of these and some other members of the genus *Bos* – yaks (the dzo or yattle[6]), banteng, and gaur. Hybrids such as the beefalo breed can even occur between taurine cattle and either species of bison, leading some authors to consider them part of the genus *Bos*, as well.[7] The hybrid origin of some types may not be obvious – for example, genetic testing of the Dwarf Lulu breed, the only taurine-type cattle in Nepal, found them to be a mix of taurine cattle, zebu, and yak.[8] However, cattle cannot successfully be hybridized with more distantly related bovines such as water buffalo or African buffalo.

The aurochs originally ranged throughout Europe, North Africa, and much of Asia. In historical times, its range became restricted to Europe, and the last known individual died in Masovia, Poland, in about 1627.[9] Breeders have attempted to recreate cattle of similar appearance to aurochs by crossing traditional types of domesticated cattle, creating the Heck cattle breed.

A Holstein Fresian cow, a typical member of the *Bos taurus taurus* sub-species

Żubroń, a wisent and cattle hybrid

Etymology

Cattle did not originate as the term for bovine animals. It was borrowed from Anglo-Norman *catel*, itself from medieval Latin *capitale* 'principal sum of money, capital', itself derived in turn from Latin *caput* 'head'. *Cattle* originally meant movable personal property, especially livestock of any kind, as opposed to real property (the land, which also included wild or small free-roaming animals such as chickens — they were sold as part of the land).[10] The word is a variant of *chattel* (a unit of personal property) and closely related to *capital* in the economic sense.[11] The term replaced earlier Old English *feoh* 'cattle, property', which survives today as *fee* (cf. German: *Vieh*, Dutch: *vee*, Gothic: *faihu*).

The word "cow" came via Anglo-Saxon *cū* (plural *cȳ*), from Common Indo-European *gʷōus* (genitive *gʷowés*) = "a bovine animal", compare Persian *gâv*, Sanskrit *go-*, Welsh *buwch*.[12] The plural *cȳ* became *ki* or *kie* in Middle English, and an additional plural ending was often added, giving *kine*, *kien*, but also *kies*, *kuin* and others. This is the origin of the now archaic English plural, "kine". The Scots language singular is coo or cou, and the plural is "kye".

In older English sources such as the King James Version of the Bible, "cattle" refers to livestock, as opposed to "deer" which refers to wildlife. "Wild cattle" may refer to feral cattle or to undomesticated species of the genus *Bos*. Today, when used without any other qualifier, the modern meaning of "cattle" is usually restricted to domesticated bovines.[13]

Terminology

In general, the same words are used in different parts of the world, but with minor differences in the definitions. The terminology described here contrasts the differences in definition between the United Kingdom and other British-influenced parts of the world such as Canada, Australia, New Zealand, Ireland and the United States.[14]

Look up ***cattle*** or ***cow*** in Wiktionary, the free dictionary.

- An "intact" (i.e., not castrated) adult male is called a **bull**. A wild, young, unmarked bull is known as a "micky" in Australia.[15] An unbranded bovine of either sex is called a "maverick" in the USA and Canada.
- An adult female that has had a calf (or two, depending on regional usage) is a **cow**.
- A young female before she has had a calf of her own[16] and is under three years of age is called a **heifer** (/ˈhɛfər/ ***HEF**-ər*).[17] A young female that has had only one calf is occasionally called a **first-calf heifer**.

- Young cattle of both sexes are called **calves** until they are weaned, then **weaners** until they are a year old in some areas; in other areas, particularly with male beef cattle, they may be known as **feeder calves** or simply feeders. After that, they are referred to as **yearlings** or **stirks**[18] if between one and two years of age.[19]
- A castrated male is called a **steer** in the United States; older steers are often called **bullocks** in other parts of the world,[20] but in North America this term refers to a young bull. Piker bullocks are micky bulls (uncastrated young male bulls) that were caught, castrated and then later lost.[15] In Australia, the term "Japanese ox" is used for grain-fed steers in the weight range of 500 to 650 kg that are destined for the Japanese meat trade.[21] In North America, draft cattle under four years old are called working steers. Improper or late castration on a bull results in it becoming a coarse steer known as a **stag** in Australia, Canada and New Zealand.[22] In some countries, an incompletely castrated male is known also as a **rig**.
- A castrated male (occasionally a female or in some areas a bull) kept for draft purposes is called an **ox** (plural oxen); "ox" may also be used to refer to some carcass products from any adult cattle, such as ox-hide, ox-blood, oxtail, or ox-liver.[17]
- A **springer** is a cow or heifer close to calving.[23]
- In all cattle species, a female twin of a bull usually becomes an infertile partial intersex, and is called a **freemartin**.
- Neat (horned oxen, from which neatsfoot oil is derived), beef (young ox) and beefing (young animal fit for slaughtering) are obsolete terms, although **poll, pollard** or **polled cattle** are still terms in use for naturally hornless animals, or in some areas also for those that have been disbudded or dehorned.
- Cattle raised for human consumption are called **beef cattle**. Within the American beef cattle industry, the older term beef (plural beeves) is still used to refer to an animal of either sex. Some Australian, Canadian, New Zealand and British people use the term **beast**.[24]
- Cattle bred specifically for milk production are called **milking or dairy cattle**;[14] a cow kept to provide milk for one family may be called a **house cow** or **milker**. A **"fresh cow"** is a dairy term for a cow or first-calf heifer who has recently given birth, or "freshened."
- The adjective applying to cattle in general is usually **bovine**. The terms "bull", "cow" and "calf" are also used by extension to denote the sex or age of other large animals, including whales, hippopotamuses, camels, elk and elephants.

An Ongole bull

A Hereford bull

Singular terminology issue

Cattle can only be used in the plural and not in the singular: it is a plurale tantum.[25] Thus one may refer to "three cattle" or "some cattle", but not "one cattle". No universally used singular form in modern English of "cattle" exists, other than the sex- and age-specific terms such as cow, bull, steer and heifer. Historically, "ox" was not a sex-specific term for adult cattle, but generally this is now used only for draft cattle, especially adult castrated males. The term is also incorporated into the names of other species, such as the musk ox and "grunting ox" (yak), and is used in some areas to describe certain cattle products such as ox-hide and oxtail.[26]

"Cow" is in general use as a singular for the collective "cattle", despite the objections by those who insist it to be a female-specific term. Although the phrase "that cow is a bull" is absurd from a lexicographic standpoint, the word "cow" is easy to use when a singular is needed and the sex is unknown or irrelevant – when "there is a cow in the road", for example. Further, any herd of fully mature cattle in or near a pasture is statistically likely to consist mostly of cows, so the term is probably accurate even in the restrictive sense. Other than the few bulls needed for breeding, the vast majority of male cattle are castrated as calves and slaughtered for meat before the age of three

years. Thus, in a pastured herd, any calves or herd bulls usually are clearly distinguishable from the cows due to distinctively different sizes and clear anatomical differences. Merriam-Webster, a US dictionary, recognizes the sex-nonspecific use of "cow" as an alternate definition,[27] whereas Collins, a UK dictionary, does not.


A Brahman calf

Colloquially, more general nonspecific terms may denote cattle when a singular form is needed. Australian, New Zealand and British farmers use the term "beast" or "cattle beast". "Bovine" is also used in Britain. The term "critter" is common in the western United States and Canada, particularly when referring to young cattle.[28] In some areas of the American South (particularly the Appalachian region), where both dairy and beef cattle are present, an individual animal was once called a "beef critter", though that term is becoming archaic.

Other terminology

Cattle raised for human consumption are called "beef cattle". Within the beef cattle industry in parts of the United States, the term "beef" (plural "beeves") is still used in its archaic sense to refer to an animal of either sex. Cows of certain breeds that are kept for the milk they give are called "dairy cows" or "milking cows" (formerly "milch cows"). Most young male offspring of dairy cows are sold for veal, and may be referred to as veal calves.

A cow's moo
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The term "dogies" is used to describe orphaned calves in the context of ranch work in the American West, as in "Keep them dogies moving".[29] In some places, a cow kept to provide milk for one family is called a "house cow". Other obsolete terms for cattle include "neat" (this use survives in "neatsfoot oil", extracted from the feet and legs of cattle), and "beefing" (young animal fit for slaughter).

An onomatopoeic term for one of the most common sounds made by cattle is "moo" (also called *lowing*). There are a number of other sounds made by cattle, including calves *bawling*, and bulls *bellowing*. Bawling is most common for cows after weaning of a calf. The bullroarer makes a sound similar to a bull's territorial call.[30]

Characteristics

Anatomy

Cattle are large quadrupedal ungulate mammals with cloven hooves. Most breeds have horns, which can be as large as the Texas Longhorn or small like a scur. Careful genetic selection has allowed polled (hornless) cattle to become widespread.

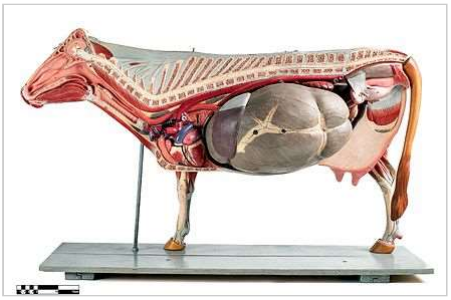
Cattle are ruminants, meaning their digestive system is highly specialized to allow the use of poorly digestible plants as food. Cattle have one stomach with four compartments, the rumen, reticulum, omasum, and abomasum, with the rumen being the largest compartment. The reticulum, the smallest compartment, is known as the "honeycomb". Cattle sometimes consume metal objects which are deposited in the reticulum and irritation from the metal objects causes hardware disease. The omasum's main function is to absorb water and nutrients from the digestible feed. The omasum is known as the "many plies". The abomasum is like the human stomach; this is why it is known as the "true stomach".

Cattle are known for regurgitating and re-chewing their food, known as cud chewing, like most ruminants. While the animal is feeding, the food is swallowed without being chewed and goes into the rumen for storage until the animal can find a quiet place to continue the digestion process. The food is regurgitated, a mouthful at a time, back up to the mouth, where the food, now called the cud, is chewed by the molars, grinding down the course vegetation to small particles. The cud is then swallowed again and further digested by specialized microorganisms in the rumen. These microbes are primarily responsible for decomposing cellulose and other carbohydrates into volatile fatty acids cattle use as their primary metabolic fuel. The microbes inside the rumen also synthesize amino acids from non-protein nitrogenous sources, such as urea and ammonia. As these microbes reproduce in the rumen, older generations die and their cells continue on through the digestive tract. These cells are then partially digested in the small intestines, allowing cattle to gain a high-quality protein source. These features allow cattle to thrive on grasses and other tough vegetation.

Dairy farming and the milking of cattle was once performed largely by hand, but is now usually replaced by machine

Gestation and size

The gestation period for a cow is about nine months long. A newborn calf's size can vary among breeds, but a typical calf weighs between 25 to 45 kg (55 to 99 lb). Adult size and weight vary significantly among breeds and sex. The world record for the heaviest bull was 1,740 kg (3,840 lb), a Chianina named Donetto, when he was exhibited at the Arezzo show in 1955.[31] The heaviest steer was eight-year-old 'Old Ben', a Shorthorn/Hereford cross weighing in at 2,140 kg (4,720 lb) in 1910.[32] Steers are generally killed before reaching 750 kg (1,650 lb). Breeding stock may be allowed a longer lifespan, occasionally living as long as 25 years. The oldest recorded cow, Big Bertha, died at the age of 48 in 1993.



Anatomy model of a bovine (cow)

Reproduction

On farms it is very common to use artifice, such as artificial insemination, to obtain a cattle with the fewest physiologically deficient individuals. With this artificial selection it is possible to obtain a herd more resistant to diseases and with size that makes the commercialization of bovine derivatives viable.

Artificial insemination or **intrauterine insemination** is a medically assisted reproduction technique consisting of the artificial deposition of semen in the female's genital tract.[33] It is used in cases where the spermatozoa can not reach the fallopian tubes or simply by choice of the owner of the animal. It consists of transferring, to the uterine cavity, spermatozoa previously collected and processed, with the selection of morphologically more normal and mobile spermatozoa.

Reproductive system of a bovine female.

Udder

A cow's udder contains two pairs of mammary glands, (commonly referred to as *teats*) creating four "quarters".[34] The front ones are referred to as *fore quarters* and the rear ones *rear quarters*.[35]

Male genitalia

Bulls become fertile at about seven months of age. Their fertility is closely related to the size of their testicles, and one simple test of fertility is to measure the circumference of the scrotum: a young bull is likely to be fertile once this reaches 28 centimetres (11 in); that of a fully adult bull may be over 40 centimetres (16 in).[36][37]

Ox testis.

Bulls have a fibro-elastic penis. Given the small amount of erectile tissue, there is little enlargement after erection. The penis is quite rigid when non-erect, and becomes even more rigid during erection. Protrusion is not affected much by erection, but more by relaxation of the retractor penis muscle and straightening of the sigmoid flexure.[38][39][40]

Weight

The weight of adult cattle always depends on the breed. Smaller kinds, such as Dexter and Jersey adults, range between 272 to 454 kg (600 to 1,000 lb). Large Continental breeds, such as Charolais, Marchigiana, Belgian Blue and Chianina, adults range from 635 to 1,134 kg (1,400 to 2,500 lb). British breeds, such as Hereford, Angus, and Shorthorn, mature between 454 to 907 kg (1,000 to 2,000 lb), occasionally higher, particularly with Angus and Hereford.[41]

Bulls will be a bit larger than cows of the same breed by a few hundred kilograms. Chianina bulls can weigh up to 1,500 kg (3,300 lb); British bulls, such as Angus and Hereford, can weigh as little as 907 kg (2,000 lb) to as much as 1,361 kg (3,000 lb).

It is difficult to generalize or average out the weight of all cattle because different kinds have different averages of weights. However, according to some sources, the average weight of all cattle is 753 kg (1,660 lb). Finishing steers in the feedlot average about 640 kg (1,410 lb); cows about 725 kg (1,600 lb), and bulls about 1,090 kg (2,400 lb).[42]

In the United States, the average weight of beef cattle has steadily increased, especially since the 1970s, requiring the building of new slaughterhouses able to handle larger carcasses. New packing plants in the 1980s stimulated a large increase in cattle weights.[43] Before 1790 beef cattle averaged only 160 kg (350 lb) net; and thereafter weights climbed steadily.[44][45]

Cognition

In laboratory studies, young cattle are able to memorize the locations of several food sources and retain this memory for at least 8 hours, although this declined after 12 hours.[46] Fifteen-month-old heifers learn more quickly than adult cows which have had either one or two calvings, but their longer-term memory is less stable.[47] Mature cattle perform well in spatial learning tasks and have a good long-term memory in these tests. Cattle tested in a radial arm maze are able to remember the locations of high-quality food for at least 30 days. Although they initially learn to avoid low-quality food, this memory diminishes over the same duration.[48] Under less artificial testing conditions, young cattle showed they were able to remember the location of feed for at least 48 days.[49] Cattle can make an association between a visual stimulus and food within 1 day – memory of this association can be retained for 1 year, despite a slight decay.[50]

Calves are capable of discrimination learning[51] and adult cattle compare favourably with small mammals in their learning ability in the Closed-field Test.[52]

They are also able to discriminate between familiar individuals, and among humans. Cattle can tell the difference between familiar and unfamiliar animals of the same species (conspecifics). Studies show they behave less aggressively toward familiar individuals when they are forming a new group.[53] Calves can also discriminate between humans based on previous experience, as shown by approaching those who handled them positively and avoiding those who handled them aversively.[54] Although cattle can discriminate between humans by their faces alone, they also use other cues such as the color of clothes when these are available.[55]

In audio play-back studies, calves prefer their own mother's vocalizations compared to the vocalizations of an unfamiliar mother.[56]

In laboratory studies using images, cattle can discriminate between images of the heads of cattle and other animal species.[57] They are also able to distinguish between familiar and unfamiliar conspecifics. Furthermore, they are able to categorize images as familiar and unfamiliar individuals.[53]

When mixed with other individuals, cloned calves from the same donor form subgroups, indicating that kin discrimination occurs and may be a basis of grouping behaviour. It has also been shown using images of cattle that both artificially inseminated and cloned calves have similar cognitive capacities of kin and non-kin discrimination.[58]

Cattle can recognize familiar individuals. Visual individual recognition is a more complex mental process than visual discrimination. It requires the recollection of the learned idiosyncratic identity of an individual that has been previously encountered and the formation of a mental representation.[59] By using 2-dimensional images of the heads of one cow (face, profiles, ¾ views), all the tested heifers showed individual recognition of familiar and unfamiliar individuals from their own breed. Furthermore, almost all the heifers recognized unknown individuals from different breeds, although this was achieved with greater difficulty. Individual recognition was most difficult when the visual features of the breed being tested were quite different from the breed in the image, for example, the breed being tested had no spots whereas the image was of a spotted breed.[60]

Cattle use visual/brain lateralisation in their visual scanning of novel and familiar stimuli.[61] Domestic cattle prefer to view novel stimuli with the left eye, i.e. using the right brain hemisphere (similar to horses, Australian magpies, chicks, toads and fish) but use the right eye, i.e. using the left hemisphere, for viewing familiar stimuli.[62]

Temperament and emotions

In cattle, temperament can affect production traits such as carcass and meat quality or milk yield as well as affecting the animal's overall health and reproduction. Cattle temperament is defined as "the consistent behavioral and physiological difference observed between individuals in response to a stressor or environmental challenge and is used to describe the relatively stable difference in the behavioral predisposition of an animal, which can be related to psychobiological mechanisms".[64] Generally, cattle temperament is assumed to be multidimensional. Five underlying categories of temperament traits have been proposed:[65]

- shyness-boldness
- exploration-avoidance
- activity
- aggressiveness
- sociability

In a study on Holstein–Friesian heifers learning to press a panel to open a gate for access to a food reward, the researchers also recorded the heart rate and behavior of the heifers when moving along the race towards the food. When the heifers made clear improvements in learning, they had higher heart rates and tended to move more vigorously along the race. The researchers concluded this was an indication that cattle may react emotionally to their own learning improvement.[66]

Ear postures of cows are studied as indicators of their emotional state and overall animal welfare.[63]

Negative emotional states are associated with a bias toward negative (pessimistic) responses towards ambiguous cues in judgement tasks – as encapsulated in the question of "is the glass half empty or half full?". After separation from their mothers, Holstein calves showed such a cognitive bias indicative of low mood.[67] A similar study showed that after hot-iron disbudding (dehorning), calves had a similar negative bias indicating that post-operative pain following this routine procedure results in a negative change in emotional state.[68]

In studies of visual discrimination, the position of the ears has been used as an indicator of emotional state.[53] When cattle are stressed, this can be recognised by other cattle as it is communicated by alarm substances in the urine.[69]

Cattle are very gregarious and even short-term isolation is considered to cause severe psychological stress. When Aubrac and Fresian heifers are isolated, they increase their vocalizations and experience increased heart rate and plasma cortisol concentrations. These physiological changes are greater in Aubracs. When visual contact is re-instated, vocalisations rapidly decline, regardless of the familiarity of the returning cattle, however, heart rate decreases are greater if the returning cattle are familiar to the previously-isolated individual.[70] Mirrors have been used to reduce stress in isolated cattle.[71]

Senses

Cattle use all of the five widely recognized sensory modalities. These can assist in some complex behavioural patterns, for example, in grazing behaviour. Cattle eat mixed diets, but when given the opportunity, show a partial preference of approximately 70% clover and 30% grass. This preference has a diurnal pattern, with a stronger preference for clover in the morning, and the proportion of grass increasing towards the evening.[72]

Vision

Vision is the dominant sense in cattle and they obtain almost 50% of their information visually. [73]

Cattle are a prey animal and to assist predator detection, their eyes are located on the sides of their head rather than the front. This gives them a wide field of view of 330° but limits binocular vision (and therefore stereopsis) to 30° to 50° compared to 140° in humans.[53][74] This means they have a blind spot directly behind them. Cattle have good visual acuity (1/20)[53] but compared to humans, the visual accommodation of cattle is poor.[73]

Cattle have two kinds of color receptors in the cone cells of their retinas. This means that cattle are dichromatic, as are most other non-primate land mammals.[75][76] There are two to three rods per cone in the fovea centralis but five to six near the optic papilla.[74] Cattle can distinguish long wavelength colors (yellow, orange and red) much better than the shorter wavelengths (blue, grey and green). Calves are able to discriminate between long (red) and

short (blue) or medium (green) wavelengths, but have limited ability to discriminate between the short and medium. They also approach handlers more quickly under red light.[77] Whilst having good color sensitivity, it is not as good as humans or sheep.[53]

A common misconception about cattle (particularly bulls) is that they are enraged by the color red (something provocative is often said to be "like a red flag to a bull"). This is a myth. In bullfighting, it is the movement of the red flag or cape that irritates the bull and incites it to charge.

Taste

Cattle have a well-developed sense of taste and can distinguish the four primary tastes (sweet, salty, bitter and sour). They possess around 20,000 taste buds. The strength of taste perception depends on the individual's current food requirements. They avoid bitter-tasting foods (potentially toxic) and have a marked preference for sweet (high calorific value) and salty foods (electrolyte balance). Their sensitivity to sour-tasting foods helps them to maintain optimal ruminal pH.[73]

Plants have low levels of sodium and cattle have developed the capacity of seeking salt by taste and smell. If cattle become depleted of sodium salts, they show increased locomotion directed to searching for these. To assist in their search, the olfactory and gustatory receptors able to detect minute amounts of sodium salts increase their sensitivity as biochemical disruption develops with sodium salt depletion.[78][79]

Audition

Cattle hearing ranges from 23 Hz to 35 kHz. Their frequency of best sensitivity is 8 kHz and they have a lowest threshold of −21 db (re 20 $\mu N/m^{-2}$), which means their hearing is more acute than horses (lowest threshold of 7 db).[80] Sound localization acuity thresholds are an average of 30°. This means that cattle are less able to localise sounds compared to goats (18°), dogs (8°) and humans (0.8°).[81] Because cattle have a broad foveal fields of view covering almost the entire horizon, they may not need very accurate locus information from their auditory systems to direct their gaze to a sound source.

Vocalisations are an important mode of communication amongst cattle and can provide information on the age, sex, dominance status and reproductive status of the caller. Calves can recognize their mothers using vocal and vocal behaviour may play a role by indicating estrus and competitive display by bulls.[82]

Olfaction and gustation

Cattle have a range of odiferous glands over their body including interdigital, infraorbital, inguinal and sebaceous glands, indicating that olfaction probably plays a large role in their social life. Both the primary olfactory system using the olfactory bulbs, and the secondary olfactory system using the vomeronasal organ are used.[83] This latter olfactory system is used in the flehmen response. There is evidence that when cattle are stressed, this can be recognised by other cattle and this is communicated by alarm substances in the urine.[69] The odour of dog faeces induces behavioural changes prior to cattle feeding, whereas the odours of urine from either stressed or non-stressed conspecifics and blood have no effect.[84]

Several senses are used in social relationships between cattle

In the laboratory, cattle can be trained to recognise conspecific individuals using olfaction only.[83]

In general, cattle use their sense of smell to "expand" on information detected by other sensory modalities. However, in the case of social and reproductive behaviours, olfaction is a key source of information.[73]

Touch

Cattle have tactile sensations detected mainly by mechanoreceptors, thermoreceptors and nociceptors in the skin and muzzle. These are used most frequently when cattle explore their environment.[73]

Magnetoreception

There is conflicting evidence for magnetoreception in cattle. One study reported that resting and grazing cattle tend to align their body axes in the geomagnetic North-South (N-S) direction.[85] In a follow-up study, cattle exposed to various magnetic fields directly beneath or in the vicinity of power lines trending in various magnetic directions exhibited distinct patterns of alignment.[86] However, in 2011, a group of Czech researchers reported their failed attempt to replicate the finding using Google Earth images.[87]

Behavior

Under natural conditions, calves stay with their mother until weaning at 8 to 11 months. Heifer and bull calves are equally attached to their mothers in the first few months of life.[88] Cattle are considered to be "hider" type animals, but in the artificial environment of small calving pens, close proximity between cow and calf is maintained by the mother at the first three calvings but this changes to being mediated by the calf after these. Primiparous dams show a higher incidence of abnormal maternal behavior.[89]

Beef-calves reared on the range suckle an average of 5.0 times every 24 hours with an average total time of 46 min spent suckling. There is a diurnal rhythm in suckling activity with peaks between 05:00–07:00, 10:00–13:00 and 17:00–21:00.[90]

Studies on the natural weaning of zebu cattle (*Bos indicus*) have shown that the cow weans her calves over a 2-week period, but after that, she continues to show strong affiliatory behavior with her offspring and preferentially chooses them for grooming and as grazing partners for at least 4–5 years.[91]

Video of a calf suckling

Reproductive behavior

Semi-wild Highland cattle heifers first give birth at 2 or 3 years of age and the timing of birth is synchronized with increases in natural food quality. Average calving interval is 391 days, and calving mortality within the first year of life is 5%.[92]

Dominance and leadership

One study showed that over a 4-year period, dominance relationships within a herd of semi-wild highland cattle were very firm. There were few overt aggressive conflicts and the majority of disputes were settled by agonistic (non-aggressive, competitive) behaviors that involved no physical contact between opponents (e.g. threatening and

spontaneous withdrawing). Such agonistic behavior reduces the risk of injury. Dominance status depended on age and sex, with older animals generally being dominant to young ones and males dominant to females. Young bulls gained superior dominance status over adult cows when they reached about 2 years of age.[92]

As with many animal dominance hierarchies, dominance-associated aggressiveness does not correlate with rank position, but is closely related to rank distance between individuals.[92]

Dominance is maintained in several ways. Cattle often engage in mock fights where they test each other's strength in a non-aggressive way. Licking is primarily performed by subordinates and received by dominant animals. Mounting is a playful behavior shown by calves of both sexes and by bulls and sometimes by cows in estrus,[93] however, this is not a dominance related behavior as has been found in other species.[92]

The horns of cattle are "honest signals" used in mate selection. Furthermore, horned cattle attempt to keep greater distances between themselves and have fewer physical interactions than hornless cattle. This leads to more stable social relationships.[94]

In calves, the frequency of agonistic behavior decreases as space allowance increases, but this does not occur for changes in group size. However, in adult cattle, the number of agonistic encounters increases as the group size increases.[95]

Grazing behavior

When grazing, cattle vary several aspects of their bite, i.e. tongue and jaw movements, depending on characteristics of the plant they are eating. Bite area decreases with the density of the plants but increases with their height. Bite area is determined by the sweep of the tongue; in one study observing 750-kilogram (1,650 lb) steers, bite area reached a maximum of approximately 170 cm^2 (30 sq in). Bite depth increases with the height of the plants. By adjusting their behavior, cattle obtain heavier bites in swards that are tall and sparse compared with short, dense swards of equal mass/area.[96] Cattle adjust other aspects of their grazing behavior in relation to the available food; foraging velocity decreases and intake rate increases in areas of abundant palatable forage.[97]

Cattle avoid grazing areas contaminated by the faeces of other cattle more strongly than they avoid areas contaminated by sheep,[98] but they do not avoid pasture contaminated by rabbit faeces.[99]

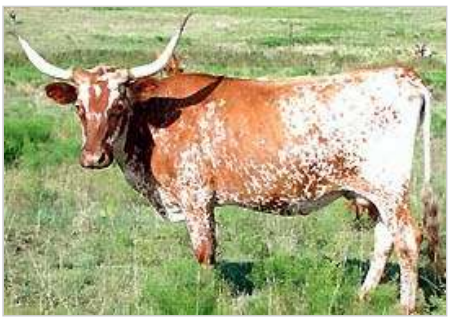
Genetics

In the 24 April 2009, edition of the journal *Science*, a team of researchers led by the National Institutes of Health and the US Department of Agriculture reported having mapped the bovine genome.[100] The scientists found cattle have about 22,000 genes, and 80% of their genes are shared with humans, and they share about 1000 genes with dogs and rodents, but are not found in humans. Using this bovine "HapMap", researchers can track the differences between the breeds that affect the quality of meat and milk yields.[101]

Behavioral traits of cattle can be as heritable as some production traits, and often, the two can be related.[102] The heritability of fear varies markedly in cattle from low (0.1) to high (0.53); such high variation is also found in pigs and sheep, probably due to differences in the methods used.[103] The heritability of temperament (response to isolation during handling) has been calculated as 0.36 and 0.46 for habituation to handling.[104] Rangeland assessments show that the heritability of aggressiveness in cattle is around 0.36.[105]

Quantitative trait loci (QTLs) have been found for a range of production and behavioral characteristics for both dairy and beef cattle.[106]

Domestication and husbandry


Texas Longhorns are a US breed

Cattle occupy a unique role in human history, having been domesticated since at least the early neolithic age.

Archeozoological and genetic data indicate that cattle were first domesticated from wild aurochs (*Bos primigenius*) approximately 10,500 years ago. There were two major areas of domestication: one in the area that is now Turkey, giving rise to the taurine line, and a second in the area that is now Pakistan, resulting in the indicine line.[107] Modern mitochondrial DNA variation indicates the taurine line may have arisen from as few as 80 aurochs tamed in the upper reaches of Mesopotamia near the villages of Çayönü Tepesi in southeastern Turkey and Dja'de el-Mughara in northern Iraq.[1]

Although European cattle are largely descended from the taurine lineage, gene flow from African cattle (partially of indicine origin) contributed substantial genomic components to both southern European cattle breeds and their New World descendants.[107] A study on 134 breeds showed that modern taurine cattle originated from Africa, Asia, North and South America, Australia, and Europe.[108] Some researchers have suggested that African taurine cattle are derived from a third independent domestication from North African aurochsen.[107]

Usage as money

As early as 9000 BC both grain and cattle were used as money or as *barter* (Davies) (the *first grain remains* found, considered to be evidence of pre-agricultural practice date to 17,000 BC).[109][110][111] Some evidence also exists to suggest that other animals, such as camels and goats, may have been used as currency in some parts of the world.[112] One of the advantages of using cattle as currency is that it allows the seller to set a fixed price. It even created the standard pricing. For example, two chickens were traded for one cow as cows were deemed to be more valuable than chickens.[110]

Modern husbandry


This Hereford is being inspected for ticks; cattle are often restrained or confined in cattle crushes (squeeze chutes) when given medical attention.

Cattle are often raised by allowing herds to graze on the grasses of large tracts of rangeland. Raising cattle in this manner allows the use of land that might be unsuitable for growing crops. The most common interactions with cattle involve daily feeding, cleaning and milking. Many routine husbandry practices involve ear tagging, dehorning, loading, medical operations, vaccinations and hoof care, as well as training for agricultural shows and preparations. Also, some cultural differences occur in working with cattle; the cattle husbandry of Fulani men rests on behavioural techniques, whereas in Europe, cattle are controlled primarily by physical means, such as fences.[113] Breeders use cattle husbandry to reduce *M. bovis* infection susceptibility by selective breeding and maintaining herd health to avoid concurrent disease.[114]


This young bovine has a nose ring to prevent it from suckling, which is usually to assist in weaning.

Cattle are farmed for beef, veal, dairy, and leather, and they are less commonly used for conservation grazing, simply to maintain grassland for wildlife – for example, in Epping Forest, England. They are often used in some of the most wild places for livestock. Depending on the breed, cattle can survive on hill grazing, heaths, marshes, moors and semidesert. Modern cattle are more commercial than older breeds and, having become more specialized, are less versatile. For this reason, many smaller farmers still favor old breeds, such as the Jersey dairy breed. In Portugal, Spain, southern France and some Latin American countries, bulls are used in the activity of bullfighting; *Jallikattu* in India is a bull taming sport radically different from European bullfighting, humans are unarmed and bulls are not killed. In many other countries bullfighting is illegal. Other activities such as bull riding are seen as part of a rodeo, especially in North America. Bull-leaping, a central ritual in Bronze Age Minoan culture (see Bull (mythology)), still exists in southwestern France. In modern times, cattle are also entered into agricultural competitions. These competitions can involve live cattle or cattle carcases in hoof and hook events.

In terms of food intake by humans, consumption of cattle is less efficient than of grain or vegetables with regard to land use, and hence cattle grazing consumes more area than such other agricultural production when raised on grains.[115] Nonetheless, cattle and other forms of domesticated animals can sometimes help to use plant resources in areas not easily amenable to other forms of agriculture.

Sleep

The average sleep time of a domestic cow is about four hours a day.[116] Cattle do have a stay apparatus,[117] but do not sleep standing up,[118] they lie down to sleep deeply.[119] In spite of the urban legend, cows cannot be tipped over by people pushing on them.[120]

Economy


Holstein cattle are the primary dairy breed, bred for high milk production.

The meat of adult cattle is known as beef, and that of calves is veal. Other animal parts are also used as food products, including blood, liver, kidney, heart and oxtail. Cattle also produce milk, and dairy cattle are specifically bred to produce the large quantities of milk processed and sold for human consumption. Cattle today are the basis of a multibillion-dollar industry worldwide. The international trade in beef for 2000 was over $30 billion and represented only 23% of world beef production.[121] The production of milk, which is also made into cheese, butter, yogurt, and other dairy products, is comparable in economic size to beef production, and provides an important part of the food supply for many of the world's people. Cattle hides, used for leather to make shoes, couches and clothing, are another widespread product. Cattle remain broadly used as draft animals in many developing countries, such as India. Cattle are also used in some sporting games, including rodeo and bullfighting.

Cattle meat production

Cattle meat production (kt)

Country	2008	2009	2010	2011
Argentina	3132	3378	2630	2497
Australia	2132	2124	2630	2420
Brazil	9024	9395	9115	9030
China	5841	6060	6244	6182
Germany	1199	1190	1205	1170
Japan	520	517	515	500
USA	12163	11891	12046	11988

Source: Helgi Library,[122] World Bank, FAOSTAT

About half the world's meat comes from cattle.[123]

Dairy

Certain breeds of cattle, such as the Holstein-Friesian, are used to produce milk,[124][125] which can be processed into dairy products such as milk, cheese or yogurt. Dairy cattle are usually kept on specialized dairy farms designed for milk production. Most cows are milked twice per day, with milk processed at a dairy, which may be onsite at the farm or the milk may be shipped to a dairy plant for eventual sale of a dairy product.[126] For dairy cattle to continue producing milk, they must give birth to one calf per year. If the calf is male, it generally is slaughtered at a young age to produce veal.[127] They will continue to produce milk until three weeks before birth.[125] Over the last fifty years, dairy farming has become more intensive to increase the yield of milk produced by each cow. The Holstein-Friesian is the breed of dairy cow most common in the UK, Europe and the United States. It has been bred selectively to produce the highest yields of milk of any cow. Around 22 litres per day is average in the UK.[124][125]

Hides

Most cattle are not kept solely for hides, which are usually a by-product of beef production. Hides are most commonly used for leather which can be made into a variety of product including shoes. In 2012 India was the world's largest producer of cattle hides.[128]

Feral cattle

Feral cattle are defined as being 'cattle that are not domesticated or cultivated'.[129] Populations of feral cattle are known to come from and exist in: Australia, United States of America, Colombia, Argentina, Spain, France and many islands, including New Guinea, Hawaii, Galapagos, Juan Fernández Islands, Hispaniola (Dominican Republic and Haiti), Tristan da Cunha and Île Amsterdam,[130] two islands of Kuchinoshima[131] and Kazura Island next to Naru Island in Japan.[132][133] Chillingham cattle is sometimes regarded as a feral breed.[134] Aleutian wild cattles can be found on Aleutian Islands.[135] The "Kinmen cattle" which is dominantly found on Kinmen Island, Taiwan is mostly domesticated while smaller portion of the population is believed to live in the wild due to accidental releases.[136]

Environmental impact

A report from the Food and Agriculture Organization (FAO) states that the livestock sector is "responsible for 18% of greenhouse gas emissions".[137] The report concludes, unless changes are made, the damage thought to be linked to livestock may more than double by 2050, as demand for meat increases. Another concern is manure, which if not well-managed, can lead to adverse environmental consequences. However, manure also is a valuable source of nutrients and organic matter when used as a fertilizer.[138] Manure was used as a fertilizer on about 15.8 million acres of US cropland in 2006, with manure from cattle accounting for nearly 70% of manure applications to soybeans and about 80% or more of manure applications to corn, wheat, barley, oats and sorghum.[139] Substitution of manure for synthetic fertilizers in crop production can be environmentally significant, as between 43 and 88 megajoules of fossil fuel energy would be used per kg of nitrogen in manufacture of synthetic nitrogenous fertilizers.[140] A **cow** does on overage release between 70 and 120 kg of **Methane** per year. **Methane** is a greenhouse **gas** like carbon dioxide (CO2). But the negative effect on the climate of **Methane** is 23 times higher than the effect of CO2.[141]

Cattle in dry landscape north of Alice Springs, Australia (CSIRO)

One of the cited changes suggested to reduce greenhouse gas emissions is intensification of the livestock industry, since intensification leads to less land for a given level of production. This assertion is supported by studies of the US beef production system, suggesting practices prevailing in 2007 involved 8.6% less fossil fuel use, 16.3% less greenhouse gas emissions, 12.1% less water use, and 33.0% less land use, per unit mass of beef produced, than those used in 1977.[142] The analysis took into account not only practices in feedlots, but also feed production (with less feed needed in more intensive production systems), forage-based cow-calf operations and back-grounding before cattle enter a feedlot (with more beef produced per head of cattle from those sources, in more intensive systems), and beef from animals derived from the dairy industry.

Cattle near the Bruneau River in Elko County, Nevada

The number of American cattle kept in confined feedlot conditions fluctuates. From 1 January 2002 through 1 January 2012, there was no significant overall upward or downward trend in the number of US cattle on feed for slaughter, which averaged about 14.046 million head over that period.[143][144] Previously, the number had increased; it was 12.453 million in 1985.[145] Cattle on feed (for slaughter) numbered about 14.121 million on 1 January 2012, i.e. about 15.5% of the estimated inventory of 90.8 million US cattle (including calves) on that date. Of the 14.121 million, US cattle on feed (for slaughter) in operations with 1000 head or more were estimated to number 11.9 million.[144] Cattle feedlots in this size category correspond to the regulatory definition of "large" concentrated animal feeding operations (CAFOs) for cattle other than mature dairy cows or veal calves.[146] Significant numbers of dairy, as well as beef cattle, are confined in CAFOs, defined as "new and existing operations which stable or confine and feed or maintain for a total of 45 days or more in any 12-month period more than the number of animals specified"[147] where "[c]rops, vegetation, forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility."[148] They may be designated as small, medium and large. Such designation of cattle CAFOs is according to cattle type (mature dairy cows, veal calves or other) and cattle numbers, but medium CAFOs are so designated only if they meet certain discharge criteria, and small CAFOs are designated only on a case-by-case basis.[149]

A CAFO that discharges pollutants is required to obtain a permit, which requires a plan to manage nutrient runoff, manure, chemicals, contaminants, and other wastewater pursuant to the US Clean Water Act.[150] The regulations involving CAFO permitting have been extensively litigated.[151] Commonly, CAFO wastewater and manure nutrients are applied to land at agronomic rates for use by forages or crops, and it is often assumed that various constituents of wastewater and manure, e.g. organic contaminants and pathogens, will be retained, inactivated or degraded on the land with application at such rates; however, additional evidence is needed to test reliability of such assumptions .[152] Concerns raised by opponents of CAFOs have included risks of contaminated water due to feedlot runoff,[153] soil erosion, human and animal exposure to toxic chemicals, development of antibiotic resistant bacteria and an increase in *E. coli* contamination.[154] While research suggests some of these impacts can be mitigated by developing wastewater treatment systems[153] and planting cover crops in larger setback zones,[155] the Union of Concerned Scientists released a report in 2008 concluding that CAFOs are generally unsustainable and externalize costs.[156]

An estimated 935,000 cattle operations were operating in the USA in 2010.[157] In 2001, the US Environmental Protection Agency (EPA) tallied 5,990 cattle CAFOs then regulated, consisting of beef (2,200), dairy (3,150), heifer (620) and veal operations (20).[158] Since that time, the EPA has established CAFOs as an enforcement priority. EPA enforcement highlights for fiscal year 2010 indicated enforcement actions against 12 cattle CAFOs for violations that included failures to obtain a permit, failures to meet the terms of a permit, and discharges of contaminated water.[159]

Grazing by cattle at low intensities can create a favourable environment for native herbs and forbs; in many world regions, though, cattle are reducing biodiversity due to overgrazing.[160] A survey of refuge managers on 123 National Wildlife Refuges in the US tallied 86 species of wildlife considered positively affected and 82 considered negatively affected by refuge cattle grazing or haying.[161] Proper management of pastures, notably managed intensive rotational grazing and grazing at low intensities can lead to less use of fossil fuel energy, increased recapture of carbon dioxide, fewer ammonia emissions into the atmosphere, reduced soil erosion, better air quality, and less water pollution.[156]

Cattle grazing in a high-elevation environment at the Big Pasture Plateau, Slovenia

Some microbes in the cattle gut carry out anaerobic process known as methanogenesis, which produces methane. Cattle and other livestock emit about 80 to 93 Tg of methane per year,[162] accounting for an estimated 37% of anthropogenic methane emissions,[137] and additional methane is produced by anaerobic fermentation of manure in manure lagoons and other manure storage structures.[163] The 100-year global warming potential of methane, including effects on ozone and stratospheric water vapor, is 25 times as great as that of carbon dioxide.[164] Methane's effect on global warming is correlated with changes in atmospheric methane content, not with emissions. The net change in atmospheric methane content was recently about 1 Tg per year,[165] and in some recent years there has been no increase in atmospheric methane content.[166] Mitigation options for reducing methane emission from ruminant enteric fermentation include genetic selection, immunization, rumen defaunation, diet modification and grazing management, among others.[167][168][169] While cattle fed forage actually produce more methane than grain-fed cattle, the increase may be offset by the increased carbon recapture of pastures, which recapture three times the CO_2 of cropland used for grain.[156]

Health

The veterinary discipline dealing with cattle and cattle diseases (bovine veterinary) is called buiatrics.[170] Veterinarians and professionals working on cattle health issues are pooled in the World Association for Buiatrics, founded in 1960.[171] National associations and affiliates also exist.[172]

Cattle diseases were in the center of attention in the 1980s and 1990s when the Bovine spongiform encephalopathy (BSE), also known as mad cow disease, was of concern. Cattle might catch and develop various other diseases, like blackleg, bluetongue, foot rot too.[173][174][175]

In most states, as cattle health is not only a veterinarian issue, but also a public health issue, public health and food safety standards and farming regulations directly affect the daily work of farmers who keep cattle.[176] However, said rules change frequently and are often debated. For instance, in the U.K., it was proposed in 2011 that milk from tuberculosis-infected cattle should be allowed to enter the food chain.[177] Internal food safety regulations might affect a country's trade policy as well. For example, the United States has just reviewed its beef import rules according to the "mad cow standards"; while Mexico forbids the entry of cattle who are older than 30 months.[178]

Cow urine is commonly used in India for internal medical purposes.[179][180] It is distilled and then consumed by patients seeking treatment for a wide variety of illnesses.[181] At present, no conclusive medical evidence shows this has any effect.[182] However, an Indian medicine containing cow urine has already obtained U.S. patents.[183]

Digital dermatitis is caused by the bacteria from the genus Treponema. It differs from foot rot and can appear under unsanitary conditions such as poor hygiene or inadequate hoof trimming, among other causes. It primarily affects dairy cattle and has been known to lower the quantity of milk produced, however the milk quality remains unaffected. Cattle are also susceptible to ringworm caused by the fungus, *Trichophyton verrucosum*, a contagious skin disease which may be transferred to humans exposed to infected cows.[184]

Mycobacterium vaccae is a non pathogenic, possibly even beneficial bacteria, that is seen naturally in soil;[185] that was first isolated from cow dung.[186]

Effect of high stocking density

Stocking density refers to the number of animals within a specified area. When stocking density reaches high levels, the behavioural needs of the animals may not be met. This can negatively influence health, welfare and production performance.[187]

The effect of overstocking in cows can have a negative effect on milk production and reproduction rates which are two very important traits for dairy farmers. Overcrowding of cows in barns has been found to reduced feeding, resting and rumination.[187] Although they consume the same amount of dry matter within the span of a day, they consume the food at a much more rapid rate, and this behaviour in cows can lead to further complications.[188] The feeding behaviour of cows during their post-milking period is very important as it has been proven that the longer animals can eat after milking, the longer they will be standing up and therefore causing less contamination to the teat ends.[189] This is necessary to reduce the risk of mastitis as infection has been shown to increase the chances of embryonic loss.[190] Sufficient rest is important for dairy cows because it is during this period that their resting blood flow increases up to 50%, this is directly proportionate to milk production.[189] Each additional hour of rest can be seen to translate to 2 to 3.5 more pounds of milk per cow daily. Stocking densities of anything over 120% have been shown to decrease the amount of time cows spend lying down.[191]

Cortisol is an important stress hormone; its plasma concentrations increase greatly when subjected to high levels of stress.[192] Increased concentration levels of cortisol have been associated with significant increases in gonadotrophin levels and lowered progestin levels. Reduction of stress is important in the reproductive state of cows as an increase in gonadotrophin and lowered progesterone levels may impinge on the ovulatory and lutenization process and to reduce the chances of successful implantation.[193] A high cortisol level will also stimulate the degradation of fats and proteins which may make it difficult for the animal to sustain its pregnancy if implanted successfully.[192]

Oxen

Oxen (singular **ox**) are cattle trained as draft animals. Often they are adult, castrated males of larger breeds, although females and bulls are also used in some areas. Usually, an ox is over four years old due to the need for training and to allow it to grow to full size. Oxen are used for plowing, transport, hauling cargo, grain-grinding by trampling or by powering machines, irrigation by powering pumps, and wagon drawing. Oxen were commonly used to skid logs in forests, and sometimes still are, in low-impact, select-cut logging. Oxen are most often used in teams of two, paired, for light work such as carting, with additional pairs added when more power is required, sometimes up to a total of 20 or more.

Draft Zebus in Mumbai, Maharashtra, India

An ox is a mature bovine which has learned to respond appropriately to a teamster's signals. These signals are given by verbal commands or by noise (whip cracks). Verbal commands vary according to dialect and local tradition. In one tradition in North America, the commands are:

- "Back up": go backwards
- "Gee": turn right
- "Get up": walk forward
- "Haw": turn left
- "Whoa": stop


Oxen used in Plowing

Oxen can pull harder and longer than horses. Though not as fast as horses, they are less prone to injury because they are more sure-footed.

Many oxen are used worldwide, especially in developing countries. About 11.3 million draft oxen are used in sub-Saharan Africa.[194] In India, the number of draft cattle in 1998 was estimated at 65.7 million head.[195] About half the world's crop production is thought to depend on land preparation (such as plowing) made possible by animal traction.[196]

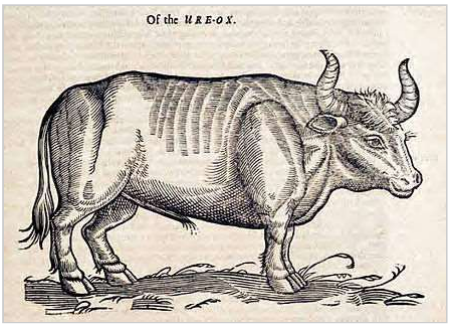

Riding an ox in Hova, Sweden

Religion, traditions and folklore

Hindu tradition

Cattle are venerated within the Hindu religion of India. In the Vedic period they were a symbol of plenty [197]:130 and were frequently slaughtered. In later times they gradually acquired their present status. According to the Mahabharata they are to be treated with the same respect 'as one's mother'.[198] In the middle of the first millennium, the consumption of beef began to be

disfavoured by lawgivers.[197]:144 Although there has never been any cow-goddesses or temples dedicated to them,[197]:146 cows appear in numerous stories from the Vedas and Puranas. The deity Krishna was brought up in a family of cowherders, and given the name Govinda (protector of the cows). Also, Shiva is traditionally said to ride on the back of a bull named Nandi.



The "Ure-Ox" (Aurochs) by Edward Topsell, 1658

Milk and milk products were used in Vedic rituals.[197]:130 In the postvedic period products of the cow – milk, curd, ghee, but also cow dung and urine (gomutra), or the combination of these five (panchagavya) – began to assume an increasingly important role in ritual purification and expiation.[197]:130–1

Veneration of the cow has become a symbol of the identity of Hindus as a community,[197]:20 especially since the end of the 19th century. Slaughter of cows (including oxen, bulls and calves) is forbidden by law in several states of the Indian Union. McDonald's outlets in India do not serve any beef burgers. In Maharaja Ranjit Singh's empire of the early 19th century, the killing of a cow was punishable by death.[199]


In Hinduism, the cow is a symbol of wealth, strength, abundance, selfless giving and a full Earthly life.

Other traditions

- The Evangelist St. Luke is depicted as an ox in Christian art.
- In Judaism, as described in Numbers 19:2 (http://www.mechon-mamre.org/p/pt/pt0419.htm#2), the ashes of a sacrificed unblemished red heifer that has never been yoked can be used for ritual purification of people who came into contact with a corpse.
- The ox is one of the 12-year cycle of animals which appear in the Chinese zodiac related to the Chinese calendar. See: Ox (Zodiac).
- The constellation Taurus represents a bull.
- An apocryphal story has it that a cow started the Great Chicago Fire by kicking over a kerosene lamp. Michael Ahern, the reporter who created the cow story, admitted in 1893 that he had fabricated it for more colorful copy.
- On 18 February 1930, Elm Farm Ollie became the first cow to fly in an airplane and also the first cow to be milked in an airplane.
- The first known law requiring branding in North America was enacted on 5 February 1644, by Connecticut. It said that all cattle and pigs had to have a registered brand or earmark by 1 May 1644.[200]
- The akabeko (赤べこ, *red cow*) is a traditional toy from the Aizu region of Japan that is thought to ward off illness.[201]
- The case of *Sherwood v. Walker*—involving a supposedly barren heifer that was actually pregnant—-first enunciated the concept of mutual mistake as a means of destroying the meeting of the minds in contract law.
- The Fulani of West Africa are the world's largest nomadic cattle-herders.
- The Maasai tribe of East Africa traditionally believe their god Engai entitled them to divine rights to the ownership of all cattle on earth.[202]

In heraldry

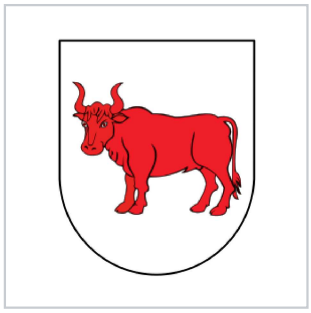
Cattle are typically represented in heraldry by the **bull**.

Arms of Mecklenburg region, Germany

Arms of Turin, Italy

Arms of Kaunas, Lithuania

Arms of Turek, Poland



Arms of Bielsk Podlaski, Poland

Arms of the Azores

Legend of the founding of Durham Cathedral is that monks carrying the body of Saint Cuthbert were led to the location by a milk maid who had lost her dun cow, which was found resting on the spot.

An idealized depiction of girl cow herders in 19th-century Norway by Knud Bergslien.

Population

For 2013, the FAO estimated global cattle numbers at 1.47 billion.[203] Regionally, the FAO estimate for 2013 includes: Asia 495 million; South America 348 million; Africa 305 million; Europe 122 million; North America 102 million; Central America 46 million; Oceania 42 million; and Caribbean 9 million. The following table shows the cattle population in 2009.[204]

As of 2003, Africa had about 231 million head of cattle, raised in both traditional and non-traditional systems, but often an "integral" part of the culture and way of life.[205]

Cattle population

Region	2009	2013 [206]
India	285,000,000 (By 2003)[207]	194,655,285
Brazil	187,087,000	186,646,205
China	139,721,000	102,668,900
USA	96,669,000	96,956,461
European Union	87,650,000	
Argentina	51,062,000	52,509,049
Pakistan	38,300,000	26,007,848
Australia	29,202,000	27,249,291
Mexico	26,489,000	31,222,196
Bangladesh	22,976,000	22,844,190
Russia	18,370,000	28,685,315
South Africa	14,187,000	13,526,296
Canada	13,945,000	13,287,866
Others	49,756,000	

See also

- 1966 anti-cow slaughter agitation
- British Cattle Health Initiative
- Bull-baiting
- Bullocky
- Bulls and Cows (game)
- Cattle age determination
- Cattle judging
- Cow tipping
- Cowboy
- Factory farming
- Category:Individual cattle
- List of cattle breeds
- List of domesticated animals
- Ranch

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Notes

1. The noun *cattle* (which is treated as a plural and has no singular) encompasses both sexes. The singular, *cow*, unambiguously means the female, the male being *bull*. The plural feminine form *cows* is sometimes used colloquially to refer to both sexes collectively, as *e.g.* in a herd, but that usage can be misleading as the speaker's intent may indeed be just the females. The bovine species *per se* is clearly dimorphic.

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