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## Optimising the Management of Riparian Buffer Strips to Enhance Biodiversity<sup>1</sup>

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### Summary

- The establishment of riparian buffer strips along riverbanks have long been used to protect watercourses from diffuse pollution and enhance biodiversity.
- The Scottish Rural Development Programme (SRDP) 2014-2020 permits two different widths of buffer strips each with differing management requirements. Buffer strips can also qualify as *Ecological Focus Areas* (EFAs), under the Common Agricultural Policy (CAP) greening requirements aimed at increasing the environmental sustainability of intensive agriculture systems.
- This briefing provides an overview of the biodiversity and wider benefits (such as reducing diffuse pollution, mitigating flood risk and restoring ecological connectivity) associated with buffer strips and highlights how placement, structure and management can help enhance the benefits obtained.
- Wider buffer strips are not only more effective at protecting watercourses from diffuse pollution but also deliver the greatest benefits to biodiversity. They provide foraging resources for insect pollinators, stable habitats that favour immobile species such as flightless ground beetles and overwintering habitats (e.g. grassy tussocks) for a range of invertebrates.
- Management could increase the biodiversity value of buffer strips by enhancing plant diversity and preventing scrub encroachment. Mowing is feasible where buffer strips can be established without fencing, but where buffer strips are fenced grazing is a more cost effective and practical option. Allowing livestock access to buffer strips, however, conflicts with their effectiveness at mitigating diffuse pollution.
- Planting trees in buffer strips provides habitat for woodland species, enhances woodland connectivity and mitigates flood risk. The increased shading, however, can adversely impact on flowering plants and insect pollinators. Tree planting should therefore be targeted to buffer strips where improving woodland connectivity or natural flood management is the desired outcome.
- The widespread fencing of watercourses in diffuse pollution priority catchments could result in the simplification of riverbank habitats at the catchment scale. Spatial modelling techniques should be employed to ensure that a diversity of riverside habitats is achieved at a landscape scale and to help optimise the multiple benefits arising.
- Grazing is not currently permitted within EFA buffer strips. There is a need to consider how EFAs and SRDP measures can best be integrated (or management restrictions in EFA buffer strips removed) in order to increase the biodiversity and other benefits to be gained from the combined use of these measures.



<sup>1</sup> This research was undertaken within the Scottish Government Rural Affairs and the Environment Portfolio Strategic Research Programme 2011-2016, Programme 1: Environment. 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

Agri-environment schemes and the compulsory greening requirements introduced under the Common Agricultural Policy reform aim to reverse biodiversity declines and enhance the environmental sustainability of agricultural systems. Riparian buffer strips are widely adopted as a means of protecting watercourses from a range of agricultural pollutants and if managed appropriately have the potential to enhance biodiversity. Figure 1 summarises the influence of riparian management on the abundance and diversity of flowering plants, ground beetles and insect pollinators. Buffer strips are a recognised EFA and the SRDP 2014-2020 permits two widths of buffer strips differing in their management requirements. This briefing provides an overview of the biodiversity and wider benefits (such as reducing diffuse pollution, mitigating flood risk and restoring ecological connectivity) associated with buffer strips and highlights why structure, placement and management can help enhance these benefits.

### Impact of buffer strip width on biodiversity

The impact of fencing and buffer strip width varies according to a species ecology and resource requirements (Figure 1). Beetles that are riparian specialists and those associated with agricultural fields are more abundant in unfenced margins<sup>4</sup>. A wider suite of invertebrate species, including insect pollinators<sup>5</sup> and immobile ground beetles<sup>4</sup>, benefit from fencing, with the benefits derived being greatest in buffer strips over five meters wide. Wider buffer strips also tend to be more effective at reducing diffuse pollution as they create a greater barrier against the management practices of the field and provide a larger area of vegetation to intercept pollutants<sup>6</sup>.



### Management of riparian buffer strips to enhance their biodiversity value

Vegetation with a diverse range of plant species, heights and densities provide a greater range of resources and thus benefit a wider suite of invertebrates. While fencing can increase the structural diversity of vegetation it reduces the number of plant species with the lack of management benefitting highly competitive plant species<sup>5</sup>. Some form of management is therefore required if enhancing biodiversity is the desired outcome of buffer strip establishment.

### *Planting Game Cover Crops or Wildflower Mixtures*

Establishing wildflower, nectar-bearing and/or game cover crop mixtures can enhance the biodiversity value of field margins. However, cultivation next to watercourses results in pollution by fine sediment particles and bank destabilisation, and consequently is not permissible within two meters of a watercourse. Furthermore, as watercourses facilitate the spread of invasive plant species seed mixtures should be restricted to species that are native to the catchment in question. Given these constraints, management approaches that encourage natural regeneration without cultivation (e.g. through restricted grazing or mowing) are preferred for riparian buffer strips.

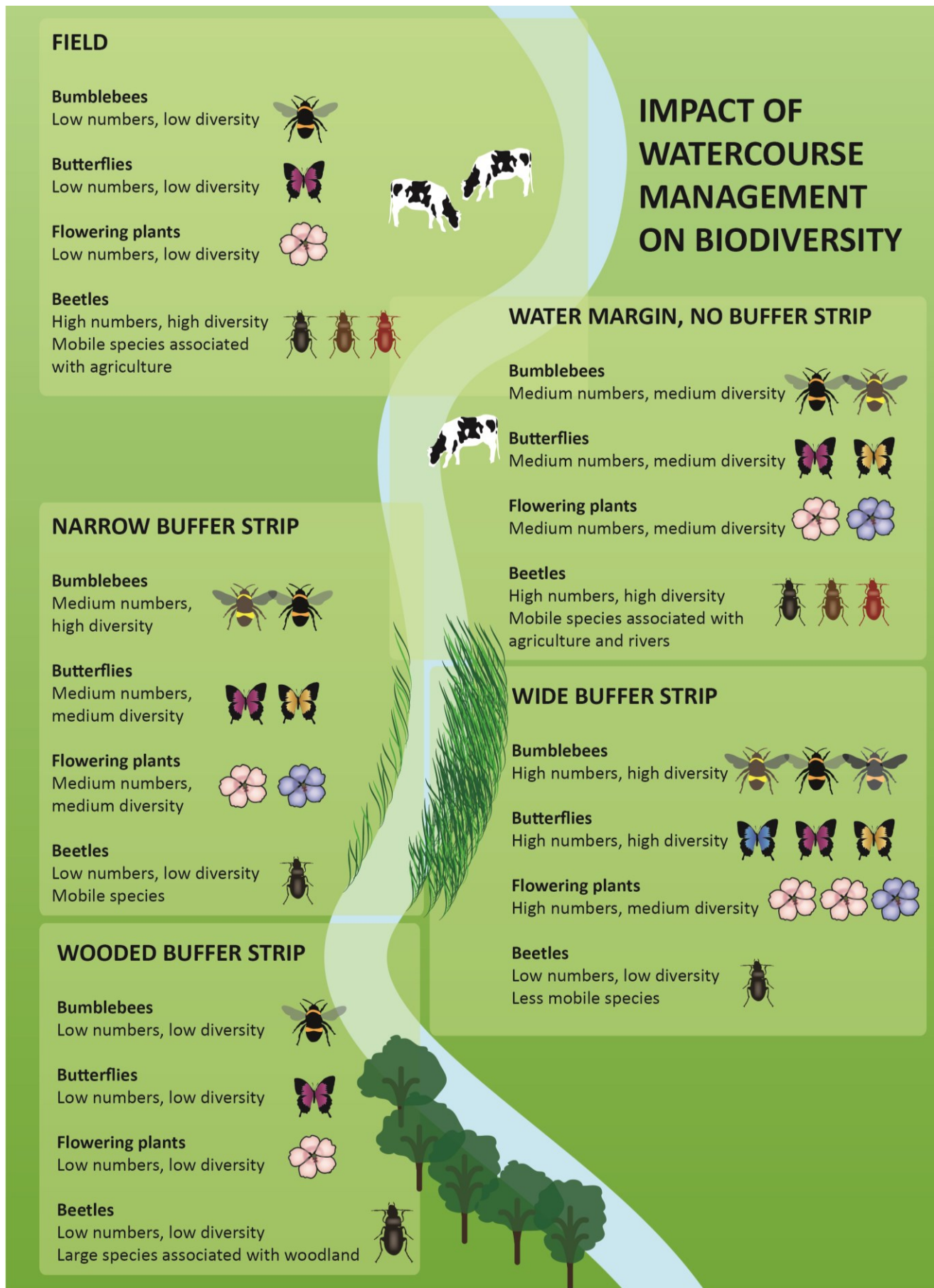
### *Grazing and Mowing*

Restricted grazing or mowing can increase the biodiversity value of buffer strips by enhancing plant diversity and preventing scrub encroachment<sup>5</sup>. Mowing is feasible where buffer strips can be established without fencing (e.g. at the edges of arable fields), but where buffer strips are fenced (as in most grassland situations) grazing is a more cost effective and practical option. However grazing can decrease habitat stability, increase the risk of fecal contaminants entering the watercourse and result in poaching adjacent to watercourses. It should therefore be restricted in duration (e.g. to a two week period annually) and should be conducted outside of the bathing season to minimise the risk to human health in bathing waters downstream<sup>5</sup>.

<sup>4</sup>Stockan & Cole 2014. [Impact of riparian buffer strips on the ecological structure of ground beetle populations](#). RPC RB 2014/07.

<sup>5</sup>Cole & Stockan 2015. [The role of riparian buffer strips in the conservation of insect pollinators](#). RPC RB 2015/12.

<sup>6</sup>Rasmussen et al. 2011. [Buffer strip width and agricultural pesticide contamination in Danish lowland streams: Implications for stream and riparian management](#). *Ecological Engineering* 37, 1990–1997.



**Figure 1:** Impact of watercourse management on biodiversity. Symbol number and colour represents abundance and diversity: 1 = low numbers, 2 = medium numbers, 3 = high numbers, 1 colour = low diversity, 2 colours = medium diversity, 3 colours = high diversity.

## **Afforestation**

Trees in riparian field margins help to stabilise river banks, reduce run-off due the vegetation trapping sediments and slow the flow of water from the land into the receiving water bodies thus helping to reduce the risk of flooding<sup>7</sup>. Planting trees also provides shelter for livestock, habitat for woodland species and enhances woodland connectivity. In dense woodlands shading can, however, adversely influence flowering plants and insect pollinators. Tree planting should therefore be targeted to buffer strips where improving woodland connectivity or natural flood management is the desired outcome.

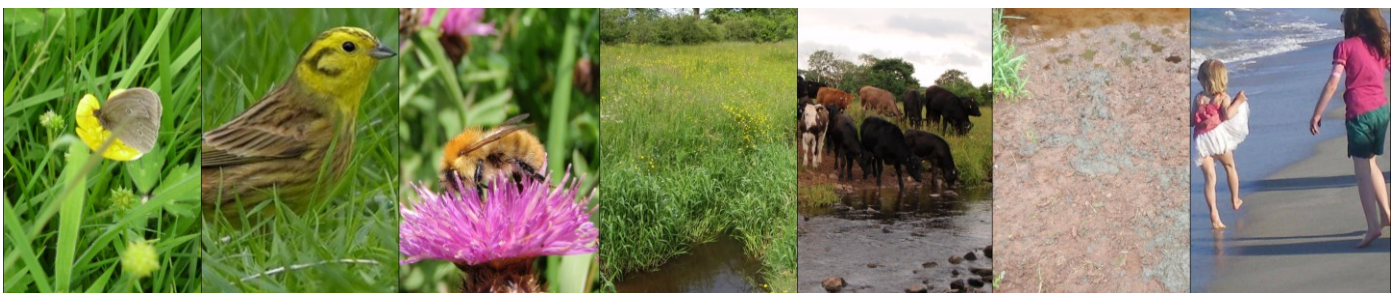
## **Catchment scale approach**

Riparian field margins are frequently disturbed by the watercourse resulting in dynamic and diverse ecosystems that support many specialist species. The widespread fencing of watercourses in diffuse pollution priority catchments whilst enhancing the ecological status of water bodies could result in an oversimplification of riverbank habitats at the catchment scale. Spatial modelling techniques should be employed to ensure that a diversity of riverside habitats is achieved at a landscape scale and to help optimise the multiple benefits gained (e.g. diffuse pollution mitigation, flood management and ecological connectivity).

## **Policy Implications/Conclusions**

- Spatial modelling should underpin decisions regarding riparian afforestation and buffer strip creation to ensure that the inherent diversity of riparian habitats is maintained at the catchment scale and to maximise the multiple benefits derived from land taken out of production
- While grazing is permitted within wider SRDP buffer strips it is not permitted within EFA buffer strips due to EFA specifications at the EU level not enabling management prescriptions to have additional restrictions (e.g. to only permit grazing outside of the bathing season). Better integration of greening and SRDP management requirements would increase the benefits that land managers can derive from riparian buffer strips.
- Additional management requirements for wider SRDP buffer strips may reduce uptake by land managers. A cost benefit analyses to identify in monetary terms the range of potential benefits derived from wider buffer strips could encourage farmers to implement this option.

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<sup>7</sup>Stockan & Cole 2014. [Soil and Vegetation Responses to Forested Riparian Buffer Strips](#). RPC RB 2014/14.