

Dengue and the Landscape: A Threat to Public Health

by

Hannah L. Rusch and Jim Perry

Department of Fisheries, Wildlife & Conservation Biology
University of Minnesota—Twin Cities



Part I – Introduction to the Problem

Kemar labored under the tropical sun all day trying to make progress clearing out the drainage canals surrounding his field. It was slow work whacking reeds with his machete and trying to pry up the roots from the swampy soil. As evening approached, Kemar heard the rumble of thunder over the hills. He straightened his stiff back and looked skyward. A dark wall of clouds announced the approaching rain. After last year's drought, Kemar initially welcomed the rain. However, the intensity of this year's rain presented its own troubles.

Night quickly fell as Kemar gathered his tools and walked home down the gravel road. He saw his neighbor LeJohn out in his yard. "Hello LeJohn, you alright?" Kemar asked.

"I'd be better if there weren't so many mosquitoes," replied LeJohn, as he killed another mosquito. "The mosquitoes are breeding up worse than ever before. They are so thick this year that my family and I can't get any rest at night. And on top of it all, Shanae is sick now," LeJohn complained.

"What does she have?" Kemar asked.

"I'm not sure," said LeJohn. "She's been complaining of a headache and nausea, joint and muscle pain, and today she found a rash on her body."

"Did she go to the hospital yet?" Kemar asked gently. The Port Maria Hospital sat on top of the hill south of Kemar's field. Although it was just a short distance away, Kemar knew that neither LeJohn nor Shanae had regular employment and hadn't had any for a while; he also knew that going to the hospital was expensive.

"Why don't you come inside and see her?" suggested LeJohn, avoiding the question.

The two men walked into LeJohn's humble home. LeJohn, like many people in the community, had built his own house out of ply board. The windows were small and without screens. The storm fluttered the curtains as Kemar and LeJohn approached Shanae, who was resting on the bed. Despite the heat of the day, she was wrapped up in a blanket. Kemar felt Shanae's forehead.

"LeJohn, she has a fever. She needs to see a doctor. I'll take her," Kemar offered.

Kemar and LeJohn supported Shanae as they walked to the nearest taxi stop, which was located next to a newspaper kiosk. Kemar read the headline on a front page, "77 dengue cases." He continued to read:

Wednesday, August 04, 2010

Dengue Fever continues its march across Central American and Caribbean countries. Yesterday the Health Minister told journalists that of the 77 laboratory-confirmed cases, seven are the more severe form of the illness—dengue hemorrhagic fever (DHF).

So far, no cases of dengue shock syndrome had been reported, nor had there been any related deaths.

The Health Ministry is on high alert in light of the growing number of cases of dengue fever and dengue hemorrhagic fever in the country and region. Consequently fogging and oiling activities have been intensified. Fogging is being carried out in approximately 800 communities across the island.

Just then a taxi for the Port Maria Hospital pulled up. Kamar, LeJohn, and Shanae got in and after a short drive they arrived at the hospital.

Question

1. Which of the conditions described in Kamar's landscape are favorable to mosquito breeding?
2. Thinking more broadly, are there other influences that might contribute to increased mosquito breeding?
3. Given what you know so far about this case, develop at least one hypothesis to explain the cause of Shanae's illness.

Part II – Mosquitoes in the City

Dr. Ling approached the bench outside the hospital where Kamar, LeJohn, and Shanae were waiting. “The laboratory test has confirmed that Shanae has dengue fever,” Dr. Ling announced. “Unfortunately, there is not a specific treatment or vaccine for dengue fever. The best we can do is ensure she is hydrated and monitor her health.”

Kemar thought of the article he had just read. “The newspaper is reporting that the number of cases is increasing,” said Kamar.

“Yes,” Dr. Ling replied. “In recent decades, we have seen more dengue fever cases reported not only in Jamaica, but in the tropics all around the world, especially in urban areas. This rise in dengue cases is alarming because it could also lead to an increase in the number of cases of the more dangerous condition, dengue hemorrhagic syndrome.”

“What causes dengue fever?” LeJohn asked.

“Dengue fever is caused by a virus carried by the *Aedes aegypti* mosquito and transmitted by mosquito bites,” said Dr. Ling. “*A. aegypti* thrive in urban areas because there is an abundance of human hosts and favorable breeding sites. Artificial containers such as tin cans, tires, metal drums, and buckets as well as shaded and vegetated areas that hold small pools of water are the mosquitoes’ favored breeding sites. Stagnant water collected in these areas provides excellent breeding conditions. Adults lay their eggs in the small water bodies; the larvae emerge from the eggs and grow to become mature adults within about four weeks. The adults remain close to their hatching sites, ranging only one to thirty meters, which is another reason why the species favors densely populated urban areas.”

“One concern we have is that as the temperature rises, the incubation period of the *A. aegypti* decreases. The probability of a dengue outbreak increases as the number of *A. aegypti* mosquitoes increases.”



Figure 1. An *Aedes (Ochlerotatus) sp.* mosquito on human skin. Photo by ARS Photo Unit, United States Department of Agriculture, Image Number K4705-9, <http://www.ars.usda.gov/is/graphics/photos/mar09/k4705-9.htm>.

Questions

1. What global trends might explain the rise in dengue fever cases around the world in recent decades?
2. Given what you know now about *A. aegypti* breeding sites, can you identify any additional variables in Kamar’s landscape that are favorable to mosquito breeding?
3. What measures might be taken to reduce or prevent dengue fever?

Part III – Formulating Solutions

A few weeks later, the mosquitoes were still dense, but Shanae had recovered from dengue fever. Although the newspaper said that fogging and oiling to prevent mosquito breeding were to be intensified, Shanae was disappointed that there was no sign of increased efforts in her neighborhood. Worried about the health of her community, Shanae decided to find out why no action had been taken. She walked up the hill to the Port Maria Hospital and asked to speak with Mr. Mac, the head of the Vector Control department of the Ministry of Health.

“Mr. Mac, why haven’t mosquito control crews been to my neighborhood? My neighbors and I are getting sick, but no one from the Ministry of Health seems to care,” Shanae complained.

“It’s not that we don’t care, Shanae. It is our duty at the Ministry of Health to promote the well-being of the citizens. We are doing what we can with the resources we have. If we are to increase mosquito control efforts, we will have to divert money from other health programs. It’s not easy to convince people that money should be taken from programs like maternal health and child nutrition or healthy lifestyles and be spent on killing mosquitoes instead.”

“Something must be done though,” Shanae demanded.

“I agree,” said Mr. Mac. “The Ministry of Health needs the help of the citizens to help prevent the spread of dengue fever.”

“What can we do?” Shanae asked.

Questions

1. In class today: Develop a management plan to prevent mosquito breeding. Select the scale you feel is most appropriate (e.g., local, regional, global) and explain why you chose this scale. What are the short- and long-term benefits to public health of your management plan? What are the environmental implications of your management plan?
2. Post to the course site before next class: Design a public education program to educate Shanae’s community members about dengue fever. Your plan should be at least one full page. What message will your education program communicate? How will information be disseminated? What are the three important variables the education program must consider?
3. Read and post a critique (250-word minimum) of the management and education plans of at least one peer. What are the strengths and weaknesses in the plans? Have any important considerations been ignored?



Image in title block is ©BlessEdd - Fotolia.com. Case copyright held by the **National Center for Case Study Teaching in Science**, University at Buffalo, State University of New York. Originally published August 1, 2011. Please see our **usage guidelines**, which outline our policy concerning permissible reproduction of this work.