

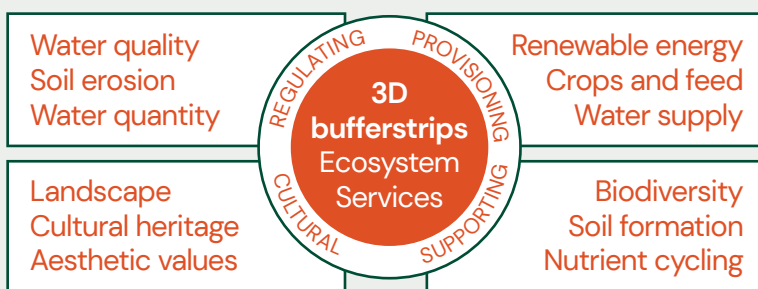
Exploring Rural Ecosystem Services: 3D bufferstrips



This factsheet is part of a series that is exploring the diverse range of ecosystem services are supplied by Scotland's rural sector's stock of natural capital. The topics included within the series are [Agroforestry](#), [Arable](#) and [3D Buffer Strips](#). Download the all the factsheets and listen to the Podcasts on the [series webpage](#).

Ecosystem Services are the contributions that Natural Capital provides for human wellbeing and quality of life.

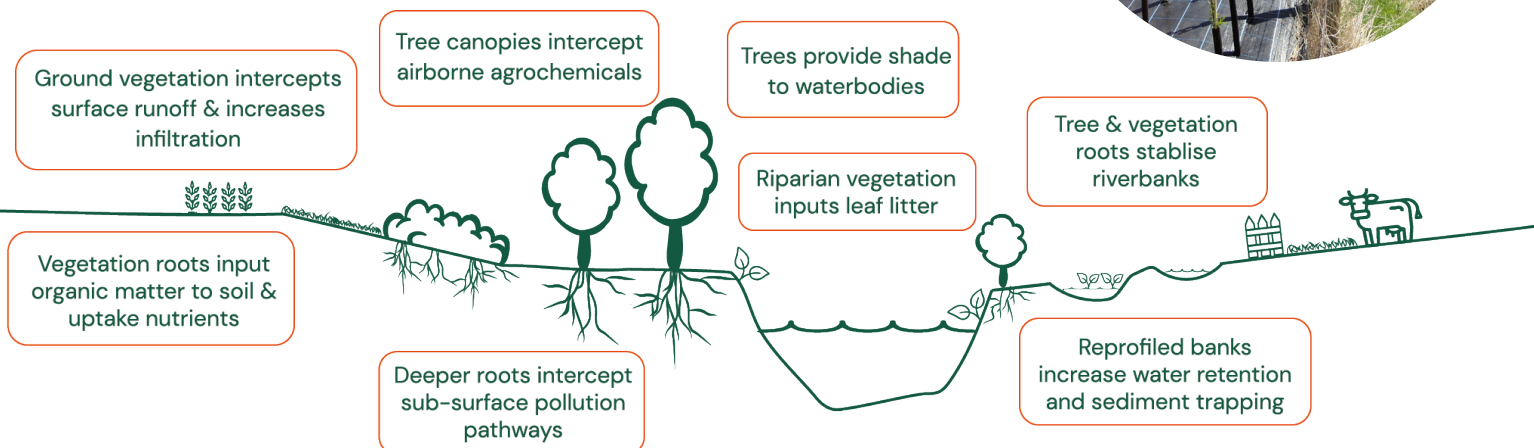
Read more bout Natural Capital and Ecosystem Services on the [Thriving Natural Capital Website](#).



What are 3D buffers?

3D buffers are riparian buffer strips and can be designed to build on and enhance the ecosystem services provided by standard buffers by combining the benefits of grassy and woody buffers. In Scotland, bufferstrips are regulated, and whilst these provide a basic physical border separating agriculture or development from streams, certain sites require additional protection. Examples include: where excess nutrient loading becomes greater than the buffer's soil and vegetation retention capacity; at concentrated points for surface runoff carrying sediment; and contributing to flooding or subsurface tile drain pathways.

3D buffers are designed to consider subsurface flows, pollution pathways and are space efficient. In addition, they can be implemented on zones of least productivity (often low, wet, unworkable field corners). Their widths can vary, between 6-12 meters where needed, depending on pollution pressure, status of waterbody and ecological goals.



More information on ecosystem services by 3D buffers

		Ecosystem Service		
		Water Quality	Water Quantity	Habitat Provisioning
Dimension	Overland vegetation	Trees act as physical barriers to poaching & windblown chemicals such as fertiliser. They also protect water against solar heating and through stabilising riverbanks from erosion they reduce excess sediment from entering the water.	Trees increase infiltration of water. Their canopies intercept rainfall whilst their roots stabilise banks, reducing erosion and risk of river straightening.	Trees provide shade for in-stream species such as Salmon and regulating water temperature. They can reduce algal blooms and provide habitat for nesting for birds. They also provide on land wildlife corridors.
	Surface	A vegetated soil surface minimises sediments and particulate bound contaminants contributing to runoff. It also slows the flow of water and enables dissolved components to enter soil. The vegetation can also uptake of surplus nutrients.	Ground vegetation provides roughness and increases soil infiltration, which helps to reduce water velocity and volume.	Vegetation can include flowering plants for pollination and including a diverse range of vegetation benefits insects and natural pest predators.
	Sub-surface	Roots stabilise and retain pollutants. The Intercept sub surface pollutant pathway such as artificial drainage and increase microbial processing of nutrients.	Roots and good soil structure retains water and slows the flow of vertical drainage	Good soil health, microbial and animal diversity supports multiple below and above ground services.

What to be aware of

Whether field, farm or catchment scale, buffers need to be bespoke and designed to address site specific problems, pressures and the ecological status of waterbodies and local conditions. Check the latest assessment of Scotland's water bodies on the [Water Environment Hub website](#).

Maintenance is required to ensure the services provided by buffers continue to be effectively supplied. This can include control of invasive species, soil removal and reuse or disposal, and harvesting of vegetation for nutrient removal. Visit the FAS website to [learn about control of invasive species on water margins](#).

Buffers at the field edge work best as part of a chain of treatment. Appropriate actions should be taken to control pollution at source and limit transport mechanisms, therefore good soil and crop management in the upslope field is crucial. For more information, visit the [FAS Soils and Crop page](#) and read the [Farming for a Better Climate Soil Management Guide](#).



Image: E Caldwell

Where to start

1. Listen to the '[Exploring Rural Ecosystem Services](#)' Podcast series and the 3D buffer episode with Marc Stutter from James Hutton Institute.



Marc is soil and water scientist at the James Hutton Institute who lives on a small Aberdeenshire farm. His interest in the environmental quality of streams, controlling nutrient pollution. Work with colleagues on flood mitigation and soil loss showed how simple natural processes can be re-designed back into more uniform river corridors to enhance beneficial processes; this led to the 3D buffers concept.

2. Existing buffers can be enhanced to be 3D buffers by adding structural diversity to combat site-specific pressures. This should consider above and below ground water and contaminant pathways, roles of deeper rooting vegetation, soils enriched in carbon and with diversity in wetness, ground profiles and tree canopies to combat issues of runoff, loss of habitat and climate change impacts on water quality.

3. View your land on various [soil risk maps that show your soil's risk of erosion, runoff, leaching and both topsoil and subsoil compaction](#).

4. Consider speaking to your local advisor about completing the following to understand local conditions – Soil survey, topography survey, compaction assessment and hydrology assessment.



Where to find more information

The concept of 3D buffers is new and evolving, download more information on them, their concepts, and their separate dimensions below:

- 3D Buffers: Read the CREW Policy Note – [Can improved design concepts for riparian buffer measures and placement improve uptake and best practice in Scotland?](#)
- Discover the pioneering research and analysis behind 3D buffers – [3D Buffers Strips, Designed to deliver more for the environment](#) by Professor Marc Stutter, Dr Mark Wilkinson. The James Hutton Institute and Dr Tom Nisbet, Forest Research.
- Overland vegetation: Learn more about why rivers need trees, slowing the flow of water and much more in [Wood Wise, Trees for Water](#) by The Woodland Trust, the [FAS Riparian Woodland page](#) and the [Riverwoods Evidence Review](#) which looks at the environmental and societal benefits of river woods.
- Vegetated Buffers: FAS improving biodiversity factsheets; [Livestock farm](#) and [Arable Farms](#)
- Soil: Read '[The factory of life, Why soil biodiversity is so important](#)'
- Diffuse Pollution: Learn more about Diffuse pollution pathways in CREW's [A state of knowledge overview of identified pathways of diffuse pollutants to the water environment](#).
- Read the [General diffuse pollution prevention solutions guidance document](#).

Visit Farming and Water Scotland to find up to date information on how to reduce diffuse pollution on your land and ensure that you are complying with regulations.

