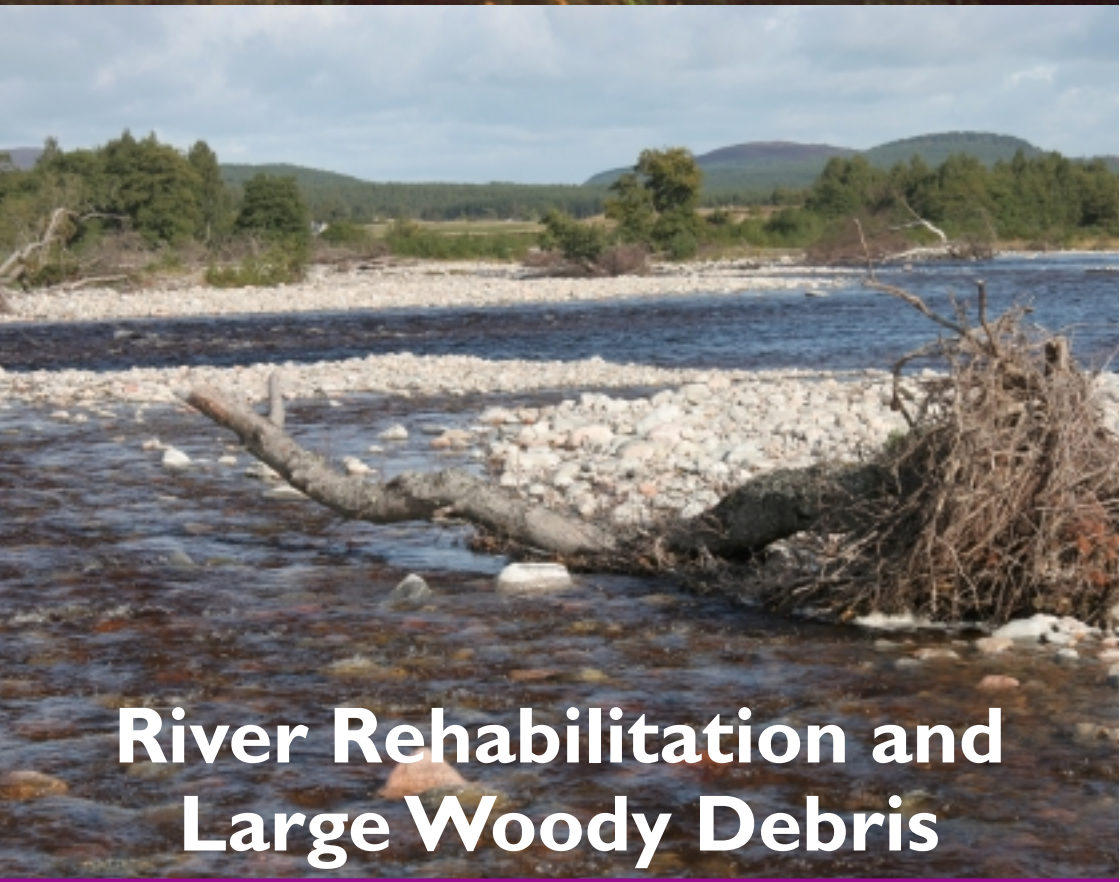
Fish Live in Trees Too!



River Rehabilitation and Large Woody Debris

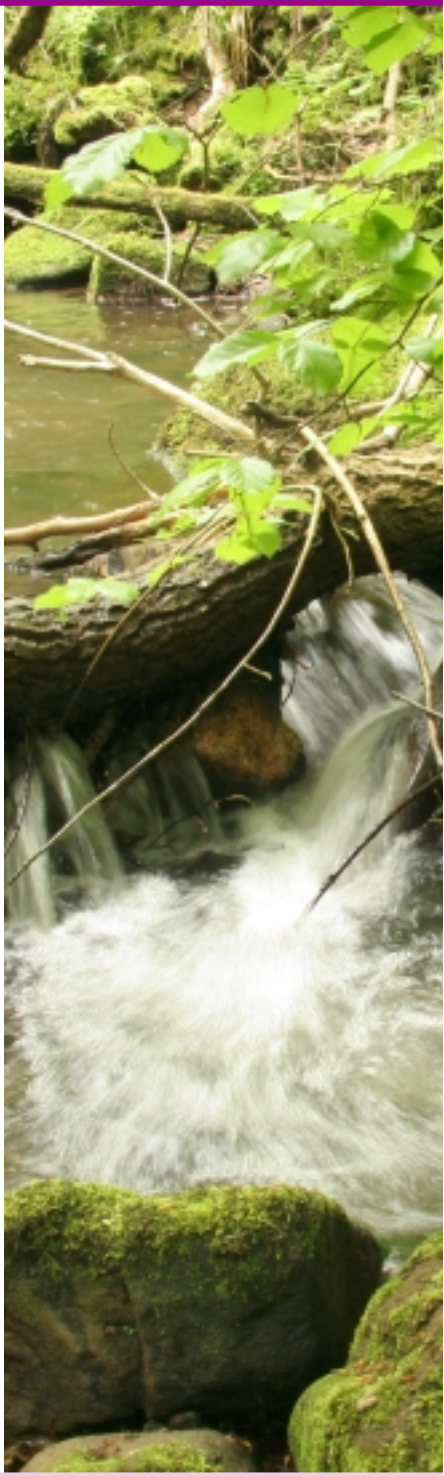
Working for a **Living Landscape**

What is LWD?

Entire trees, branches or root plates that have fallen into watercourses are commonly referred to as Large Woody Debris (LWD).

LWD often spans the entire width of smaller streams to accumulate into 'debris dams', whilst in main rivers wood collects in backwaters, shallows or wooded margins. These larger pieces of wood have a profound influence on physical structure and flows in watercourses.

In recent times LWD has captured the worldwide attention of practitioners, researchers, anglers, highways engineers, flood risk managers and conservationists. It is becoming increasingly recognised as an important management tool for accelerating the rehabilitation of degraded watercourses and their floodplains, providing natural flood defence, and a host of other benefits.



Gutted. The Trent River Catchment Board carrying out routine maintenance along the River Dove in the 1940s using a drag line. Notice the LWD removal and the creation of a trapezoidal channel.

Why was LWD removed?

Until quite recently most people's first move was towards the chainsaw or drag-line when encountering build ups of wood in the watercourses they manage. These accumulations were often seen as a nuisance: a cause of channel instability, a barrier to fish movement, and a hazard that blocks culverts and bridges. Traditional management involved regular 'stream cleaning' to completely remove wood from the channel. In combination with a regime of land drainage and river engineering, by the 1980s the majority of our rivers and streams were managed into deeper, straighter, single channels. Riverside trees were also removed and with it the supply of wood they could have provided. Even the language used to describe this material: 'snag', 'blocker', 'blockage', 'jam', conjures up images of a problem that needs tackling.

Over the past thirty years, a plethora of worldwide research into the subject of wood in watercourses has been carried out. Results show that LWD is a vital component of a healthy functioning watercourse, diversifying its structure and the wildlife it supports. Woody debris in the channel is a particularly important habitat for invertebrates and for fish.

Cheap River Rehabilitation

Thankfully attitudes towards woody debris are changing. It is increasingly being viewed as a cheap form of natural river rehabilitation and flood defence. In recent years the Environment Agency has begun to alter its management of rural watercourses in England and Wales. Previously 'blockages' (the collective name afforded by river engineers to the various types of LWD) were removed as a matter of routine. Bankside trees with branches growing out over a river were also regularly cut back.

Recently a more relaxed approach has been adopted which saves (taxpayers') money and staff time (time that can be more effectively deployed undertaking checks and maintenance of bridges and culverts). Some watercourses are beginning to show signs of recovery as woody debris acts as a catalyst to trap gravels and silts, raise bed levels, and help create pool, riffle and backwater sequences.

What can river managers do?

There appear to be limitless opportunities to use LWD imaginatively in the rehabilitation of degraded watercourses. But when is the appropriate time to intervene and re-introduce LWD in watercourses? 'Re-snagging' has become a common river restoration technique in the USA, Australia and other parts of the world. Is it just a case of replicating these schemes here in the UK?

Ironically, the ideal scenario is a hands-off approach to river management. Many degraded rivers and streams just need time and space to recover - to allow natural processes to reassert themselves.

Nevertheless, there are watercourses throughout the UK that are candidates for rehabilitation trials using the introduction of LWD. Perhaps the emphasis should be on relatively small-scale schemes with a strong element of consultation with interested parties. Where implemented, baseline surveys should be undertaken together with an ongoing monitoring programme.

Monitoring for shingle beetles, spiders and flies at a river rehabilitation site on the Trent. Follow up surveys that study 'indicator species' help to gauge the success of restoration works.

Leaving Room for Rivers

River management is entering a new phase; one where natural processes such as erosion and deposition are left unchecked; one where rivers and streams are provided with space to choose their own pathways and channel shapes. LWD has an important role to play in helping to speed up these processes.

Help increase the input of LWD into our watercourses:

- Do not disturb naturally occurring LWD in the channel, riparian zone or floodplain.
- Protect and buffer native woodlands and wetlands along stream and river corridors.
- Rotate or reduce livestock grazing within riparian zones.
- Buffer watercourses against intensive agriculture and allow them to naturally re-vegetate.
- Avoid the uniform pollarding of willows encouraging a much higher percentage to mature, split and collapse.
- Avoid making 'quick' changes to wooded river and stream corridors. Fisheries management often advocates the implementation of intensive coppicing regimes to reduce shading (sometimes called 'daylighting'). These programmes should be scaled right down and undertaken over a greater period of time, or not carried out at all.
- Identify appropriate areas to re-establish European beavers throughout the UK.

© LAURIE CAMPBELL

The only engineer we need to manage our watercourses!
The European beaver is a missing native 'keystone species' in the UK.
It has an important role to play in the diversification and enrichment of our riparian woodlands and wetlands.

In May 2009 three families of European beavers were re-introduced to Knapdale Forest in mid-Argyll. **The Scottish Beaver Trial** is a five year experiment that is being closely monitored by Scottish Natural Heritage on behalf of the Scottish Government. The partnership is led by Scottish Wildlife Trust, Forestry Commission Scotland and the Royal Zoological Society of Scotland. More info: www.scottishbeavers.org.uk

© LAURIE CAMPBELL

The Scotch Brook, Staffordshire. As unmanaged willows shed large limbs and collapse across streams, channel complexity increases and, correspondingly, habitat niches are generated for an increased range of species.

A flagship species for LWD. The Red Data Book hoverfly, *Chalcosyrphus eunotus*, (nicknamed the 'Logjammer Hoverfly' due to its habit of perching on LWD in headwater streams) is a good example of a species that benefits from a lack of management, as seen in the Scotch Brook catchment.

River Churnet, Tittesworth, Staffordshire Moorlands

Severn Trent Water owns and manages the Tittesworth Water estate. In the 1980s a section of the River Churnet's banks was reinforced with gabions (steel baskets filled with rock) to help protect a nearby road and footpath. The energy and power of the River Churnet soon undermined the gabions. Staffordshire Wildlife Trust offered to trial a more sustainable option: the use of an Engineered Log Jam and bank support using living willow tree trunks.

Objectives

- To trial the use of the first Engineered Log Jam (ELJ) in the UK.
- To trial techniques that help to mitigate the effects of climate change.
- To use Tittesworth as a national demonstration site for the management of LWD.
- To promote the use of ELJs at other appropriate sites in the UK.

The scheme was carried out in the summer of 2009. Baseline surveys of fish, vegetation, geomorphology, mammals, macro-invertebrates and stream corridor *Diptera* (true flies) were commissioned prior to undertaking the works.

View of the collapsing gabions in 2008

Partners

The Peak District National Park Authority (Sustainable Development Fund), Severn Trent Water, Staffordshire Wildlife Trust.

More info: The reports relating to this scheme can be viewed at: www.staffs-wildlife.org.uk/page/tittesworth-woody-debris-project

August 2009. The gabion baskets were removed and replaced with living, sprouting willow trunks.

The 'Key Piece' of the ELJ was a 5 tonne oak tree trunk. This was 'keyed' into river bed and supported with oak posts driven deep into the substrate. Further strength was created by adding a 'T piece'.

A further 22 tonnes of trunks and root plates were used to construct the ELJ.

View of the completed ELJ and the entrance to an old side channel.

September 2009. It works! Just two weeks after the ELJ had been completed, a late summer storm resulted in spate conditions. The position of the ELJ re-activated an old channel. It is estimated that, at the peak, a third of the River Churnet's flow was diverted into this former channel.

Dove River Catchment

The River Dove has benefited from the successful reintroduction of Atlantic salmon, instigated in the 1990s. LWD entering the channel is now, more often than not, being left in situ. It helps provide salmon and other fish with shelter from fast flows, shade (and cooler water), cover from predators, territory markers, feeding opportunites, and spawning and nursery sites.

Chop & Drop. A sycamore becomes LWD in the Upper Dove. Introduced material needs to be longer than the channel width.

Brown Trout (top) and Salmon Parr

As the supply of LWD increases in the Dove river catchment, so habitat conditions for salmonids are also improving.

Alpine Rivers in the UK: The Liza and the Feshie

It is important to have 'reference rivers' to help inform rehabilitation efforts elsewhere. Two of the finest examples in the UK are the River Liza in the Lake District and the River Feshie in the Cairngorms. Here unchecked natural processes can be observed first hand. Major changes in channel shapes and deposition patterns are on show after each spate. Pioneer islands, scour holes, ephemeral pools and mid-channel sediment bars appear and disappear as the braided rivers shift across their floodplains.

Wild Ennerdale is an established partnership that is led by the Forestry Commission, the National Trust, United Utilities and Natural England. The partnership's vision is "to allow the evolution of Ennerdale as a wild valley for the benefit of people, relying more on natural processes to shape its landscape and ecology". The River Liza is the physical embodiment of this vision.

More Info: www.wildennerdale.co.uk/index.html

Channel braiding on the Feshie

The UK Biodiversity Action Plan (BAP) species, Northern silver stilleto fly *Spiriverpa lunalata,* is a specialist of these exposed riverine sediment habitats.

LWD and sprouting driftwood often becomes embedded in the river's substrate. This results in the development of additional features such as ephemeral pools, germination zones and islands.

Croxall, Staffordshire

Croxall Lakes is a former sand and gravel quarry that is now a Staffordshire Wildlife Trust (SWT) nature reserve. A baseline geomorphological assessment demonstrated that the rivers at the site were effectively 'fossilised' by centuries of river dredging.

Lowland river islands are rare features in the UK, due to the impact of past engineering works. SWT has mimicked natural processes to create new living islands within the newly widened channel.

Objectives

- River restoration (widening) at the Tame-Trent-Mease river confluences to help trigger natural processes.
- To trial the creation of new river islands using live willow trees.

Partners

Natural England, Lafarge Aggregates (Landfill Communities Fund), The Environment Agency, The National Forest Company, SWT, May Gurney, Network Rail.

More info: www.staffs-wildlife.org.uk/page/river-braiding-reedbed-creation

Aerial view showing the location for the river widening project.

September 2009. The River Trent at Croxall prior to the works.

43,000 cubic metres of soil were removed during the channel widening scheme and deposited in the two lakes at the site to create substrate and shallows for new reedbeds. Gravels were retained and used to create river islands and mid-channel sediment bars.

Several new willow river islands were created within the widened channel.
(i) a scrape was excavated in the river substrate, (ii) live willow trees were placed into the scrape with their root plates facing in an upstream position,
(iii) clay and gravels were placed on top of the LWD,
(iv) …and the island is left to develop and strengthen naturally as the willow grows adventitious roots into the river bed.

May 2010. A view of one of the newly created river islands - note the leaves.

May 2010. A view of the completed river widening scheme with islands, sediment bars, backwaters and lagoons.

A measure of success. Croxall now has the potential to provide habitats for rare and locally threatened wildlife. These include the BAP species Depressed river mussel *Pseudanadonta complanata*, the Southern silver stilleto fly *Cliorismia rustica*, and the elusive water shrew.

Depressed river mussel

Southern silver stilleto fly

Water shrew

Navigation Farm, Staffordshire

50 hectares of former arable land adjacent to the River Trent were entered into an agri-environment scheme in 2005. A restoration project was carried out in Autumn 2006.

Objectives

- To restore the link between the River Trent and its floodplain through the re-profiling of over a kilometre of riverbank.
- To 're-wet' and graze areas of floodplain grassland.
- To maintain a high water table and natural drawdown zones using a 'passive' system (i.e. no weirs, sluices or water level management structures).
- To create new habitat (including wet grassland, open water and exposed riverine sediments) for Northern lapwing, white-clawed crayfish, depressed river mussel, shingle beetles and spiders, bullhead, brook lamprey, eel, water shrew and Eurasian otter.

Two streams, which had historically crossed the site, were diverted back across the floodplain. Water in these streams has been impeded using log jams as 'leaky barriers'. These have provided habitat for foraging lapwing chicks, as well as cover and full access for aquatic species along the length of the watercourse.

White-clawed crayfish

One of the constructed log jams along the newly diverted brook.

Partners

Natural England, The Environment Agency, Staffordshire Wildlife Trust, Staffordshire FWAG.

Eurasian otter

Stream & Wetland Restoration in the New Forest

Dockens Water, Highland Water & Black Water

A series of ambitious, imaginative and inspiring restoration projects have been carried out in the New Forest in recent years.

Objectives

- To restore 600 hectares of wetland habitat.
- To realign watercourses with their natural floodplains.
- To restore ten kilometres of damaged watercourse.

Partners

Dockens Water: Hampshire & Isle of Wight Wildlife Trust, Aggregates Levy Sustainability Fund.

Highland Water and Black Water (Life3): Forestry Commission, Environment Agency, Natural England, Hampshire County Council, National Trust and RSPB.

More info:
www.newforestlife.org.uk/life3

Dockens Water in 2004 shortly before the project was undertaken.

LWD was installed at a number of sites to raise riverbed levels and create additional habitats in the channel.

A new channel was excavated and river re-profiling carried out.

January 2008, three years on. The restoration work has been very successful. There is now a much better link between Dockens Water and its floodplain.

Life3 scheme at Highland Water to raise bed levels.

Highland Water after the restoration works.

Reading

Broadmeadow, S.B., Jones, J.G., Langford, T.E.L., Shaw, P.J. & Nisbet, T.R. (2010) The Influence of Riparian Shade on Lowland Stream Water Temperatures In Southern England and their Viability for Brown Trout. www.onlinelibrary.wiley.com/doi/10.1002/rra.1354/pdf

Godfrey, A. (2003) A Review of the invertebrate interest of coarse woody debris in England. English Nature Research Report 513. (Free publication can be ordered from: enquiries@naturalengland.org.uk)

Gurnell, A., Tockner, K., Edwards, P. & Petts, G (2005) Effects of deposited wood on biocomplexity of river corridors. Front Ecol Environ 2005; 3(7): 377-382 www.unc.edu/depts/geog/information/colloquia/Abstract_aGurnell.pdf

Herrera Environmental Consultants Inc. (2006) Design Guidelines for the use of Engineered Log Jams (ELJs) in Scottish Rivers. Technical Report to the Scottish Environment Protection Agency, Stirling, UK. www.sepa.org.uk/water/water_regulation/guidance/idoc.ashx?docid=3808b106-3a12-4e61-a7af-f6833c2078f7&version=-1

Jukes,A. (2009) *Chalcosyrphus eunotus* A Red Data Book hoverfly: Its status, distribution, ecology and conservation. Report to Staffordshire Wildlife Trust. www.staffs-wildlife.org.uk/page/logjammer-hoverfly

Linstead, C. & Gurnell A.M. (1999) Large woody debris in British Headwater Rivers. Environment Agency Research & Development Technical Summary Report: W 185. http://publications.environment-agency.gov.uk/pdf/STR-W185-e-e.pdf.

Mott, N. (2006) Managing Woody Debris in Rivers, Streams & Floodplains. Staffordshire Wildlife Trust, Stafford, UK. www.staffs-wildlife.org.uk/page/woody-debris

Opperman, J., Merenleder, A., & Lewis, D (2006) Maintaining Wood in Streams: A Vital Action for Fish Conservation. ANR University of California Publication 8157 www.landstewards.org/otherDocs/MaintainingWoodInStreams.pdf

Richardson,R. (2005) Restoring Rivers with Engineered Log Jams. River Restoration Centre Newsletter. Issue 21. 3-5. www.therrc.co.uk/newsletters/rrn21.pdf

Scottish Native Woods. (2000) Restoring and Managing Riparian Woodlands www.scottishnativewoods.org.uk/index.asp?pg=52

Websites

The Wildlife Trusts	www.wildlifetrusts.org
Environment Agency	www.environment-agency.gov.uk
Peak District National Park Authority	www.peakdistrict.gov.uk
UK BAP	www.ukbap.org.uk
Buglife	www.buglife.org.uk
Forest Research	www.forestresearch.gov.uk/fr/INFD-7CEC75
WWF	www.clim-atic.org/documents/WWF%20Floodplanner.pdf
	www.clim-atic.org/documents/WWF%20slowing%20the%20flow.pdf

Credits

Author: Nick Mott
Design: Martin Adams
Photography (unless otherwise credited): Nick Mott / Staffordshire Wildlife Trust
Additional Photography: Cover Sue Scott (Salmon), p4 courtesy of Environment Agency (R.Dove), p17 Stephen Hewitt (N.Stiletto fly), p21 Josef Hlasek (River mussel & water shrew), Stephen Hewitt (S.Stilleto fly), p24 Jim Day / Hampshire & Isle of Wight Wildlife Trust (Dockens Water), p25 Maxine Elliott / Environment Agency (Life3 works)

Publication Data

Mott, N. (2010) Fish Live in Trees Too! River Rehabilitation and Large Woody Debris. Staffordshire Wildlife Trust, Stafford, UK.
Printed by George Street Press, Stafford – Wildlife Trust Corporate Members
© Staffordshire Wildlife Trust (Registered Charity No.259558)
http://www.staffs-wildlife.org.uk

A PDF version of this booklet is available to download from:
www.staffs-wildlife.org.uk/page/river-rehabilitation

water for wildlife

This Booklet has been produced with funding from:

PEAK DISTRICT NATIONAL PARK AUTHORITY

Supported by the Sustainable Development Fund

water for wildlife