Welfare of Animals: Political and Management Issues

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Current Concepts of Sustainability

In the past, systems were called unsustainable when a resource became depleted so much that it became unavailable to the system, or when a product of the system accumulated to a degree that prevented the functioning of the system. The meaning of sustainability is now much wider. A system can be unsustainable because of negative impacts on human welfare including health, animal welfare, or the environment. A definition of sustainability is: a system or procedure is sustainable if it is acceptable now and if its expected future effects are acceptable, in particular in relation to resource availability, consequences of functioning and morality of action (Broom, 2014). It is important that new, sustainable systems be developed in place of some current crop and animal production practices. Such changes are being driven by consumers who now require transparency in commercial and government activities and evaluate sustainability and the ethics of food production as part of product quality (Broom, 2010, 2017a). A food production system might be unsustainable because of: adverse effects on human welfare, including health; poor welfare of animals; inefficient usage of world food resources; harmful environmental effects such as low biodiversity or insufficient conservation; unacceptable genetic modification; not being "fair trade" in that producers in poor countries are not properly rewarded; or damage to rural communities. Where consumers demand that sustainable systems are used, if they are not used, retail companies, production companies and countries that do not produce good quality, sustainable products are likely to be boycotted and hence forced to change (Bennett et al., 2002; Broom, 2014).

At present, harms to human welfare, especially to human health, are the largest factor leading to unsustainability. Attempts to provide a healthy diet have led to a dramatic increase in the production of farmed fish, in part because they contain poly-unsaturated fats (Wall et al., 2010). Another human and animal health impact is that in all aspects of farming, antibiotic use will have to decrease, in most countries via legislation. This is because of the development of antibiotic resistance, largely resulting from misuse of antibiotics in human medicine but partly because of prophylactic and growth-promoting, rather than just therapeutic, use in livestock farming (Ungemach et al., 2006).

Close confinement of animals, individual rearing of social animals such as pigs and cattle, and other systems for housing and managing animals that do not meet the needs of the animals are so much disliked by many consumers that they will not buy the animal products. An increasing result of this is the number of people who decide to become vegetarian or vegan. Other people just decide not to buy particular animal products. Hence some widely-used animal housing systems are unsustainable (Broom, 2017a). Animal welfare is discussed further below, together with data on welfare in some sustainable livestock production systems.

Many people in the world are unwilling to accept the use of genetically modified plants and few people accept the use of genetically modified or cloned animals. This antipathy is partly dislike of modifying what is natural. Another aspect is that modified organisms may have allergenic proteins and many of the public do not believe that proper checks on such possibilities are in place. Animals which are genetically modified may have welfare problems so there should be checks, using a wide range of welfare indicators, before they are used in any way (Broom, 2008, 2014).

In most countries, agricultural methods that result in low biodiversity are a consequence of widespread herbicide and pesticide use and are perceived to be the norm by many farmers and some of the general public. Livestock production can also result in pollution, locally and on a world-wide scale, e.g. via greenhouse gas production. Greenhouse gas production can be reduced in various ways, for example by modified feeding systems. Maintaining resources, such as soil with good structure, and retaining water that might be lost from the soil are important objectives, as are minimising usage of carbon-based energy and imported fertilisers. Soil is often damaged by tillage and greenhouse gases are emitted (Pagliai et al., 2004). A specific example of livestock farming methods leading to dramatic environmental effects is the widespread death of vultures in India caused by the use of the veterinary drug diclofenac. The population declined to only 3% of its former level but is starting to recover following legislation.

One cause of inefficiency of use of food and energy resources is that much human food in homes, restaurants and shops and some food for farm animals is wasted. Almost all of this waste could be prevented. In addition, much food that humans could eat is fed to animals that are then eaten by people. This is a much less efficient process than for the humans to eat the food directly. What can be done in animal production to exploit existing resources better (Herrero et al., 2010)? Herbivores eating forage plants do not compete with people for food. Those that eat mainly cereals, such as pigs or poultry, or ruminants fed cereals, compete with humans so forage plant eaters are more important (Broom et al., 2013). Similarly, herbivorous fish are more important than those fish that eat other fish. Land used for agriculture is sometimes degraded or for other reasons is not exploited efficiently. Too much

energy from fossil fuels is used in cultivation and transport of feed and products, as well as in production of fertilisers and other materials and equipment.

In many countries now, consumers have discovered that producers of food in poor countries are often not properly rewarded for their work. Most profits from the sale of some basic products bought by many people were found to go to large companies. This is considered morally wrong by most consumers and, as a consequence of publicity about unfairness to poor producers, products like coffee, cocoa and fruit are among those that are independently checked and have a Fair Trade label (Nicholls and Opal, 2005). Hence the producers receive a larger part of the money paid by shoppers in relatively rich countries.

When small-scale rural farmers are out-competed by large-scale production, local communities may disappear. The general public often find this unacceptable so schemes are introduced by governments to safeguard such communities. Consumers may also buy locally-produced products, regarding this as a part of product quality. In the European Union, subsidies to preserve rural communities have prevented large cities from becoming ever larger (Gray, 2000; Broom, 2010).

Some Systems for the Future

Three-level plant production, including pasture, shrubs with edible leaves and trees that may also have edible leaves, are examples of silvopastoral systems. The major development of such systems so far is in tropical and sub-tropical countries. A cattle production system, that is referred to as semi-intensive because the density of cattle is quite high during rotation through pasture and *Leucaena* plots, is explained by Murgueitio et al. (2011) and Broom et al. (2013). There are also possibilities for feeding tree and shrub leaves to pigs, poultry or farmed fish. Where shrubs and trees are too high for animals to reach, branches can be cut and fed to the animals. This can be especially valuable during dry periods when there is little pasture or shrub growth, for example the use of ramon trees with high levels of protein in the leaves in Yucatán and other parts of Mexico.

Semi-intensive three-level silvopastoral systems produce more edible plant material and more animal products than pasture-only systems (Murgueitio et al., 2011, Broom, 2017b). Nitrogen-fixing plants are used so artificial fertiliser is not needed. They generally have better soil structure, better water-retention and less soil loss (Murgueitio et al., 2008). They also have much greater biodiversity than monoculture, single-level systems. There was less pollution run-off because of water-holding properties of soil, less methane production per kg meat and better carbon sequestration. Land and conserved water use for beef cattle were lower than for monoculture pasture or for feedlot systems (Broom in prep). Workers on silvopastoral farms reported better job satisfaction (Broom et al., 2013).

Animal Welfare and Some Examples of Its Role in Sustainability

Poor welfare of animals is considered by the public in most countries to be a major cause of unsustainable livestock production and poor quality of animal product. Welfare is the state of the individual as regards its attempts to cope with its environment (Broom, 1986) so can be measured scientifically. The brain controls almost all attempts to cope, including feelings which are adaptive coping mechanisms and a part of functioning. Animal disease can have a large impact on animals so health is a key part of welfare. Welfare measures, such as those of behaviour, physiology, immune system function, clinical condition and body damage, are described by Blokhuis et al. (2010), Broom and Fraser (2015). As a result of much animal welfare science research, we now have information about the needs of the main farm animal species so consideration of these is the first step in evaluating systems for keeping and managing animals. This approach has largely superseded the less precise five freedoms approach.

A point is emphasised in the "one health" and "one welfare" discussions is that, like health, welfare has exactly the same meaning for human and non-human animals. We can consider the welfare of all animals that are alive, but the term does not apply to plants or inanimate objects. The killing of animals is a moral issue but, where animals are killed, welfare issues concern the period up to death. Humane killing means treatment of animals prior to death in such a way that their welfare is good to a certain high degree. Euthanasia means "a good death" so it does not just mean humane killing. The definition is the same for humans and other animals: euthanasia is the killing of an individual for the benefit of that individual and in a humane way. Killing pets, laboratory or farm animals for owner convenience is not euthanasia (Broom, 2007, 2014).

The most important animal welfare problems concern animals that are very numerous. The commonest animal kept by people is the chicken used for meat production. There are 4000 million in Europe (Broom, 2017a), and broiler chickens grow in body size too fast for their leg development. Most meat chickens have difficulty in walking, because of pain in their legs, for 20% of their lives. Welfare outcome indicators, such as walking tests and measurement of occurrence of hock burn and breast blisters give information about poor welfare in broilers. Changes in genetic selection and feeding, so that growth is slower, could solve the problem. However, measures of foot-pad dermatitis as required in E.U. legislation, do not deal with leg weakness, the most important animal welfare problem.

Laying hen welfare is best when they are kept in a good aviary environment and is slightly improved for some birds by access to the open air (free-range). Battery cages do not provide for most of the needs of hens, for example hens need to perch, investigate by pecking, lay eggs in an acceptable nest, escape from injurious pecking attempts and have exercise in order to avoid bone weakness and breakage. Birds kept for breeding broilers are fast-growing but food-restricted so they are often hungry, a serious cause of poor welfare. The public perceives, as a result of good scientific information, that poor welfare is the main sustainability issue for chicken meat production and egg production.

Trout and salmon are the second and third commonest farmed animals in Europe. Major welfare problems for these fish are poor water quality, disease, and fin-chewing, associated with high stocking density. However, there are other sustainability issues since both species are predators and have to be fed other fish products. Herbivorous fish such as carp, grass carp or *Tilapia* do not have this problem. There is sometimes environmental damage from pollution resulting from fish nitrogenous waste, unused fish food and chemicals used to control parasites such as sea-lice in salmon.

The welfare of farmed rabbits is often particularly poor with causes including lack of space, the necessity to stand on wire-mesh flooring, disease and no time between litters for breeding females (EFSA, 2005). The greatest duck welfare problems are lack of access to open water for almost all ducks and force-feeding for foie gras production (Liste et al., 2012; Rochlitz and Broom, 2017). Turkeys may be kept at too low a light level and be unable to breed naturally because of large breast muscle size (Marchewka et al., 2013).

One of the worst examples of poor welfare in any animal is that resulting from the confinement of pregnant sows in stalls or tethers. This is a particularly cruel practice for such a sophisticated social animal and there is much behavioural, physiological and other evidence for it. The welfare of growing pigs is poor when they lack sufficient suitable material to manipulate and are kept at too high a density, or on flooring that damages their feet. Transport is particularly stressful for pigs. The diet currently provided to most pigs is nutritionally similar to that suitable for humans. They can usefully be fed on some materials that people do not eat, or on human food waste if it is appropriately treated to ensure that there is no transmission of disease (zu Ermgassen et al., 2016).

When calves, which are social animals, are kept in small individual crates their welfare is very poor. Also, it is wasteful to produce male dairy calves for which there is no market but the sexing of semen is gradually allowing that problem to be solved. Apart from farm operations without anaesthesia or analgesia and high densities in feedlots, the welfare of beef cattle is usually good. However we have now reached a situation where the poor welfare of high-producing dairy cows, because of lameness, mastitis and reproductive disorders, is perhaps the second worst animal welfare problem. Cattle production can be unsustainable for other reasons. Dairy cattle can utilise pasture plants, a resource unavailable to humans as food. However, many are fed concentrates that humans could eat. Cows producing 9000 kg of milk per lactation may have 40% of concentrates in their diet and, in some countries, 96% of their protein is usable by humans. This entails a net loss of nutrients for humans. If dairy cows have a diet with 70% or more forage plants and 30% or less concentrates there is a net food benefit for humans. The production of methane by ruminants, such as cattle and sheep, is important because of its properties as a greenhouse gas but the rumen micro-organisms that produce the methane can be greatly reduced in number by a modified diet.

The welfare of animals kept on pasture-only systems is usually better than that of animals in feedlots but can be poor because of heat-stress, parasitic and other infectious disease and low nutrient availability with associated competition. The welfare of animals in silvopastoral systems has been demonstrated to be better in various ways than that on pasture-only systems (Broom et al., 2013; Broom, 2017b). The beneficial effects of shade are substantial in hot weather. High temperature increases water and energy loss and reduces foraging times in paddocks fully exposed to the sun (Améndola et al., 2016). Less sun exposure results in less sun-burn, less cancer and less photosensitization. Anxiety and fear, including fear of humans, can be reduced when partial concealment is possible. This leads to better human–animal interactions and easier handling (Mancera and Galindo, 2011). More choice of food in silvo-pastoral systems results in more control by each individual animal of its environment and so social behaviour is more normal (Améndola et al., 2016).

The increase in predators in silvopastoral systems lowers the populations of ticks and injurious insects, such as horn flies, and hence reduces the incidence of diseases such as anaplasmosis (Murgueitio and Giraldo, 2009). Reduction in diseases also leads to reduced antibiotic use. The presence of nitrogen-fixing shrubs such as *Leucaena* improves animal nutrition and this, together with the better water-retention by the soil, reduces the likelihood of thirst and starvation. Feeding behaviour is improved at high temperature and humidity when the animals are in a silvopastoral system (Ceballos et al., 2011). It may be that the improvement in dietary choice contributes to this beneficial effect.

Animal welfare is now regarded as a matter of public morality by the World Trade Organization, following the judgement on the seal-skin trade issue (e.g see Broom, 2017a). This judgement reflects an increasingly widespread view around the world.

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