River restoration in rural areas

This factsheet provides a short introduction to issues facing rivers flowing through rural areas and how to restore them, under the following headings:

1. **Rivers in rural settings**
2. **Particular issues in rural rivers**
3. **Ways to restore rural rivers**
4. **Benefits of rural river restoration**
5. **Further information**

1. Rivers in rural settings

In rural settings catchment characterization and land management drive both the river's morphology and biodiversity, and it's issues. Rural restoration issues and solutions are therefore more area-based or diffuse, requiring whole farm catchment based approaches.

Both urban and rural rivers have historically been **straightened for navigation or land drainage**; however rural streams have been degraded in different ways to urban rivers. **Diffuse and point source pollution** occurs in both rural and urban areas. **Intensification of farming** practices has led to increased **diffuse or non-point source pollution** in rural rivers. Rural land use is beginning to be considered in Flood Management as practices are increasingly contributing to flood risk. Also Natural Flood Management (NFM) aims to apply upstream solutions to urban flooding issues downstream of rural areas.

2. Particular issues in rural rivers

Farming activities

Cattle accessing waterbodies for drinking water cause **bank erosion** and increased **suspended sediment** in rivers (Figure 1). This can prevent vegetation growth on riverbanks further destabilising banks. Bare arable fields and excessive fertiliser application also contribute nutrients to waterways. These diffuse sources of sediment can have detrimental consequences on river water quality and habitats, such as altered chemical composition and **sediment choking** of spawning areas. Also, point source pollution from **slurry** entering the river can have detrimental, sometimes **fatal impacts** on fish species.

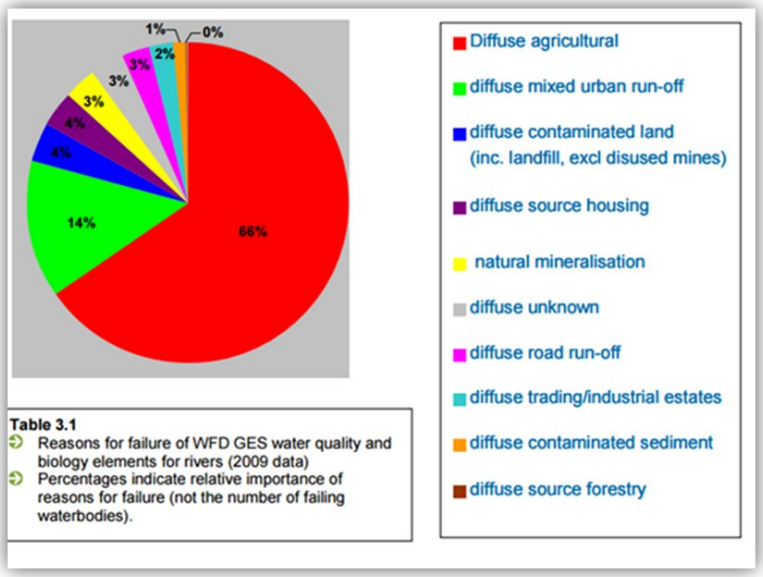

Figure 1 Chart showing the substantial influence of diffuse pollution on river water quality in England. Image from Environment Agency.

Figure 2 Farm tracks and poorly maintained access points create direct runoff. Image from Environment Agency.

Increased runoff generation and soil loss

Water draining from the land can carry potential pollutants. Agricultural land practices can cause **diffuse water pollution** which is difficult to regulate. This includes any runoff from land activities such as farming and animal rearing which can **compact soils** reducing infiltration (Figure 2). Soils entering rivers harm aquatic life and alter sediment regime.

Water quality impacts

Phosphate and nitrate are common nutrients found in watercourses but levels are enhanced when **fertiliser** spread on fields enters a river through runoff. Pesticide application can also cause problems within rivers.

Flooding and Climate Change

More intense, frequent rainfall in the future will **mobilise more sediment** more often, increasing the need to prevent soil erosion, and intercept and store more sediment. The compaction of soils, coupled with these future climate predictions, will also cause increased overland flow.

3. Ways to restore rural rivers

In rural settings, restoration techniques mostly involve **naturalising** the course of the channel, and **managing the surrounding land**, or a combination of the two. In-channel techniques, such as those implemented in urban rivers, have less impact and fewer benefits in rural streams.

Agricultural practices and soil management

Reducing sediment loss from agricultural fields can be achieved through **planting a cover crop** to avoid excess soil erosion after rainfall, or **avoiding fertiliser application during rainfall** events. Providing **fenced areas for grazing animals** to access rivers for drinking water avoids detrimental bank erosion, and prevents direct pollution through defecation. It is important to prioritise tackling the source of the problem such as soil compaction and farming techniques. When this is not possible, Rural Sustainable Drainage Systems (RSuDs) offer an alternative option.

Restoring natural channel morphology and natural processes

Naturalising a previously straightened, diverted or realigned river in rural landscapes returns the **flow diversity**, encouraging creation of natural **features, habitats** and **biodiversity**. It can also slow the flow in upstream reaches, aiding **NFM** and reducing downstream flood risk. One example is on Swindale Beck in Cumbria where the natural channel was reinstated and remeandered (Figure 3).

Figure 3 Swindale Beck 2 months after completion of restoration. Image from RRC.

Rural Sustainable Drainage Systems (RSuDS)

The successful implementation of Sustainable Drainage Systems (SuDS) in urban areas has led to the development of RSuDS, a **natural approach** to **flood management** and **land drainage** aiming to:

⇒ Slow the flow by **intercepting runoff** and drainage, to reduce localised flood risk

⇒ **Improve water quality** by trapping sediment to meet Water Framework Directive standards

⇒ Improve ecological status of rivers and **encourage biodiversity** by providing habitats such as wetlands

⇒ **Recharge groundwater** levels









Examples of RSuDS include leaky dams (Figure 4) to reduce flow velocity and offer **habitat diversity**, and floodplain ponds for **sediment and flood water storage**. These techniques are still being established in rural areas but could greatly improve **catchment water management** by adapting practices to facilitate more intense, frequent rainfall predicted due to climate change.

Figure 4 Example of a leaky dam on the River Frome, Stroud. Image from Stroud District Council.

Natural engineering methods help **landowner-community** relationships by involving local residents and improving awareness of land management and NFM.

RSuDS techniques (Table 1) aim to reduce diffuse pollution through **targeting the source**, diverting and **slowing the drainage** path, and **protecting the affected waterways**. Techniques depend on local climate, geology, pathways, sources and topography. Therefore techniques are **spatially and temporally variable**.

Option	Technique
Ditches	*Grassed waterways* - Open, vegetated channels to encourage sediment accumulation and water infiltration
	Infiltration basins/filter drains - To retain sediment, store runoff, filter pollutants and encourage water to infiltrate into soil
Ponds	Permanent or temporary retention areas to store water and benefit biodiversity
Woodland shelters	Bind soils for bank stability and reduce erosion; limits compaction and increases infiltration; intercept rainfall and reduce overland flow
Buffer strips	*Hedgerows/dry stone walls* - To attenuate runoff
	Riparian buffer strips - Planting parallel to watercourses to keep grazing and agricultural activities away from the waters edge, to avoid erosion, over-spraying and faecal input
	Water diversions - Raised banks divert runoff and redirect flow to other RSuDS methods
Wetlands	Constructed/restored to a previous condition to improve water quality and flood storage
Farm buildings	*Cross drains* - Slow/divert runoff from a vulnerable flow route such as a farm track
	Green roofs - Plants on building roofs enhance drainage; intercept, store and delay runoff
	Rainwater collection - Impermeable surfaces/storage tanks collect rainfall for farm use
Alternatives	*Biobed* - Retain nutrients/pollutants/spillages from agricultural activity in straw/soil pits
	Sedimentation boxes - Permeable pits leading to tile drains encourage sediment to settle
	Soak-away - Drains filled with stones to allow rainfall and runoff to infiltrate into soil
	Trees for bank protection - Tree stems, roots, branches to increase bank stability

Table 1 Rural river enhancement techniques - RSuDS methods to avoid runoff of both water and sediment.

One example of **rural woodland restoration** is on Highland Water, a small stream in the New Forest National Park, where a wide, shallow channel was restored to avoid bank erosion, encourage seasonal flooding, and provide better habitats for wildlife (Figure 5). **Floodplain reconnection** was carried out using old maps of the previous watercourse pre-modification. Using historic maps is helpful when restoring rural channels where there may be space to remeander.

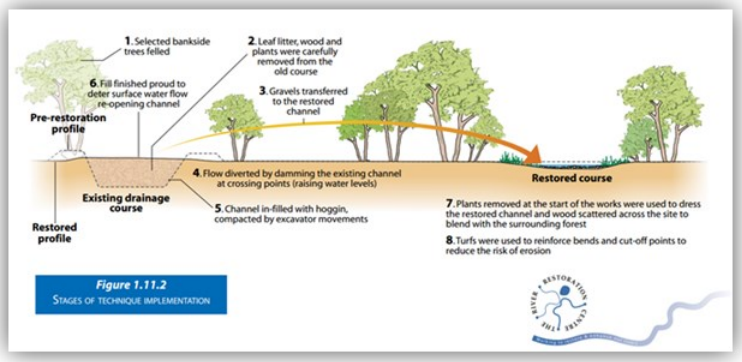

Figure 5 Highland Water remeander project. Image from RRC Manual of techniques here.

An example of a **larger scale approach** is the Pontbren Project in Wales, which uses woodland, hedges and tree planting to enhance farming activities. Set up by a group of farmers, this project has improved wildlife and reduced runoff as well as helped the farm business. This initiative uses many techniques and demonstrates the impact of effective collaboration and cooperation of stakeholders.

Figure 6 Fencing to avoid bank poaching by livestock. Image from RRC.

Environmental Stewardship Schemes

These schemes support farmers in their efforts to **adapt the way they farm their land** in order to improve the environment. Grants and advice are available for rural land managers, such as Catchment Sensitive Farming (CSF) and The Environmental Co-operation Action Fund (Scotland), to reduce land runoff through land management techniques such as fenced drinking points for livestock (Figure 6). One example of good stewardship is the Wye (Herefordshire) Improvement Project which focused on improving waterway status.

4. Benefits of rural river restoration

⇒ Reducing runoff and soil loss **retains fertiliser and pesticide in soils** and improves farming **productivity**

⇒ Better **land management** can **reduce costs** and encourage catchment-scale improvements

⇒ Fencing off areas for animals or using fords makes better use of available land and **avoids loss of valuable farmland** through bank trampling

⇒ Animals are at less risk of waterborne diseases and liver fluke

⇒ Reducing chemical pollutants and suspended sediments in waterways **improves biodiversity**

5. Further information

For more information and examples of rural river restoration techniques, have a look at these case studies, or search the RRC Manual of Techniques. Check out the RiverWiki page and the UK Projects Map and search for keywords to find examples of projects using a variety of techniques. For more information on RSuDS, have a look at the Environment Agency guidance document or find out more about the Stroud RSuDs project which gives a specific example of successful implementation.

For more information on river restoration, have a look at our factsheets available on the RRC website.