What works in conservation?

Making recommendations from the best available evidence

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Best Practices workshop, Copenhagen 7 December 2017

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Outline

- Methods of synthesizing evidence
- The Conservation Evidence approach
- An example for natural pest regulation in agriculture
- What is known about pollinators and pollination?

NERC SCIENCE OF THE ENVIRONMENT

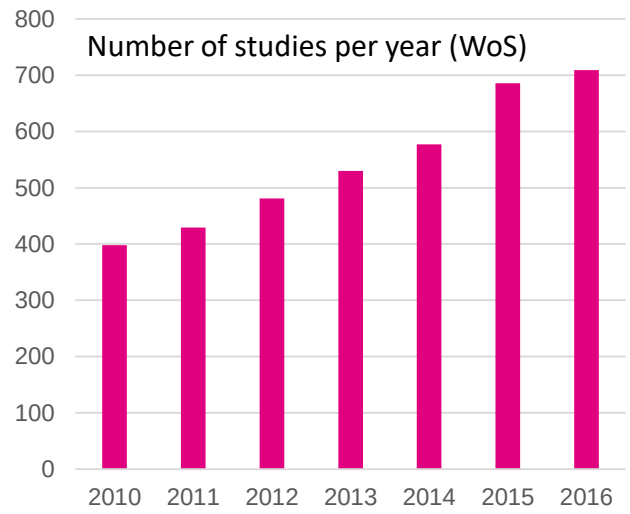
European Commission

Waitrose

The Nature Conservancy

Methods of synthesizing evidence

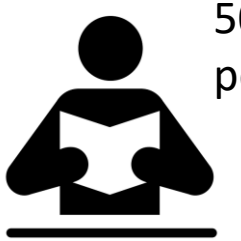
How do agri-environment schemes affect farmland biodiversity?



Topic search Web of Science:

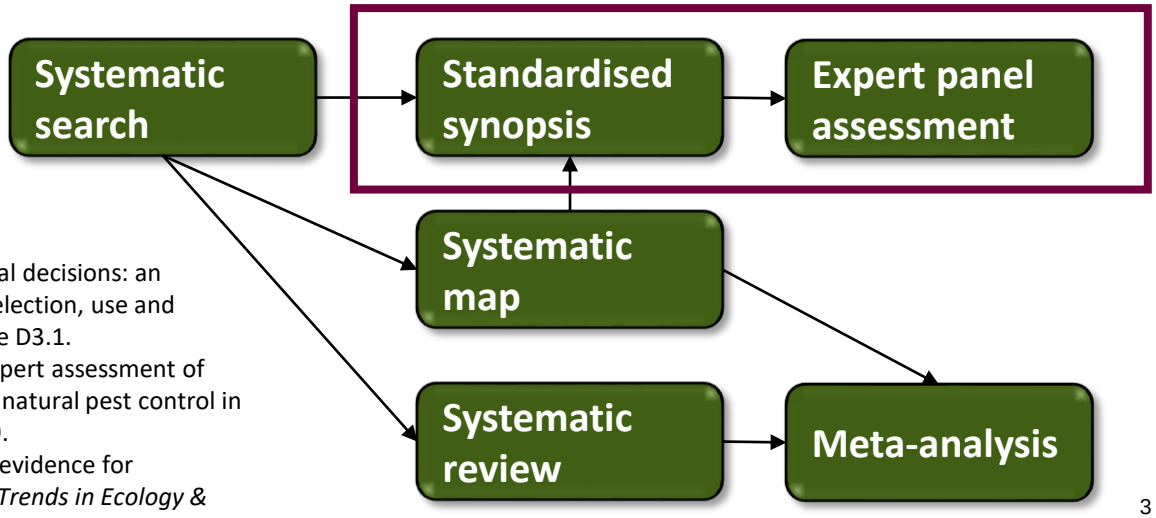
(agriculture OR "greening measure*" OR "agri-environment schemes" OR "agrienvironment schemes)

AND biodiversity



500 papers/year = one person @ 50% FTE

Complex evidence → Simple answer



FIND OUT MORE

- Dicks *et al.* (2017) Knowledge synthesis for environmental decisions: an evaluation of existing methods, and guidance for their selection, use and development – a report from the EKLIPSE project. Eklipse D3.1.
- Dicks *et al.* (2016) What works in conservation? Using expert assessment of summarised evidence to identify practices that enhance natural pest control in agriculture. *Biodiversity and Conservation* **25**: 1383-1399.
- Dicks, L.V., Walsh, J., Sutherland, W.J. (2014) Organising evidence for environmental management decisions: a '4S' hierarchy. *Trends in Ecology & Evolution* 29: 607-613.

www.eklipse-mechanism.eu

The MEG has also produced a report 'Knowledge synthesis on environmental decisions' covering the range of different available methods for knowledge synthesis. The report covers 21 existing methods, together with advice on their selection, use and development.

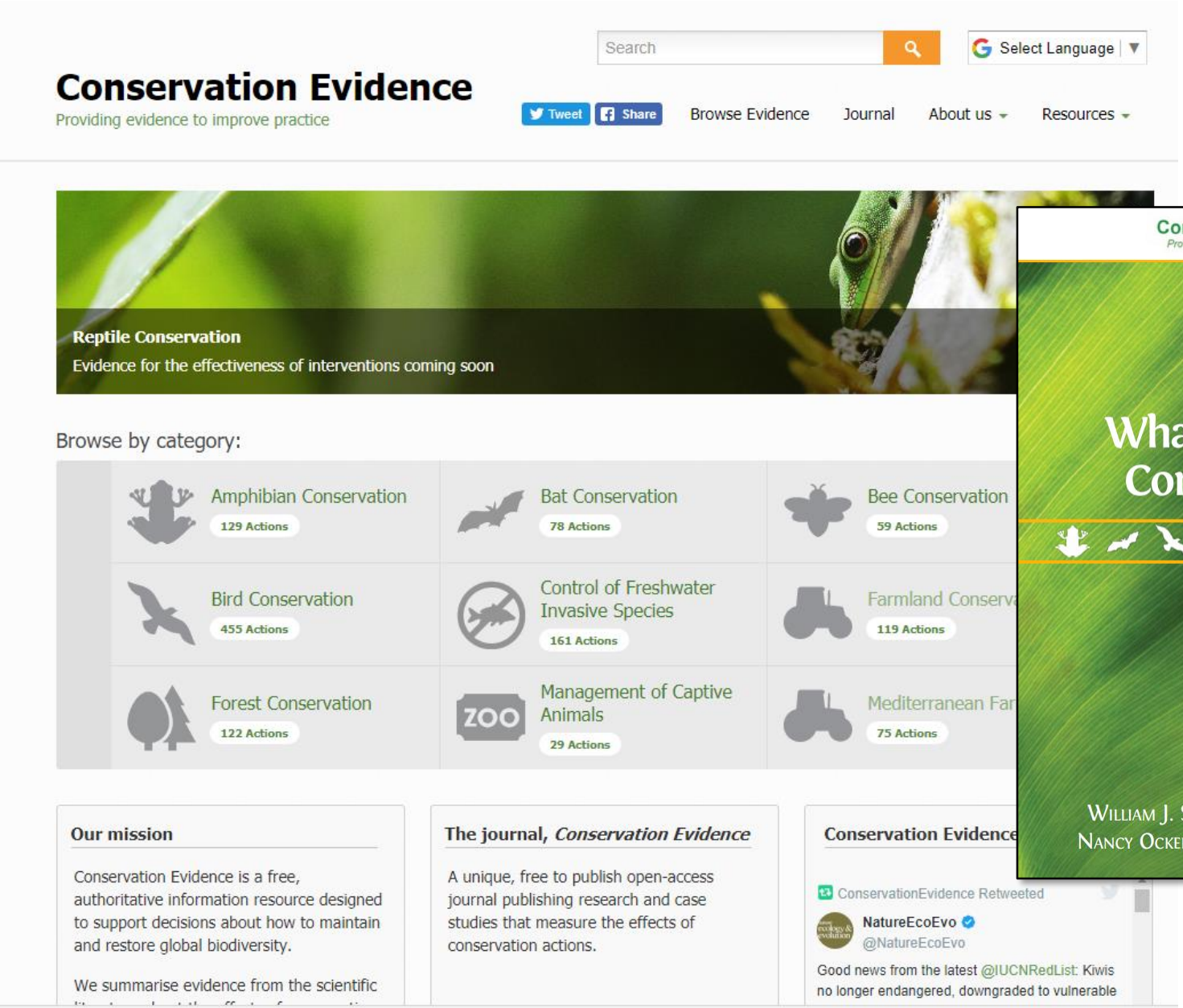
Relatedly, the Group also produced individual methods guidance notes briefly describing each of the 21 methods covered in the report and listing their strengths and weaknesses; they also provide key references and examples of where a method has been used for policy decisions. For the overall context we recommend reading the complete report.

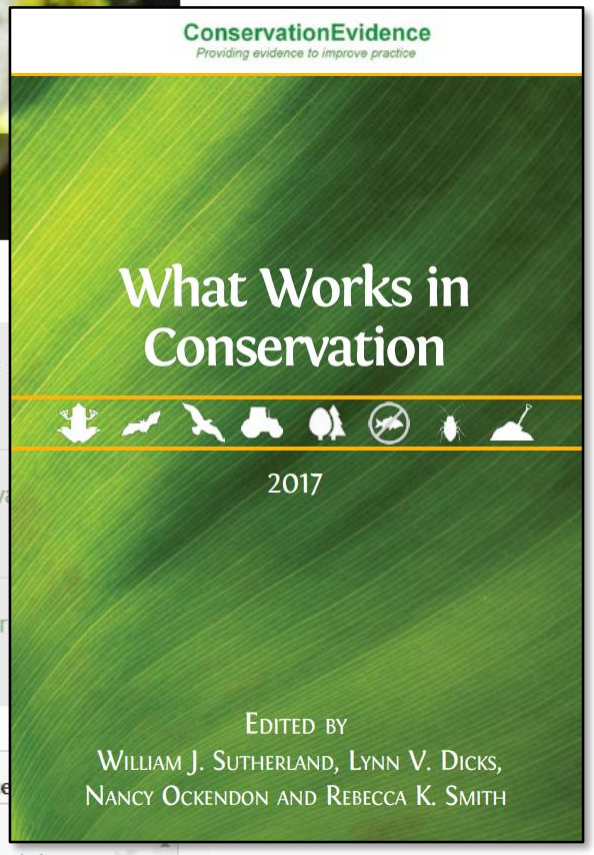
Knowledge synthesis guidance notes

1. Systematic review
2. Solution scanning
3. Synopses and summaries
4. Meta-analysis
5. Rapid evidence assessment
6. Scoping review
7. Systematic map
8. Vote counting
9. Non-systematic literature reviews
10. Expert consultation
11. Multiple expert consultation + Delphi
12. Causal criteria analysis
13. Bayesian belief networks
14. Focus groups
15. Discourse analysis
16. Joint fact finding
17. Scenario analysis
18. Structured decision-making
19. Collaborative adaptive management
20. Participatory mapping
21. Multi criteria decision analysis

EKLIPSE
Knowledge & Learning Mechanism
on Biodiversity & Ecosystem Services

www.conservationevidence.com





What do we know about the CAP greening measures?

Systematic search → Standardised synopsis → Expert panel assessment

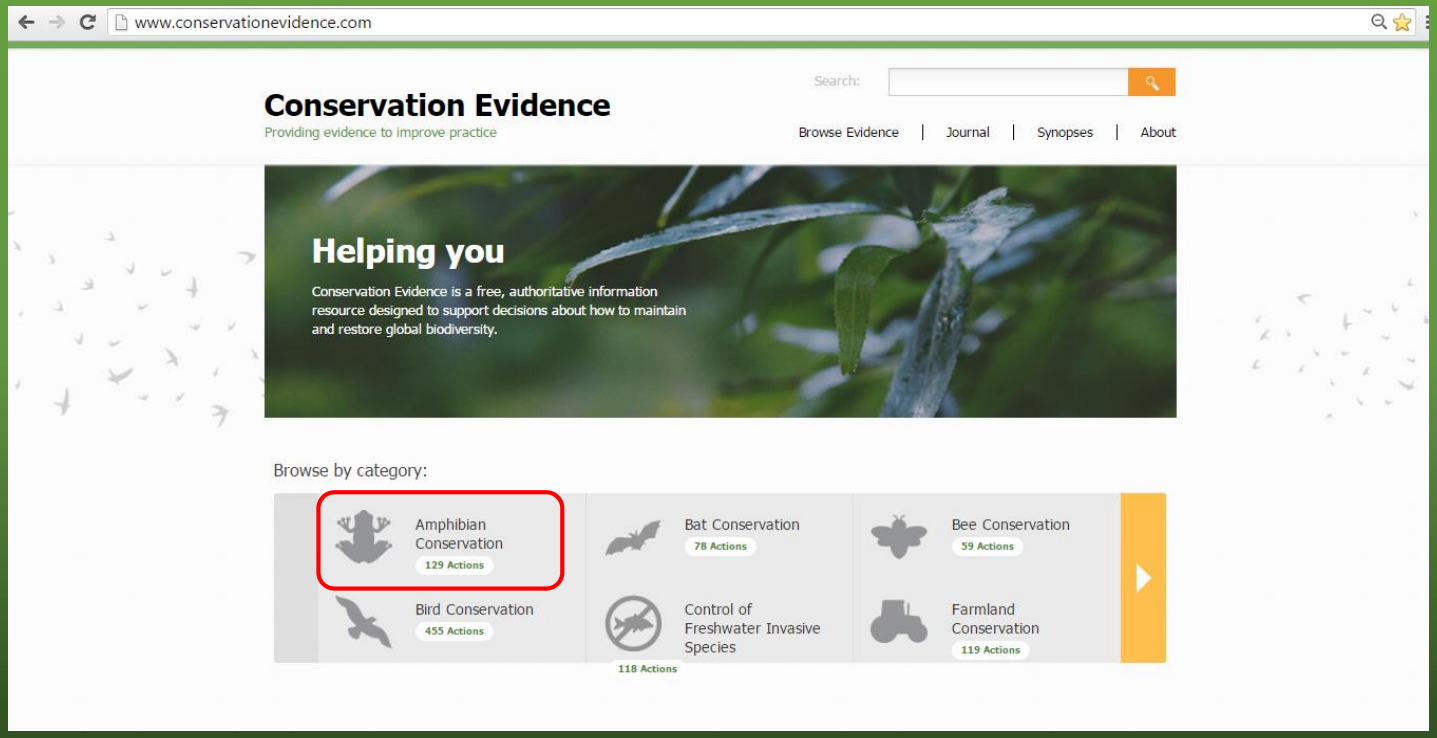
Practices included in greening	Other practices known to work (categorised 'beneficial' by Conservation Evidence)
Increase crop diversity	Create skylark plots
Provide buffer strips on water courses	Restore species-rich grassland
Increase semi-natural habitat in landscape	Mowing techniques to reduce bird mortality
Manage hedges to benefit wildlife	Reduce agri-chemical inputs generally
Grass buffer strips	Plant nectar flower mix/wildflower strips
Provide or retain fallow land (set-aside)	Use organic rather than mineral fertilizers
Create uncultivated margins	Plant wild bird seed cover/mix
	Leave cultivated areas uncropped

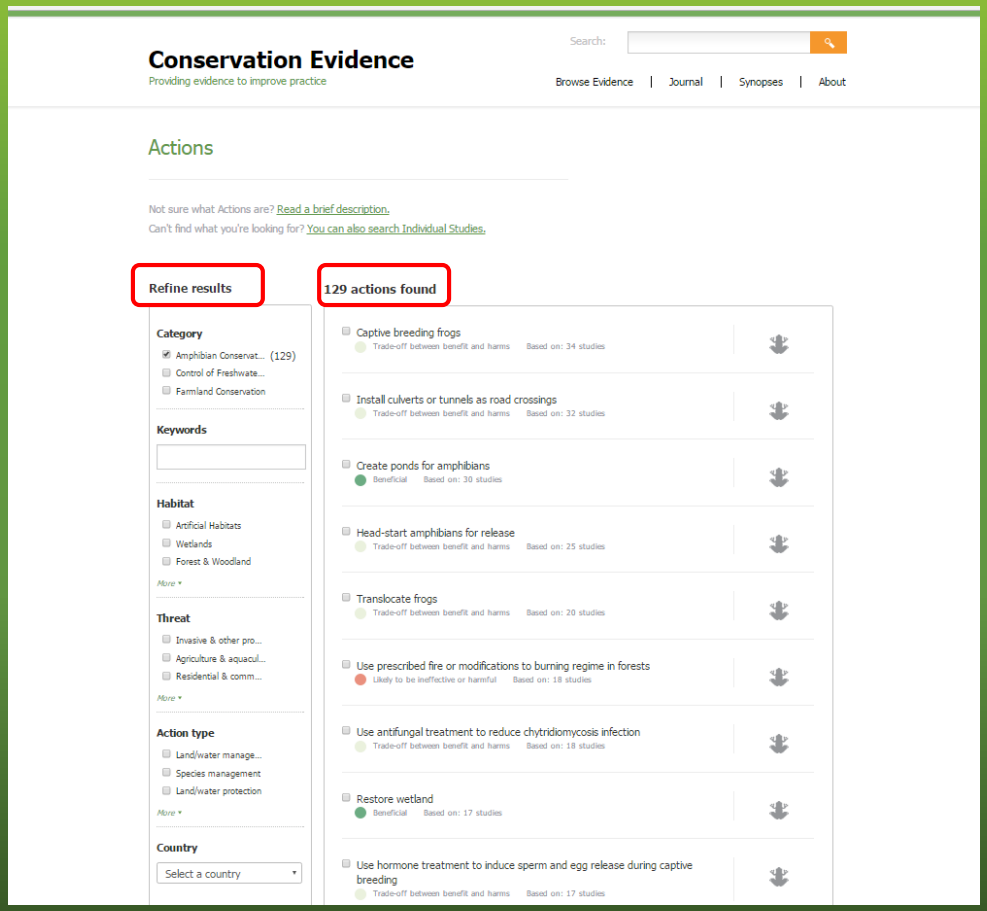
Sources:
Dicks *et al*. (2014) *Conservation Letters* 7, 119-125.
Dicks *et al* (2014) *Farmland Conservation: evidence for the effects of interventions.* Pelagic Pulbishing
www.ConservationEvidence.com

- **Beneficial**
- **Likely to be beneficial**
- **Unknown effectiveness**
- **Likely to be ineffective or harmful**

Using Conservation Evidence

- Search CE website for appropriate studies

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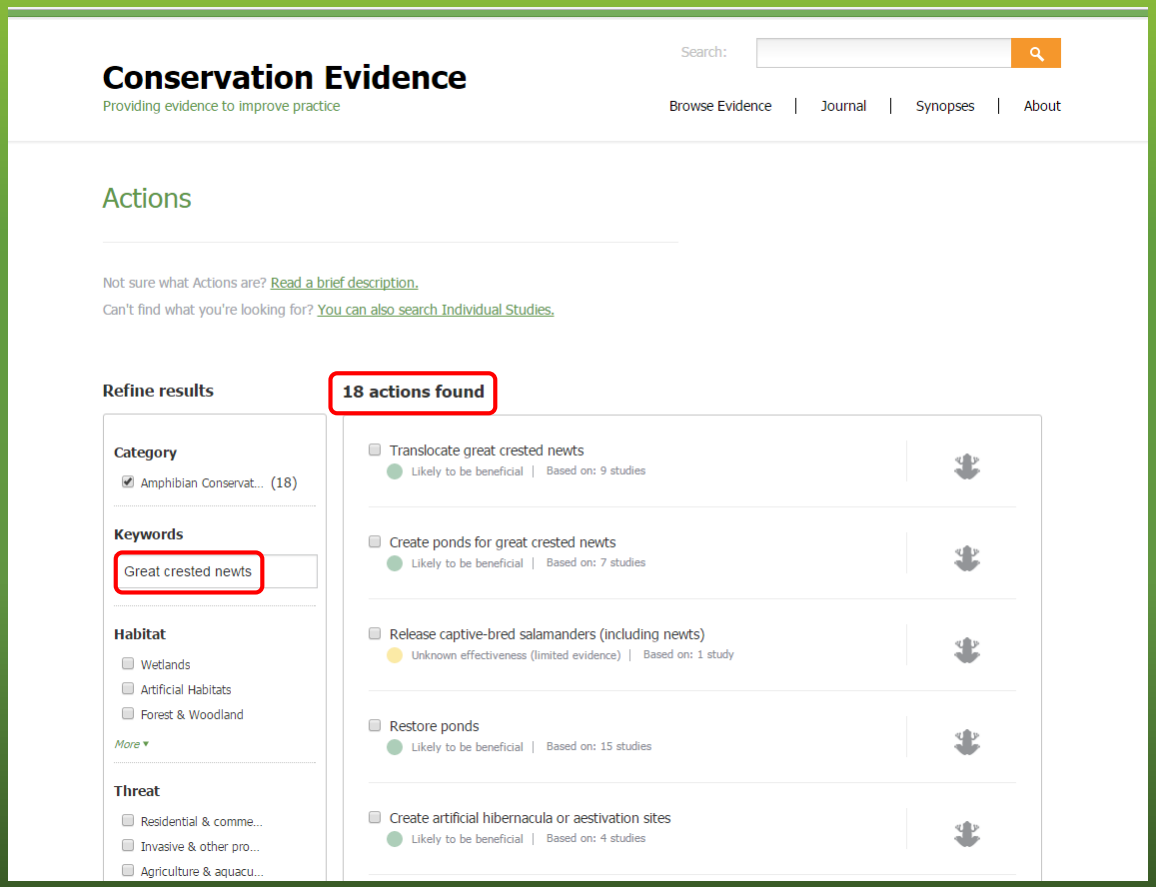
Refine results
129 actions found
Category
Amphibian Conservat... (129)
Control of Freshwate...
Farmland Conservation
Keywords
Habitat
Artificial Habitats
Wetlands
Forest & Woodland
More
Threat
Invasive & other pro...
Agriculture & aquacul...
Residential & comm...
More
Action type
Land/water manage...
Species management
Land/water protection
More
Country
Select a country
Captive breeding frogs
Trade-off between benefit and harms Based on: 34 studies
Install culverts or tunnels as road crossings
Trade-off between benefit and harms Based on: 32 studies
Create ponds for amphibians
Beneficial Based on: 30 studies
Head-start amphibians for release
Trade-off between benefit and harms Based on: 25 studies
Translocate frogs
Trade-off between benefit and harms Based on: 20 studies
Use prescribed fire or modifications to burning regime in forests
Likely to be ineffective or harmful Based on: 18 studies
Use antifungal treatment to reduce chytridiomycosis infection
Trade-off between benefit and harms Based on: 18 studies
Restore wetland
Beneficial Based on: 17 studies
Use hormone treatment to induce sperm and egg release during captive breeding
Trade-off between benefit and harms Based on: 17 studies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Actions
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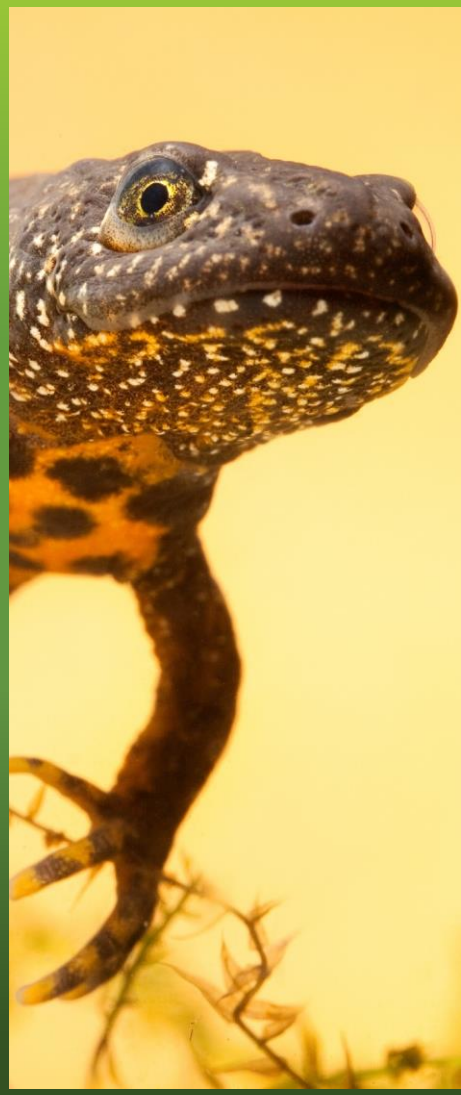
Refine results
18 actions found
Category
Amphibian Conservat... (18)
Keywords
Great crested newts
Habitat
Wetlands
Artificial Habitats
Forest & Woodland
More
Threat
Residential & comme...
Invasive & other pro...
Agriculture & aquacu...
Translocate great crested newts
Likely to be beneficial | Based on: 9 studies
Create ponds for great crested newts
Likely to be beneficial | Based on: 7 studies
Release captive-bred salamanders (including newts)
Unknown effectiveness (limited evidence) | Based on: 1 study
Restore ponds
Likely to be beneficial | Based on: 15 studies
Create artificial hibernacula or aestivation sites
Likely to be beneficial | Based on: 4 studies



Using Conservation Evidence

- Click through to look at evidence

Translocate great crested newts

Key messages

- Four of six studies (including one review and one replicated study) in the UK found that translocated great crested newts maintained or established breeding populations. The review found that populations were present one year after release in 37% of cases and one study found that although translocations maintained a population in the short term, within three years breeding failed in 48% of ponds. One systematic review of 31 great crested newt studies found that there was no conclusive evidence that mitigation that included translocations resulted in self-sustaining populations.
- One review in the UK found that great crested newts reproduced following 56% of translocations, in some cases there was also release of head-started larvae and/or habitat management.

Effectiveness category:
Likely to be beneficial

Effectiveness: 50%

Certainty: 50%

Harms: 10%

From the synopsis...

Amphibian Conservation
View all

Source countries

Supporting evidence

1
A before-and-after study in 1990–1993 of six ponds at an opencast coal site near Manchester, UK (Horton & Branscombe 1994) found that translocated great crested newts *Triturus cristatus* established a breeding population over the first two years. The number of newts captured at the site increased from 473 in 1992 to 892 in 1993 (1,063 released). Between one and 223 metamorphs were caught leaving created ponds and 1–197 leaving existing ponds each year from 1991 to 1993. In 1990–1991, three ponds were created and three others managed for amphibians within a mitigation area for works at the mine. Artificial egg laying substrate (plastic strips) was provided in new ponds. A total of 813 newts in 1991, 250 in 1992 and 625 in 1993 were translocated from mine to conservation ponds. Newts were monitored using drift-fencing with pitfall traps around the ponds and site boundary.

Using Conservation Evidence

- Scroll down

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2
A review of translocation programmes in 1990–1994 for great crested newts *Triturus cristatus* in England, UK (May 1996), extended in later studies (Oldham & Humphries 2000, Edgar, Griffiths & Foster 2005), found that adults returned to ponds in most cases and bred in 61% of translocations monitored. However, longer-term monitoring over 6–18 years showed that 53% of 15 translocations before 1990 failed. In 1990–1994, adults returned in subsequent years in 92% of 92 cases monitored, although newts were already present at 10 ponds. Seventy-two translocations from development sites involved adults (average: 197; total: 13,115), juveniles (57; 914), larvae (32; 501) and many eggs. Twelve translocations involved collecting eggs and rearing and releasing larvae (average: 643) and juveniles (63) for introduction purposes. Habitat enhancement (e.g. log piles, hibernacula, tree planting) was undertaken in 79% of 28 cases where there was partial habitat destruction. Where there was complete habitat destruction, newts tended to be moved to existing sites. Licenses for all translocation projects between 1990 and 1994 were reviewed and 74 licensees contacted for information. Extra monitoring information was obtained for translocations undertaken before 1990.

3
A before-and-after study in 1985–1993 in England, UK (Cooke 2001) found that a new breeding population was established from 38 translocated great crested newts *Triturus cristatus*. Although no newts were observed six years after translocation, *ad hoc* monitoring over the next few years found increasing

Referenced papers

1. Horton P.J. & Branscombe J. (1994) *Case study: Lomax Brow: great crested newt project.* Proceedings of the Conservation and Management of Great Crested Newts, English Nature, Peterborough, 104-110.
2. May R. (1996) The translocation of great crested newts, a protected species. MSc thesis. University of Wales.
3. Cooke A.S. (2001) Translocation of small numbers of crested newts (*Triturus cristatus*) to a relatively large site. *Herpetological Bulletin*, 75, 25-29
4. Edgar P.W., Griffiths R.A. & Foster J.P. (2005) Evaluation of translocation as a tool for mitigating development threats to great crested newts (*Triturus cristatus*) in England, 1990-2001. *Biological Conservation*, 122, 1990-2001
5. Lewis B., Griffiths R.A. & Barrios Y. (2007) Field assessment of great crested newt *Triturus cristatus* mitigation projects in England. Natural England report. Natural England Research Report NERR001.
6. Neave D.W. & Moffat C. (2007) Evidence of amphibian occupation of artificial hibernacula. *Herpetological Bulletin*, 99, 20-22
7. McNeill D.C. (2010) Translocation of a population of great crested newts (*Triturus cristatus*): a Scottish case study. PhD thesis. Department of Ecology & Evolutionary Biology. University of Glasgow.
8. Lewis B. (2012) An evaluation of mitigation actions for great crested newts at development sites. PhD thesis. The Durrell Institute of Conservation and Ecology, University of Kent.
9. Oldham R.S. & Humphries R.N. (2000) Evaluating the success of great crested newt (*Triturus cristatus*) translocation. *Herpetological Journal*, 10, 183-190

Expert assessment process (based on the Delphi process)

10 - 50 experts from research, NGOs and industry

Read summarised evidenc

Score and comment on:

i) Effectiveness of i

ii) Certainty of evid

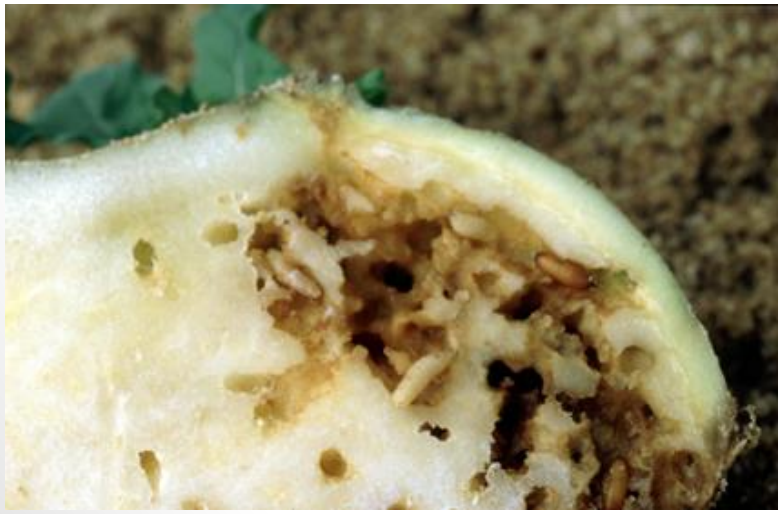
iii) Negative side eff

Two rounds of scoring, cor
Place interventions in cate

Final round of scoring if dis

Mukherjee, N., Hugé, J., Sutherland, W.J., McNeill, J., Van Opstal, M., Dahdouh-Guebas, F., Koedam, N. (2015). The Delphi technique in ecology and biological conservation: applications and guidelines. Methods in Ecology and Evolution 6, 1097-1109.

Natural pest regulation



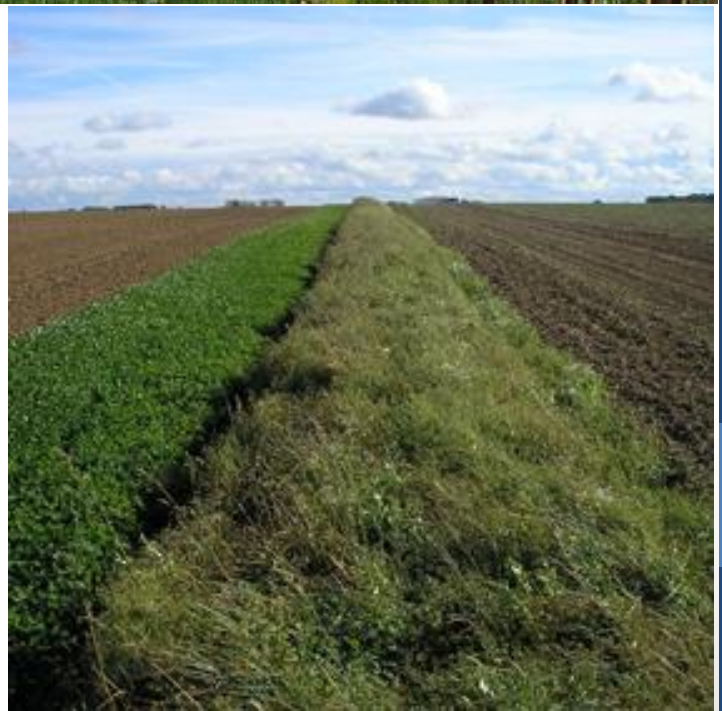
An element of 'Integrated Pest Management'

- Integrated pest management (IPM) is a toolkit of management actions and techniques to control pests, weeds and diseases, and to ensure low pesticide input and/or targeted use to minimise risks to the environment

- One element of IPM is **managing natural ecosystems** to enhance the natural pest control service.

- But what's the best way to do this?

- There are **92** different actions to enhance natural pest control
- We have found **3,947** experimental studies testing their effectiveness



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Synopses

ENHANCING NATURAL PEST CONTROL AS AN ECOSYSTEM SERVICE

Evidence for the effects of selected actions

Wright, H.L., Ashpole, J.E., Dicks, L.V., Hutchison, J. & Sutherland, W.J.

NERC Knowledge Exchange Programme on Sustainable Food Production

NATURAL ENVIRONMENT RESEARCH COUNCIL

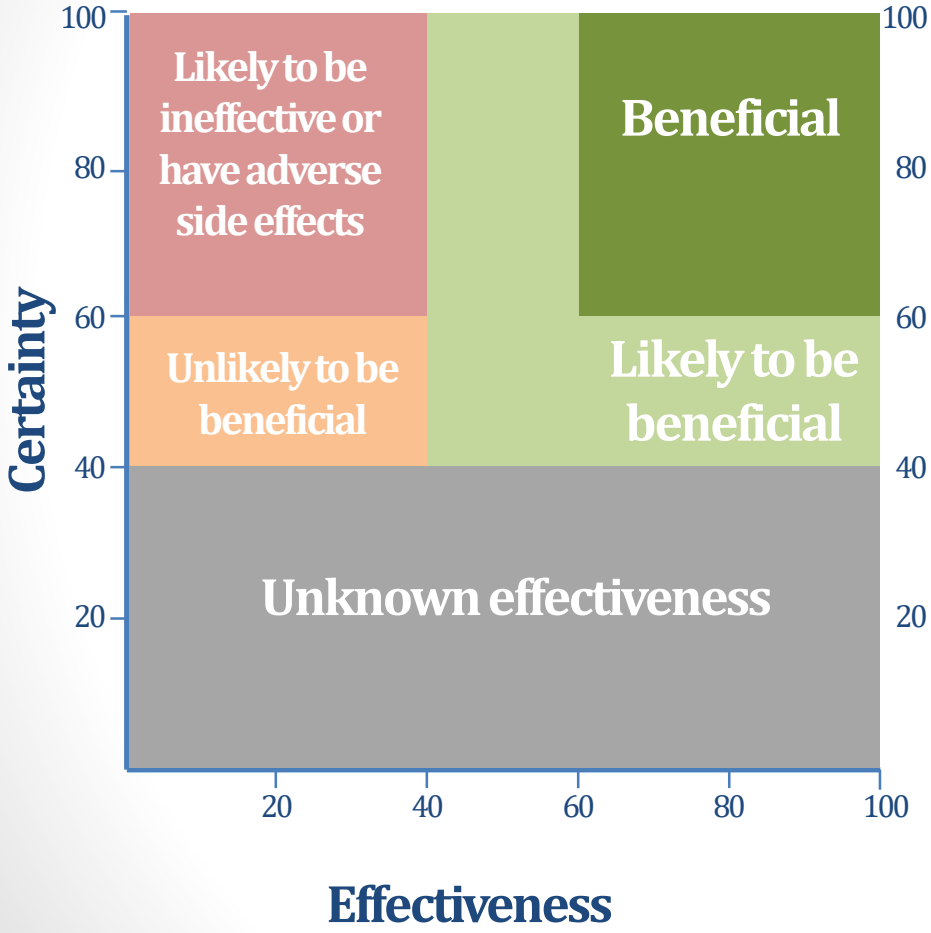
UNIVERSITY OF CAMBRIDGE

1

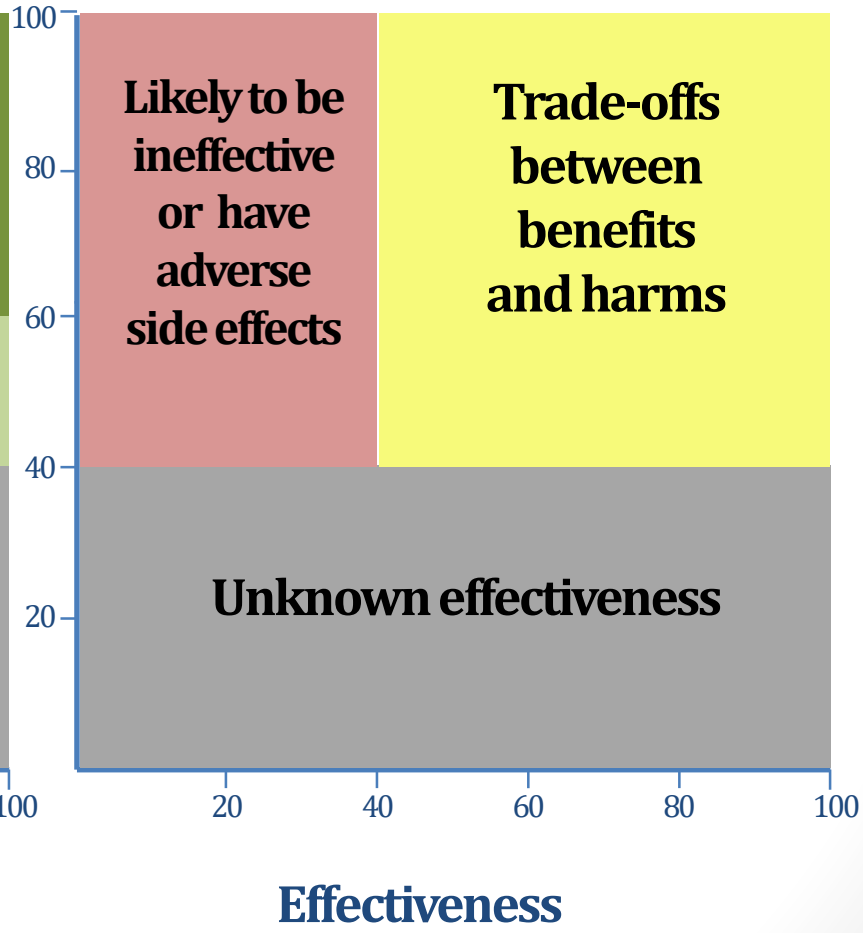
Waitrose

Assigning evidence categories

Without negative side effects (< 20%)



With negative side effects (> 20%)



Outcomes of assessment

Categorisation of practices based on effectiveness in enhancing natural pest regulation	
Beneficial	Combine trap and repellent crops in a push-pull system
Likely to be beneficial	Grow non-crop plants that produce chemicals that attract natural enemies Use chemicals to attract natural enemies Exclude ants that protect pests Grow plants that compete with damaging weeds
Trade-offs	Leave part of the crop or pasture unharvested or uncut Use crop rotation in potato farming systems
Unknown effectiveness	Use pesticides only when pests or crop damage reach threshold levels Incorporate parasitism rates when setting thresholds for insecticide use Alter the timing of insecticide use Delay herbicide use Use alley cropping Plant new hedges Allow natural regeneration of ground cover beneath perennial crops Isolate colonies of beneficial ants Delay mowing or first grazing date on pasture or grassland
Unlikely to be beneficial	Create beetle banks
Likely to be ineffective or to have adverse side-effects	Incorporate plant remains into the soil that produce weed-controlling chemicals Use grazing instead of cutting for pasture or grassland management Use mixed pasture

Source: Dicks *et al.* (2016) What works in conservation? Using expert assessment of summarised evidence to identify practices that enhance natural pest control in agriculture. *Biodiversity and Conservation* **25**: 1383-1399.

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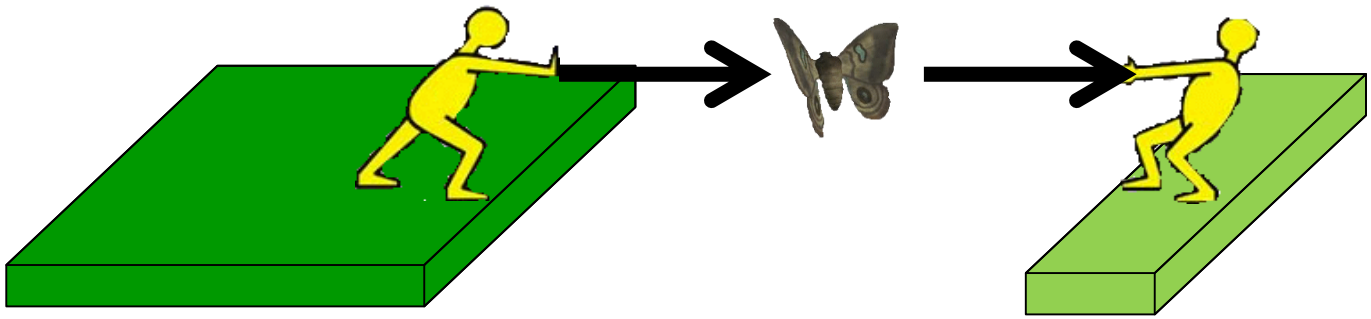
Push-pull system = beneficial

PUSH

from target crop

PULL

in trap crop & control



- Evidence limited to small maize farms in Kenya and South Africa
- Ample scope for more research

Image: ICIPE/Rothamsted Research

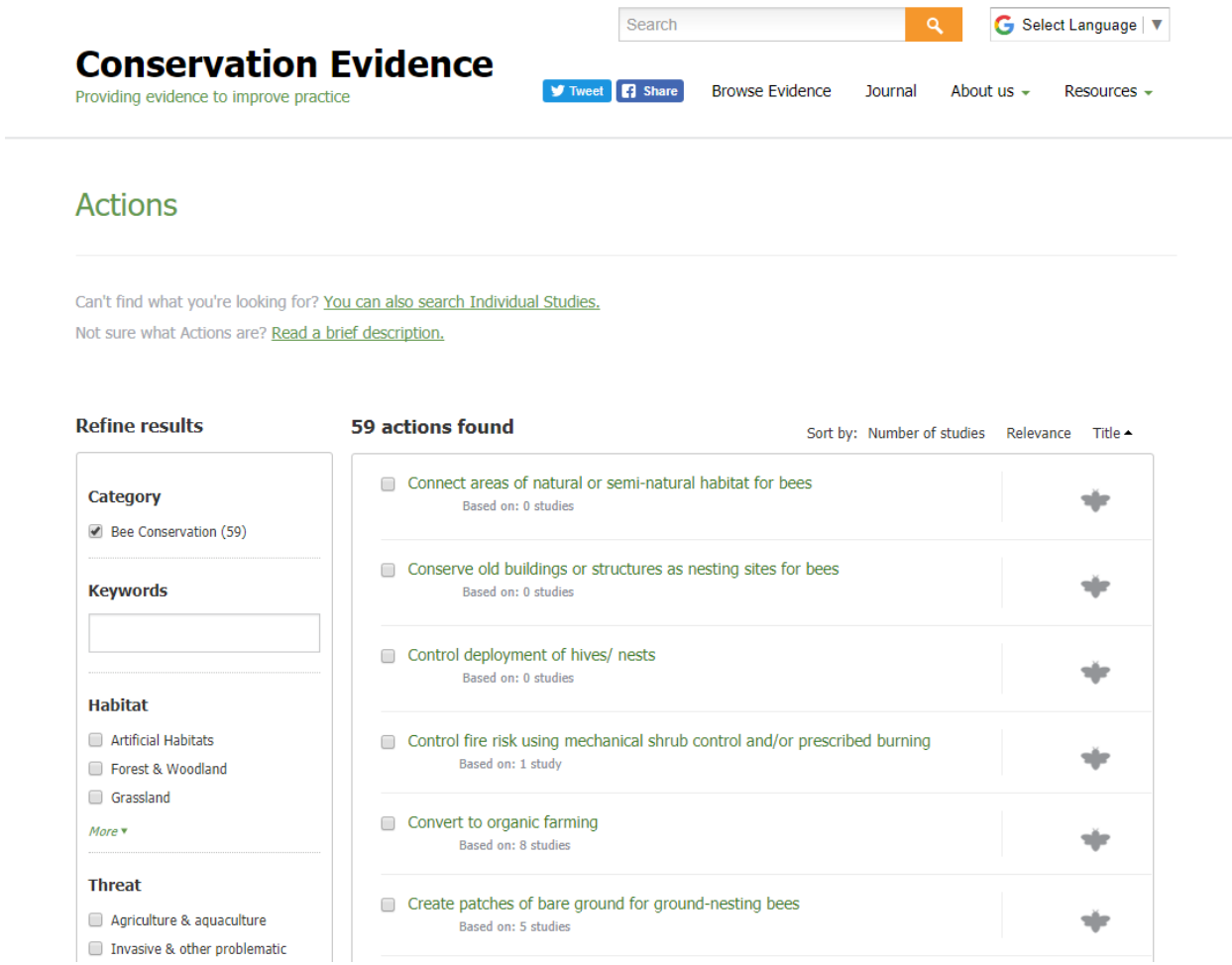
Crop rotation in potatoes = tradeoffs

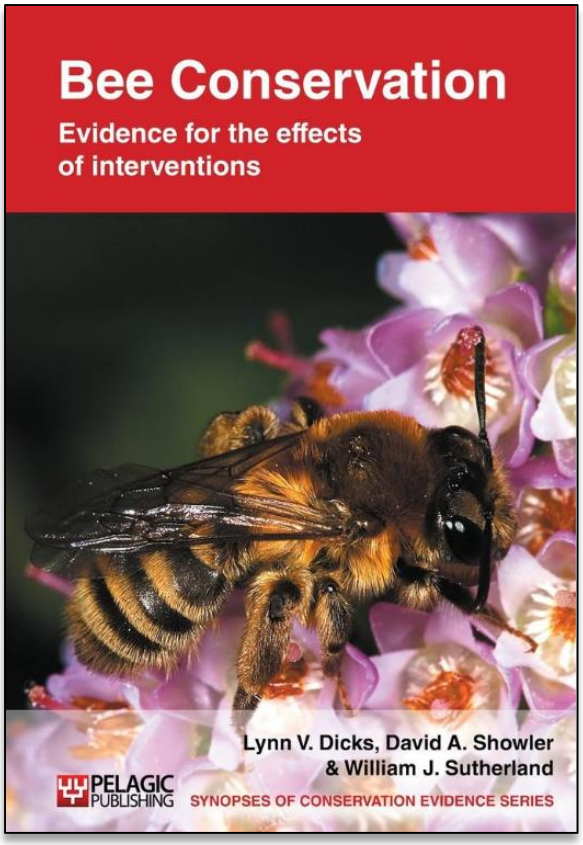
- Effects vary depending on the rotation and pest
- Particularly effective for controlling Colorado potato beetle, less effective for lesion nematodes and diseases
- Some studies show increases in pest species

Beetle banks = unlikely to be beneficial

- Increased natural enemies and reduced pests **shown** in, or close to the banks
- Enhanced pest control **not** shown within crops
- Hedge bottoms harbour more predators (2 UK studies)

What about pollinators and pollination?





Action: Provide artificial nest sites for bumblebees

Key messages

- We have captured 11 replicated trials of bumblebee nest boxes. Several different types of nest box have been shown to be acceptable to bumblebees, including wooden or brick and tile boxes at the ground surface, underground tin, wooden or terracotta boxes and boxes attached to trees.

- Three replicated trials since 1989 in the UK have shown very low uptake rates (0-2.5%) of various nest box designs (not including underground nest boxes), while seven trials in previous decades in the UK, USA or Canada, and one recent trial in the USA, showed overall uptake rates between 10% and 48%.

- Wooden surface or above ground nest boxes of the kind currently marketed for wildlife gardening are not the most effective design. Eight studies test this type of nest box. Five (pre-1978, USA or Canada) find 10-40% occupancy. Three (post-1989, UK) find very low occupancy of 0-1.5%. The four replicated trials that have directly compared wooden surface nest boxes with other types all report that underground, false underground or aerial boxes are more readily occupied.

- Nest boxes entirely buried 5-10 cm underground, with a 30-80 cm long entrance pipe, are generally the most effective. Seven replicated trials in the USA, Canada or the UK have tested underground nest boxes and found between 6% and 58% occupancy.

- We have captured no evidence for the effects of providing nest boxes on bumblebee populations.

Effectiveness category:
Awaiting assessment

Effectiveness: not assessed

Certainty: not assessed

Harms: not assessed

Where has this evidence come from?

Bee Conservation
View all

Click here to see the list of journals searched for this synopsis, and here to see all the journals searched for all synopses.

Source countries

Action: Plant parks and gardens with appropriate flowers

Key messages

Two replicated trials in the USA and Canada have found more wild bees (either more species or more individuals) in gardens planted with bee forage or native plants, relative to conventionally managed gardens. Another USA trial found more bee species after the addition of bee forage plants to a community garden. Three trials in the UK or USA have shown that native flowering plants or bee forage plants are well used by wild bees when planted in gardens. A UK trial demonstrated that some popular non-native or horticulturally modified garden flowers are not frequently visited by insects, despite providing nectar in some cases.

Supporting evidence from individual studies

1

Natural shaped, rather than horticulturally modified varieties of garden plants are recommended for foraging insects. A trial of nearly natural and horticulturally modified varieties of six popular garden plants in the Cambridge University Botanic Gardens, Cambridgeshire, England (Comba et al. 1999a) found that bumblebee visits to hollyhock Alcea rosea and larkspur Consolida sp. were more frequent on natural, single-petalled forms than on horticulturally modified, double-petalled varieties. Bee visits to four of the flower types - nasturtium Tropaeolum majus, pansy Viola x wittrockiana, marigold Tagetes patula and snapdragon Antirrhinum majus were infrequent despite ample nectar provision from some varieties. There was a tendency for wild bees to prefer natural flower shapes in pansy, marigold and snapdragon, but not in nasturtium.

2

A trial of 25 native flowering herb species planted in the Cambridge University Botanic Gardens, UK,

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Awaiting assessment

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Bee Conservation
View all

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Source countries

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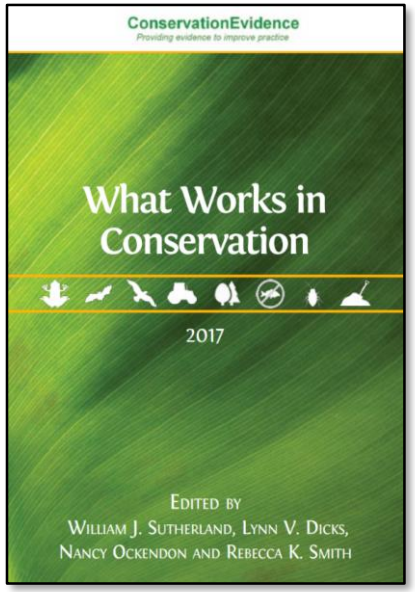
@LynnDicks

Key messages

- A large, complex evidence base can inform management for biodiversity and ecosystem services
- This can be summarised into simple messages
- Local contextual knowledge is still needed to interpret the evidence



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