Gloucestershire headwater streams – site visits, May 2015

Toadsmoor

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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).

The headwater system running through Toadsmoor Valley has extensive naturally functioning stream/spring/flush habitat. We only had time to inspect one of the stream heads fed by tufa springs, near Middle Lipiatt from SO 879 041 to SO 877 042.

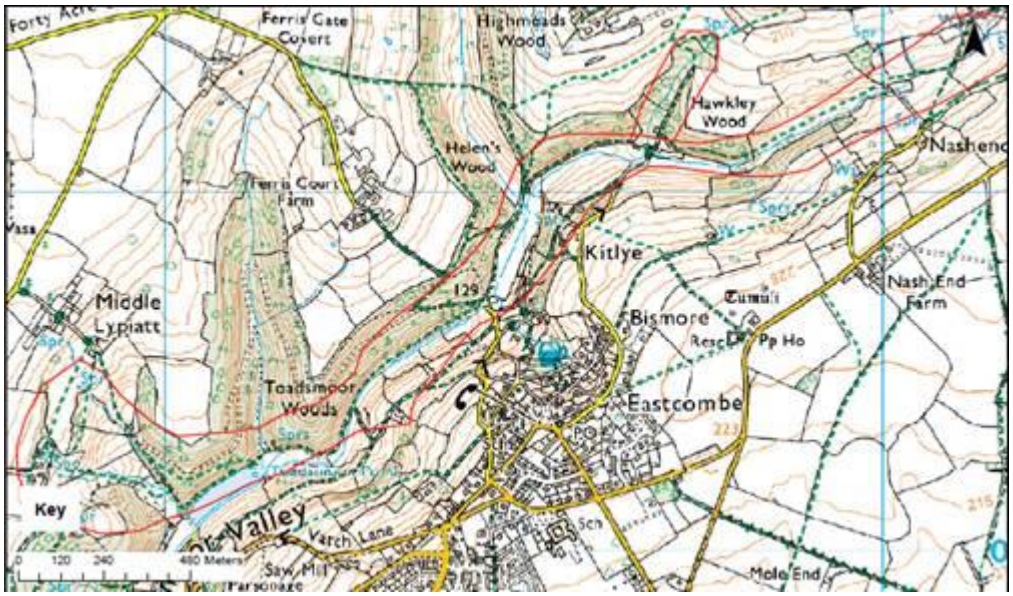

Figure 1. Toadsmoor valley. Red line indicates the extent of naturally functioning stream/spring/flush system.

The parts of the catchment we could see contain a mixture of woodland and semi-improved pasture (Figure 2), a benign landscape for naturally functioning headwater stream systems.

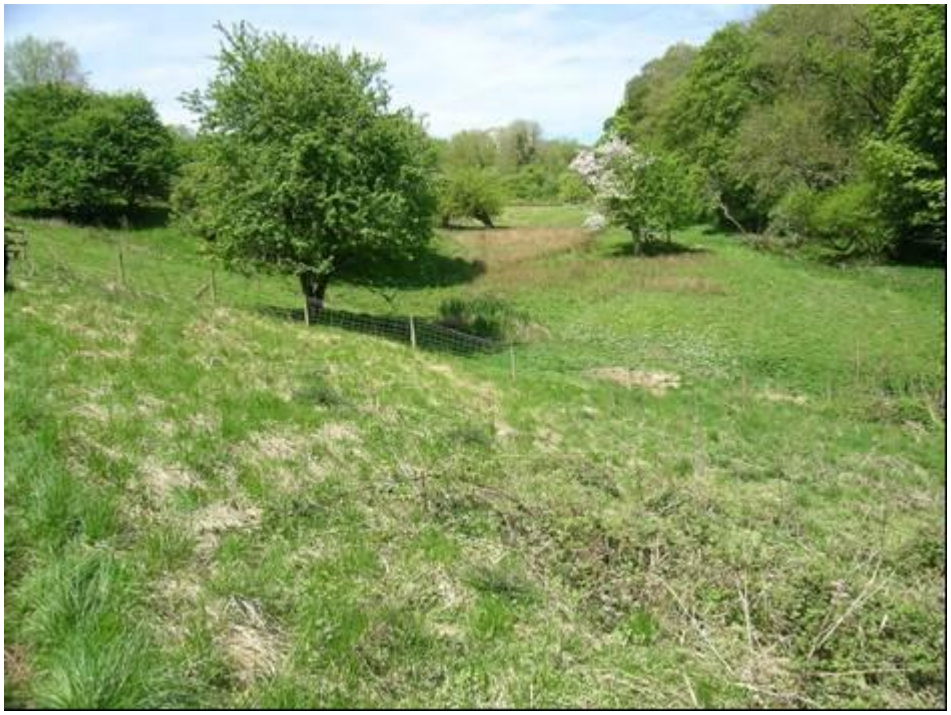

Figure 2. Surrounding landscape.

The stream head we visited is located in open rough pasture on a huge tufa mound formed over a long period of time (Figure 3). Stream margins and slopes below the springheads contain extensive and diverse flush vegetation (probably with greatest resemblance to M22 *Juncus subnodulosus-Cirsium palustre* fen meadow, although the eponymous rush is not present), including an abundance of marsh valerian and small sedges, areas of lesser pond-sedge dominance, and runnels with fool's water-cress. The main stream channel consists of tufa cascades, providing a varied habitat mosaic including fine and coarse substrates, woody material and leaf litter, variations in water depth, and exposed humid cascades with an abundant lower plant flora (Figure 4) including the moss *Palustriella commutata (*previously *Cratoneuron commutata)* and the liverwort *Pellia endivifolia*.

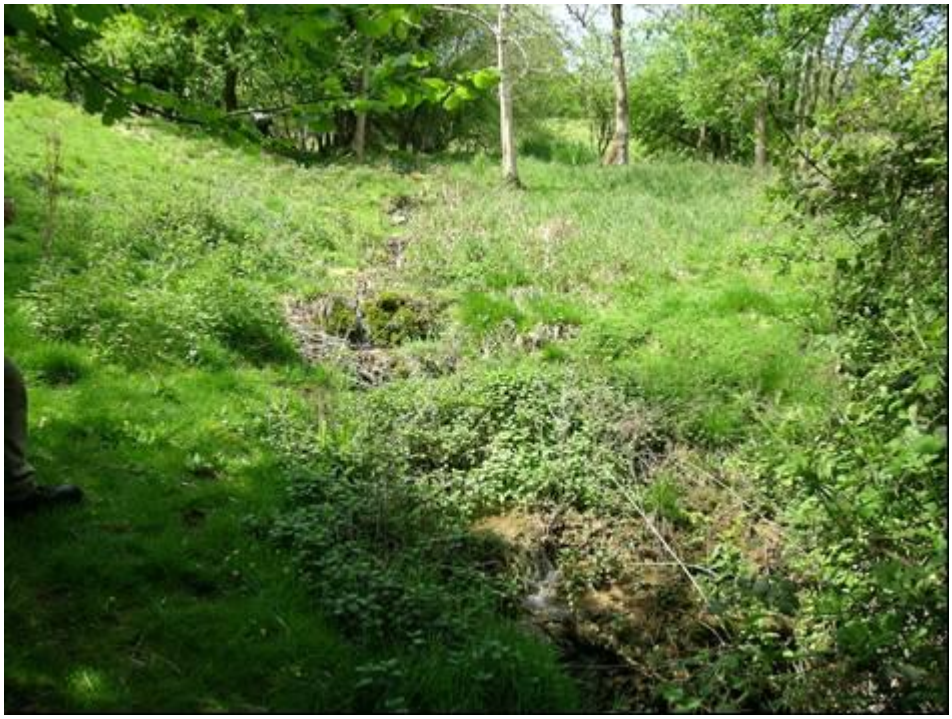

Figure 3. Intact stream/spring/flush mosaic.

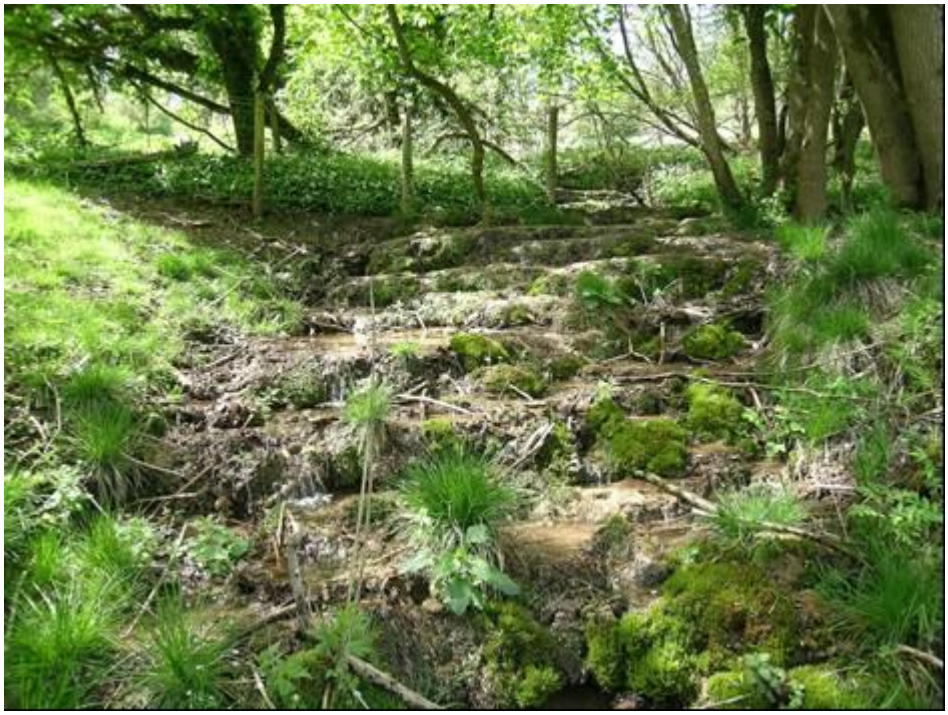

Figure 4. Tufa cascade with Cratoneuron and other mosses and liverworts.

A brief inspection of the invertebrate community was made at a number of points along the walk (made into a composite sample). Freshwater shrimps (*Gammarus* sp.) were abundant, alongside numerous caddis-fly larvae, stonefly and mayfly nymphs, beetle larvae and leeches. Stoneflies present were all specimens of the predatory *Isoperla grammatica*, which is a widespread riffle-dwelling species of

streams and rivers. The caddis-fly assemblage was quite diverse, with cased species (Limnephilidae and Glossosomatidae) and net-spinning caseless species (*Wormaldia occipitalis* and *Hydropsyche* sp.) Glossosomatid larvae form weak cases attached to stable substrates and were very abundant on tufaceous surfaces, perhaps strengthened by tufa formation around their cases. *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 most common in upland environments but the tufa cascades at this site clearly provide a similar environment. 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, in contrast to the predatory *Hydropsyche* species. Beetle larvae were all of the Scirtidae family, which are only aquatic in their larval stage and move out into wetland vegetation as adults. The natural flush/stream transition area sampled is an ideal environment for meeting the full life cycle requirements of these beetles.

Unlike many woodland streams visited in the area, the morphology of the channel in the stretch we visited seems primarily dictated by the tufa formation, in the absence of significant amounts of woody debris. However, the tufa cascades may have formed over the sparse woody material available.

Unfortunately Himalayan balsam is invading the site rapidly. There is an abundance of seedlings growing up in the wet margins of the stream.

We also briefly inspected the adjacent stream head above the farmhouse, at SO 877 045. This was dry at the time of the visit, and may be naturally ephemeral. The morphology appeared similarly natural (Figure 5), with a higher coverage of bankside trees and woody material in the channel. The ephemeral habitat provided by the channel is likely to give rise to specialist invertebrate species not found in nearby perennial sections.

Key messages

Overall, this stream is an excellent example of a highly natural tufaceous stream, with excellent continuity with its springs and flushes. The Himalayan balsam needs to be tackled as a matter of urgency to avoid serious damage to the vegetation.

1. Priority habitat mapping

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

The site should be included in an inventory of Habitats Directive Annex 1 habitat 7220 (petrifying springs with tufa formation (*Cratoneurion* vegetation)[1].

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 - Current management in the grassland areas we visited seems suitable, providing an open mid-height sward suitable for a range of wetland plant species, and avoiding damage to the delicate tufa cascade. Wooded sections require no active management.

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.

Drainage of slopes and valley bottom – changes in vegetation and evidence of previous ground disturbance suggest that small drains and pipes may be reducing the extent and wetness of the flushed slopes, particularly towards the bottom of the valley slope. Investigation of any such modification is recommended, and any pipes or drains should be blocked/removed/in-filled and natural water-flow patterns restored.

[1] This habitat is identified at European level as a priority feature, i.e. a sub-set of the Annex I habitat types that are defined as being "priority" because they are considered to be particularly vulnerable and are mainly, or exclusively, found within the European Union (Article 1d). The importance of these priority habitat types is emphasised at several places in the Directive (Articles4 and 5 and Annex III), not only in terms of the selection of sites, but also in the measures required for site protection (Article 6) and surveillance (Article 11).

http://jncc.defra.gov.uk/ProtectedSites/SACselection/habitat.asp?FeatureIntCode=H7220

Trees and woody material – At least patchy bankside tree cover is suitable, even in open grassland areas, to provide the tree roots and woody material necessary for full expression of the habitat mosaic. Woody material should be left *in situ*.

Himalayan balsam – An initiative to remove balsam is needed as a matter of urgency. Fortunately, as the site forms a small headwater catchment, the potential for recolonization from upstream areas is low. Screening of the headwater catchment should be undertaken to ensure that all populations are identified,

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 Toadsmoor 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.

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.

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.