Dr Anna M Stewart-Ibarra leads a team of researchers based in Ecuador, to deepen our knowledge of mosquito-borne viral diseases. Countries throughout the tropics and subtropics currently face an alarming situation with concurrent epidemics of dengue fever, Zika fever and chikungunya. Conventional vector control and surveillance methods against these viruses have failed to effectively control outbreaks and there is a lack of preventative vaccines readily available. Dr Stewart-Ibarra is using a social-ecological systems (SES) approach to understand how the biophysical and social systems interact to influence the complex dynamics behind these disease epidemics.

Dr Stewart-Ibarra is Director of the Latin America Research Program of The Center for Global Health & Translational Science (CGHATS), at the State University of New York, Upstate Medical University. She is a founding member and director of The Global Health Research Platform, a CGHATS programme based in Machala, Ecuador, that supports research, educational and clinical initiatives to overcome and understand mosquito-borne diseases. Dr Stewart-Ibarra’s interdisciplinary team is currently studying dengue fever and other tropical infectious diseases in the area.

Dr Stewart-Ibarra first embarked on her work a decade ago when she began her PhD research on mosquito larval habitat, and climate and social-ecological drivers of dengue fever transmission in the region. Her initial studies in Machala provided the first evidence regarding the effect of climate and social drivers on dengue fever epidemics in the region. Dengue fever, a virus transmitted by the Aedes aegypti mosquito, has emerged as one of the top public health concerns worldwide. Her novel approach to the investigation of dengue fever led her and her colleagues to uncover vital information on how social vulnerability interacts with climatic factors to influence the risk of vector borne diseases.

**URBAN MOSQUITOES SPREAD EMerging VIRUSES**

Dengue fever, Zika fever, and chikungunya are diseases caused by viruses that are transmitted to people primarily by two species of mosquito vectors: the female Aedes aegypti and Aedes albopictus. Aedes aegypti have adapted specifically to urban environments, breeding in containers with standing water around the home, and biting throughout the day. Aedes aegypti are a highly invasive species, and today, they are common across the tropics and subtropics, posing a major public health threat with the emergence of new outbreaks of viral diseases that are spread by the mosquito.

Due to Zika virus rapidly emerging as a major threat to public health, the National Science Foundation (NSF) recently funded $1.7 million worth of rapid response (RAPID)
Dr Stewart-Ibarra’s current research, supported by one of these grants awarded to Upstate Medical University, involves the study of Zika virus transmission in people and mosquito vectors, in relation to climatic and social-ecological factors in southern coastal Ecuador. Findings from the project will help public health officials develop an early warning system that incorporates climate and mosquito vectors, in relation to climatic microclimate on disease transmission, and the economic burden of these diseases on families in affected areas. Her team’s work is based in several cities in Ecuador, including Machala, Huaquilias, Portovuelo, and Zaruma. These localities vary in their elevation, climate and socioeconomic conditions, allowing the researchers to investigate how these factors influence the numbers of mosquitoes and disease transmission rates. The results they are obtaining are providing crucial information for establishing effective measures to control the spread of Zika and other mosquito-borne diseases worldwide.

**KNOWLEDGE ON A LOCAL SCALE**

Currently, there are no vaccines available for Zika or chikungunya, and people have limited access to the dengue fever vaccine, licensed recently by Sanofi Pasteur. The need to find effective alternative strategies for management of these diseases is therefore all the more pressing. The only way to control the spread at present is by controlling mosquito populations, which depend on a complex interplay of social and environmental factors. Dr Stewart-Ibarra’s research findings are helping to inform public health officials about how to best develop strategies, particularly in high-risk communities.

Through a grant from the US Department of Defense to Upstate, she and her colleagues have developed a prototype for a new, low-cost portable device to specifically attract and exterminate Aedes aegypti mosquitoes.

In the urban areas where Dr Stewart-Ibarra is conducting research, many people are living in suboptimal housing conditions. This leaves them far more exposed to bites and vulnerable to acquiring a febrile infection. Her studies have also shown that the economic burden of controlling the mosquitoes is significant for low-income households.

On a community level, the researchers have found that mosquito breeding and dengue risk is surprisingly clustered as specific households. A high prevalence of disease was found to be associated with risk factors that included the condition of the house, amount of shade on the patio, and access to piped water. Any water-bearing container can become a mosquito breeding ground, such as 55 gallon drums, tires, and rubber. Her studies have shown that preventative practices to reduce disease transmission can be as straightforward as covering or cleaning up water receptacles, altering shade on the property, and using mosquito nets. Her studies found that rainfall had affected mosquito abundance in certain communities but not others, due to differences in housing conditions. In areas where the mosquito was found breeding in discarded outdoor containers filled with rainwater, rainfall did have an effect on mosquito abundance. In areas where the mosquito was found breeding in discarded outdoor containers filled with rainwater, rainfall did not have an effect. In areas where the mosquito was found breeding in discarded outdoor containers filled with rainwater, rainfall did have an effect on mosquito abundance.

Dr Stewart-Ibarra’s initial studies provided the first evidence regarding the role of climate and social risk factors in the transmission of dengue fever in this region.
It is imperative that researchers learn all they can about the climate events that trigger vector-borne outbreaks to better predict and prevent epidemics.