

# MODIRISK

## Mosquito vectors of disease: spatial biodiversity, drivers of change, and risk

### DURATION OF THE PROJECT

Phase 1: 15/12/2006 – 31/01/2009  
Phase 2: 01/02/2009 – 31/01/2011

### BUDGET

1.042.086 €

### KEYWORDS

Eco-climatic changes, Culicidae, taxonomy, spatial distribution models, population genetics, ecology of invasive species

### CONTEXT

MODIRISK aims at studying biodiversity of mosquitoes and monitoring/predicting its changes, and hence actively prepares to address issues on the impact of biodiversity change with particular reference to invasive species and the risk to introduce new pathogens. This is essential in the perspective of the ongoing global changes creating suitable conditions for the spread of invasive species and the (re)emergence of vector-borne diseases in Europe. The main strengths of the project in the context of sustainable development are the link between biodiversity and health-environment, and its contribution to the development of tools to better describe the spatial distribution of mosquito biodiversity. MODIRISK addresses key topics of the global initiative Diversitas, which was one of the main drivers of the 'Research programme Science for a Sustainable Development' (SSD).

work of CO<sub>2</sub>-baited traps will be used throughout Belgium in a grid-based (10 x 10 km) sampling approach where different habitats in each grid will be sampled. The spatial database for Belgium will be completed with existing records from The Netherlands.

Longitudinal population dynamic studies of endemic and invasive vector species will be conducted in selected field sites in Belgium based on the results from the cross-sectional surveys. Additional laboratory experiments will be conducted to measure the impact of temperature on flight performance, oviposition and larval development. Winter survival and competition between invasive and endemic species will also be studied. The outcomes of the longitudinal field studies and the laboratory trials will be used to assess whether the invasive species are timely records or well established populations. Furthermore they will serve as a basis for Pest Risk Assessment (PRA) enabling to identify a set of drivers needed for the development of 'what-if' scenarios.

### PROJECT DESCRIPTION

#### Objectives

Mosquito-borne diseases are prime candidates as (re)emerging vector-borne disease in Europe. Knowledge of the taxonomic and functional biodiversity of both endemic and invading mosquito species as well as the factors driving change is missing in Belgium. Acquiring this knowledge is an essential step towards understanding current risk and preparing for future threats. Therefore the objectives of MODIRISK are (1) to inventorize endemic and invading mosquito species in Belgium considering environmental and taxonomic elements of biodiversity, (2) to assess the population dynamics of selected endemic and invasive mosquito species and their interrelationship (3) to model mosquito biodiversity distribution at a 1km resolution, and (4) to disseminate project outputs.

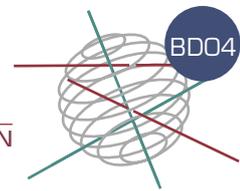
#### Methodology

Cross-sectional field surveys will be conducted during the first phase of the project to inventorize mosquitoes. A net-

Based on the results of the cross sectional surveys, distribution models, predicting the probability of presence of Culicidae species at a 1km resolution, will be developed. The models will be based on multivariate analysis techniques and use ground measured and remotely sensed eco-climatic data as main predictor variables. Additional field surveys will be conducted in the second phase of the project in Belgium and in The Netherlands to validate and further fine tune the produced models. The model outputs will enable to understand the factors (mainly eco-climatic, but also human driven such as land use, urbanisation) determining the observed distribution patterns. They will also enable to highlight Culicidae biodiversity hotspots which are of prime importance when addressing the issue of emergence of diseases. Documented 'what-if' scenarios will be developed based on information extracted from the PRA, the spatial distribution models and published climate change patterns.

Based on the experience gained during MODIRISK a cost-effective monitoring strategy will be designed. The results of comparative trap trials of different trapping systems, opera-





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ting on different attractants, and conducted to evaluate how trapping devices can be used for Culicidae monitoring in general and as sentinel monitoring system for invasive species in particular, will also be included in this integrated approach.

linking up with a project in The Netherlands will result in more robust results and prepare for later expansion of activities in Europe.

## EXPECTED RESULTS AND /OR PRODUCTS

## INTERACTION BETWEEN THE DIFFERENT PARTNERS

The activities of the different partners of this interdisciplinary network are complementary and strongly interlinked. For each work package (monitoring, population assessment, modelling, and dissemination) a responsible is assigned, but all partners also contribute to the other work packages. The integration of the project data with data from The Netherlands will improve the developed distribution models.

### Link international programmes

MODIRISK fills up an essential knowledge gap in Europe, and the expansion of model outputs through

MODIRISK will provide data on the distribution of endemic and invasive mosquitoes in Belgium, and their population status. It will supply predictive spatial models on the presence/absence of mosquitoes and will contribute to understand the impact of eco-climatic changes on their distribution. An improved understanding of the biodiversity of mosquito vectors is an essential step towards an improved understanding of the ecology of the diseases they transmit. The project will also provide an adapted spatial sampling strategy approach for the monitoring of endemic and invasive arbovirus vectors and on different trapping systems that can be used in such a monitoring systems.

## PARTNERS - ACTIVITIES

**Institute of Tropical Medicine (ITM):** General co-ordination, cross-section and longitudinal mosquito monitoring, morphological and molecular identification, model building, data management

**Royal Belgian Institute of Natural Sciences (RBINS):** Cross-section and longitudinal mosquito monitoring, morphological identification, holding biological database

**Université Catholique de Louvain (UCL):** Cross-section mosquito monitoring, morphological identification, population study, Pest Risk Assessment

**Avia-GIS (Avia-GIS):** Spatial sampling strategy, remote sensing, spatial modelling, 'What If' scenario's, data management and spatial information system.

**Wageningen University (WU):** Cross sectional mosquito monitoring, link with data from The Netherlands

## CONTACT INFORMATION

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### Follow-up Committee

For the complete and most up-to-date composition of the Follow-up Committee, please consult our Federal Research Actions Database (FEDRA) by visiting <http://www.belspo.be/fedra> or <http://www.belspo.be/ssd>

