Rural Policy Centre Research Briefing

SRUC

December 2014 (RPC RB 2014/14)

Soil and vegetation responses to forested riparian buffer strips[1]

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Key message: There are clear soil and vegetation responses to forested riparian buffer strips, which indicate their potential to store and slow flood waters and thus to assist in the delivery of Natural Flood Risk Management.

Key Findings

- This briefing provides a summary of research that investigates soil and vegetation trends and characteristics associated with forested riparian buffer strips.
- Within intensive agricultural catchments, fenced buffer strips are an increasingly used to protect watercourses from pollution. The transition from herbaceous to forested buffer strip can arise though tree planting or natural regeneration. Forested buffer strips have the potential to provide multiple benefits including pollution reduction, flood mitigation, biodiversity and woodland corridors that facilitate the movement of wildlife.
- Soils in forested buffer strips are characteristically:
  - Drier; due to increased water uptake and storage by trees and thus able to absorb more water overall.
  - Less compact; allowing run-off water and nutrients to filter into the ground rather than being washed straight into the adjacent stream.
  - More acidic and nutrient-rich; a likely consequence of decomposing plant litter which has been able to accumulate.
  - Characteristics were more pronounced where there was a greater percentage of native tree species.

Wooded buffer strip in the Tarland catchment

- Increased moss cover in forested buffer strips further indicates their potential to absorb water thus slowing flood waters.
- Soil characteristics and shading by trees influence plant assemblages so that forested buffer strips contain fewer sun-loving, specialist riparian and flowering plant species (with adverse effects on insect pollinators), compared to herbaceous buffer strips.
- However, the vegetation in forested buffer strips is structurally complex (e.g. leaf litter, dead wood, ground vegetation, shrub layer and woodland canopy) thereby providing a greater variety of microhabitats for species including invertebrates, birds and amphibians.
- Forested buffer strips within agricultural catchments show all the signs of providing flood management. However, since plant diversity is reduced by afforestation, some buffer strips without trees should be retained in order to support a wider range of biodiversity.

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[1] 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 and Rationale

Fenced buffer strips, either herbaceous or forested, have the potential to provide multiple benefits in agricultural catchments. Generally the first and foremost role of these buffer strips is for the vegetation to slow and intercept sediment and pollutants before they enter the watercourse thus helping towards water quality goals. Additionally, these strips have the potential to promote biodiversity, improve ecological connectivity and aid flood mitigation. However, it is fundamental to understand the soil and vegetation characteristics of water margins in order to predict and optimise these multiple benefits.

SRUC and the James Hutton Institute have carried out in-depth field experiments to determine how the structure and management of buffer strips impact on the benefits they deliver. This research brief reports the soil and vegetation trends and characteristics associated with forested buffer strips. These results will help inform management prescriptions for riparian margins that exploit their potential to deliver multiple benefits.

Methods and Results

Studies were conducted within three river catchments: the intensive lowland catchment of the Ugie, Moray and the extensive upland catchments of the Tarland and North Esk, Aberdeenshire. Vegetation composition was sampled using 1 m x 1 m quadrats. Soil samples were taken at the beginning of each field season and analysed in the laboratory.

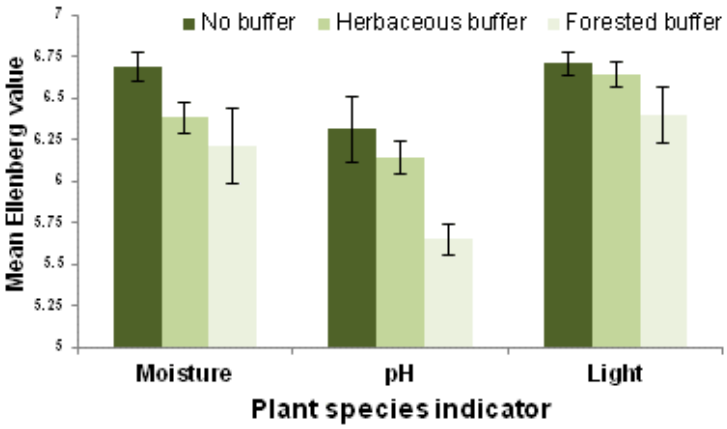

Figure 1. *Soil and microclimate characteristics of water margins using Ellenberg indicators values. Ellenberg values are derived from plant species composition.*

There was a clear soil and vegetation response to buffering which was particularly evident in forested buffer strips as shown in Figure 1. The soil of forested buffer strips was drier and more acidic containing higher levels of nutrients (phosphorus and nitrogen). Though moss cover and the structural diversity of vegetation increased, plant richness declined[4]. Flowering plants, those requiring a high level of sunlight and riparian specialists, were among those generally lost. Many of these factors indicate a more shaded and drier habitat due to the increased water uptake and storage, and shading by trees. The lower abundance of flowering plants in wooded margins has implications for insect pollinators.

Implications for Land Management

These studies have shown that forested buffer strips have the potential to assist in Natural Flood Risk Management. This result leads to four management recommendations:

- Since forested buffer strips are less suitable for flowering plants, pollinators and riparian specialists, their widespread implementation is not recommended. Rather, they should be strategically placed where they can best deliver multiple benefits such as ecological connectivity, flood management and diffuse pollution mitigation.
- Where flooding is likely and/or problematic, then incorporating trees into the design of riparian buffer strips can enhance their capacity to absorb water.
- Establishing forested buffer strips adjacent to native woodlands will enhance ecological connectivity for woodland species.
- When selecting tree species during the establishment of a forested buffer strip, then a range of native species should be chosen to optimise biodiversity and flood mitigation benefits.

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[4]Stockan *et al.* (2012) Investigating riparian margins for vegetation patterns and plant-environmental relationships in northeast Scotland. *Journal of Environmental Quality* 41, 364-372. DOI: 10.2134/jeq2010.0518