

A bee's eye view of landscape change

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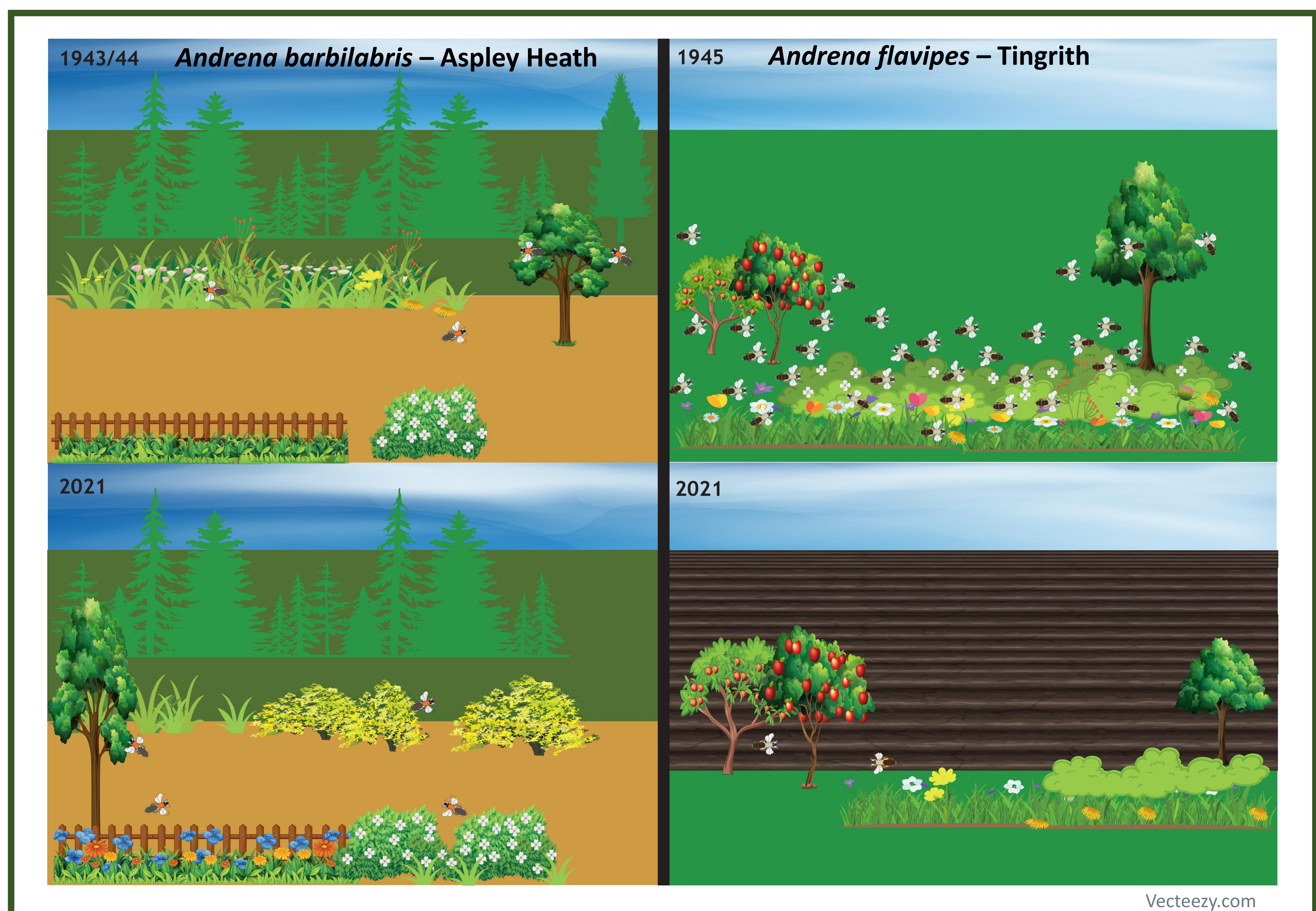
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Background

Pollinator declines are linked to landscape change affecting availability of floral resources ¹ yet little is known about how solitary bees respond to landscape change, despite evidence of their importance in pollinator systems ². Historic pollen records for Bedfordshire ³, gave a unique opportunity to analyse changes in the diet of two species of *Andrena* bees, from the same sites almost 80 years apart; and to examine potential links between landscape change and the bees' diets. It was expected that our work would show similar results to a previous study ⁴ with no overall change in diet breadth, but show similar changes in proportions of different pollens in the diet.

Methods

In 2021, sites visited during the 1940s were revisited and pollen collected from two species of solitary bee (*Andrena flavipes* and *A. barbilabris*). Both bees take a wide range of pollen and are thought to have foraging ranges of less than 300m. ⁵ To provide a direct comparison, pollen was collected and identified using Chambers' methods ⁶. Unpublished data on pollen samples from the 1940s were obtained from Chambers' notebooks. Data were digitised and classified into plant families for statistical analysis using 'R': Wilcoxon test was used to determine differences in pollen use between the time periods; and iNEXT calculated Chao species richness of the total pollens used. Landscape change was analysed using QGIS.



Results – *Andrena barbilabris*

- Diet composition varied significantly: there were reductions in Rosaceae ($p=0.004$), Aceraceae ($p=0.014$), and Ranunculaceae ($p=0.01$); and increases in Cornaceae ($p<0.001$) and Fabaceae ($p<0.001$)
- Diet breadth appeared to decrease: Chao species richness of 42.3 ± 12.3 in 1940s; 30.4 ± 22.8 in 2021 (but large standard errors)
- Pollen from trees/shrubs increased from 75% to 90% ($\chi^2 p<0.001$)
- In 2021 65% of pollens were from > 500m from nests (Unexpected)
- Minimal landscape change

Results – *Andrena flavipes*

- Diet composition varied significantly: there was a reduction in Salicaceae ($p=0.012$); and increases in Aceraceae ($p<0.001$) and Asteraceae ($p=0.004$)
- Diet breadth appeared to decrease: Chao species richness of 42.9 ± 23.5 in 1940s; 29.1 ± 13.0 in 2021 (but large standard errors)
- Pollen from trees/shrubs increased from 61.7% to 65.4% ($\chi^2 p<0.001$)
- Significant increase in pollen taxa per load from 2.4 to 3.3 ($p=0.006$)
- Number of bees caught/hour significantly reduced from 36 to 2 ($p=0.007$)
- Major landscape change: grassland decreased from 91% to 16%; arable increased from 3.5% to 78.2% within 500m of nests

Conclusions

Both species exhibited dietary flexibility, taking a wide range of pollens and the pollen load composition differed over time. Changes in the diet of both bees appear to reflect changes in land-use, particularly the loss of flower-rich grassland as agriculture has intensified. Although landscape changes were less marked at Aspley Heath the bee's-eye view highlights local changes which are not readily apparent at the landscape scale and highlights the importance of understanding how species respond to change. The fact that these species persist at sites at which they have been recorded for almost 80 years, even though the floral resources appear suboptimal, suggests the importance of familiar nesting sites may be underestimated, and further research is needed.

References

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