What works in conservation?
Making recommendations from the best available evidence

Dr Lynn Dicks
University of East Anglia

Best Practices workshop, Copenhagen 7 December 2017
Outline

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

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.
www.ekclipse-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 procured 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
Conservation Evidence
Providing evidence to improve practice

Reptile Conservation
Evidence for the effectiveness of interventions coming soon

Browse by category:
- Amphibian Conservation (139 Actions)
- Bat Conservation (78 Actions)
- Bee Conservation (99 Actions)
- Bird Conservation (455 Actions)
- Control of Freshwater Invasive Species (161 Actions)
- Farmland Conservation (115 Actions)
- Forest Conservation (122 Actions)
- Management of Captive Animals (29 Actions)
- Mediterranean Forests (75 Actions)

Our mission
Conservation Evidence is a free, authoritative information resource designed to support decisions about how to maintain and restore global biodiversity.

We summarise evidence from the scientific literature, reports and grey literature.

The Journal, Conservation Evidence
A unique, free to publish open-access journal publishing research and case studies that measure the effects of conservation actions.

What Works in Conservation
2017

Edited by
William J. Sutherland, Lynn V. Dicks, Nancy Ockendon and Rebecca K. Smith
### What do we know about the CAP greening measures?

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

**Sources:**

www.ConservationEvidence.com
Using Conservation Evidence

- Search CE website for appropriate studies
## Conservation Evidence

**Actions**

Not sure what Actions are? Read a brief description. Can’t find what you’re looking for? You can also search Individual Studies.

#### 129 actions found

<table>
<thead>
<tr>
<th>Action Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Captive breeding frogs</td>
<td>Trickle drip between benefit and harm</td>
</tr>
<tr>
<td>Install culverts or tunnels as road crossings</td>
<td>Trickle drip between benefit and harm</td>
</tr>
<tr>
<td>Create ponds for amphibians</td>
<td>Spillway</td>
</tr>
<tr>
<td>Create habitat for amphibians</td>
<td>Spillway</td>
</tr>
<tr>
<td>Translocate frogs</td>
<td>Spillway</td>
</tr>
<tr>
<td>Use prescribed fire or modifications to burning regime in forests</td>
<td>Native</td>
</tr>
<tr>
<td>Use antifungal treatment to reduce chytridiomycosis infection</td>
<td>Native</td>
</tr>
<tr>
<td>Restore wetland</td>
<td>Native</td>
</tr>
</tbody>
</table>

#### Refine results

- **Category**
  - Amphibian Conservation...
  - Control of Fishwarren...
  - Forward Commutation...

- **Keywords**

- **Habitat**
  - Artificial Habitats...
  - Wetlands...
  - Forest & woodland...

- **Threat**
  - Species & other pre...
  - Agriculture & entom...
  - Residential & conn...

- **Action type**
  - Landwater manage...
  - Species management...
  - Landwater protection...

- **Country**
  - Select a country...
Conservation Evidence

Providing evidence to improve practice

Actions

Not sure what Actions are? Read a brief description.
Can’t find what you’re looking for? You can also search Individual Studies.

18 actions found

Refine results

Category
- Amphibian Conservation (18)

Keywords
- Great crested newts

Habitat
- Wetlands
- Artificial Habitats
- Forest & Woodland
- More *

Threat
- Residential & comm...
- Invasive & other pr...
- Agriculture & aquac...

- 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.

**Supporting evidence**

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

A before-and-after study in 1990–1993 of six ponds at an open cast 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 fences with pitfall traps around the ponds and site boundary.

A before-and-after study in 1985–1993 in England, UK (Cooke, 2001) found that a new breeding population was established from 28 translocated great crested newts Triturus cristatus. Although no newts were observed six years after translocation, further monitoring over the next few years found increasing numbers.

Referenced papers

Expert assessment process (based on the Delphi process)

10 - 50 experts from research, NGOs and industry

Read summarised evidence

Score and comment on:

i) Effectiveness of intervention
ii) Certainty of evidence
iii) Negative side effects

Two rounds of scoring, comments or discussion and rescoring

Place interventions in categories

Final round of scoring if disagreement

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
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
Assigning evidence categories

**Without** negative side effects (< 20%)
- Likely to be ineffective or have adverse side effects
- Unlikely to be beneficial
- Likely to be beneficial
- Unknown effectiveness

**With** negative side effects (> 20%)
- Likely to be ineffective or have adverse side effects
- Trade-offs between benefits and harms
- Unknown effectiveness
### 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 |

## Outcomes of assessment

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

• Evidence limited to small maize farms in Kenya and South Africa

• Ample scope for more 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?

<table>
<thead>
<tr>
<th>Category</th>
<th>59 actions found</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bee Conservation</strong></td>
<td>✅ Connect areas of natural or semi-natural habitat for bees</td>
</tr>
<tr>
<td></td>
<td>Based on: 6 studies</td>
</tr>
<tr>
<td></td>
<td>✅ Conserve old buildings or structures as nesting sites for bees</td>
</tr>
<tr>
<td></td>
<td>Based on: 6 studies</td>
</tr>
<tr>
<td></td>
<td>✅ Control deployment of hives/ nests</td>
</tr>
<tr>
<td></td>
<td>Based on: 6 studies</td>
</tr>
<tr>
<td></td>
<td>✅ Control fire risk using mechanical shrub control and/or prescribed burning</td>
</tr>
<tr>
<td></td>
<td>Based on: 1 study</td>
</tr>
<tr>
<td></td>
<td>✅ Convert to organic farming</td>
</tr>
<tr>
<td></td>
<td>Based on: 8 studies</td>
</tr>
<tr>
<td></td>
<td>✅ Create patches of bare ground for ground-nesting bees</td>
</tr>
<tr>
<td></td>
<td>Based on: 5 studies</td>
</tr>
</tbody>
</table>
**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 16% 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 witrockiana, 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,
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