Coppice Fascines to Enhance River Biogeochemical Cycling

Ben Howard[1,2] (BCH823@bham.ac.uk), Stefan Krause[1], Nick Kettridge[1], Sami Ullah[1], Ian Baker[2]

[1]University of Birmingham, Geography Earth and Environmental Sciences, BIFoR (Forest Edge); [2]Small Woods Association

Background

The attenuation of nitrogen (N) has become a river management priority due to the negative implications of elevated concentrations. fascines (coppice wood bundles) have the potential to increase biogeochemical cycling when installed into river banks and beds, in a similar way to naturally occurring large woody debris.

By manipulating channel geomorphology, fascine installation alters streamflow characteristics. These changes are expected to facilitate an increase in stream water residence time in the hyporheic zone and therefore increase N removal by denitrification. Furthermore, fascines provide a persistent source of carbon (C) which will increase the availability of dissolved organic C and the ratio of C:N, thereby increasing the rate of denitrification.

I intend to investigate these processes primarily using 3 experimental designs.

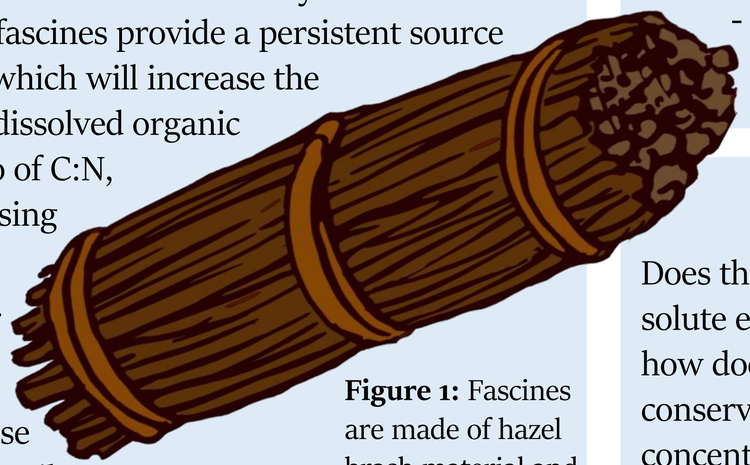

Figure 1: Fascines are made of hazel brash material and are typically about 2.4 meters long.

About the Author

My background is in conservation biology and forest management. I am interested in how research impacts practice, policy and industry.

Mesocosm

Does coppice wood provide a source of labile carbon for use in microbial respiration and increase denitrification?

Treatments: 3 repeats under oxic, suboxic and anoxic conditions:

- Stream water
- Stream water and sediment
- Stream water, sediment and wood bundle

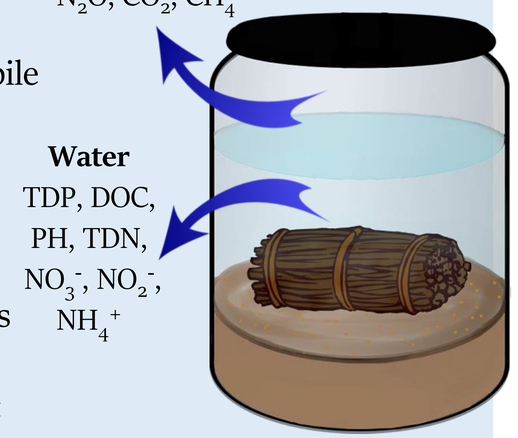

Figure 2: A mesocosm containing stream water, sediment, and coppice wood. TD=total dissolved. DO=dissolved organic.

Recirculating Flume

Does the presence of fascines produce an increase in solute exchange between the stream and the bed and how does positioning affect this? Injection of a conservative tracer will be used to calculate the solute concentration decay to estimate the exchange rate between the surface and the sub-surface.

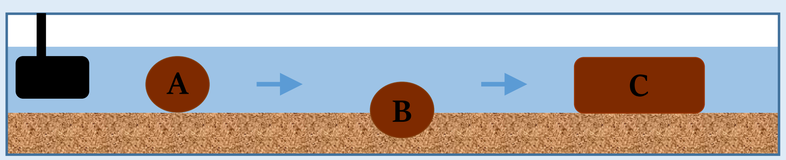

Figure 3: Plan view of fascines in 3 positions: (A) perpendicular to flow on top of sediment; (B) perpendicular to flow half buried in sediment; (C) parallel to flow on top of sediment. Arrows represent direction of flow. Black box represents water pump.

Reach-scale Tracer

Does fascine installation increase stream metabolism in low-land streams?

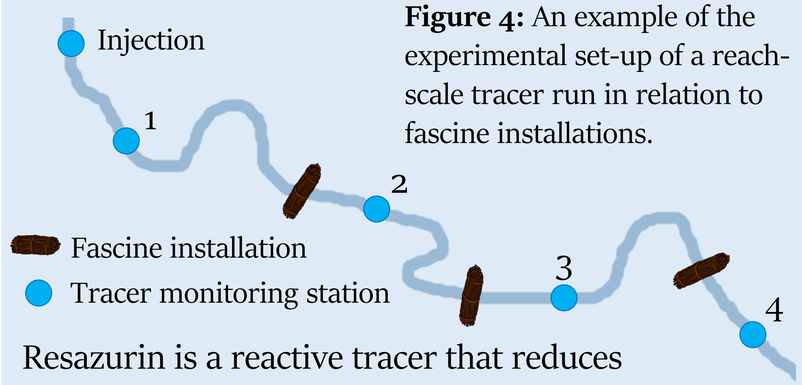

Figure 4: An example of the experimental set-up of a reach-scale tracer run in relation to fascine installations.

Resazurin is a reactive tracer that reduces irreversibly in the presence of aerobic bacteria. Used alongside a conservative tracer, it will quantify metabolic activity associated with transient storage zones, before and after fascine installation.

Impact

If fascine installation proves to be effective at enhancing biogeochemical cycling, it offers a low-cost, low-impact bioengineering technique that also provides a paradigm of other ecosystem services. The use of fascines has socio-economic benefits and supports the advocation of coppicing in the UK and the inclusion of small wood management in policy and grant schemes.

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