iDAlert
Infectious Disease decision-support tools and Alert systems

Case study

Heidelberg

Mosquitoes: From Nuisance to Public Health Concern

In Germany mosquitoes were traditionally considered a nuisance. In recent years, the detection of arboviruses, like West Nile Virus (WNV), in domestic mosquito species (as well as in animal and human hosts) and the emergence of invasive species, like Aedes Albopictus, which transmit several highly pathogenic viruses for humans, resulted in mosquitoes also being considered a risk factor for disease transmission. Therefore, since about a decade, several national and regional mosquito monitoring and arbovirus surveillance projects have been initiated.

Case Study Objectives

1. **Understand the impacts of urban microclimates on mosquito activity and human-mosquito interactions.**

2. **Explore the effects of urban interventions on climate-sensitive infectious diseases and their hosts to aid decision-makers in planning healthy and sustainable urban environments.**

This case site has been chosen as Aedes Albopictus mosquitoes are an increasing threat in the Rhein-NeckarKreis (RNK) and Heidelberg region due to climate change improving environmental suitability. They are also well-known vectors of arboviruses, including dengue, chikungunya and Zika viruses. Their recurring reintroduction through trade and travel, as well as the city's unique position as a small but central location in a larger metropolitan area also make it an interesting site to study.

Heidelberg is located along highway A5 which connects Germany to Italy from where the first *albopictus* populations were likely introduced to the country.

The number of *albopictus* populations has increased in the upper rhine plain in recent years, including populations in ludwigshafen and heidelberg.

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Current Measures & Case Study Focus

Despite measures like monitoring, using biological control agents and releasing sterile male mosquitoes, it has not been possible to eradicate the *Albopictus* populations. Therefore, continued, improved monitoring and surveillance is essential.

Identifying hot spots and controlling mosquito populations are important preventive measures. Moreover, screening of mosquito populations is pivotal for early detection of viruses, should they establish local transmission. To increase and create synergies with existing efforts in the IDAlert project and the other case sites, the Heidelberg case study will focus on the following core components:

- Generation and piloting of high-resolution geospatial indicators
- Delivery of climate change and vector-borne disease survey
- Promotion of citizen science mosquito initiative in Heidelberg & RNK
- Evaluation of the effect of urban interventions
- Development of predictive models and indicators for mosquito activity and mosquitohuman interactions

Activities

A digital survey will be conducted in Heidelberg and RNK to assess local knowledge, attitudes, beliefs, and practices related to climate change and vector-borne diseases. The survey will focus on mosquito risk perception, avoidance strategies, and mobility patterns. The Heidelberg IDAlert team will collaborate with local partners, including the Public Health Authority and entomologists, to promote Mosquito Alert and enhance vector surveillance protocols and awareness.

> *In the face of climate change, mitigating its impact and fostering sustainable livelihoods is crucial. Urban interventions, while well-meaning, can inadvertently affect climate-sensitive diseases. Rigorous assessments are essential to comprehend the link between urban microclimates, mosquito activity, and human-mosquito interactions. This study illuminates these connections, aiding disease understanding.* ~ Joacim Rocklöv

Research Aims & Outputs

By utilising expertise from the Heidelberg Institute for Geoinformation Technology (HeiGIT), the Heidelberg case study will generate high-resolution geospatial data, covering micro-climate, environmental factors, land use changes, urban morphology, economic activity, and human mobility patterns. These data will be used to analyse mosquito activity and interactions between mosquitoes and humans in Heidelberg and the RNK. Ongoing tiger mosquito monitoring, which involves 200-300 geotagged ovitraps collected biweekly, will be supplemented by additional traps if necessary. The surveillance data, combined with micro-scale indicators, will enable spatio-temporal analyses of mosquito activity concerning indicators and human mobility. Finally, predictive models will also be developed to assess the impact of urban interventions on mosquito activity and to promote healthy routes.