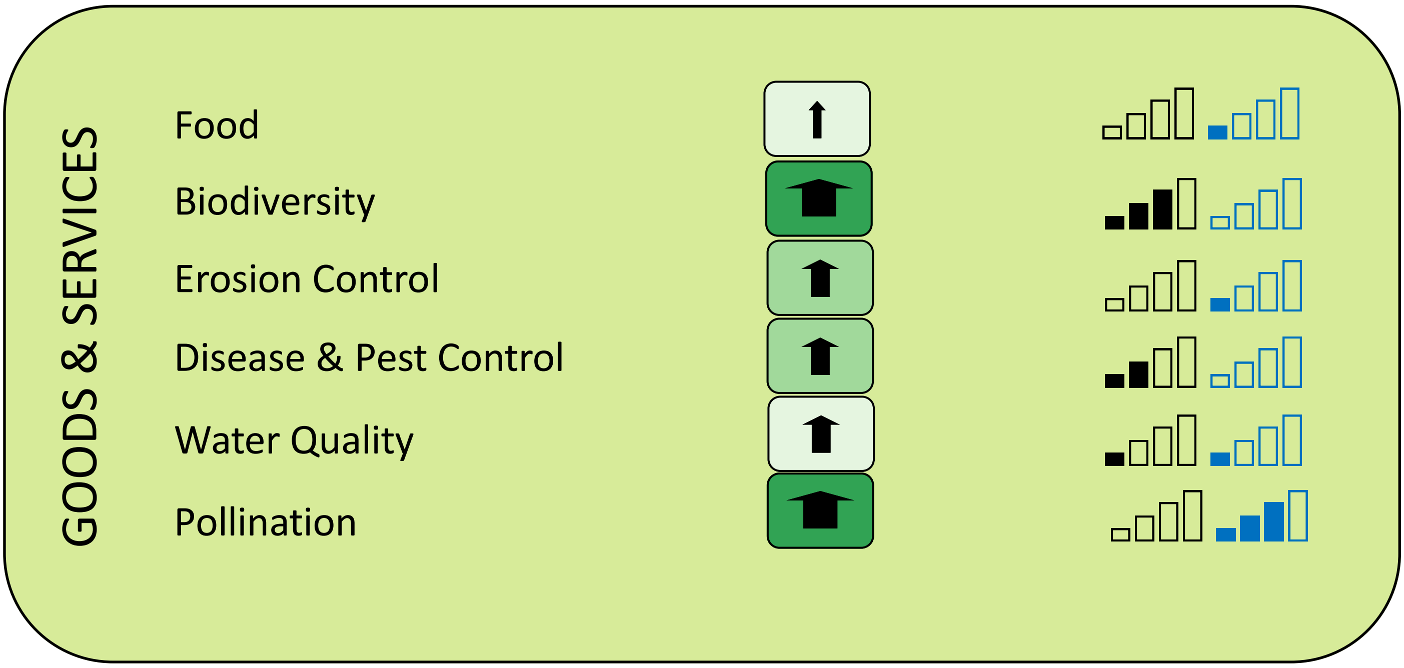
MANAGING ECOSYSTEM SERVICES

LOWLAND AGRICULTURE

CREATE BUFFER ZONES

Create and manage zones between agriculture and other habitats.



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.

KEY

Quality of Evidence

Good

Medium

Poor

Quantity of Evidence

Number of sources showing direct evi-

Number of sources showing indirect evidence

Magnitude and Direction of Effect

Direction

Magnitude

Strong

Medium

Low

MANAGING ECOSYSTEM SERVICES

LOWLAND AGRICULTURE

CREATE BUFFER ZONES

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: ***Weak Evidence:-*** In France, sown grass strips on field margins were shown to reduce ingress of weed species into arable crops[1]. The benefits to food production were not demonstrated.

CULTURAL

Biodiversity: *Strong Evidence:-* The benefits to farmland birds of different types of field margin management were investigated in the UK[2]. While game cover crops and rotational set-aside provided the best seed supply, other types of managed strips could also benefit birds, and even low diversity strips could benefit birds in intensively farmed areas. A different study in the UK also found that game cover crops close to hedges were favoured by farmland birds, though maize was not used by many species[3]. Beetle assemblages were analysed with respect to the vegetation structure and species composition of field margins in England[4]. Tussock grasses and forbs would be expected to produce the most resources for beetles, but for regional diversity, a range of planting schemes was suggested. In addition, the management of UK field margins through fencing from grazing and reduction in fertilizer application could lead to a 60% increase in invertebrate biomass[5]. Field margins in the UK that received either no management or a single July silage cut were found to have the highest abundance and species richness of beetles[6]. Such field margins can host a range of beetles of conservation concern[7]. Arthropod abundance is greater in UK field margins than in the crop but lower than in the hedge itself[8]. Colonisation is usually within 11-15 months of the sowing of the field margin. Scarification can significantly reduce the levels of soil invertebrates in UK field margins, bringing levels of invertebrates close that that in the field itself[9]. In contrast, a UK study found that scarification was highly beneficial for the introduction of wild flowers, and, in combination with a graminicide herbicide, could increase both wildflower diversity and butterfly diversity[10]. A Danish study looked at the effects of buffer width on plant diversity[11]. It found that very large buffer zones (up to 24m wide) were required to maximise species diversity.

CULTURAL

Biodiversity: *Strong Evidence:-* In the UK, the effects of 6m wide buffer strips were investigates with regard to their effects on plants, bees and orthopterans[12]. Not only did the strips themselves have a positive effect on diversity, but they also boosted the diversity of the pre-existing field boundary, probably reflecting the buffering effect. There were no beneficial effects shown for bird numbers, spiders or beetles. In contrast, in France, a sown strip did not appear to effect the diversity of the boundary and so did not act as a buffer from the field[1]. A study from North Yorkshire, UK found clear evidence that sown field margins were preferred to cropped margins, with double the number of invertebrates of similar areas that were cropped to the edge[13]. Sown wildflower margins attracted more nectar and pollen feeding invertebrates.

REGULATING

Erosion Control: *Strong Evidence:-* Purposefully constructed small field wetlands can trap considerable quantities of sediment and are especially important during periods of high rainfall when soil is bare[14,15]. ***Weak Evidence:-*** A review of buffer strips in Northern Europe using arable fields buffered by grassland, short rotation forestry or coppice and undisturbed vegetation suggested a range of benefits, including the reduction in erosion via increased infiltration, sediment trapping and the stabilising effects of roots[16].

Disease and Pest Control: *Strong Evidence:-* The influence of grass buffer strips on cereal aphid numbers was examined in a study in England[17]. Levels of control were positively related to the proportions of linear grass margins, with natural predators of aphids achieving 87% control after 14 days. The links between management regime and pernicious weed species was investigated in a UK study[18]. Annual scarification can enable desirable annuals and sown perennial species to coexist but can also promote pernicious weeds. Sown grass strips adjacent to hedges at farms in Wiltshire were found to reduce the abundance of a range of pernicious weed species and their potential ingress into the crop[19]. A similar effect was found in a study in France[1]. ***Moderate Evidence:-*** A modelling approach in France suggested that grass margins were important for predators such as the beetle *Pterostichus melanarius* for biological control of pests[20].

Water Quality: *Moderate Evidence:-* A European-wide review of the functioning of buffer strips suggests that they have an important role in reducing erosion and diffuse pollution from arable fields[2]. A model of phosphorus transport from arable fields in England found that the installation of buffer zones (as well as constructed wetlands) would cost £3-£5 for every kg of phosphorus saved from run-off[21]. The effectiveness of grassed buffer strips for the removal of nitrates depends on the residence time of run-off within the strip and the lack of any other preferential bypass flow paths[22].

Pollination: *Strong Evidence:-* Five different field margin treatments were investigated in the UK with regard to the benefits to pollinators[23]. Field margins sown with a grass and wildflower mix had the highest bumblebee abundance. Unsown natural regeneration attracted bees only in the second year.

REGULATING

Pollination: ***Strong Evidence (continued):-*** Legume-based 'pollen and nectar flower' mixes quickly provides a foraging resource for bumblebees and can maintain a long season of food availability to pollinators in this UK study[24]. Grass mixes were much less effective. Uncropped field margins in the UK are also of benefit to non-pest butterflies[25]. This effect is found in both organic and non-organic farms with more butterflies found over uncropped field margins than crop edges[26]. In a UK study, significantly more bumblebees visited a naturally regenerated field margin than a cropped field margins managed as conservation headlands[27]. Bumblebees tended to prefer different plant species to honeybees so the species composition of the field margin is important for pollinator diversity. The presence of weed species within sunflower fields in the Netherlands and Belgium was found to be important for maintaining pollinator numbers[28]. Small patches of sown bee forage (0.25 ha) were had greater densities of some pollinators than other patches (1 ha) in a UK study and were shown to be more beneficial in areas of more homogenous intensively farmed areas[29]. Different management regimes of sown field margins in the UK benefits different species[30]. Stopping fertilization, reducing cutting frequency and not grazing benefits butterflies, while bumblebees requires the sowing of flower-rich mixtures. Intensive management is required to maximise pollinator numbers in UK arable systems with cutting of half the margin in may or early June to extending the flowering season followed by an autumn cut of the whole patch[31]. ***Moderate Evidence:-*** A study from North Yorkshire found that margins sown with wildflowers attracted more flying insects such as butterflies, bumblebees and pollen beetles[16]. Bee numbers were also lower in the centre of fields without a 6m wide buffer strip in a study in Southern England[13]. In Hertfordshire, England, a range of different plant species were investigated as potential sources of pollinator forage[32]. Sequential sowings were found to provide forage from early summer to late autumn after the crops had finished and other food was scarce. A model suggests that the maintenance of small parcels of pollinator habitat on farms is better than fewer larger but more widely spaced parcels[33].

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