

Christina Umstatter   

^a SAC, King's Buildings, West Mains Road, Edinburgh, EH9 3JG, UK

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Abstract

A virtual fence can be defined as a structure serving as an enclosure, a barrier, or a boundary without a physical barrier. The concept of virtual fencing occurs increasingly in discussions wherever free-ranging livestock is managed. It is especially interesting because of its potential to initially enhance ecological management, improve management by turning manual labour into cognitive labour as well as improve the life-style of livestock managers. All of these have the potential to reduce costs. Moreover, it opens up the possibility of managing areas that are not manageable at the moment. Therefore, a patent and literature search was conducted to investigate what virtual fencing involves, what opportunities there are for implementing it and what issues still need to be tackled. It was found that there are many different approaches in the development of virtual fencing, which can be split into three categories: first, to contain animals in a defined area or keep them out of a defined area using devices that are animal-borne; second, to contain animals without mounting a device onto the animal; and third, keeping animals apart with a moving fence line or using a virtual fence as a remote gathering device. The first two categories deal with static control of livestock, whereas the third category could be described as a control within moving boundaries. However, despite many patents having been found, only very few products are available on the market.

Two important development areas are the energy use of the device and provision of a system that animals can easily understand, in order to assure welfare standards. The paper critically analyses the wide range of developments to date and points out the advantages and challenges virtual fencing offers. It also provides an indication of how far we are from a marketable product.

Research highlights

► Definition virtual fence: a structure serving as a boundary without a physical barrier. ► 1. Category: containing animals in a defined area using animal-borne devices. ► 2. Category: containing animals without mounting a device onto the animal. ► 3. Category: moving fence lines (keeping animals apart or gathering livestock). ► Major open questions: energy supply and animal welfare.

Keywords: Animal welfare; Fence injury; Global positioning system; Learning behaviour; Nature conservation; Remote gathering

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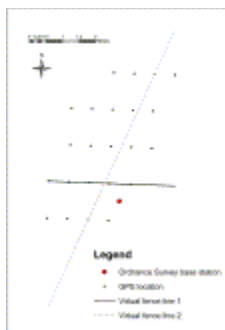


Fig. 1. Example of the issue of GPS error and its potential impact on learning behaviour of an animal contained by a virtual fence (one GPS collar collected fixes whilst being placed on an Ordnance Survey base station in Crianlarich, UK. If one assumes that the GPS collar represents an inactive animal, it is possible to demonstrate the issue of GPS error and the impact it could have on an animal if a virtual fence line would be established. The rectangular distribution of points is due to the reduced number of decimals for the location coordinates).

Table 1.

Example farms to give an indication for fencing costs.



Table 2.

Advantages and disadvantages of different fencing types.



Table 3.

Summary of virtual fence patents.



 Correspondence address: SAC, Hill & Mountain Research Centre, Kirkton, Crianlarich, FK20 8RU, Scotland, UK. Tel.: +44 1838 400210 begin_of_the_skype_highlighting +44 1838 400210 end_of_the_skype_highlighting; fax: +44 1838 400248.