

# The economics of animal welfare

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## Summary

This paper examines four examples of animal welfare issues, demonstrating the interactions between welfare and economic principles. Welfare issues associated with purebred companion animals are examined in terms of predicted inherited diseases, highlighting the power of supply and demand in perpetuating traits in pets that compromise their well-being. The livestock industry is presented from the point of view of pig production and the impact that a major disease (pleurisy) has on production and the animals' welfare. The authors investigate the conflicting and complementary demands of animal welfare and economic gains during the transport and slaughter of livestock and poultry. Finally, wildlife species are considered in terms of their prevalence as pests, and the different types of economic analysis that have been conducted to understand the losses caused by these organisms. Also included in this example are decisions made about cost effectiveness and opportunity costs, and regulatory and financial barriers to the development of humane control agents. In conclusion, animal welfare is illustrated as a central factor in the benefits that humans enjoy from the role played by animals in society. There are, however, trade-offs between optimal animal welfare and meeting the needs of modern human society.

## Keywords

Animal welfare – Breeding – Companion animal – Economics – Livestock – Pest – Pig – Pleurisy – Porcine – Production – Slaughter – Supply chain – Swine – Transport – Wildlife.

## Introduction

Societal and economic pressure for improvements in animal welfare has become an increasingly important driving force for changes in the management of companion, production and wildlife species. This has occurred in parallel with changes in thinking about the way that humans interact with animals, resulting in better awareness of the welfare of animals. The public's changing perceptions about what animals experience, coupled with advances in science and international export requirements, have resulted in significant improvements in animal welfare, with changes in government legislation reflecting the increased concern for and awareness of the welfare of animals under the influence of human actions.

However, it is important to recognise that the language and focus of economics and animal welfare can be disparate. Fundamentally, economic theory is focused on factors relating to human demands, wants and preferences (1). When discussed in terms of animal production, economic theory relates to resource allocation to achieve maximisation of profits and/or minimisation of costs.

In contrast, animal welfare is concerned with the experience of the individual animal, in terms of negative (pain, stress, boredom, anxiety, fear, etc.) and positive (happiness, excitement, mental stimulation, etc.) states of welfare. This is an important paradox to acknowledge as, from an economics viewpoint, animal welfare relates primarily to human demand or preferences and not to the experience of the animal.

An important determinant of animal welfare has been how decision-makers adapt production systems to respond to:

- consumer preferences, demands and price signals
- market-based expectations
- pressure to improve efficiencies and minimise production costs
- societal values and changes in legislation reflecting those values, and
- the provision of instruments to solicit changes in practice or to ensure minimum standards are met.

Examples of these include:

- changes in production systems (e.g. the move from cage-based to free-range poultry layer production systems)

- the development of premium products (e.g. premiums for welfare-friendly, certified products)
- cost minimisation (e.g. the intensification of dairy production)
- the provision of outcome-based minimum standards (e.g. broiler-stocking densities)
- research into alternatives to controversial husbandry practices, in response to lobbying and potential international trade restrictions (e.g. research into non-surgical alternatives to mulesing of Merino lambs)
- agricultural/production subsidies (e.g. rewarding per-unit production, resulting in intensification and oversupply or, alternatively, subsidies to improve the adoption of animal welfare practices).

The other important aspect to consider is the value of livestock in farming systems, particularly in European and American systems, which receive government subsidies for livestock production. As such, the health and welfare of livestock species are well worth monitoring and significant technological advances in precision agriculture are being made to improve their welfare in production systems (2). Examples include the identification of pig genes, which could be candidates for editing to regulate immune responses to African swine fever (3), and the use of accelerometers (4) and pedometers (5, 6) to remotely detect early signs of lameness.

More recently, the welfare of wildlife and companion animals has been receiving more attention. For wildlife, culling badgers (*Meles meles*) in the United Kingdom (UK) to control bovine tuberculosis (bTB) and its impact on badger and cattle welfare has recently been debated. The discussion has revolved around arguments on the economic impact of badgers as maintenance hosts for bTB, the welfare trade-off between badgers and cattle populations, the potential spread of the disease from immigration of uninfected and emigration of diseased animals into and out of control areas, the intrinsic value that different societal groups place on badgers and the environment, conservation concerns for an indigenous species and the rights of free-living wild animals. For companion animals, attempts to manage the unethical trafficking of pets and spread of disease across Europe have been made by the European Union (EU) in the form of the Pet Travel Scheme. This initially developed to improve animal welfare and to ensure commonality between EU Member States. Further to this is a more complex debate about the ethics of purebred pets, movement controls, rearing conditions, insufficient husbandry, behavioural disorders and inherited illnesses, which are discussed later in this paper.

A number of studies have examined farm animal welfare and economics. The Farm Animal Welfare Committee (FAWC)

examined the trade-off between farm animal welfare and the externalities of production (1). It reported severe negative externalities associated with livestock production (e.g. double-muscling cattle). However, the Committee also highlighted the fact that some initial production compromises made to protect animal welfare can eventually result in improved overall economic output (e.g. regulating transport journey times results in less-stressed animals and improved meat quality). Meanwhile, Frank (7) canvassed the important but under-discussed contribution that economics can make to animal welfare issues, based largely on the themes of cost-benefit analysis and economic efficiency from the perspective of overpopulation (stray animals), agriculture and vivisection.

This paper sets out to piece together knowledge about the economics of animal welfare through the lens of key principles of economics (such as supply, demand, pricing and opportunity cost), using case studies of companion animals (predictable inherited diseases and resulting illness), livestock disease (pleurisy in pigs) and operations (livestock transport and slaughter), and wildlife management (pest control). For each of these examples, animal welfare status can either influence or be affected by different stages of the respective production chains (Fig. 1). For example, in wildlife management, the inputs (toxicants, traps, nets, etc.) and actions (implementation of the control measures) have severe negative impacts on the welfare of the pest species (pain and distress), while conversely improving the welfare or conservation of a valued resource (e.g. livestock, native species, property, foodstuffs). This represents a conscious decision to trade off the welfare of the pest species against the economic or societal value of the other resource.

In livestock and companion animal (commercial breeding) production chains, the inputs and production process can have both negative impacts on welfare (e.g. increased stocking densities to maximise productivity, resulting in increased incidence of disease and conspecific conflict) and positive effects (the provision of enrichment cages for layer hens). Adopting practices that enhance welfare can simultaneously reduce production costs, increase efficiency and improve output quality (e.g. reduced stress in abattoirs results in improved slaughter-line speeds and reduced carcass damage).

Overlaying this are legislative requirements, the concerns of consumers and the general public, and demands for ethical production systems, which can externally influence all aspects of the production chain. The main message from this paper is that animal welfare is a central factor in the provision of animals in society and is considered from the perspectives of human demands and goals, and outputs and outcomes.

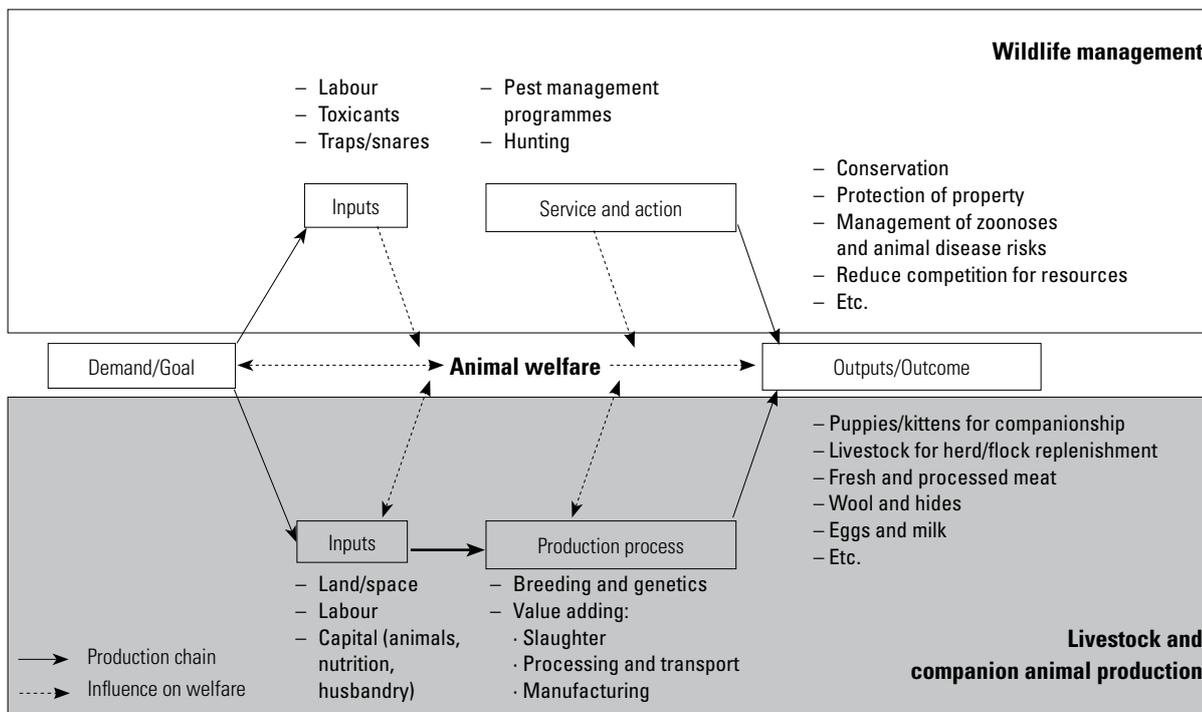
## Predictable inherited diseases in purebred companion animals

Much is known about predictable inherited diseases of purebred companion animals and there is a long history of ethical debates about the genetic selection of some traits. McGreevy and Nicholas (8) and Rooney (9) discuss the traits that are deliberately bred into dogs to satisfy human preferences, which have negative impacts on animal health and welfare. For example, cocker spaniels that have been selected for skull shape often suffer from brain defects, the miniature poodle and greyhound that are bred for fine legs are susceptible to fractures, and brachiocephalic traits in Boston terriers and pugs lead to a variety of respiratory and skin conditions. There are also conditions which have not emerged from selection for a desirable trait but are a consequence of pure breeding; for example: white-coat deafness in cats (10), patent ductus arteriosus in dogs of poodle ancestry (11) and hip dysplasia in German shepherds (12).

McMillan *et al.* (13) found that dogs purchased from non-commercial breeders were far less likely to experience behavioural disorders than dogs purchased at pet shops. Previous work by McMillan *et al.* (14) showed that a significant number of dogs from commercial breeding establishments (CBEs or ‘puppy farms’) exhibited

behavioural abnormalities, but they also found that there were significantly higher rates of health problems in former CBE breeding dogs. Unfortunately, these health problems were not defined in their paper. Despite numerous warnings, demand for purebred companion animals (particularly dogs) continues to fuel the perpetuation of unethical breeding practices. Similarly, the prevalence of predictable inherited disorders continues to be sufficiently severe that veterinary research into managing inherited conditions thrives (for recent examples, see: Pohl *et al.* [15], Packer *et al.* [16], Roedler *et al.* [17]).

Euromonitor (18) and Greenbaum (19) discuss the humanisation of companion animals and the impact that this is having on society. Euromonitor (18) suggests that single-occupant households and those composed of couples sometimes substitute pets for children. Further to this, it is predicted by IBISWorld (20) that the number of couples without children in the UK will increase by 3% by 2018, thereby suggesting a likely increase in spending on pets by those who are substituting them for children. At present, the market for veterinary care in the UK is dominated by pet care (45.5%) which, according to IBISWorld (20), is split between households with children (26.1% of the £3.2 billion market) and households without children (19.3% of the £3.2 billion market). Both of these markets are substantial and likely to grow, based on the premise of the humanisation of pets in society.



**Fig. 1**  
**Animal welfare and its impact on wildlife management and livestock/companion animal production chains**  
 The arrows denote animal welfare as either an influencing factor or a consequence of production/management externalities

The conclusions that can be drawn from these data are that CBEs are servicing demand created from the structure of society. Very little convincing, scholarly evidence directly addresses the rise of purebred animals in society and the costs of their ongoing veterinary treatment. While research continues on understanding the epidemiology of predictable inherited diseases in purebred companion animals, the economics of these conditions continue to need attention.

## Pleurisy in pigs

Rushton (21) discusses the importance of pigs in society and outlines the major diseases affecting their global production, including African swine fever, classical swine fever, Aujeszky's disease (pseudorabies), and porcine reproductive and respiratory syndrome. Since the publication of Rushton's study (21), pleurisy in pigs has received attention as a major UK disease which causes carcass losses. These losses are due to pleural stripping or, in the most extreme cases, excessive trimming of the chest cavity. Garcia-Diez and Coelho (22) found that 21.2% of 161,001 carcasses included in their sample were condemned because of pleurisy. From a welfare perspective, pleurisy can be a chronic condition causing dyspnoea (breathlessness) and pleuritic pain (23, 24). Severe dyspnoea is known to be an unpleasant form of suffering in both humans and animals (25, 26). Pleurisy in pigs can be associated with a cough, especially when animals are moved, which can cause further irritation and dyspnoea. Pigs with pleurisy are generally exercise-intolerant (27), appear physically depressed and have a reduced appetite (23). Pleurisy can also be associated with other respiratory diseases and can lead to secondary infections.

In terms of the UK-wide impact of this disease, Holt *et al.* (28) commented that pleurisy and other related respiratory conditions cause substantial economic losses in the value chain, due to increased mortality, morbidity and treatment costs and reduced growth rates, feed conversion efficiency and carcass quality. Eze *et al.* (29) noted that respiratory conditions in pigs have been increasing in Scotland, England and Wales since 2009, with pleurisy being the worst of the respiratory conditions in England and Wales. Tucker *et al.* (30) also brought attention to the disease, citing results from the UK's British Pig Health Scheme indicating that 68% of 3,674 batches of slaughtered pigs in the UK were affected with pleurisy. This research showed the economic impact of pleurisy on both the production and processing phases of the value chain. At the production end, reduced carcass weight (28, 31) and increased age at slaughter were calculated as costing producers 226 pence (p) per pig while, at the processing end, a reduction of in-line speed and associated staff costs (i.e. increased inspection and trimming times) were calculated at 29 p per

pig. These calculations were based on a prevalence rate of 10%. Therefore, if 68% of the 10.5 million pigs slaughtered annually in the UK (32) are affected by pleurisy, and it costs the supply chain 255 p per pig, then this disease is costing the value chain approximately £18.21 million per annum.

The proposed solution for managing pleurisy in pigs points to farm management. Jäger *et al.* (23) studied the factors associated with this disease in England and Wales and, despite having a very small sample size ( $n = 121$ ), found that the following husbandry practices increased the risk of pleurisy:

- i) no all-in, all-out pig flow
- ii) rearing pigs with an age difference of more than one month in the same air space, and
- iii) repeated mixing or moving of pigs during the rearing phase.

In contrast, the following husbandry practices decreased the risk of pleurisy:

- i) filling wean-to-finish or grower-to-finish systems with piglets from fewer than three sources, compared to farrow-to-finish systems
- ii) cleaning and disinfecting grower and finisher accommodation between groups of pigs, and
- iii) extending the down time of grower and finisher accommodation.

Despite these findings, research has yet to be conducted on the costs and benefits of these practices to farm businesses.

## Transport and slaughter

There is much debate about animal welfare during the slaughter process: from the farm gate, during transportation, at markets, in lairage, and during the actual act of slaughter (33, 34, 35). In the livestock production process, there are often conflicting demands between improving animal welfare and increasing economic gains. However, improving the welfare of livestock has a positive impact on efficiencies, quality, marketability and the general economics of the entire slaughter-based system and supply chain (36, 37, 38). Germane factors include housing and handling conditions at the farm, conditions and stock-handling skills in the slaughterhouse, and acknowledging consumer demands by conducting welfare audits of the transport and slaughter systems.

The objective of modern intensive food production systems is high input and rapid output to generate efficiency benefits from economies of scale and the application

of technology. Product quality in the abattoir is greatly influenced by poor health and welfare, injuries, stress and metabolic exhaustion. These factors can have a significant impact on carcass quality and resulting marketability. Excessively stressed livestock can complicate the loading and unloading of transports, resulting in increases in the incidence of animals found dead on arrival (DoA), fighting between conspecifics, slips and falls on ramps and raceways, and balking (refusal to move) (35, 39). This can result in slowdowns in the slaughter production chain, which can have a negative impact on productivity, leading to the need for excessive use of movement aids, such as electric cattle prods. The use of such devices can cause further stress and pain (through collisions with herd mates or inanimate objects), compromise animal welfare, increase carcass damage and make subsequent stunning more difficult (40, 41). Trauma-based injuries can result in significant losses due to carcass rejection or downgrading, in which the carcass is only found suitable for processed meats and/or needs the affected regions to be trimmed. This disfiguring of the carcass also makes it less marketable (39). For example, the presence of horns in cattle during transport can result in additional bruising and damage to the hide, which is used in leather production. It has been estimated that, in Australian conditions, dehorning could prevent the loss of 1.5 kg/per carcass of bruised tissue from trimming (39).

In the poultry industry, increases in DoAs from threshold levels at the slaughterhouse can be a major cause for concern in terms of economic loss and compromised animal welfare. Deaths can be related to farm housing conditions, on-farm health, catching–handling injuries, environmental conditions and stocking densities. Although such causes of death constitute compromised welfare, the poultry industry accepts a level of DoAs during transport, where the economic impact is low (generally less than 0.2%) (39). Broiler transport mortality has been reported as 0.18% in the main poultry-producing regions of France (42), which is similar to reports of 0.12% and 0.25% in the UK (43) and Czech Republic (44), respectively. Chauvin (42) reported that for one flock the DoA rate was 3.9%. This was caused by a vehicle breakdown and highlights the importance of continued vehicular movement in ensuring adequate ventilation, and time spent in the transporter as a factor in mortality-related losses.

The act of stunning and slaughter can have significant effects on animal welfare and commercial productivity. Stunning and handling systems, such as controlled atmospheric stunning (for poultry and pigs), waterbath stunning (poultry), V-restrainers with manual and automatic electrical stunning (sheep), and captive bolt stunning (cattle), have significantly increased line speeds, worker safety and slaughterhouse productivity. In addition, when correctly performed, they reduce the potential for pain and suffering

during the act of slaughter as the animals are unconscious and insensible. However, increased line speeds and automation can have negative impacts in terms of welfare. Examples include pre-stun shocks when the wings of poultry enter the waterbath before their heads (45), aversion to high concentrations of CO<sub>2</sub> prior to unconsciousness in pigs (46), and incomplete concussion following captive bolt stunning, due to incorrect marksmanship, gun/cartridge selection or inadequate equipment maintenance (47, 48, 49, 50).

In more developed countries, there has been a rise in consumer sensitivities towards the concepts of ‘ethically produced’ and ‘ethically slaughtered’ livestock (51). This has been driven by many factors, but has resulted in an increased consumer demand for improved animal welfare and growing awareness of its importance among retailers and suppliers. Supermarkets and restaurant chains, for example, now invest significant resources in monitoring and auditing animal welfare in their supply chains and using animal welfare in their marketing campaigns (52). Such investment has led to significant improvements in animal welfare standards in audited slaughterhouses (53, 54). Furthermore, the concept of ‘higher welfare standards’ is now used by retailers to differentiate their products from those of their competitors, and to support premium pricing of ‘animal-welfare-friendly’ labelled foodstuffs (55).

## Wildlife pest management

There are a variety of reasons why wild animals are classified as pests. They can impact on human and animal health, act as vectors for disease and cause significant damage to property, foodstuffs, other commercial resources and native flora and fauna (Table I). However, wildlife pests can also bring benefits to biodiversity and even human recreational activities (56). While wildlife pests can limit agricultural yields and cause ecological damage, how a wildlife pest is defined depends on social, economic, regulatory, and environmental circumstances. Furthermore, a body of literature has emerged questioning the cost effectiveness of some wildlife management programmes (57, 58) and – where wildlife is valued as a resource – the opportunity costs of such programmes (59). For example, Zivin *et al.* (59) considered the dual role of feral pigs in the California rangelands, which harm both agricultural and natural environments but also provide land-owners with lucrative earnings from hunting rights.

Significant resources are invested worldwide in the control of wildlife pest species. Such controls may include habitat removal, repellent use, exclusion methods and lethal control. There are no reliable estimates of the global economic impacts of vertebrate pests. However, a number of authors have examined regional impacts. It is

**Table I**  
**Principal reasons for the control of vertebrate pest species and examples of control strategies**

Reason for control	Examples of control
Damage to agricultural and horticultural crops	Introduced diseases (e.g. myxomatosis)
Damage to forestry, nurseries and plantations	Use of kill traps for grey squirrels
Competition with livestock for resources	Free-bullet culling of kangaroos
Risk of predation of livestock and farmed fish	Shooting cormorants around fish farms
Risk of predation of game animals and pets	Trapping and shooting of foxes
Damage to property (commercial and personal)	Rodent anticoagulant bait stations
Consumption and contamination of stored feedstuffs	Glue board traps in factories
Risk of transmission of specific diseases to livestock	1080 control of brushtail possums (for tuberculosis)
Risk of transmission of zoonotic diseases to humans	Trapping of voles and field mice (for hantavirus)
Damage to ecosystems and biodiversity (conservation)	Translocation of non-native herbivores
Risk of predation of endangered or conserved wildlife	Trapping predators on offshore islands, to use as wildlife sanctuaries
Risk of overpopulation (and emaciation) in the species	Toxicant control
Risk of human predation	Shark nets

estimated that, in South-East Asia, non-indigenous pest species cause annual economic losses of US \$33.2 billion (including invertebrate and plant species) (60), while, in the United States (USA), such losses are estimated at over US \$66.3 billion (vertebrates only) (61).

More specifically, it has been estimated that, in Australia, the European rabbit (*Oryctolagus cuniculus*) costs the economy between AUS \$0.6 and \$1.0 billion annually (62). This cost occurs through direct competition with livestock and damage to the environment. Rabbits are Australia's costliest vertebrate pest species and it is estimated that AUS \$20 million is spent each year on the control of rabbits alone (63), principally through the use of lethal methods (e.g. toxicants, shooting, traps and introduced diseases).

Despite the impacts of vertebrate pests and the very real need for their management, their control is a controversial subject, with opinion-holders possessing polarised viewpoints and cultural differences. The welfare of production, research, teaching and – more recently – companion animal species has received significant attention. Meanwhile, the welfare of free-living wildlife under the influence of humans has, in the past, not received the same level of consideration (64). However, there is now increased public and scientific awareness of the welfare of pest species during control programmes. Control methods (both lethal and non-lethal), when used correctly to manage wildlife pest populations, nonetheless generally cause some degree of pain and suffering.

Globally, rodents are the most damaging vertebrate pest species in terms of economic impact and transmission of human disease. Singleton (65) states that Asian smallholder rice producers frequently report yield losses of 20–30% per

annum due to rodents. It was estimated that a loss of 5% would equate to 30 million tonnes of rice, which would be enough to feed 180 million people for a year (65). Rodenticides and, in particular, the anticoagulants and zinc phosphide are the predominant control method for managing rat and mouse populations. Although these are often very effective (66, 67), there is widespread concern about the humaneness of anticoagulant poisons (68, 69, 70, 71, 72) and the risk to non-target species through greater persistence and through primary and secondary poisoning routes (71, 72, 73).

It is widely acknowledged that there is a need for more effective and humane toxicants for rodents. However, since the development of second-generation anticoagulants in the 1980s, there has been little investment in new agents (74). In fact, over the last 50 years, there has been a decline in the number of registered vertebrate pesticides (75). This drop in development and in the number of available products has been associated with increased registration costs for new and existing control agents, significantly lower profit margins when compared to invertebrate pesticides or herbicides, and the withdrawal of agents, based on environmental, non-target, human health and animal welfare concerns (75). However, there has recently been government and private investment in the development of novel methaemoglobin- (MetHb-) inducing vertebrate toxicants in New Zealand, Australia and the UK, with the aim of improving humaneness and minimising the risk to non-target species. Of this class of compounds, para-aminopropiophenone (PAPP) has been registered as a control agent for stoats and feral cats (76). However, PAPP and its analogues have been found to be insufficiently toxic to be practical as rodenticides (77, 78).

There is an obvious economic, ecological, human health and regulatory need for the continued control of vertebrate pest species and the development of new and more humane control methods. However, it is essential that there is continued reevaluation of the humaneness and effectiveness of current and newly developed control methods. This must be undertaken in conjunction with serious consideration of the cost-effectiveness and opportunity costs of the control programme (79).

## Conclusion

This paper has explored four different animal-welfare-related issues that have a significant impact on animal production, operation and services. It has demonstrated the under-recognised relationship between animal welfare and basic economic theory, thereby revealing fruitful ground for further investigation. The authors have focused on the interaction between animal welfare and considerations of

supply, demand, pricing and production losses. The vital point of this paper is that welfare is managed and promoted for individuals or for groups of animals, whereas economic principles are considered from the perspective of society, thus offering an interesting anomaly for future enquiry. In conclusion, the authors have shown that animal welfare is a moderating factor in the relationship shared by humans (as a society) and animals (as individuals or groups), but that there are trade-offs that must be made between optimal animal welfare and meeting the needs of modern human society. ■

## L'économie du bien-être animal

T.J. Gibson & E.L. Jackson

### Résumé

Les auteurs analysent les effets réciproques du bien-être animal et des principes de l'économie à travers quatre exemples. La problématique du bien-être des animaux de compagnie de race est examinée en lien avec les maladies à prédisposition génétique, ce qui permet de souligner l'influence de l'offre et de la demande dans la perpétuation de traits génétiques particuliers à ces animaux, au péril de leur bien-être. Le secteur de l'élevage est examiné à travers l'exemple de la production porcine en étudiant l'impact d'une maladie majeure (pleurésie) sur la production et le bien-être des porcs. Les auteurs abordent ensuite les exigences antinomiques ou complémentaires du bien-être animal et de la rentabilité économique dans le domaine du transport et de l'abattage des animaux d'élevage et des volailles. Enfin, les espèces sauvages sont examinées du point de vue de leur rôle en tant que nuisibles, en exposant les différentes manières d'expliquer au moyen d'analyses économiques les pertes causées par les nuisibles. Cet exemple aborde également les décisions en matière de rentabilité et les coûts d'opportunité, ainsi que les obstacles réglementaires et financiers à l'utilisation d'agents pouvant servir à contrôler les maladies par des méthodes respectueuses du bien-être animal.

En conclusion, le bien-être animal apparaît comme un facteur central des bénéfices que les humains retirent des animaux et de leur rôle dans la société. Il y a néanmoins des compromis à trouver entre l'optimisation du bien-être animal et les exigences d'une société moderne.

### Mots-clés

Abattage – Animaux de compagnie – Bétail – Bien-être animal – Chaîne d'approvisionnement – Économie – Faune sauvage – Nuisibles – Pleurésie – Porcin – Porcs – Production – Reproduction – Suidés – Transport.



## Economía del bienestar animal

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### Resumen

Apoyándose en cuatro ejemplos de bienestar animal, los autores ponen de manifiesto cuán imbricados están entre sí los temas de bienestar y los principios económicos. Ante todo examinan los problemas de bienestar que sufren los animales de compañía de pura raza por lo que respecta a sus previsible enfermedades hereditarias, subrayando el poder de la ley de la oferta y la demanda para perpetuar en ellos una serie de rasgos que comprometen su bienestar. A continuación se detienen en la ganadería industrial, y más concretamente en la producción porcina y la influencia que ejerce una enfermedad importante (la pleuresía) en el bienestar de los animales y en la propia producción. Después exponen los imperativos antagónicos y complementarios que se plantean en clave de bienestar animal y de beneficio económico durante las operaciones de transporte y sacrificio de ganado y aves de corral. Por último, considerando las especies de animales salvajes desde el punto de vista de su prevalencia como plagas, exponen los distintos tipos de análisis económico que se han realizado para aprehender las pérdidas resultantes de las plagas. Valiéndose de este ejemplo examinan también las decisiones adoptadas en materia de rentabilidad y de costos de oportunidad, así como las barreras reglamentarias y económicas que dificultan un funcionamiento más compasivo de los agentes de control.

El bienestar animal, en conclusión, aparece como un factor central de los beneficios que extrae el ser humano de la función que cumplen los animales en la sociedad. Sin embargo, es preciso hallar un compromiso entre los niveles óptimos de bienestar animal y la satisfacción de las necesidades de la sociedad humana moderna.

### Palabras clave

Animales de compañía – Animales salvajes – Bienestar animal – Cadena de suministro – Cerdos – Economía – Ganadería – Plagas – Pleuresía – Porcino – Producción – Reproducción – Sacrificio – Transporte.



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