

# Impact of global warming on arboviral diseases

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## EMERGING ARBOVIRAL DISEASES

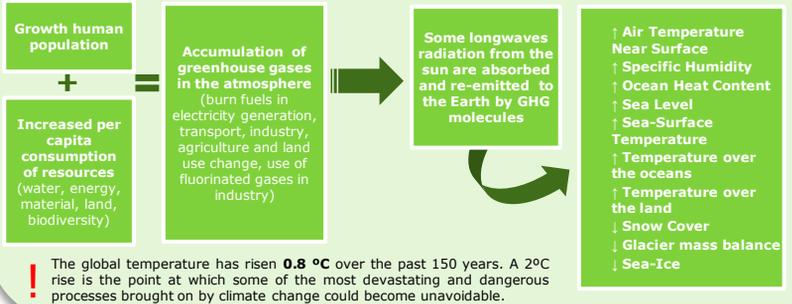
In the past 50 years, many **vector-borne diseases** have emerged. Some of these diseases are produced for exotic pathogens that have been introduced into new regions and others are endemic species that have increased in incidence or have started to infect the human populations for first time (new pathogens).

Many of these vector-borne diseases are caused by **arbovirus**. Arboviruses are virus transmitted by **arthropods** vectors, such mosquitoes, ticks or sanflies. The virus is usually transmitted to the vector by a blood meal, after replicates in the vector salivary glands, where it will be transmitted to a other animal upon feeding. Thus, the **virus is amplified by the vector** and without it, the arbovirus can't spread.

In 1991, Robert Shope, presented the hypothesis that **global warming** might result in a worldwide increase of zoonotic infectious diseases. Today, we can say that during the past 50 years patterns of emerging arbovirus diseases have change considerably. Can this be attributed to climate change?

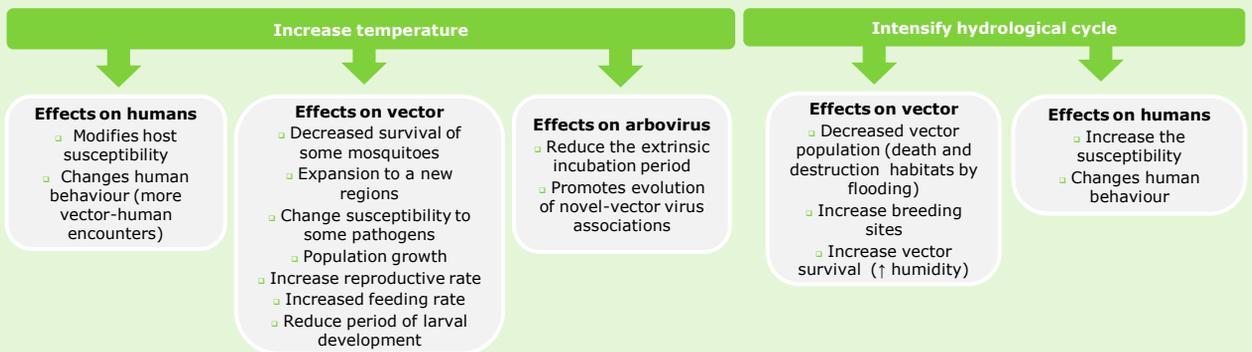
## GLOBAL WARMING

The accumulation of greenhouse gases (GHG) in the atmosphere by **human activity** altered the balance of radiation of the atmosphere, altering the **TEMPERATURE** at the Earth's surface [1].



## IMPACT OF GLOBAL WARMING ON ARBOVIRAL DISEASES

→ Climate is a key determinant of the emergence of infectious diseases: it **constrains the range of infectious diseases** and influence **pathogens, vectors, hosts defences** and **habitat**. Arthropod vectors are cold-blooded (ectothermic) and thus especially sensitive to climatic factors [1].



## THE SPREAD OF A DANGEROUS VECTOR

*Aedes albopictus* is the fastest spreading vector over the past two decades and is considered the **most invasive mosquito species in the world** [2]

- ◆ It's original from **Southeast Asia**. Now is present in **North, Central and Southern America**, parts of **Africa**, northern **Australia** and several countries in **Europe**
- ◆ Is associated with the transmission of several arbovirus, such **Dengue**, **West Nile**, **Chikungunya**, **Yellow fever** and **Japanese encephalitis**
- ◆ Is adapted a **temperate climates**
- ◆ Can **compete** and **eradicate** resident species



Figure [1]: Suitability of the establishment of the tiger mosquito under the minimum climate change scenario, long term (2030). (source: [www.eea.europa.eu/data-and-maps/figures/suitability-of-the-establishment-of-](http://www.eea.europa.eu/data-and-maps/figures/suitability-of-the-establishment-of-))



Figure [2]: *Aedes albopictus* (© James Gathany, CDC)

## EMERGING MOSQUITO-BORNE DISEASES

**Dengue** is the **world's fastest-spreading tropical disease** and represents a pandemic threat [3].

- ◆ **First isolated:** Japan (1943)
- ◆ **Actually range:** **Africa, America, Eastern Mediterranean, South Pacific and Europe**
- ◆ **Cycle:** **human-mosquitoes**
- ◆ **Transmission:** only by the **bite** of the mosquito
- ◆ **Disease:** **Dengue Fever, Dengue Haemorrhagic Fever and Dengue Shock Syndrome**

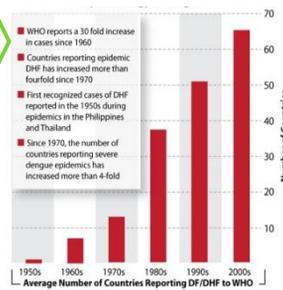


Figure [3]: Dengue epidemiology (source: DengueMatters, [www.denguematters.info/content/issue-11-spotlight-dengue](http://www.denguematters.info/content/issue-11-spotlight-dengue))

**Because of the absence of available vaccine, the primary preventive measure to reduce dengue infections is the control of mosquito populations** [4]

- Monitoring mosquito populations
- Source reduction
- Biological control
- Chemical adulting
- Personal protections measures
- Genetic modified mosquitoes

## CONCLUSIONS

Climate is a factor that determine; the **geographic and temporal distribution of arthropods**, the **characteristics of arthropod life cycles**, the **dispersal patterns** and **evolution of arbovirus** and the **efficiency of the transmission**.

However, climate is only one of many factors which has influence in the arboviral emergence. Others would be deforestation, land use, international trade and travel, host density or globalization [5].

## REFERENCES

- [1] Anthony J. McMichael, Rosalie E. Woodruff (2008) "14 - Climate change and infectious diseases" *Social Ecology of Infectious diseases*: 378-407.
- [2] Paupy C, Delatte H, Bagny L, Corbel V, Fontenille D (2009) "*Aedes albopictus*, an arbovirus vector: from the darkness to the light" *Microbes Infect.* 11(14-15):1177-85
- [3] WHO (2009). *Dengue Guidelines for Diagnosis, Treatment, Prevention and Control*. Geneva: World Health Organization.
- [4] A Marm Kilpatrick, Sarah E Randolph. (2012) "Drivers, dynamics, and control of emerging vector-borne zoonotic diseases" *The Lancet*, Volume 380 (9857): 1946-1955.
- [5] Robert W. Sutherst (2004) "Global Change and Human Vulnerability to Vector-Borne Diseases" *American Society for Microbiology*, Volume 17(1): 136-173.