STUDY ON LANDSCAPE FACTORS INFLUENCING SPATIAL DISTRIBUTION AND ABUNDANCE OF *Aedes albopictus* (Skuse) TO IMPROVE LOCAL SCALE DISTRIBUTION MODELLING

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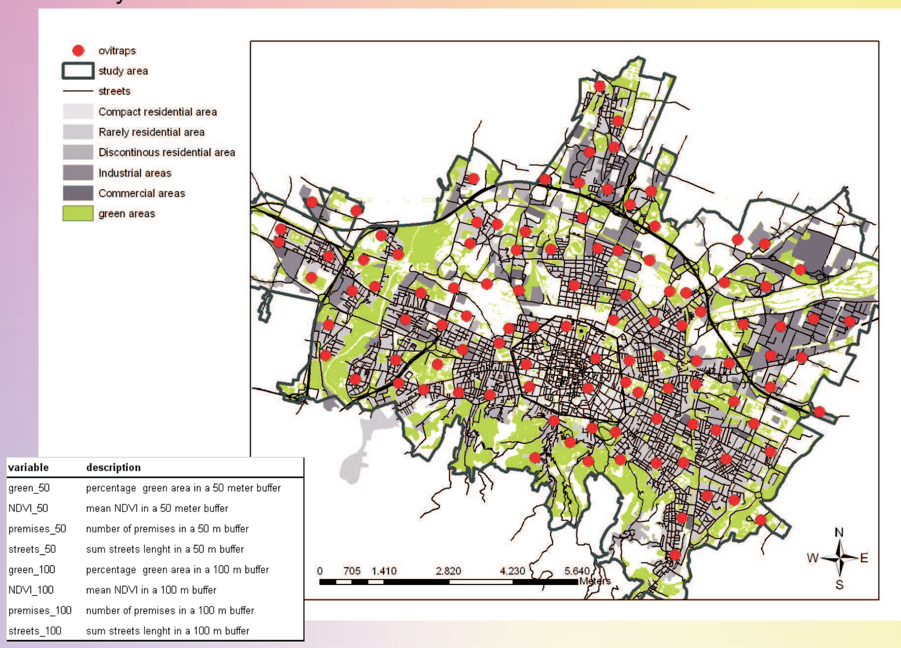
Introduction

Distribution and density of *Aedes albopictus* populations in urban areas are promoted by local scale environmental variables such as vegetation covering, land use, premises condition, catch basins number and quality, etc.
Study of possible correlations between ovitrap monitoring data and environmental data at local scale can provide useful information to improve species distribution-abundance landscape-based models. This modelling approach is more precise than the classic geostatistics in describing mosquitoes abundance in particular when datasets are less autocorrelated and not stationary.



Bologna city study area; red dots represent ovitrap locations; on the bottom-left the variables description used in logistic models.

Materials and Methods

The present study was carried out within the framework of the Emilia-Romagna *Ae.albopictus* monitoring and control program with the aim to investigate the correlations between some environmental data (urban vegetation areas, Normalized Difference Vegetation Index obtained from Multispectral QuickBird images of 2.8 m geometric resolution aquired July 22, 2003; number of premises and density of streets obtained from Emilia-Romagna Layers), and mean eggs density using data from 107 ovitraps positioned in the urban area of Bologna (8,608 Ha) according to standard criteria at a mean distance of 600 m, checked weekly during the favourable season 2009 (May-September).
In this study we used high/low mosquito abundance rather than presence/absence as the response variable. The mean was used to split the dataset into high and low abundance.
"Buffering" GIS procedure was used to extract the values of the variables within circular area (50 and 100 m) around 107 study ovitraps.
We evaluated whether ovitrap data were autocorrelated by *Global Moran's I* (significant correlation between data from closer ovitraps) for each monitoring month and for the whole monitoring season.
Then Logistic model was applied to mean eggs densities of four months (June, July, August and September) and for whole season to identify the variables influencing mosquito distribution-abundance. To simplify the data analysis, each variable was categorized into ten percentiles.
Akaike's Information Criterion (AIC) was used to rank candidate models to promote the creation of *Ae.albopictus* distribution models in urban areas and to produce smoothed maps of arboviruses (Chikungunya and Dengue) risk of transmission at high resolution.

Results

Tab.1; Global Moran's I calculated for each month and for the whole season 2009.

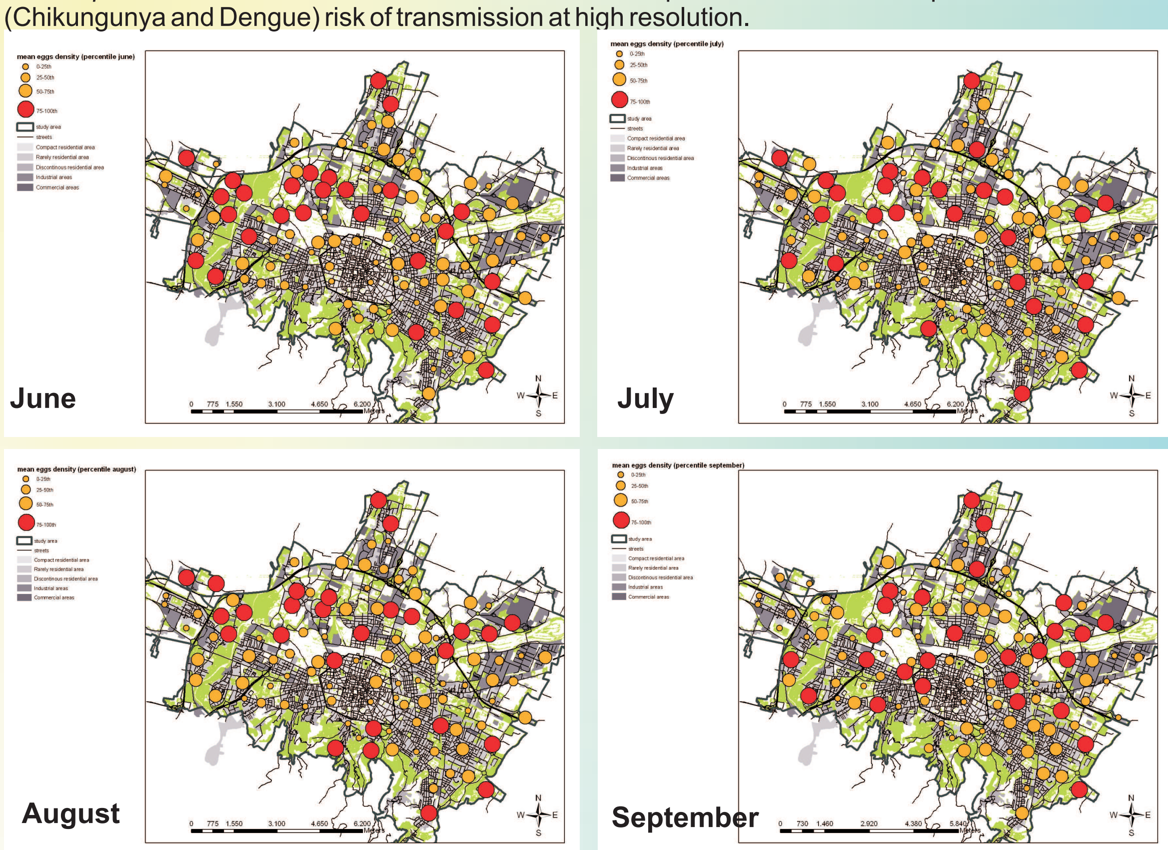
Month	Global Moran's I	Z-score	P-value
June	0.03	3.58	0.01
July	0.01	2.22	0.05
August	0.01	1.66	0.10
September	-0.01	0.22	> 0.10
Season (June-September)	0.01	1.35	> 0.10

A total of 83,972 eggs were collected from June to September (18 weeks) in 107 ovitraps. Eggs density resulted not autocorrelated in the four months and for the whole season (Tab. 1).
In Table 2 the results of significant logistic regression model were reported.
Ae.albopictus was most abundant during June in areas with high NDVI and low streets density.

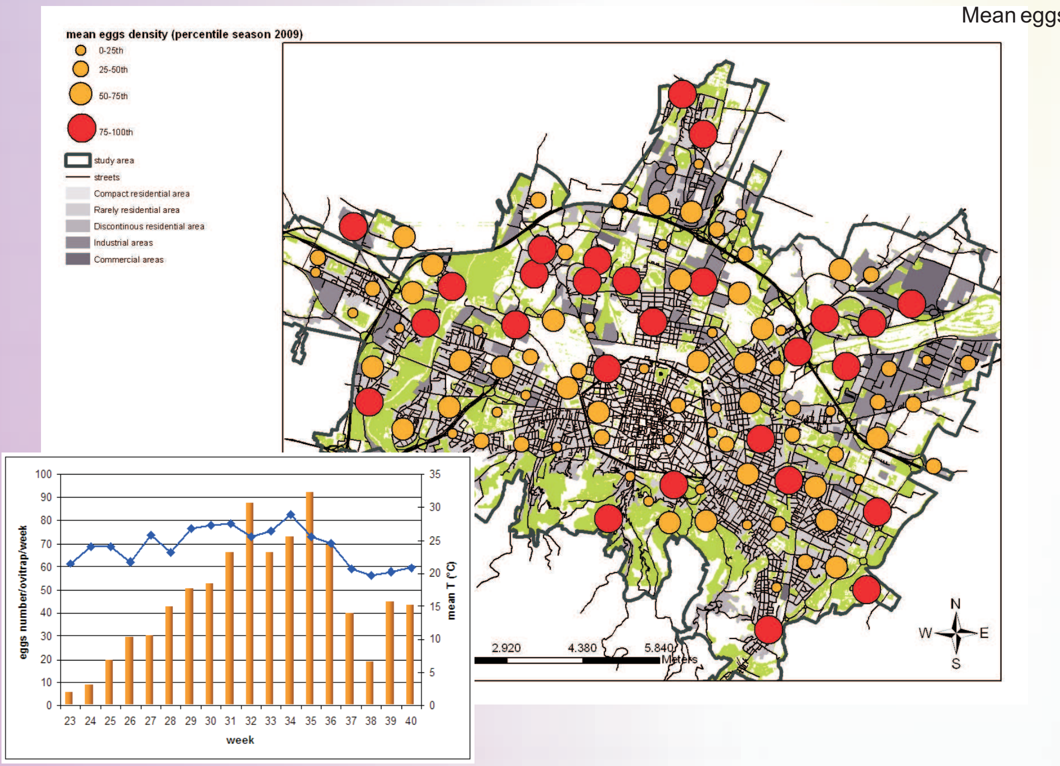
Tab.2; Significant Output from Logistic regression model with high versus low abundance of *Ae.albopictus* eggs and parameters as explanatory variables calculated.

	variable	Odds Ratio	95% C.I.for OR Lower	95% C.I.for OR Upper	P-Value	AIC
June	streets_50	0.859	0.750	0.985	0.029	142.359
	NDVI_100	1.171	1.021	1.344	0.024	141.991
	streets_100	0.846	0.737	0.971	0.017	141.350
August	NDVI_50	1.158	1.008	1.329	0.038	139.633

In August the mosquito population was influenced only by NDVI; while there were not significant correlations in the logistic regression for months of July, September and for the whole season.



Mean eggs density maps for each monitoring month (ovitraps data were subdivided into percentiles).

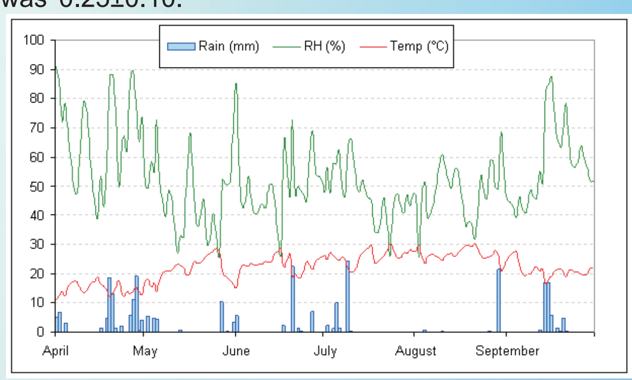


Mean eggs density map for the whole summer season 2009 (June-September); on the bottom-left, the seasonal population trend (bars) and the mean Temperature trend (line).

Discussion and Conclusion

The study of possible correlations between some environmental parameters and *Ae.albopictus* eggs abundance in a urban area of large dimensions showed controversial results. We found correlations in June and August but no correlations in July, September and in the whole season. The NDVI index calculated in high resolution satellite images seems to be the best predictor of *Ae.albopictus* abundance (lowest AIC) in August.
28 ovitraps were >75th percentile in August and the mean NDVI calculated in 50 meters buffer circles around the ovitraps was 0.25±0.10.

The not statistically significant results in July and September could be due to the major dispersion of the species while in August when there were very low precipitations, high mean temperatures and low relative humidity (26.6° C and 48% RH - figure on the right) mosquito adults search for shaded and green areas.



This preliminary study can be used to identify variables and monitoring dataset useful for creating habitat suitability maps for the potential CHIK/DEN vector, which represent the probability of trapping high eggs number at high resolution for big cities of Emilia-Romagna Region.
These maps could therefore guide future vector control operations focusing on the most suitable habitats for *Ae.albopictus* and therefore aiding in disease prevention measures, while supporting optimization of the available resources in vector control programs.

ACKNOWLEDGMENTS
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