Modelling the global distribution of mosquito-spread diseases

Level: MSc
Start: Anytime
Project form: Literature study and statistical modelling
Supervision: Floris Neijnens (floris.neijnens@ru.nl)

Background

Many diseases are not directly transmitted between humans, but instead are carried by organisms called vectors. Mosquitoes are one of the most notable vector species, and can spread diseases such as malaria, chikungunya, and dengue (Hotez and Kamath, 2009). Mosquitos in the family *Culicidae* are particularly active disease spreaders, because of their environmental abundance, high diversity and habitat preference near human settlements (Benedict et al. 2007, Ding et al. 2018). Global environmental change may lead to an increase in mosquito prevalence, pointing at a need to better understand and forecast their distribution.

Aim

The aim of this project is to model the global distribution of a selection of mosquito species in relation to relevant abiotic factors in freshwater systems (e.g. nutrients, water temperature).

Approach and outcome

You will develop global species distribution models (SDMs) for a selected mosquito species. Firstly, you will conduct a literature and data search to identify one or more relevant mosquito species, potential factors influencing their survival and reproduction, and occurrence records. Next, you will model the species' occurrence as a function of the environmental factors that you identified. You will then use this statistical relationship to assess the occurrence and potential spread of mosquito species to new areas (e.g. Figure 1, Ding et al. 2018).

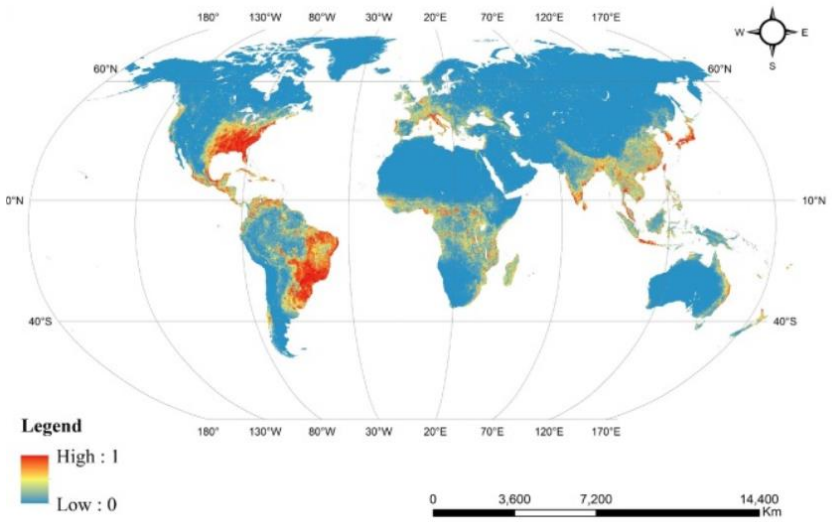

Figure 1: Simulated distribution of the mosquito species *Aedes albopictus* (Ding et al. 2018).

Sources

Benedict MQ, Levine RS, Hawley WA, Lounibos LP. 2007. Spread of the Tiger: Global risk of invasion by the mosquito Aedes albopictus. *Vector-borne and zoonotic Diseases* 7:76-85.

Ding F, Fu J, Jiang D, Hao M, Lin G. 2018. Mapping the spatial distribution of *Aedes aegypti* and *Aedes albopictus*. *Acta tropica 178*:155-162.

Hotez PJ, Kamath A. 2009. Neglected tropical diseases in sub-Saharan Africa: review of their prevalence, distribution, and disease burden. *PLoS Neglected Tropical Diseases* 3:e412.