



Africa El Niño and increased risk of Rift Valley fever – Warning to countries



Contributors: Claudia Pittiglio^a, Julio Pinto^a, Susanne Münstermann^b, Pierre Formenty^c, Juan Lubroth^a, Stephane de la Rocque^c, Eran Raizman^a, Daniel Beltran-Alcrudo^a

^a Food and Agriculture Organization of the United Nations (FAO); ^b World Organisation for Animal Health (OIE); ^c World Health Organization (WHO)

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Introduction

Rift Valley fever (RVF) is a zoonotic, viral, vector-borne disease representing a threat to human health, animal health and livestock production in Africa, the Near East and potentially, Europe and the rest of the world.

Rift Valley fever primarily affects sheep, goats, cattle, camels, buffaloes, and antelopes. The majority of human infections result from contact with the blood or organs

of infected animals (Figure 1). The socio-economic impact of the disease on people's livelihoods and on trade can be high due to significant losses in livestock production (meat and milk), closure of livestock markets and bans on livestock movement and slaughtering. In Kenya, the RVF epidemic that occurred in 2006–2007 induced estimated losses to the economy of more than 2.1 billion Kenyan Shillings (USD32 million) and extended to various stakeholders in the marketing chain (Rich and Wanyioke, 2010). Other negative impacts included losses in production, increases in unemployment, and a reduction in operating capital among slaughterhouses and butchers.

Outbreaks of RVF are closely associated with periods of heavy rains and prolonged flooding, which increase habitat suitability for vector populations. These factors can drive vector abundance and population dynamics, thus influencing the risk of disease emergence, transmission and spread (Anyamba *et al.*, 2012). In East Africa, RVF epidemics take place periodically every 10 years and are associated with periods of heavy rainfall that occur during the warm phase of the El Niño/Southern Oscillation (ENSO) phenomenon (Anyamba *et al.*, 2012). These findings have enabled the successful development of forecasting models and early warning systems for RVF based on satellite images and weather/climate forecasting data that allow authorities to predict RVF outbreaks, identify potential RVF risk areas and thereby to implement measures to prevent their emergence and mitigate their consequences (Anyamba *et al.*, 2010). In 2006–2007, a climate-based model developed by the Goddard Space Flight Center (GSFC) of the National Aeronautics and Space Administration (NASA), predicted the risk of RVF occurrence in the Horn of Africa several weeks before the

first signs of the disease were recorded in livestock and humans. This facilitated strategic preparedness and significantly enhanced field response (FAO, 2006; WHO, 2006; Anyamba *et al.*, 2010). In contrast, accurate, climate-based early warning systems have not yet been fully elucidated for West Africa because drivers of RVF emergence and spread are not as well known for that region. Outbreaks of RVF in Senegal and Mauritania are associated with different patterns of precipitation anomalies and the effect of El Niño or other climate-affecting phenomena are still poorly understood.

The Goddard Space Flight Center, FAO, WHO, OIE and other partners have been monitoring climatic conditions to forecast the risk of RVF vector amplification in East Africa for the past few years, and have provided recommendations and early warning messages for countries at risk of RVF outbreaks on several occasions. During the past twelve months there has been an increasing concern about the predicted El Niño event and its impact on public and animal health, particularly in Africa. In December 2014, FAO, OIE and WHO issued an awareness communication based on the information provided by the GSFC and climate models on El Niño.

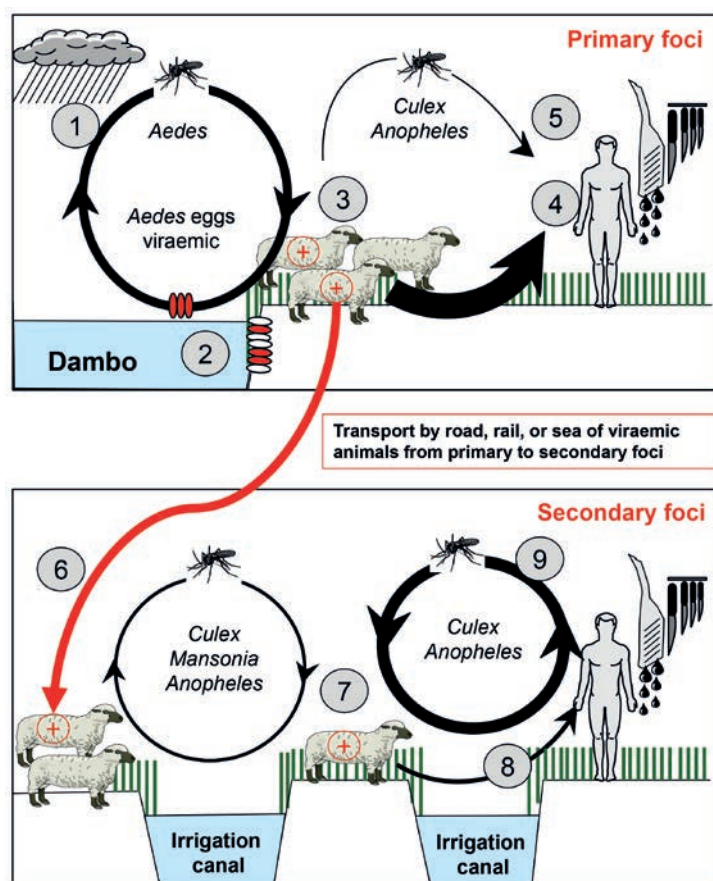
The purpose of this communication is to **warn countries in East Africa about the increased risk of occurrence of RVF outbreaks associated with the El Niño event forecasted in late 2015 and 2016.**

RVF epidemic in 2006–2007

The last RVF outbreak in East Africa started in Kenya in December 2006, following a period of heavier than usual rainfall and widespread flooding, and spread until December 2007 to Somalia, Tanzania and Sudan (Figure 2).

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Figure 1. Schematic transmission of Rift Valley fever

Source: P. Formenty, WHO

Primary foci:

- 1) Following heavy rainfall, dambos with *Aedes* breeding sites are flooded for at least a 10-15 day period.
- 2) A portion of the infected *Aedes* eggs leave dormancy and after hatching, adults emerge infected with the RVF virus.
- 3) *Aedes* female mosquitoes are aggressive, mammophilic blood-feeders; they bite surrounding domestic ruminants (cattle, camels, sheep, goats) that serve as amplification hosts for the virus. The RVF animal outbreak is characterized by massive abortion of females and die-off of young ruminants.
- 4) The large majority of human infections result from direct or indirect contact with the blood or organs of infected animals during slaughtering or butchering; assisting with animal births; delivering veterinary care, or from the manipulation of fresh carcasses or foetuses.
- 5) Later in the course of the outbreak, secondary vectors such as *Culex* breeding in stagnated waters also contribute to the transmission of RVF virus to humans, after acquiring the virus during a previous blood meal on an infected animal.

The ⊕ indicates RVF infected sheep.

Secondary foci:

- 6) Domestic animals infected with RVF at the primary site are imported to irrigation areas by road, rail or sea.
- 7) Irrigation schemes are persistent habitats for *Culex*, *Mansonia* and *Anopheles* mosquitoes, whose abundant populations increase the circulation of the virus between amplifying hosts (cattle, camels, sheep, goats).
- 8) As in primary foci, human infection may result from direct or indirect contact with the blood or organs of infected animals.
- 9) Most cases of human infection, however, result from bites from infected mosquitoes having acquired the virus during a previous blood meal on an infected animal.

The epidemic led to substantial losses of livestock and over 900 human deaths, and an economic loss estimated to exceed USD60 million because of disruption in trade.

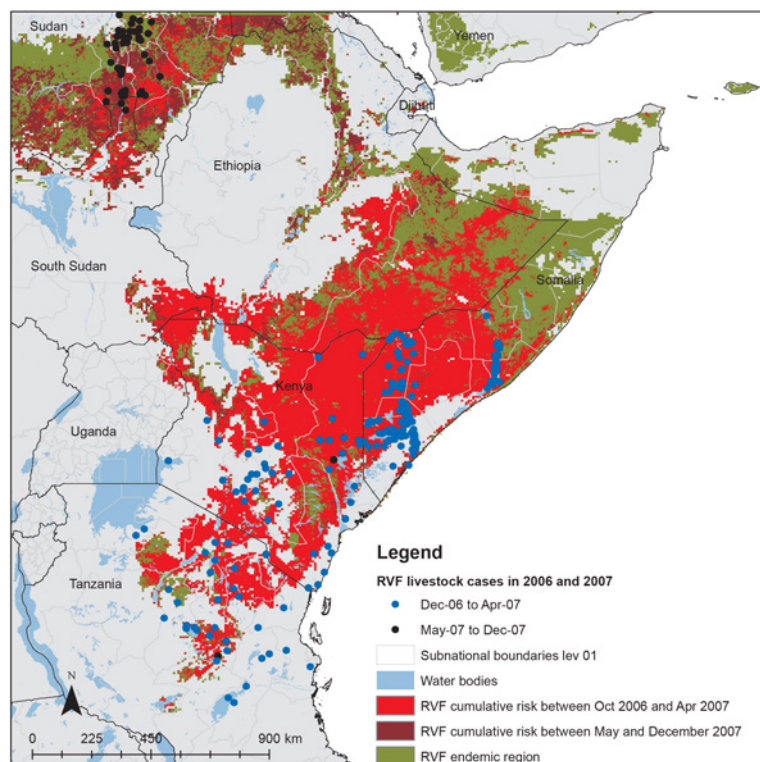
First RVF outbreaks in Mauritania reported in 2015

Mauritania already notified in October 2015 the first cases of RVF in humans. Between 29 September and 11 October, outbreaks were detected in sheep and goat flocks in three regions, located in the centre-south-west part of the country (Figure 3). These cases followed a period of extensive rains and floods in the region during the preceding rainy season. During the same period Mauritania notified 25 human cases to WHO, including 8 human deaths. Unlike previous events, the current RVF episode appears not to be characterized by a massive wave of abortion preceding the human cases. All the confirmed animals were destroyed. In Mauritania, RVF susceptible species are not vaccinated. Five large outbreaks of RVF occurred in Mauritania in 1998, 2003, 2010, 2012 and 2013, generally during the months of September and October.

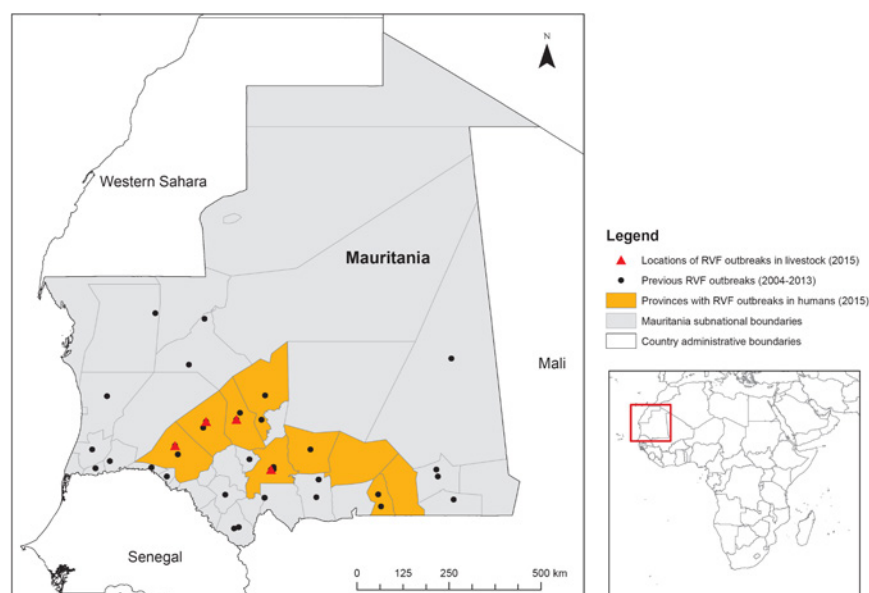
Update on RVF climate forecast in East Africa

Risk modelling based on near-real-time satellite climate and vegetation data, can monitor the first signals of a possible increase in vector abundance and RVF risk, and provide information for prevention and risk mitigation. In East Africa, a modelling approach developed by the NASA GSFC team (Anyamba *et al.*, 2009), based on near-real-time, satellite-derived climate data, such as precipitation and the Normalized Difference Vegetation Index (NDVI), is used to identify and map areas with persistent, heavy, above-average rains and vegetation anomalies over the last three consecutive months, which determine suitable environmental conditions for vector amplification. Results are then interpreted and assessed in relation to El Niño and Sea Surface Temperature (SST) indicators and precipitation forecasts, and compared with historical data.

Since September 2015, NASA GSFC have intensified their monitoring activity to produce weekly maps of precipitation anomalies and monthly RVF risk maps in response to the predicted and current development of the El Niño event in East Africa. Most climate models indicate that El Niño conditions are currently present. Positive equatorial SST anomalies continue across most of the Pacific Ocean and there is an approximately 95% chance that El Niño will continue through the Northern Hemisphere's 2016 winter before gradually weakening during spring. The phenomenon looks very similar to the occurrence in 1997–1998, which caused an RVF epidemic in East Africa.

Figure 2. RVF outbreaks in 2006–2007 and predicted risk areas for vector amplification.

Source: FAO

Figure 3. RVF outbreaks in Mauritania.

Source: FAO

The latest RVF update for East Africa for the period 1 September–12 November, 2015, prepared by NASA/GSFC, GIMMS and AFHSC-GEIS, highlights regions of rainfall hotspots (> 50 mm above the long-term mean) in southern Sudan and

eastern South Sudan, Somalia, southern and northern Ethiopia, northern and central Tanzania, central and southern Kenya, and western Yemen. Small, localized potential RVF risk areas were predicted in southern Somalia for October 2015 (Figures 4a-d

and 5a-d). Abundant rains which occurred in early November have already caused flooding, river inundations, and road closures in many parts of Kenya. Elevated risks for maintained flooding are projected, as locally heavy rain is expected to continue during the next weeks. Heavy rain continues for portions of Somalia, South Sudan, northern Tanzania, and southern Ethiopia, raising flooding concerns in these countries. In some locations, the rainfall estimates and anomalies for October and mid-November 2015 are similar to, or above, values observed in 1997/1998 and/or in 2006/2007, when major outbreaks occurred in the Republic of Kenya, the Federal Republic of Somalia and the United Republic of Tanzania. These include data from reference meteorological stations El Douiem in the Republic of Sudan and Manyara Ranch in the United Republic of Tanzania (Figure 5c).

Preparedness and Awareness Activities on RVF

A variety of training activities and simulations related to Good Emergency Management Practice (GEMP) were held throughout much of East Africa (2013–2014). In the aftermath of the training, Kenya and Tanzania have formed national RVF task forces to increase awareness and preparedness to respond to an eventual outbreak of RVF.

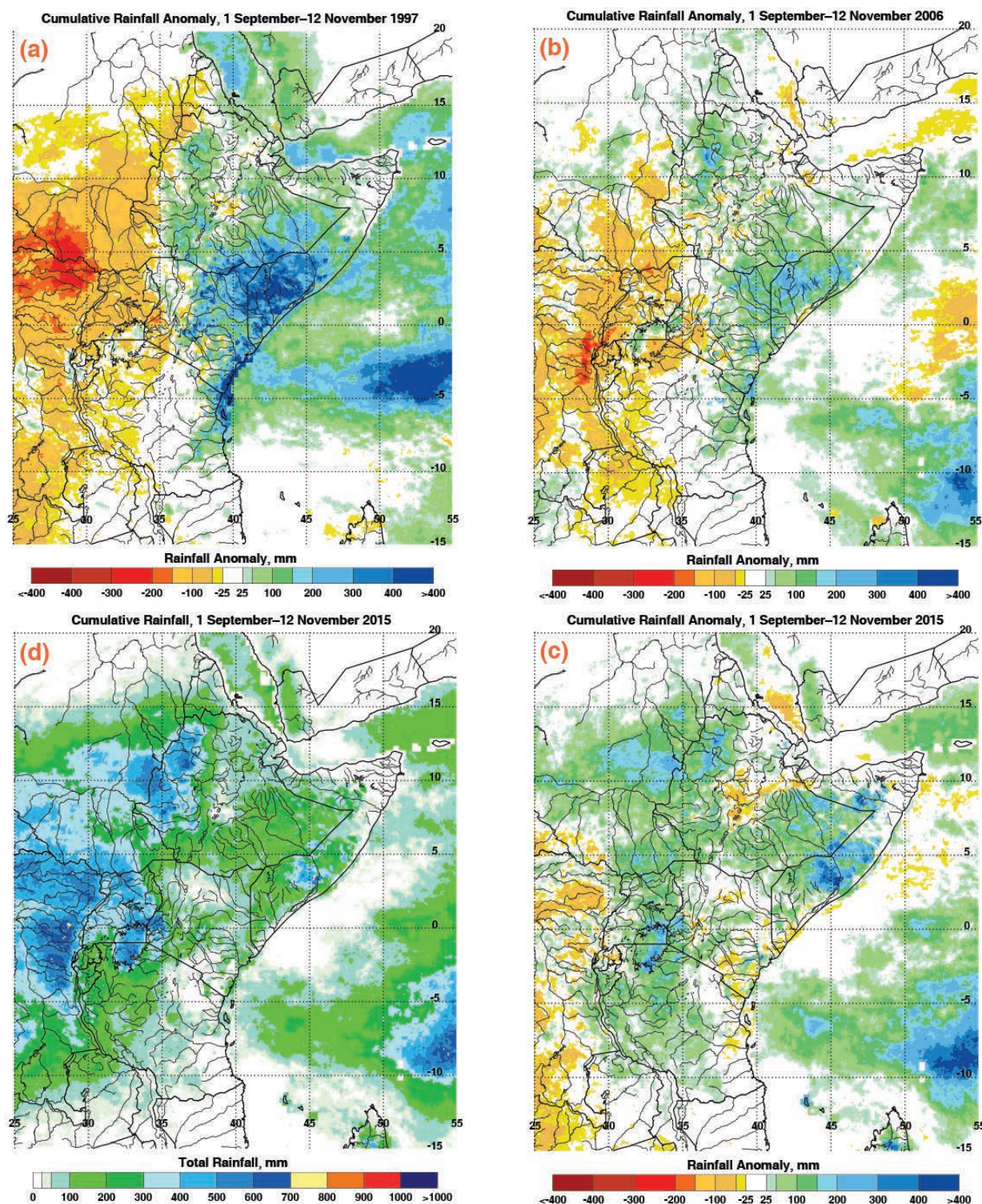
In April 2015, GF-TADs (OIE-FAO) organized an Inter-Regional Conference on “New options for trade, prevention and control of RVF” in Djibouti, where 19 countries from Africa and the Middle East reviewed the surveillance systems, contingency plans and new opportunities offered by recent advances on the side of vaccine and diagnostic tests, and the revision of the chapter in RVF in the OIE *Terrestrial Animal Health Code*.

From 18–19 November, the *Inter-Governmental Authority for Development* (IGAD) convened the chief veterinary officers of its Member States to assess the preparedness for RVF, as agreed as a result of the Djibouti conference.

Related RVF monitoring and preparedness efforts in Eastern Africa have included:

- The elaboration of a contingency plan for dissemination where the risk of possible RVF outbreaks are highest (August to September 2015). Both veterinary and medical officers were included, using the One Health approach.
- Despite being a very risky strategy that could at this point spread the disease, vaccination against RVF is being conducted in four high-risk counties (Garissa, Kilifi, Baringo and Wajir). None of the other countries in the region has embarked on risk-based vaccination at this point.

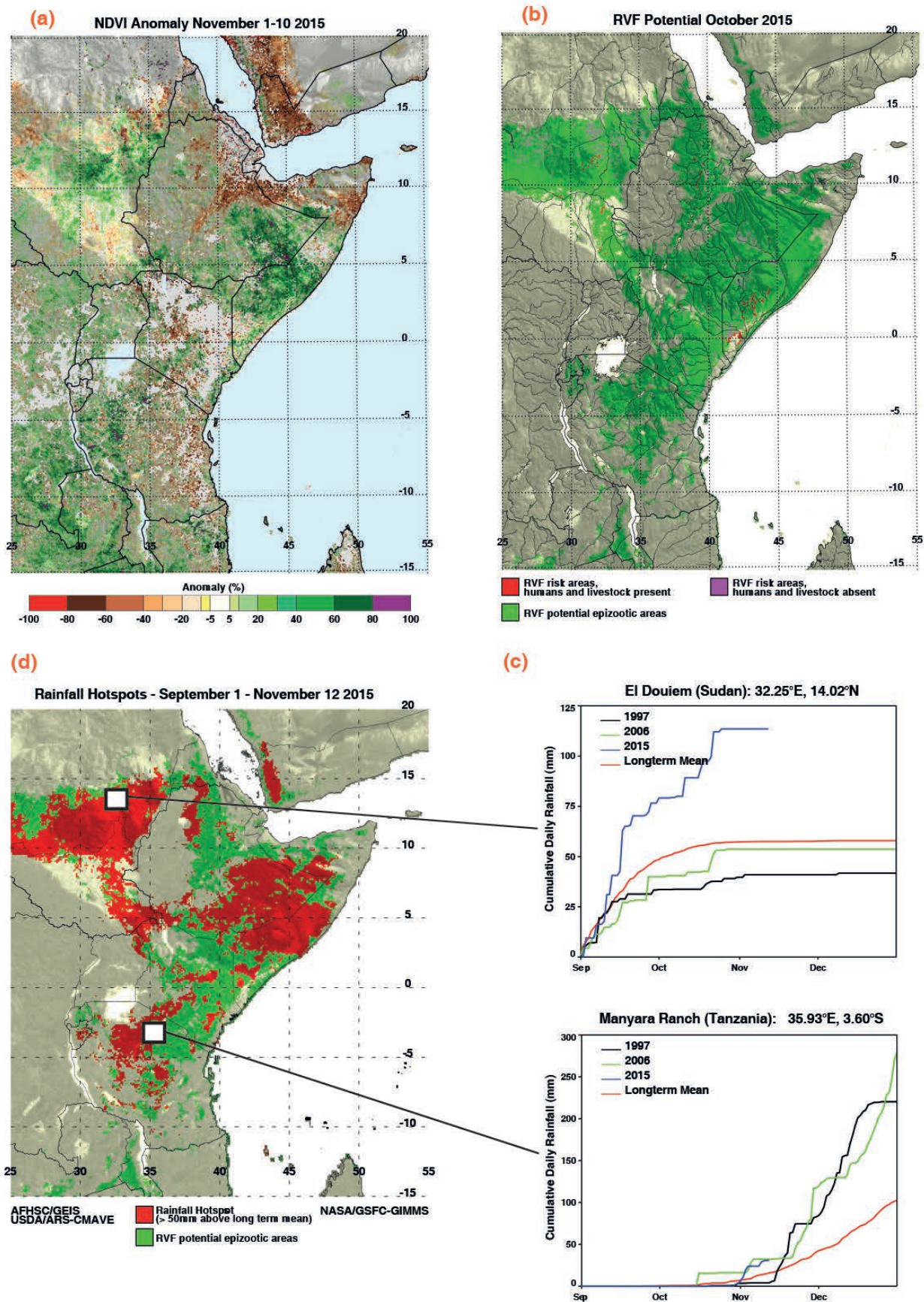
Figure 4. Cumulative rainfall anomalies between 1 September and 12 November for the years 1997 (a), 2006 (b), and 2015 (c). Cumulative rainfall between 1 September and 12 November for 2015 (d).



Source: GIMMS Group, NASA Goddard Space Flight Center

- Awareness creation has been conducted in Kenya through the support of FAO using local FM radios in high risk areas, especially in the Northeast.
- Surveillance: Active disease search methodologies have been put into practice and sentinel herds/flocks continue to be monitored in the country. An enhanced passive surveillance form was developed and finalized for RVF outbreak-alert use.
- Tanzania has reactivated their multisectoral RVF National Task Force (NTF) to enhance awareness particularly in high-risk zones.
- Surveillance is ongoing in the high-risk zones and awareness campaigns have begun. Electronic platforms involving veterinary officers and medical staff have been established to aid in sharing RVF-related information.
- Somalia and South Sudan are struggling to consolidate the necessary resources to enhance their preparedness and implement the appropriate phases of their contingency plans.

Figure 5. NDVI anomalies for November 1- 10 2015 (a), RVF potential risk map for October 2015 (b), meteorological stations experiencing rainfall anomalies (c) and rainfall hotspots for September 1 and November 12 2015 (d).



Source: GIMMS Group, NASA Goddard Space Flight Center

- Sudan and Somalia have reportedly secured minimal stocks of insecticide to assist with vector control.

In Northern Africa, in the framework of the EU-supported Vmerge project, FAO organized a two-day training in Tunis from 8-9 October 2015 focusing on preparedness for early detection and contingency planning for RVF. The training was attended by 30 participants including all REMESA¹ network focal points from Algeria, Mauritania, Morocco and Tunisia, plus Senegal.

In addition, FAO and the International Livestock Research Institute (ILRI), along with relevant technical partners in Eastern Africa, have recently updated the risk-based 2010 *Decision-support framework for prevention and control of Rift Valley fever epizootics in the Greater Horn of Africa*, providing guidance on how to plan and monitor activities in the different RVF alert stages. The document can be downloaded from the ILRI website: <http://hdl.handle.net/10568/21783>.

FAO has created a *RVF newsletter* that is disseminated to a wide range of stakeholders including international agencies, research, public, and private institutions, public health professionals, national veterinary services, and policy-makers. If you would like to receive newsletter updates or share any information, please contact us at RVF@fao.org.

WHO/FAO/OIE recommendations

Given the potential risk for increased RVF activity based on abnormally high rainfall in the identified areas of Sudan, South Sudan, Somalia, Kenya and Tanzania, FAO, WHO and OIE encourage these countries to immediately:

- Raise awareness and communicate the risk of RVF (most often first seen in animals before humans) with stakeholders;
- Include aspects of occupational and exposure hazards (butchers, slaughter plant personnel, veterinarians and assistants) in communication campaigns and public awareness;
- Heighten the level of surveillance (active through serological surveillance of sentinel flocks/herds and clinical or syndromic surveillance) for RVF in animals in at-risk areas. This should include increased surveillance in markets or places where large numbers of at-risk animals are traded or congregated.
- Advocate the immediate notification of any RVF outbreak to the OIE through the World Animal Health Information System, in line with country obligations and the inclusion of RVF in the 6-monthly reports to the OIE.
- Urgently develop, evaluate and update, where appropriate, the national contingency plans and increase levels of preparedness (multisector – health, veterinary services, security and police force, transportation, communication), as detailed in the document “Trans-sectoral coordination framework for the prevention and response to Rift Valley fever” by de La Rocque & Formenty, 2014. Countries are encouraged to engage in this One Health approach, by using the tools developed jointly by OIE/WHO/World Bank with the support of FAO (Integrated IHR – PVS tool² and Trans-sectoral Coordination Framework).
- Promote the registration of safe and quality assured vaccines that meet or exceed OIE standards;
- Promote targeted vaccination by trained personnel of susceptible animals in known at-risk areas.
 - The use of vaccination as a control option for RVF is aimed at limiting virus circulation in enzootic areas and preventing epidemics in disease free areas and is most effective when used in conjunction with other control strategies, including surveillance, quarantine and movement controls. Vaccination against RVF in East Africa (mainly in the Republic of Kenya and the United Republic of Tanzania) is undertaken normally in response to the occurrence of RVF outbreaks using a live vaccine prepared from an attenuated strain of the RVF virus (Smithburn strain). Given the side effects associated with the use of live vaccines, uptake has been limited in areas of East Africa where RVF is enzootic. A new generation of vaccine, Clone 13, currently in use in the Republic of South Africa, offers a high level of protection with minimal side effects. Recognizing that the Clone 13 vaccine is safe and efficacious against RVF, countries at risk of RVF occurrence or incursion are therefore strongly encouraged to ensure its timely registration.
 - Mass vaccination is one of the tools for preventing RVF epidemics in animals. However, vaccination is not recommended in the event of known or ongoing RVF virus circulation, as inappropriate vaccination can exacerbate the spread of virus transmission. Specific requirements for RVF vaccine production are available in the Manual of Diagnostic Tests and Vaccines for Terrestrial Animals 2014, Chapter 2.1.1.4.³
- Monitor the NASA/AFHSC/USDA Rift Valley fever Risk Monitoring site for updates.⁴
- Vector control.* The use of insecticides, repellents on animals and humans, mosquito netting and strategic larvicidal treatment for mosquito breeding habitats, can decrease the risk of virus transmission in at-risk areas.
- Livestock trade issues.* The OIE Terrestrial Animal Health Code (2015) clearly separates “Country or zone free from RVF virus (RVFV) infection” from “Country or zone infected with RVFV” during the inter-epizootic period. For the purposes of trade, the infective period for RVF is 14 days. This means that even in the presence of disease or infection, the OIE Terrestrial Animal Health Code allows for continued trade of ruminants and meat from unaffected areas in infected countries, if certain specific conditions of quarantine, vaccination and maturation of meat are met. This is based on timely and prompt notification of infection or disease to the OIE (OIE, 2015).⁵
- Best practices for risk reduction:*
 - Animal husbandry and slaughtering practices. Gloves and other appropriate protective clothing should be worn and care taken when handling sick animals or their tissues, or when slaughtering animals;
 - Consumption of fresh blood, raw milk or animal tissue. In the epizootic regions, all animal products (blood, meat and milk) should be thoroughly cooked before eating⁶;
 - Protecting the individual and the community against the risk of mosquito bites by using impregnated mosquito nets, personal insect repellent if available, light coloured clothing (long-sleeved shirts and trousers), and by avoiding outdoor activity at peak biting times of the vector species.
 - Implementing standard precautions in health care settings. The WHO precautions on health care for RVF should be consulted.⁷

¹ REMESA - Réseau méditerranéen de santé animale – includes five southern European countries and 10 northern African and Middle East countries.

² www.oie.int/en/for-the-media/press-releases/detail/article/bridging-who-and-oie-tools-to-better-control-global-health-risks-at-the-human-animal-interface/

³ http://www.oie.int/fileadmin/Home/eng/Health_standards/tahm/2.01.14_RVF.pdf

⁴ <http://www.ars.usda.gov/Business/docs.htm?docid=23464>

⁵ http://www.oie.int/index.php?id=169&L=0&htmfile=chapitre_rvf.htm

⁶ <http://www.who.int/mediacentre/factsheets/fs207/en/>

⁷ <http://www.who.int/csr/resources/publications/standardprecautions/en/index.html>

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Technical support

FAO

Headquarters (GLEWS coordinator)
Dr. Julio Pinto
julio.pinto@fao.org

Nairobi office (ECTAD)
Dr. B. A. Diop
bouna.diop@fao.org

OIE

Headquarters
Dr. S. Münstermann
s.munstermann@oie.int

Nairobi Office
Dr. P. Bastiaensen
p.bastiaensen@oie.int

WHO

Headquarters
Dr. P. Formenty
formentyp@who.int

Brazzaville Office
Dr. N. Ndayimirije
ndayimirijen@who.int

NOTES



CONTACT)))

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