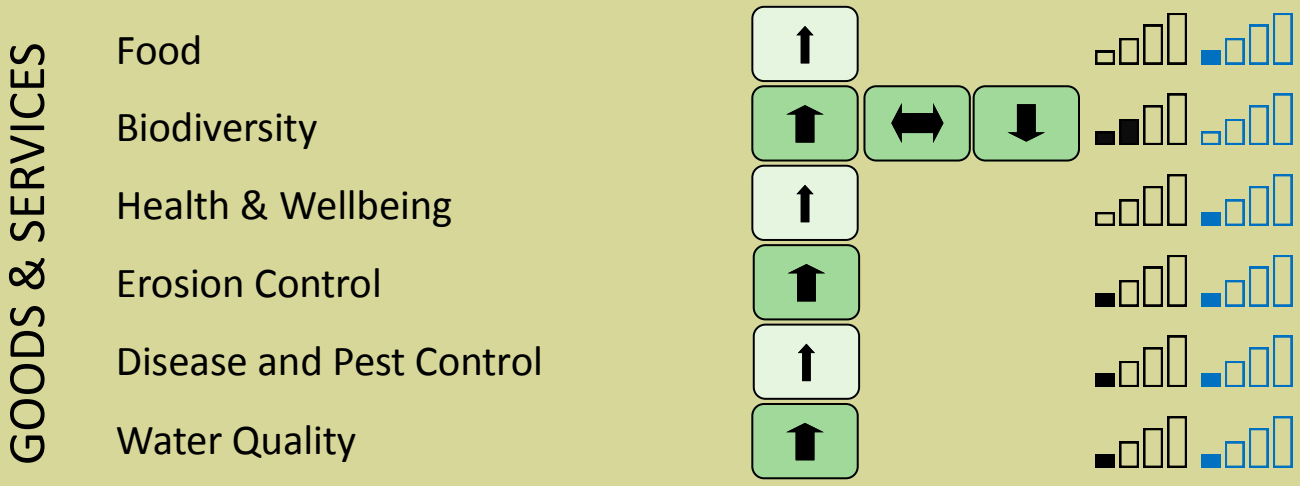
Prevent livestock such as cattle and sheep from having direct access to the river bank through the use of fencing or hedging.

MANAGING ECOSYSTEM SERVICES

FRESHWATER

EXCLUDE LIVESTOCK FROM RIVER BANKS

GOODS & SERVICES



These pages represent a review of the available evidence linking management of habitats with the ecosystem services they provide. It is a review of the published peer-reviewed literature and does not include grey literature or expert opinion. There may be significant gaps in the data if no published work within the selection criteria or geographical range exists. These pages do not provide advice, only review the outcome of what has been studied.

Full data are available in electronic form from the Evidence Spreadsheet.

Data are correct to March 2015.

KEY

Quality of Evidence

Good

Medium

Poor

Quantity of Evidence

Number of sources showing direct evidence

Number of sources showing indirect evidence

Magnitude and Direction of Effect

Direction

Magnitude

Strong

Medium

Low

MANAGING ECOSYSTEM SERVICES

FRESHWATER

EXCLUDE LIVESTOCK FROM RIVER BANKS

Provisioning Services—providing goods that people can use.

Cultural Services—contributing to health, wellbeing and happiness.

Regulating Services—maintaining a healthy, diverse and functioning environment.

PROVISIONING

Food: ***Weak Evidence:-*** The effect of grazing regime on food supply for salmonid fish on adjoining streams has been investigated. A study from North America found that rotational grazing generated more riparian vegetation and terrestrial invertebrates in the stream food chain than intensive grazing[1]. A similar result was found in another study, also from North America, where streamside variables most favourable to salmonid fisheries were obtained from lower grazing intensities[2]. Although a potential link to salmonid fisheries is implied, no direct link is demonstrated, and the link to streamside vegetation is implied as a function of grazing intensity.

CULTURAL

Biodiversity: ***Strong Evidence:-*** A study into field margins separating livestock from water courses in Scotland found that invertebrate diversity did not increase until the margins were greater than 5.4 m wide[3]. This study concludes that biodiversity banks of less than 2.5 m wide, typically suggested to prevent access of livestock to water are unlikely to increase invertebrate abundance. This is supported by the finding that in the UK, unfenced field margins adjacent to watercourses had a higher carabid beetle diversity and species richness than fenced margins[4]. A study from Northern Utah in the USA investigated the links between removing livestock access to the waters edge and a range of environmental factors[5]. Concerning biodiversity, it found a reduction in non-native plants and a decrease in the occurrence of whirling disease, a parasitic disease of native salmonid fish.

Health & Wellbeing: ***Moderate Evidence:-*** Studies in this area generally link cattle density and access to stream and river banks with the amount of Coliform bacteria in the water. A model which was validated on a Scottish dairy farm found that *E. coli* bacterial contamination of rivers could be reduced by both lowering stocking density and not allowing cattle to directly enter the water[6]. A UK study found that installation of streamside fencing would be the single most effective method of reducing coliform bacteria levels in the water[7]. ***Weak Evidence:-*** The failure of a long term water quality improvement initiative in West Virginia USA may have been due to increased livestock numbers[8]. The same study showed that removal of cattle led to a decrease in faecal coliform bacteria in subterranean drainage in grazed karst areas but there is no direct link shown with exclusion of cattle from the water's edge.

REGULATING

Erosion Control: ***Moderate Evidence:-*** In Idaho, USA, unregulated grazing was found to significantly increase the potential for sediment loss, largely from shallow slope banks which cattle preferred[9]. A simulation study, also from Idaho, suggested that moderate grazing could depress the stream-bank surface by 3 cm, while heavy grazing could depress it by 11.5 cm[10]. A study from Australia[11] showed that fencing of a riparian area to exclude livestock, and planting with eucalyptus trees reduced sediment loss from 100 to 10 kg ha^{-1} yr^{-1}.

Disease and Pest Control: ***Moderate Evidence:-*** A simulation model which was validated on a Scottish dairy farm found that *E. coli* bacterial contamination of rivers could be reduced by both lowering stocking density and not allowing cattle to directly enter the water[6]. A study from Utah found that removing cattle access from stream sides caused a reduction in non-native plants and a decrease in the occurrence of whirling disease, a parasitic disease of native salmonid fish[5]. ***Weak Evidence:-*** The failure of a long term water quality improvement initiative in West Virginia USA[8] may have been due to an increase in livestock numbers with increased nutrients and bacteria entering the water due to cattle access. The same study showed that removal of cattle led to a decrease in faecal coliform bacteria in subterranean drainage in grazed karst areas but there is no direct link shown with exclusion of cattle from the water's edge.

Water Quality: ***Moderate Evidence:-*** The levels of phosphorus entering water courses is significantly higher in areas dominated by livestock farming than that dominated by arable in lowland England[12]. Livestock farming on heavy clay soils can lead to total Phosphorus loads of up to 2 kg $ha^{-1}year^{-1}$, though the extent to which this is dependent on access of livestock to the river bank is unclear. A model which was validated on a Scottish dairy farm found that nutrient contamination of rivers could be reduced by both lowering stocking density and not allowing cattle to directly enter the water by the provision of fencing and drinking troughs[6]. The establishment of a minimum distance for cattle to graze from the water course could be an important factor to limit run-off of excrement, but the effectiveness is debatable[13].

REFERENCES

1. Saunders, W.C., Fausch, K.D., 2012. Grazing management influences the subsidy of terrestrial prey to trout in central Rocky Mountain streams (USA), Freshwater Biology 57, 1512-1529. doi: 10.1111/j.1365-2427.2012.02804.x.
2. Clary, W., 1999. Stream channel and vegetation responses to late spring cattle grazing, Journal of Range Management 52, 218-227. doi: 10.2307/4003683.
3. McCracken, D.I., Cole, L.J., Harrison, W., Robertson, D., 2012. Improving the Farmland Biodiversity Value of Riparian Buffer Strips: Conflicts and Compromises, Journal of Environmental Quality 41, 355-363. doi: 10.2134/jeq2010.0532.
4. Cole, L.J., Brocklehurst, S., Elston, D.A., McCracken, D.I., 2012. Riparian field margins: can they enhance the functional structure of ground beetle (Coleoptera: Carabidae) assemblages in intensively managed grassland landscapes? Journal of Applied Ecology 49, 1384-1395. doi: 10.1111/j.1365-2664.2012.02200.x.
5. Hansen, E.S., Budy, P., 2011. The potential of passive stream restoration to improve stream habitat and minimize the impact of fish disease: a short-term assessment, Journal of North American. Benthological Society 30, 573-588. doi: 10.1899/10-018.1.
6. McGechan, M.B., Lewis, D.R., Vinten, A.J.A., 2008. A river water pollution model for assessment of best management practices for livestock farming, Biosystems Engineering 99, 292-303. doi: 10.1016/j.biosystemseng.2007.10.010.
7. Hampson, D., Crowther, J., Bateman, I., Kay, D., Posen, P., Stapleton, C., Wyer, M., Fezz, C., Jones, P. & Tzanopoulos, J.(2010) Predicting microbial pollution concentrations in UK rivers in response to land use change. Water Research, 44(16):748–4759
8. Boyer, D., 2005. Water quality improvement program effectiveness for carbonate aquifers in grazed land watersheds, Journal of the American Water Resources Association 41, 291-300. doi: 10.1111/j.1752-1688.2005.tb03735.x.
9. Hopfensperger, K.N., Wu, J.Q., Gill, R.A., 2006. Plant composition and erosion potential of a grazed wetland in the Salmon River Subbasin, Idaho, Western North American Naturalist 66, 354-364. doi: 10.3398/1527-0904(2006)66[354:PCAEPO]2.0.CO;2.
10. Clary, W., Kinney, J., 2002. Streambank and vegetation response to simulated cattle grazing, Wetlands 22, 139-148. doi: 10.1672/0277-5212(2002)022[0139:SAVRTS]2.0.CO;2.
11. McKergow, L., Weaver, D., Prosser, I., Grayson, R., Reed, A., 2003. Before and after riparian management: sediment and nutrient exports from a small agricultural catchment, Western Australia, Journal of Hydrology 270, 253-272. doi: 10.1016/S0022-1694(02)00286-X.
12. Jarvie, H.P., Withers, P.J.A., Bowes, M.J., Palmer-Felgate, E.J., Harper, D.M., Wasiak, K., Wasiak, P., Hodgkinson, R.A., Bates, A., Stoate, C., Neal, M., Wickham, H.D., Harman, S.A., Armstrong, L.K., 2010. Streamwater phosphorus and nitrogen across a gradient in rural-agricultural land use intensity, Agriculture Ecosystems & Environment 135, 238-252. doi: 10.1016/j.agee.2009.10.002.
13. Oliver, D.M., Heathwaite, A.L., Hodgson, C.J. & Chadwick D.R. (2007) Mitigation and Current Management Attempts to Limit Pathogen Survival and Movement Within Farmed Grassland. Advances in Agronomy, 93:95–152