



Off-Stream Cattle Watering Sites (Without Fencing) Protect Riparian Areas and Water Quality



The current studies (presented here) examine the effectiveness of using cattle off-stream watering sites (without fencing off waterway access) to protect riparian areas and water quality. Providing cattle with an alternative water source to the river can help protect streambank soil and vegetation and can decrease nutrient loading to water bodies by shifting cattle traffic and nutrient distribution from the riparian zone to off-stream watering sites located on adjacent upland pastures.

Research on beneficial management practices (BMPs) that reduce the risks to water quality, riparian zone soil health, and stream and streambank vegetation associated with livestock access to streams and riparian areas is now available. Over the past decade, Agriculture and Agri-Food Canada (AAFC) scientists at the Lethbridge Research Centre in Alberta have evaluated BMPs at a site on the Lower Little Bow River and the results are outlined below.

The main cause of cattle damage to riparian areas—uncontrolled and often season-long grazing¹—can be managed through the use of BMPs such as streambank fencing or off-stream watering (Figure 1), or by using other practices such as salt blocks or shade structures.

The use of streambank fencing to protect riparian areas and water quality was examined in a previous AAFC study.² However, some producers identified cost as a possible deterrent to adopting this BMP.



Figure 1. Off-stream cattle watering system: ThermoSink® Energy Free Watering System
(Photo : Dwayne Rogness, County of Lethbridge)

Evaluation of Beneficial Management Practices (BMPs)

Other BMPs that AAFC scientists have studied in the Lower Little Bow River Watershed project include: streambank fencing (with a cattle crossing), conversion to perennial cover, manure management and buffer strips. These projects are helping scientists understand how BMPs perform and interact with land and water and help producers determine which BMPs are best for their operations and regions.



THE THREE STUDIES

AAFC conducted a series of three off-stream watering studies in the Lower Little Bow River Watershed.

Study 1 – Nutrient distribution and leaching

Nutrient enrichment and potential leaching were examined at off-stream watering sites and natural river access sites³. Soil samples were taken adjacent to three active off-stream watering sites, four active river access sites along the unfenced river reach, and two discontinued river access sites along the fenced reach. The samples were analyzed for soil test phosphorus and nitrate-nitrogen to determine if nutrient enrichment and leaching occurred.

Study 2 – Cattle behaviour, water quality and riparian health

The influence of off-stream watering on cattle behaviour, river water quality and the environmental quality of the riparian zone were examined.⁴

Cattle access to the river remained in place (i.e. no fencing), and three off-stream waterers were installed at approximately 290 and 730 metres off the Lower Little Bow River (Figure 2). This study examined the BMP's effectiveness in changing cattle behaviour and its effect on river water quality and riparian health.

Providing off-stream waterers without fencing still allows cattle to access the river at any time. Researchers observed and recorded instances of cattle grazing on riverbanks and wading in or drinking from the river. Cattle were counted and observed at set times during the study to assess their activity level near or in the water.

The river water was sampled upstream (control) and downstream from cattle access points, and was evaluated for various sediment, nutrient and pathogen concentrations and loads.

A full riparian health assessment was completed both pre-BMP and post-BMP. Because rainfall can be sporadic in this region, rainfall simulations were used to evaluate runoff quantity and quality in the riparian zone. Soil and vegetation properties were also evaluated at the rainfall simulation locations.

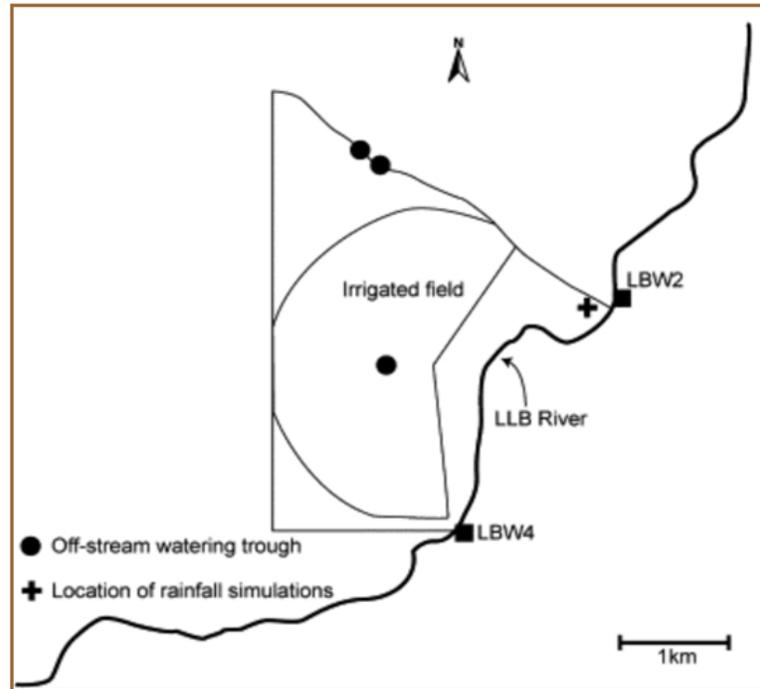


Figure 2. Map of study area showing location of three water troughs, relative to the Lower Little Bow (LLB) River, upstream (LBW4) and downstream (LBW2) sampling sites, and location of the cattle access site where vegetation, soil and rainfall simulation variables were measured.

Study 3 – Indicators of cattle activity

Various soil properties for indicating cattle activity at off-stream and river access sites were evaluated.⁵ Nine soil chemical and physical properties were examined along 100-metre transects adjacent to five off-stream watering sites and three river access sites to determine which soil properties were the best indicators of cattle activity. The soil properties included nitrogen, phosphorus, chloride, carbon and bulk density.



STUDY RESULTS

Overall, providing cattle access to off-stream watering sites had a positive impact on certain vegetation, soil and water quality aspects. While these improvements, discussed below, were not as significant as when cattle were excluded from waterways with fencing, off-stream watering is a more economical practice.

Study 1 : Nutrient distribution and leaching

Greater enrichment of nutrients—specifically nitrogen and phosphorus—was detected in the surface soil at the off-stream watering troughs compared to three natural cattle watering sites along the unfenced river reach. This finding suggests that this BMP was effective in shifting nutrient distribution away from the river and preventing further degradation of water quality. In addition, leaching of nitrate-nitrogen occurred to a 60-centimetre depth adjacent to the longest active off-stream watering system.

Study 2 : Cattle behaviour, water quality and riparian health

Cattle behaviour

The table below shows that the number of cattle observed on the riverbank, in the river or drinking from the river decreased after the off-stream watering system was installed. The trend of 20% fewer cattle on the riverbank, 72% fewer cattle in the river and 3% fewer cattle drinking from the river confirmed that off-stream waterers do affect cattle behaviour and result in less cattle traffic near the river. It should also be noted that cattle accessing waterways is dependent on the distance of waterers, the impact of which was not analyzed in this study.

Water quality

Off-stream watering mitigated water quality degradation in the Lower Little Bow River, and these findings are consistent with decreased cattle near or in the river and with riparian health improvement.

However, certain water quality variables such as fecal coliforms and *E. coli* concentrations were significantly increased downstream in the two subsequent years, suggesting that the BMP was not effective at mitigating water quality degradation for these variables. Bacteria may have increased downstream in certain years because of direct fecal deposition by cattle in the river or runoff through fecal pats on the adjacent riparian zone. However, it is also possible that increased concentrations of bacteria downstream that were detected post-BMP originated from wild animals such as birds or muskrats. While both of these animals were observed to be in the river, point-source contamination was not identified during this study.

Riparian health

Unmanaged grazing of riparian pastures can damage vegetation and soil in the riparian zone and can reduce riparian health. The second study confirmed that off-stream waterers can attract cattle away from the river and can result in improved riparian health. Improved scores were measured for five of the eleven riparian health assessment criteria (two vegetation and three soil/hydrology criteria).⁶ The riparian area adjacent to the unfenced river reach improved moderately over two years (from a health score of 60% to 65%), but still within the range of 'healthy but with problems.' Rebuilding riparian health takes time.

Study 3 : Indicators of cattle activity

This study found that chloride was the best indicator of cattle activity at watering sites not affected by soil salinity and high natural chloride levels. This was because cattle manure has high chloride compared to non-saline soils. Soil test phosphorus was the best overall indicator of cattle activity at off-stream watering sites and river access sites in saline and non-saline soils. Certain soil properties were also influenced by distance from watering site, stocking rate, precipitation and age of water trough.

Table 1. Observed changes in daily cattle numbers (per kilometre) in and near the river (before and after BMP implementation)

	On riverbank	In the river	Drinking from the river
Before off-stream cattle watering installed (year 1)	474	32	124
After off-stream cattle watering installed (year 2)	379	9	120
Percent change	-20	-72	-3.2

CONCLUSIONS

While not all measured water quality parameters were improved in this study, off-stream watering did reduce the number of cattle entering the river as well as cattle traffic on the riverbanks. A moderate improvement in riparian health was also noted and this provides additional forage for cattle to graze over time.

Using off-stream waterers without fencing is substantially less costly than installing streambank fencing and provides a reasonable compromise between cost and protection of riparian areas and waterways. Other options to entice cattle away from waterways and riparian areas may include the use of portable windbreaks, scratching posts or mineral blocks.

It is important to note that managed and controlled grazing of riparian pastures is still required in conjunction with off-stream watering systems in order to protect riparian areas. The four key principles of good range management that will help in protecting riparian areas are: balance animal demand with the available forage supply; distribute livestock evenly; avoid or minimize grazing the range or pasture during vulnerable times; and provide effective rest after grazing.⁷

In addition, other studies have shown that cattle that have access to a consistent and clean source of water are more likely to gain weight more quickly and remain healthier. This combination of healthier cattle and increased biomass production of rangeland and riparian areas can offset the cost of installing waterers at appropriate intervals and distances from waterways.⁸



¹Fitch, L. and B.W. Adams. 1998. Can cows and fish co-exist? Can. J. Plant Sci. 78:191-198.

²AAFC 2011. Streambank Fencing in Southern Alberta: An Analysis of Benefits and Costs. <http://www.agr.gc.ca/eng/?id=1338317210925>

³Miller, J.J., T.W. Curtis, E. Bremer, D.S. Chanasyk and W.D. Willms. 2009. Soil test phosphorus and nitrate adjacent to artificial and natural cattle watering sites in southern Alberta. Can. J. Soil Sci. 90: 331-340.

⁴Miller, J., D. Chanasyk, T. Curtis, T. Entz and W. Willms. 2011. Environmental quality of Lower Little Bow River and riparian zone along an unfenced reach with off-stream watering. Agricultural Water Management. 98: 1505– 1515.

⁵Miller, J.J., T.W. Curtis, E. Bremer, D.S. Chanasyk and W.D. Willms. 2013. Evaluation of selected soil properties for indicating cattle activity at off-stream watering and river access sites in southern Alberta. Can. J. Soil Sci. 93(3): 343-358.

⁶<http://www.cowsandfish.org/publications/assessment.html>

⁷Fitch, L., B. Adams and K. O'Shaughnessy. 2003. Caring for the Green Zone: Riparian Areas and Grazing Management - Third Edition. Lethbridge, Alberta: Cows and Fish Program. ISBN No. 0-9688541-2-5.

⁸Lardner, H.A., B.D. Kirychuk, L. Braul, W.D. Willms and J. Yarotski, J. 2005. Australian Journal of Agricultural Research. 56: 97-104.

For more information, contact:

Dr. Jim Miller
Research Scientist
Agriculture and Agri-Food Canada
Lethbridge Research Centre
Lethbridge, Alberta
Telephone: 403-317-2219
Email: Jim.Miller@agr.gc.ca.

To find out more about the Lower Little Bow River project from 2004-2013, visit www.agr.gc.ca/webs.