



April 2014 (RPC RB 2014/07)

Impact of riparian buffer strips on the ecological structure of ground beetle populations¹

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Key message: Buffer strips should be strategically placed within the landscape to maximise their ability to deliver biodiversity and water quality goals rather than universally implemented. Establishing buffer strips that are over five metres wide and implementing management actions to create a mosaic of riparian habitats at the catchment level will enhance their biodiversity value.

Key Findings

- This briefing summarises the findings from a series of field-based studies that investigate the effects of the design and management of riparian buffer strips using ground beetles as indicators of biodiversity.
- Establishing buffer strips to protect watercourses from pollution is a key agri-environment measure within intensively managed agricultural catchments. As a result, riparian buffer strips are becoming widespread throughout the UK. Buffer strips have the potential to provide multiple functions, delivering both biodiversity and water quality benefits.
- Ground beetle populations were investigated in three Scottish river catchments to determine the impact of buffer strip type (fenced or unfenced), width, vegetation composition (wooded or non wooded) and management (cutting or grazing) on biodiversity.
- Fenced riparian buffer strips provide a stable semi-natural habitat within intensive agricultural landscapes which support unique populations of ground beetles compared to the adjacent fields.
- Hygrophilous (moisture-loving) beetles and species typically associated with agricultural land were found to be most abundant in unfenced margins and least abundant in wooded margins.
- Margins over five metres wide harbour beetles which are flightless while wooded margins support larger, autumn breeding species.
- Management to open the vegetation structure and prevent scrub encroachment may enhance the biodiversity value of buffer strips. Such actions, however, should be carefully timed to ensure they do not unduly interfere with the buffer's ability to protect the watercourse from pollution.
- Rather than universal implementation, buffer strips should be strategically placed where their benefits (biodiversity and pollution mitigation) are maximised.
- To optimise their biodiversity value, riparian buffer strips should be over five metres wide and management actions should be implemented to create a mosaic of riparian habitats at the catchment level.

*Riparian buffer strip, Tarland and the ground beetle *Nebria brevicollis**



¹ This research was undertaken within the Scottish Government Rural Affairs and the Environment Portfolio Strategic Research Programme 2011-2016, Programme 1: Environmental Change. For more information please see: <http://www.scotland.gov.uk/Topics/Research/About/EBAR/StrategicResearch/future-research-strategy/Themes/ThemesIntro>

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Introduction and Rationale

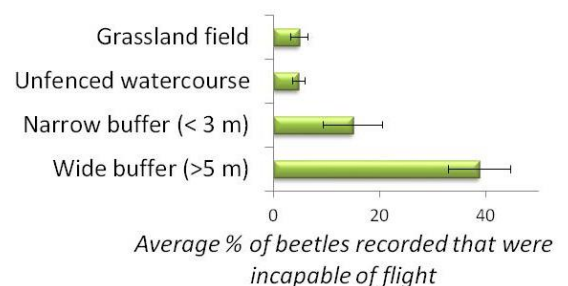
Intensively managed agricultural land provides highly disturbed habitats with vegetation that is species poor and structurally similar⁴. Within these fields, fences are increasingly being erected to protect watercourses from diffuse agricultural pollution. The resultant riparian buffer strips introduce stable semi-natural habitats which have the potential to promote biodiversity and act as ecological corridors.

SRUC and the James Hutton Institute have conducted a number of field experiments to determine how the structure and management of buffer strips impacts on biodiversity. This research uses ground beetles as indicators of biodiversity and investigates impacts on the ecological structure of beetle populations to gain a better understanding of the underlying factors affecting population structure. This research will help inform policy decisions and thus guide management prescriptions for riparian zones that capitalise on their potential to deliver multiple benefits from land taken out of production.

Methods and Results

Studies were conducted on two intensively managed lowland river catchments (Cessnock, Ayrshire and Ugie, Moray) and one extensive upland catchment (Tarland, Aberdeenshire). Pitfall traps were used to monitor ground beetles. Research in the Cessnock focused on margin width while research in the Ugie and Tarland focused on vegetation composition and margin management.

The ecological structure of beetle populations in unfenced riparian zones was similar to the adjacent fields. Buffer strips over five metres wide supported flightless species⁵, while wooded buffers supported larger species⁶. The prevalence of these ecological traits (large body size and poor dispersal) indicates that increased habitat stability in these buffer strips was driving ground beetle populations. Management (i.e. grazing or cutting) increased the number of beetles sampled.



Restricted grazing or mowing to open up the vegetation structure is likely to benefit a wider range of wildlife including flowering plants, foraging birds and bumblebees. Management practices, however, create habitat instability which can adversely impact on larger more immobile species.

Policy Implications

These studies have shown that buffer strips of different width and vegetation composition support distinct populations of ground beetles. This result leads to five policy-relevant recommendations:

- To benefit biodiversity it is recommended that buffer strips should be at least five metres wide. This will help create habitat stability within the buffer strip which will favour immobile species.
- Enhancing habitat diversity at the catchment level will favour a wider suite of species. This can be achieved by grazing or cutting some margins and planting some with trees.
- Management actions (i.e. grazing or cutting) should be conducted at a sufficiently small scale (e.g. only part of a continuous buffer strip should undergo management within any one year) to enable immobile species to recolonize from adjoining undisturbed buffer strips.
- The implementation of grazing management to buffer strips should be conducted in autumn or winter to minimise adverse effects of livestock faecal contamination on bathing water quality.
- Rather than universal implementation, riparian buffer strips should be strategically placed and designed (e.g. width, management) to maximise their benefits to biodiversity and water quality.
- Management actions should be timed to ensure they do not unduly impact on the diffuse pollution mitigating properties of the buffer strips.

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⁴ Habitats that vary little with respect to height and plant structures present (e.g. stems, leaves, flowers and grassy tussocks).

⁵ 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](https://doi.org/10.1111/j.1365-2664.2012.02200.x).

⁶ Stockan, J. A., Baird, J., Langan, S. J., Young, M. R., Iason, G. R. (2014), Effects of riparian buffer strips on ground beetles (Coleoptera, Carabidae) within an agricultural landscape. *Insect Conservation and Diversity*, 7: 172–184. doi: [10.1111/icad.12043](https://doi.org/10.1111/icad.12043)