Gloucestershire headwater streams – site visits, May 2015

Kingscote Woods

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In attendance: Chris Mainstone (Natural England), Chris Uttley (Stroud District Council), Ann Skinner (Environment Agency), Iain Diack (Natural England), Richard Spyvee and Pete Bradshaw (Gloucestershire Wildlife Trust).

We walked up the stream from the bottom end of the wood at Horsley (ST 838 978) up to and through the top end of the wood at ST 822 973 (Figure 1), looking out onto the upper catchment. We had insufficient time to explore the springs at the top of the catchment, or the southern tributary and its springs.

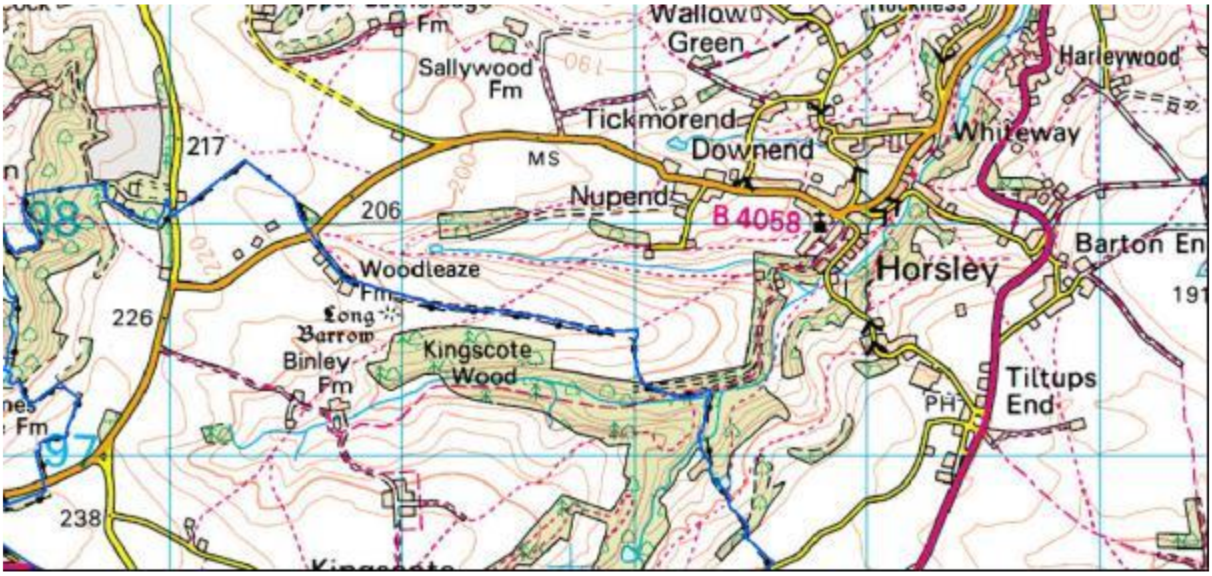

Figure 1. The stream system in Kingscote Wood

The downstream end of the stream is degraded through channelization associated with a poplar plantation (Figures 2 and 3). The stream habitat mosaic has been lost, as has hydrological connectivity with the steep banks. There are no bankside trees interacting with the channel, and no woody material in the channel.to provide any habitat diversification. The disturbed banks, presumably covered in spoil from the stream, are dominated by nettles.

Figure 2. The deepened and straightened stream channel running through a poplar plantation.

Figure 3. The top end of the poplar plantation looking downstream.

Upstream of the plantation, stream gradient increases and the woodland becomes semi-natural. The unmanaged channel contains reasonable amounts of woody material, creating variation in current velocities, bed substrates, and water depth. It is this variation that provides the habitat mosaic necessary to support the full range of characteristic biota.

Figure 4. The unmanaged channel upstream of the plantation.

Further upstream, a fallen tree has created a partial dam, catching leaf litter and small woody debris and generating a scour-pool and riffle downstream. This combination of biotopes is characteristic of naturally functioning woodland streams. The leaf litter caught by the dam is fundamental to the trophic structure of the stream ecosystem, providing food for leaf-shredding invertebrates which in turn break the leaves down into assimilable nutrients for the rest of the food web.

Figure 4. Habitats created by a fallen tree.

The invertebrate community is dominated by freshwater shrimps (*Gammarus*), typically the dominant leaf-shredder in woodland alkaline streams. The predatory stonefly *Isoperla grammatica* was also found, along with some Baetid mayflies, one cased caddis-fly larvae (Limnephilidae) and quite abundant Chironomid (midge) larvae. Overall the invertebrate diversity found was low, although sampling was brief. One interesting discovery was larvae of the beetle family Scirtidae – these have aquatic larvae but adults that live in damp bankside vegetation, which suggests reasonable hydrological connectivity between the channel and its riparian zone.

The shallow cross-section of the stream channel is very evident in the unmanaged stream section (Figure 5), providing a gradual change in hydrological conditions through the riparian zone that can be exploited by wetland flora and fauna (e.g. Scirtid beetles).

Figure 5. Shallow cross-section of the natural stream bed.

Tufa-forming springs feed into the main channel at intervals (Figures 6 and 7), associated with Cratoneuron moss which is indicative of the Habitats Directive Annex I habitat H7220 (petrifying springs with tufa formation).

Figure 6. Small tufa mound formed by a spring that drains into the main stream.

Figure 7. Tufa spring with Cratoneuron moss running down into the main stream.

Coming out of the top end of the wood into open land, the stream still appears relatively unmodified, with shallow cross-section and well-vegetated shallow banks (Figure 8). The lighter conditions allow some submerged higher plants to grow, including less water-parsnip. The shallow banks provide a niche for marginal plants such as brooklime to establish, which characteristically encroach into the channel as flows recede through the summer months.

Figure 8. The stream running through the upper catchment.

Although there was no time to walk further upstream, the 1:25,000 scale OS map shows abundant springs feeding in. With the combination of semi-natural grassland and woodland in the upper catchment, it seems highly likely that the stream/mire system is intact throughout. The same is also likely to be true of the tributary flowing from the south and joining the main stream immediately upstream of Horsley.

Key messages

Overall, this stream is an excellent example of a highly natural tufaceous stream, with good continuity with its springs and flushes.

1. Priority habitat mapping

This stream and its interconnected spring and flush habitat, all the way to the springs and flushes upstream of the wood, should be included in the priority river habitat map for England (Mainstone *et al*. 2014, 2015). The site should also be included in an inventory of SAC habitat 7220 (petrifying springs with tufa formation (Cratoneurion).

2. Objectives

Natural ecosystem function is the over-arching objective for stream habitat including associated flush and springs, as outlined in the freshwater and wetland habitat narrative (Mainstone *et al*. 2016). Management should seek to intervene as little as possible, acting only to restore natural function (particularly relating to the role of bankside trees and wood debris).

3. Management issues

Trees and woody debris - The importance of the interaction between standing and fallen wood and stream habitat is clear here as it is elsewhere in the headwater stream systems recently visited in Sussex and Kent. Fallen trees across mire and stream habitat should be left in place to generate characteristic habitat mosaics and provide dynamism in the stream/mire system. Debris dams should be allowed to develop and decay naturally.

Although running through woodland, bankside trees are relatively uncommon. This means that interaction with tree root systems is relatively infrequent. Bankside tree root systems are important contributors to the full expression of stream habitat mosaics, instigating plan form movement but preventing excessive channel destabilisation, and generating the bulk of woody debris in the stream. Selective planting of appropriate bankside trees at this site would be beneficial.

Intervention is needed in the ditched channel running through the poplar plantation, to restore national stream function. The additional of large woody debris dams at intervals along the channel should be sufficient to raise bed levels and initiate plan form movement, both necessary to restore the natural stream habitat mosaic. Observations at other sites in the locality demonstrate how efficient woody debris dams are at restoring bed levels, through the capture of coarse and tufaceous substrates delivered by the upstream catchment.

Nutrient inputs - An increase in external nutrients, from domestic sources or agriculture for instance, destroys the characteristic trophic structure of headwater streams. Leaf litter decomposition becomes less important as easier sources of nutrients are exploited. The role of shredders declines and species may be lost, as other species feeding on other nutrient sources (for instance, 'scrapers' feeding on algae) out-compete them. Artificial nutrient inputs should be avoided wherever possible.

Gloucestershire headwater streams as a network

The headwater streams of the south Cotswolds in Gloucestershire, including their associated spring and flush habitat, constitute a highly important habitat resource. There are many fine naturally functioning examples of stream habitat, most of which are still connected to intact flush and spring habitat. These streams have retained much of their natural function because of the steep topography of the area, which has resulted in the retention of semi-natural woodland and relatively unimproved grassland.

Their association with broadleaved woodland (some ancient), adds to the biodiversity importance of the landscape. Whilst these streams have high conservation value in their own right, they are also critical to the health of downstream river systems, and when functioning naturally they provide a range of ecosystem services that are too often taken for granted (Mainstone *et al.* 2016). These services include nutrient processing, water cooling (in association with woodland or riparian trees) and flow regulation, the latter in relation to moderating peak flows and supporting base flows in dry weather.

Damaged streams and stream sections can and should be restored to higher levels of natural habitat function, with all of the biodiversity and societal benefits that brings. Headwater streams are too easily forgotten by the decision-making processes that govern water management (including the Water Framework Directive) and so greater reliance needs to be placed on biodiversity drivers (protected sites and priority habitat) to make sure they receive the attention they deserve (Mainstone *et al.* 2016).

The Kingscote stream/spring/flush system should be seen as part of a series of headwater systems of high conservation value running off the south Cotswolds that should be conserved in an integrated way, based on naturally ecosystem functioning. Key messages to include:

- Maintain or restore continuity of natural water-related habitat from valley mires, through springs to stream channels.
- Minimise physical interventions to the channel and its margins.
- Maintain tree cover (and increase to patchy cover where needed) and retain fallen trees and woody debris unless there is a significant safety risk – woody material is an essential element of natural stream/mire function.
- Be aware of water resource and water quality pressures in the catchment and raise awareness of the need to control these pressures to protect natural ecosystem function.

In addition, a local initiative to find or develop definitive names for all of the streams in the area would be a positive step for headwater stream conservation. The lack of names (or at least well-known names) seems symptomatic of a lack of societal value assigned to headwater streams. A naming initiative would help focus greater attention on them and their conservation importance, encourage greater care over activities affecting them, and foster public engagement.

Potential SSSI notifications for stream habitat in this area, including associated flushes and springs, should be considered within a wider perspective on SSSI notifications, which includes terrestrial habitats (particularly ancient broadleaved woodland) and rare species such as bryophytes. An integrated approach to notifications is necessary to ensure that the links between these features, and the dependency of characteristic species on natural ecosystem function, is properly captured. This needs to be supported by appropriate use of priority habitat mapping, to ensure that valuable sites not selected for SSSI notification receive the recognition (and the drive for restoration where necessary) that they deserve. A new initiative is being set up to allow stakeholders to contribute to our collective knowledge of the naturalness of headwater streams and help refine the English priority river habitat map. A webpage and data portal is being developed by the Freshwater Biological Association which should be operational this summer.

References and further reading

Mainstone and Hall (2016) A narrative for conserving open freshwater and wetland habitats in England. Natural England Research Report NERR064. Natural England.

Mainstone, C.P., Skinner, A., Peters, S. and Rogers, M. (2015) Refining the priority river habitat map for England: a report on recent revisions and proposals for on-going refinement. Natural England joint publication JP012.

Mainstone, C.P., Laize, C., Webb, G. and Skinner, A. (2014) Priority river habitat in England – mapping and targeting measures. Natural England joint publication JP006.