

ANNOUNCEMENT

Report on a project: BeeNet at the start

The global worries on the decline of pollinators are driving actions and projects around the world. There is an impelling need to establish their current status to properly build the best sustainable support to the important ecosystem service that pollinators deliver. Many governments are moving in this direction, with a view to better understand the national landscape and its management. Italy, with its large variety of wild Apoidea and the conservation efforts on local strain of *Apis mellifera*, has recently implemented the efforts in establishing a research baseline on the most important group of pollinators, the bees. Since more than ten years ago, two research projects - ApeNet (2009-2010) and BeeNet (2011-2014) - carried out by Italian Institutions, developed a honey bee monitoring network. The first BeeNet project was funded by MIPAAF (Ministero delle politiche agricole alimentari e forestali) led by CREA (Consiglio per la Ricerca in agricoltura e l'analisi dell'economia agraria - Centro Agricoltura e Ambiente) in collaboration with the Entomology area of the *Alma Mater Studiorum* Università di Bologna, the Istituto Zooprofilattico Sperimentale delle Venezie (IZS-VE) and the Sistema Informativo Nazionale per lo Sviluppo dell'Agricoltura (SIN). The new project maintained the title BeeNet, since the same concept of network on honey bees is implemented; however, it was strengthened to align in the European context of bee monitoring, including both the honey bees and the wild bees. The main goal of the project is a large integration of information deriving from the landscape ecology, the field monitoring, the agricultural context and practices, and the implementation of RDPs (rural development programs) measures. Bees are intended in the project as warning systems that inform, thanks to their intrinsic conditions, on the quality of the environment where they act. The environment under testing is the agricultural one, according with its local characteristics of seminatural or intensive practices. After COVID-time and its restrictions on travels, the project now started at almost full capacity. BeeNet is carrying on two main monitoring schemes, that have been built in agreement with the different lifestyles of the honey bees (managed by beekeepers) and the wild bees (nesting wildly). For both schemes, the project tested protocols in the region Emilia-Romagna and then conveyed final versions to collaborators: technicians of national and local beekeepers associations and research groups of some Italian universities (details in the supplemental material). The first tasks were devoted to identifying suitable locations where to carry on the field monitoring, applying landscape analyses through the CORINE Land Cover (CLC) cartography. For wild bees, we selected 24 locations in 11 regions, most of them coupled so to have one monitoring occurring in an area characterized

by intensive agriculture, and one in an area with seminatural agriculture. The analyses included defining the best suited CLC thematic categories, verifying their distribution in the region, including logistic facilitation. Once the location was identified, a field inspection helped in fixing the 200 m transect along which wild Apoidea are monthly collected. For the honey bees, again CLC was employed to characterize the surroundings of 415 apiaries that collaborative beekeepers put at the disposal of the project. Altitude, exposure and soil use of almost 1% of the entire national territory (293198 ha) helped in selecting 359 fixed monitoring stations. Each station-apiary is made of five hives that are checked four times a year, during which samples of beebread and of adult bee foragers are also collected. One third of the stations are further equipped with smart-hives that collect data on the hive conditions and transfer them thanks to the IoT technology. The large number of samples expected by these protocols need a solid organizational structure to be properly delivered and stored, and a well-planned agenda for efficient analyses. The figure represents the CREA core team that enthusiastically committed to solve any burden; just as examples: from the transfer of delicate Apoidea specimens to their identification by expert taxonomists in a laboratory newly installed in Bologna; from the maintenance of the cold chain to preserve the DNA of sampled honey bees (supported by regional headquarters of Istituti Zooprofilattici Sperimentali, IZS; details in the supplemental material), to the delivery of analyses of pathogens to individual beekeepers; from the testing of available smart-hives to the refinement of the technology to serve research purposes. First deliverables are listed in the supplemental material. BeeNet is devoted to build a large network, where bees play the outstanding role of sentinels to inform us on the health of the agroecosystem we manage and possibly drive state intervention.

