

River Bank Protection

Working with nature to prevent and control bank erosion

Introduction

Rivers are dynamic ecosystems meandering and changing course within the floodplain. Banks are constantly being eroded and are reformed in areas where silt is deposited. In their natural state rivers form green arteries within our countryside, providing both habitat for river species and corridors for movements of wetland species. Rivers, particularly those in the UK lowlands, are not usually free to follow their natural course. Engineering techniques have been used to alter the course of rivers, for bank protection and to protect land and property from flooding. To prevent erosion in the 20th century, engineering solutions typically involved cladding a sloping soil bank with hard materials including:



Hard revetment provides no bank side or marginal habitat.

- rip-rap (large boulders)
- concrete blocks or precast concrete units
- metal sheet piling
- gabions (wire mesh cages with tightly packed stones)

These attempts to prevent erosion of river banks can rarely offer a long-term solution, since they do nothing to address the causes

of erosion. Hard engineering solutions have reduced the distribution and abundance of species. In addition, they can contribute to erosion further downstream by channelling water downstream at a faster rate.



Poaching of banks by overgrazing is a major cause of bank erosion.

Causes of Erosion

- Overgrazing - If allowed unrestricted access to banks, livestock, in particular cattle, can break down the banks causing silting in the channel.
- Mismanagement of bankside trees - If trees are allowed to shade out all other vegetation they can reduce habitat diversity. The river can undercut the trees' root system causing the trees to become unstable, eventually falling into the water. A toppled tree causes local erosion producing a "tear point" which can lead to erosion moving further down the river bank.
- Recreation - Rivers and wetlands are very popular sites for visitors. Irresponsible driving of powerboats can cause waves (boatwash) that erode banks and undercut trees. Many public paths run alongside rivers. However, heavy use of a footpath may damage the surface and surrounding plants, leading to erosion.

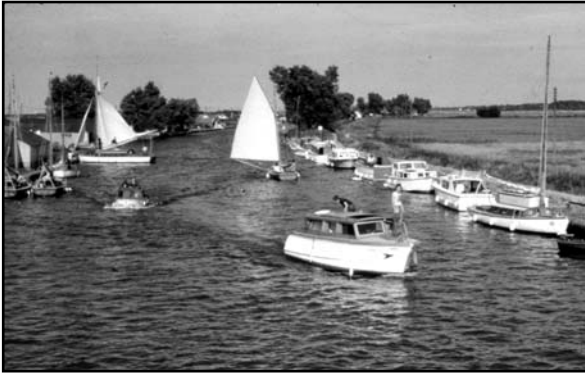
CAUTION

Some bare muddy river bank areas can harbour rare invertebrates and muddy poached areas can be a refuge for plant species such as tri-lobed water-crowfoot (*Ranunculus tripartitus*).

Earth cliffs can offer an ideal habitat for burrow-nesting birds such as kingfisher (*Alcedo atthis*) or sand martin (*Riparia riparia*). Therefore, such habitats should be left wherever possible provided they are safe and causing

no other environmental damage.

Before carrying out any river channel modification consult with your local planning authority to ascertain if permission is required. In addition, it may be necessary to obtain Environment Agency permission for any works affecting river beds and banks in England and Wales. The Rivers Agency should also be consulted for works in the river channel in Northern Ireland and the landowner in Scotland.



Boating speed restrictions and zoning recreational activity, can reduce recreational pressures on waterways.

Preventing Erosion

Addressing the causes of erosion is the only long-term solution to the problem of erosion.

Reducing Recreational Pressure

Zoning of uses to reduce disturbance, can allow the public to enjoy the river while protecting vulnerable sites. Paths and car parks should be sited away from critical areas and moving the course of an eroding path may be the only long-term solution. To reduce boatwash, encourage the local navigation authority to impose and enforce speed limits.

Exclude Livestock

Plants can protect against erosion. Fencing an area to permanently exclude livestock or temporarily exclude them during vulnerable times of the year can reduce erosion. In some areas, reducing the stocking densities may allow grazing all year round. In many cases, simply fencing livestock away from a badly poached bank (bank eroded by hooves) is sufficient to allow marginal vegetation to recover.



Fencing out livestock can allow marginal vegetation to establish.

The Way of Nature

It is now possible to use engineering techniques that work with the natural stabilising forces of trees and plant roots. Roots bind the soil in the bank and vegetation reduces the erosive forces of water. Plants are able to adapt to changing conditions and can provide long-term, low cost bank reinforcement. Allowing vegetation to recover may have the added benefit of naturally narrowing over-widened channels, which in turn raises water-levels

Using vegetation to support and protect the bank is advantageous because it:

- improves wildlife habitat
- improves fish spawning habitats
- is easily achieved
- offers long-term protection
- integrates into other protection schemes
- has low capital costs
- integrates into the landscape better than hard engineering methods

Trees, Stakes or Poles



Soft engineering structures work with nature to counteract erosion.

The presence of well-managed trees can reduce river bank erosion by as much as 90 per cent. Willows are useful when planted as green stakes driven into the toe of the bank for protection and back-filled with suitable material. The new shoots will continue to reinforce the surface soil and bind the material used to build up the bank.

Willow stakes simply planted on the bank, quickly build root systems to bind the soil together and provide food for water voles in winter and diversity for wetland species. Try to use locally available native willow. Willows that are regularly managed will provide plenty of healthy willow stakes that can be used to protect other areas.

Spiling



Willow can be coppiced providing a sustainable supply of willow stems for bank protection.

This is a variation on the use of willow bundles but here 7.5cm diameter stakes are driven into the bank and live osier willow withies are woven between them. The bank is then back-filled with suitable material. The growing osier willows provide bank reinforcement and are readily colonised by wildlife. This technique is more difficult than faggoting but uses less material. It is most suitable for the protection of steep banks.

Faggots

Usually made from osier willow, poplar or hazel, these comprise brushwood or brashings of approximately 2.5cm diameter in bundles of 35-40cm across. They are bound together with wire or woven together and then held in place by poles.

They will encourage the accumulation of silt and vegetation roots will bind the newly accumulated silt to the bank. Faggot mattresses can be formed by staking a loose spread of willow and faggots.



Faggots provide a flexible tool for bank protection.

Hurdles

If a small portion of gently sloping bank is eroding, hazel wattle hurdles (approx 1.8m square) can be fixed to an eroding bank with stakes. This allows the vegetation to recover by temporarily protecting the bank. The hurdle will not grow, and will slowly rot, leaving a cover of vegetation to bind the bank. The rotting hurdles provide habitat for beetles, fungi and many other species which feed on rotting wood.



Hazel hurdles can be used to repair the damage done by overgrazing, but erosion will continue if the cause is not dealt with by fencing livestock or reducing stocking densities.

Geotextiles

A geotextile is a mesh made from man-made or natural materials, which can be designed to biodegrade over time. Geotextiles can be open meshes, grids or three-dimensional honeycombs. All these geotextile structures can be used to retain soil to a set shape (profile) at the toe of the bank until plants establish and consolidate the bank. If water voles are present when using geotextiles, it is essential to ensure that burrow entrances are not blocked when back-filling behind a reinforcing structure. Geotextiles are most successful when combined with vegetation planting and when they follow the natural contours of the bank.

Tall Wetland and Bankside Plants

Tall wetland plants that have leaves and/or stems above the water are known as emergent plants. Emergent plants such as common reed and reed canary-grass can be used to help protect banks. Both plant species have a dense root structure and tall leafy growth which helps to bind the bank and reduce wave action/erosive power of the water. Silt is trapped around the vegetation, which helps build the bank.

A mixture of grasses, scrub and trees with a fringe of marginal emergent and wetland plants is likely to provide the best protection from erosion. In addition to providing strong erosion prevention, this rich mixture of marginal and bankside (riparian) plants has other advantages which are listed as follows.

- Reeds, tall grasses and herbs will help to provide cover, food and nesting sites for a wide range of wildlife for wetland birds.
- Emergent plants provide ideal habitats for emerging insects such as dragonflies and damselflies.
- Many wetland plants flower, creating attractive, visually pleasing fringes along river banks.
- Underwater tree roots can provide spawning areas for coarse fish.
- Low branches and tree roots can provide refuge for fish from predators and flood flows.
- Trees and shrubs can shade the water edges, providing a cooler water area in mid-summer as well as reducing the growth of aquatic algae.
- Invertebrates living in the marginal plants and falling from trees can provide food for fish and other invertebrates.



Photos - Purple-loosestrife & Boating © The Wildlife Trusts; all other photographs © Dr Nick Giles

Information & Advice

Further information on river bank protection can be found in:

- Understanding River Bank Erosion. The Environment Agency (1998).
- Policy and Practice for the Protection of Floodplains. Environment Agency (1997).
- The New Rivers and Wildlife Handbook. RSPB, NRA and The Wildlife Trusts (1994).

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For further information on the conservation of water and wetlands species and habitats please visit:

www.wildlifetrusts.org