River Restoration NEWS

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NEWSLETTER of the RIVER RESTORATION CENTRE

Tel/Fax: 01525 863341 Email: rrc@theRRC.co.uk

A Tough Time for this Year's Judges of the WTT Awards

Allan Frake from the Environment Agency tells us who the winners were.

The Wild Trout Conservation Award is an annual award run by the Wild Trout Trust (WTT) that recognizes and encourages positive initiatives for fisheries and conservation management. The judges had a tough time shortlisting the finalists from England, Scotland and Wales, as the standard of habitat enhancement projects this year was yet again high.

The awards are sponsored by 'Classic Malts' with prizes in both individual and professional partnership categories. The awards were presented by Lord (David) Steel of Alkwood at a ceremony on the 18th of October.

River Chess

The Professional/Partnership category:

This year's winners were the Tale Valley Trust having completed a series of ambitious projects on this tributary of the River Otter in Devon. Enhancement measures included the use of faggots, accumulation of large woody debris, coppicing and fencing. Other initiatives included recruiting an Education Ranger and projects to promote water vole populations. The judges were particularly impressed by the demonstration river walk incorporating some excellent visual interpretation of good and bad land management practice.

The Amateur award:

David Hyde and Stephen Stewart collected this award for restoring part of the River Chess, Hertfordshire. They have re-energised a section of river using flow deflectors and hurdles. Installing 'trash dams' and replanting sedge and water-crowfoot (*Ranunculus sp.*), also increased ecological diversity and trout are now thriving.

Runners up:

The 'Go Wild in Cumbria' project demonstrated a very robust package of habitat improvement projects linked to an extremely successful angling voucher scheme whilst the Lincolnshire Chalk Streams Partnership has successfully begun to resurrect the degraded Waithe Beck, near Market Raisen.

If you wish to enter your project in next year's Conservation Award competition, the entry form and guidance notes can be downloaded from the Wild Trout Trust website – www.wildtrout.org

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For further information on the RRC and its activities please view the RRC website on:

www.theRRC.co.uk

Restoration of the Pontbren Catchment

Implications for Flood Risk and Sediment Management

There is a growing body of evidence to suggest that intensive grazing increased surface runoff and soil erosion in upland areas of the UK during the second half of the twentieth century. New research conducted as part of the Flood Risk Management Research Consortium (FRMRC) aims to quantify the effects of upland management practices on flood hydrology and sediment transfer and investigate how a community-driven initiative at Pontbren (mid-Wales) could hold important implications for catchment-scale restoration. Alex Henshaw, from the University of Nottingham, explains.

Effects of land management practices in UK uplands

Post-war agricultural policy and economic incentives have led to important changes in UK land management. The expansion of grassland through land drainage and reseeding has facilitated an increase in the stocking density of grazing animals. Sheep numbers have increased significantly in most of the UK; this rise has been especially pronounced in upland and marginal areas. There is increasing evidence to suggest that intensively grazed soils become less permeable through a combination of poaching and top-soil compaction (Stevens *et al.*, 2002). Reductions in infiltration capacity have led to increased surface runoff, particularly during storm events, and elevated the risk of flooding downstream (Heathwaite *et al.*, 1990; James and Alexander, 1998; Holman *et al.*, 2002). High stocking density has also been identified as a key cause of soil erosion in upland areas, enhancing the potential for erosion through damage to the protective vegetation cover and trampling of soils.

Sediment input to watercourses may be amplified directly, for example through the erosion of stream banks by livestock, or indirectly through the transport of suspended sediments across the catchment surface by overland flow. Increased delivery of fine sediments to streams can destroy fish spawning habitats, reduce reservoir storage capacity and transport harmful heavy metals and pesticides. Anecdotal accounts suggest that upland management practices have and continue to significantly affect river regimes, with flashier runoff responses, higher peak discharges and reduced base flows being reported. Such changes could have important implications for patterns and rates of coarse fluvial sediment transfer and therefore the stability of alluvial channels. In turn, channel instability has serious implications for aquatic and riparian habitats and the ecosystems they support.

Pontbren

The Nant Pontbren (Figure 1) is a headwater tributary of the River Banwy in Montgomeryshire, mid-Wales. Located near Llanfair Caereinion in the upper reaches of the Severn basin (Figure 2), the Pontbren catchment covers an area of 18 km^2, ranges in elevation from 150 m to 400 m above sea level, and receives over 800 mm of rain fall annually. Land use is a mixture of agriculturally-improved pasture and woodland, and the majority of land in the catchment (1000 ha) is owned by members of the Pontbren Group.

Figure 1 Nant Pontbren in flood (courtesy of CEH Bangor)

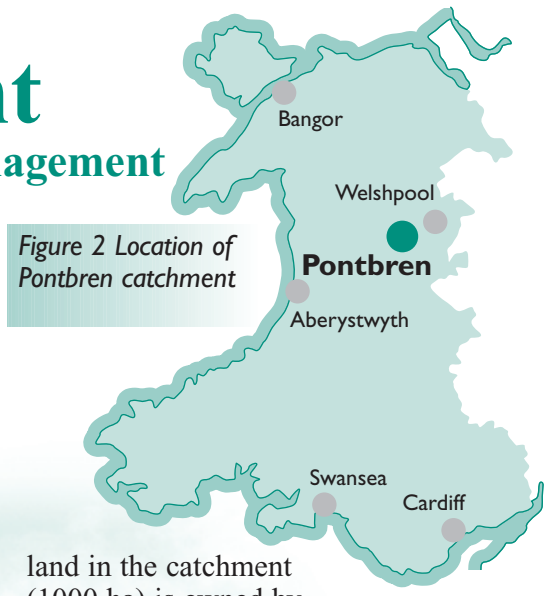

Figure 2 Location of Pontbren catchment

The Pontbren Group, formed in 1997, is a self-regulating consortium of ten farming families who are taking a more sustainable approach to land management, in order to ensure a viable economic future for their farms. They aim to reduce their costs and workload by reducing the management of the most marginal land. Utilising grants from the Forestry Commission, Welsh Assembly General and the Wales Council for Voluntary Action through its ENFYS Programme, and with advice from Coed Cymru (www.coedcymru.org.uk), the farmers have fenced off the least productive areas of land and planted trees in order to provide shelter for livestock and yield coppice woodchip for use as animal bedding (Figure 3). It is hoped that 15% of the catchment area will be eventually restored to woodland, compared with just 1.5% at the time of the project's inception. Hedgerows and wetland areas have been restored on the farms, and sheep stocking densities have been reduced. Stream banks have also been protected from livestock access.

Hydrological and environmental benefits

While benefiting the farmers financially, there is increasing evidence to suggest that the changes are having positive hydrological and environmental effects. Where tree

shelterbelts had been created, overland flows had been observed disappearing into the ground. A study was undertaken by the Centre for Ecology and Hydrology and University of Wales Bangor to examine the impact of the planting on soil structure and function. In areas planted with trees, water could enter the soil at a rate up to 60 times greater than adjacent grassland. The work also suggested changes occur relatively quickly – within 2-6 years of planting (Carroll *et al.*, 2004). The majority of trees planted have been native, broad-leafed varieties, with pioneer species such as alder and birch complemented by oak and ash. The creation of new habitats has significantly increased biodiversity throughout the catchment, attracting new species of birds to the area, such as Green Woodpecker and various types of raptor. The scheme has also created an abundance of prey and new hunting grounds for predators such as otters and tawny owls.

FRMRC research at Pontbren

While simple measurements and observations at Pontbren have established the broad benefits of catchment restoration, relatively little hard data exist to provide the sort of evidence base essential to persuade sceptics and policy makers of the advantages of upland catchment restoration for downstream flood risk management. With this objective in mind, Pontbren was selected as a major field study site for work performed by the FRMRC. The consortium is a £5.6 million, EPSRC-funded initiative (in collaboration with NERC, the Joint Defra/EA Flood and Coastal Erosion Risk Management R&D programme, the Scottish Executive, the Rivers Agency (NI) and UK Water Industry Research) intended to provide the science base necessary to enhance UK flood risk management practice.

Figure 4 Equipment monitoring runoff and fine sediment delivery from catchment surface

Pontbren has been selected as a key study site by the 'Land Use Management' and 'Geomorphology, Sediments and Habitats' Research Priority Areas within the FRMRC. A multi-scale experimental programme is underway to quantify the effects of upland management practices on flood hydrology and sediment transfer (Figure 4). The potential for strategically-placed, small-scale planting of tree buffer strips to improve the infiltration capacity of extensive areas of grazed pasture is being investigated. New modelling tools are being developed in order to study the potential impacts on hydrology at the catchment scale. Spatial patterns and rates of sediment transfer are also being monitored to develop a sediment budget for Pontbren. Understanding the influence of upland management practices on both erosion and connectivity within the sediment transfer system is vital for future control strategies. If benefits can be demonstrated, the measures being undertaken at Pontbren could have significant implications for catchment-scale restoration in upland and marginal areas throughout the UK.

References

Carroll, Z.L., Bird, S.B., Emmett, B.A., Reynolds, B. and Sinclair, F.L. (2004). Can tree shelterbelts on agricultural land reduce flood risk? *Soil Use and Management,* **20**, 357-359.

Heathwaite, A.L., Burt, T.P. and Trudgill, S.T. (1990). The effect of land use on nitrogen, phosphorus and suspended sediment delivery to streams in a small catchment in southwest England. In J.B. Thornes (ed) *Vegetation and erosion.* Chichester: John Wiley & Sons Ltd.

Holman, I.P., Hollis, J.M. and Thompson, T.R.E. (2002). *Impact of agricultural soil conditions on floods – Autumn 2000.* R&D Technical Report W5B-026/TR. Bristol: Environment Agency.

James, P.A. and Alexander, R.W. (1998). Soil erosion and runoff in improved pastures of the Clwydian Range, North Wales. *Journal of Agricultural Science,* **130**, 473-488.

Stevens, P.A., Reynolds, B., Emmett, B.A., Thompson, T.R.E, Loveland, P.J., Jarvis, S.C., Haygarth, P., Thomas, H.R., Owen, D-H., Roberts, R. and Marsden, T. (2002). *Critical appraisal of state and pressures and controls on the sustainable use of soils in Wales.* Final report to the Environment Agency and National Assembly for Wales. Contract number 11406.

Alex Henshaw
E-mail: lgxajh2@nottingham.ac.uk

For further information:
www.floodrisk.org.uk
www.coedcymru.org.uk

Figure 3 Tree shelterbelt at Pontbren (courtesy of Coed Cymru)

The Boscastle Flood
The Geomorphological Consequ

Valerie Bain, Roger Bettess, HR Wallingford.

On 16 August 2004, exceptionally intense and prolonged storm conditions centred over the North Cornwall coast and the headwaters of Bodmin Moor generated extreme flooding in and above the coastal villages of Boscastle and Crackington Haven. The flood event caused severe damage to buildings and infrastructure and has had a huge impact on the local communities although thankfully, no one was killed. The flooding had significant geomorphological impact on the Valency and Crackington Stream catchments and by understanding the geomorphological response to the event, it is possible to gain a better appreciation of how the river may adjust in the future which has implications for riparian landowners.

Figure 1 below shows the geographical location of the River Valency and its tributaries above Boscastle. The catchment is located on the north coast of Cornwall.

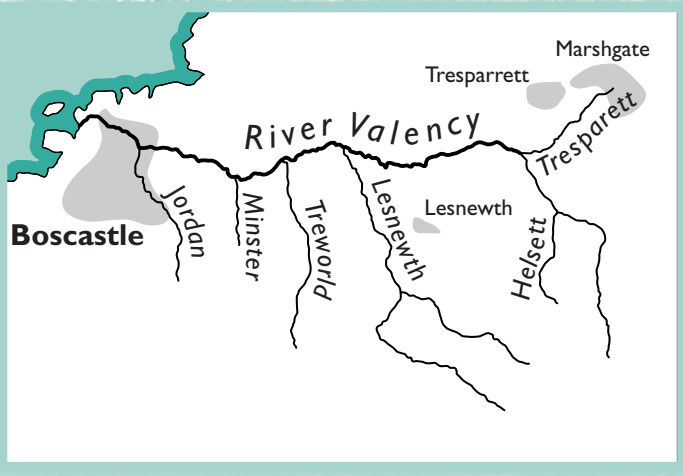

Figure 1 The Valency catchment showing the main river and its tributaries

The catchment area above Boscastle is approximately 20 km^2. The catchment rises to approximately 300 m AOD and the main branch of the River Valency is approximately 7 km long; thus the slope of the river is steep. There are a number of tributaries which are also steep, and some of them are incised as they approach the main channel. The soils are generally thin over impermeable bedrock. The catchment is predominantly rural with much of the land given over to grassland. There are significant areas of woodland adjacent to the main river and its tributaries.

Following the flood event, a flood forensics study was carried out for the Environment Agency by HR Wallingford, with support from Halcrow, Royal Haskoning, The Met Office, CEH Wallingford and others. The flood event on the Valency was modelled using a combination of hydrological and hydraulic models. The predicted peak discharge in the centre of Boscastle was around 180 m^3/s. This compares with Flood Estimation Handbook estimates of the Q_{med} (the median annual flow) at Boscastle of 4 m^3/s. The best estimate of the annual exceedance probability of the 2004 Boscastle flood has been assessed at around 0.0025; i.e. a flood of the assessed magnitude has a 0.25% chance of recurring in any year (equivalent to a return period of 400 years). The 2004 event was evidently exceptional in magnitude.

Six months after the flood event, HR Wallingford carried out an investigation into the geomorphological impacts of the flood on the Valency and Crackington Stream catchments. Field data were collected by a walk-over survey of the main channel and the tributaries and the major geomorphological impacts were recorded, photographed and subsequently mapped in a GIS. Due to the extensive length of river that had to be surveyed in a limited time, a thorough geomorphological audit was not possible, however, the survey that was implemented has enabled an understanding of the geomorphological impacts at a catchment scale. The study showed that the flood of 16th August 2004 caused widespread and significant changes to the channel and valley geomorphology of the Valency and its tributaries, more so than in the adjacent Crackington Stream catchment.

Figure 2 Channel incision to bedrock level; Lesnewth Stream, Valency catchment

# of 16th August 2004
ences in the Valency Catchment

Field mapping has identified numerous instances of channel movement, and has revealed evidence of numerous debris jams and headcuts. Incision and bank erosion were commonplace, and in places were extremely severe. Figure 2 shows a reach on Lesnewth Stream, a tributary of the Valency, where the channel bed has been incised to bedrock level.

In terms of their geomorphological impact, debris jams played a significant role and were often the instigator for bank erosion and incision. Much of the floodplain is wooded, with steep valley sides, and the flood flow was evidently funnelled down the valley with high velocities and stream power, up-rooting large numbers of trees and shrubs on the floodplain. The debris carried by the flow was then deposited in the channel and on the floodplain, where there were obstructions to the large woody objects passing, or where the channel slope and the energy of the water reduced. These debris jams then instigated local changes in the geomorphology; if they blocked the channel completely they often resulted in channel movement; if not, then they caused a decrease in velocity and associated sediment deposition upstream and erosion and scour pools downstream. Figure 3 shows a debris jam across the pre-flood main channel, which caused the formation of a new channel, shown in Figure 4.

The overall effect of these changes in geomorphology is that the river channels are now greatly oversized with respect to their mean annual flow. It is expected that in the months and years to come, the rivers will tend towards the re-achievement of an equilibrium channel form. It is expected that there will be aggradation in reaches where the post-flood slope is over-steep and further erosion of new channels where the flow is cutting through deposits or forming new routes .

Figure 4 Channel change caused by debris jam (previous channel on left of photo); River Valency, looking upstream

This article has shown how in an extreme flood event, natural river processes, especially in steep, wooded catchments, are difficult to prevent. Yet as highlighted in the article by Helen Dangerfield *et al.* and elsewhere, woody debris is an essential physical habitat parameter.

If you have any views on this issue and its implications for future river restoration we would love to hear from you via email. RRC@theRRC.co.uk.

Figure 3 Debris jam across main channel (new channel formed, shown on left of photo); River Valency, looking downstream

Further Reading

Fenn, C., Bettess, R., Golding, B., Farquharson, F., Wood, T. (2005) *The Boscastle Flood of 16 August 2004: Characteristics, Causes and Consequences*. DEFRA.

HR Wallingford (2005) *Flooding in Boscastle and North Cornwall, August 2004*. Phase 2 Studies Report. HR Wallingford Report.

For further information please contact Valerie via email: vba@wallingford .co.uk

Catchment Action Plans

How Fluvial Audits Can Help Identify River Habitat Options

In 2003, the Rivers Esk, Tees, and Wear were all identified as failing to reach their salmon spawning potential. An investigation into the possible influence of river morphology and physical habitat conditions on fish stocks was commissioned by the Environment Agency (EA) and supported by the North Yorkshire Moors National Park. The project used a Fluvial Audit (a 'whole river' approach to assessing river geomorphology) to prioritise objectives and actions within the catchment. The project identified restoration options for the benefit of salmon, but also promoted good river management for the benefit of a wide range of riverine species consistent with the Water Framework Directive.

Helen Dangerfield, Joanna Eyquem, Suzie Hewitt, and Steve Bailey have jointly worked on this project and this article provides a short summary of its outcomes.

Project objectives

The main objectives of the project were to:

- Characterise existing geomorphological conditions and provide an improved baseline data set to help inform river management.
- Provide management advice in the form of 'Catchment Geomorphological Action Plans' for each catchment, incorporating a system of action prioritisation and recommendations for future works.

Catchment geomorphological action plans for management guidance

These Action Plans were devised to deliver the findings from the project in the form of a user-friendly management guide. The plans demonstrate the benefits of managing rivers and floodplains at the catchment scale, underpinned by geomorphological understanding. At the back of the reports, alongside a glossary, is a 'further information' section providing sufficient supporting information to the user.

The delivery of the management objectives was achieved through consideration of 4 Physical Habitat Parameters (Table 1). Each parameter was assessed using data from the Fluvial Audit to identify the main issues of concern and to suggest appropriate rehabilitation actions at specified locations based on favourable, catchment-wide river morphology.

Figure 1 Bank slumping and erosion in the River Esk

Table 1 Physical Habitat Parameters used to analyse baseline geomorphological conditions and explain how management objectives were derived.

Physical Habitat Parameter	Description
Substrate conditions	Character of bed sediment and extent to which bed is impacted adversely by morphological processes.
Morphological diversity	Range of morphological habitat types and consideration of the impact of channel modification.
River continuity	Degree of channel segmentation in an upstream/downstream direction (eg. in channel structures or natural bedrock controls) and extent of impact on sediment transport and species migration.
Shelter and shading	Availability of in-channel refuge (eg. undercutting banks or aquatic vegetation) and extent of shading from riparian and in-channel vegetation which is critical for salmon life cycles.

Case study: River Esk

At a catchment scale, morphological diversity was found to be good except in a small number of isolated reaches where the channel had been modified. The study showed this river still possesed many of its natural characteristics and hence highlighted the importance of considering morphological processes when planning and implementing channel works. There was also extensive provision of shelter and shading.

The Esk and several of its tributaries are naturally segmented by waterfalls and bedrock sections. Artificial barriers to sediment transport or species migration were found to be clustered rather than dispersed throughout the catchment. The removal of single structures would not necessarily achieve any significant benefit, but a review of in-channel structures may highlight future opportunities.
The key issue throughout much of the main River Esk is excessive deposition of fine sediments. Diffuse sourcing from accelerated bank erosion was found

Figure 2 Cattle poaching and vehicle access to the channel causing point supply of sediment

to be contributing (see Figure 1) to fine sediment deposition. Point sources of fine sediment to the channel were frequent, with over half of the sources from cattle access and field drains (see Figure 2).

The objectives for the Esk reflected the analysis of the 4 Physical Habitat Parameters. The objectives were supported by key actions with follow up guidance and suggestions for implementation (Table 2). Individual reaches were identified where these specific actions can be fulfilled.

Dissemination and uptake

A series of workshops were held with the EA to disseminate the outcomes from the Action Plans, in each of the three catchments: Wear, Esk and Tees. The workshops consisted of an initial session on the reasons for assessing baseline geomorphology and demonstrated the benefits of managing rivers and floodplains at the catchment scale. This helped to raise awareness of how geomorphology and the outputs of a Fluvial Audit can be used as a tool for catchment management.

Key findings from workshop delivery

The use of Physical Habitat Parameters assisted in the identification of geomorphological issues and priorities for each catchment and thus the objectives and actions. The workshops therefore needed to be tailored to deliver the objectives to the specific catchment requirements and related target audiences. Careful planning meant that the workshops provided a good forum for exchanging ideas about how objectives can be achieved and implemented.

Passive restoration ('do nothing') or prevention of future deterioration, were key objectives in all three catchments and it was found that further work is required to develop an implementation strategy. Consultation, co-ordination and communication were shown to be crucial in both identifying known issues and achieving uptake of catchment actions. Early consultation is essential to gain support for the planning process and to encourage ownership of the plans. Strong communication pathways, especially with riparian owners, need to be established and maintained if restoration actions that take account of catchment scale issues are to be delivered.

Summary

Integrated catchment management brings many benefits. However, it is important that the findings are subsequently translated into practical measures and actions (including passive measures) implemented by river managers and users at the catchment-scale. The development of a non-technical Action Plan based on Physical Habitat Parameters and dissemination through end-user workshops, encourages the uptake of actions backed up by an understanding of river behaviour from the Fluvial Audit. The Action Plans are designed to be dynamic and flexible enough to integrate with other initiatives.

This article was based on work initially carried out by Jacobs Babtie

Authors affiliation:
Helen Dangerfield and Joanna Eyquem
(Royal Haskoning formerly of Jacobs Babtie)
Suzie Hewitt (Jacobs Babtie)
Steve Bailey (EA)

For further information contact Helen or Steve:
h.dangerfield@royalhaskoning.com
steve.bailey@environment-agency.gov.uk

Table 2 Objectives and Actions

Objective	Action
Management of fine sediment	1. Reduction of catchment sourcing of fine sediment 2. Riparian buffer zone management 3. Restriction of grazing 4. Management of field drains 5. Develop a long term management and enhancement strategy
Preservation of favourable conditions	6. Limit adverse interventions
Review of bank protection and artificial structures	7. Review the function of bank protection and structures
Adoption of an integrated approach to future fisheries management	8. Work with other EA departments 9. Link up with other catchment initiatives 10. Documentation and coordination of the action taken

News and Events

Conferences

Riverine Hydroecology: Advances in Research and Applications

Incorporating the 10th International Symposium on Regulated Streams and 2nd International Symposium on Wood in World Rivers

August 14th-18th 2006 - University of Stirling, Scotland.

For more information e-mail Tory Milner on v.s.milner@stir.ac.uk
or visit www.sbes.stir.ac.uk/riversconference

7th ANNUAL NETWORK CONFERENCE

Heriot -Watt University, Edinburgh
26th -27th April 2006

Ecological River Restoration: Combining Ecology and Engineering

Address: Chris Spray
(Director of Environmental Science, SEPA)

Keynote speeches: Prof. Steve Ormerod (Cardiff University) and Ronnie Falconer (Jacobs Babtie)

Effective river restoration and habitat enhancement needs to combine stream ecology and sustainable engineering solutions that work with natural river processes. But, how do you ensure that the flood risk is adequately managed whilst retaining a functioning river system with a range of ecological habitats and how can we address the inherent uncertainty of dynamic rivers with the anthropogenic need for structural security?

A call for papers and posters

If you are interested in giving a paper (presentations usually 15-20 mins in length), or completing a poster, please contact either Jenny Mant or Chris Banks at the centre via rrc@therrc.co.uk

Presenters should provide a suggested title by the 30th of November. We will contact you regarding abstracts in mid December. A final programme will be circulated in the New Year with details of exact costs.

The main aim of this conference is to provide a forum for discussion. Make this your opportunity to voice your opinions on how we can deliver sustainable river restoration in the context of habitat enhancement, river maintenance, bank protection, fisheries and flood management.

New member of the RRC staff

Please join us in welcoming Chris Banks who is the Centre's new Infomation Officer

Publications

Water Meadows

Mark Everard
£25.00, Forrest Text
ISBN 0955074010

Many historical references to water meadows have tended to be extrapolations of what others know about wet meadows. This book advocates that water meadows have their own distinct habitat with characteristic biota and economic objectives which cannot be casually compared to other forms of wet grassland. It provides a fascinating account of water meadows' rise, function and decline, whilst looking at both the potential for natural and cultural conservation. The book is compiled in such a way that it should be of interest to anyone fascinated by the relic landscape of water meadows. In addition it includes useful data in terms of habitat functions and agricultural roles.

Restoration Ecology – The New Frontier

Edited by Van Andel, J & Aronson, J
£32.50, Blackwells
ISBN 063205834X

Includes a chapter on restoration of rivers and floodplains by Jenny Mant and Martin Janes of the RRC.

LIFE for the River Avon Project!

It has just been announced that this project has now successfully secured £1.2m from the EU LIFE fund and will run from 2005 to 2009.

The river system, one of the most highly prized lowland river systems in the UK, has been heavily modified for mills, water meadows, water supply and drainage. Many small-scale, uncoordinated restoration projects have been completed mainly to improve fish habitat, rather than wider ecological conditions.

The project will address the need for a strategic approach to river channel restoration, and integrated management of the River Avon SAC.

Partners include: English Nature, the Environment Agency, the Wiltshire and the Hants and Isle of Wight Wildlife Trusts. Additional funding has been provided by Wessex Water and the RRC has supplied technical support.

For further information, contact:
dagmar.junghanns@english-nature.org.uk

RRC is most grateful to all those who have contributed text or photos for this Newsletter

The following statutory organisations provide Core Funding for the River Restoration Centre and their Representatives form the Advisory Board who together with RRC's Directors make up the RRC Council.

Environment Agency · ENGLISH NATURE · SEPA Scottish Environment Protection Agency · RIVERS Agency · SCOTTISH NATURAL HERITAGE