

Waggle Dance Decoding: Investigating Honey Bee Foraging

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The honey bee waggle dance is a unique communication behaviour made only by honey bees. So remarkable is the dance that the Austrian scientist Karl von Frisch was awarded a Nobel Prize in 1973 for its discovery. The decoding of waggle dances has given LASI researchers a special opportunity for studying honey bee foraging – no other animal ‘tells’ researchers where it has been foraging. By videoing and decoding the dances made by bees living in observation hives, we can study their foraging over an area of almost one hundred square kilometres and at any distance. The results tell us how the bees are using the landscape for foraging. This tells us what can be done to make the landscape more bee-friendly.

The main reason why the number of hives in Britain has declined over the past century is almost certainly because bee food supply, flowers providing nectar and pollen, has declined. The intensification of agricultural land, which covers 80% of Britain, is the major factor and has reduced the value of the countryside to bees and other wildlife. Flower-rich hay meadows have almost all been ‘improved’, arable fields have fewer weeds, and clover is less used in pastures. If we want to make Britain a more bee-friendly country we need to increase the numbers of flowers. But to do this in the most effective way, and to maintain food production, we need better information on how foraging honey bees use the landscape.

One main way that LASI has been researching honey bee foraging is by ‘listening’ to the bees. That is, by decoding their waggle dances. Waggle dances are made by workers foraging at high quality flower patches. The dance communicates the direction and distance of the flower patch to the dancer’s nestmates. We first video the dances using observation hives. We then decode the dances by playing them back frame by frame on a computer to measure the waggle run angle, which gives the direction of the flower patch from the hive, and duration, which gives distance. We can then map the dances to determine where the bees are foraging and the distances they travel.



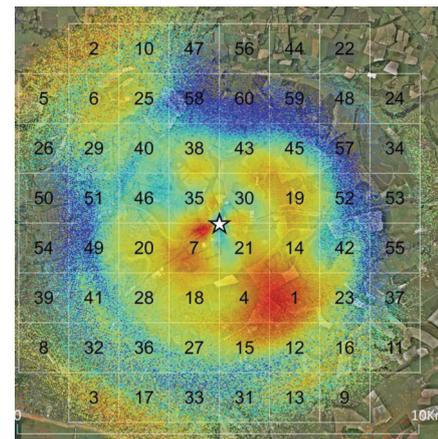
A honey bee pollen forager making a waggle dance back in the hive. Photo by C. Grüter.

We began by studying the dances made over a whole foraging season (two seasons actually), which runs from March to October. This had never been done before. The results showed a clear seasonal trend, in which average foraging distance was low in early spring, March and April, at less than one kilometre. Average distance increased in May and June until by July and August it averaged two to three kilometres, before reducing again in September and October. Honey bees do not travel long distances to forage for the fun of it, as this wastes time and energy. The longer summer foraging distances tell us that summer is a more challenging season in which to find high quality patches of flowers. It also tells us that this is the season to focus on if we want to help the bees with more flowers.

So far, we have also used dance decoding in five other projects. We have compared the foraging in different land use types, and also in urban versus rural areas. It seems that foraging is not significantly different in urban versus rural areas, indicating that towns are neither better nor worse than the countryside, but there is more foraging in countryside areas that benefit from ‘high-level stewardship’. We have also investigated foraging on two crops, apple and oil seed rape. The results from the study of oil seed rape show that bees will not travel more than 1.5–2km to spring-flowering oil seed rape, but travel further to summer-flowering rape. This fits well with our results showing that bees forage at greater distances in summer than spring.

Videos from the LASI YouTube Channel ‘LASI Bee Research and Outreach’

- Dancing bees cast their votes on the best land-types and areas for their food collection. https://www.youtube.com/watch?v=AMU1KOF_Tck
- Using the honey bee waggle dance to understand seasonal foraging challenges. <https://www.youtube.com/watch?v=yELA7pvNUQI>
- Apple pollination and the honey bee waggle dance. <https://www.youtube.com/watch?v=hbGRVwoqJVQs>



Honey bee foraging intensity in 94 square kilometres of land around LASI over two foraging seasons by decoding more than 5,000 waggle dances over 2 years. LASI is the star in the centre. A foraging hot spot can be seen 2–3 km to the south east of LASI. This is an area of down land and is especially visited by honey bees in the summer. LASI is surveying this area to determine the most attractive sub-habitats and flower species for honey bees and other flower-visiting insects. From Couvillon et al. 2014b.

References

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