**Environmental sustainability in the equine veterinary profession**

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“*Pour ce qui est de l'avenir, il ne s'agit pas de le prévoir, mais de le rendre possible* “

“*As for the future, it is not a question of foreseeing it, but of making it possible*” Antoine de Saint-Exupéry

***Intro***

We are becoming increasingly aware of the environmental harm humans cause, and we realise there are limits to natural resource extraction. The climate crisis is a major cause of the social, economic and ecologic disruption which we face. Our future currently holds more extreme weather events, air and water pollution, loss of biodiversity, water and food insecurity and altered vector-borne disease patterns.

Sustainable development has been defined by the UN Brundtland Commission as “*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*”. The UN published 17 sustainable development goals to target by 2030; goals include reduced inequalities, clean water and sanitation, responsible consumption and production, and life on land and below water.

Sustainable thinking reflects good governance and future-proofs businesses by identifying how global megatrends will affect us. We can use it to improve financial, social and ecologic resilience in the face of legislative, resource-availability and societal changes in response to the climate crises. In this editorial, we explore the role for engagement with sustainability within the equine veterinary sector.

***Greenhouse gases***

The current crisis stems from the introduction of large quantities of greenhouse gases into the atmosphere, mostly carbon dioxide (CO2) from industrial burning of fossil fuels since the 1800s. The current global increase in temperature since the pre-industrial era is around 1oC. In 2015, an international treaty was signed in Paris committing the signing 195 countries to remaining within 2oC of the pre-industrial era. The Intergovernmental Panel on Climate Change (IPCC) estimates that if global warming continues at the current pace, we will reach 1.5oC between 2030 and 2052 (IPCC 2018). Even at 1.5oC, the IPCC predicts extreme weather events and changes in sea level. Additional risks may result, including forced migration, damage to vital infrastructure and increased conflict. These will have catastrophic and additive effects on all global communities, and the developing countries which have contributed least are likely to suffer most. It is easy to imagine the impacts on equestrian activities, including the need to adapt to more extreme weather events such as flooding.

Equestrian activities can also produce carbon emissions. Both energy and transport are widely used in the equine sector, and in 2017 these represented the top two sources of UK carbon emissions at 27% and 24%, respectively. We do not have a carbon footprint of the veterinary sector, but the UK’s National Health Service (NHS) healthcare emissions contributed around 6.3% of the total carbon footprint (27.12 million tonnes CO2 equivalents, MtCO2e) of England in 2017. Volatile anaesthetic agents, including isoflurane and sevoflurane, are also potent greenhouse gases (Jones and West 2019). The NHS’s current 5 year plan includes reducing emissions from anaesthetic gases by 50%; translated to our sector, this could impact on provision of hospital equine anaesthesia.

There is currently little literature identifying the carbon emissions emitted by horses. One study assessed the carbon emissions of draft horses used for forestry work, and estimated emissions of 48.1 tonnes CO2e during the 20 year lifespan of a horse, including basic veterinary care (but not including transport) (Engel *et al.* 2012). For an average 500kg horse carrying out lighter work, we estimate roughly 1 tonne CO2e per equine life-year. Included in this total is methane, and whilst horses emit around 3 times less methane than ruminants, global equine methane emissions are estimated at 26.5 MtCO2e per annum (Elghandour *et al*. 2019). Methane has a high heat absorption capacity but a lower duration in the atmosphere, which may reduce its impact if the concentrations remain stable over time. Agricultural and livestock land-use has the potential to increase overall carbon sequestration and biodiversity, but transformation to sustainable systems will be needed to mitigate greenhouse gas emissions (Costain 2019).

Per capita, the UK produced around 6.7 tonnes CO2e in 2018 (datasource: UK government and Office for National Statistics, 2018). The UK government has committed to net zero carbon emissions by 2050. Horse ownership could occupy an increasingly large part of an owner’s carbon budget; however, this should be balanced with the social value of equine activities as well as potential for lower carbon emissions resulting from active lifestyles and less travel from home.

***Biodiversity***

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services recently reported that “*nature and its vital contributions to people, which together embody biodiversity and ecosystem functions and services, are deteriorating worldwide*” (IPBES 2019). They also reported an accelerating extinction rate of tens to hundreds times higher than baseline rates. This will cause losses of essential natural services including reducing vulnerability to extreme climate events, carbon sequestration, promoting mental and physical health, medicines, genetic resources, livelihoods, cultural services, food and energy. Ecosystems may also be destabilised; for example, some UK vector-borne diseases such as Lyme’s disease are showing increasing incidence, which may relate in part to climate changes (Tulloch *et al.* 2019).

***Air, water and soil pollution***

Grazing horses are capable of damaging natural ecosystems causing soil erosion and compaction, vegetative damage and increased movement of sediment, nutrients and pathogens into nearby surface waters (Bott *et al.* 2013). Equestrian activities may also be in direct conflict with other users of natural capital. The UK sustainable development principles state that ‘*any plan should take into account how the environment can be protected and enhanced*’. Pasture management such as rotating paddocks and avoiding overstocking may mitigate negative impacts, and also improve biodiversity, soil fertility, increase CO2 sequestration and reduce feeding costs. Owner-oriented programmes offering sustainable management systems are already available. Veterinary surgeons will be expected to be conversant in the concerns and regulatory requirements of their clients, including the local authority and Natural England guidance on land management.

Horse manure is rich in nutrients; a 450kg horse produces around 7 tonnes per year of nitrogen and phosphate-rich faeces (Bott *et al.* 2013). In the UK, horse manure may not be classed as waste if used as soil fertiliser. However, it must not be spread near water, or stored where there is a risk of run-off into watercourses, as the nutrients can cause eutrophication. Compliance with Nitrate Vulnerable Zones and Groundwater legislation may also be required, including for wastewater run-off from stabling areas.

Horse waste may also be rich in veterinary pharmaceutical residues (VPR). The benzimidazoles (e.g. fenbendazole) may be less harmful, but the macrocyclic lactones (e.g. ivermectin) are highly toxic to coprophagic invertebrates (Horvat *et al.* 2012) and persistant; after oral administration in horses with ivermectin, moxidectin and doramectin, faecal contamination persisted for 4 days (Gokbulut *et al.* 2001). In addition, VPR may not be removed by wastewater treatment. In a French agricultural region, researchers found VPRs in 20% of tap water samples (Charuaud *et al.* 2019). Further research is needed to establish the ecosystem toxicity of equine pharmaceuticals and establish appropriate stabling periods after treatment, but selective deworming, faecal worm counts in adults and sound pasture management should be standard practice.

***Sustainable procurement and waste management***

Around 25% of the NHS carbon footprint comes from procurement of pharmaceuticals and medical equipment. Understanding the resource costs of pharmaceuticals can help to target emission reductions; during manufacture, up to 100kg of waste per kg of pharmaceutical may be generated, and the lifecycle carbon emissions for 20 common anaesthetic drugs was calculated as 11 – 3,000kg CO2e per kg drug (Parvatker *et al.* 2019). Reducing resource use is also the first step of the waste hierarchy within The Waste (England and Wales) Regulations 2011. Next, re-use and recycling should be addressed; up to 40-60% of medical perioperative waste can be recycled to join the circular economy. A robust waste segregation policy will ensure legal compliance, including adherence to the waste hierarchy which promotes the most environmentally friendly means of waste disposal. Avoiding incineration of plastics (particularly PVC) can reduce respiratory pollutants such as dioxins. Lastly, legally-compliant disposal is necessary for hazardous waste streams to avoid harm to aquatic and soil ecosystems.

**Engaging with sustainability**

A recent British Veterinary Association (BVA) survey found that “*89% of vets said that they would like to play a more active role in sustainable animal agriculture*”, and it is a key ambition in the 2015 BVA/Royal College of Veterinary Surgeons VetFutures report for the UK veterinary profession to be clear about its wider role in society, including environmental sustainability. The 2019 BVA position statement on sustainable animal agriculture recommended that at individual, community and national levels “*the veterinary profession is well-placed to advise and influence sustainable animal husbandry practices at whole system levels and …. all veterinary surgeons should be able to articulate the contributions that the profession can make to the sustainable agriculture agenda*”. More resources are becoming available, including from the recently formed VetSustain group ([www.vetsustain.org](http://www.vetsustain.org) accessed 4th October 2019).

Moving forward at sufficient pace is essential. We must demand leadership from our professional institutions, and seek support from sustainability professionals. Our practices must develop bold and robust policies which reflect environmental and social values. As the relevance of sustainability increases for younger generations, sustainability should be included on teaching curricula (as it is for medical schools). Most importantly, individuals should engage within their own sphere of influence; we can use telemedicine and teleconferencing, we can avoid flights, and we can demand that sustainability remains high on the political agenda.

**Conclusions**

An alternative definition of sustainability was proposed by Newcastle University; “*Enough, For All, Forever*”. We must only take what can be replaced. We must pay the true social and environmental cost of resource use, and we must not do so at the expense of others. Horse owners will look to the veterinary sector to assist in providing low carbon care as standard practice. Meeting these challenges will require transformative change within individuals, businesses and institutions. There are frightening prospects ahead, but also outstanding opportunities for our sector, communities and world.

We can foresee the future for our world, and now our task is to enable the better outcomes.

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