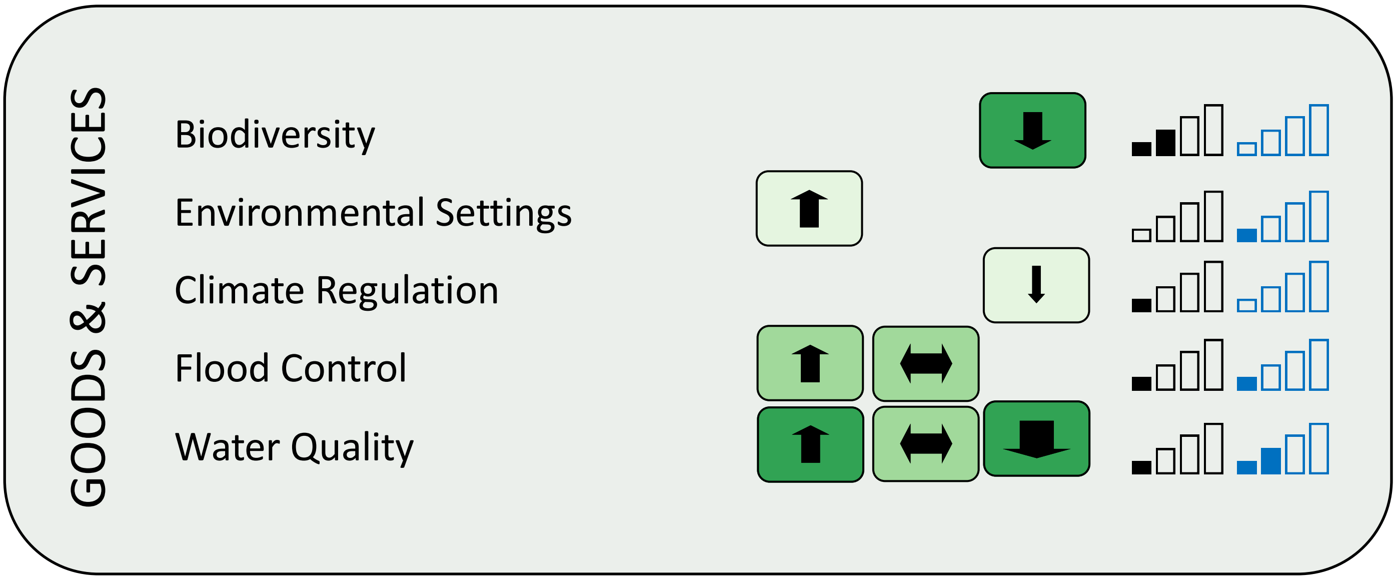
MANAGING ECOSYSTEM SERVICES

UPLANDS

RESTORE PEATLAND VEGETATION

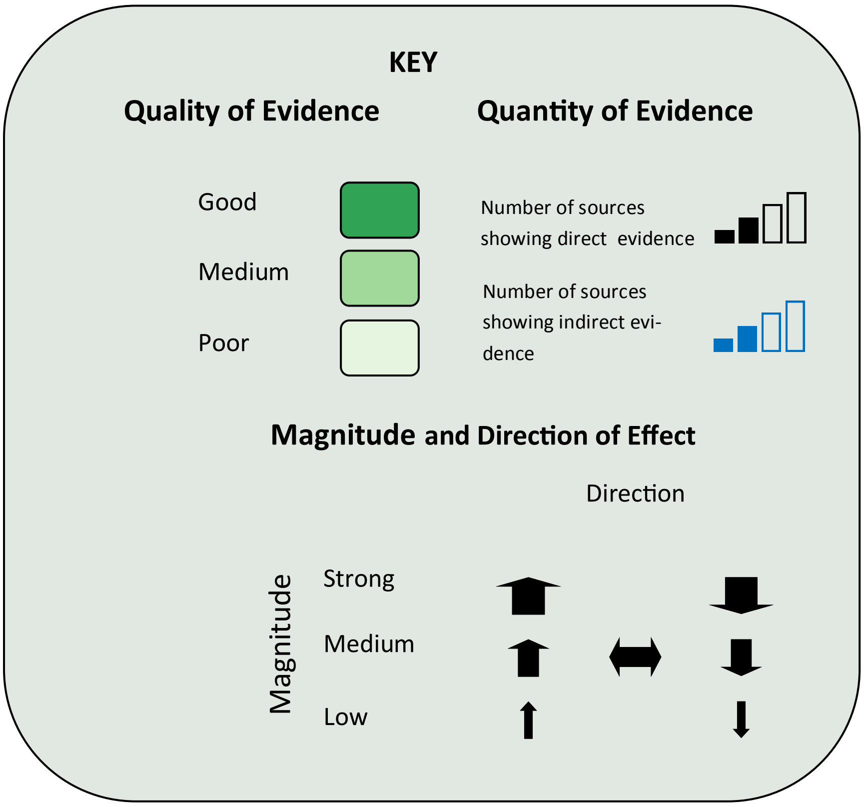
Raise the water table on previously drained upland peat soils using dams to restore *Sphagnum* dominated peatland vegetation.



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

UPLANDS

RESTORE PEATLAND VEGETATION

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.

CULTURAL

Biodiversity: ***Moderate Evidence:-***—A UK study showed that drained upland sites had a lower invertebrate diversity than drain-blocked sites and that streams in drain-blocked catchments had a similar invertebrate richness, species composition and community structure to intact sites[1].

Environmental Settings: ***Strong Evidence:-*** A lowering of water table depth can affect archaeological remains by allowing them to dry out, oxidise and decay which is applicable to both lowland and upland peat[2]. ***Weak Evidence:-*** The effect of managing landscapes to manipulate the water table, can have a number of implications for archaeology, including preservation through re-wetting through to damage caused by mitigation works[3]. Of particular concern are archaeological remains lost or damaged through drying of peat or through the cultivation of former peatlands[4].

REGULATING

Climate Regulation: *Strong Evidence:-* There are relatively few studies on greenhouse gas production in restored peat, most studies look at intact or degraded peat or lowland systems[5]. A study tracking restoration of a peatland in the UK by raising the water table showed that pre-restoration it acted as a carbon dioxide (CO_2) source, while two years post-restoration it had returned to being a carbon sink[6]. Methane emissions however are shown to increase when former drained peat agro-ecosystems are returned to natural conditions[7]. Peatland restoration through flooding can lead to the release of high levels of CO_2 and methane (CH_4) from the initial flooding due to the decomposition of organic matter on the surface[8]. The balance of greenhouse gas emissions/sinks is highly dependent on the water table level and management with a study from Germany showing that lowland minerotrophic fen systems released nitrous oxide (N_2O) and CH_4 when water tables were high[9]. It is unclear whether these findings from lowland systems are applicable to upland systems. Lowering or raising the water table level by 5cm can affect the CH_4 emission levels by as much as 30-50% for lowland wet grasslands on peat soils[10], the above-ground biomass of sedges appearing to influence the release of methane by stimulating the transport of CH_4 to the surface[11]. ***Moderate Evidence:-*** A laboratory study confirmed the potential for newly inundated high carbon soils to produce CO_2 and CH_4. It found that flooded peat was relatively inert with regard to greenhouse gas emission but that production can be significantly increased where plant material in the form of roots is present. This has implications for the flooding of vegetated areas[12]. However, there is some evidence that the restoration of forestry-drained peatlands results in less methane than expected due to the poor establishment of methanogens (methane producing micro-organisms) even 10-12 years following restoration[13].

Flood Control: *Moderate Evidence:-* A review of the benefits of peatlands for water management in Scotland has shown that undrained mires are most beneficial for delaying storm run-off[14]. The study does not establish what happens when previously drained mires are returned to their natural state. Data on water tables at restored peat sites in Northern England suggest that restored sites are intermediate between drained and intact sites but that water table dynamics (and hence flood alleviation) are unpredictable[15].

REGULATING

Water Quality: ***Strong Evidence:-*** Drains through peatlands in Northern England that had been blocked either naturally or artificially to restore peatland vegetation and hydrological function resulted in a reduction in suspended sediment compared with unblocked drains[16]. Blocked drains on UK peatlands also had 28% less dissolved organic carbon and hence less water discolouration than unblocked drains, though the effect was highly site dependent, with some sites showing no difference between blocked and unblocked drains[17]. Re-wetting of peat can cause mobilisation of pollutants from the upper degraded peat layers. Phosphorus can be mobilised through re-wetting, though the extent depends on the level of peat degradation and the amount of iron (Fe), the more iron, the less phosphorus is mobilised[18]. In Germany, a re-wetted peatland showed seasonal variations in nitrogen and phosphorus balances, but overall, the peatland retained inorganic nitrogen but exported organic nitrogen and phosphate[19]. Re-wetting degraded peat can also mobilise other pollutants such as arsenic, deposited during the UK industrial revolution[20], and bromide[21]. ***Moderate Evidence :-*** A modelling approach to phosphorus leaching from re-wet peat in Germany established that there was little danger of water quality deterioration from phosphorus mobilisation[22]. The actual link between re-wetting of degraded peat and phosphorus loss into run-off may be due to the higher levels of microbial cycling in degraded peat, the higher the levels of degradation, the greater the phosphorus loss[23].

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