Environment Agency

Evidence

3D buffer strips – designed to deliver more for the environment

Project summary

This report considers how we can improve the effectiveness of riparian buffer zones to help tackle agricultural pollution. The project assesses the effectiveness of traditional grass buffer strips and suggests ways that buffers can deliver more for the environment.

The study shows that more careful vegetation management, including tree planting and additional 'engineered' design features such as incorporating ridges, swales, and mini-wetlands, can capture and retain diffuse agricultural pollutants most effectively. Three-dimensional buffer zones (those that intercept pollution below ground, as runoff travels over the soil surface and then above ground in the vegetation canopy) maximise multiple environmental, farm business and public goods outcomes.

Method
The review evaluated the effectiveness of five different types of riparian (the interface between land and river) buffer in preventing diffuse pollutant loss from a range of sources entering watercourses. The buffers ranged from simple grass strips to wooded, raised ground and engineered designs. Effectiveness was evaluated by an expert group which scored each design against a range of functions including flood mitigation and pollution reduction, as well as their potential to deliver multiple environmental benefits.

Results
Wooded and engineered buffers scored the highest and grass vegetated buffers the lowest for diffuse pollution control, carbon retention, and geomorphic and flood management benefits. Trees were highlighted as an important feature of buffers as they reduce airborne spray drift of agrochemicals, utilise soil nutrients and provide many ecosystem services (the benefits that we freely gain from the natural environment), over their long lifespan. Figure 1 shows how vegetation and additional features on the buffer zone next to a watercourse can capture and retain diffuse pollutants.

The width of a riparian buffer is an important factor and should be at least 6 m to enhance functionality, however the report demonstrates that more complex designs are required where there is a risk of the buffer capacity being overwhelmed.

Conclusions
For riparian buffers to function effectively, good soil and crop management is required in the upslope field. Buffer design should be based on the nature of the pollution pressure, status of the water environment and specific ecological and other goals.

There is a substantial body of evidence that establishing wooded buffers improves most ecosystem functions. Problematic sites with high pollutant pressures need greater intervention such as engineered buffer designs. Effective installation and maintenance of riparian buffer areas determines how well buffers function in the short and long-term.

This project will provide the evidence for improved advice and guidance on buffer design options and their effectiveness at field and catchment scale. Demonstration studies would increase awareness and potential uptake as part of a shared agenda with Natural Flood Management communities.

This summary relates to information from the following project: Improving the benefits from watercourse field margins using 3D buffer strips

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Forestry Commission

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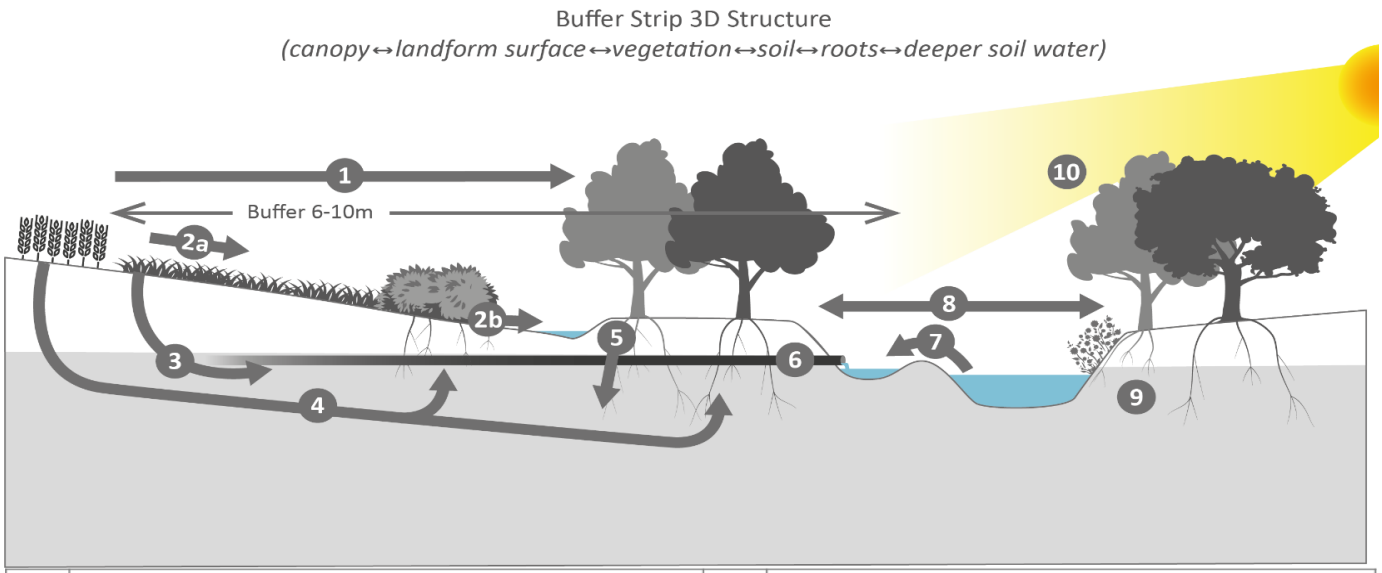
Fig 1 shows how vegetation and additional features on the buffer zone next to a watercourse can capture and retain diffuse pollutants



1	Reduced airborne spray drift of agrochemicals due to interception by tree canopy	6	Stopping direct discharges from soil drains to watercourses allows time for pollution removal
2	Filtering pollutants in runoff by trapping particles amongst vegetation (2a) and by water retention in hollows created by resculptured ground profiles (2b).	7	Altered bank profiles promote rewetting, water retention and sediment trapping
3	Improved infiltration and delayed vertical drainage promotes natural processing of nutrients and other contaminants by soil microbes and plants	8	Growth of riparian and aquatic vegetation increases channel 'roughness' and leaf litter inputs, aiding processing and removal of pollutants
4	Nutrient uptake and utilisation by growing vegetation	9	Tree rooting stabilises banks reducing erosion and sediment input
5	Enhanced levels of soil organic matter aids natural attenuating processes in soils	10	Increased shading cools water temperature and reduces thermal stress to aquatic life