Environmental conditions affect human health in the Amazon forest

LUCIA: Land use, climate and infections in Western Amazonia
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http://institutodegeografia.org/lucia/

Summary:

A computer model to estimate malaria transmission as a result of changes in climate and land-use proves useful for public policy making and reduce social and economic consequences.

Climate change, migrations or land use changes due to urbanization, road building and deforestation for agriculture and trade, increase the occurrence of infectious vector-borne diseases transmitted by mosquitoes and some animals.

In the south-western Amazon, two types of parasite are responsible for malaria cases, a potentially fatal disease. They are *Plasmodium falciparum* and *Plasmodium vivax*, which infect humans through the bite from mosquitoes *Anopheles darlingi* and cause the disease.

A computer model simulating the activity of the agents present in the infection process - mosquitoes, parasites and human beings- was able to reproduce accurately spatial and temporal variations in the transmission of malaria in environments with low endemicity that are subject to river flooding, a frequent event in the Amazon region of Brazil, Ecuador, and Peru. The information obtained makes it possible to develop public policies to reduce the social and economic impacts on the people affected by the parasite.

With the support of the Inter-American Institute for Global Change Research (IAI), economist and demographer Alisson F. Barbieri, Institute of Geosciences, Federal University of Minas Gerais in Belo Horizonte, Brazil, and his network *Land Use, Climate and Infections in Western Amazonia* (LUCIA), which includes researchers from several countries, validated the Agent based model (ABM) in three regions of western Amazon to prove how the combination of land use and climate dynamics impact on the vulnerability and health of people: in the northeast of Ecuador, where three factors, i.e., mining, indigenous people and settlers; in Machadinho, Brazil, where agricultural expansion and deforestation increase the vulnerability of its inhabitants; and in Madre de Dios, Peru, where gold mining and deforestation impact on human health.

Based on the case of Perú, the model was validated with information on malaria incidence reported empirically in the locality of Padre Cocha, from 1996 to 1998. The model includes the representation of agents –mosquito habits, different transmission patterns of infection by *Plasmodium*, as well as the population dynamics in the region–, and of the environment where the malaria infection cycle takes place; for instance climate changes or floods in the adjacent water bodies.

Studies showed that risk is low in the center of the settlement, away from the rivers, while homes that are in the peripheries are more susceptible for the disease. Moreover, the management of sources of mosquito larvae development is key to vector eradication or reduction, which was simulated by the model.

Consequently, once the model was able to reproduce past conditions that matched the records, although not all the factors were represented in their full complexity, several potential scenarios were put forward in order to understand the effects of management of the places of larvae development, in an area of more than 200 meters around settlements. It was found that eliminating larvae sources causes the disease to disappear. In view of these research results Ecuador has already modified their mining-related policies, says researcher Barbieri.

Sponsored by the IAI, researchers continue their research based on the lessons learned. One of which is the importance of involving decision makers from the inception phase of research projects. Another lection is that measuring vulnerability needs to consider not only human and social aspects but also environmental conditions.

In addition, the migration that is taking place in the region in the past years, makes it necessary for national health monitoring and surveillance systems to consider past migrations and environmental conditions to correlate them with disease episodes.