Multiple Benefits of Natural Infrastructure in Agricultural Landscapes

Billions of dollars are spent annually recovering from increasingly frequent and severe floods and removing nutrients and herbicides from drinking water. Natural infrastructure has been shown to prevent damages from both pollution and flooding in agricultural landscapes. Strategically building back some of the region's natural infrastructure could improve water quality and reduce flood risk.

Defining natural infrastructure

Natural infrastructure includes both natural features and engineered structures that mimic or promote natural processes over time. This encompasses structural practices in which soil, rocks or vegetation are used to intercept and alter the flow of water. In this way, natural infrastructure slows and stores water on the landscape to reduce downstream flood peaks and remove nutrients and other pollutants.

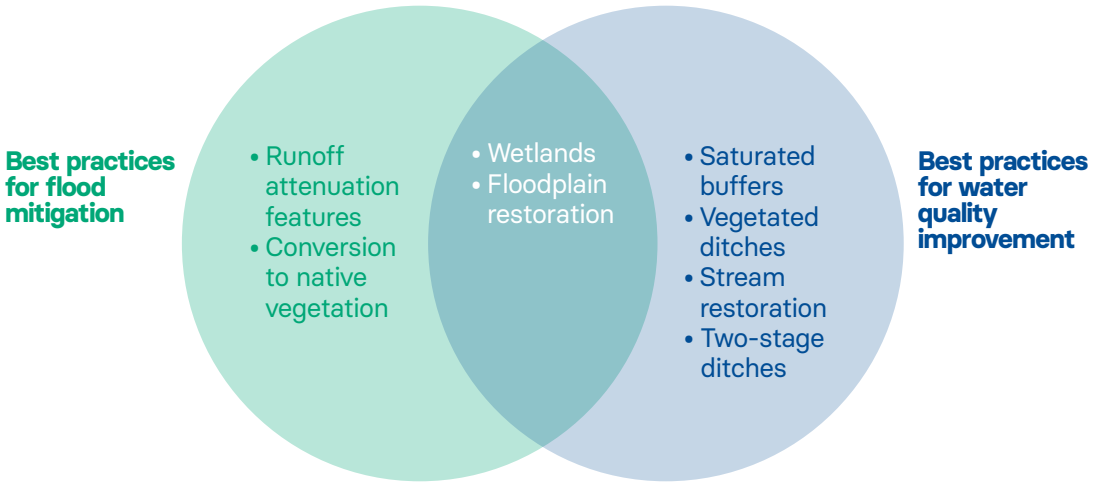
In contrast to grey infrastructure, such as levees, floodwalls and dams, natural infrastructure can provide multiple benefits including reduced flood risk, improved water quality, carbon sequestration, improved wildlife habitat, sediment retention, drought mitigation and recreational opportunities.

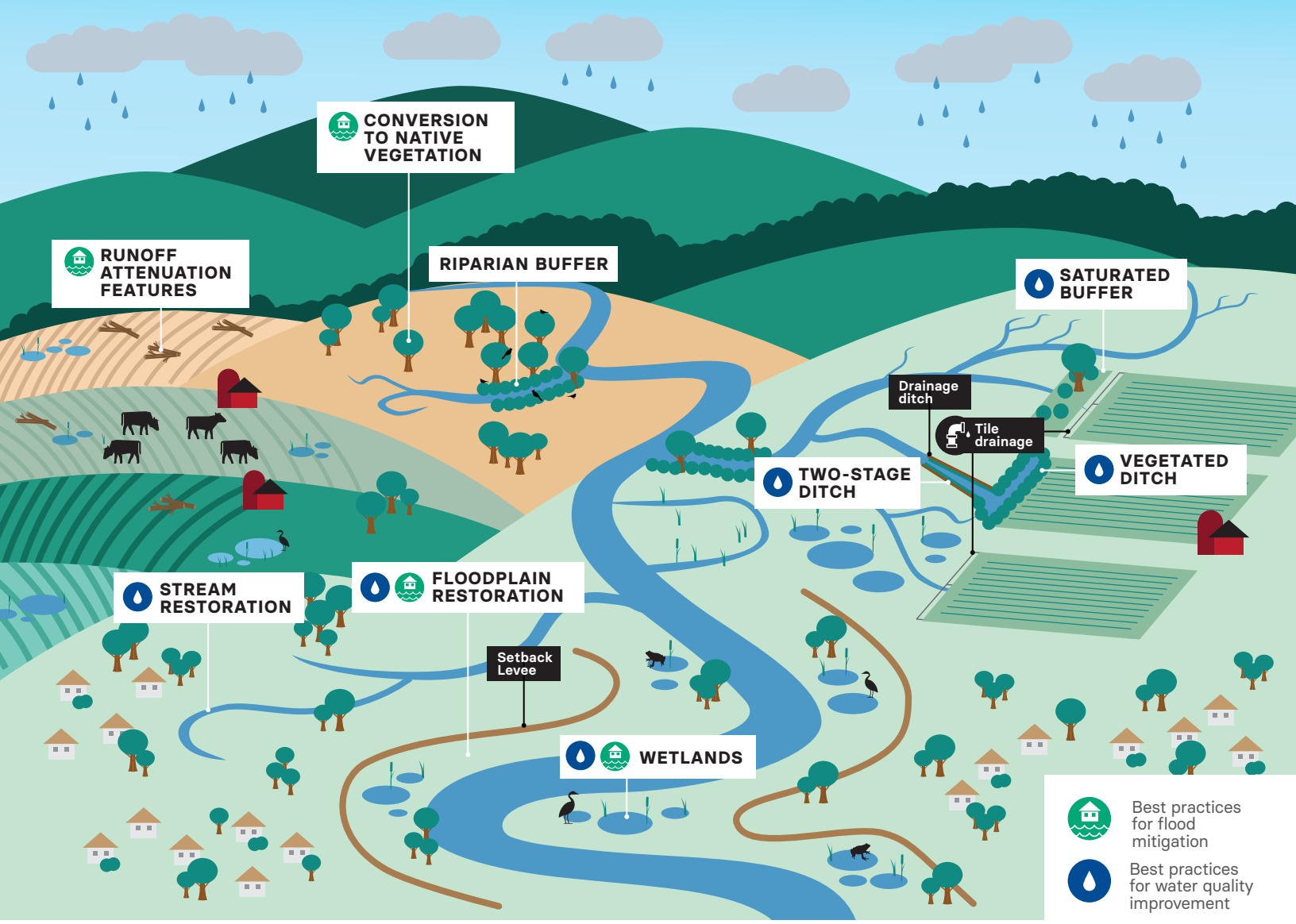
Proactive investments in natural infrastructure can save money in the following ways:

- Strategic implementation on just 1-5% of agricultural lands could reduce flood risk and nitrogen loads by 30–40%.
- Natural infrastructure can be an alternative to costly dams and reservoirs or building new water treatment plants.
- The return on investment for floodplain restoration can be as high as $5 saved in future flood events for every $1 spent.

Natural infrastructure in agricultural landscapes

A robust literature review of 19 types of natural infrastructure features commonly found in agricultural landscapes — including both the quantity of evidence for flood and nutrient mitigation benefits of these features, as well as the potential level of flood risk reduction and nutrient reduction — resulted in eight features that show the greatest benefit for flood protection and water quality.





Upland portions of a watershed

Wetlands in the upland are usually shallow and small, but they can be several acres.

Runoff attenuation features are a broad group of natural infrastructure practices that temporarily store surface water on the landscape as well as improve water retention in the soil.

Conversion to native vegetation reduces flooding due to higher rates of interception, infiltration and evapotranspiration of rainfall.

Treating tile drainage

Saturated buffers reconnect subsurface drainage with vegetated buffers to promote denitrification.

Wetlands that treat tile drainage intercept flow from larger tile drains (usually draining areas of several hundred acres) can be designed to provide both water quality improvement and floodwater storage.

Small streams or drainage ditches

Two-stage ditches are modified agricultural drainage ditches where pipes drain onto the constructed floodplain or 'benches' on either side of the channel.

Vegetated ditches are drainage ditches that are planted with grasses or other vegetation to reduce sediment and nutrient pollution.

Riparian buffers are forested areas starting at a stream bank and extending some distance until the adjacent land use begins.

Wetlands in the floodplain are often left behind when a stream follows a U-shaped meander and gets cut off.

Medium to large rivers

Floodplain restoration gives the river room to flood periodically, when denitrification can occur.

Stream restoration restores the structure of the river, reducing stream bank erosion, improving water quality and restoring aquatic habitat.