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RESEARCH SPOTLIGHT

Highlighting exciting new research from AGU journals

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Using rainfall estimates to predict malaria transmission

Malaria kills nearly a million people each year, mostly in rural Africa. The disease is spread by mosquitoes, which thrive in wet areas, so malaria transmission is closely linked to rainfall. Rainfall estimates could therefore be used to help predict potential malaria transmission. However, rain gauge networks are sparse in many of the rural areas that are hit hardest by malaria.

Teresa Yamana

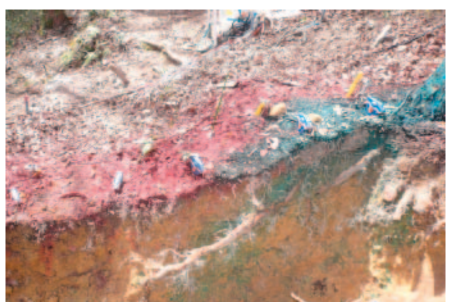
Water pools, such as this one in Niger, can be breeding grounds for malaria-carrying mosquitoes. A new study uses satellite-based rainfall observations in a model for predicting malaria transmission.

Yamana and Eltahir show that satellite-based rainfall estimates can be used with a model called the Hydrology, Entomology and Malaria Transmission Simulator (HYDREMATS). They demonstrated that the model requires rainfall data with at least 1-hour resolution, which can be provided by satellite observations. They ran the HYDREMATS model with ground-based observations and with satellite-based observations and found that the satellite-based observations worked well in simulating the dynamics of mosquito populations and thus in predicting malaria transmission. Predicting mosquito population activity could help planners determine where to focus efforts to limit the spread of the deadly disease. (*Water Resources Research*, doi:10.1029/2010WR009744, 2011) —ET

Trees may enhance landslide hazards

The amount of water saturated in soil layers depends on many factors, such as weather, climate, local geology, slope steepness, vegetation cover, and vegetation type. In forests, vegetation plays a key role in regulating soil saturation; tree canopies intercept rainfall that is then partitioned into water that drips off leaves (throughfall) and water that runs down tree trunks (stemflow). As a result, the water that reaches the soil layer is not evenly distributed along the forest floor. Patterns in this water distribution may influence how and where landslides occur.

Seeking to determine these patterns, *Liang et al.* observed two similarly sized trees at the same elevation on a 28° hillslope in a forest in Taiwan. They measured overall precipitation as well as water saturation surrounding each tree for 1 year, except that for the second tree they devised an apparatus by which stemflow running down the tree trunk was captured and prevented from reaching the soil. After the year was over, the authors added the stemflow-catching apparatus to the first tree and recorded soil water saturation for an additional year. By comparing data about soil saturation around both trees and on the tree whose conditions changed, the authors were able to show that stemflow preferentially funnels water to around the tree base and along tree roots. In fact, blocking stemflow caused a nearly 75% reduction in soil water storage surrounding the trees and a nearly 70% reduction in water reaching the soil-bedrock layer, where deep roots penetrate.



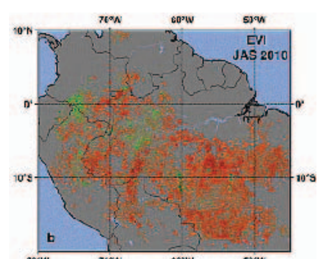
How do trees filter the precipitation that reaches the forest floor? Using dyes as tracers, an experiment shows that water hitting tree trunks gets funneled along thick roots (blue dye) and that water hitting leaves pools and penetrates upper soil layers (red dye).

To get an idea of how rain interacts with trees, the authors then sought to separate throughfall from stemflow through an experiment on one of the two trees in the study. Using a sprinkler, the authors showered the tree and areas surrounding it with water dyed red, to represent throughfall. About a half hour later, they focused a stream of water, dyed blue, onto the side of the tree trunk facing upslope to represent stemflow. After some time, the authors dug a trench to see where their water had percolated through the soil. As expected, they found that the red dye was more diffusely spread in the upper layers of soil, whereas blue dye traveled deeper, hugging thick roots.

These observations help to support the idea that water from stemflow could contribute to saturation of the soil-bedrock interface, a factor that could greatly increase landslide hazards on steep slopes. (*Water Resources Research,* doi:10.1029/2010WR009856, 2011) —MK

Amazon region became less green due to 2010 drought

New research shows that the Amazon region became significantly less green due to a severe 2010 drought. *Xu et al.* analyzed satellite-based measurements to compare the greenness of Amazon vegetation due to the 2010 drought to that caused by a severe drought in 2005. They found that the decline in greenness due to the 2010 drought affected an area 4 times greater than the area affected in 2005. More than half of all drought-stricken forest showed greenness declines in 2010, compared to only 14% in 2005. Furthermore, the declines in greenness in 2010 persisted past the time when rainfall returned to normal levels. Vegetation that is not as green absorbs less carbon dioxide (CO_2), leaving more CO_2 in the atmosphere, possibly accelerating global warming. (*Geophysical Research Letters*, doi:10.1029/2011GL046824, 2011) —ET



Spatial patterns of July-August-September (JAS) 2010 standardized anomalies of normalized difference vegetation index (NDVI) in vegetated areas of drought show that the Amazon region became less green due to the 2010 drought. Red colors indicate areas where greenness declined.

—MOHI KUMAR and ERNIE TRETKOFF, Staff Writers