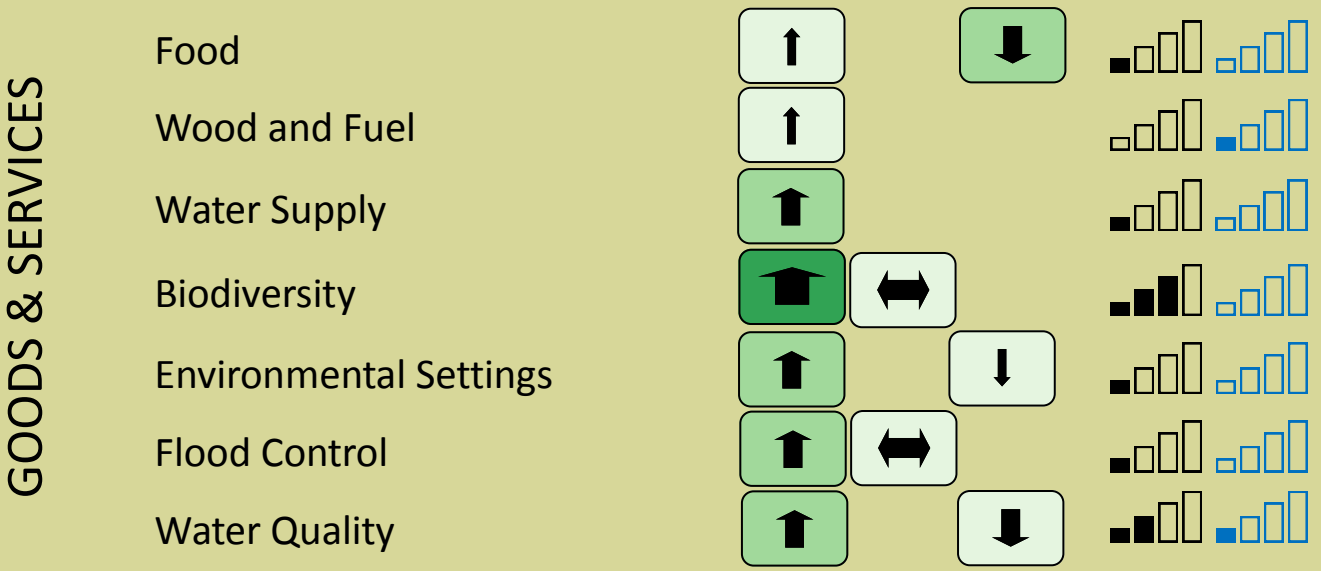
Remove or lower flood defences to allow seasonal flooding of the floodplain.

MANAGING ECOSYSTEM SERVICES

FRESHWATER

INCREASE SIZE OF ACTIVE FLOODPLAIN

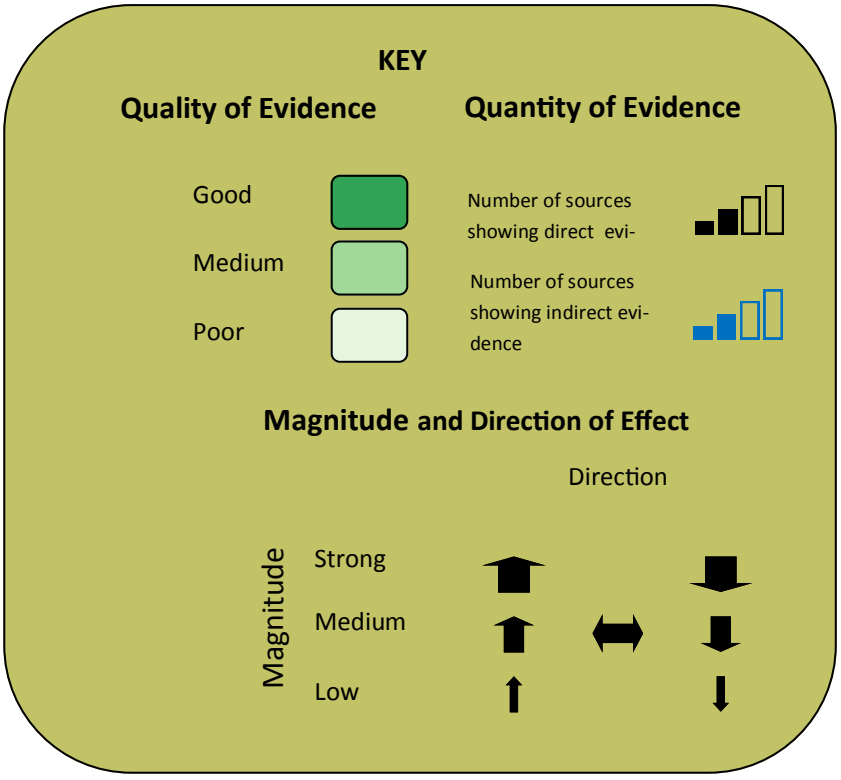
GOODS & SERVICES




These pages represent a review of the available evidence linking management of habitats with the ecosystem services they provide. It is a review of the published peer-reviewed literature and does not include grey literature or expert opinion. There may be significant gaps in the data if no published work within the selection criteria or geographical range exists. These pages do not provide advice, only review the outcome of what has been studied.

Full data are available in electronic form from the Evidence Spreadsheet.

Data are correct to March 2015.



MANAGING ECOSYSTEM SERVICES

FRESHWATER

INCREASE SIZE OF ACTIVE FLOODPLAIN

**Provisioning Services**—providing goods that people can use.

**Cultural Services**—contributing to health, wellbeing and happiness.

**Regulating Services**—maintaining a healthy, diverse and functioning environment.

## PROVISIONING

**Food**: ***Strong Evidence:-*** Unusually high seasonal flooding of agricultural land, such as that during the 2007 flood events in the UK, causes considerable financial impact at the individual farm level due to crop loss and increased feed costs for livestock[1]. While these losses are small compared with the financial losses from flooding of urban areas, they were large at the scale of the individual farm. Evidence from a study in Germany shows that seasonal flooding of man-made ponds greatly increased the diversity and abundance of fish[2] but this may be more relevant to recreational fishing that food production. ***Moderate evidence:-*** A review of a range of flood alleviation techniques from around the world concludes that in terms of the financial costs of flood alleviation, connecting rivers with floodplains to reduce the risk of downstream flooding can be more expensive and take two to three times as much land out of production as conventional drainage practices[3]. The schemes showed additional benefits however in terms of improved water quality, flood regulation and enhanced wildlife habitat.

**Wood and Fuel:** ***Moderate Evidence:-*** A study across a number of rivers within Europe (including the River Ouse in the UK), has shown that seasonal flooding events favours the natural restoration of river-plain woodlands[4]. There is no evidence however that this stock of timber is utilized.

**Water Supply:** ***Moderate Evidence:-*** Studies of an aquifer in France has shown that flood – water recharge of an aquifer allows the storage and slow release of stored water[5].

## CULTURAL

**Biodiversity**: ***Strong Evidence:-*** A study from Italy demonstrates that the lateral (off river i.e floodplain) dimension is important in maintaining high invertebrate density and diversity which would be fulfilled by the presence of an active floodplain[6]. In Poland, temporary ponds in floodplains, supported by occasional over-topping, contain many species of invertebrates of conservation concern[7]. This is supported by a study from Europe (including the UK) which found strong evidence that ponds and ditches support a high diversity of aquatic plants and invertebrates[8]. In a comparative study of flooded vs. non-flooded meadows in the Netherlands, there was strong evidence to suggest that flooding does not significantly affect the diversity of the seed bank, leading to no net increase in diversity[9]. A similar study showed that flooding regime is less important than mowing regime for maintaining floral diversity in flood meadows[10].

## CULTURAL

**Biodiversity:** ***Moderate Evidence:-*** A modelling approach demonstrated that large-scale biodiversity can be improved by changes in water flow with temporary water courses, associated with temporary channels and ponds generating higher biodiversity[11]. This concept is supported by evidence from England that temporary ponds, which can be created during flooding events, support a range of nationally scarce plants and invertebrates[12]. There is some evidence to show that Snipe (*Gallinago gallinago*) do not appear to have benefitted from increased levels of surface flooding however, so increased connection of rivers with floodplains, and increased flooding, may not benefit this species[13].

**Environmental Settings:** ***Strong Evidence:-*** A study in Luxemburg presents strong evidence that residents living close to a floodplain viewed the restoration of the floodplain as very valuable, even though they didn't view floodplains as a threatened landscape[14]. ***Weak Evidence:-*** A review on the effects of climate change, including flood mitigation measures, suggests that archaeological remains in Britain may be damaged by unsympathetic management such as changes to flood management regimes. However, this is specific to individual cases so few generalisations can be made[15].

## REGULATING

**Flood Control:** ***Strong Evidence:-*** A study on the river Cherwell in Oxfordshire shows that reconnection of rivers with floodplains reduces peak flow by 10-15% and increases peak levels within the floodplain by 0.5-1.6m[16]. This can have beneficial effects on flood reduction downstream. ***Moderate evidence:-*** A study in the USA shows that while reduction of levees which allows the river to flood can reduce the economic costs of small to medium sized floods, it can increase the economic cost of rare large-scale floods[17]. This finding was also supported by another USA study which showed that reconnection of the floodplain to the rivers was not an economically viable solution for reducing flood damage and costs[18].

**Water Quality:** ***Strong Evidence:-*** Water quality, with regard to nitrogen and phosphorus, is improved with greater connectivity between the river and the floodplain[19]. Moderate evidence from a study from France shows that mixing of low nitrate sub-surface water from the floodplain with high nitrate water from the river can dilute the overall nitrate levels[5]. A review of seven projects around the world presents moderate evidence that reconnection of rivers with floodplains results in lowered nitrate levels[3]. A study of re-meandering rivers (with implied reconnection with floodplains) from Denmark provides strong evidence that phosphorus is retained (between 0.13 and 10 kg P $Ha^{-1}$ $yr^{-1}$), while nitrogen is removed (between 52 and 337 kg N $ha^{-1}$ $yr^{-1}$)[20]. However, a study from Norfolk suggests that this stored phosphorus can become re-mobilised during flooding events, and so reconnection of the floodplain with the river may increase phosphorus mobility into the river system[21] ***Moderate Evidence:-*** Three rivers in the UK, the Brede, Cole and Skerne have shown that reconnection with the floodplain increases the deposition of sediment-associated phosphorus, but the effect on water quality is unclear[22].

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