

VIRTUAL HERDING RESEARCH UPDATE

TECHNOTE 7: USE OF VIRTUAL HERDING TECHNOLOGY FOR ENVIRONMENTAL OUTCOMES



Background

Environmental management of land, particularly agricultural land, is becoming more important and virtual fencing for improving environmental outcomes was identified very early on as a potential use of virtual herding (VH) technology. The application of VH technology for improving environmental outcomes was the basis of an initial Grant from the Victorian Government in 2014, through the Goulburn Broken and North East Catchment Management Authorities (CMA) in Victoria. This initial support enabled a feasibility study with Agersens into using VH technology to keep cattle out of rivers and waterways.

The results of this feasibility study were very promising and subsequently, the Goulburn Broken CMA and North East CMA became the driving force to attract additional funding to conduct the first commercial application of the prototype neckband devices to exclude a herd of cattle from river access at Tumberumba, in Southern NSW in 2017. A second commercial study in 2019 used updated pre-commercial prototypes to exclude a herd of cattle from a regenerating area of sapling growth within a grazing paddock in South Australia.

Potential application of VH technology to improve environmental outcomes

To achieve better environmental outcomes, the application of virtual herding technology may be used to exclude livestock from environmentally-sensitive areas such as:

- Wet areas
 - Pugging is the term used for when cattle damage both the soil structure and the pasture. Pugging is a form of compaction as it seals the soil surface and exacerbates waterlogging of the topsoil. As pasture is the cheapest source of feed for most farmers it is vital to minimise the damage that cattle can do to pastures by pugging up the paddocks. Pugging has the potential to cause serious damage to pasture with 20 per cent to 80 per cent reduction in pasture growth and 20 to 40 per cent reduction in pasture utilisation. VH technology offers a management option that dairy farmers can use to minimise pugging damage by establishing a flexible virtual fence to avoid intensive grazing on the areas of paddocks where pugging damage is likely.
- Regenerative Areas
 - Some areas in livestock production are more prone to overgrazing and subsequent erosion. Use of VH technology to exclude livestock from these areas for certain periods may allow the pastures and vegetation to regenerate.

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- Riparian zones
 - Livestock can cause significant damage to waterways and traditional fencing isn't always the answer because it may be expensive as well as being vulnerable to fire and flood. VH technology offers an opportunity to restrict livestock from riparian areas without the use of inflexible permanent fences.
- Weed control and managing regenerative areas
 - VH technology has the potential to target a wide range of weeds including weeds of national significance and the suppression of these weeds through targeted intensive grazing. For example, intensive grazing pressure has been shown to reduce

serrated tussock, Brome grass and Chilean needle grass populations. The technology's potential application to target the exclusion of weeds can have additional benefits in reducing over-grazing in areas that may be vulnerable to weed incursions, or by excluding livestock at times where spread of a particular weed may be promoted by livestock. A major constraint to the use of grazing for targeted weed control is achieving sufficient grazing pressure on the targeted area while avoiding damage from over-grazing on other areas of the landscape. VH technology offers a solution by restricting animals to certain areas for weed control.

CASE STUDY

Tumbarumba, NSW

A 5-week trial was conducted on an 11 ha land area in May and June 2017 to assess the application of the VH system in excluding cattle from a riparian area (Figure 1). Angus heifers (11 animals) were fitted with pre-commercial prototype neckbands and given free access to the paddock area for three weeks.

A single straight virtual fence line was activated to prevent the animals from accessing the river across a 10-day period. The cattle remained out of the river for the vast majority of the 10-day period, although they did keep trying to pass through the fence line each day. This indicates that the cattle were still motivated to access the river area during the exclusion period but the virtual fence was sufficient to deter them. A small group of four cattle did break through the virtual fence three days into the trial (Figure 2), but within 30 minutes these animals were turned back to join the rest of the herd by the neckband algorithm which continues to deliver signals as the animals go further into the exclusion area.

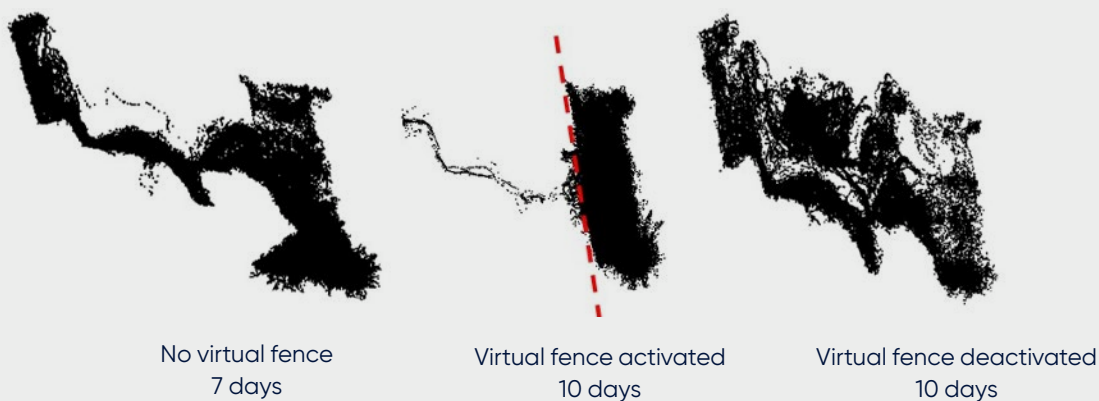
The temporary fence line was deactivated after 10 days and the cattle ventured into the river area within a few hours of the fence being turned off (Figure 2).

Full details of this study are available in the open access publication: Campbell DLM, Haynes SJ, Lea JM, Farrer WJ, Lee C. (2018) *Temporary Exclusion of Cattle from a Riparian Zone Using Virtual Fencing Technology. Animals*, 22; 9(1). pii: E5. doi: 10.3390/ani9010005.

Figure 1 The riparian zone on the Tumbarumba commercial property that cattle were restricted from accessing.



Figure 2 The GPS locations of all animals in the commercial virtual fencing trial. Images display cattle movement when no virtual fence was present, when a virtual fence was activated (dashed red line), and when that virtual fence was subsequently deactivated with days of each period length indicated below each image.



CASE STUDY

Eden Valley, SA

A 6-week trial was conducted in a single 14 ha commercial paddock in South Australia during May and July 2019. The aim of this trial was to test the application of VH technology to exclude 20 Santa Gertrudis heifers from a regenerating sapling area using a contoured fence line.

Cattle were fitted with neckbands and given two days to acclimate to wearing the devices before placing them into the test paddock containing a regenerative planting of native saplings. A series of training fences were used over the first two weeks that morphed from a straight line to a multi-angled fence that followed the contours of the sapling area (Figure 3).

Over the 6-week trial the animals remained within the inclusion zone for most of the trial duration (Figure 4). There were incursions into the exclusion zone, but typically were for short durations of time with less than 20 minutes per animal spent in the the exclusion zone across the sapling area relative to the grazed across the 6-week period. Despite the few incursions, the saplings remained protected and pasture analysis showed better pasture quality in the exclusion zone across the sapling area relative to grazed area (inclusion zone, Figure 5). The fences were activated a few metres back from the trees to allow a buffer zone, particularly during the initial training period when the animals were learning the cues of the virtual fence.

This trial demonstrated that VH technology could be used to keep cattle out of specific areas within grazing paddocks with minimal labour requirements.

More details are presented in the scientific publication; Campbell, D.L.M., Ouzman, J., Mowat, D., Lea, J.M., Lee, C., and Llewellyn, R. (2020). *Virtual fencing technology excludes beef cattle from an environmentally sensitive area. Animals*, 10(6),1069. doi.org/10.3390/ani10061069

Figure 3 Map of the commercial paddock at Eden Valley showing the succession of virtual fence lines protecting regenerating saplings that were presented to the animals across the days of the trial.

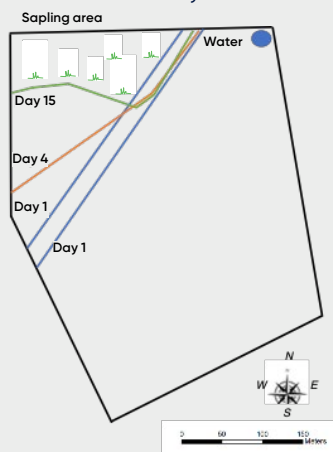


Figure 4 GPS plots showing average daily movement within the paddock across the first two weeks of the trial as the fence lines were becoming progressively more contoured and the final trial week. The legend indicates the number of recorded GPS points.

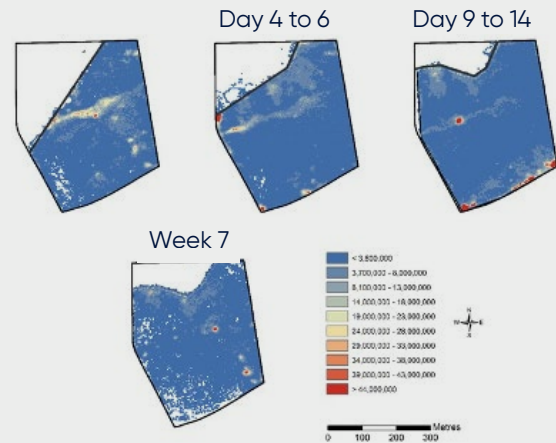
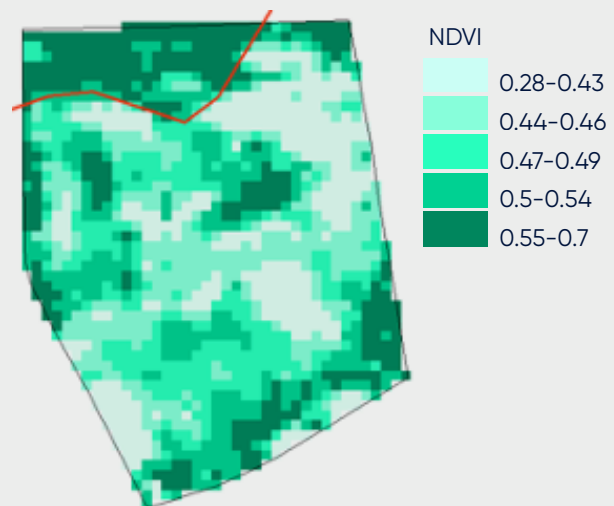


Figure 5 The Normalised Differential Vegetation Index (NDVI) at the conclusion of the trial indicating a higher vegetation index within the exclusion zone. The virtual fence line is indicated in red.



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