Inventorying and monitoring crop pollinating bees: Evaluating the effectiveness of common sampling methods.

***Background**:* Documented bee declines, notably in agricultural landscapes, threaten future food security. Yet, evaluations of methods to inventory and monitor bees are rarely carried out in different crops or focus specifically upon crop pollinating species.

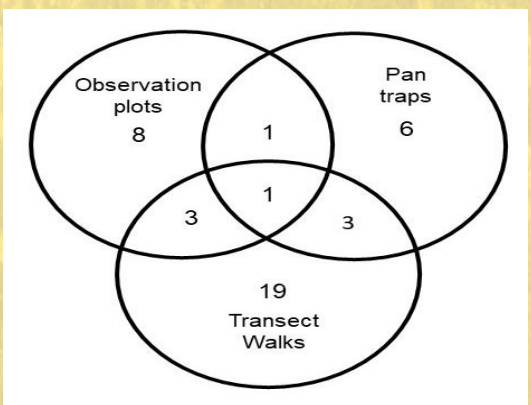
Aim and Objectives: Using Great Britain as a case study, and apples, field beans, oilseed rape and strawberries as focal crops we:

(i) Investigated the frequency with which passive & active methods are used to survey crop pollinators in the wider literature.
(ii) Compared the abundance, richness and proportion of crop pollinating bee species detected by observation plots, pan traps, transect walks.
(iii) Assessed the similarity of crop pollinator species communities sampled by active and passive methods, and evaluated to what degree body size and trap colour influences detection rates.

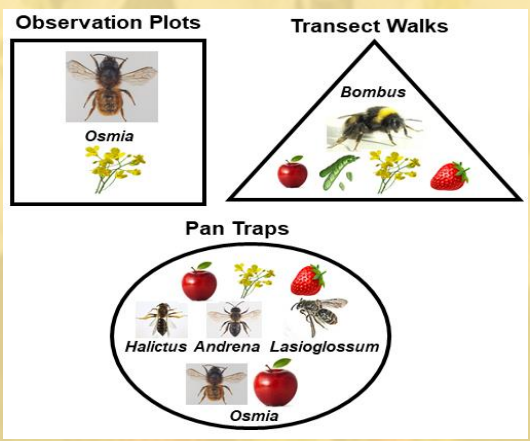
We consider how this information could be used to inform protocols to effectively sample and monitor the bee communities of crops.

Key Findings:

- Transect walks are the most common survey method used to sample bee crop pollinators, but they often record larger species (i.e., Bumblebees) and miss smaller solitary species.
- Crop type is likely an important determinant of the most suitable survey methods to sample bee pollinator communities.
- Our results indicate that the most efficient methods to sample bee species in agricultural landscapes is dependent upon crop type and pollinator community composition.



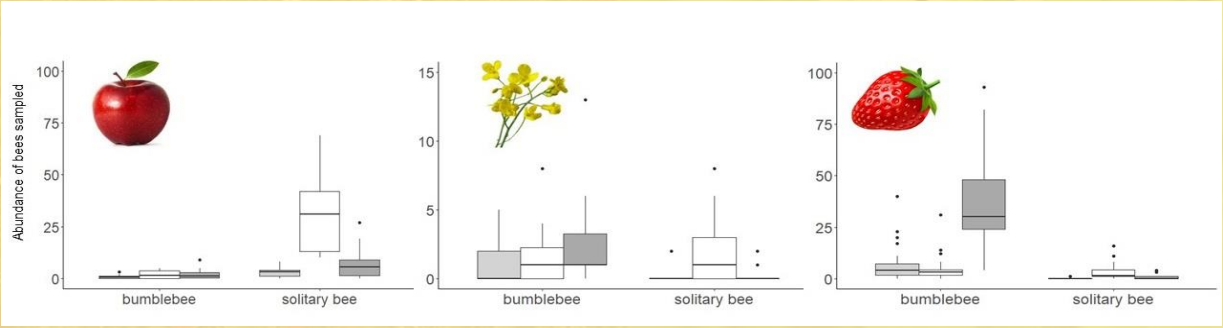
Number of studies that used each sampling method, or a combination of methods to sample bee communities in the wider literature.



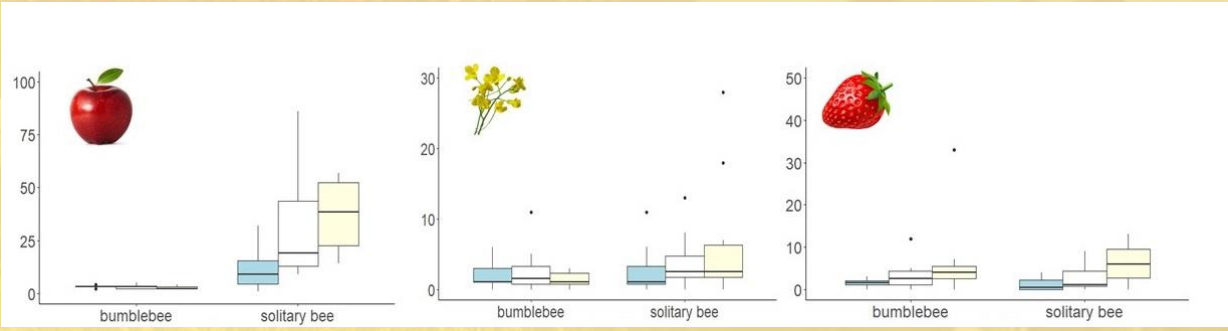
Which survey method sampled the greatest abundance & species richness of different genera per crop in our datasets

Results:

- There was a significant dissimilarity between the species communities sampled by transect walks and pan traps in all crops.
- Pan traps sampled a greater proportion of the total bee pollinators in all crop sites, except bean, where more species were sampled by transect walks.
- Bumblebees were sampled most frequently by transect walks. Solitary bees were sampled more often by pan traps.



- Blue & white pan traps caught the most Bumblebees. Yellow ones caught the highest number of solitary bees.



Recommendations:

- Transect walks alone are sufficient to monitor bee species in crops which are almost exclusively bumblebee pollinated.
- Pan traps, and potentially observation plots, should be considered for surveys of crops for which solitary bees are important pollinators.
- Visual surveys may benefit from employing separate searches for bumblebees and solitary species, to reduce the chances of smaller species being missed.

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