WORLD-CLASS AND INTERDISCIPLINARY EXCELLENCE RESEARCH.

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Development of a spatio-temporal pollination model in k.LAB (ARIES)

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1 INTRODUCTION

Harmonizing food production with biodiversity conservation requires identifying the ecological functions that enhance agricultural productivity, like pollination. Pollination by animal vectors increases the productivity of many of the crops consumed across the world, however, we lack detailed spatial information on the distribution of pollination services and how they are affected by different management practices within agricultural systems. This study aims at developing a series of quantitative spatial and temporal models of the flows between pollinator populations and crops within agricultural landscapes.

The objective: To create a tool that can be used both by (1) farmers who use managed honeybees and depend on natural habitats as foraging sites for honeybees when the crop is not flowering; (2) farmers who depend on wild pollination services to increase their productivity and (3) environmental authorities for protected area planning.

Figure 1. Study area (North East of Sicily).

Table 1. Pollination dependency of the crop types studied (Klein et al. 2007).

Crop Type	Crop Pollination Dependency
Almond Trees	0.75
Apple Trees	0.65
Carob Trees	0.5
Pear Trees	0.65
Barbary Figs	0.25

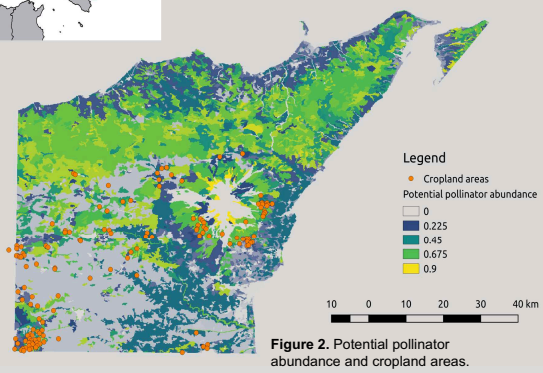
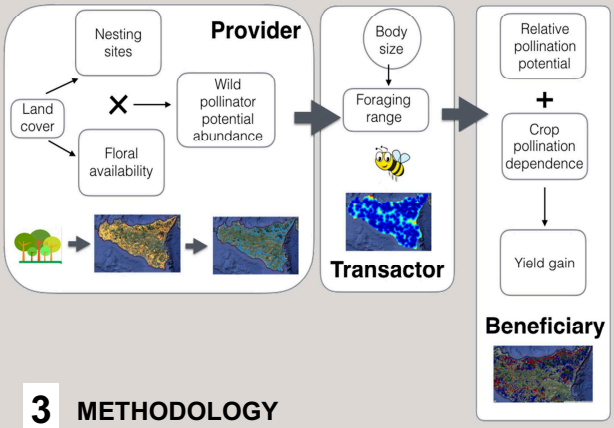


Figure 2. Potential pollinator abundance and cropland areas.

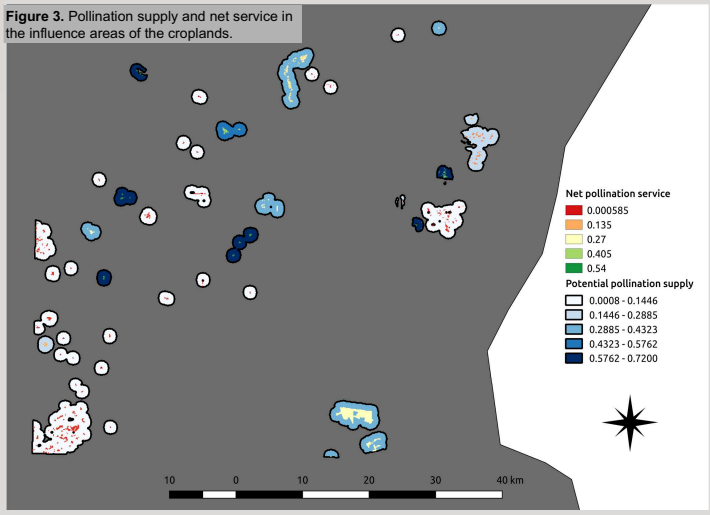
2 CONCEPTUAL FRAMEWORK



3 METHODOLOGY

The model was developed using k.LAB, the open-source software powering ARIES, a semantic modelling technology to assist ecosystem service assessment and valuation. Five crop types dependent on pollination were studied in the North East of the island of Sicily (Italy; figure 1 and table1). Values of nesting suitability (NS) and floral availability (FA) were assigned to the different land cover categories using CORINE 2012 based on previous studies (ESTIMAP). A potential pollinator abundance for each land cover category was then computed as the product of the NS and FA values. A map with inverse distance weighted values (IDW) was computed up to 1km around each cropland area, which was the maximum flight distance set for pollinators. The potential pollinator abundance map was multiplied by the IDW map to obtain a final pollination supply value for each influence area around croplands. The mode of the pollinators abundance values was then computed for each influence area and multiplied by the crop pollination dependency value (CPD) in order to assess the net pollination supply for each cropland area.

Figure 3. Pollination supply and net service in the influence areas of the croplands.



4 RESULTS & DISCUSSION

Figure 2 shows the cropland areas studied in the NE of Sicily and the resulting values of potential pollinator abundance in the landscape based on the NS and FA values correspoding to the CORINE land cover categories present in the study area. The main results of the model can be seen in Figure 3 showing the influence areas around croplands colored by their potential pollination supply value (PPS), as well as the net pollination service computed for each cropland area (CPD x PPS).

The model can be easily applied in other study areas and used by different beneficiaries and end-users to identify and evaluate the effect of different landscape management alternatives and configurations, such as green infrastructures, at both regional and local level.

Future versions of the model will include the effect of solar radiation and temperature on the activity of pollinators over time.

5 ACKNOWLEDGEMENTS

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6 REFERENCES

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