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severn and avon vales flourishing floodplains project

Peter Jones reviews some of the academic literature on floodplain conservation and restoration, and reflects on the characteristics of floodplains and the achievements of floodplain projects, drawing on outcomes from the Severn and Avon Vales Flourishing Floodplains project

The Severn and Avon Vales Flourishing Floodplains project, which concluded in March 2023, aimed to restore 'threatened wetland habitats in the farmed landscapes of the Severn and Avon Vales, helping to increase biodiversity, store carbon, improve soil and water quality, and connect people with nature'.¹ This article highlights some of the characteristics of floodplains, reviews some of the academic literature on floodplain conservation and restoration, outlines some of the achievements of the Severn and Avon Vales project, and concludes with some reflections on floodplain projects.

Floodplains

In simple terms, a floodplain is defined as 'a generally flat area of land next to a river or stream',² which becomes covered in water when the river exceeds bank-full capacity. A floodplain consists of the river itself, sometimes called the floodway, and the flood fringe, which extends from the outer banks of the river to the edge of its valley. Floodplains are formed by both erosion and deposition. Erosion removes small areas of land, creating a wide, flat area on either side of the river, and, during a period of flood, material being carried by the river is deposited as the river loses its speed and energy. The material deposited on the floodplain is known as alluvium, and is rich in nutrients.

In outlining some of the beneficial characteristics of floodplains, the European Environment Agency³ reported that natural undisturbed floodplains are areas of very high biodiversity, that they support

both habitats and species that have adapted to the environmental conditions provided by the cycle of flooding, waterlogging and drying, and that they often provide intermittent habitats for a range of water-dependent species. The European Environment Agency also reported that flooding and waterlogging create a wide variety of ecological niches that are in permanent exchange with the river and its catchment, and that these niches act to support ecological resilience over time. At the same time, floodplain soils often comprise peat with a high organic matter content. When waterlogged, peat has a high carbon storage capacity.

More specifically, floodplains deliver a range of ecosystem services—such services can be classified as provisioning, regulating, or cultural. Provisioning services are the tangible products that people obtain from ecosystems. They are vital for the economy, and include biomass, water and fibre, and energy, and many have well developed markets and valuation systems. Regulating services embrace the ways that ecosystems control or modify the environment, and they include climate regulation. Cultural services are more intangible benefits and are linked, in a variety of ways, to human wellbeing.

The European Environment Agency³ listed a wide range of ecosystems services provided by undisturbed floodplains. Here, provisioning services included flood control, agricultural plant production, and grazing; regulating services included flood control and the conservation of biodiversity; while in terms



Floodwater on a River Severn floodplain

of cultural services floodplains are used for a wide variety of recreational activities.

However, the European Environment Agency has also described floodplains as 'a natural system under pressure',³ and suggested that two of the main pressures are hydromorphological and pollution. Hydromorphological pressures, often caused by channel straightening, drainage, and water abstraction, for example, include changes to water retention and flow, and changes to the physical characteristics of rivers and their floodplains. These changes often affect the ecology of the natural system, not least in that they can reduce or eliminate the lateral connectivity between the river and its floodplain, which can, in turn, reduce habitat quality and species diversity.

Pollution from mining activities and manufacturing industry, as well as power plant cooling water, and waste water, also find their way into rivers. At the same time, nutrient supplements and pesticides, in widespread use in farming, are also moved into rivers and streams, either via groundwater or in surface run-off, and may cause eutrophication, which can cause algal blooms which block off sunlight and kill fish.

There seems to be limited accurate information on the extent of floodplains in the UK. The European Environment Agency⁴ reported that the area of floodplain in the UK covers 13,188 square kilometres (which is roughly twice the area of Devon). Heritage *et al.*⁵ reported a total of 5,458 square kilometres of floodplain in England and Wales. In 2017 a report in

the *Guardian* newspaper suggested that natural floodplains cover about 5% of England, from upland areas and tablelands to low-lying marshes, such as the Somerset Levels and the Fens of East Anglia.⁶

Large parts of London are built on the River Thames' tidal floodplain, but the highest risk of river flooding is in outer and west London, and comes from the tributaries of the River Thames or its non-tidal sections. By way of a contrasting setting, in the eastern part of the South Downs, the major river floodplains that run from the Arun in the west to the Cuckmere in the east form the base of valleys that have carved through the chalk uplands, and contain rivers flowing towards the coast.

Literature review—floodplain restoration and nature conservation on floodplains

Entwistle *et al.*⁷ reported that river degradation had been quantified across Great Britain following adoption of the European Water Framework Directive—but noted that this classification process had concentrated on in-channel conditions, and had largely ignored floodplain presence, and argued that this lack of consideration would undoubtedly see floodplains further ignored as part of the, then, current Water Framework Directive driven restoration agenda.

Nevertheless, floodplain restoration and nature conservation on floodplains in the UK have attracted attention in the academic literature in recent years, and three relevant interrelated themes—namely, floodplain restoration; the impact of restoration on

plant communities; and nature conservation on floodplains—can be identified within that literature. The aim here is to reflect the range and variety of this work, rather than to provide a comprehensive review.

Firstly, some 20 years ago Acreman *et al.*⁸ investigated the impacts of floods on hypothetical changes to river channel geometry by the construction or removal of embankments to prevent water spreading onto the floodplain of the River Cherwell between Banbury and Oxford. Their results suggested that floodplain rehabilitation could be a valuable part of the flood management strategy, and that it could lead to increased inundation of the floodplain, which can be positive for ecological restoration.

Ball⁹ reviewed selected floodplain restoration projects in the UK with the aim of examining their effectiveness, in terms of both environmental improvement and the decision-making of the planning and stakeholder groups that led to their implementation. The findings suggested that the most successful projects clearly communicated the multiple benefits of restoration, and that key stakeholders and landowners were involved at the planning stage.

In noting that the extension of ecological restoration of river channels to include floodplains increased the complexity of the restoration process, not least because of the range and diversity of stakeholders and management institutions involved, Adams *et al.*¹⁰ drew on a survey of river managers in the UK to identify the institutional factors relevant to the success, or failure, of floodplain restoration projects. Their analysis led them to conclude that local stakeholders were critical to the success of restoration projects, that large institutional owners created the most favourable context for restoration, and that local communities could contribute very positively to the success of projects.

Research by Moss¹¹ on institutional drivers and constraints in floodplain restoration in Europe included a case study of the River Parrett in Somerset. Here, a restoration scheme launched in 2000 adopted an integrated approach to meet flood defence needs in a way that was designed to benefit wildlife and support the local economy. The support of local communities was important in accessing funding, in stimulating joint projects, and in initiating dialogue between stakeholders throughout the catchment area.

Secondly, Toogood *et al.*¹² examined the sensitivity of floodplain grassland plant communities to water regimes using the reciprocal transplantation of an inundation grassland and a flood meadow, within an English floodplain. The results from both communities showed substantial annual variations related to hydrology, but in general terms vegetation seemed to be responding to drier conditions following a major flood event. This drying trend was characterised by increased

species diversity, a greater abundance of competitive species, and fewer wetland plants.

Rothero *et al.*¹³ claimed that despite 30 years spent looking to restore species-rich floodplain meadows, the extent and level of restoration success in the UK remained unknown. They reported on a three-year project which, from 2016 to 2018, evaluated over 150 floodplain meadow sites across the UK. Restoration success was measured by floristic composition, species richness, site ownership, and the quality of ongoing management. The results revealed that 25% of restoration sites demonstrated successful restoration, while 60% of sites showed some signs of restoration. Further, the degree of restoration success showed no significant correlation to the state of the site prior to restoration, or to the method of restoration, while the ownership of the site and site management both positively influenced restoration success.

Richards *et al.*¹⁴ studied the changing composition of plant communities at a number of sites in a restoration project designed to improve the quality of floodplain grazing marsh in the UK. The findings revealed significant differences in composition between the pre- and post-restoration stages, and plants with traits for moisture tolerance became more abundant, although there was no increase in floodplain grazing marsh species at the end of the project.

Clilverd *et al.*¹⁵ sought to assess the spatial patterns of plant communities in relation to the physical and chemical conditions of the soil, and the impacts of floodplain restoration involving embankment removal, on the River Glaven in Norfolk. They found that, while the restored regime may be suitable for more diverse plant assemblages, such benefits could be overridden unless water levels were managed during the growing season. In conclusion, Clilverd *et al.*¹⁵ argued that hydrological modelling, combined with measures of plant water requirements, could provide practical and adaptive management tools to estimate the response of floodplain communities to changing water regimes.

Thirdly, Rouquette *et al.*¹⁶ assessed the relative merits of various methods of valuing nature conservation interests in a case study of agricultural floodplains in England. Seven methods of valuing nature conservation interests were assessed and compared, but each emphasised a different type of conservation, and the authors concluded that, where objectivity was the key, assessment against independently defined criteria, or targets, should be the preferred method.

Posthumus *et al.*¹⁷ explored changes in rural land use in floodplains by measuring the range of ecosystem services provided by different management scenarios. Six alternative floodplain management scenarios were developed to reflect different priorities for land use in lowland floodplain areas, and the results indicated that were both



Floodplains can, in theory, provide valuable ecosystem services, but in many places the opportunities for the provision of such services are limited or threatened

synergies and conflicts between ecosystem services delivered in these areas. The authors argued that their integrated ecosystems management approach would help to inform future policy, and practice, for floodplain management.

Hill *et al.*¹⁸ noted that ponds were common landscape features on floodplains, where there was lateral connectivity with rivers, but research on the ecology and hydrology of temperate ephemeral and perennial floodplain ponds lagged behind that of other shallow waterbodies. With this in mind, the authors examined the aquatic macroinvertebrate diversity of 34 ponds on two unregulated floodplain meadows in Leicestershire. The results suggested that niche characteristics, rather than neutral colonisation processes, dominated the structure of invertebrate communities of floodplain ponds; that the maintenance of pond networks, with varying hydroperiod lengths and environmental characteristics, should be encouraged as part of conservation management strategies; and that this would support and enhance aquatic biodiversity at a landscape scale.

The Severn and Avon Vales Flourishing Floodplains project

The Severn and Avon Vales are low-lying open agricultural landscapes along the Severn and Avon rivers, stretching from Worcester on the Severn and Stratford-upon-Avon, down to Slimbridge in Gloucestershire, while the Cotswolds to the east, the Forest of Dean to the south-west, and the Malvern Hills to the west form abrupt boundaries. The vales were once a connected mosaic of floodplain meadows, arable fields, marshes, and small wetlands, and the grasses and wild flowers found there provided a habitat for a wide variety of species, such as curlews, newts and eels, and the scale of this landscape essentially made it more valuable than the sum of its constituent parts.

However, almost 90% of these natural habitats have either been lost or now have substantially reduced biodiversity. The arable land, which accounts for some 25% of the floodplain, is mainly made up of small fields, although there are also some large fields, and it is under low-intensity farming. The larger fields, including Upton Ham and Upham Ham, were managed as common land, and traditionally in these systems hay strips were allocated to parishioners and then, once the hay had been taken, the local farmers would put their animals on these unfenced areas, which were then grazed in common.

The Severn and Avon Vales Flourishing Floodplains project, which began in 2021 and was supported by the Green Challenge Fund, was a partnership between the Wildfowl and Wetlands Trust, the Floodplain Meadows Partnership, and the Farming and Wildlife Advisory Group South West.

The Wildfowl and Wetlands Trust, established in 1946, is an international wildfowl and wetlands conservation charity. The Floodplain Meadows Partnership looks to give evidence-based advice to managers and landowners on floodplain meadow management, support and encourage floodplain restoration, undertake research on ecohydrology on floodplain meadows, and act as an advocate for floodplain management and restoration. Since 2008, the Partnership has received funding from a number of sponsors, including the Esme Fairburn Foundation and the Garfield Weston Foundation, and is hosted by the Open University. The Farming and Wildlife Advisory Group South West is a registered charity representing the region's farmers and landowners in the delivery of wildlife conservation. Essentially, all the project partners were united by the vision of bigger, better, and more connected wetlands, providing a haven for wildlife, and helping local people to connect with nature.

Between 2021 and 2023, the Severn and Avon Vales project embraced a variety of initiatives designed to restore floodplain habitats along the Avon and Severn and support wildlife within the farmed landscape. More specifically, the primary goal of the project was to create and restore healthy floodplain habitats to support a large range of dependent species. In the floodplain meadows, where the grasslands are cut for hay every summer, there has been a focus on the creation or restoration of a network of some 40 wildlife-rich ponds and small wetland features across a 4,000 hectare landscape.

The project team were also involved in surveying 1,000 hectares of floodplain meadows, with a view to restoring some 20 hectares of this habitat, and in building the evidence base to help to assess the importance of floodplain meadows as stores for soil carbon. Pilot surveys were also undertaken to investigate the nutrient-rich food sources created by flying insects, including mayflies, damselflies

and midges, as they emerged from ponds in the summer, and to track their path through the wider food web.

Initiatives designed to protect and conserve the 35 breeding pairs of curlews in the Severn and Avon Vales have also been an important element within the project. The Breeding Birds Survey reported a decline of over 40% in the breeding population of these birds in the UK between 1995 and 2008.¹⁹ A small number of curlews were fitted with global positioning tags, which enabled researchers to determine adult feeding areas, movements outside the breeding season, and the links between breeding and wintering sites. At the same time, some curlew nests were fitted with temperature probes and nest cameras, and careful nest monitoring provided valuable insights into the predation pressures faced by curlews and causing poor survival rates for their chicks.

Researchers, along with citizen science volunteers, also surveyed over 100 ponds for the presence of the European eel, another endangered species. These eels were detected in over 35% of the ponds surveyed, and future research will focus on the characteristics of ponds favoured by the eels.

Support from local farmers and landowners, local communities and volunteers has made a vital contribution to the Flourishing Floodplains project. For example, farmers participated in a number of events, including meadow walks, pond and wetland restoration visits, and workshops about regenerative farming practices. The project team made over 50 farm visits to offer detailed advice on soils, climate resilience, water management, and wildlife-friendly farming. Within the project farmers and landowners worked with the project team to restore some 36 hectares of floodplain meadow, sourcing species-rich meadow seeds from traditional donor meadows, and in some meadows individual plugs of wildflowers were hand-planted by volunteers.

Concluding reflections

The literature review of floodplain restoration and nature conservation on floodplains and the outline of the achievements of the Severn and Avon Vales Flourishing Floodplains project offer some valuable insights into the local management of floodplain environments. At the same time, four issues—the first two specific and second two more general—merit concluding reflection.

First, while the Flourishing Floodplains project can rightly claim a number of positive achievements, both in valuable practical conservation work and in encouraging the active participation of farmers, landowners, communities and volunteers in the project, without continuing management many of its achievements may soon be lost. This is a worrying challenge for many conservation projects, not least for those with fixed-term funding which have made extensive use of volunteers.

Secondly, floodplains can, in theory, provide valuable ecosystem services, but the opportunities for the provision of such services within the Severn and Avon Vales project area are either limited or threatened. In addressing food production, for example, Natural England²⁰ suggested that the mixed farming in much of the area was at risk from farm economics. In addressing water availability, Natural England²⁰ suggested that low flow levels, due to over-abstraction, were detrimental to biodiversity, particularly during periods of low rainfall. In a more positive vein, in turning to cultural ecosystem services, Natural England²⁰ reported that a sense of place was provided by the Severn and Avon rivers and their floodplains, not least by the remnants of unimproved meadow and gravel terraces that support fruit-growing

Thirdly, and more generally, the Green Alliance²¹ claims that 90% of floodplains in the UK are not fit for purpose, in that the majority of them are occupied by urban development, arable farming, and improved grassland. Such areas are not only liable to flooding, but, as modified floodplains, they move water quickly downstream, thus creating flood hazards for communities. Looking to the future, the Green Alliance's vision is one of an alternative use of floodplains, forming part of a broad nature recovery network of green corridors running through the countryside, linking existing natural habitats, and reaching into towns and cities. Here, the argument is that re-purposing floodplains can help to address the consequences of the climate and nature crises. In reality, current pressures to build more houses, and to intensify farming practices, appear to make this more of a green pipedream than an economic reality.

That said, in posing the question 'could our ancient floodplain meadows help to turn the tide on our nature and climate emergencies?', the Wildfowl and Wetlands Trust²² raised the underlying issue of the role of floodplains in contributing to the transition to a sustainable future. In many ways the Flourishing Floodplains project is reminiscent of the traditional conservation slogan 'Think global, act local', not least in that, if it encourages people who have participated in the project to engage more fully with challenging global sustainability agendas, then that can only be to the good. However, the counter-argument is that the restoration of floodplain environments within the UK can make but a very small contribution to the world's pressing climate and nature crises, while unsustainable patterns of consumption hold sway.

Finally, what is the current role of the planning system in floodplain management? While England's National Planning Policy Framework²³ asserts that 'planning policies and decisions should contribute to and enhance the natural and local environment', its single reference to floodplains concerns 'managing flood and coastal erosion risk by protecting, restoring

and emulating the natural 'regulating' function of catchments, rivers, floodplains and coasts'. That said, floodplains receive more attention in Planning Practice Guidance on flood risk and coastal change²⁴ (as they did in the now-withdrawn PPG25: *Development and Flood Risk Practice Guide*²⁵). Current Planning Practice Guidance advocates for the role of natural flood management techniques, and working with natural processes, to protect, restore and emulate the natural functions of floodplains, but the overwhelming thrust of the guidance is on accommodating development, particularly new housing development, rather than on conservation per se.

● **Peter Jones** works in association with the School of Business at the University of Gloucestershire. The views expressed are personal.

Notes

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