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ALBIS: integrated system for risk-based surveillance of invasive mosquito Aedes albopictus

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The continuous expansion of invasive Asian tiger mosquito, Aedes albopictus, combined to its ability to transmit arboviruses (e.g. dengue, chikungunya) is raising major public health concern in Europe. Furthermore, there is a real risk that this mosquito will colonize also urban areas North of the Alps in the next years. In fact, the spatial distribution and colonization of new areas by invasive mosquito species Ae. albopictus depends on several environmental parameters, such as winter and summer temperatures, and precipitation patterns. A key factor for Ae. albopictus to establish at higher latitudes is the capability to develop cold-tolerant overwintering diapausing eggs under specific environmental conditions. Weather-driven abundance models are used to map the areas of potential distribution and to predict temporal dynamics of Ae. albopictus and the transmission potential of arboviruses.

In Switzerland, Ae. albopictus can reach the North of the Alps exploiting the traffic crossing the country, in particular, the A2 motorway connecting Southern Europe to Northern Europe. According to predictions based on a climate-driven large-scale model, the Lake of Geneva and, to some extent, the Swiss Plateau are suitable for the spread of Ae. albopictus North of the Alps, while other areas in Switzerland (e.g., the city of Zurich) seem currently too cold in winter for the survival of eggs.
However, this model is based on remotely sensed temperature data and does not take into account the particular climatic conditions existing in urban settings, where the species thrives. The presence of urban heat islands and the milder winter conditions of urban microhabitats may increase the probability of diapausing eggs to overwinter and favour even more the colonization of new cities. Preliminary data collected during the 2016-2017 winter season in Canton Ticino and the cities of Basel, Zurich and Geneva show that temperatures in typical breeding sites (i.e. catch basins) are higher compared to external controls and exceed the thresholds for survival of diapausing eggs.
There is therefore an urgent need for appropriate monitoring tools and risk-based surveillance of Ae. Albopictus populations. This project aims to bring a shift of paradigm in data analysis and monitoring of Ae. albopictus by making data collection and analysis more automated, more dynamic and efficient.

This contribution presents the designed system that integrates: istSOS an OGC Sensor Observation Service server implementation with a user friendly interface and rich feature collection to easily manage your sensor network and distribute your data in a standard way (www.istsos.org) with low-cost and on-line IoT sensors based on the open LoRA protocol to monitor temperature, humidity and light; biological data from in-situ specimen; adaptive predictive models of species based on monitoring data;
This outcome can only be achieved through the integration of multidisciplinary aspects such as mosquito surveillance expertise, environmental monitoring system, d population modelling and geospatial technologies. This shift is critical in order to support the activities of the newly created Swiss National Coordination Center for the Monitoring and Control of Invasive Mosquitoes, managed by LMA (SUPSI).