



# Mosquito-borne viral diseases in the light of climate change and globalisation: How is research linked between scientific disciplines?

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## Background

### Climate and Global Change and Mosquito-borne viral diseases:

Recently, the growing body of literature illuminates the impact of climate change and globalisation on vector-borne infectious diseases in Europe (Fig.1). The perception of determining factors is controversial and differs between diseases. Dealing with questions of infection diseases regarding genetical, virological or physiological issues, scientists of biology, human medicine and veterinary sciences already have build networks. Climate and global change issues and their ecological impacts are widely investigated by ecologists and scientists from geo and environmental sciences.

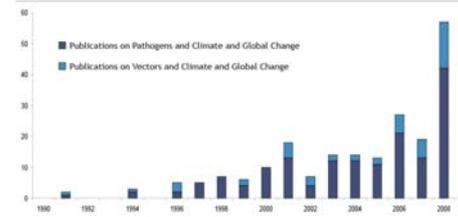


Fig 1. A growing number of scientific papers is dealing with mosquito-borne diseases / vectors and climate + global change issues

## Methods

The question arose, if relations between these scientific groups are established to solve research queries in the field of mosquito-borne diseases and climate change and global change issues. Therefore we addressed three main questions:

**A) Scientific disciplines:** Which discipline dominates literature on vectors and pathogens in a rapidly changing European environment?

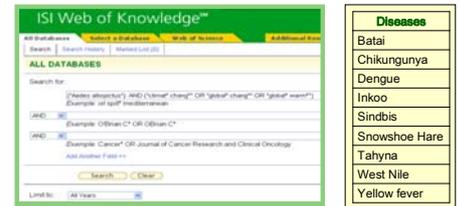
We conducted a literature review in the ISI Web of Knowledge over all human mosquito-borne viruses and their vectors in Europe in the context of changing climate and global change (Fig. 2).

**B) Citation behaviour:** Do scientists consider results of other disciplines to extend their expertise?

We create a citation map with backward citations for selected (Impact factor) publications for each scientific discipline. Only the first generation records, that are directly cited by the publication were examined.

**C) Interdisciplinary cooperation:** Which options of interdisciplinary collaborations exist?

We reviewed the publications to find prime examples of multidisciplinary cooperation.



Vector Species	Coquilletidia richiardii	Ochlerotatus cantans
Aedes albopictus	Culex pipiens	Ochlerotatus caspius
Aedes cinereus	Culex torrentium	Ochlerotatus cataphylla
Aedes vexans	Culiseta annulata	Ochlerotatus communis
Anopheles claviger	Culiseta impatiens	Ochlerotatus flavescens
Anopheles hyrcanus	Culiseta inornata	Ochlerotatus hexodontus
Anopheles maculipennis	Culiseta morsitans	Ochlerotatus punctor

Fig 2. Search strings of the literature survey: combining vector and pathogen of mosquito-borne diseases in Europe with changing climate and global change issues.

## Results

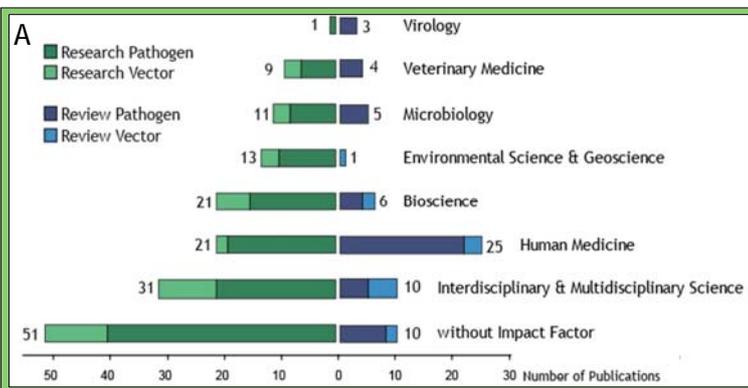


Fig 3. Involvement of scientific disciplines dealing with vectors and pathogens in a changing European environment

### A) Scientific disciplines:

Only 51 of overall 222 publications deal with vector species, the others concern pathogens. The majority of publications could be attributed to human medicine (46) and interdisciplinary & multidisciplinary science (41) and biosciences (27).

Whereas research on pathogens and climate as well as global change issues is found over all scientific disciplines, publications on vector species interestingly are focused in interdisciplinary journals and even more in multidisciplinary journals (Fig.3).

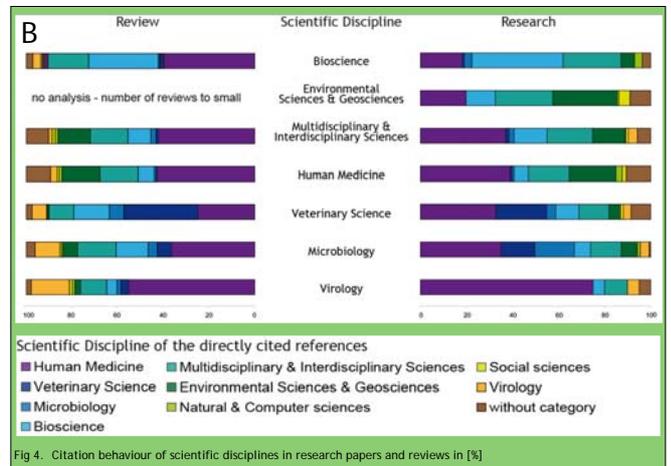


Fig 4. Citation behaviour of scientific disciplines in research papers and reviews in [%]

### B) Citation behaviour:

The citation behaviour of 10 publications per scientific discipline (research and review, 5 respectively) was examined by analysing 4935 cited references: the majority of references are attributed to the human medicine literature, an unexpected low proportion of cited references belong to the biosciences category (Fig 4).

However multidisciplinary and interdisciplinary articles are cited in each scientific discipline with at least 10%. Results of environmental sciences and geosciences receive surprisingly high attention in human medicine publications.

### C) Interdisciplinary cooperation:

Studies on mosquito-borne diseases are supposed to be an interdisciplinary field that could be based on several disciplines for a better understanding how epidemics evolve.

We find relatively large portion of literature in multi- and interdisciplinary journals such as Nature, Science and EHP. Several multidisciplinary approaches exist, where researcher of different disciplines are just working parallel to answer a research question. However, truly interdisciplinary work which should attempt to combine different scientific positions is rare.

## Conclusions

- Main challenges in research on mosquito-borne diseases: differences in scale (microorganisms to mammals, microhabitat conditions to global climate change) and time-delayed response of infectious disease due to environmental changes
- Communication networks between scientific disciplines and share of specific methods is time consuming, however promise new insights in the future development of mosquito-borne diseases

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