Rift Valley fever in a zone potentially occupied by Aedes vexans in Senegal: dynamics and risk mapping

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This paper presents an analysis of the interaction between the various variables associated with Rift Valley fever (RVF) such as the mosquito vector, available hosts and rainfall distribution. To that end, the varying zones potentially occupied by mosquitoes (ZPOM), rainfall events and pond dynamics, and the associated exposure of hosts to the RVF virus by Aedes vexans, were analyzed in the Barkedji area of the Ferlo, Senegal, during the 2003 rainy season. Ponds were identified by remote sensing using a high-resolution SPOT-5 satellite image. Additional data on ponds and rainfall events from the Tropical Rainfall Measuring Mission were combined with in-situ entomological and limnimetric measurements, and the localization of vulnerable ruminant hosts (data derived from QuickBird satellite). Since "Ae. vexans productive events" are dependent on the timing of rainfall for their embryogenesis (six days without rain are necessary to trigger hatching), the dynamic spatio-temporal distribution of Ae. vexans density was based on the total rainfall amount and pond dynamics. Detailed ZPOM mapping was obtained on a daily basis and combined with aggressiveness temporal profiles. Risks zones, i.e. zones where hazards and vulnerability are combined, are expressed by the percentages of parks where animals are potentially exposed to mosquito bites. This new approach, simply relying upon rainfall distribution evaluated from space, is meant to contribute to the implementation of a new, operational early warning system for RVF based on environmental risks linked to climatic and environmental conditions.