Food and Agriculture Organization of the United Nations

GLOBAL ANIMAL DISEASE INTELLIGENCE REPORT

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JULY – NOVEMBE 2015

Summary

Animal disease situation

The reporting period was characterized by the continued spread of Foot-and-Mouth Disease (FMD). With a recent detection in Morocco, serotype O continues to spread in Northern Africa, SAT 2 is prevalent in Southern Africa and serotype A has been found in Saudi Arabia and Turkey.

Vector-borne diseases such as Lumpy Skin Disease (LSD) and Rift Valley fever (RVF) were also observed. LSD was introduced into Greece and the Russian Federation, while new outbreaks were recorded in Turkey. RVF was reported in Mauritania between September and October in humans and small ruminants.

Overall, the reporting period was characterized by continued, albeit lower-level circulation of Avian Influenza (AI) in previously affected countries in Africa, Asia and the Middle East. There were no reports from the Americas while there were new incursions of different low and highly pathogenic avian influenza (HPAI) viruses into European countries.

A high diversity of non-H5N1 influenza virus subtypes associated with disease outbreaks in poultry and wild birds was reported in Asia and the Americas during the reporting period.

In West Africa, the Ebola virus continued to circulate in humans at very low levels in Guinea and Liberia; the number of weekly cases having been reduced to less than five cases in each country. Liberia has had two re-emergence events during this period.

In the Near East, Jordan, Kuwait and Saudi Arabia continued to identify human cases of Middle East respiratory syndrome (MERS-CoV) during the reporting period. In Southeast Asia, the first occurrence of cases imported into the Republic of Korea and Thailand was reported from April to June 2015. Following the introduction and spread of MERS-CoV in the Republic of Korea, few cases were reported in early July. No new cases have been reported since.

Drivers of disease emergence and spread

Slight changes in global meat prices were observed during this period, with decreased prices for pork and beef and increased prices for mutton meat. These changes in meat prices may have caused livestock producers and dealers to move animals to those areas where prices are more profitable. Disease pathogens may have spread as a result of these movements.

Countries across the globe celebrated two major festivals; namely, Eid-al-Fitr in July and Eid al-Adha in September. These festivals usually increase the demand for certain animal products, resulting in more live animal trade and movement.

Risk assessment

RVF IN MAURITANIA

Given that livestock in Mauritania are not vaccinated against RVF, if conditions persist, the potential risk of transmission and spread is expected to continue.

FMD SEROTYPE O SPREAD TO SOUTHERN EUROPE

The presence of serotype O "India 2001" topotype indicates that the virus involved in the current outbreaks in Morocco is very closely related to strains from the recent FMD epidemic in Algeria and Tunisia. Widespread infection in small ruminants would increase risk of carriage of infection on vehicles or personnel and the introduction of the disease into countries of southern Europe, such as Spain. Given

that bans on the importation of susceptible animals and products are in effect in Spain to prohibit the introduction of live animals or products that could carry the virus, the likelihood that the virus could be introduced into the European Union via legal trade is negligible.

LSD INTRODUCTION TO OTHER EUROPEAN COUNTRIES

LSD might be introduced into other European countries through the movement of infected animals and the introduction of vectors. Implementation of vaccination campaigns and restriction on the movement of animals and animal products within the affected areas and to the rest of Europe should contribute to limiting the spread of the disease in Greece.

Global animal disease forecasting

Table 2 summarizes global disease forecasting for December 2015 to February 2016, based on qualitative risk assessments, information generated by the Food and Agriculture Organization of the United Nations (FAO) and external sources of disease information.

The overall animal disease situation and infection pressure in the various regions during the upcoming three-month period is considered medium to high for the following reasons:

- Increased risk of H5N1 HPAI outbreaks is expected throughout South and Southeast Asia during the upcoming months, as, historically, the number of H5N1 HPAI outbreaks increases between November and March.
- Medium to high risk of persistent and LSD spread within the areas in the Middle East, to areas in the Caucasus, Central Asia and Southeast Europe is expected given the favourable forecasted climatic conditions during the next three months in these regions.
- Low risk of spread of FMD serotype O from North Africa to Southern Africa is expected.
- Medium risk of RVF in Eastern Africa is expected, given the high (greater than 90 percent) chance that El Niño will continue through the Northern Hemisphere in the autumn of 2015 with around an 85 percent chance that it will last through the 2015–2016 Northern Hemisphere winter. Above normal precipitation (rain) may occur in East Africa during the latter half of the year. Countries should remain vigilant as to the potential increase in arthropod-borne pathogen activity.
- Low risk of MERS-CoV spread is expected due to decreased reports of human cases of MERS-CoV in the Middle East region, given the observed seasonality patterns where peaks are generally observed from March to April.
- Low risk of Ebola spread is expected, although there are continued human cases of Ebola virus disease in affected countries in West Africa.

SECTION 1

Overview of the animal disease situation

Livestock disease events

Foot-and-Mouth Disease (FMD)

During the reporting period (July to November 2015), several FMD serotypes were observed within several regions. FMD serotype O continued to spread in Northern Africa with a recent detection in Morocco. SAT 2 continued to spread in Southern Africa while two new serotype A strains were detected in Saudi Arabia and Turkey.

In early November, **Morocco** officially confirmed the detection of FMD serotype O during an outbreak that occurred in late October in a mixed farm (cattle and sheep) located in the Sidi Bennour Province (Central Region), approximately 800 km from the Algerian border. Of the 17 susceptible cattle and 14 sheep present on the farm, FMD was confirmed in 10 unvaccinated cattle. Since then, five additional outbreaks were reported affecting mostly mixed production farms located in provinces of the central region. Genotyping results from samples taken from affected farms in Morocco in November have confirmed the virus as serotype O "India 2001" topotype. This virus has a 99.2 percent and 98.90 percent of homology with an FMD strain isolated in Tunisia and Algeria in 2014, respectively. Figure 1a shows outbreak locations for each quarter from 2014 to the current period.

As a result of this epidemic, Morocco has adopted a preventive strategy, including strengthening border controls, and introducing a routine preventive vaccination campaign in cattle (first round in August–November 2014; second round in February–May 2015). The vaccine used includes both O Manisa and O 3039 strains.

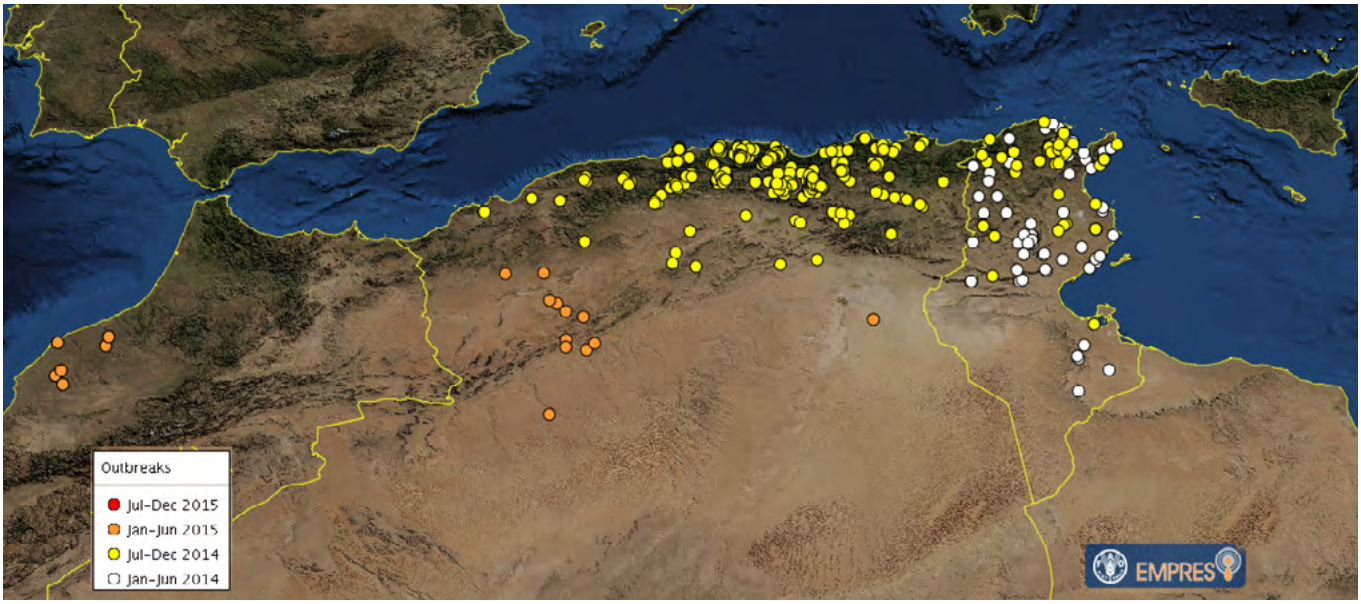
In Morocco, the last reported outbreak of FMD occurred in 1999 (a regional epidemic caused by a West African type O virus, that first affected Tunisia and spread to Morocco via Algeria). The Moroccan authorities responded by implementing nation-wide vaccination in cattle until 2006. From 2012, the World Organisation for Animal Health (OIE) has recognized Morocco as a country with an FMD control programme.

Since 2014, type O "India 2001" topotype has been detected in North Africa, specifically in Algeria, Libya and Tunisia. The most recent outbreaks were reported in April 2015 in Algeria.

In **Southern Africa**, several countries continued reporting outbreaks of FMD (specifically, serotype SAT 2 was reported in **Angola**, the border between **Angola** and **Zambia**, **Botswana**, **Malawi**, and **Zimbabwe**). FMD-affected countries include **Angola** (2), **Botswana** (14), **Malawi** (1), **Namibia** (5), **Zambia** (2) and **Zimbabwe** (86). Figure 1b shows outbreak locations in the time period specified in the report.

In **Asia**, FMD was reported in **Israel**, **Saudi Arabia**, **Turkey** and **West Bank**. During the period of this report, two new FMD serotype A strains were isolated in **Saudi Arabia** and **Turkey** from two outbreaks which occurred in September. Genotyping of samples from these outbreaks sent to the OIE reference laboratory, revealed two strains closely related (99 percent of homology) to the serotype A circulating in **India**.

Figure 1a. FMD outbreaks reported in Northern Africa from July 1 to November 30



Israel reported outbreaks due to serotype O in a swine farm located in Fassuta, and a beef cattle herd located about 3 km southeast of Fassuta. The region has also reported FMD outbreaks in a sheep flock in Nablus district, **The West Bank**. In Israel, an annual vaccination campaign is ongoing. Cattle are vaccinated with a trivalent O/A/Asia1 vaccine while small ruminants (sheep and goats) are vaccinated with a bivalent O/A vaccine.

Figure 1b. FMD outbreaks reported in Southern Africa from July 1 to November 30

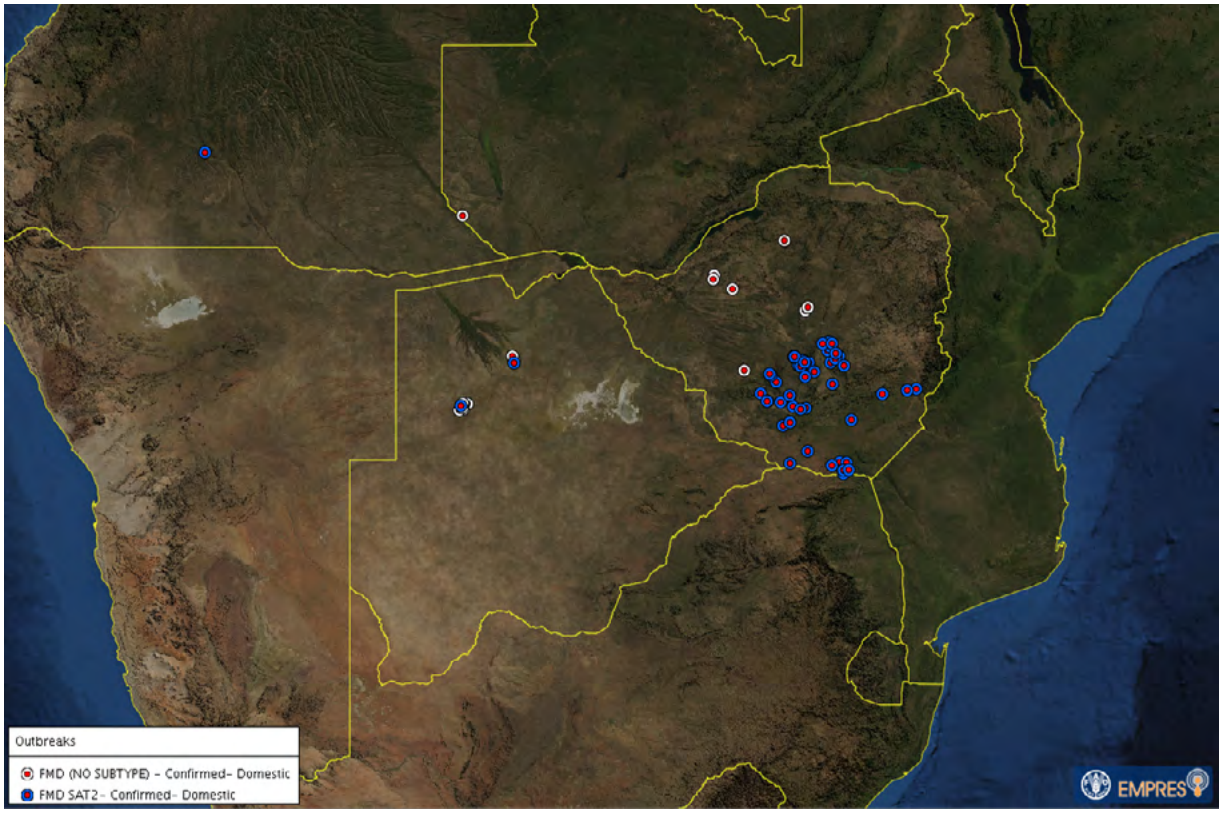
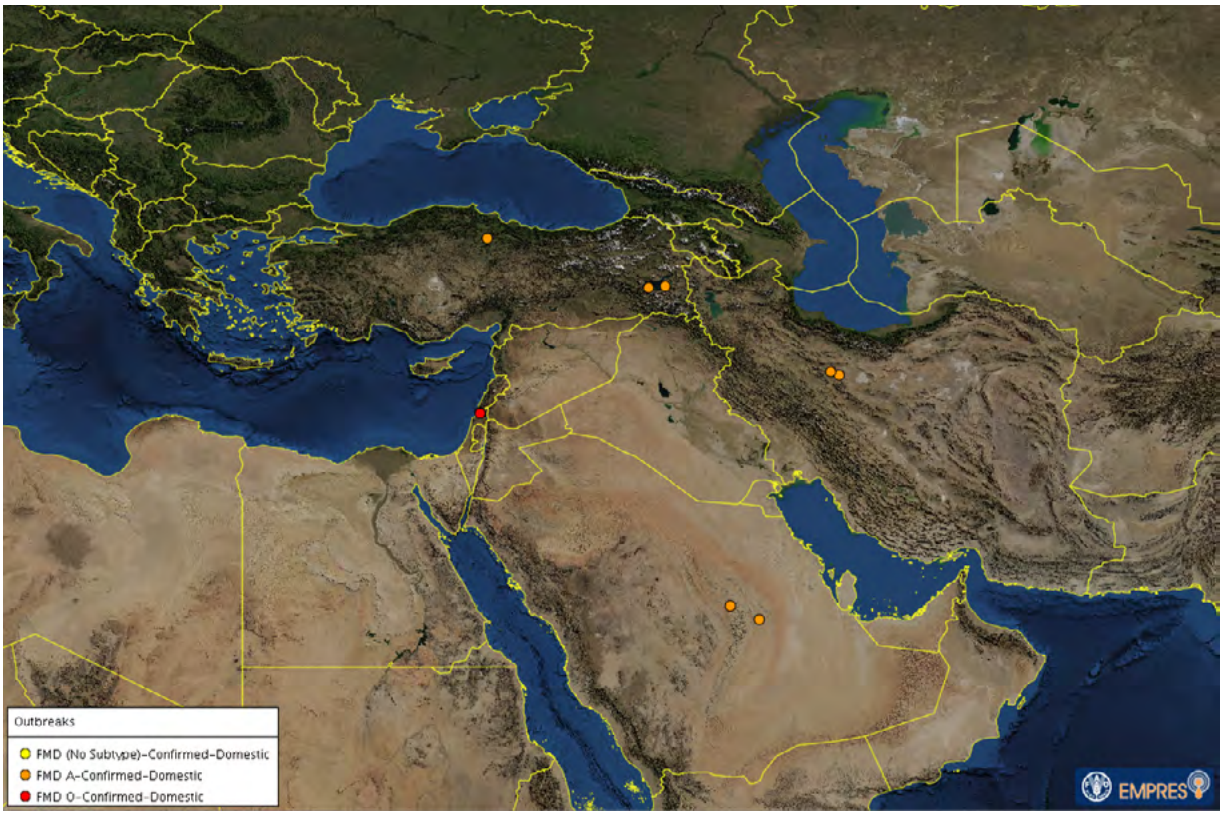


Figure 1c. FMD outbreaks reported to the OIE in Asia from July 1, 2015 to November 30, 2015



Lumpy Skin Disease (LSD)

During the reporting period, LSD was reported in **Greece**, the **Russian Federation** and **Turkey** (see Figure 2a). The outbreaks in Turkey are not displayed on the map.

On 18 August 2015, LSD was detected in Greece in the Evros region. As of 8 December 2015, Greece has reported 111 outbreaks of LSD in the Evros region on the border with Turkey in three provinces (Anatoliki Makedonia Kai Thraki, Voreio Aigaio and Kentriki Makedonia).

The disease was first observed in two cattle beef farms, both within 15 km from the closest confirmed LSD outbreak in Turkey. Animals were kept free grazing in the delta of the Evros River which is characterized by high humidity and abundance of vectors.

Control measures have included depopulation of clinical animals (stamping out), implementation of enhanced surveillance strategies in the area of the Evros Prefecture (10 km zone around one of the two LSD outbreaks in European Turkey expanded in Greek soil), and the Greco-Turkish border of the Evros Prefecture). In addition, Greece implemented increased biosecurity at the entry points to Greece from Turkey with an emphasis on vehicle disinfection. Other control measures included banning (1) live bovine animals and wild ruminants, (2) bovine semen, (3) fresh meat produced from bovine animals, and meat preparations and meat products produced from such fresh meat, (4) milk and dairy products from bovine animals and (5) unprocessed animal products and by-products of bovine animals). Despite depopulation and the fact that the vaccination campaign was implemented on 5 September, the disease has spread to regional units located approximately 90 km from the original detection (regional units of Kavala and Xanthi). In early September, Greece implemented a bovine vaccination campaign in the affected areas using a live attenuated virus (Neethling strain). Movement into other European Union states of vaccinated animals, bovine younger than 6 months of age, and unvaccinated animals born to dams vaccinated against LSD is prohibited. Some specific restrictions apply also to the movement of susceptible animals, fresh meat and other related commodities within the country and the affected region.

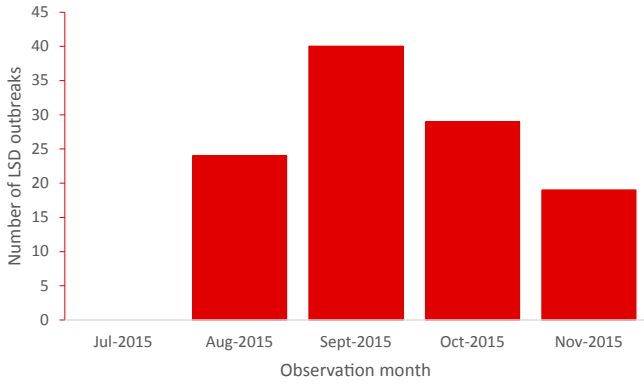
Figure 2a. shows the LSD outbreaks in Greece since the disease was first detected.

In September 2015, the disease was reported in the Russian Federation in Dagestan, Chechnya and North Ossetia, close to the border with Azerbaijan where numerous LSD outbreaks were reported during 2014. By November 30, 5 329 animals had been

Figure 2a. LSD outbreak distribution in Europe (as of 18 November 2015)

destroyed in Greece as a consequence of the disease. Figure 2b shows the epidemic curve of the LSD epidemic in Greece. As of November 2015, the rapid detection and implementation of mitigations have contributed to limiting the spread and impact of the outbreaks.

Figure 2b. LSD outbreaks reported in Europe (July to November, 2015)



Rift Valley fever (RVF)

In October 2015, Mauritania confirmed 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-southwest part of the country (Figure 3). These cases followed a period of extensive rain and flooding in the region during the past rainy season. During the same period, Mauritania notifed the World Health Organization (WHO) of 25 human cases, 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. Four large outbreaks of RVF occurred in Mauritania in 1998, 2003, 2010, 2012 and 2013, generally during the months of September and October. In Mauritania, RVF outbreaks are usually associated with periods of heavy rain followed by a dry spell of seven days and then heavy rain (Caminade *et al.* 2014). This precipitation pattern is different from the one observed in East Africa, which is characterized by persistent torrential, abnormal heavy rains (Anyamba *et al.*, 2012). The different rainfall patterns trigger eggs hatching from two main mosquito species (*Aedes* and *Culex* sp.) in different habitats across west and east African regions (Vignolles *et al.*, 2011).

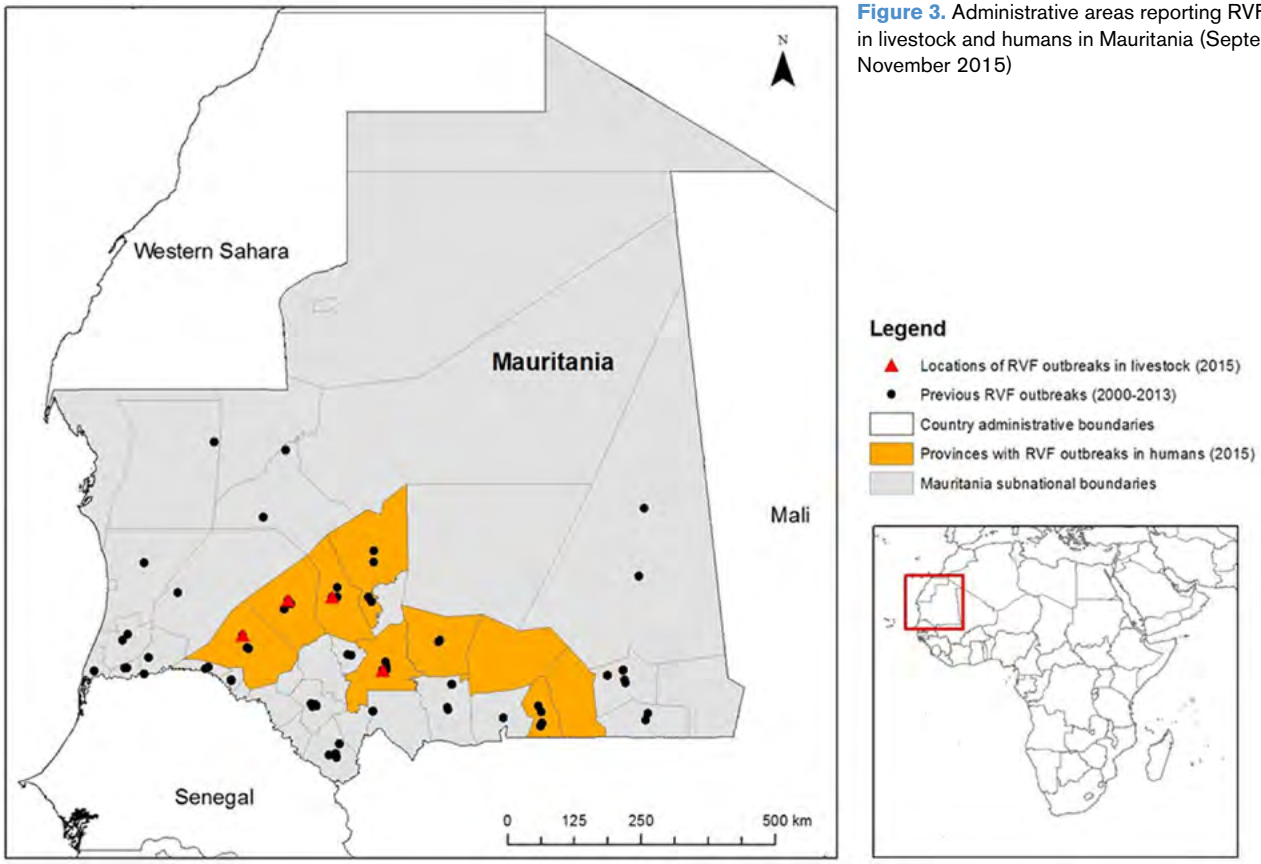


Figure 3. Administrative areas reporting RVF cases in livestock and humans in Mauritania (September–November 2015)

Zoonotic disease events

Avian Influenza (AI) – HPAI H5N1

Overall, the reporting period was characterized by continued, albeit lower level circulation of AI in previously affected countries in **Asia**, the **Middle East** and **Africa**, a lack of reports from the **Americas**, and new incursions of different HPAI viruses into several **European** countries (see Figures 4a, 4b and 4c).

In **West Africa**, H5N1 HPAI is still actively circulating in six countries; namely, **Burkina Faso**, **Côte d'Ivoire**, **Ghana**, **Niger** and **Nigeria**, all of which confirmed incursions during early 2015.

Nigeria, the first country to confirm a new incursion of H5N1 HPAI in poultry in West Africa, in early 2015, remains the country with the highest number of reported outbreaks. A total of 71 outbreaks were reported with 75 percent of these coming from the southern states of Lagos (23 percent) and Rivers states (52 percent), implying a geographical shift in reporting from the previous period when most reports came from the Plateau State (71 percent) located in the centre. Newly affected states in the current period include the Federal Capital Territory (a live bird market in Abuja), Bayelsa, Abia, Kogi and Enugu states. Thus far, outbreaks have occurred in 23 out of 33 states across Nigeria affecting primarily medium-sized farms (5 000–10 000 birds). More than 1 644 000 birds have been depopulated (death and culling) in 512 farms (including 10 live bird markets) and 1 zoological garden. It is unknown exactly why outbreaks appear to have shifted geographically from the north and centre to the south of the country. **Niger** has not reported any outbreaks in the second semester of 2015. **Ghana** reported 17 outbreaks from 1 July–30 November 2015, similar to the 11 outbreaks observed in the previous four months. Most outbreaks were reported from the Greater Accra region, as well as Western, Eastern and Central regions. **Côte d'Ivoire** saw ten outbreaks from 1 July–30 November 2015; all but one were observed in the autonomous district of Abidjan (the other outbreak occurred in the Comoe District), compared with 1 February–30 June of the same year, where five out of six reported outbreaks were in Vallée du Bandama. **Burkina Faso** reported 36 outbreaks from February–June 2015, but only 3 in the current five-month period. The H5N1 HPAI strain circulating in West Africa (isolated from poultry samples in Burkina Faso, Côte d'Ivoire, Ghana, Niger and Nigeria) is the genetic clade 2.3.2.1c. Viruses from this clade have also been found earlier this year in poultry and wild birds in Europe (Bulgaria, Romania, and Turkey) and Asia (China, India, Kazakhstan, Russian Federation and Viet Nam). The West Africa strains are most similar to the isolates from Europe, demonstrating some genetic heterogeneity compared with H5N1 clade 2.3.2.1c isolates from Asia.

H5N1 HPAI has been endemic in **Egypt** since 2006. In the five-month period from 1 July–30 November, nine outbreaks were reported in six governorates (Fayoum, Cairo, Suhag, Giza, Menia, Menoufia), with no known human cases. This is greatly reduced from the previous five-month period, where Egypt had reported 232 poultry outbreaks of H5N1 and 89 human cases. During this period in 2014, 72 poultry outbreaks and 11 human cases had been reported. Outbreaks in Egypt are detected through a combination of both passive and active surveillance efforts and the General Organization for Veterinary Services (GOVS)-FAO Community Animal Health Outreach system, in place since 2008. However, an apparent slowdown in the implementation of the various surveillance tools in recent months may have resulted in under-reporting of outbreaks. The FAO Emergency Centre for Transboundary Animal Diseases (ECTAD) office in Egypt is collaborating with the veterinary services on swift reactivation of surveillance activities. The H5N1 HPAI poultry and human isolates circulating in Egypt are clade 2.2.1.2. They are genetically similar to previously detected viruses in the area (and different from the virus circulating in West Africa). This clade has also been isolated from poultry in Gaza Strip, Israel and The West Bank.

H5N1 HPAI was reported in poultry and wild birds in the **Middle East** while outbreaks continued in countries in Asia where the disease is endemic.

Outbreaks or positive surveillance findings of H5N1 HPAI were confirmed in the **Middle East**, in **Gaza Strip**. A total of 106 poultry outbreaks or positive surveillance findings have been confirmed since March 2015. Among positive holdings, most were described as keeping ducks (47) or classified as backyards (37). Targeted active surveillance in ducks, as silent carriers of H5N1 HPAI virus, implemented by the Gaza Veterinary Services may explain the relatively higher percentage of duck holdings. The virus found in Gaza Strip shows close genetic similarity to the viruses detected in The West Bank and Israel earlier in 2015, and all cluster with Egyptian viruses isolated in 2014. The last outbreak was observed on 24 September 2015 in a backyard farm in Beit Lahia, North Gaza. Since then, no new outbreaks have been reported.

In **Eastern** and **Southeastern Asia**, four countries reported H5N1 HPAI during the reporting period: **Cambodia**, **China**, **Indonesia** and **Viet Nam**. In **China**, wild bird (great black headed gull) was found to be positive. **Indonesia** reported 12 outbreaks (11 in backyard duck or chickens and 1 outbreak in a commercial layer farm), while **Viet Nam** reported 13 cases, mostly in backyard poultry. No human cases were reported in the region during the reporting period.

In the **United States of America,** no new cases of H5N1 HPAI were reported during this period. The viruses found in the United States of America are not the same as the H5N1 viruses found in Asia, Europe and Africa, some of which have caused human fatali-

ties. The H5N1 HPAI strain that emerged during the last season in the United States of America and Canada was a new mixed-origin virus that combined the H5 gene from the Asian H5N1 HPAI virus with the N gene from native North American AI viruses found in wild birds (see http://www.usda.gov/documents/usda-avian-influenza-factsheet.pdf).

In **Europe**, **France** confirmed the presence of zoonotic H5N1 HPAI on 25 November 2015 in a backyard holding in Dordogne Department. Genetic analysis indicated a high similarity to low pathogenic H5N1 viruses circulating in Europe previously. This suggests mutation from H5N1 LPAI and to high pathogenicity or virulence. The event is, therefore, not related to the Asian-origin H5N1 HPAI viruses that have spread to Eastern Europe and West Africa in late 2014. Heightened surveillance in the affected region subsequently enabled the detection of two other H5 HPAI subtypes in samples collected from two additional poultry farms in Dordogne Department. The two samples were taken from a commercial duck farm and a goose holding in late November 2015. H5N2 HPAI was later confirmed in the goose farm sample. Results from advanced genetic analysis were not yet available at the time of writing this report.

Figure 4a. Monthly number of HPAI outbreaks/cases stratified by continent since 2003. Insert shows the number of reports between July 2010 and July 2015.

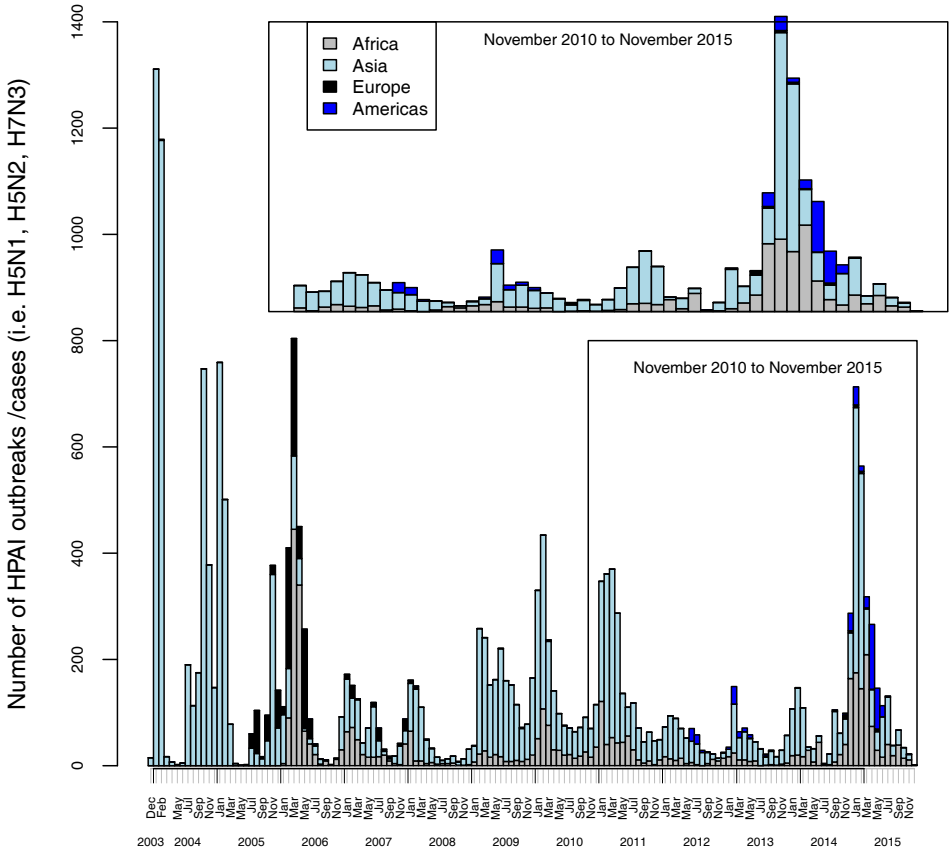


Figure 4b. Number of H5N1 HPAI outbreaks/cases stratified by species affected by quarter since 2003. Red line shows the number of countries affected.

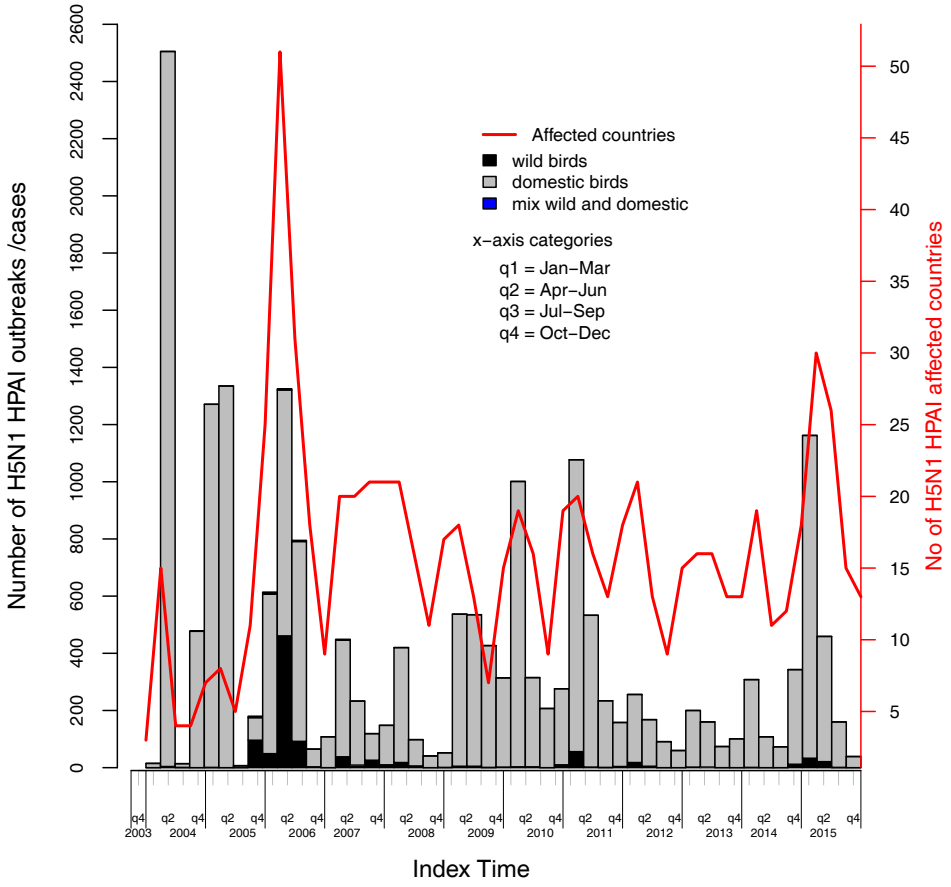
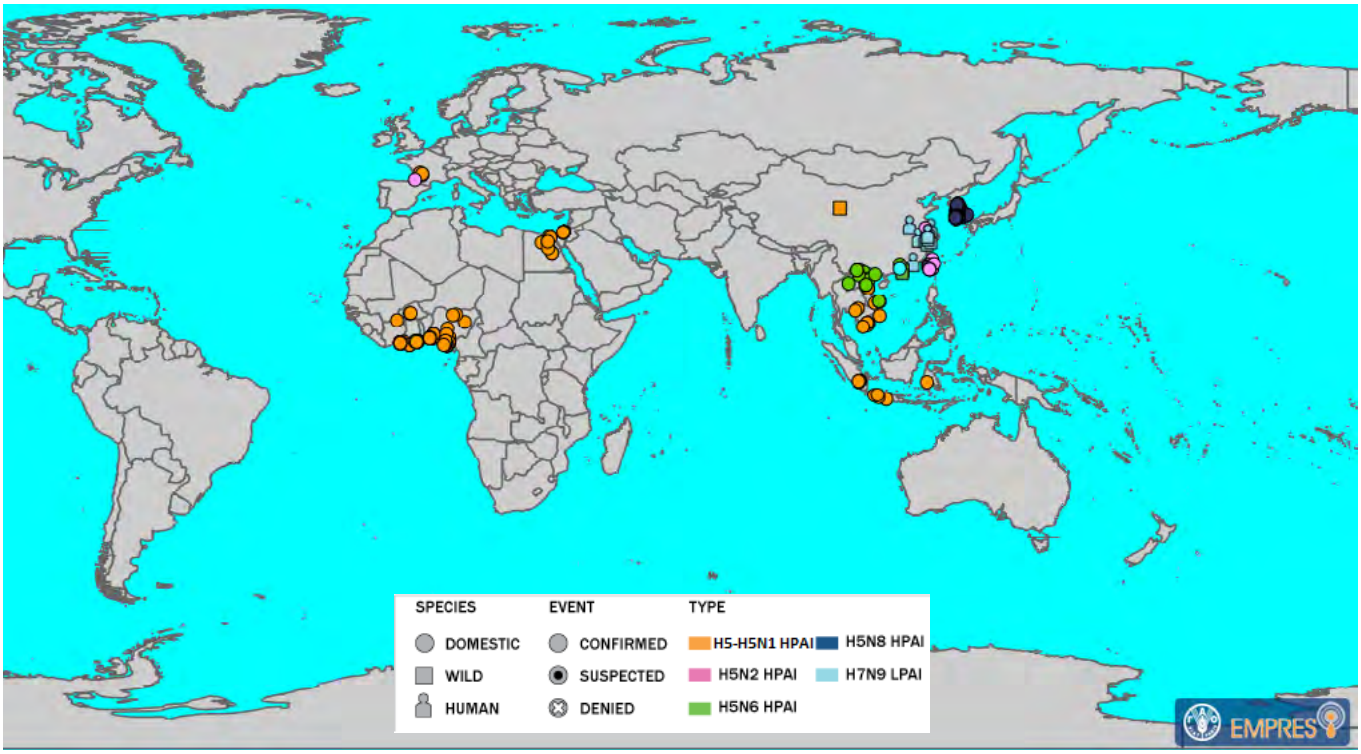


Figure 4c. Map of relevant AI events in animals and humans reported globally (April–June 2015)



Other Avian Influenzas (AI)

A diversity of non-H5N1 influenza virus subtypes associated with disease outbreaks in poultry and wild birds was reported in **Asia** and the **Americas** during the reporting period (see Figure 4c).

H5N8 HPAI affected two duck farms in **Taiwan** Province of China and caused 73 outbreaks in the **Republic of Korea**. This is the third season that the Republic of Korea is affected. H5N8 emerged in January 2014 and shares the H5 gene with the H5N1 HPAI clade 2.3.4.4 viruses. Though the virus spread to Europe and the Americas in late 2014 there have not been new outbreaks outside of Asia during the reporting period. No human case of H5N8 HPAI infection has been reported to date. In addition to the observed intercontinental spread, this virus has shown a predilection to genetically reassort with local LPAI strains giving rise to the emergence of new subtypes, particularly the North American H5N2 HPAI as well as novel strains of H5N2 and H5N3 HPAI in Taiwan Province of China.

H5N2 HPAI continued to cause outbreaks in China during the reporting period. **Taiwan** Province of China reported 28 outbreaks in different poultry species (chickens, ducks, geese and turkeys), while on mainland China 1 outbreak occurred in a commercial goose farm in Jiangsu Province in August 2015. No human case of H5N2 HPAI infection has been reported to date.

H5N6 HPAI has caused 14 outbreaks in Northern **Vietnam** from July to October 2015, with an apparent increase compared to previous months. **Lao People's Democratic Republic** and **China** both reported one outbreak, in Xaignabouli (3 October) and Guangdong (6 August) Provinces, respectively, and one wild bird (oriental magpie-robin) was found infected in **China**, **Hong Kong SAR** (17 November). In addition, one human case (37-year-old female) from Yunnan Province, **China**, was diagnosed in July and died shortly after hospitalization. Since the virus emerged in April 2014, four human cases have been reported, resulting in three deaths.

China continued to report human cases of infection with H7N9 LPAI. Between July and November 2015, 9 new cases of H7N9 infection in humans, with at least 3 deaths, were reported, increasing the total number of cases since the start of the epidemic in 2013 to 682, with at least 271 deaths. Since its emergence in March 2013, a seasonal pattern has become apparent for H7N9 human case distribution with case numbers peaking during the November to February period; the number of cases is therefore expected to increase in the coming months. The continued reporting of human cases suggests that the virus is still circulating in affected areas of China. The R_o in the second (2014) and third (2015) waves appear quite low and below 1, which may lead to the early conclusion that the potential for pandemicity or endemicity is low.

No new outbreaks were reported in the **United States of America** since the last report of H5N8 HPAI in Indiana and outbreaks/cases of H5N2 HPAI in wild and domestic birds in several states. The HPAI strains detected include viruses of the H5N2, H5N8 and H5N1 subtypes, all sharing the same H5 gene belonging to Clade 2.3.4.4.

Canada notified OIE that Ontario is free of notifiable AI. Canada reported outbreaks caused by Clade 2.3.4.4 H5N2 HPAI virus in the provinces of Ontario and British Columbia in early 2015.

In **Europe**, **France, Germany** and the **United Kingdom of Great Britain and Northern Ireland** reported non-zoonotic H5N1 influenza virus subtypes during the reporting period. Both Germany and the United Kingdom of Great Britain and Northern Ireland reported H7N7 HPAI in July caused by viruses closely related to Dutch H7N7 LPAI virus of 2015, considered as a common progenitor virus for the viruses detected in those countries. In the United Kingdom of Great Britain and Northern Ireland, one layer farm was affected in Lancashire while in the Germany, one layer farm was affected in Emsland region, Lower Saxony. Genetic analysis revealed that the viruses isolated in the United Kingdom of Great Britain and Northern Ireland and in Germany are not the same. Also, the virus found in Germany showed close homology to low pathogenic H7N7 viruses which have been circulating in Europe for some time, implying mutation from LPAI to HPAI.

Ebola

An epidemic of Ebola virus disease (EVD) has been ongoing in **West Africa** since December 2013, mainly affecting **Guinea**, **Liberia** and **Sierra Leone**. The number of cases in the most affected countries peaked in autumn 2014 and has slowly decreased since then. **Liberia** was also declared free of Ebola in May 2015.

Since the end of July, the number of cases has continuously decreased to less than five cases per week reported in the two countries with still active transmission of Ebola. On 7 November 2015, WHO declared Sierra Leone free of EVD transmission after 42 days without an active case. **Guinea** has not reported new cases since 29 October.

Since the end of June, **Liberia** experienced two re-emergence episodes. The first was the occurrence of a cluster of six Ebola cases between 29 June and 12 July. The second was the re-emergence in a family cluster of three cases in Monrovia on 22 November, after being declared free for the second time on 3 September. Investigations to determine the origin of the infection are still ongoing (see Figure 5).

As of 29 November 2015, WHO has reported 28 637 EVD cases (i.e. confirmed, suspected and probable cases) in **West Africa,** including 11 315 deaths. In the three most affected countries, the reported number of cases is 28 601 with 11 300 deaths. Countries that have reported an initial case or localized transmission include **Italy**, **Mali**, **Nigeria**, **Senegal**, **Spain**, the **United Kingdom of Great Britain and Northern Ireland** and the **United States of America**. This is the largest-ever documented outbreak of EVD, both in terms of outbreak and geographical spread. Scientific evidence is growing of the persistence of the virus in various sites of the body in people who have recovered from acute EVD as well as unusual late complications in an Ebola survivor.

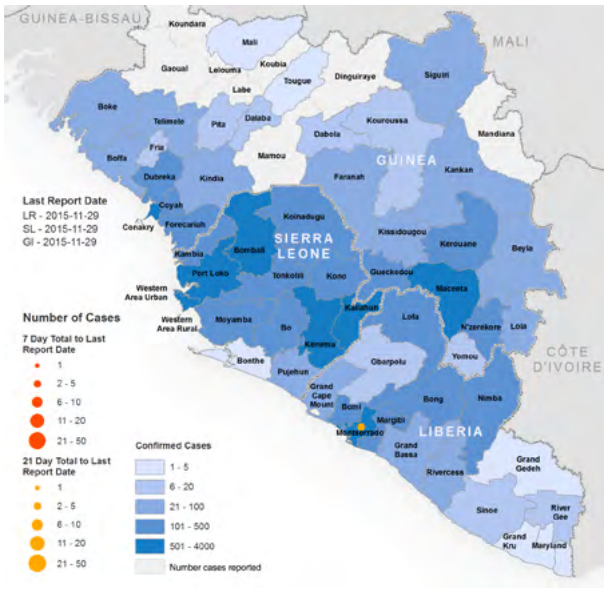


Figure 5. Geographical distribution of new and total confirmed cases in Guinea, Liberia and Sierra Leone

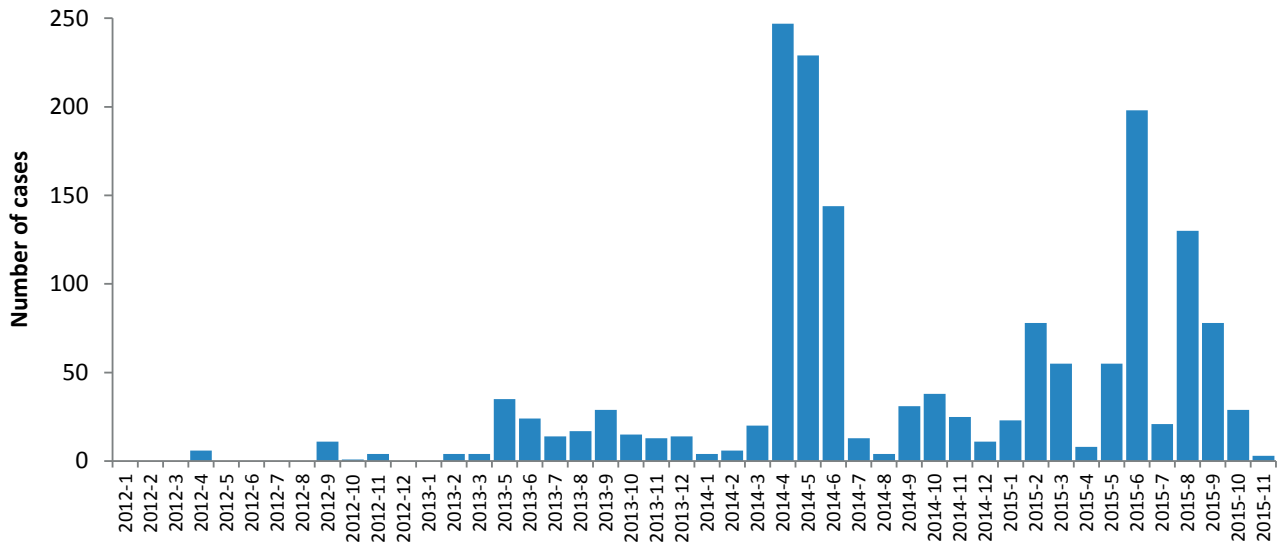
MERS-CoV

During the reporting period, MERS-CoV cases were mostly recorded in the **Middle East**. Apart from one case reported in **Kuwait** in September, most cases occurred in **Saudi Arabia** (n=240) and Jordan (n=16). In Saudi Arabia, a significant increase in cases was observed in August with 130 cases reported, most of which were linked to a nosocomial outbreak in Riyadh. The number of cases in Saudi Arabia has now declined with four cases reported in November (see Figure 6). Nosocomial transmission was also the major driver of the cases which occurred in **Jordan** (Amman) between August and September.

Outside the Middle East, cases of MERS-CoV were recorded in the **Republic of Korea** (n=4) and the **Philippines** (n=1). In the Republic of Korea, four cases occurred in early July; these were the last cases related to a large outbreak which began in May 2015 when a case returned to Seoul from the Middle East. A total of 185 cases and 36 deaths were recorded in the Republic of Korea and 1 case in **China**. The case in the Philippines had a history of travel in **Saudi Arabia**.

Between April 2012 and October 2015, 1 635 human cases of MERS-CoV including 628 deaths were reported by local health authorities of 26 countries worldwide; all cases having a direct or indirect connection with the **Middle East**. The source of the virus remains unknown, but the both pattern of transmission and virological studies point towards dromedary camels in the Middle East being a reservoir from which humans sporadically become infected. However, the mechanisms for zoonotic transmission are yet to be determined. Human-to-human transmission is amplified among household contacts and in healthcare settings, as was clearly shown in the recent outbreaks in the Republic of Korea and in Saudi Arabia.

Figure 6. Monthly number of MERS-CoV human cases between April 2012 and November 2015



SECTION 2

Drivers of animal disease incursion and spread

Well studied factors/drivers that influence the dynamics of animal and zoonotic diseases globally include: changes in land use, and thus, agro-ecological dynamics; human behaviour and movements (including animals and food products), whether because of trade opportunities or cultural practices, or to escape civil unrest; intensification of contact between wildlife and livestock or human species because of urban expansion or environmental encroachment; unprecedented erratic fluctuations in climate; and the lack of access to goods and services in areas stricken by poverty and hunger, among others. This section describes briefly the changes in major drivers that could have influenced the pattern of disease observed during this reporting period (July to November 2015).

Given the complex nature of the interaction between drivers and disease occurrence, this section does not attempt to provide proof of association or causation, but highlights some key disease risk factors that may provide some insight into the incursion and spread of animal diseases in different ecosystems.

Agro-ecological drivers: Rainfall and temperature are known to affect pathogen survival in the environment and disease vector behaviour. High temperatures and heavy seasonal rainfall as well as the presence of water (i.e. flooding, rivers, etc.) are generally associated with an increase in arthropods which may increase the likelihood of transmission and occurrence of vector-borne diseases such as LSD[1], RVF and trypanosomosis in areas where these diseases are endemic. But expansion can occur to new areas (non-endemic) because of climatic change. The persistence and stability of AI viruses is increased as the result of low temperatures and high relative humidity in tropical settings. Additionally, wild bird migration patterns and the potential to introduce pathogens such as H5N1 viruses may be impacted by alterations in migratory pathways because of climatic change. Dryness and low precipitation trigger livestock/pastoral movement and cause the congregation of livestock at water points and grazing areas, where wildlife species also occur. In these areas, the increased contact between different livestock herds and between domestic/wildlife species further increases the risk of disease spillover and spread in livestock and wildlife, as in the case of FMD.

Precipitation: From August to early November 2015, heavy, abnormal and torrential rains and floods were observed across **West Africa**, particularly in **Burkina Faso**, **Guinea**, western **Mali**, southern **Mauritania**, western **Niger** and **Senegal**. Analysis of satellite-estimated rainfall amounts showed that the 2015 rainy season was among the wettest for the past 30 years. A well-defined bimodal pattern of rainfall was observed in the region with wet conditions to the north, and drier-than-normal conditions along the southern coast of the Gulf of Guinea. Unusually heavy and widespread rains fell in **Algeria**, **Northern Egypt** and the **Western Sahara**. Most of the Sahel registered 120 percent or more of normal rainfall since the start of August 2015. Analysis of a satellite-derived vegetation health index (VHI) indicated widespread positive vegetation conditions resulting from the persistently wet season observed. In **East Africa**, heavy rains were observed from late October and early November in **Ethiopia**, **Kenya**, **Somalia**, northern **South Sudan** and southern **Sudan.** Torrential rains continued in the region over the past weeks, causing floods in **Kenya**, **Somalia** and the **United Republic of Tanzania.** In particular, the significantly heavy rains since early November have triggered numerous floods and river inundation, leading to thousands of displaced people and fatalities across several provinces in **Kenya**. The elevated risk for flooding is maintained in the region as locally heavy rain is expected to continue during the coming weeks. Unusually heavy rains also fell in western **Yemen**. A delayed season, below-average rainfall was observed from mid-November in Southern Africa, particularly in some regions of **Angola**, **Namibia**, **South Africa**, **Zambia** and **Zimbabwe**. Above-normal precipitation occurred in **Central Asia** in early August, in some regions of **Afghanistan**, **Kazakhstan**, **Pakistan** and **Tajikistan**, and then returned to near-average conditions. Since mid-October a persistent cold front occurred in **Kazakhstan**, **Turkmenistan** and **Uzbekistan**, causing heavy rains and snowfall in localized areas. Heavy rains and major floods occurred in **India** and the **Philippines**. During the reporting period, the **Caribbean** and **Central America** were characterized by a persistent, long period of dryness, except for the passage of the tropical storm Erika in late August that caused landslides and floods particularly in the islands, including **Dominica**. Poor rains occurred during October and November in the region. During the last week of November heavy rains occurred in **El Salvador, Guatemala** and southern and eastern **Nicaragua**. More information can be found here.

A strong and mature El Niño continues in the tropical Pacific Ocean. The majority of international climate outlook models indicate that the 2015–2016 El Niño will strengthen slightly before the end of the year. Models and expert opinion suggest that peak three-month average surface water temperatures in the east-central tropical Pacific Ocean will exceed 2 °C above average, placing this El Niño event among the three strongest previous events

[1] Evidence for LSD classification as a vector-borne disease: Recent studies have demonstrated vertical transmission of LSDV by R. (B.) decoloratus ticks (Tuppurainen *et al.*, 2013a) and transstadial transmission by A. hebraeum adults, moulted from nymphs fed on experimentally-infected cattle (Lubinga *et al.*, 2013a, 2015).

since 1950 (1972–1973, 1982–1983, 1997–1998). More information can be found here.

Temperature: The combined average temperature over global land and ocean surfaces for each month of the reporting period was the highest in the 136-year period of record. For July, the temperature was 0.81 °C above the twentieth century average of 15.8 °C, surpassing the previous record set in 1998, while in August, it was 0.88 °C above the twentieth century average of 15.6 °C. In September and October 2015, the temperature was 0.90 °C and 0.98 °C above the twentieth century average of 15.0 °C and 14.0 °C, respectively. Monthly temperature during the reporting period is currently increasing at an average rate of 0.06 °C per decade. October marked the sixth consecutive month a monthly global temperature broke records and was also the greatest anomaly for any month in the 1 630 months of recordkeeping. Large regions of Earth's land surfaces were much warmer than average, particularly in **Africa**, **Europe**, **Central** and **South America**, south and eastern **Asia**, and **North America**. In October 2015, record warmth was observed across the entire southern half of **Australia**, part of southern and southeastern **Asia**, much of central and southern **Africa**, most of **Central America** and northern **South America**, and parts of western **North America**. **Argentina**, parts of northeastern **Canada**, central **Japan** and scattered regions of western and central **Russia** were cooler or much cooler than average. More information can be found here.

Festivals: Two festivals were celebrated in various countries around the world during this period, associated with increased movements of animals and animal products, and people. These include the end of Ramadan, Eid-al-Fitr in July, and Eid al-Adha in September, in countries with notable Muslim populations. During these two celebrations, large numbers of sheep and goats are marketed for feasting and celebrations. This may have increased the possibility of pathogen introduction and disease transmission among small ruminants during the festivities, including pestes des petits ruminants (PPR), FMD and brucellosis, though data available on disease reports do not report this. Large (multimillion) aggregations of pilgrims for the observation of religious rites were also expected in the sacred city of Makkah in Saudi Arabia. This could also lead to the introduction of pathogens and their spread between humans given the close human-to-human contact (i.e. MERS-CoV, influenza and other emerging zoonotic or non-zoonotic diseases).

Animal trade: Inter-country trade in live animals as recorded by the United Nations (cattle, sheep, poultry) during the reporting period did not show significant increases compared to a similar period in previous years. As with previous years live animal trade was dominated by bovine and swine followed by poultry. See Figure 7 (a) and (b). **Azerbaijan** was the major importer of live bovine (35.4 x 104 kg; US$10 million) from six countries, namely **Georgia**, **Hungary**, the **Netherlands**, the **Russian Federation** and **Ukraine**. Azerbaijan was also a major importer of live poultry (25.8 x 103 kg; US$1.94 million) during this period. **Austria** dominated the import and export of live pigs during this period. For small ruminants, **Azerbaijan** was the major importer from three countries (**Georgia**, **Kazakhstan** and the **Russian Federation**), while **Australia** was the major exporter to nine countries (**Bahrain**, **Egypt**, **Israel**, **Kuwait**, **Malaysia**, **New Zealand**, the **Philippines** and the **United Arab Emirates**).

No data were available on informal trade between countries. Generally, reliable data are not available on informal trade/movement of animals and animal products between countries (frequently, data are underestimated, but often depicted as greater in terms of quantities and economic value than sanctioned, registered formal trade). It is assumed that incentives for informal trade may increase during periods of increased demand (i.e. festivities) and where there are price differences across borders.

The changes in the **global meat prices** showed an overall decrease (meat price index[2] ranged from 172.7 to 158.6) but varied by commodity type; price indices for beef, pork and poultry decreased, while that of ovine increased. The reduction in beef prices was due primarily to reduced import demand in the United States of America. The reduction in pork prices was due, in part, to an oversupply within the European Union which caused both domestic and export prices to fall. See FAO's Food Price Index (FPI) for more details.

Price differentials across regions and borders increase incentives for unregulated animal and animal product-related movements and, consequently, the potential for transboundary spread of pathogens or diseases. National changes in prices were observed in various regions: In the **Americas**, poultry prices decreased across various regions of **Bolivia** and **Paraguay**. In **Africa**, poultry prices increased in **Algeria** and in the **Middle East** (**Gaza Strip** and **The West Bank** where H5N1 HPAI outbreaks occurred), while in **Tunisia**, prices decreased. In **Southeast Asia, Thailand** had an increase in poultry prices. No information was available from H5N1 HPAI countries in **West Africa** at the time of writing.

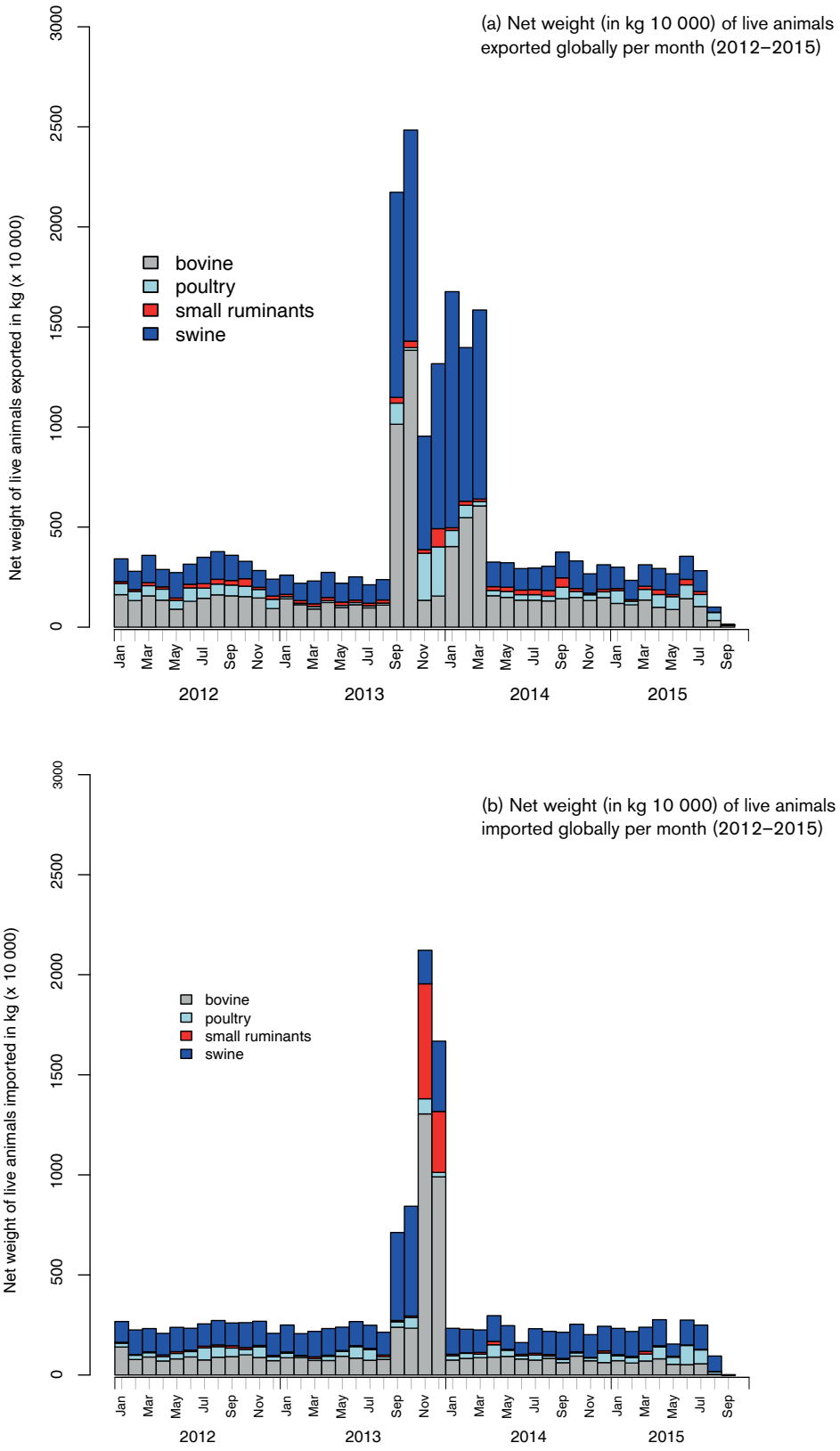
Bovine meat prices increased in **Indonesia**, **Mongolia**, and the **Russian Federation** and decreased in **Mauritania** and **Tunisia**. Ovine meat prices increased in **Algeria**, while camel meat decreased in **Mauritania**. Average pork prices increased in **China** and the **Russian Federation**.

Civil unrest: A number of events related to natural disasters and social unrest were observed which could have resulted in changes

[2] The FAO Food Price Index is a measure of the monthly change in international prices of a basket of food commodities. It consists of the average of five commodity group price indices, weighted with the average export shares of each of the groups for 2002-2004 (see http://www.fao.org/worldfoodsituation/foodpricesindex/en)

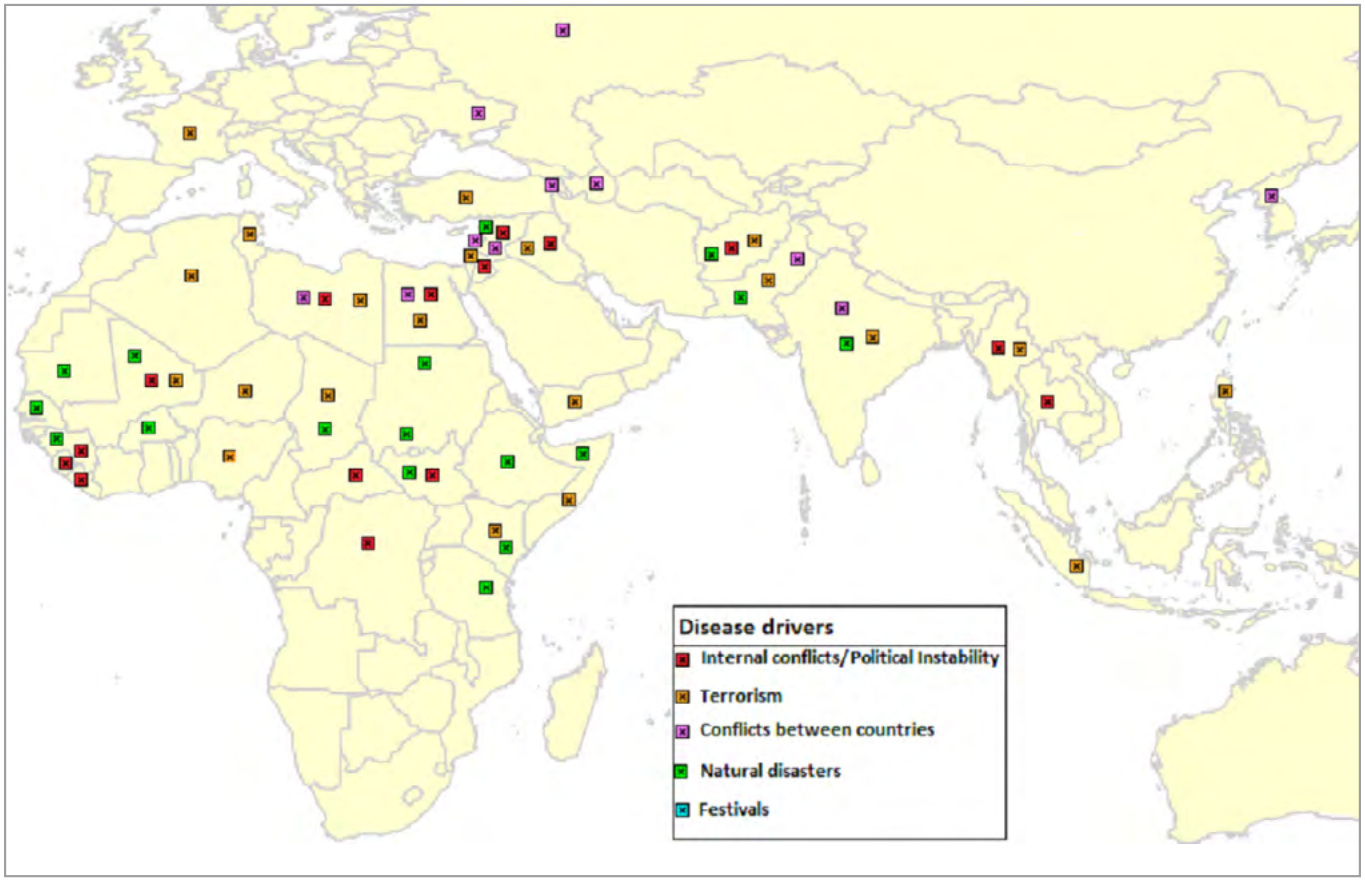
in animal health conditions in countries across the globe (see Figure 8). Violence, radicalism and political instability were observed in several countries in **North Africa** (Egypt, Libya and Tunisia), **Central** and **West Africa** (the Central African Republic, Mali and Nigeria), **West Central Asia** (Afghanistan) and the **Middle East** (Lebanon, the Syrian Arab Republic and The West Bank). Such situations generally result in interruptions in basic public services, including those related to public and animal health services and activities, leading to higher incidence of diseases going unreported and in their unmonitored and uncontrolled spread. Related population movements also occur. Some of these movements involve animals and animal products, changing geographic locations of

Figure 7. Monthly global trade in live animals (2012–2015)



demands for animals and animal products and, therefore, trade and notable price differentials. Countries with higher levels of activities (i.e. those reporting more than two events) include **Afghanistan**, **Egypt**, **Israel**, **Libya**, **Mali**, **Myanmar**, **Pakistan**, **South Sudan**, the **Syrian Arab Republic**, **The West Bank** and **Yemen**. In countries like **Nigeria**, where extremist anti-government groups are operating in particular areas, and in **Libya**, where a functional government is absent, reports of H5N1 HPAI have occurred.

Figure 8. Map of selected disease drivers reported globally from July to September 2015



SECTION 3

FAO risk assessment activities

Risk assessment for RVF in Mauritania

Between September and October 2015, RVF outbreaks were reported in domestic livestock in five provinces of southern Mauritania (Aleg, Maghta Lahjar, Moudjera and Kiffa). These provinces were previously affected between 2004 and 2013 (see Table 1). RVF outbreaks are, in general, associated with climate variability, which is known to influence the development and survival of both the RVF virus and the vector (*Aedes* spp. and *Culex* spp.), as well as vector habitat suitability through changes in the vegetation and the land-surface conditions. In northern **Senegal** and southern **Mauritania**, the onset of RVF outbreaks appears to be associated with rainless periods of seven days (time needed for mosquito embryogenesis) followed by an intense rainfall during the late rainy season (August–September–October) (Caminade *et al.*, 2014). These meteorological events lead to the filling of temporary ponds, causing mass hatching of *Aedes* eggs potentially infected by the RVF virus (Anyamba *et al.*, 2012). Analyses of rainfall and vegetation patterns that may have triggered RVF vector amplification in the affected regions in Mauritania in 2015 were conducted by examining rainfall and normalized difference vegetation index (NDVI) anomalies from satellite-derived climate data (RFE – 5 km resolution; and eModis – 250 m resolution) acquired every ten days for the period between 2000 and 2015. The results showed patterns similar to those observed in the region during previous outbreaks. For all affected regions in Mauritania, a trend was observed which was characterized by above-average precipitation throughout the 2015 rainy season, with a peak during mid-late August, a dry spell of about seven days between September–October, followed by intensive rainfall events of above 10 mm per day, which is the threshold considered to trigger massive hatching of mosquito eggs in this region (Soti *et al.*, 2012) (Figure 9a). The results also show positive NDVI anomalies during the period September to October, indicating suitable environmental condi-

Table 1. Provinces affected by RVF epidemics between 2000 and 2015 available in EMPRES-i (FAO)

REGIONS	PROVINCES	2000	2001	2002	2003	2004	2005	2008	2010	2012	2013	2015
ADRAR	AOUJEFT								■			
ASSABA	KIFFA	■		■	■	■	■	■		■		■
ASSABA	GUERROU									■		
ASSABA	KANKOSSA					■	■	■				
BRAKNA	ALEG									■		■
BRAKNA	BOGHE	■					■	■				
BRAKNA	BABABE									■	■	
BRAKNA	MAGHTA LAHJAR									■	■	■
GORGOL	M'BOUT	■	■		■			■				
GUIDIMAKHA	SELIBABY	■	■				■	■			■	
GUIDIMAKHA	OULD YENGE				■	■						
HODH ECH CHARGI	AMOURJ									■		
HODH ECH CHARGI	NEMA	■	■	■	■		■			■		
HODH ECH CHARGI	DJIGUENI	■	■	■			■			■		
HODH ECH CHARGI	OUALATA									■		
HODH EL GHARBI	TINTANE				■		■	■		■		
HODH EL GHARBI	KOBENNI	■										
HODH EL GHARBI	TAMCHEKETT									■		
INCHIRI	AKJOUJT								■			
TAGANT	MOUDJERIA									■		■
TAGANT	TIDJIKJA	■	■		■	■	■	■		■		
TRARZA	ROSSO									■	■	
TRARZA	MEDERDRA										■	
TRARZA	OUAD NAGA									■		
TRARZA	R'KIZ	■						■				

Source: EMPRES-i (FAO)

tions for mosquito amplification (Figure 9a). A map of cumulative rainfall anomalies from September to November 2015 (Figure 9b) showed that the four affected provinces experienced more than 300 mm above average cumulative rainfall. The map in Figure 9b shows a spatially bimodal precipitation pattern in Mauritania with wettest areas located in the south and north, and dry areas located in the centre of the country. The recent RVF cases occurred in the identified wet area in the south of the country which is surrounded by the dry area. This suggests that livestock herds may have been moved from arid to the wettest areas in search of water and pastures, which may have enhanced the risk of disease transmission to susceptible animals. Given that livestock in Mauritania are not vaccinated against RVF, if conditions persist, the potential risk of transmission and spread is expected to continue.

Figure 9a. Trend in of precipitation and NDVI within affected areas (Mauritania) from June to November for 2003, 2015 and average values (2000–2010)

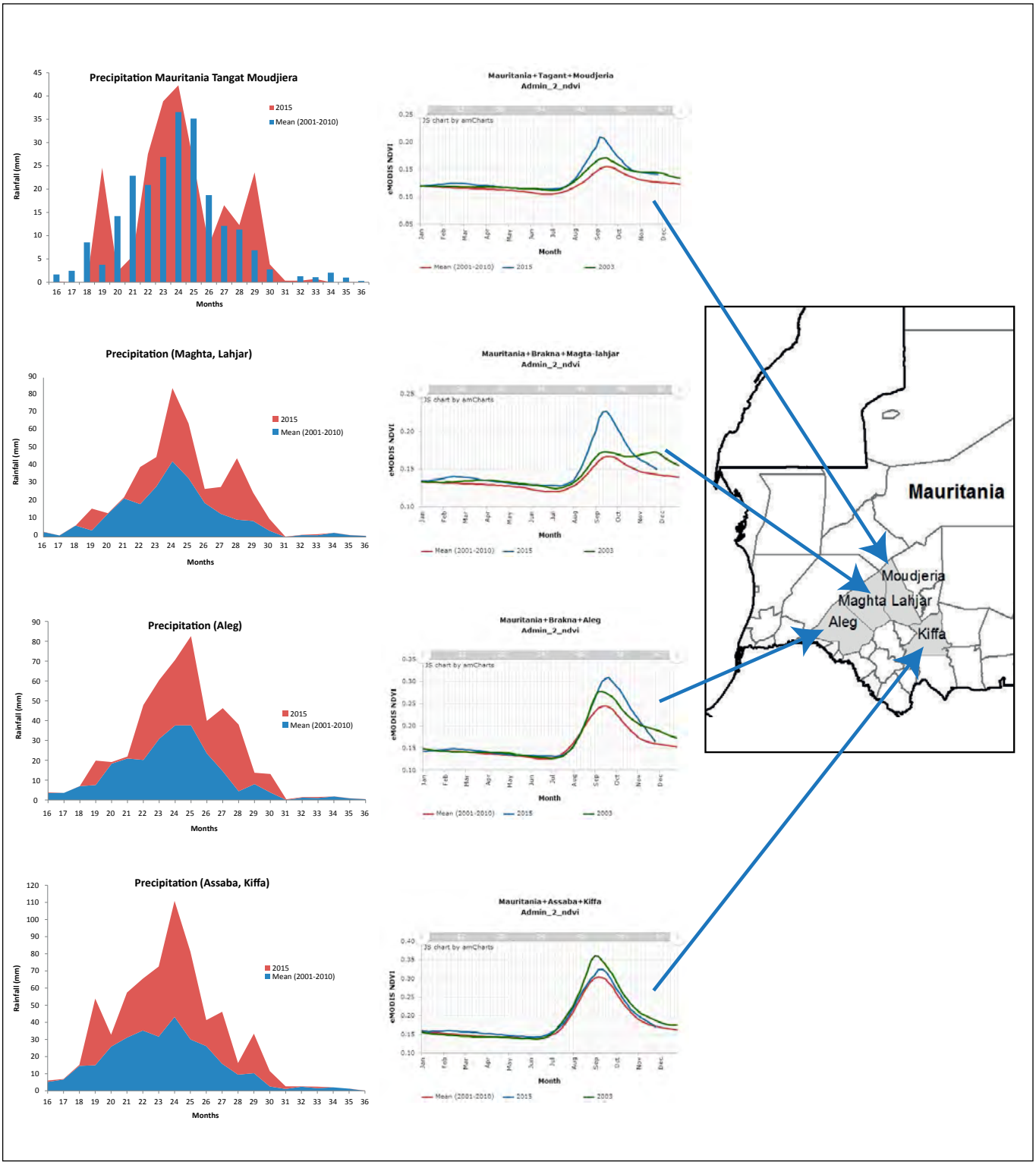
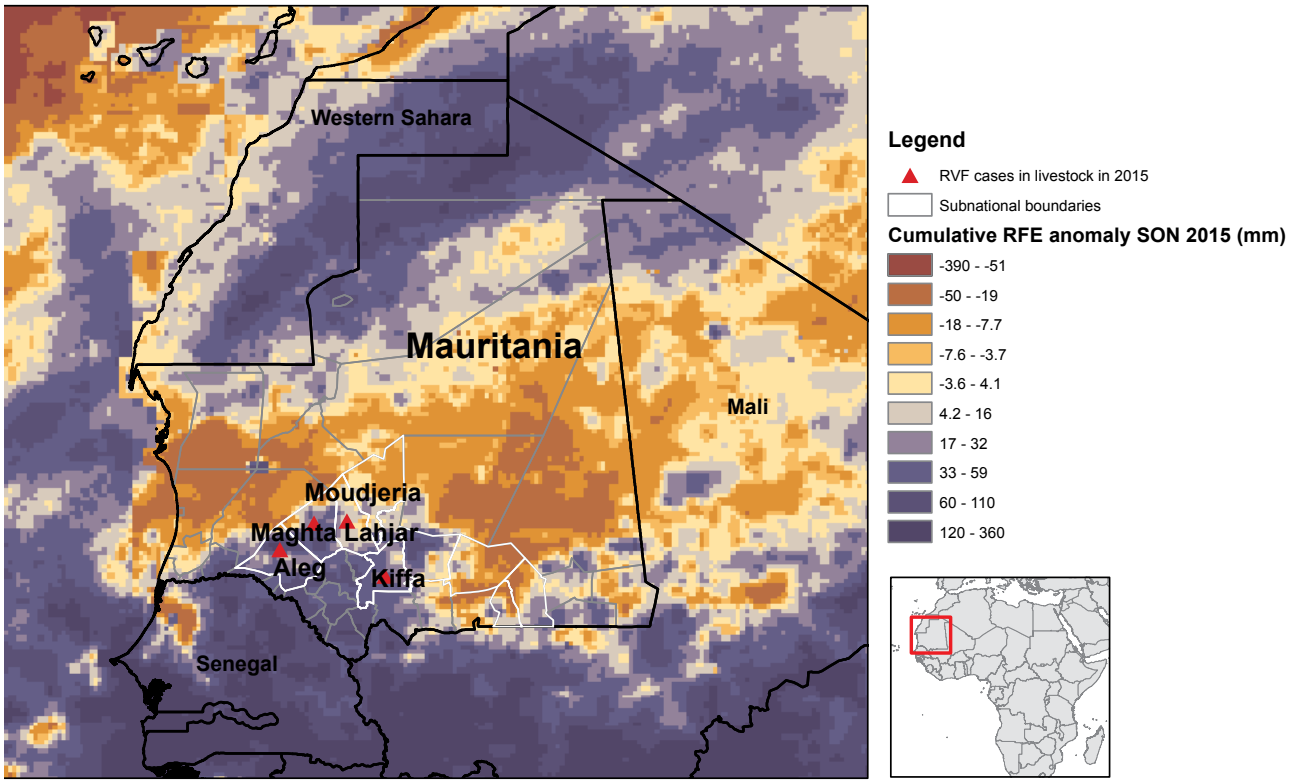


Figure 9b. RVF cases in livestock (red) and provinces with human cases (grey polygons) during September–October 2015 overlaid on cumulative rainfall anomalies for September–October–November 2015



Risk assessment for FMD spread in Northern Africa and Southern Europe

The presence of serotype O "India 2001" topotype indicates that the virus involved in the current outbreaks in Morocco is very closely related to strains from the recent FMD epidemic in Algeria and Tunisia. The most likely explanation is persistence of virus circulation in Tunisia or Algeria that has not been detected by passive or active surveillance and connected to the informal movement of livestock and products through the borders. Serological surveillance in small ruminants is the usual means to detect such circulation, although sampling may need to be extensive to rule out undetected circulation in sheep in areas where internal movements are significant, such as Algeria. Serological surveillance, particularly in sheep, is therefore recommended. Widespread infection in small ruminants would increase risks of carriage of infection on vehicles or personnel, increasing the risk for the introduction of the disease into countries of the European Union, which have the status of "FMD-free countries" where vaccination is not practiced.

Bans on the importation of susceptible animals and products are in effect in Spain to prohibit the introduction of live animals or products that could carry the virus. Specifically, Spain prohibits the importation of FMD-susceptible animals and animal products from Algeria, Libya, Morocco and Tunisia, and the cities of Ceuta and Melilla. The likelihood that the virus could be introduced into the European Union via legal trade remains negligible.

Risk assessment for LSD introduction to other European countries

The most likely scenario by which LSD could be introduced into other European countries is by the movement of infected animals or contaminated products. Conversely, the spread is limited in distance when restrictions exist regarding movement into non-affected areas. An alternative pathway for LSD incursion is through the introduction of contaminated vectors from infected neighbouring regions.

The implementation of vaccination campaigns and restriction in the movement of animals and animal products within the affected areas and to the rest of Europe should contribute to limiting the spread of the disease in Greece. These factors would further contribute to reduce the likelihood of introduction into other European countries. While the illegal movement of susceptible animals from the vaccinated region is difficult to assess, it is considered unlikely. In addition, the risk of disease introduction through the illegal trade of hides is unlikely since hides from an affected animal would be poor quality, prohibiting their entry into the marketplace.

Disease awareness campaigns and training for farmers, veterinary personnel and border control staff should continue, especially for regions at a higher risk of introduction of LSD.

SECTION 4

Disease forecasting

Table 2 provides a summary of the expected disease situation globally for the next three months (from December 2015 to February 2016). Assessments are based on observed trends in disease and disease drivers such as civil unrest, climatic conditions and the opinions of FAO-associated experts across the globe.

Table 2. Summary of forecasts for December 2015 to February 2016 (see previous three-month period)

DISEASE OR DISEASE DRIVERS	THREAT FORECAST	GEOGRAPHIC AREAS	LEVEL[5]	NOTES
Avian Influenza(AI)				
	Further spread of H5N1 HPAI	Middle East (Israel, West Bank, Gaza Strip)	Low	Limited capacity to implement adequate control measures in West Bank area; historically low reporting period for H5N1 HPAI.
	Spread of H5N1 from Egypt to neighbouring countries	North Africa (Libya) and Middle East (Israel, West Bank, Gaza Strip)	High	Egypt remains endemic and therefore continues to act as a potential source of virus for the region. Civil unrest, extremism and political instability in the region may exacerbate the possibility of disease spread due to inadequate control measures such as movement control, quarantine and rigorous/continuous vaccination.
	Risk of H5N1 HPAI endemicity (Nigeria) and further regional spread	West Africa	Medium to high	Though reports of affected countries have decreased, underreporting is likely. Continued circulation of H5N1 HPAI in Nigeria since early 2015 suggests the possibility to become endemic. Nigeria provides a potential source of virus for the region. Inadequate control measures such as movement control, quarantine and vaccination further facilitate regional spread.
	Risk of regional spread of subtypes H5N1, H5N2, H5N6 and H5N8 in poultry	East and Southeast Asia	High	Seasonally high period for AI activity. H5 AI viruses are expected to continue circulating and may spread to previously unaffected countries in the region or even over longer distances, as was observed during winter 2014/2015. Up to six different AI subtypes are currently co-circulating in Asia, which provides an opportunity for genetic reassortment.
	Further spread of H7N9 from China	East and Southeast Asia	Medium to high	H7N9 so far has not spread outside China, after three seasons of circulation. With the presence of poultry trade (formal and informal) between China and neighbouring countries, cross-border spread is likely to occur. The expected increase in trade/poultry movement associated with increased demand for poultry during the upcoming New Year festivities is likely to increase the risk of cross-border spread.
	Risk of human exposure to AI viruses from poultry	East and Southeast Asia, Egypt and West Africa	Medium to high	Seasonally high period for AI activity in endemic countries. Higher levels of virus circulation will increase the opportunities for human exposure. Local practices that either increase or decrease human exposure may result in differential risks across population groups and countries.
	Risk of emergence of new AI strains	East and Southeast Asia	Medium to high	Up to six different AI virus subtypes are co-circulating in Asia which provides an opportunity for genetic reassortment. Increased AI activity expected over the coming months will further increase this risk.
	Regional spread of H5 AI	North America	Low	No outbreaks reported from United States of America and Canada.
	Regional spread of H5 HPAI and LPAI	Europe	Low to medium	The recent report of H5N1 and H5N2 AI in France constitutes a risk for the region, if containment and control measures should fail. However, France has emergency operating procedures in place that are functional and have proven effective in the past. High levels of biosecurity on farms can effectively prevent further virus spread.

[5] **Low** = An event is unlikely; **Medium** = An event is possible but not likely; **High** = An event is a strong possibility; **Very high** = An event is highly likely; **Extremely high** = An event is imminent.

(cont.)

DISEASE OR DISEASE DRIVERS	THREAT FORECAST	GEOGRAPHIC AREAS	LEVEL[5]	NOTES
FMD serotype O				
	New incursions of FMD (serotype O) within affected countries (Mongolia and Republic of Korea)	Eastern Asia	Low to medium	Possible incursions from neighbouring infected countries due to uncontrolled animal movement.
	Regional spread from North Africa	Southern Europe (Spain)	Negligible	Bans on the importation of susceptible animals and products are in effect in Spain to prohibit the introduction of live animals or products that could carry the virus. Specifically, Spain prohibits the importation of FMD-susceptible animals and animal products from Algeria, Ceuta, Libya, Melilla, Morocco and Tunisia.
	Regional spread within Southern Africa	Namibia and Zimbabwe	Medium to high	Civil unrest and political instability in the region may exacerbate the possibility of disease spread due to inadequate control measures such as movement control, quarantine and vaccination. In Namibia and Zimbabwe in Southern Africa, there could be possible spread between livestock and wildlife during the dry season at water points and grazing areas where animals congregate.
Lumpy Skin Disease (LSD)				
	Continued regional spread and increased threat to livelihoods and food security	Middle East, The Caucuses, Central Asia and Southeast Europe	Low	Given the importance of insect vectors in the disease transmission dynamics, forecasted climatic conditions during the next three months in the region are not favourable given the low temperatures. Border control and close livestock (cattle) inspection is highly recommended.
Rift Valley fever (RVF)				
	Possible occurrence of outbreaks	East Africa: Kenya, Somalia, South Sudan, Uganda and the United Republic of Tanzania	Medium to high	The consensus of ENSO prediction models indicate continuation of strong El Niño conditions during the November–January 2015–2016 season in progress. Above normal rains may occur in East Africa during the latter half of the year. Countries should remain vigilant. Registration of quality control vaccines and vaccination campaigns in high-risk areas is highly recommended.
MERS CoV				
	Continued occurrence of human cases in Saudi Arabia	Middle East (Saudi Arabia)	Low to medium	Evidence points to seasonal patterns in reporting/ occurrence with peaks during the period March–April, with cases expected to decrease after April.
	Possible spread to neighbouring countries	Middle East, North Africa	High	Movement of camels, likely considered to be an important spread pathway, is probable in the region; uncertainties related to modes of transmission from infected camels to susceptible humans that may not show symptoms of infection.
Ebola				
	Spread of Ebola in humans from currently affected countries	West Africa	Low to medium	Very low and deficient health services in the three most affected countries could lead to a further spread of disease, which is not yet under control, and heavy reliance on international aid support.

[5] **Low** = An event is unlikely; **Medium** = An event is possible but not likely; **High** = An event is a strong possibility; **Very high** = An event is highly likely; **Extremely high** = An event is imminent.

SECTION 5

New publications or articles

Influenza

Zhang, Y., Feng, C., Ma, C., Yang, P., Tang, S., Lau, A., Sun, W. & Wang, Q. 2015. The impact of temperature and humidity measures on influenza A (H7N9) outbreaks–evidence from China. *Int J Infect Dis.* 20: 122–124 (available at www.sciencedirect.com/science/article/pii/S1201971214016981).

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Verhagen, J.H., van der Jeurd, H.P., Nolet, B.A., Slaterus, R., Kharitonov, S.P., de Vries, P.P., Vuong, O., Majoor, F., Kuiken, T. & Fouchier, R.A. 2015. Wild bird surveillance around outbreaks of highly pathogenic avian influenza A(H5N8) virus in the Netherlands, 2014, within the context of global flyways. *Eurosurveillance*, 20(12): 21069 (available at www.eurosurveillance.org/ViewArticle.aspx?ArticleId=21069).

Sources of Information

Centers for disease control and prevention (CDC)
http://www.cdc.gov/vhf/ebola/outbreaks/2014-west-africa/case-counts.html

EMPRES-i
http://empres-i.fao.org/eipws3g/

EUFMD Monthly reports
http://www.fao.org/ag/againfo/commissions/eufmd/commissions/eufmd-home/fmd-surveillance/situation-reports/en/

FAO EMPRES Watch
Emergence of lumpy skin disease in the Eastern Mediterranean Basin countries:
http://www.fao.org/docrep/019/aq706e/aq706e.pdf

FAO Food Chain Crisis Management Framework - Early Warning Bulletin
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Recommended citation
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Acknowledgments
This report was prepared by the FAO/GLEWS team of the animal health service and was made possible through funding support provided by the Defense Threat reduction Agency (DTRA) of the United States.

I5494E/1/03.16

ISBN 978-92-5-109158-6