4 Services provided by nature

4.1 This section provides evidence about the different services provided by nature. Specific services may be of interest to different policy makers and practitioners, so you may choose to focus just on those. Alternatively, you may be interested in overarching themes such as economic competitiveness, so **Chapter 2** and **Chapter 3** may be useful in identifying how the environment contributes to those themes.

4.2 It is important to note that not all services provided by nature are included here. The ones chosen are the ones which on the basis of current evidence are most important in the context of environmental projects. The ones selected are also those for which we have available scientific and economic evidence.

4h Pest control

A limited amount of evidence suggests that natural predators can be effective pest control on agricultural crops, however there are limitations to this approach.

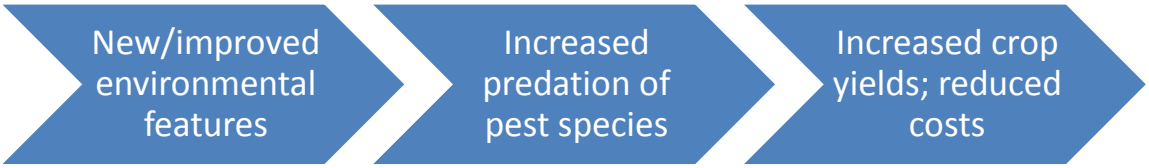
Introduction

4.45 An important part of farming is controlling unwanted pests which can damage crops and reduce yields. Traditionally this is done by means of the application of pesticides, which commonly kill beneficial invertebrates as well as the target pest species. Crop protection costs can vary between £94 and £592 per hectare, or between 23 and 45 per cent of all variable costs (Department for Environment Food and Rural Affairs 2013). Besides the cost, pesticides can have a range of negative environmental and human health impacts if incorrectly applied (Health and Safety Executive 2014). The risk of this occurring is lower in small scale protected cropping systems, such as poly-tunnels for soft fruit.

4.46 Integrated Pest Management (IPM) is a broad approach encompassing the use of threshold levels to determine when pests require control, monitoring of pest numbers, prevention of pests through techniques such as crop rotation, and biological control through the application of predator species (such as ladybirds). This approach can be effective in protected cropping systems where conditions can be tightly controlled and introduced predator species can be contained. This is more problematic for field crops (Centre for Alternative Land Use 2011).

4.47 Beneficial natural predator species can be encouraged through the provision of shelter, alternative prey, flower-rich habitat and an appropriate environment (Holland and Ellis 2008), particularly grassy habitats such as field margins (Holland, Storkey et al. 2014).

Theory of change



Can the benefit be quantified?

4.48 The benefit can be quantified but is likely to be highly dependent on the specific crop and climate context. This includes factors such as natural predator species present, other prey availability, use of any alternative crop protection measures, and general climate conditions that may affect both predator and prey species. Natural predators cannot be controlled and applied to fields like traditional pesticides, and therefore introduce an element of uncertainty into the farming system. This, combined with risk aversion on the part of farmers, has meant that the encouragement of natural predators as part of a pest control strategy has not been widely adopted (Holland, Oaten et al. 2008), outside of enclosed cropping systems.

How strong is the evidence?

4.49 In some situations, there is good evidence that pest control by natural predators may offer a benefit to agricultural productivity and profitability. To date, the evidence has focused specifically on aphids.

Evidence

- Natural predators were found to remove 99 per cent of aphids from wheat test plots in Dorset and Hampshire, UK. Aerial predators such as flies offered rapid and effective control, whereas crawling predators had a slower and less significant, but complementary impact. The

presence of field margins significantly increased the level of pest control provided by aerial predators (Holland, Oaten et al. 2012)[101].

- Across the UK and Europe, the bird cherry-oat aphid is a common pest on cereal crops. In Sweden, natural control of the bird cherry-oat aphid by ground-dwelling beetles and spiders was found to be responsible for a 303 kg increase in spring barley yields per hectare. This represents a 15 percent yield increase on conventional farms, and a 30 percent increase on organic farms, compared to when no natural predators were present. Natural predators can also reduce the amount of insecticide required to control aphid infestation (Ostman, Ekbom et al. 2003)[102].
- In New Zealand, predation of aphids by natural predators on organic fields was found to be worth on average US$35 per hectare per year in avoided costs, compared to when natural predators were artificially excluded. On conventional fields the contribution of natural predators was found to be insignificant due to the use of pesticides (Sandhu, Wratten et al. 2010)[103].

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[101] The study was conducted using square metre treatment plots within 14 different fields of winter wheat.

[102] It is worth noting that this particular aphid is also a problem in the UK. The authors note that high yield losses might be expected during the conversion from insecticides to biological control, as insecticides will have reduced the population of beneficial natural enemy species.

[103] There was wide variation in the amount of aphid predation between fields, with five out of 15 organic fields not recording enough natural predation to avoid incurring pest control costs. None of the conventional fields recorded enough natural predation to avoid incurring pest control costs.