Cattle evolved as grazing and browsing animals and were domesticated approximately 8–10 thousand years ago to serve humans by providing meat, milk, draught power, and many minor benefits, from buttons to blue cheese (Phillips, 2018, p. 1). In addition to the approximately 1 billion cattle worldwide, there are approximately 200 million buffaloes, mainly in Asia (Shahbandeh, 2021).

Cattle production systems are differentiated in most countries into separate herds for beef and dairy production, but in some, such as the British Isles, the two are integrated. Separate breeds have been developed for high milk production and rapid growth, and it is the high-producing, single-purpose herds that have the most welfare risks because the physiology of the cattle is often strained to their limit. This is especially true for dairy cows, whose longevity in intensive milk-producing herds has declined from about 10 years a few decades ago to just 2–3 years now (Hu et al., 2021). Intensive dairying has practices that cause pain to the cows, and they also suffer from fever, fatigue, anxiety, and stress. Unhealthy conditions, such as during heat stress, impair cows’ immune systems, increasing their risks of disease, particularly around the time of parturition. Such welfare problems will make it difficult for dairy farmers to maintain social license in the face of public concerns, not just about welfare, but also emissions, food security, food quality, and water usage. Alternatives are available that reduce welfare concerns, for example restricted suckling systems and sheltering cows after their productive life has ended. These get good public support but require greater resources, with the potential to increase polluting emissions and use of scarce resources, such as water.

The growing demand for cattle products, especially milk and meat, has led to intensification of both dairy and beef production systems. In many countries, farms now operate as large businesses with thousands of cows, whereas only 50 years ago the majority of farms had fewer than 100 cows, run by a family. This has had positive and negative effects on cattle welfare. On the positive side, a large farm can purchase up-to-date equipment, which may enable better rationing to supply the needs of high-yielding cows, sick cows to be detected earlier and cows to be milked when they want, rather than at times determined by the farmer. Considerable potential exists to expand the use of new technologies to improve the welfare of cattle, but the motivation is not always present unless it means that the cattle produce more milk or grow faster. On the
negative side, intensification of cattle production into large farms has diminished the contact of cattle workers with their animals, and the intimate bond between the stockperson and their animals has largely vanished. Humans are an inherently social species; we thrive on bonds that we create with both humans and animals. This bond helped to create a caring attitude towards the individual animal in small farms, whereas nowadays the bonds are absent and cattle are known by numbers not names. Managers of large farms usually have profit as their overriding objective. Diseases, such as acidosis, may be tolerated, unless profit is adversely affected. Recurrent lameness and mastitis have become commonplace, despite the many scientific advances to reduce their prevalence in the herd. Another sign that cows are being overstressed is reproductive failure, causing high culling rates because cows fail to become pregnant.

Welfare problems arise in all aspects of cattle production systems. In this chapter I describe the role of diseases, feeding, housing, routine procedures, reproductive management and genetics, transport, handling and slaughter, mostly with reference to cow welfare, but also with special reference to bulls and calves.

Common cattle diseases

The most prevalent diseases in cattle herds are usually lameness and mastitis. There are situations in which lameness is rare, but in intensive dairy farming it is common, particularly if cows are kept indoors on concrete floors, because of the pressure walking and standing on concrete for long periods imposes on the cows’ feet.

The welfare impact of cattle diseases is determined by the duration and the severity of the disease. Common symptoms of pain in cows include withholding the part of the body generating the pain, such as a limb, bruxism (clenching of the teeth) and cessation of rumination. However, as prey animals cattle do not readily exhibit signs of pain.

High milk-producing cows need diets which have unnaturally high energy and protein concentrations if they are to avoid excessive weight loss. Grass alone is usually insufficient for this purpose; hence cows are fed supplements indoors. Standing on concrete puts more pressure on the hooves than is experienced at pasture, with the result that laminitis, or inflammation of the laminae of the hoof, is common. Lame cows experience pain in the affected limb, making it difficult to walk, stand to feed, and interact with other cows. Extremely lame cows have elevated heart and respiration rates (Tadich et al., 2013). The duration of lameness is usually one to two months (Phillips, 1990; Eriksson et al., 2020), longer for sole ulcers, white line disease, and heel erosion than interdigital phlegmon or digital dermatitis (Whay et al., 1998).

Mastitis, or inflammation of the udder caused by bacterial infection, also usually lasts about one month (Ruegg, 2017), but is often recurring within and between lactations. The udder of infected cows is swollen and sensitive to touch, making them appear lethargic, dejected, and in pain (Frössling et al., 2017). Lying down may put particular pressure on the infected gland, causing more pain.

Acidosis, or accumulation of acid in the rumen following overconsumption of carbohydrates, is common in early- to mid-lactation cows. The resulting inflammatory cytokines may damage the rumen wall (Zhao et al., 2018), and even in its subacute form inflammatory markers are evident in the blood (Gozho et al., 2005). Ketosis is a similar production-related disease, in which cows produce ketone bodies whilst mobilising body tissue to meet their energy requirements for lactation. This makes cows lethargic and withdrawn (Sahar et al., 2020). Less common but potentially fatal are hypocalcaemia and hypomagnesaemia, deficiencies of calcium and magnesium in the diet. The former is most common around the start of lactation, before cows release enough calcium from their bones to sustain output of calcium in milk, and the latter is most
commonly due to excessive potassium fertiliser application to stimulate pasture growth, since potassium in the rumen inhibits magnesium absorption. Dairy cows also suffer from metritis, or infection of the uterus, in which the reproductive tract becomes inflamed, and the passage of urine can be painful.

Bovine respiratory diseases are common in stressed cattle, especially during and after transport. Most are caused by viral pathogens, often followed by bacterial infections. Infected cattle experience hypoxia, hypercapnia and eventually respiratory failure. They attempt to compensate by increasing their heart output but usually become anxious and gasp for air. Other infectious diseases include tuberculosis, a bacterial infection mainly of the lungs, Johne’s disease, a bacterial infection of the gastrointestinal tract, and Foot and Mouth disease, a viral infection that causes bruxism and irritation to the feet of cattle. Developed countries have eradicated many of these infectious diseases by a rigorous culling policy of infected herds, but they are common in the emerging economies, such as India and Brazil, which together have 56% of the world’s cattle.

Feeding

Cattle are naturally herbivorous, characterised by their ability to digest fibrous feeds, with the aid of a modified forestomach, the rumen, which contains microbes that digest the feed. Boluses of partially digested feed are regularly regurgitated into the mouth to be chewed and mixed with saliva, before returning into the rumen. This process is mostly carried out whilst the cattle are lying quietly, particularly at night.

Cattle are well suited to grazing in herds, with careful selection of the best pasture. They will also take forbs and browse, and many rangeland systems for beef cattle rely on these, as well as spinifex grass. Grasslands are prone to variation in grass growth, as a result of fluctuations in circannual temperature and water availability, part of which is both predictable and normal. However, anthropogenic climate change, with its associated increase in temperature and fluctuations in water availability, will create challenges for cattle farming (Giridhar and Samireddypalle, 2015), particularly in the rangelands, where rainfall is naturally variable and there are limited opportunities to mitigate this with, for example, irrigation. More cattle will starve as a result, a condition characterised by a shortage of nutrients causing a reduction in functionality, such as reproductive failure (Hogan and Phillips, 2015). When starving, cattle initially are more active in seeking an alternative feed supply, their appetitive behaviour expands to include non-traditional potential feeds (pica), but eventually if no source of nutrients is found they become lethargic, as energy expenditure outweighs the chance of finding feed. Strategies to manage drought include selling cattle, but only the breeding animals as a last resort, purchasing fodder or moving cattle to areas with available feed. Action is often too slow, but better weather forecasting is facilitating timely action. With rangelands mostly managed by large corporations, profit is all important, and there is a temptation to overstock land, using carrying capacity in good years as a guide. Overstocking degrades pastureland, further depleting feed resources and allowing weed invasion.

Greater control of cattle feed supply is possible on intensively managed grasslands, particularly if irrigation is used. Fertilisers are often used to accelerate pasture growth, although this may create a nutrient imbalance, for example when potassium fertilisers deplete the sodium in plants which is required by grazing animals. Supplements are often necessary to correct nutrient deficiencies in grazing cattle, even on rangelands where phosphorus is commonly deficient, causing cattle to have weak bones. For high-yielding dairy cows, supplements are commonly used to increase energy and protein intakes, but this has the risk of the metabolic disorders referred to above. Concentrate supplements are often mixed with roughage in a Total Mixed Ration, which is offered to the cattle behind a feeding barrier. Thorough mechanical mixing is
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required, otherwise the diet will not be balanced for some cows. The feeding barrier should be of solid construction, otherwise cattle will get sores on their shoulders when they push forward to reach the feed (Phillips, 2018, p. 143). They often toss the mix into the passage, especially if it is old and stale. On smaller farms, cattle may eat wet conserved grass (silage) directly from a mound of grass clamped between two walls. To stop them eating unevenly from the “clamp”, an electrified wire may be suspended between them and the silage. Some young cows (heifers) become frightened and eat little. Also, those losing their milk teeth may have difficulty extracting the silage.

Beef cattle are often raised initially on pasture but transferred to feedlots for the final stages of growth. There they are fed a diet rich in cereals, and sometimes exclusively cereals, which risks metabolic disorders, especially if the cattle are introduced to the feed suddenly after being on rangelands. Feedlot cattle engage in stereotyped oral behaviours, usually tongue rolling, when fed inadequate roughage because the cereal feed is eaten rapidly and there is insufficient stimulation of the mouth. Antimicrobial compounds, such as the ionophore sodium monensin, may be included in the ration as they improve the efficiency of digestion in the rumen, however, they are now banned in many countries because of the development of antimicrobial resistance, which reduces the efficacy of the antimicrobials when used in human medicine.

Housing

Most dairy cows are kept indoors for ease of management, in particular of their diet. Some barns have individual stalls for tying the cattle (tie-stalls), which offer them little opportunity for movement or interaction with other cows. Cows are usually milked in the tie-stalls. However, many farms have advanced to loose (free walk) housing of their cattle, with a feeding barrier, passageway for feeding, and a lying area. The lying area may be simply an earth floor with straw bedding, which gives the cows a comfortable surface on which to lie. At high stocking densities there is a risk of cows’ teats being trodden on, which may lead to mastitis. More commonly cows are given raised concrete beds on which to lie, either side of a passageway, with separation dividers creating a cubicle (free stall) for each cow. They have more difficulty lying down and rising in cubicles compared with a straw-bedded yard, and they have often develop lesions on their legs (Blanco-Penedo et al., 2020). The size and shape of the bed, and construction of the divider, are critical if cows are to be comfortable. If the bed is too short, the cows’ rear end hangs over into the passageway; too long, and they excrete on the bed, not in the passageway, which can cause mastitis. Too wide and they can turn around; too narrow and they knock their hocks on lying and rising. If cows find the cubicles uncomfortable, they lie in the passageways, get dirty, and contract mastitis. Passageways need to be scraped regularly to remove excreta, either mechanically by blades passing down the passage, or by hand. Mechanical scraping can trap cows’ tails unless a suitable trip switch is incorporated. In future, consumer demand for cows to be able to display natural behaviour will mitigate against buildings with cubicles or tie-stalls (Galama et al., 2020).

Dairy cows are milked between one and three times daily. Traditionally this occurs in a parlour, with milkers in a pit so that the cows are at the milkers’ waist height to avoid having to bend down to place teat cups on the cows’ udders. Each teat cup consists of a solid tube with a flexible liner, and the space between these two is evacuated in a pulsatile manner, about once every second. Thus milk is removed from the udder by creating a vacuum between the liner and the tube, many times a minute, so that milk is sucked from the teat in a manner simulating a calf suckling her mother’s teat. The setting of the vacuum level and pulsation frequency is critical in avoiding pain to the cow during milking and development of mastitis (Bramley,
Robotic milking, in which a cow voluntarily enters a stall and a robot attaches a cluster of teat cups to her udder, is increasingly popular as it does not require a milker to get cows into a parlour and attach the teat cups. Although offering cows more freedom, it raises welfare concerns as the milker is no longer present during the milking process to deal with problems, and the cow–herdsperson bond is further diminished in this latest step in the automation of dairy farming (Driessen and Heutinck, 2015). However, the robot represents a consistent approach, whereas humans may treat cows well or badly in the milking parlour.

In the beef industry, feedlots have many welfare disadvantages compared with keeping cattle at pasture. First, cattle are kept at high stocking densities and the ground can become bogged in wet weather. In dry conditions, it is often dusty, leading to respiratory problems. Second, the concentrated diet is conducive to metabolic disorders and stereotyped oral behaviours, described above. Third, because the cattle are stocked at a relatively high rate and spend little time feeding and in other maintenance activities, a small proportion (2–4%, Phillips, 2018, p. 25) engage in riding behaviour, which may exhaust both the ridden and riding steers. Although this mimics sexual behaviour, it is more connected with aggression in steers, but in entire males (bulls) penises may become damaged during riding behaviour. Finally, the absence of natural shade, and often any shade, predisposes cattle to heat stress and mortality often ensues in the increasingly common heat waves.

If floor substrates like straw are unavailable, beef cattle housing may use slatted floors, in which cattle tread their excreta through slots in the floor. Walking on slatted floors is uncomfortable for cattle, and a bedded yard, using sand or other alternatives to straw, gives greater comfort.

**Routine procedures**

**Dehorning** – Cattle evolved with horns for defence from predators, but managing cattle with horns in crowded handling or transport situations is dangerous to both other cattle and humans. Hence the horns are often removed, either in a long-term genetic selection programme to produce polled (i.e. hornless) cattle, or more usually physically in each animal by disbudding (removal of the horn bud in a calf before it has attached to the skull) or dehorning (removal of the horn after it has attached to the skull). The horn is a sensitive part of the animal’s body that is highly innervated and vascularised. Horn bud removal in calves, usually with a knife, hot iron, or scoop is a painful procedure, and local anaesthesia and analgesia should be provided. Removal of horns in older cattle is a dangerous procedure, with risks of excessive blood loss, infection, and even death, but it is routinely conducted in rangeland cattle because they are only mustered once or twice a year. Often it is combined with castration, branding, and weaning in a single annual operation. The welfare advantages for cattle of being in a rangeland system – freedom to perform natural behaviour, calves remaining with their dams for at least six months, minimal handling by people – must be balanced against the welfare risks – nutrient deficiencies, ectoparasites, predation, and routine procedures being conducted at an older age when they cause more pain and risks to cattle health. Application of anaesthetic is often not practised on rangeland properties because to be most effective it would require cattle to be handled twice, with enough time in between for the anaesthetic to take effect. Increasingly an analgesic/anaesthetic combination is applied at the same time as processing of cattle, when it will have some benefit in pain relief.

It is important to remember that horns are an integral part of the identity of cattle and removing them is ethically questionable. Also, in some parts of the world cattle are attacked by wild dogs and crocodiles, and removing their horns renders them less able to defend themselves
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and their calves. Sometimes horns have to be removed because they grow into the animal’s skulls, but that is rare.

Desexing – Many cattle are desexed at an early age, to reduce the aggressive temperament in male cattle, which may reduce meat quality, and to prevent breeding in both male and some female cattle. In males it also advances the age at which an adequate fat cover for cooking develops, facilitating early marketing. Castration can use rubber rings around the testicles, which then atrophy and die, a Burdizzo clamp that crushes the spermatic cord, or surgery to completely remove the testes (Anon, 2014). However, castrated males grow slower than bulls and the practice is of questionable necessity. In females, desexing is either by a flank incision or per vaginal severance of the ovaries (Anon, 2011b). It is performed to prevent breeding in cows that are destined for slaughter.

Identification – This is necessary for individual recognition and treatment and sometimes to prevent theft. There are several methods – tagging, notching or tattooing of one ear, fire branding, microchipping, or freeze branding. All cause pain, but particularly fire branding, which should be accompanied by pain relief (Anon, 2011a). Analgesics, however, wear off and continued pain is to be expected, making it essential to choose the most pain-free method for identification.

Implants – Cattle may be implanted with slow-release devices. Some contain sex hormones to increase growth rate, in which case they are inserted into the ear, but there is evidence that the hormones make cattle more susceptible to heat stress (Gaughan et al., 2005). These are banned in many jurisdictions. Other implants contain micronutrients, in the form of boluses inserted into the rumen. Implantation is a stressful process for cattle and the necessity must be carefully considered.

Tail docking – In some wet regions of Australia and elsewhere heifers have about two-thirds of their tail removed so that they keep clean in the dirty conditions that they will have to cope with as adult cows. However, a cow’s tail is an important signalling device to other cows, as well as being used to remove flies from their hindquarters, and this practice is ethically questionable.

Reproduction management and genetic selection

Cows often have a low reproductive rate because nutrition fails to meet the demands of high-yielding dairy cows or even beef cows. Increasingly, cows are artificially supplied with female hormones in an attempt to overcome this problem. On most dairy farms semen from a bull known to have good genetic characteristics in his offspring is injected into the reproductive tract of the cows, rather than using natural insemination by a bull. The semen is frozen for storage and thawed before use. It can be sexed (Vishwanath and Moreno, 2018), which potentially avoids producing too many unwanted male calves. In intensive dairy production systems, male calves are almost worthless, so they are destroyed at just a few days of age, preventing them from having the opportunity of a life with good welfare. Because they are of minimal value, their removal from the farm and transport to an abattoir is often without consideration for their welfare. They may be transported to slaughter regardless of their condition. They may be deprived of milk for up to 30 hours and, because they do not have the same herding instinct that older calves have (Jongman and Butler, 2013), they can be more difficult to move and are manhandled or thrown with little regard for their welfare. However, even with sexed semen, a use for the increased number of female calves has to be found, given that cows usually survive 2–3 lactations. Some are exported from the intensive dairy industries of New Zealand, Chile, and Australia to Asia, to expand or replenish their dairy herds, but their welfare there must be considered in debating the ethics of this practice. Often countries in Asia are short of fodder and cows of the Holstein-
Friesian breed used in intensive dairies have big feed requirements, as well as much greater susceptibility to heat stress and tropical diseases than cows of local breeds (Moran, 2012).

Cows’ reproductive cycles may be controlled artificially by inserting a slow-release hormone treatment implant into their vagina, and insemination carefully timed following removal of the device. Thus natural mating, one of the foundations of normal behaviour and hence good welfare, is obviated in most dairy herds. As well, embryos may be removed from genetically high-producing cows by flushing the reproductive tract post insemination and inserting them into less productive cows to improve the yield potential of the herd. However, high yields predispose cows to diseases such as mastitis, and increasingly the objectives for breeding cattle are focused on disease resistance and extended lactations, rather than a high peak lactation, which is when most of the production diseases occur. A major risk of breeding methods in the past has been the reduction in genetic diversity and focus on just one breed, the Holstein-Friesian, for dairy farming. The selected cows have high milk yields, but they also require large amounts of concentrate feed, based on cereals, and are susceptible to heat stress and disease. As the world’s human population grows, cereals will be increasingly required for feeding to humans, not livestock, and breeds resistant to disease and heat stress and able to utilise by-products and other waste products will be required. Beef cattle have been mainly selected for rapid growth, which has favoured large cattle, but selection for cattle with excessive muscling has produced breeds, such as the Belgian Blue, which have difficulty giving birth without using the Caesarean operation because of their unnatural conformation.

**Bulls**

If bulls are used on dairy farms, their welfare needs careful consideration. Often they are kept in solitary confinement in a pen near to the cows, for example by the collecting yard for milking. They are let out when necessary to serve cows, by giving them access to a service box, or, in less intensively managed farms, they may be given access to cows at pasture. Solitary bulls are potentially dangerous, but aggressive behaviour can also be a problem in groups of bulls. Managing bulls is challenging and their welfare is often sacrificed for the safety of people handling them, by confining them in cramped conditions.

**Calves**

The welfare of the calf begins during pregnancy, when stress should be kept to a minimum. Calving is a critical time for cow and calf, and specialist facilities are required, including a clean calving box of adequate size. Allowing cows to calve in cubicle houses can lead to a poor welfare outcome for both cow and calf, with little comfort and a high risk of infection. Calves are usually removed from their mothers at a very young age, less than one week, far earlier than would occur under natural conditions. This induces a pessimistic mood in the calves, similar to that experienced after hot iron dehorning (Daros et al., 2014). Some degree of contact is better for the calves, for example contact over a fence, but it often does not fit in with modern management systems. The calves are then reared in some degree of isolation before being put into groups at the age of five or six weeks. This is to reduce the chances of diseases being transmitted, as calves are susceptible to pneumonia and scours, both communicable diseases. However, isolation in a pen, the normal method of containment, restricts calves’ opportunities to move and socialise with other calves, that are so desperately needed after the mother young bond is prematurely severed (Phillips, 2002). Feeding them reconstituted milk powder might seem like a circuitous route to offer cows’ milk, but it fits well with milking systems for high-yielding cows.
However, in many emerging economy countries, such as in South America, calves are allowed to suckle their mother's milk after some has been taken for human consumption. Care must be taken that calves get enough milk, but their dams do not lose too much weight, since calves extract more milk from the cow's udder than milking machines. In calf houses, milk may be fed twice a day in buckets, but this often leads to stereotyped sucking behaviour, of anything available in their pens – buckets, neighbours' ears, or mouths. It is preferable to offer milk replacer ad libitum (i.e. constantly available) via artificial teats attached to the calves' pens, with the teats leading to a vat of acidified milk to stop it spoiling, or at a “milk bar” where milk is constantly available.

After weaning off milk, the best environment for calves is sheltered grassland, provided it is not too cold, as the young calf generates limited heat. However, most weaned calves are kept in pens in barns. As they approach the time of entering the dairy herd, it is important to get heifers used to the new management system, including lying in cubicles and passing through their milking parlour.

Some calves remain on milk until slaughter at 70–150 kg to produce a pale meat called veal. After the public were alerted to serious welfare problems in this system of meat production in the last century, veal calf producers began modifying the systems of production to try to improve calf welfare without changing the characteristics of the meat. As a result, there are now diverse veal production systems (Anon, 2008); for example, some calves are now group housed, but others are still individually housed in crates to stop them from exercising, which is believed to make the meat darker and tougher (Costa et al., 2016). A concentrate supplement is sometimes fed to ensure adequate iron intake, but not always. Bedding may be restricted to prevent consumption and normal rumen development. Iron content of the ration is limited to prevent dark coloured meat, since consumers prefer white coloured meat, although the European Union has placed restrictions on this.

**Transport and handling**

All journeys cause cattle to become stressed, even if they are transported on foot. In vehicles, cattle are often overstocked and taken long distances without feed or water. Cattle are often required to be transported long distances if they have come from rangelands, which are usually in remote areas. Market price differentials also encourage cattle farmers to transport their animals further to achieve a higher sale price. Religious and cultural preferences for consuming recently killed animals and animals killed according to the standards of a religion, e.g. halal slaughter, are responsible for some cattle having to endure long journeys by sea and road, when logically carcasses would be transported instead. Many cattle travel from southern countries, e.g. Australia and Brazil, to the more populated northern countries to be slaughtered and consumed. Movement of cattle can also spread infectious diseases, such as foot and mouth disease.

Transport brings the risk of heat stress, because there are large numbers of cattle in a small space, and the heat output per animal is high. Overstocking is common in vehicles, exacerbating the heat stress risk and causing animals to knock into each other and the sides of the vehicle, bruising their muscles. Lack of feed and water also stress cattle transported over long distances. Fatigue is possible in cattle after repeated stepping to counteract the movements of the floor, especially on rough or winding roads or in heavy traffic. Some jurisdictions require livestock vehicles to be periodically unloaded to allow cattle to rest. The method of travel varies significantly in different countries; in Australia cattle are transported at high density in open-top trucks with corrugated floors, designed so that cattle do not lie down. The trucks may have several trailers and on dirt roads significant dust can enter the rear trailers. Distances are often long and
the risk of heat stress is high. In contrast to this, in Europe cattle are transported shorter distances in closed topped vehicles and unloaded periodically to rest.

Sea transport brings the risks of not only heat stress, which occurs when cattle travel from cool climatic conditions to a hot region in just a few weeks, but also accumulation of ammonia, released from the excreta which accumulates in the pens, and motion sickness (Phillips and Santurtun, 2013). Loading has special risks, particularly if there is a substantial ramp up to the ship. If tides are very variable, cattle are sometimes winched onto the ship, which must frighten them. Much fewer, but a growing number of cattle, travel by air, usually restricted to high value animals. As well as heat stress and high stocking densities, cattle in aeroplanes have to endure significant G force and noise on take-off, neither of which they are accustomed to. Further information about animal transportation is in Chapter 11.

Handling procedures are variable and of paramount concern for the welfare of cattle at all times, but particularly during transport. Moving cattle requires careful handling, respect for their welfare, and an acknowledgement by the handler that the slowest animal should determine the speed for the group. Much has been done in recent years to promote “low stress handling”, which allows animals to move under their own speed with better welfare than if people are hurrying them along. The speed at which to move cattle depends on how far they have to travel and the conditions at the time. Cattle mustered on rangelands may initially be encouraged to move towards a collecting yard by an aeroplane or helicopter, which forms them into groups. Then cowboys on horses, motorbikes, or in vehicles will take over and move them at a slower pace to the yards, so that they are not too stressed on entering the yards.

Cattle are taken through a handling race in order to inject them with slow-release micro-nutrients, vaccinations or to conduct routine procedures. A curved, solid-sided race encourages cattle to move through, and the handler should stand behind the leading cattle, working them around a “point of balance” just behind the shoulder (Grandin, 2014). Electric prods should only be used as a last resort, if the welfare of other cattle in a line is being affected. Cattle should never be shocked or hit on the head, and their tail should never be twisted or raised by the handler to motivate them to move forward. They should not be moved by placing a pincer or fingers in their nose and bulls should not have a ring inserted there to allow them to be safely handled, because it is extremely painful and can lead to inflammation. The basic principle is to move cattle by encouraging natural behaviour, not by causing pain.

Handling facilities in some emerging economy countries are necessarily simple, and sending cattle from rangelands, that have rarely been handled, for slaughter to these countries, has led to some poor welfare outcomes. For many in these countries, human welfare is a priority; animal welfare is rarely considered.

Slaughter

Most cattle are slaughtered as soon as their working life has ended. Only in India is there a system of retiring cattle to sanctuaries for the remainder of their natural life, a practice required by the Hindu faith. Cows’ welfare in the shelters may be compromised by overcrowding, poor flooring, and limited feed (Sharma et al., 2019), but conversely they are given the opportunity for extended life, including one with good welfare in the best facilities.

Slaughter can be a painful process for cattle. Of particular concern is whether cattle lose consciousness quickly, and whether the process is terminal (cattle may regain consciousness after stunning if exsanguination is not conducted rapidly enough). Some religions do not allow animals to be stunned, most notably the Jewish faith (shechita slaughter) and, according to some authorities, the Muslim faith (halal slaughter). Halal slaughter is often conducted without
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Stunning in emerging economy countries because of the cost, but there should still be a means of restraining cattle suitably for a rapid knife cut to the throat. Often this is lying them on the ground, rather than being in the standing position (Imlan et al., 2021). Boxes that invert the cattle are not suitable – they cause fear and discomfort in the cattle. If animals are not stunned, rapid and complete severance of the neck arteries is essential to allow the animals to exsanguinate and die as quickly as possible. Stunning cattle is usually achieved by firing a retracting bolt into the forehead of the animal. Most effective are the penetrating bolts, which enter the cranial cavity to inflict injury directly on the brain; less effective are non-penetrating bolts, which often necessitate repeat stuns (Neves et al., 2016). Further information about slaughtering is in Chapter 12.

Environmental stresses

Thermal stress – Cattle are particularly susceptible to thermal stress because the microbial fermentation in their rumen generates large amounts of heat. Many cattle are kept in hot parts of the world, often in small farms with few resources to mitigate the heat stress, and they are important as a source of work and capital for many subsistence farmers. In sophisticated dairy farms, cattle will be cooled by sprinklers and fans, especially at milking time; this helps them to cope with the heat and produce large quantities of milk. The heat stress experienced by cattle is dependent on the ambient temperature, humidity, solar radiation and air velocity. High-yielding dairy cows, rapidly growing beef cattle, and black-coated cattle are most susceptible. They start to take action to reduce their heat load, by sweating and panting, at temperatures as low as 25°C (Berman et al., 1985).

Facilities can be designed to reduce the risk of heat stress, but in the hotter regions of the world, this is not enough to prevent many animals experiencing heat stress and some dying, particularly in feedlots, in which animals may be crowded together without shade. Global climate change is exacerbating the problem and is expected to become progressively worse over the course of this century, perhaps pushing cattle production towards the earth’s poles.

Lighting – Cattle see the world differently to humans, with limited binocular vision but a wide field of monocular vision (330°), and an extended visual streak with concentrated light perception cells, in contrast to our own point source of excellent acuity in the form of a fovea. Cattle handlers need to be aware of their wide field of vision and good night vision, but limited ability to judge the distance of things close to them. Artificial lighting in their facilities is important to allow cows to see their way to feed and to be able to engage in social interaction at night.

Noise and vibration – Cattle hear the world differently to humans, with better hearing in the high frequency zone. This means that high pitched parlour noise, for example, may disturb cattle but not us, particularly if it exceeds 75 dB (the level created by an average vacuum cleaner or radio). This can be detected when they defecate after entry, a sign that they are stressed. Vibration from heavy machinery or traffic can also disturb cattle, especially the low frequency vibrations that travel further (Phillips, 2018, p. 156). These stresses are commonly experienced during transport, when there are multiple stresses for cattle to contend with simultaneously.

Electricity – Cattle are easily stressed by electricity, a characteristic exploited when controlling them with electric fences. Stray voltage often exists in poorly earthed barns, in water troughs, for example, or milking parlours, and cattle behaviour should alert good herdsmen to the problem. Lapping water like a dog, rather than full muzzle immersion in water, is one sign; flinching when teat cups are applied is another.
Working cattle

Cattle are used in many emerging economies, especially in South and South-east Asia, for pulling field implements, such as a plough, raising water, crushing seeds, and moving equipment and timber (Ramaswamy, 1994). Just over 25 years ago, Ramaswamy estimated that there were 246 million cattle and 60 million buffalo used for draught purposes worldwide (Ramaswamy, 1994). Pulling heavy loads can place a strain on the backs of cattle, and prolonged periods of work require adequate rest and extra nutrition, especially energy and the salts needed to replace sweating losses. Draught cattle are often beaten to make them work harder. Another welfare issue is an ill-fitting harness, which can cause chafing of the skin and deep sores. Draught cattle are usually restrained and sometimes blindfolded when undertaking this work, preventing them from engaging in normal behaviour.

Conclusions

Cattle production systems have, in the past, helped humans to colonise new lands, generating valuable foods and other resources for humans, such as draught power, from land which was marginal for other purposes. However, cattle themselves require many resources, resources which are increasingly questioned in times of diminishing availability for humans and other animals, when new technologies can allow even marginal land to be used for crops or forestry. The many welfare concerns about the cattle production systems that humans use are encouraging consumers to switch to the ever-growing number of plant-based alternatives to meat and milk. Unless the welfare issues can be addressed, and it can be shown that cattle production systems have a role to play in using by-products of plant production systems, these systems may become superseded by more efficient and less contentious methods of producing food for human consumption. Systems integrating cattle with trees and pasture, for example, offer many welfare benefits, with natural shade, drought and disease resistance, and high overall productivity, but they require careful management. Cattle, the largest animal we have domesticated on a grand scale, are inherently difficult to look after to high welfare standards. Knowledge transfer between generations of farmers is important, but increasingly at risk due to the migration of young people to the cities. High welfare systems of cattle production are attainable, but only with substantially higher costs to consumers, costs which they may not be willing to bear in the face of strong competition.

References

Farming cattle


