

# IZS

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WOAH Collaborating Centre  
for epidemiology, modelling  
and surveillance



# Vector-Borne diseases epidemiology in the Middle East and GCC

Workshop on: “Towards improved understanding & control of  
Vector-Borne Diseases in GCC and the Arabian Peninsula  
29-30 July 2024 - UAE



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## Contents

- Key elements of vector borne diseases
- VBD of major concern in the in the Middle East and GCC (BT, LSD, CCH, RVF)



Source: CDC

**Bugging You is Easy 'Cause You're Buggable'**

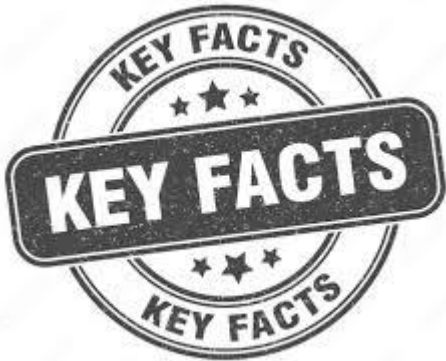
## Vector-Borne diseases epidemiology

- Vector-borne diseases (VBDs) comprise a diverse group of illnesses caused by various pathogens transmitted by **arthropod vectors**, including mosquitoes, fleas, ticks, and sand flies.
- VBDs represent a significant threat to both human and animal health, with recent years seeing a **troubling increase in their prevalence and spread**
- Every year there are about **700,000 human deaths** from vector-borne diseases occur worldwide.

## Vector-Borne diseases epidemiology

Vectors can transmit infectious diseases either **actively or passively**:

- **Biological vectors**, such as mosquitoes and ticks may carry pathogens that can multiply within their bodies and be delivered to new hosts, usually by biting.
- **Mechanical vectors**, such as flies can pick up infectious agents on the outside of their bodies and transmit them through physical contact.



## Vector-Borne diseases epidemiology

Some vectors are able to move **considerable distances**.  
Vectors can be introduced to new geographic areas for  
example by:

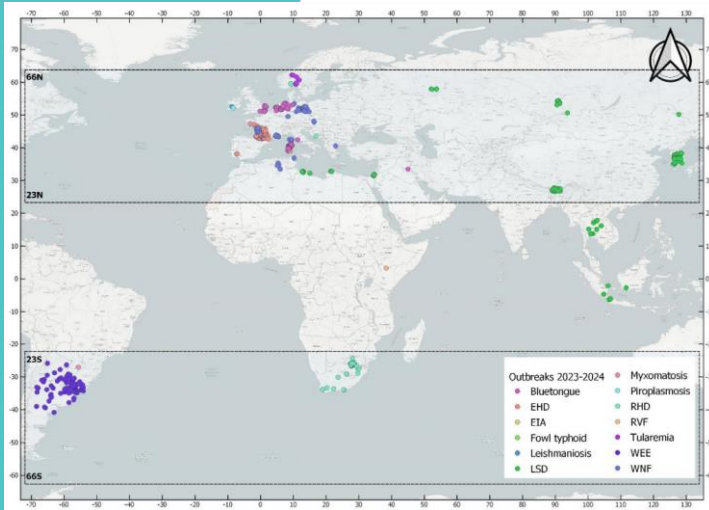
- travel of humans and **international trade**;
- **animal movement**, for instance of livestock;
- **migratory birds**;
- **changing agricultural practices**;
- **or the wind**.



## Vector-Borne diseases epidemiology

- **Climatic conditions** are modifying the **presence and persistence** of vectors and consequently the likelihood of VBD introduction and circulation
- the **impact of climate change** on the epidemiology of VBD is also a **growing concern**, with changes in **vector density, activity periods and geographical distribution** being observed
- The biological and non-biological pathways through which climate change affects VBD transmission are **not fully understood**



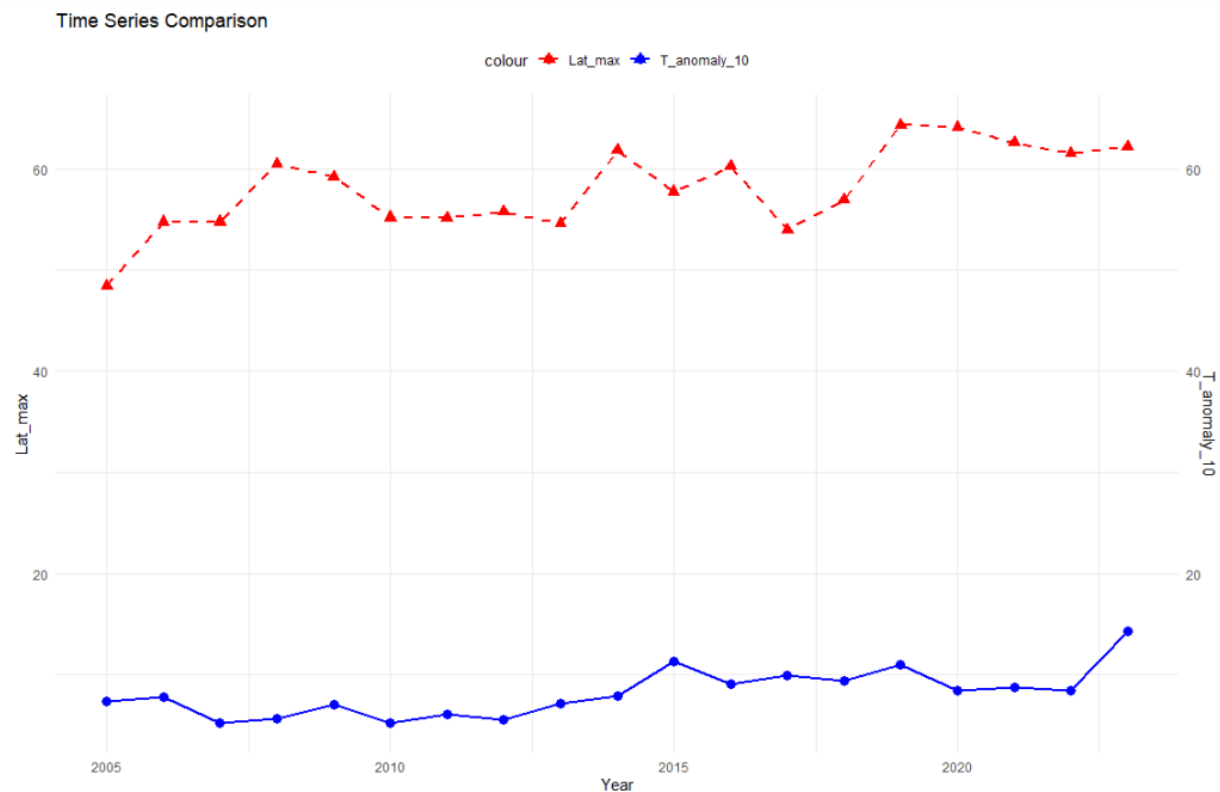


Source: WOA's report on the "Animal Health Situation Worldwide"

## Vector-Borne diseases epidemiology

- Of the 90 diseases of terrestrial animals currently listed by WOA, almost **a third are vector-borne** (entirely or for which vectors play an important role), some of which have shown a significant evolution in 2023 and early 2024
- It is worth noting that **99% of the VBD** outbreaks reported as exceptional events in 2023 and early 2024 were detected in **temperate regions** (i.e. between 23.5° and 66.5° N/S of the Equator)

# Vector-Borne diseases epidemiology



Source: WOAH's report on the "Animal Health Situation Worldwide

**Figure 18.** Time series comparison of the maximum annual latitude at which outbreaks were reported and the global annual anomaly temperature detection for the period 2005–2023. For the comparison, the temperature anomaly values have been multiplied by a factor of 10





## Bluetongue

- Bluetongue is a **non-contagious, insect-borne, viral disease of ruminants**. Bluetongue virus (BTV) belongs to the genus Orbivirus in the family Reoviridae
- **27 serotypes** have been identified, **partially correlated each other** (in vitro crossreactions and in vivo cross-protection)
- **Majority** of infections with bluetongue are **clinically inapparent**. In infected sheep and occasionally other ruminants, more severe disease can occur
- Bluetongue has a **strong impact on trade**



# Vectors of Bluetongue

## Several species of *Culicoides*

- *C. imicola* (Africa, Mediterranean)
- *C. Obsoletus* complex (Cyprus, 1977; Bulgaria, 1999; Italy 2002)
- *C. Pulicaris* complex (Italy)
- *C. chiopterus*, *C. dewulfi* (North Europe)
- *C. brevitarsis*, *C. fulvus*, *C. oxystoma*, *C. peregrinus* (Australia)
- *C. variipennis*, *C. insignis* (North America)

# Vectors of Bluetongue

## LARVAL HABITAT

Midges have different reproduction habitats according to their species:

- *C. imicola* needs moist soil (mud) exposed to sunlight
- *C. obsoletus* breeds in shadowy areas (woods)

*C. obsoletus*



*C. imicola*

# Vectors of Bluetongue

Adult midges may spread:

- **ACTIVELY** (a few hundred meters)
- **PASSIVELY** carried by wind:
  - Surface winds -> tens of Km
  - High altitude airstreams -> hundreds of Km

**Resistance of midges at low temperatures**

- *C. imicola* eggs at temperatures below 6 °C may survive 2 months
- Larval stage may persist for months
- Adult *C. imicola* may survive 2 weeks at -1,5 °C

**Adults below +12°C are not active**

BUT they die only when temperature remains close to 0°C for 1 week

## Differential diagnoses Bluetongue

- foot-and-mouth disease,
- vesicular stomatitis,
- peste de petits ruminants,
- malignant catarrhal fever,
- bovine virus diarrhea,
- contagious pustular dermatitis (contagious ecthyma), infectious bovine rhinotracheitis,
- parainfluenza-3 infection, sheep pox, foot rot, actinobacillosis, Oestrus ovis infestation, and plant photosensitization. I

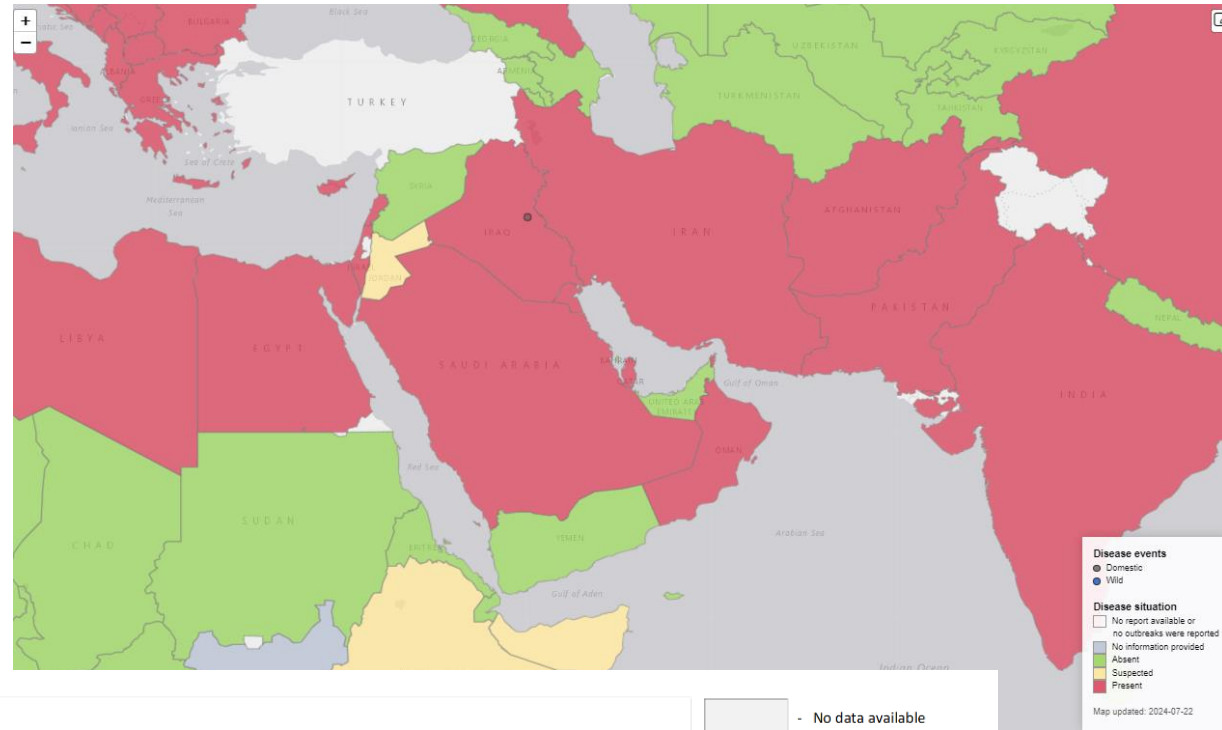


Live attenuated and  
inactivated vaccines

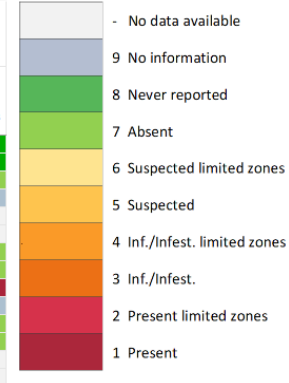
**In cattle and deer, epizootic hemorrhagic disease can also result in similar symptoms.**

# Bluetongue Geographical distribution

data source: WOA-H-WAHIS  
2005-2024



Disease <input type="text" value="Bluetongue virus [Inf. with]"/>		Country / Territory <input type="text" value="Bahrain"/>		Semester <input type="text" value="Jan-2005"/>																																				
Animal category <input type="text" value="Domestic"/>																																								
		Jan-2005	Jul-2005	Jan-2006	Jul-2006	Jan-2007	Jul-2007	Jan-2008	Jul-2008	Jan-2009	Jul-2009	Jan-2010	Jul-2010	Jan-2011	Jul-2011	Jan-2012	Jul-2012	Jan-2013	Jul-2013	Jan-2014	Jul-2014	Jan-2015	Jul-2015	Jan-2016	Jul-2016	Jan-2017	Jul-2017	Jan-2018	Jul-2018	Jan-2019	Jul-2019	Jan-2020	Jul-2020	Jan-2021	Jul-2021	Jan-2022	Jul-2022	Jan-2023	Jul-2023	
Bluetongue virus [Inf. with]	Bahrain	Domestic	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
	Wild																																							
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	Qatar	Domestic																																						
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	Saudi Arabia	Domestic	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
		Wild																																						
	United Arab Emirates	Domestic																																						
		Wild																																						
	Yemen	Domestic	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
		Wild																																						



## Lumpy skin disease

A viral disease of **cattle** characterised by severe losses, especially in naive animals.

**Family** Poxviridae,  
**Subfamily** Chordopoxviridae  
**Genus** *Capripoxvirus*.

### Symptoms include:

- Fever,
- Nodules on the skin, mucous membranes and internal organs
- Emaciation
- Enlarged lymph nodes
- Edema of the skin
- Sometimes death



**Mechanical vectors:**  
Mosquitoes, biting flies and ticks



## Risk factor Lumpy skin disease

- The main risk factors of LSD spread are associated with the introduction of the virus through **blood-feeding insects at short distance** scale and through **legal or illegal animal movements at long distance**.
- **Cattle density, higher temperatures and rainfalls** correlated with a higher vector activity should be considered factors able to increase the risk of outbreaks.







## Vector- Lumpy skin disease

- It seems that **Stomoxys calcitrans** (**stable fly**) is the **most competent** vector of LSDV, as well as the **mosquito** species **Aedes aegypti** .
- By contrast, **Culicoides nubeculosus** (**biting midges**), **Anopheles stephensi** and **Culex quinquefasciatus** (mosquitoes) are likely to be **inefficient** vectors of LSDV. It is suggested that **horseflies**, as **Haematopota spp** and **Tabanus bromiums**, could be **more effective in transmitting the virus than the stable fly** and albeit **non-biting flies** as **Musca domestica** and **Muscina stabulans** could be LSDV carriers.



## Vector- Lumpy skin disease

- LSDV was isolated from **hard ticks** as *Dermacentor marginatus*, *Hyalomma asiaticum*, *Rhipicephalus appendiculatus*, *R. Boophilus*, *Amblyomma hebraeum*, *Hyalomma truncatum*. Moreover, **intrastadial transmission and transtadial persistence** of the virus was demonstrated by ***Amblyomma hebraeum*, *R. appendiculatus*** ticks, which may play an important role in the transmission of LSDV. Moreover, **transovarial** passage occurred **in *Rhipicephalus annulatus***, and the virus could persist through the winter in *A. hebraeum* nymphs and *R. decoloratus*, implying that these ticks might serve as a reservoir.

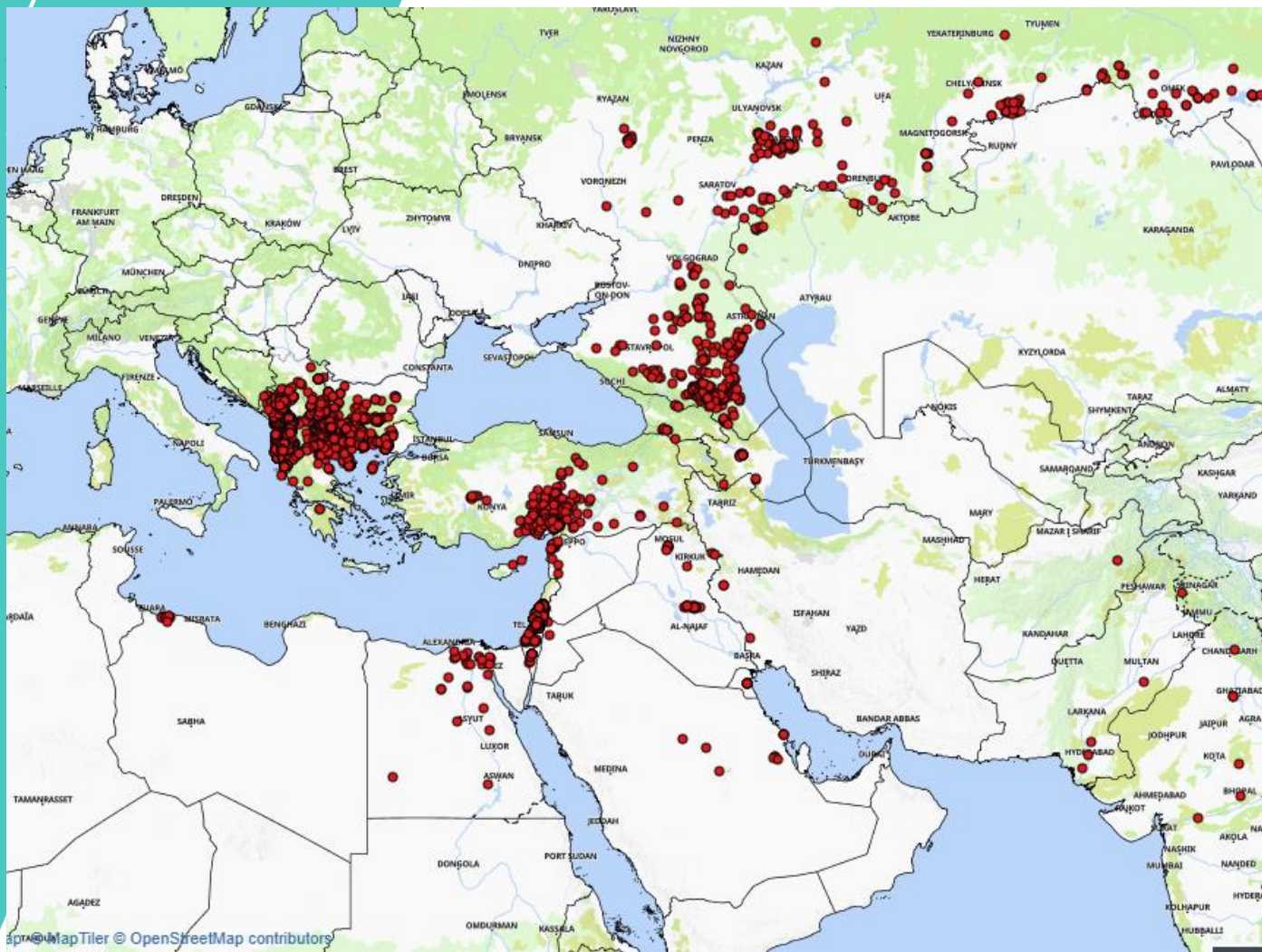


Live attenuated  
heterologous and  
homologous vaccines

## Lumpy skin disease . Differential diagnosis

<i>Other differential diagnosis for integumentary lesions</i>	<i>Differential diagnosis for mucosal lesions</i>
Dermatophilosis ( <i>Dermatophilus Congolensis</i> )	Foot and mouth disease
Dermatophytosis	Bluetongue
Photosensitisation	Bovine viral diarrhea
Actinomycosis	Malignant catarrhal fever
Actinobacillosis	Infectious bovine rhinotracheitis
Urticaria	Bovine papular stomatitis
Tick bites	
Besnoitiosis	
Nocardiasis	
Demodicosis	
Onchocerciasis	
Pseudo-cowpox and cowpox	
Epitheliotrope cutaneous lymphoma and cutaneous lymphoma	

# LSD - Historical perspective



**1929- 1989** in Africa mainly in cattle

**1989** Israel

**1991-2010** WOAH official report of outbreaks in Kuwait in Lebanon Yemen, United Arab Emirates, Bahrain, Israel in and Oman, in cattle

**2012:** outbreaks in Turkey, Jordan, Iraq , Palestinian Autonomous Territories, Azerbaijan, Iran and Kuwait

**2015** 111 outbreaks in Greece; first epidemic in Russia and Saudi Arabia

**2015-2021** outbreaks and cases reported in Europe, Georgia, Kazakhstan, Albania, Bulgaria, Montenegro, North Macedonia and Serbia

**2021-2023** in the last two years three countries reported the disease for the first time: Afghanistan, Indonesia and Lybia

(in the map) **1970-2023** LSD outbreaks (source: FAO Empres-i)



## Rift Valley Fever

RVF is a mosquito-borne viral disease affecting both **domestic and wild ruminants**, especially sheep, cattle and goats as well as **humans** (WOAH, 2019)

Young **lambs** and **goats (kids)** mortality rates of 70-100%.

**Calves and sheep:** mortality rates of 20-70%

**Adult animals and humans** mortality rates less than 10%

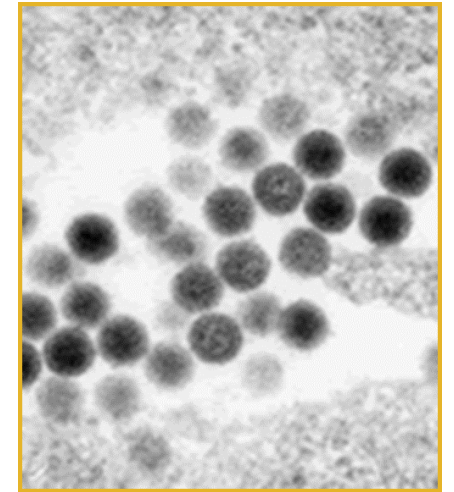
**Family** Phenuiviridae  
**Order** Bunyavirales.

### Symptoms include:

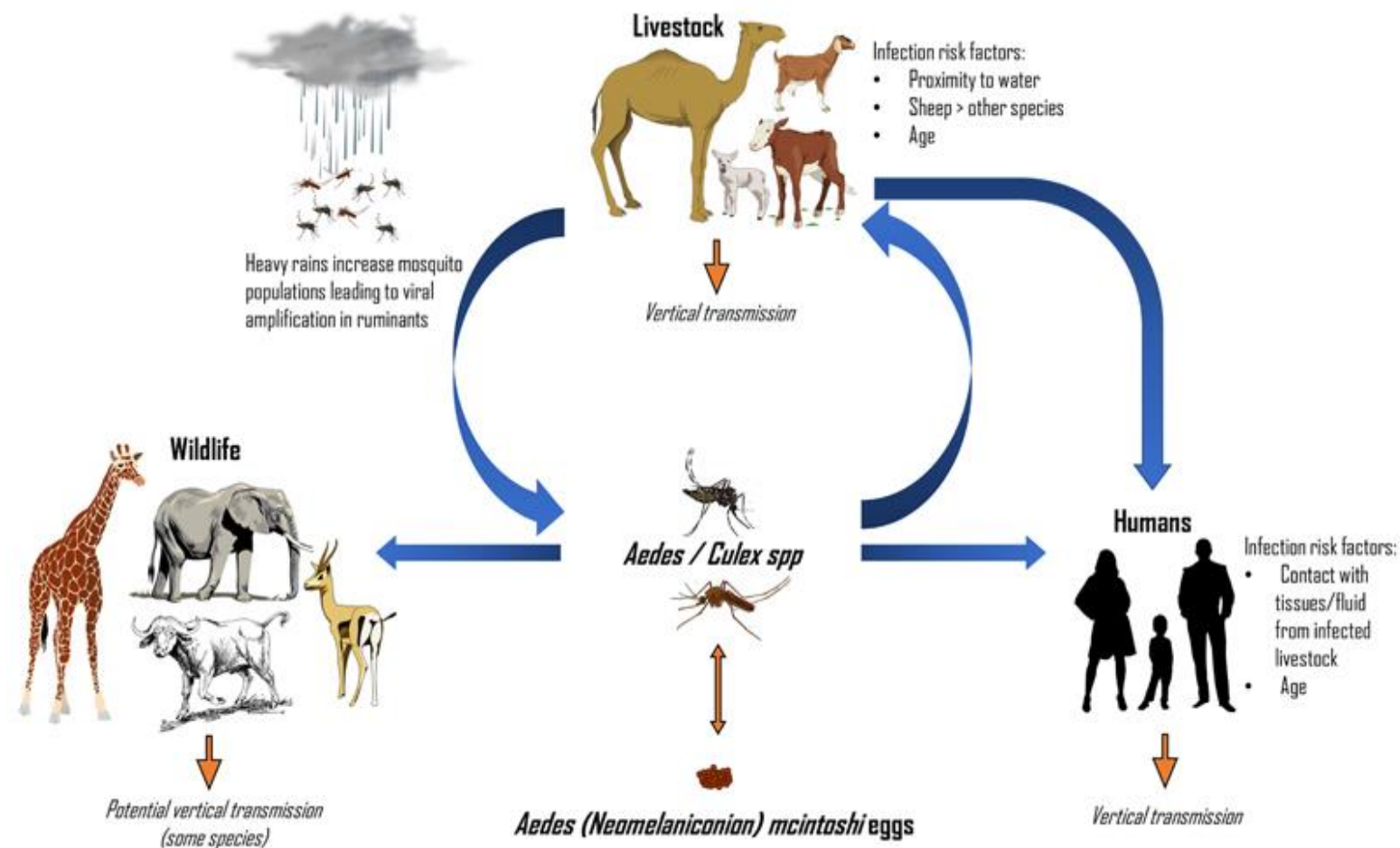
- Fever
- Listlessness
- Anorexia
- Disinclination to move
- Abortions and high morbidity and mortality rates in neonatal animals.
- “Abortion storm” in sheep



**Vectors:**  
primarily by *Culex* spp.  
and *Aedes* spp. mosquitoes



## Rift valley fever

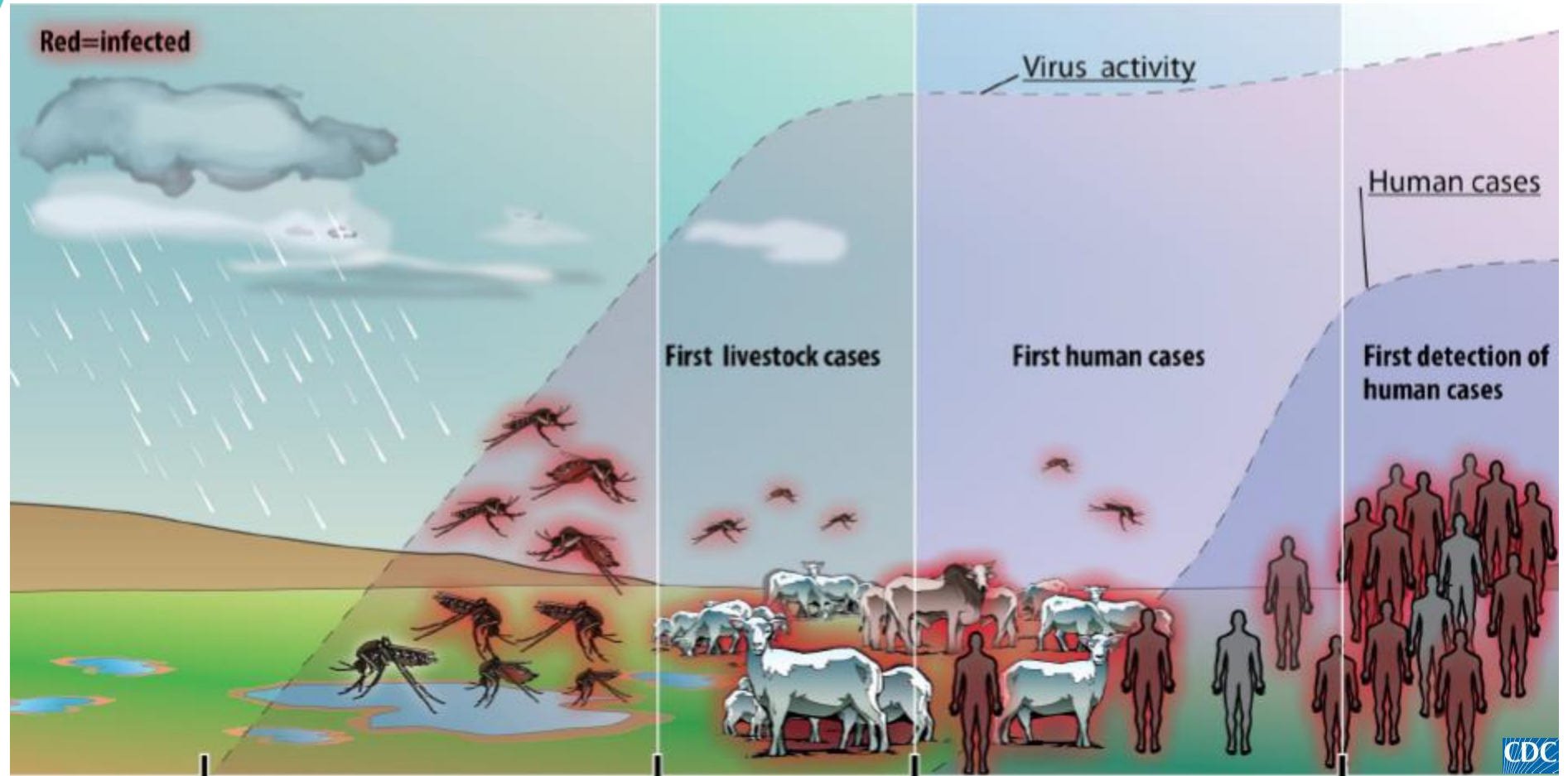


Wright D. et al., 2019

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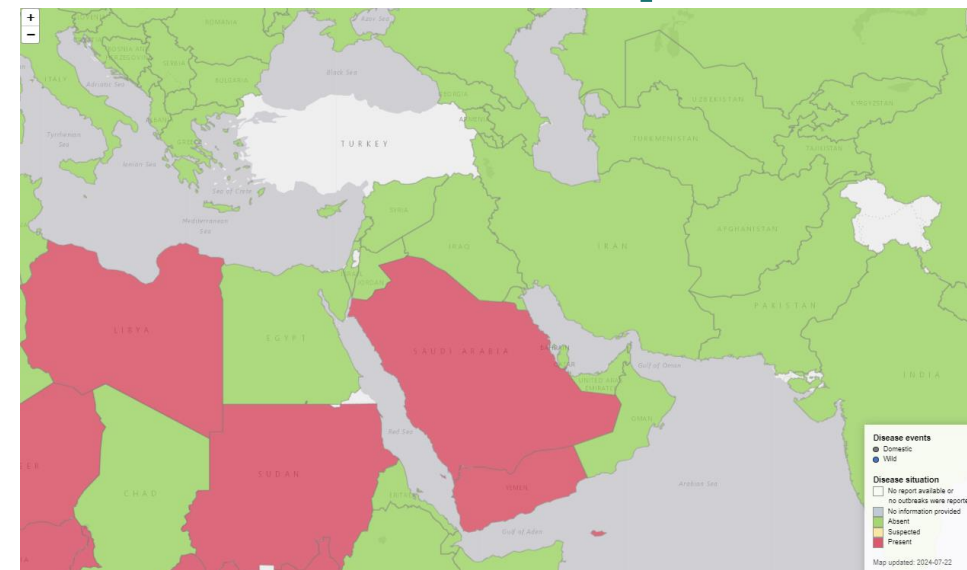
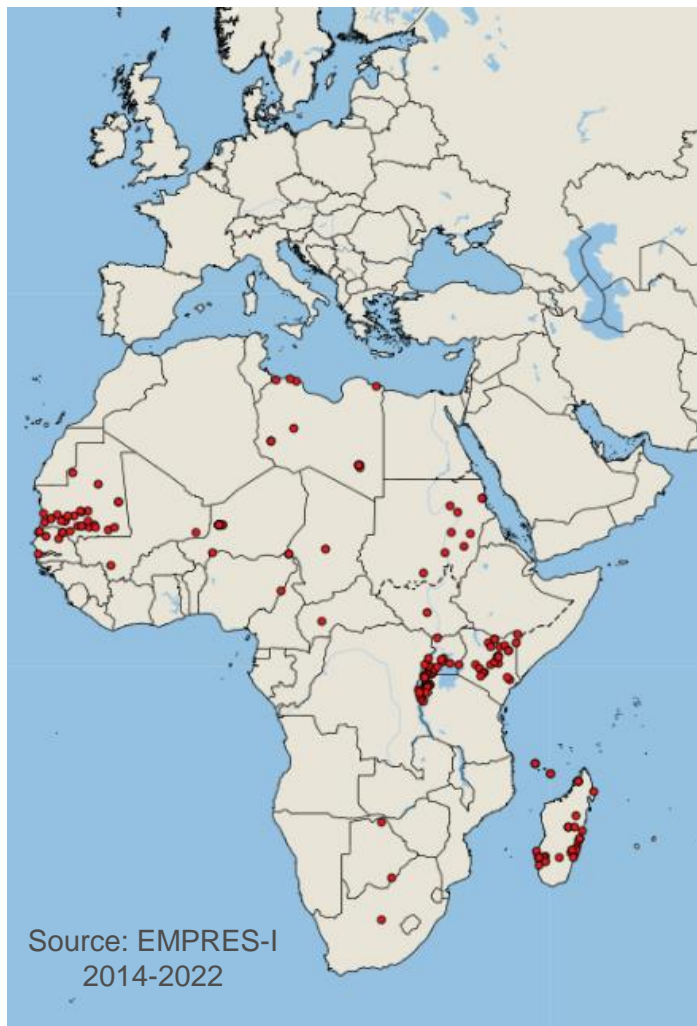






several veterinary vaccines  
have been licensed in  
endemic countries, there are  
currently no licensed RVF  
vaccines for human use

## RVF cases (animals / humans) 2014-2022



data source: WOA-H-WAHIS  
2005-2024

Disease reported as present in animals in:  
Yemen 2005-2006-2007  
KSA in 2007-2008-2010-2013-2014

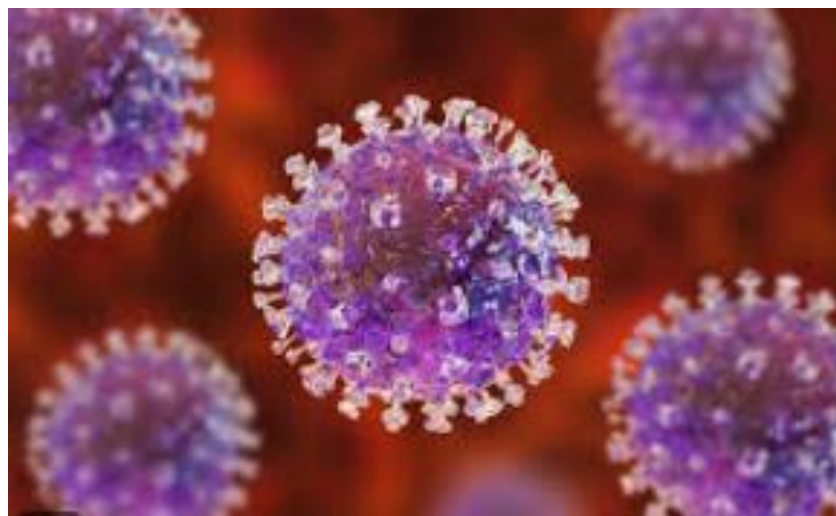


## Crimean-Congo haemorrhagic fever

- CCHF is a viral haemorrhagic fever usually **transmitted by ticks**. It can also be contracted through **contact with infected animal blood or tissues during and immediately after slaughter**.
- The principal reservoir and vector of CCHF are **ticks** of the **genus Hyalomma**, although other tick genera can be infected with CCHF virus

# Crimean-Congo haemorrhagic fever

- The virus circulates in a **tick–vertebrate–tick cycle**, but can also be transmitted **horizontally and vertically within the tick population**

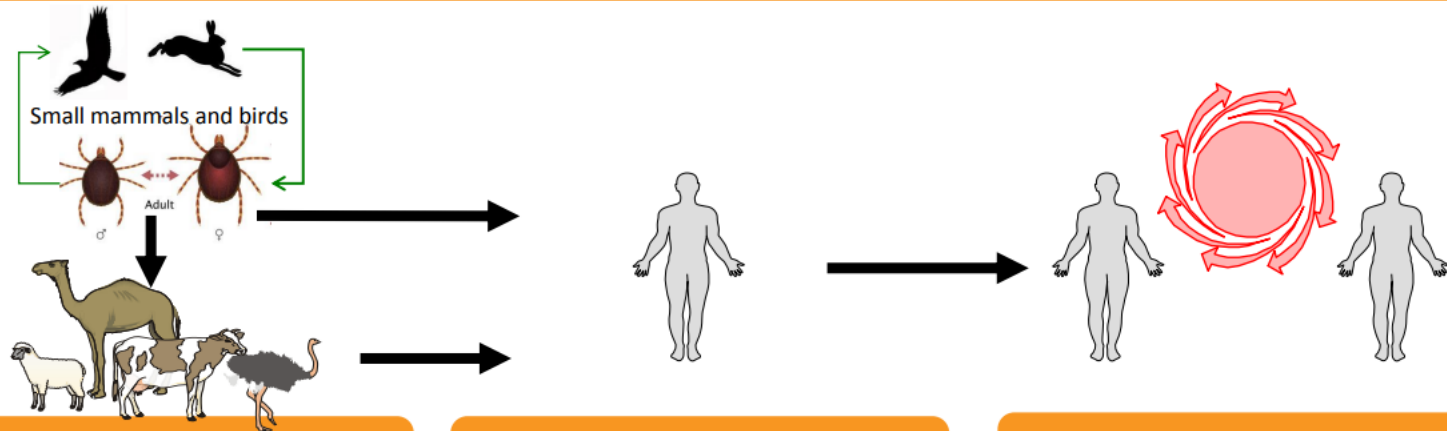


# Crimean-Congo haemorrhagic fever



World Health  
Organization

## Crimean-Congo Haemorrhagic Fever Transmission



### Reservoir *Hyalomma* ticks

- In nature, CCHF virus maintains itself in a cycle involving ticks and vertebrate.
- Most animals don't show symptoms.

### Primary human infections

- 80 to 90 % of humans are infected through:
- tick bite or direct contact with blood of infected ticks;
  - direct contact with blood/tissues of infected wild animals and livestock.

### Secondary human infections

- Secondary human-to-human transmission occurs through direct contact with the blood, secretions, organs or other body fluids of infected persons.
- High transmission risk when providing direct patient care or handling dead bodies (funerals).

## Crimean-Congo haemorrhagic fever

- **Viraemia in livestock is short-lived**, and of low intensity. These animals play a crucial role in the life cycle of ticks, and in the transmission and amplification of the virus.
- As **animals do not develop clinical signs**, CCHFV infections have no effect on the economic burden regarding livestock animal production



# Crimean-Congo haemorrhagic fever

- Ticks can be easily moved far from their original range thanks to their hosts.
- **Migratory birds** can carry ticks and related pathogens, promoting the spread along their routes

**Image source:**

Palomar AM, Portillo A, Santibáñez P, Mazuelas D, Arizaga J, Crespo A, Gutiérrez Ó, Cuadrado JF, Oteo JA. Crimean-Congo hemorrhagic fever virus in ticks from migratory birds, Morocco. *Emerg Infect Dis.* 2013 Feb;19(2):260-3. doi: 10.3201/eid1902.121193. PMID: 23347801; PMCID: PMC3559059.

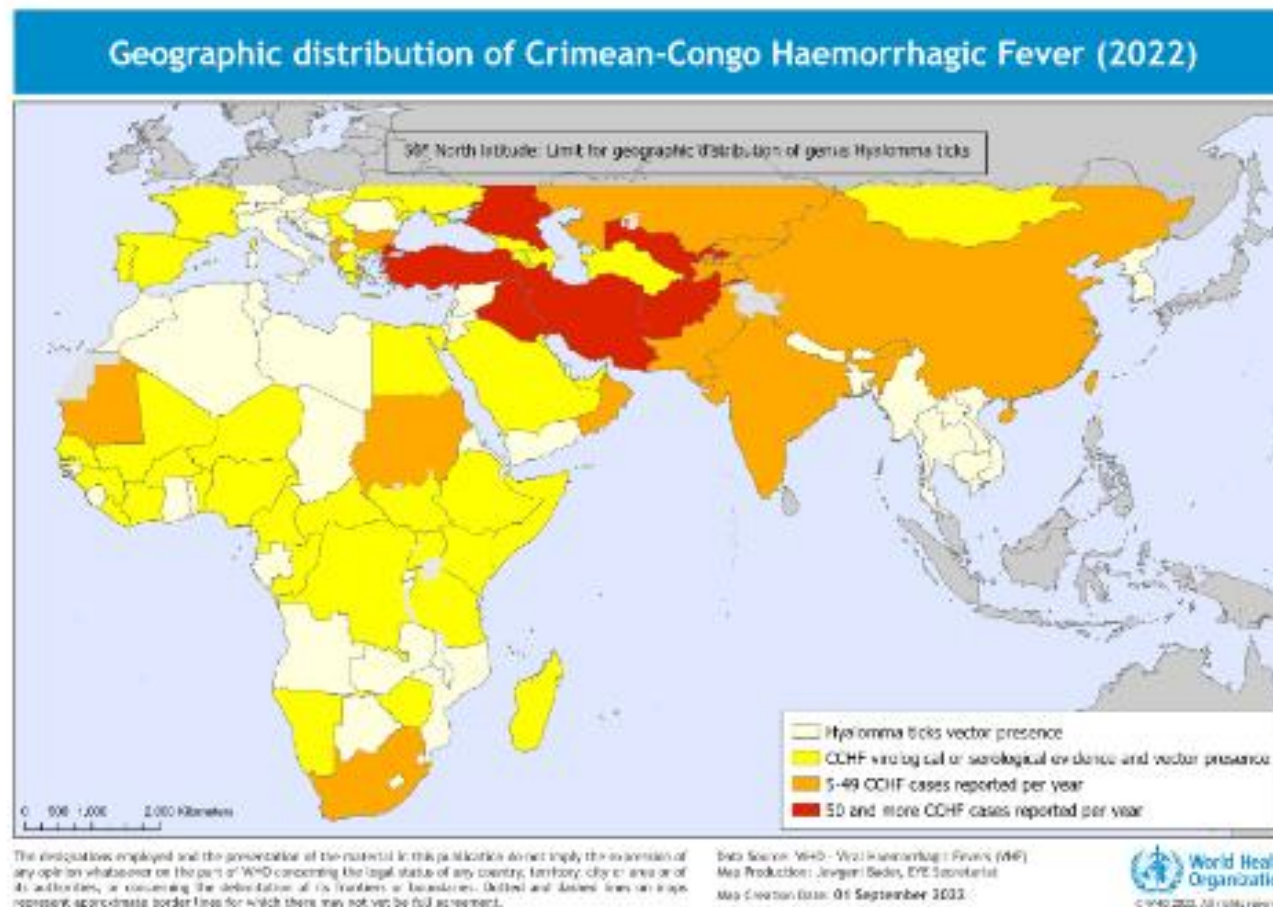


Figure 2. Bird species and tick specimens collected in Zouala, Morocco, April 2011. A) *Iduna opaca*, B) *Erythroptgia galactotes*, and C) *Phoenicurus phoenicurus* birds. D–G) *Hyalomma marginatum* tick specimens removed from...

[Expand](#)



# Crimean-Congo haemorrhagic fever







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World Organisation  
for Animal Health  
Founded as OIE

# Thank you for the attention!