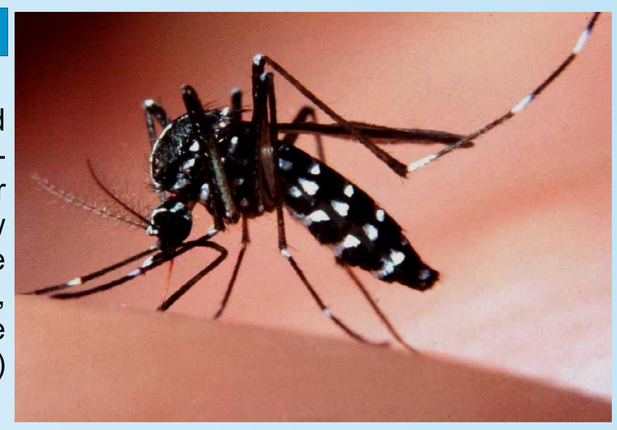
GEO-ZTONLINE.IT: THE WEB-BASED GIS EVOLUTION SUPPORTING VECTOR-BORNE DISEASES HEALTH RISK ASSESSMENT

Alessandro Albieri, Romeo Bellini , Marco Carrieri
Centro Agricoltura Ambiente "G.NICOLI", Medical & Veterinary Entomology Dept., Crevalcore (BO), Italy http://www.caa.it/entomology
Paola Angelini - Emilia-Romagna Region Public Health Service, Bologna, Italy
Claudio Venturelli - DSP Cesena, AUSL Romagna, Cesena, Italy
Luigi Colò, Giovanni Ciardi - Emilia-Romagna GIS Service, Bologna, Italy

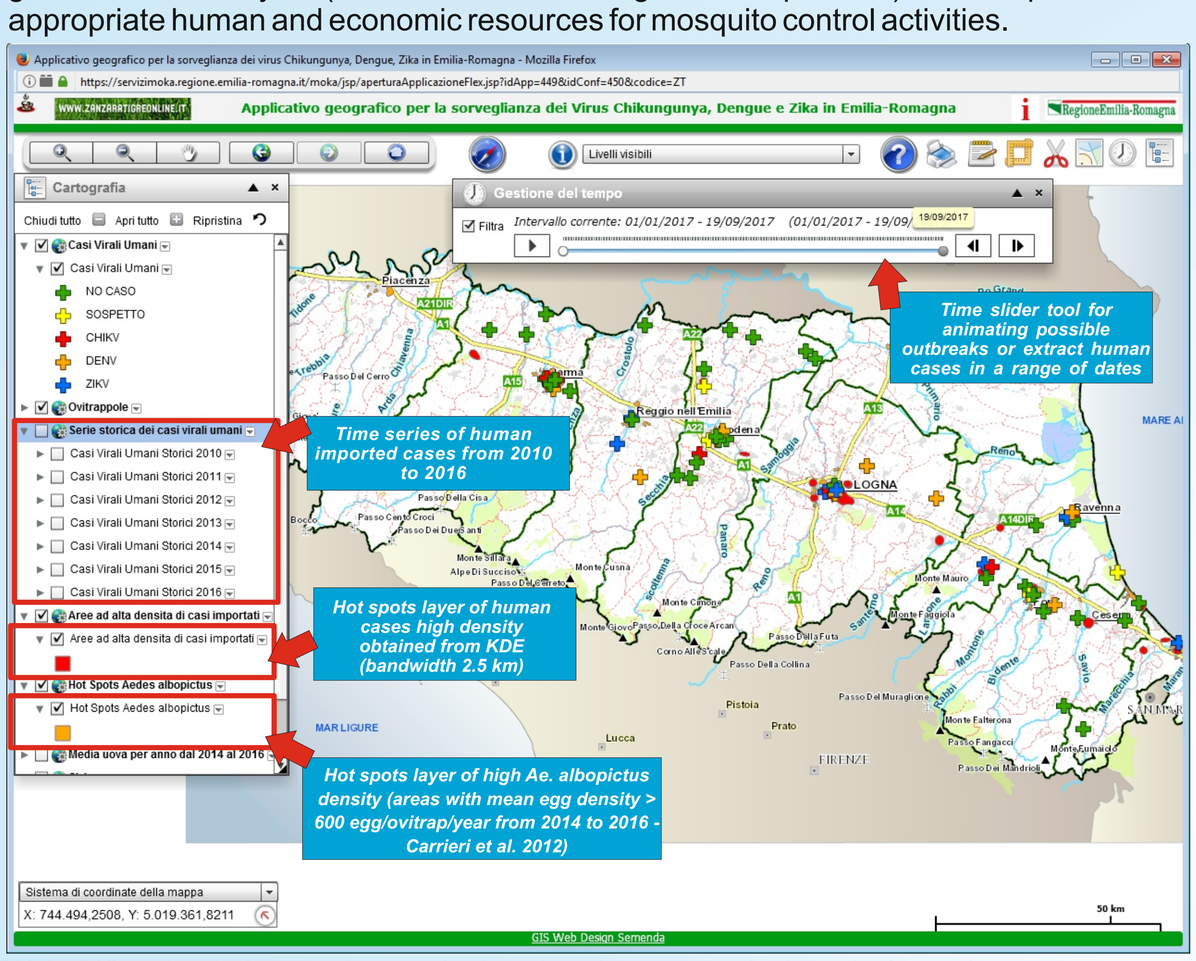
Introduction



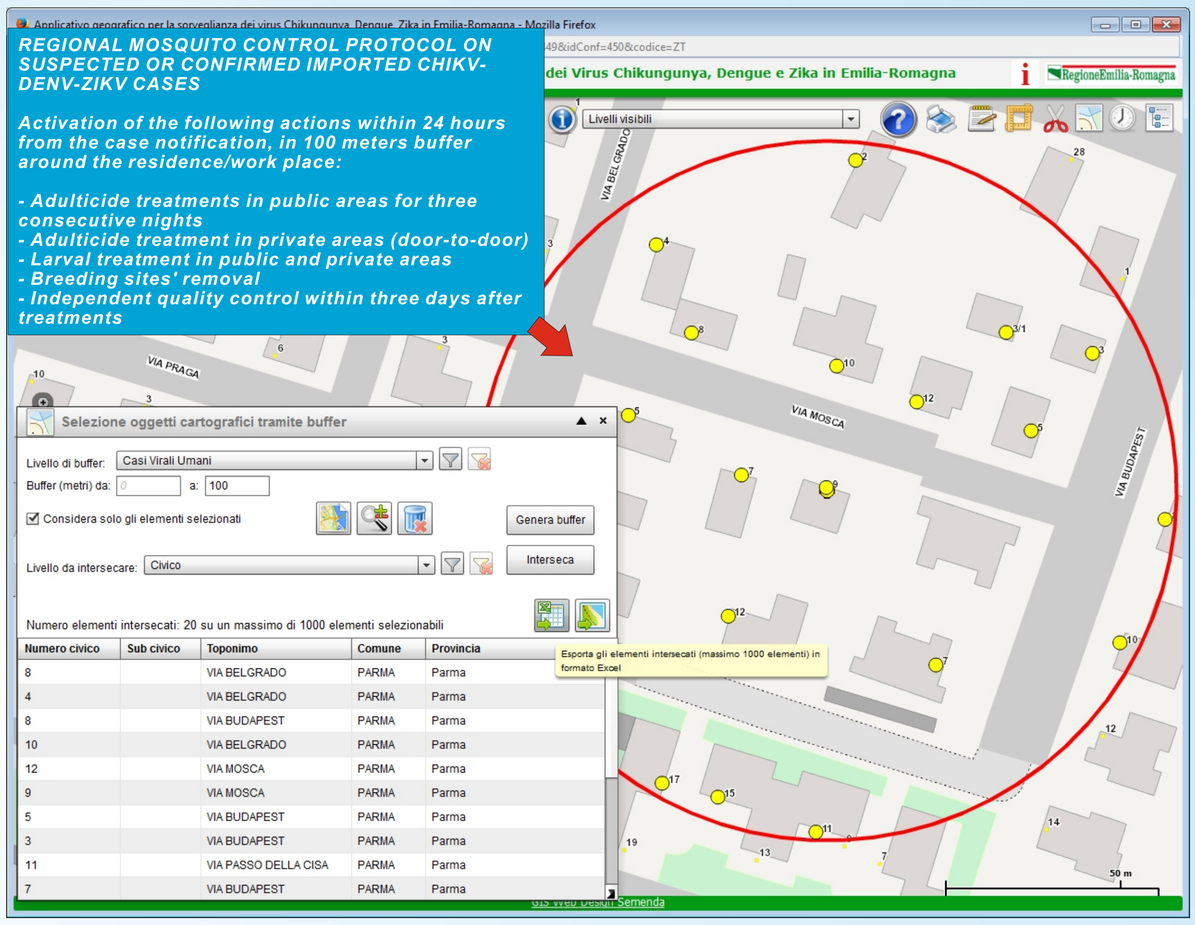
From 2014 a Web-Based Geographic Information System (Web-GIS) that enable storage and processing of spatial monitoring and public health data was adopted in the frame of the *Aedes albopictus* management of Emilia-Romagna Region, Italy. GEO-ZTONLINE.IT was developed using the regional Content Management System (CMS) Moka (www.mokagis.it) based on ArcGIS Server technology in particular the Flex framework that allows to create very productive applications in Flash technology. The Web-GIS allow the following base functions: supporting the geo-location of human cases (suspected and confirmed) of Chikungunya (CHIKV), Dengue (DENV) and Zika (ZIKV) viruses in the regional updated topographic geo-database, human cases data entry by specific form, interfacing with *Aedes albopictus* regional monitoring data (ovitraps), printing function, measure functions, interactive navigation in the map, automatic extraction of premises to be treated around suspected human cases (following the regional protocol; Albieri et al. 2014) for aiding professionals and human care decision-makers control and surveillance of CHIKV, DENV and ZIKV.

GEO-ZTONLINE.IT evolution

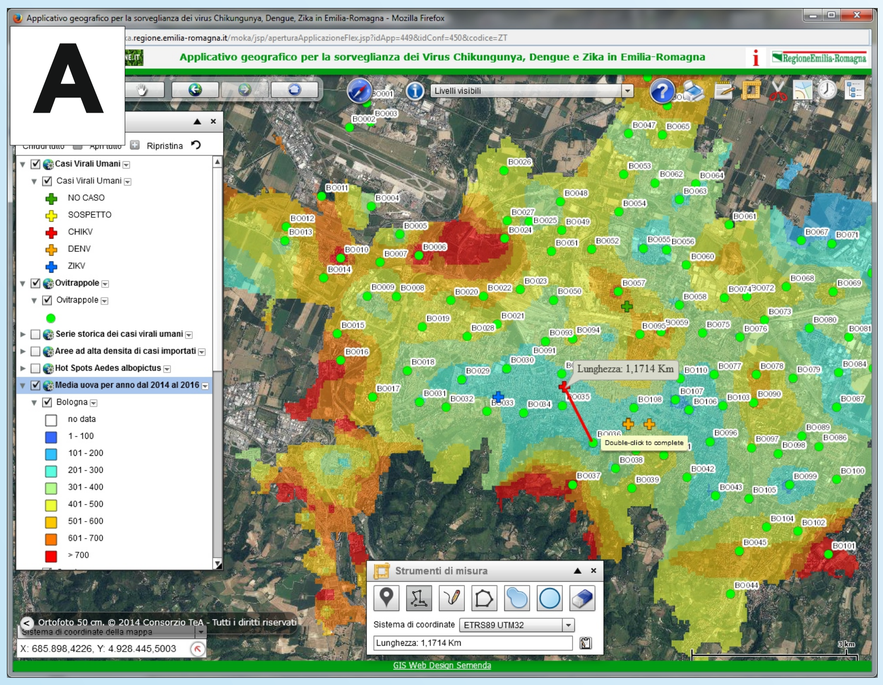
From January 2017, GEO-ZTONLINE.IT was enriched with functions and layers useful for health risk assessment: time slider for animating the spatio-temporal progression of possible outbreaks or extract human cases in a range of dates (es. monthly cases), hot spots layer of imported human cases obtained from KDE (Kernel Density Estimation) interpolation of all imported human cases from 2010 to 2016 and hot spots layer of relative high density of *Ae. albopictus* in 20 large towns (inhabited area > 550 ha) obtained from geostatistical analysis (Inverce Distance Weighted interpolation) of ovitraps data from 2014 to 2016. Hot spots layer of *Ae. albopcistus* density can be also used to address appropriate human and economic resources for mosquito control activities.



Web-GIS main window; on the top the functions buttons; on the left, the legend.



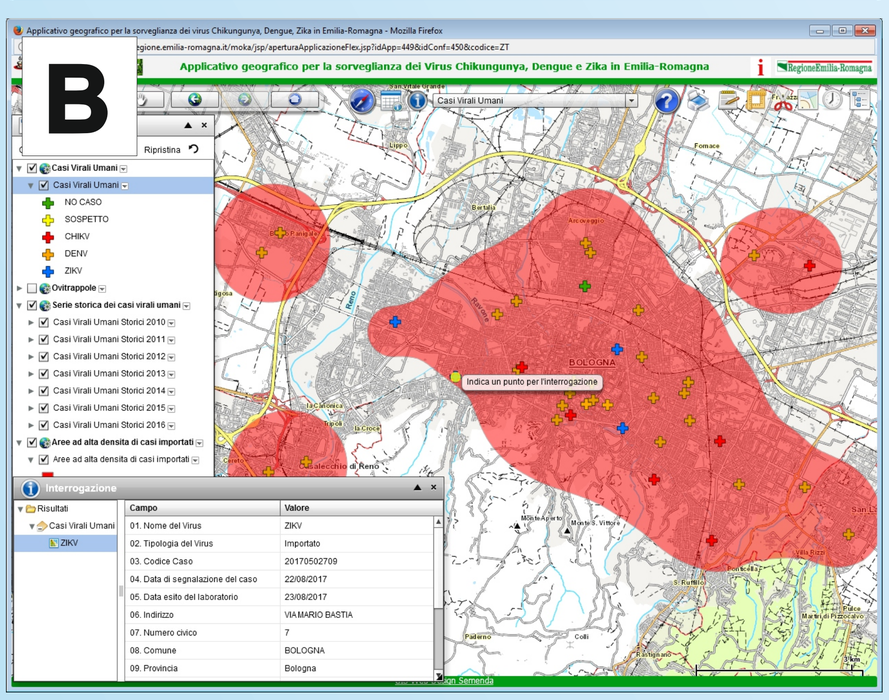
Example of premises extraction in a 100 meters buffer a suspected case for the management of mosquito control activities (larvicides and adulticides).

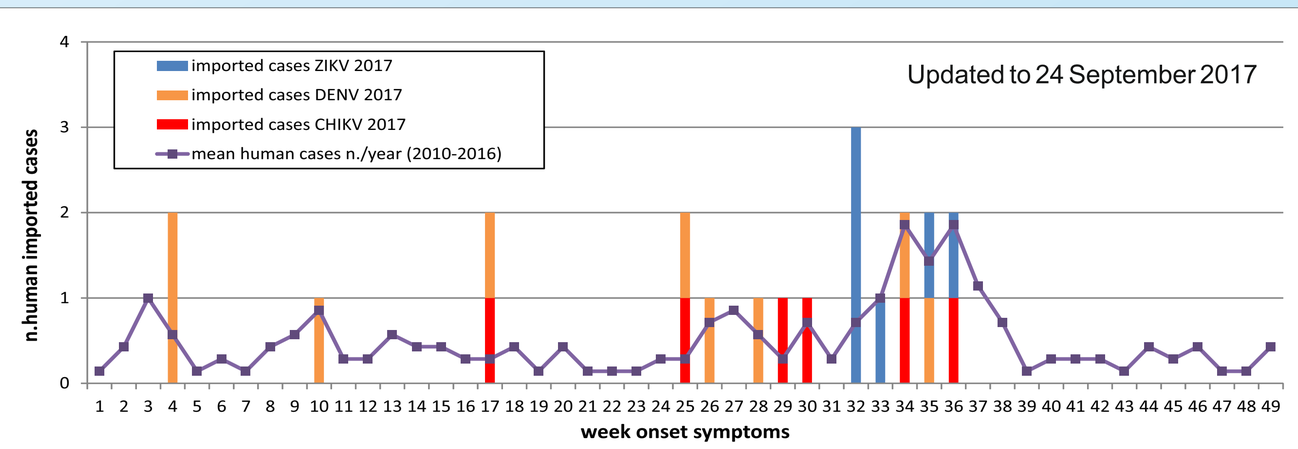


Inhabited area (> 550 ha)	Area (ha)	N. ovitraps	ovitraps average nearest distance (m)	mean ovitraps/year (July-September)	mean ovitraps/year (75th percentile)	Global Moran's I	IDW RMS
Bologna	7,689	107	615	406	510	0.10	211
Carpi	1,736	22	615	359	415	0.03	167
Cervia	1,237	43	358	415	519	-0.04	215
Cesena	3,370	47	557	476	613	0.01	246
Cesenatico	854	30	480	740	906	0.16	258
Faenza	1,424	50	345	313	402	0.3	185
Ferrara	3,531	68	503	610	825	0.27	306
Forlì	3,257	29	774	422	533	0.35	248
Formigine	685	19	497	515	601	-0.39	201
Imola	1,854	41	505	313	424	0.32	165
Lugo	990	42	349	149	229	-0.02	133
Mirandola	734	41	327	470	573	0.14	228
Modena	4,272	44	618	378	502	0.23	214
Parma	3,840	52	659	671	827	0.04	343
Piacenza	2,882	37	651	497	620	-0.04	402
Ravenna	1,830	64	328	390	424	-0.07	196
Reggio nell'Emilia	4,590	37	830	403	463	0.07	384
Riccione	1,034	50	295	693	829	0.18	275
Rimini	3,148	46	690	469	603	0.11	259
Casalecchio di Reno	559	31	320	570	729	-0.01	272

On the right, the summary table of geostatistical analysis and IDW interpolation on ovitraps of 20 inhabited areas (>550 ha).

In the figure A, *the Ae. albopictus* distribution layer (IDW interpolation) were overlapped to imported human cases (blu cross ZIKV ,orange cross DENV and red cross CHIKV) for evaluating the risk of possible outbreaks. Green dots are the ovitraps (CAA14GG model) activated in 2017.





Time series of imported cases registered from 2010 in the geodatabase of Geo-ztonline can be used to create summary trends (see the graph above) or can be overlapped to the layer of high density cases (red area in the figure B) to evaluate risk areas.
The 62% of cases registered in main cities of the region in 2017 are inside the layer of high density cases.

REFERENCES

- ALBIERI A, R BELLINI, P ANGELINI, C VENTURELLI, L COLO', G CIARDI. GEO-ZTONLINE.IT, a Web-based GIS for Chikungunya and Dengue surveillance in Emilia-Romagna region, Italy. (Poster) 19th ESOVE Conference, 13-17 October 2014, Thessaloniki, Greece.

- CARRIERI M., P. ANGELINI, C. VENTURELLI, B. MACCAGNANI, R. BELLINI. *Aedes albopictus* (Diptera: Culicidae) population size survey in the 2007 Chikungunya outbreak area in Italy. II: Estimating epidemic thresholds. J. Med. Entomol. 2012, 49(2): 388-399; DOI: http://dx.doi.org/10.1603/ME10259