

Monitoring and modelling of pathogen spillover from honey bees to wild bees

Jorge Sánchez Navarro^{1,2}, Alberto Satta¹, Robert Paxton³, Panagiotis Theodorou³, Antonella Soro³ Ignazio Floris¹, Michelina Pusceddu^{1,2}.

¹Department of Agricultural Sciences, University of Sassari, viale Italia 39 A, 07100 Sassari, Italy.

²National Biodiversity Future Center (NBFC), Piazza Marina 61, 90133 Palermo, Italy.

³General Zoology, Institute for Biology, Martin Luther University Halle-Wittenberg, Hoher Weg 8, 06120 Halle (Saale), Germany

State of the art:

Managed honey bees are known to affect wild bees in three ways:

- Direct competition for finite resources.
- Driving changes in plant communities.
- **Transmission of pathogens.**

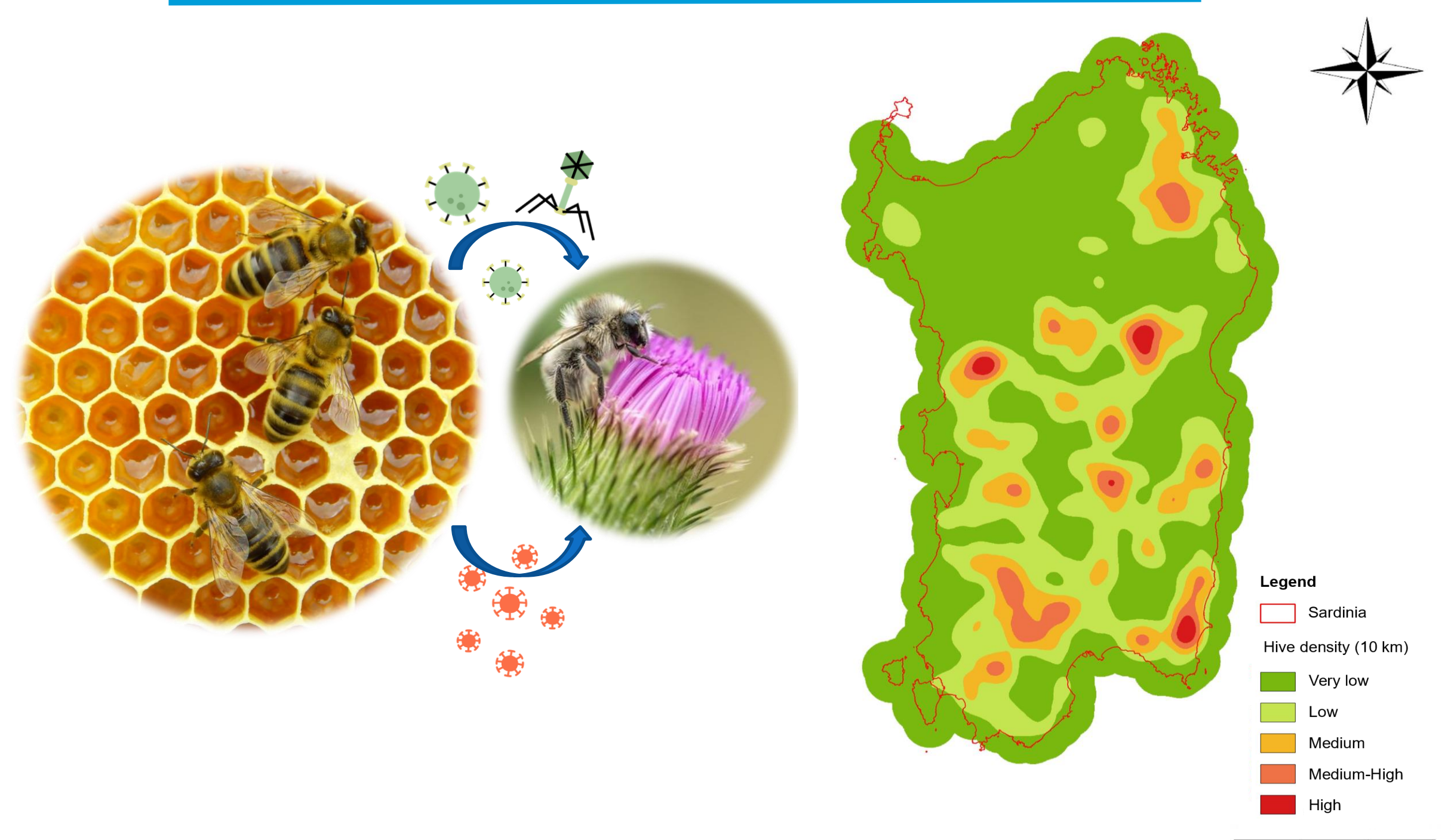
Honey bees are more likely to carry pathogens compared to wild species. Pathogen transmission often occurs through shared resources and space, usually *via* the faecal-oral route (Figueroa et al. 2019).

Project:

- Selecting sampling sites of low and high hive density throughout Sardinia, Italy.
- Monitoring and sampling honey bees, bumblebees and wild bees (Sardinia, Italy).
- Monitoring hive pathogens in honey bees and wild bees using molecular analysis (Halle, Germany).
- Performing statistical analysis to design pathogens spread models (Halle, Germany).

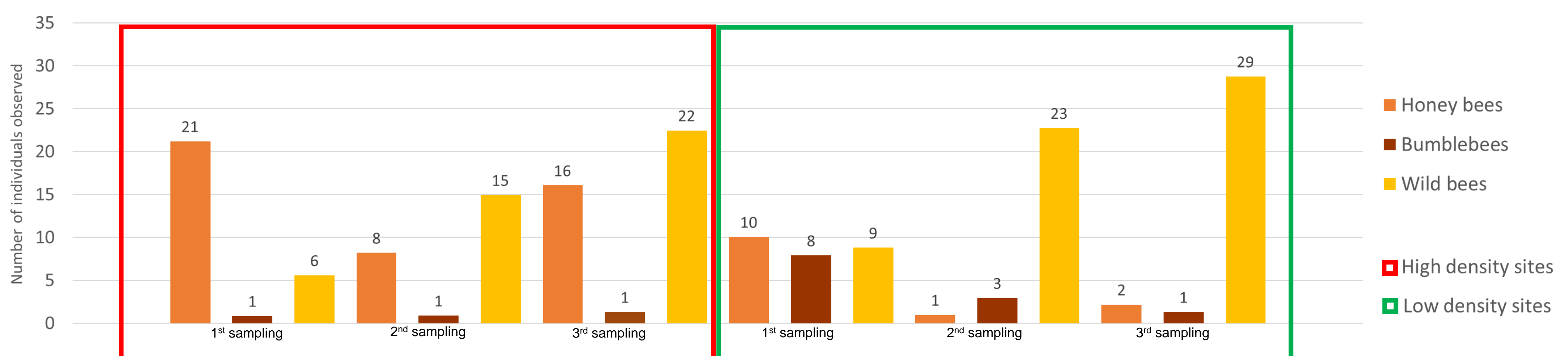
Objective:

The main aim is to develop models for pathogen spillover from managed honey bees to solitary and social wild bee species.

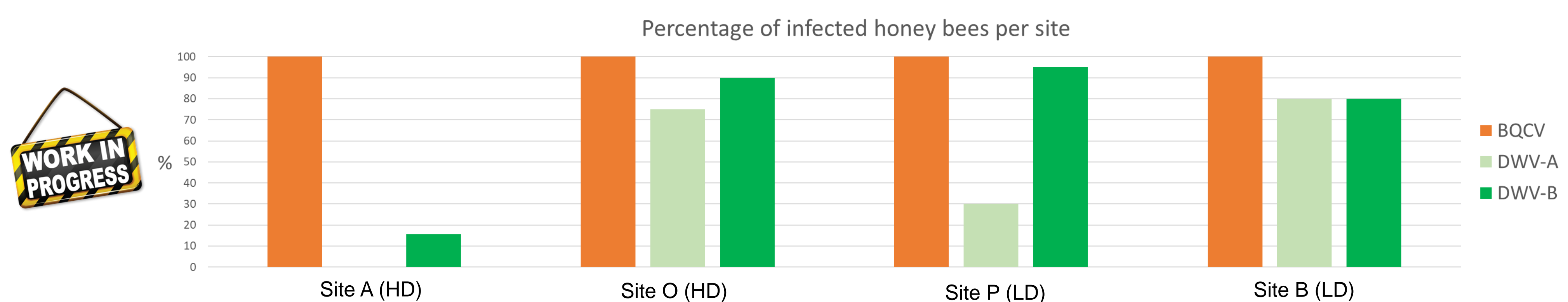


Results:

Preliminary results show an increase in bumblebees (*Bombus spp.*) populations at sites with a lower density of hives, accompanied by a decrease in the honey bee numbers at these same sites, as expected.



Based on the still limited number of *Apis mellifera* samples analyzed, Black Queen Cell Virus (BQCV) showed a prevalence of 100%, while the Deformed Wing Virus (DWV-A; DWV-B) had a prevalence of 58%. These viruses have been identified as the most abundant among various bee species throughout Sardinia (Tiritelli et al., 2024). No significant differences were found between high density of hives sites (HD) and low density of hives sites (LD).



References:

- Mallinger, R. et al. (2017). Do managed bees have negative effects on wild bees?: A systematic review of the literature. PLoS ONE, 12(12). <https://doi.org/10.1371/journal.pone.0189268>
- Figueroa, L. et al. "Bee pathogen transmission dynamics: deposition, persistence and acquisition on flowers". In: Proceedings of the Royal Society B: Biological Sciences 286.1903 (May 29, 2019). Publisher: Royal Society, p. 20190603. <https://doi.org/10.1098/rspb.2019.0603>
- Nanetti, A. et al. (2021). Pathogens spillover from honey bees to other arthropods. Pathogens, 10(8), 1044. <https://doi.org/10.3390/pathogens10081044>
- Tiritelli, R. et al. Ecological and social factors influence interspecific pathogens occurrence among bees. Sci Rep 14, 5136 (2024). <https://doi.org/10.1038/s41598-024-55718-x>

