Measuring the welfare of livestock in extensive production systems: Can we, should we?

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1. Introduction

Whether we are able to measure welfare depends on how we define both ‘measure’ and ‘welfare’. The term ‘measure’ is defined as the amount of something and suggests objective quantification. This contrasts with the term ‘assess’, which is a process of evaluation or judgement and implies subjective quantification.

If we accept the proposal put forward by Duncan and Petherick (1989, 1991) that welfare is all about the feelings experienced by animals, then it is evident that we cannot measure welfare, as feelings are subjective states that cannot be measured directly. What we are able to do, however, is to measure parameters, such as behavioural and physiological changes, and preferences shown by animals that may be correlated with feelings. This has been the pragmatic approach taken by the majority of animal welfare scientists, although it has been criticised by Duncan (1996) because we do not know what the behavioural and physiological changes mean in terms of the feelings experienced. This correlation approach means that whilst a direct measure of welfare remains elusive, a reasonable assessment of welfare can still be achieved through an appraisal of relative changes in a variety of measures.

Accepting that measuring welfare involves the assessment of a variety of behavioural and physiological responses, in this paper we address two main questions: (1) is there a need to measure the welfare of extensive, rangeland livestock?; and (2) are we able to measure their welfare? Under the first question we examine the matter of community expectations in relation to livestock management and how these are addressed in Quality Assurance (QA) schemes and legislation. Under the second question we discuss the challenges to measuring the welfare of rangeland livestock, what current options are available and what the future may bring for overcoming some of the challenges.

2. Is there a need to measure the welfare of extensive livestock?
Welfare is measured to determine animals' responses to management practices and procedures in order to determine whether our management standards and practices are appropriate, or whether modification is required.

The general community and consumers are becoming increasingly concerned about the care and management of livestock and these concerns seem to be playing an increasingly important role in purchasing behaviour (Verbeke and Viaene, 2000; Jago et al., 2000). Furthermore, as public awareness of animal welfare increases, it is likely that producers of extensively farmed livestock will come under increasing pressure to ensure high standards of animal welfare (Deag, 1996). There are two main ways in which the community and consumers are assured of high standards of livestock care and management: QA schemes and legislation.

2.1 Quality assurance (QA) schemes
There is recognition that QA programs can provide mechanisms for demonstrating and monitoring animal welfare standards, encouraging continual improvement in practices and providing assurances not just to consumers, but to customers, trading partners and governments. While QA schemes previously focussed on food safety, they are now being seen as an appropriate vehicle to provide assurance on other credence values, such as traceability, animal health and welfare. In recent years there has been considerable effort towards the development of standards and/or QA programs that incorporate animal welfare, both nationally (e.g. Barnett and Glatz, 2004; Edge et al., 2008) and internationally (e.g. Blokhuis et al., 2003; Main et al., 2003).

A major challenge for the development and application of animal welfare QA programs is the definition, measurement and interpretation of observed changes in animal behaviour and physiology within a variety of production systems. This challenge creates difficulties for the development of animal welfare standards, their practical application by auditors or assessors and for applying appropriate measures in a repeatable, robust and non-intrusive manner. These issues have not, however, stopped the development of standards and QA schemes globally, and to provide some assurance on practices in spite of these challenges these schemes tend to include both animal-based measures (physiology, behaviour, health, mortality) and resource-based measures (inputs to the system, such as management/stockmanship, routine husbandry/housing and environment). There appears, however, to be an increasing emphasis on the need for appropriate animal-based measures in QA schemes in order
to deliver assurances on the welfare of individual animals, in addition to the system within which they are managed.

2.2 Legislation

Animal welfare is predominately a State responsibility in Australia. In Queensland the Animal Care and Protection Act, 2001 is the main legislative tool to safeguard animal welfare. Under the Act, livestock producers or others responsible for livestock are the designated “person in charge” of an animal and they have a “duty of care” to the animal(s). A person breaches this duty of care if they do not take “reasonable steps to (a) provide the animal’s needs for the following in a way that is appropriate – (i) food and water; (ii) accommodation or living conditions for the animal; (iii) to display normal patterns of behaviour; (iv) the treatment of disease or injury”. Thus, producers have a legal obligation to be aware of the welfare status of rangeland livestock and to intervene in the event of injury or disease, and shortages of food and water. The Australian Model Codes of Practice for the Welfare of Animals (Welfare Codes) provide guidance on the expected practices and actions that will deliver required animal welfare outcomes and are utilised in support of the aforementioned legislation.

Recognising that a key limitation to safeguarding animal welfare in extensive systems is the frequency of inspection, an obvious gap in the Welfare Codes is guidance on the monitoring of livestock. For instance, if producers are aware of an injury or disease issue then they have an obligation to intervene, however, the Welfare Codes for cattle (Primary Industries Standing Committee (PISC), 2004) and sheep (PISC, 2006) provide little guidance on the frequency and thoroughness of monitoring and inspecting. Some might argue that there should be greater inputs (time and labour) towards frequent monitoring of all animals, whilst others might assert that to do so would be uneconomic and/or impractical. Advances are being made, however, in relatively low-cost technologies that allow remote monitoring of livestock (see 3.2 below).

3. Are we able to measure the welfare of extensive livestock?

An examination of the recent literature relating to on-farm welfare monitoring and use of animal welfare QA schemes clearly demonstrates a strong emphasis on livestock in confinement. For example, of approximately 109 English language scientific publications listed on the European Union’s Welfare Quality® website, 27 (24.8%) relate to pigs, 19 (17.4%) to poultry and 14 (12.8%) to dairy cattle, with a further 41
relating to surveys and general methods for developing protocols. The Bristol Welfare Assessment Protocol has parameters for pigs, laying hens and cattle (dairy and beef) (Whay et al., 2003a, b; Main et al., 2007). Qualitative assessment of livestock behaviour has been recommended as a tool for on-farm monitoring of welfare (Wemelsfelder and Lawrence, 2001); the majority of the work on this method has been conducted with pigs, although some work has been done with other livestock e.g. dairy cattle and sheep (Wemelsfelder, 2007).

There are several possible reasons for this emphasis on confined animals. Outdoor farming has a more favourable image (Rogers et al., 1989; Matthews, 1996), largely because of the freedom of the animals to perform a range of species specific behaviours and possibly, the perception of less stress and fewer health problems (Hemsworth et al., 1995). Additionally there is perhaps an increased focus on livestock welfare in intensive systems because extensive livestock are in a “natural” environment and are less restricted and controlled by humans (Lynch et al., 1992). Certainly, there is evidence that long-term confinement with the associated restrictions on behaviour jeopardises welfare (see review by Petherick and Rushen, 1997). However, good animal welfare requires more than the absence of behavioural restriction, as illustrated by the duty of care requirements described above. Within intensive systems, the ease with which disease can spread through large groups of animals in confined areas, or mechanical failures of environmental control systems can have disastrous consequences for welfare. Animals in confinement are usually in closer proximity to humans and consequent fear of humans by animals can induce a significant stress response with negative impacts on productivity (Hemsworth and Coleman 1998; Hemsworth, 2003). Nevertheless there remain welfare challenges in extensive production systems, including the large seasonal variations in food supply, climatic conditions, predation and the restricted opportunities for direct monitoring and supervision (Matthews, 1996; Petherick, 2005).

A further explanation for the prominence given to welfare of confined animals may relate to the relative ease of examining, measuring and regularly monitoring the welfare of livestock in intensive situations, e.g. climatic conditions in controlled environments, the ability to inspect animals individually and monitor changes at the behavioural level that may indicate health and welfare problems. In contrast, livestock in extensive systems can be grazing across large areas and there is limited opportunity to frequently observe animals when they may be spread over many ha or even km².
3.1 *Challenges for measuring the welfare of extensive livestock*

As a consequence of the low-input nature of Australia’s extensive rangeland production systems (Petherick, 2005, 2006), a key challenge to measuring the welfare of extensive livestock is the stockperson’s ability to inspect individual animals. Cattle and sheep are generally mustered only a few times a year for management procedures and health treatments (e.g. mulesing, dehorning, castration) and at these times they may be inspected at close-quarters. Measures taken under experimental conditions during such management procedures have demonstrated that welfare is compromised (Morisse *et al*., 1995; Mellor and Stafford, 1999; Kent *et al*., 2001; Grant, 2004), and suggest similar outcomes under commercial conditions. These findings provide a basis for management standards (and legislative policy) for these specific procedures, they do not, however, provide direct measures indicative of the individual animals’ typical welfare status when in the paddock.

Additional inspections of livestock depend on the size of the enterprise, and generally coincide with activities such as monitoring of water supplies and fencing, however topography and animal dispersal limit the ability for all animals to be observed. As a consequence of these difficulties, current animal-based measures of welfare include measures of productivity (e.g. liveweight gain and fertility) health records, numbers of mortalities, culls and injuries and body condition score (to reflect nutritional status). The drawback with these measures is that they are made infrequently (sometimes seasonally) and they inform of a “welfare event” following its occurrence, rather than prompting timely action, for instance, provision of improved nutrition, treatment or humane destruction of sick or injured animals.

Even when livestock can be located, observed and measurements taken in paddocks, a question remains over how representative these measures really are for both the individual and the herd, given the variability of the animals’ environment. Unlike intensively-housed livestock that generally have controlled and relatively constant environments, the environment of a rangeland animal and the associated welfare status may change dramatically in a relatively short timeframe, such as in response to severe weather, accident, disease outbreak or predation.

3.2 *Technologies for remote monitoring of livestock*

As discussed above, one of the greatest challenges for measuring the welfare of rangeland livestock is regular monitoring and inspection. One option to overcome this challenge is the utilisation of technologies to monitor livestock at certain locations in the
paddock, such as those based on radio frequency identification (RFID) tags, as used in the National Livestock Identification System (NLIS) in Australia. Placing RFID readers in specific locations allows animals to be registered, but the short communication distance (1 to 2 m) means that livestock have to be “forced” to approach readers, for example by locating them at entrances or exits to yards containing water or supplements. Constraints include animals obtaining water elsewhere or finding supplements unpalatable and consequently not moving to the required area. Also, monitoring livestock in large areas would require significant infrastructure and investment.

The commercial development of Global Positioning Systems (GPS) telemetry for animal tracking began in the early 1990s (Rodgers, 2001). Improvements in the system and reductions in cost have resulted in wider adoption for research on cattle distribution in large paddocks and rangelands in Australia (e.g. Tomkins and O’Reagain, 2007; Trotter and Lamb, 2008). A constraint with GPS technology is its high power consumption, only allowing data to be stored in the unit and not transmitted, therefore providing "retrospective" data that is consequently of little use in monitoring in “real time”. Wireless sensor networks permit real time monitoring and utilise static and mobile (attached to the animals) sensor nodes. Sensor networks not only monitor the location of animals (Mayer et al., 2004) but can also monitor some health parameters, such as brain electrical activity (de Sousa Silve et al., 2005), rumen temperature and movement (Mayer et al., 2004) and be used to estimate behavioural states, such as standing, grazing, lying and ruminating (Guo et al., 2006; Wark et al., 2007).

Although these technologies remain under development, they are showing promising potential and their use would potentially allow producers to, at least, know where individual animals are and be alerted should an individual not move for some (pre-determined) period of time. This would permit early intervention reducing any would-be suffering and preventing deaths.

4. Conclusions

At present, there are few animal-based measures that can be applied to extensive livestock production systems. These include measures of productivity (e.g. liveweight gain and fertility) health records, numbers of mortalities, culls and injuries, and body condition score (to reflect nutritional status). These tend to be taken after the event, enabling change to be made only for the future, rather than intervention at the time.
Consequently, these types of measures are best coupled with resource-based measures, such as provision of water and feed, to deliver a reasonable animal welfare assessment.

The main barriers to animal-based measures for welfare assessment of rangeland livestock is that producers do not frequently inspect and monitor their animals. Producers need to develop strategies for frequent and regular monitoring of stock to assure high welfare standards and developing technologies, such as wireless sensor networks, RFID and GPS offer potential methods. Timely intervention would prevent suffering and, perhaps reduce mortalities, enhancing welfare and profits.

5. References


