Gloucestershire headwater streams – site visits, May 2015

Tyley Bottom

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In attendance: Chris Mainstone (Natural England), Chris Uttley (Stroud District Council).

The headwater system running through Tyley Bottom is one of a number of such systems running eastwards off the limestone plateau of the South Cotswolds into Little Avon River, and then into the Severn Estuary. We walked upstream from Combe, where the stream has been dammed to form an ornamental pond.

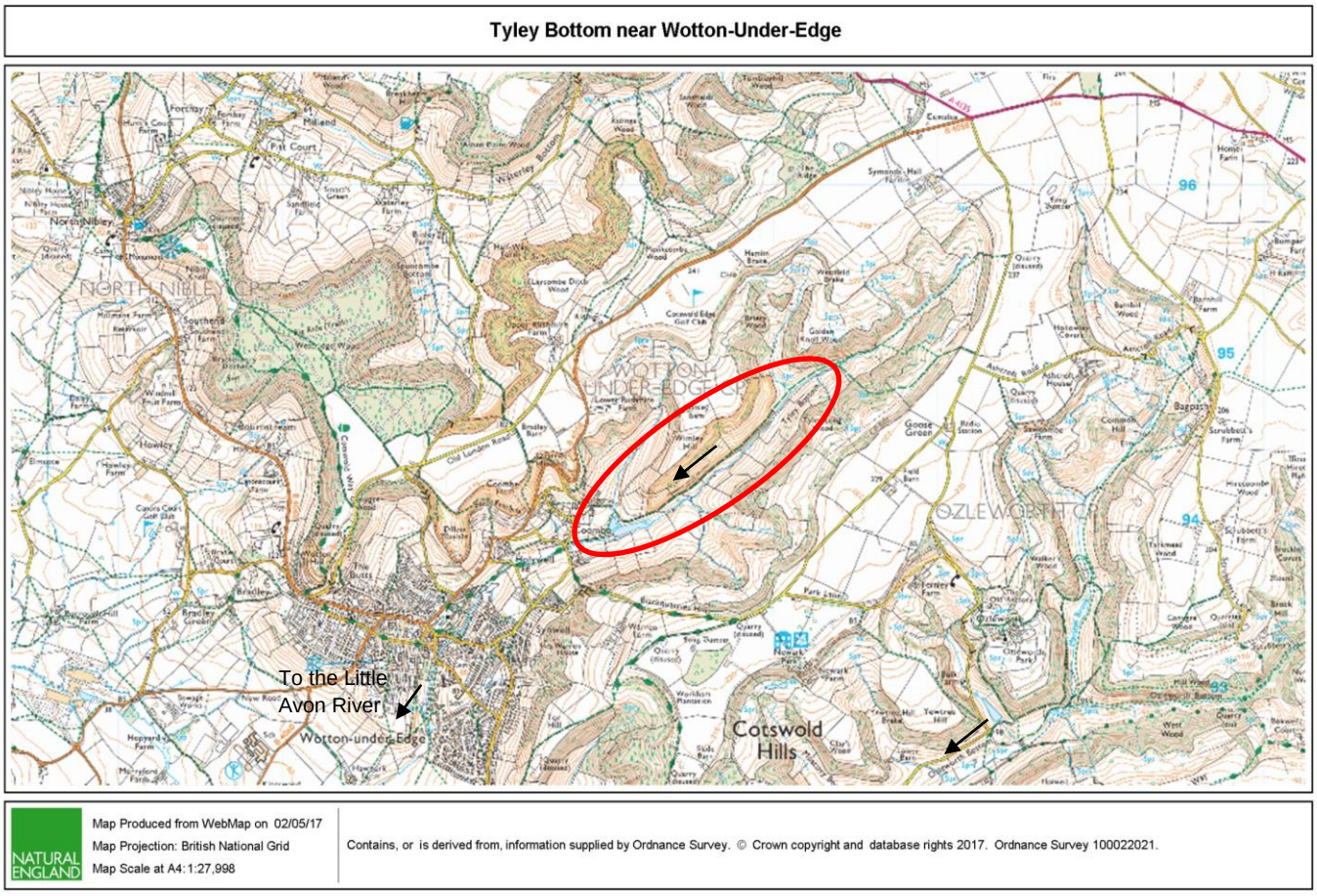

Figure 1. Tyley bottom and surrounding headwater streams. The red circle indicates the area inspected. Black arrows indicate direction of flow.

The catchment below the limestone plateau is a mixture of improved grassland and woodland/scrub (Figure 2). The density of springs shown in Figure 1 indicates the level of potential the area has for natural hydrological function, as does the relatively low intensity of land management. Intensification of land use is limited by the steep gradients running off the plateau.

Figure 2. The catchment, showing the tree-lined main stream running right-to-left through improved pasture.

Immediately above the ornamental lake the stream takes on a natural appearance, covered with a full riparian tree canopy (Figure 3) providing a good supply of woody material and leaf litter to the channel.

Figure 3. The main stream, showing good tree-lined riparian corridor.

Further upstream a tributary feeds into the main stream. This has higher stream gradient and has created a very diverse in-channel mosaic, mediated by large woody material and riparian tree root systems (Figures 4 and 5).

Figure 4. Stepped pool-cascade mosaic in the tributary stream, formed by riparian tree root systems and woody debris.

Figure 5. Fallen riparian tree in the tributary stream, with its root system stabilising the stream bed.

The incised nature of the tributary stream and the heavy riparian tree canopy provide conditions that are sufficiently humid for bryophytes and ferns (Figure 5).

Brief kick-sampling of the macroinvertebrate community was undertaken at a number of points upstream of the ornamental lake, and a composite sample formed. Stoneflies were represented by the predatory *Isoperla grammatica,* an inhabitant of fast-flowing riffle habitat with gravel substrates, and the leaf-shredding *Nemoura cambrica*, which favours finer substrates and an ample supply of leaf litter. Caseless caddis-fly larvae were represented by the headwater specialists *Plectrocnemia geniculata* and *Wormaldia occipitalis*. Plectronemia species are very active predators, spinning snare-like traps for a range of invertebrate prey. They tend to be absent in streams where fish are present, being replaced by more cryptic invertebrates that are less vulnerable to predation – this explains their high occurrence in headwater streams relative to larger streams further downstream which are less hostile to fish populations. Wormaldia species (Philopotamidae family) are interesting in that they form very narrow tube-shape nets designed to withstand high current velocities including vertical water drops in cascades. They are detritivores (using the distinctive soft labrum that is diagnostic of the whole Philopotamidae family) and rapidly eject live animals from their fine-mesh nets.

Also present were Glossosomatid caddis-fly larvae, which create very loose cases attached to rocks and graze algae of the rock surface. Freshwater shrimps (*Gammarus* sp.) were relatively common – these are shredders which thrive on leaf litter. Baetid mayfly nymphs were also quite abundant.

Overall, the macroinvertebrate community reflects the diversity of the habitat mosaic created by natural processes, and the headwater character of the streams. Only a limited proportion of the invertebrate assemblage will have been caught by the sampling performed, and our inspection did not extend right up into the spring areas. Considerably more species could be expected from sampling flushes further upstream, and returning at different times of the year when different species are more observable due to the seasonal life cycle changes.

Key messages

Overall, the system above the ornamental pond at Coombe is an excellent example of highly natural stream habitat. Although the whole system was not examined, it can reasonably be anticipated that there is good continuity with intact springs and flushes in the woodland and scrub around the fringes of the limestone plateau. Whilst the presence of the impoundment at Combe prevents natural function further downstream, it does not detract from the integrity of the headwater stream habitat upstream. It does however, prevent free movement of species in and out of the headwater system.

1. Priority habitat mapping

This stream above the ornamental pond, and its interconnected spring and flush habitat, should be included in the priority river habitat map for England (Mainstone *et al.* 2014, 2015).

2. Objectives

Natural ecosystem function is the over-arching objective for stream/spring/flush habitat, 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 where needed.

3. Management issues

Vegetation management – The stream system is largely protected from livestock by the dense riparian tree cover. It is not possible to comment on the state of the flushes further upstream. Riparian trees are performing their natural function and require no active management. Woody material should be left *in situ*.

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 Tyley Bottom valley 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. SSSI notification of naturally functioning stream habitat will be facilitated by changes currently being made to the freshwater habitats chapter of the GB SSSI selection guidelines to stress the importance of natural habitat function.

Use of the SSSI mechanism 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, C.P., Hall R., Diack, I. (2016) A narrative for conserving freshwater and wetland habitats in England. Natural England Research Reports, Number 064.

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.