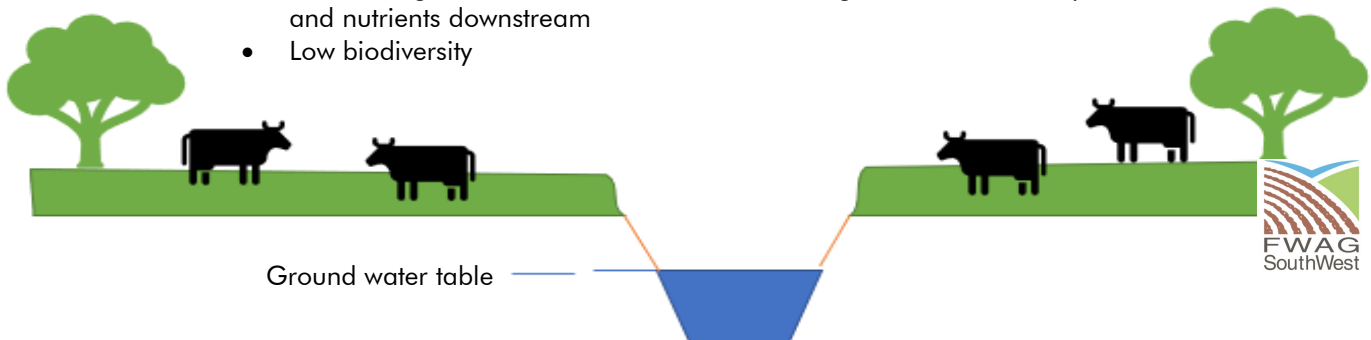


Stage Zero—the floodplain is the river!

From a farming viewpoint we often think of rivers as drainage channels that carry water away from our land as fast as possible. When a river floods over its banks (connecting with its floodplain) it means the loss of crops or grazing land. For centuries we have drained land and modified rivers so that they have become unnaturally deep-cut, narrow channels with fast flowing water well below and 'disconnected' from the surrounding floodplain (Fig. 1). We dredge or maintain rivers to keep them this way.

Fig. 1 Unrestored river channel & disconnected floodplain

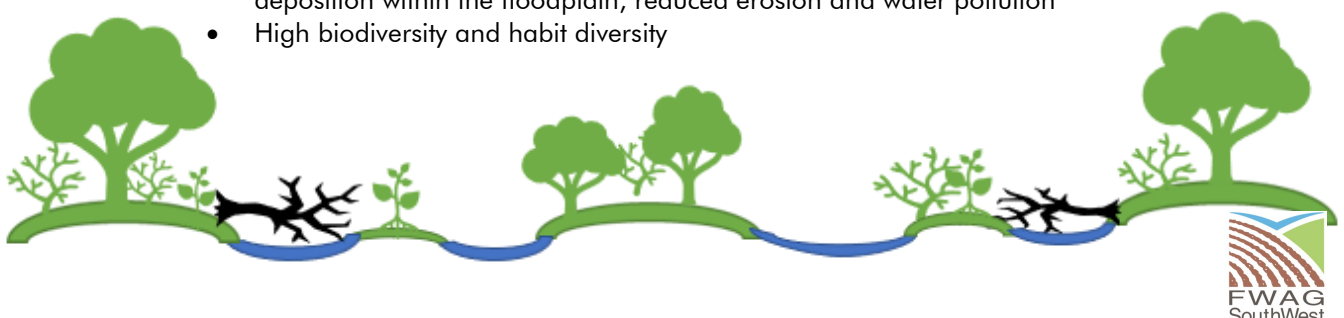
- Deep, narrow, single channel, acts as a drain and rarely overflows onto floodplain
- Ground water table has dropped from the flood plain to the river surface level
- Fast flowing water leads to downstream flooding, erosion and transport of silt and nutrients downstream
- Low biodiversity



Geological evidence shows that this channel form was rare before human intervention. Most river-systems existed as shallow, multi-braided channels, spreading and intertwining across the floodplain, or as wetland with no discernible channels - the floodplain was the river (Fig. 2). This natural form was named 'Stage Zero' by Cluer and Thorne (2013) to fit with the scientific model of stream evolution.

Fig.2 Restored 'Stage Zero' floodplain– the floodplain is the river!

- Multi-braided, shallow channels intertwine across the whole floodplain. Or wetland with no discernible channels
- Slow flow even during flood events
- High water table , provides drought resilience
- Wetland vegetation and fallen timber scattered across the floodplain help silt deposition within the floodplain, reduced erosion and water pollution
- High biodiversity and habit diversity



Although river modification has provided agricultural land, it has also had negative environmental and societal impacts, including downstream flooding, soil erosion and water pollution, loss of wetlands and biodiversity, and reduced drought resilience in surrounding agricultural land.

Rivers that are restored to 'Stage Zero' have slow flows even during flood events. They provide Natural Flood Management, drought resilience (due to a higher water table and increased water retention in surrounding land), and high biodiversity. The slow flow means that silt settles out within the floodplain. This reduces soil erosion and improves water quality by reducing levels of sediment and associated pollutants.

Stage Zero Floodplain Restoration

Stage Zero restoration has been pioneered by the US Forest Service, as shown by these before (Fig.3) and after (Fig.4) photos of Five Mile Creek, Oregon.

Fig. 3 Five Mile Creek, Oregon, USA, 2005, before restoration:
deep, single channel,
disconnected floodplain



Fig. 4 Five Mile Creek, Oregon, May 2020, following Stage Zero restoration



Before earthworks are begun, high resolution contour data and geological evidence are used to create a 3D picture of the natural shape of the flood plain and river channels. This can be compared with the present-day shape. During construction, material is cut from areas that have become artificially elevated, then used to infill the artificially deepened single channel, raising the water level so that it reconnects with, and spreads across the surrounding floodplain. Trees may need to be felled close to the single channel, to allow the earthworks, but other native trees and wetland plants may be introduced across the floodplain. Gravel beds, fish and other species are removed before infilling but replaced into the restored floodplain.

Restored floodplains mature naturally over time, settling into a variety of forms , depending on their natural characteristics. They may establish a system of multi-braided channels; a wetland with no discernible channels, or there may be a larger channel with smaller surrounding channels, all well-connected with the floodplain.



Stage Zero in Britain

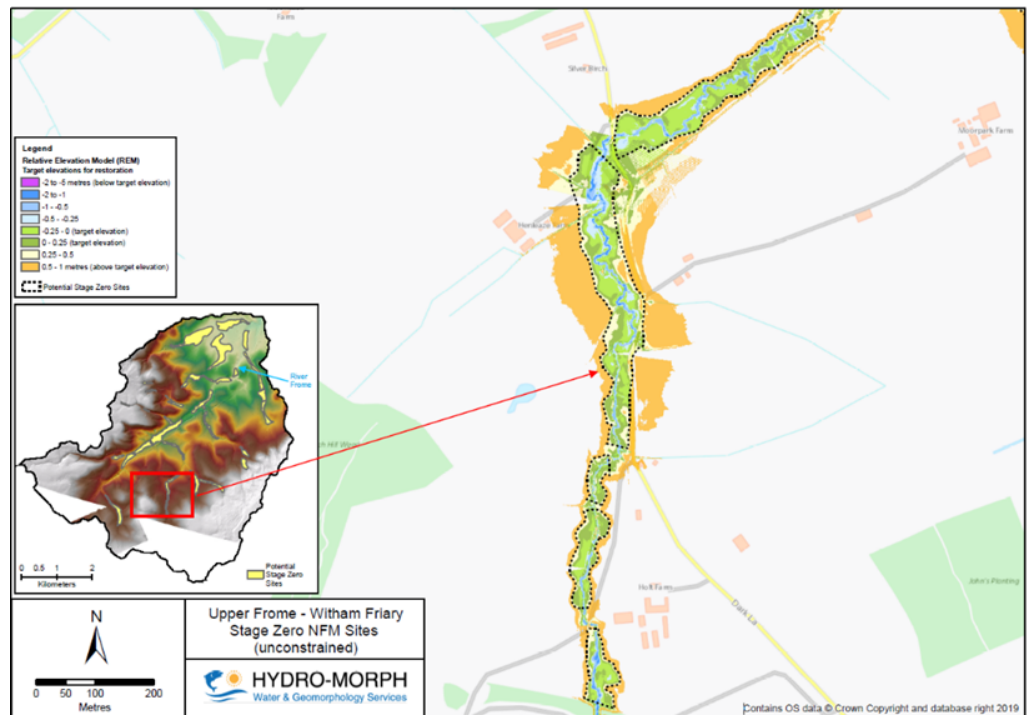
Recently there have been some small-scale Stage Zero restorations in Britain, on the River Eden in Cumbria and at the National Trust's Holnicote estate in West Somerset.

From late 2020 onwards FWAG SW will be working with local landowners and partner organisations to tackle flood risk using a range of Natural Flood Management (NFM) techniques in the headwaters of the Somerset Frome catchment. Stage Zero floodplain restoration will be one of the approaches used at suitable sites. The project aims to alleviate flooding hotspots across the upper catchment, as well as residential and highways flooding in Frome town centre – issues that have not been possible to resolve with conventional flood protection engineering. The project will also provide improvements in water quality, habitat and biodiversity.

Is Stage Zero feasible in Britain?

The US Forest Service has developed its Stage Zero work within vast tracts of wilderness and national forest. So, is it feasible to transfer this approach to Britain, where almost all rural rivers flow through farmed land owned by private businesses that need to make a profit? The black dotted line in the map below indicates the extent of the land that would be wetted up at one Somerset Frome site if it were restored to Stage Zero.

Clearly, there is a loss of land surrounding the existing channel, so the approach will not appeal to all landowners. Nevertheless, there will be opportunities where land is of lower agricultural value, where landowners wish to prioritise environmental considerations, and where financial mechanisms become available.



Information sources:

- Cluer, B. and Thorne, C. (2013) 'A Stream Evolution Model Integrating Habitat and Ecosystem Benefits', River Research and Applications (2013), Wiley Online Library. https://www.waterboards.ca.gov/northcoast/water_issues/programs/agricultural_lands/pdf/130520/Cluer_and_Thorne_2013_A_Stream_Evolution_Model_Integrating_Habitat_Ecosystem_Benefits.pdf
- Europarc Atlantic Isles 'Stage Zero river restoration approach, design and applications taken from Oregon into a UK river co' <https://vimeo.com/417996381>

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