The importance of field margins and hedgerows for stable and reliable crop pollination services

Global Food Security
Programme Activity: Resilience of the UK's Food System

Crop Pollination

Pollination by wild bees **increases the yields of mass-flowering arable crops**, like field bean and oilseed rape.


© Philip Halling

Wild bees can in turn benefit from the **floral resources** these crops provide

...but they still **need other habitats nearby** to nest in and to forage in when the crop is not in bloom

Crop Rotation

Crop rotation means these mass-flowering crops are grown in **different fields in different years**.

They are usually rotated with **cereal crops**.

Cereals provide **no floral resources** for wild bees

...and bees can only fly a **limited distance from their nest** to look for food.

Variability

Mass-flowering arable crops may get **better pollination service in some fields than in others**, depending on how many bee-supporting habitats are nearby.

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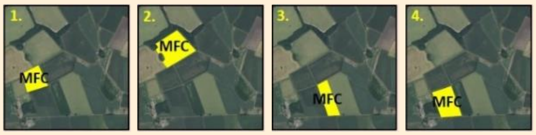
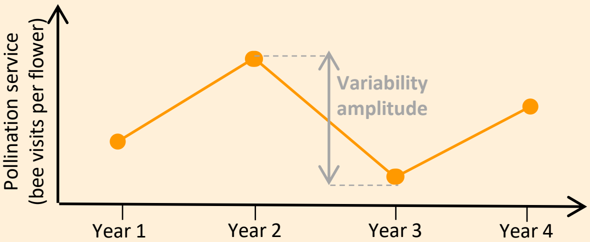
Variability in crop pollination service





The **local bee population** will get a **boost** when mass-flowering arable crops are grown nearby and **dive** when they are grown elsewhere and cereals are grown instead.

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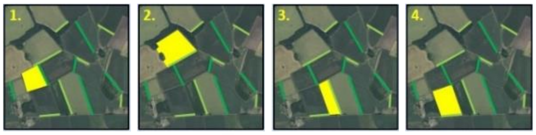
Variability in bee population size

Field Margins and Hedgerows



Introducing generous **field boundary features** can **reduce variability** in both bee population size and pollination service

More field boundary features means:

- more places for bees to **nest**
- more **floral resources to sustain bees** when mass-flowering crops are absent
- **bees are always there** to visit the flowering crop no matter which field it is grown in.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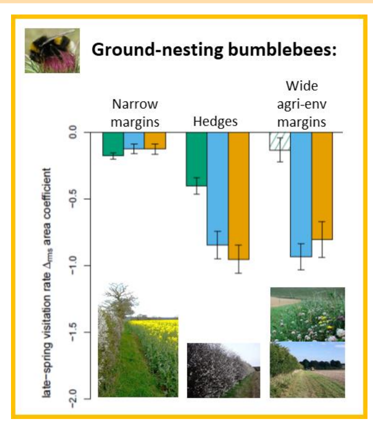
How do we know?

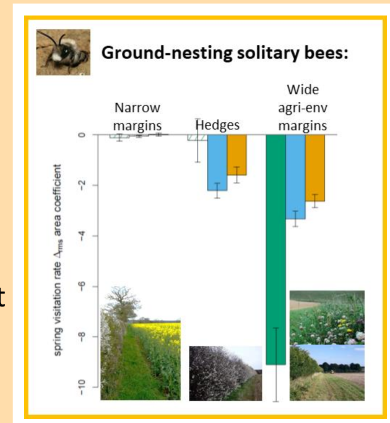
Our methodology:

- Map **117 10km² study landscapes** in England with differing amounts of arable land.
- Assuming a **6-year crop rotation sequence** (cereal-cereal-oilseed-cereal-cereal-field bean), simulate how the crop fields would change over 20 years.
- Use a **state-of-the-art pollinator model** that simulates the foraging and population processes of bees to predict **bee population size** and **pollination service** to **field bean** and **oilseed rape** in each year.
- Compare the results **with and without field boundary features** present in the landscapes, separating the mapped boundary features into three types:
  1. standard **narrow grassy margins** (1m wide), 2. **hedgerows**, 3. **wide agri-environment margins** (4m).



Results:

- **Significant decreases in variability** in **bee population size** and **pollination service** when boundary features are present.
- Level of stabilisation depends on **bee life-history and mobility** and **type of boundary feature**.
- **Mobile, long-lived bumblebees** can benefit from all tested boundary feature types.
- Wider features needed to stabilise the **less mobile and shorter-lived solitary bees**.



Maximising the stabilising benefits of field boundary features

1. **Combine multiple boundary features**.
   Different features provide stabilising benefits in different seasons.

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2. **Incorporate some larger permanent patches of semi-natural habitat**
   Necessary for stabilising less-mobile solitary bees.

3. **Increase number of boundary features** and **reduce distance between them**, where possible.
   Match spacing to foraging and dispersal range (~100-1800m) to stablise populations and service.

4. **Rotate mass-flowering arable crops through adjacent fields**, where possible.
   Better enables populations of more mobile species to follow the crop around the farmscape.

5. **Synchronise boundary feature management with crop rotation**.

e.g. ***Time hedge cutting*** *so that hedgerow is at peak flowering and boosting bee population in the year that the mass-flowering crop arrives in the field.*

e.g. ***Re-sow flower margins*** *for peak flowering when mass-flowering crop is absent from field.*

Article QR code

Photos © Nigel Mykura, Ian Calderwood, Maigheach-gheal, David Wright, Steven Falk and Tristan Bantock (www.bwars.com)

For more details, see: Gardner et al. (2021) Field boundary features can stabilise bee populations and the pollination of mass-flowering crops in rotational systems. *Journal of Applied Ecology* . https://doi.org/10.1111/1365-2664.13948

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