Food and Agriculture Organization of the United Nations

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european commission for the control of foot-and-mouth disease

GLOBAL Monthly Report

Foot-and-Mouth Disease

Foot-and-Mouth Disease Situation | 2019 | December

Foot-and-Mouth Disease Situation
Food and Agriculture Organization of the United Nations
Monthly Report

December 2019

MAIN INFORMATION SOURCES USED:

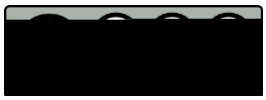
Databases:
OIE WAHIS World Animal Health Information Database
FAO World Reference Laboratory for FMD (WRLFMD)
FAO Global Animal Disease Information System (EMPRES-i)

Other sources:
FAO/EuFMD supported FMD networks
FAO/EuFMD projects and field officers

The sources for information are referenced by using superscripts.
The key to the superscripts is in references.

Please note that the use of information and boundaries of territories should not be considered to be the view of the U.N. Please, always refer to the OIE for official information on reported outbreaks and country status.

Required citation:
FAO/EuFMD. 2020. *Global Monthly Report. Foot-and-Mouth Disease Situation - December 2019*. Rome, FAO.



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I. HIGHLIGHTS

I am very pleased to be asked to write this short editorial for the GMR and take this opportunity to pass on my best wishes to everyone for the "New Year".
In December 2019, members of the OIE/FAO FMD Laboratory Network met in Busan, South Korea to collate data from recent FMD outbreaks in different parts of the world (see photo below: many thanks go to colleagues from APQA for kindly hosting this event).

We discussed and reviewed headline events for FMD that have occurred during 2019, including;

- Further expansion of the O/ME-SA/Ind-2001e lineage during 2019 into Pakistan. These new outbreaks raise concern as it is the first time that this lineage has been detected in a West Eurasian country that has the potential for onward spread into countries such as Iran and Turkey.
- Continued outbreaks of O/EA-3 (2018/19) in North Africa (Libya and Morocco) following on from cases due to A/AFRICA/G-IV during 2017. There are now two distinct viral lineages responsible for the cases detected in North West Africa (Maghreb) and North East Africa (Egypt). The shipment of these samples has been difficult and alternative methods have been used to characterise FMD viruses such as lineage specific rRT-PCR, and transfection methods for "live" virus recovery from RNA.
- Retrospective data submitted to GenBank (by scientists from Cameroon, Nigeria and USA) that confirms the presence of the SAT 1 lineage X in Cameroon in 2016.
- New incursion of SAT 2/VII lineage into Egypt – most closely related to sequences from Ethiopia.
- New outbreaks of O/EA-2 in central Zambia and the Comoros thathave been caused by two different lineages (15% nt difference). The Comoros lineage is most closely related to samples collected in Tanzania, while the Zambia outbreaks appear to represent a southern movement of the virus.

This report will be the last issue in this "monthly" format as looking forward into 2020 we have ambitious plans to relaunch these regular global updates into a quarterly format together with the data generated from WRLFMD (see: https://www.wrlfmd.org/ref-lab-reports). I have been involved as an *ad hoc* editor in the GMR since 2013 and I thank colleagues at EuFMD (particularly Drs Maria Teresa Scicluna and Melissa Mclaws) for all of their hard work behind the scenes to prepare and collate the information. I recognise the importance of tools to communicate and exchange information about the latest FMD outbreaks and on-going viral dynamics in the endemic pools. In this context, please feel free to provide feedback to colleagues at EuFMD regarding the GMR as well as any suggestions for the content of the future reports

Don King
Pirbright, 24th January 2020

II. GENERAL OVERVIEW

Pools represent independently circulating and evolving foot-and-mouth disease virus (FMDV) *genotypes; within the pools, cycles of emergence and spread occur that usually affect multiple countries in the region. In the absence of specific reports, it should be assumed that the serotypes indicated below are continuously circulating in parts of the pool area and would be detected if sufficient surveillance was in place (Table 1).*

Table 1: List of countries representing each virus pool for the period 2014 – 2018 (source EuFMD)

POOL	REGION/COUNTRIES	SEROTYPES
1	**SOUTHEAST ASIA/CENTRAL ASIA/EAST ASIA** Cambodia, China, China (Hong Kong, SAR), Taiwan Province of China, Democratic People's Republic of Korea, Republic of Korea, Lao People's Democratic Republic, Malaysia, Mongolia, Myanmar, Russian Federation, Thailand, Viet Nam	**A, Asia 1 and O**
2	**SOUTH ASIA** Bangladesh, Bhutan, India, Mauritius, Nepal, Sri Lanka	**A, Asia 1 and O**
3	**WEST EURASIA & MIDDLE EAST** Afghanistan, Armenia, Azerbaijan, Bahrain, Georgia, Iran (Islamic Republic of), Iraq, Israel, Jordan, Kazakhstan, Kuwait, Kyrgyzstan, Lebanon, Oman, Pakistan, Palestine, Qatar, Saudi Arabia, Syrian Arab Republic, Tajikistan, Turkey, Turkmenistan, United Arab Emirates, Uzbekistan	**A, Asia 1 and O (SAT 2)***
	NORTH AFRICA Algeria, Egypt, Libya, Morocco, Tunisia	**A, O and SAT 2**
4	**EASTERN AFRICA** Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Rwanda, Somalia, Sudan, South Sudan, United Republic of Tanzania, Uganda, Yemen	**O, A, SAT 1, SAT 2 and SAT 3**
5	**WEST/CENTRAL AFRICA** Benin, Burkina Faso, Cameroon, Cabo Verde, Central Afr. Rep., Chad, Democratic Republic of Congo, Congo, Côte d'Ivoire, Equatorial Guinea, Gabon, Gambia, Ghana, Guinea-Bissau, Guinea, Liberia, Mali, Mauritania, Niger, Nigeria, Sao Tome & Principe, Senegal, Sierra Leone, Togo	**O, A, SAT 1 and SAT 2**
6	**SOUTHERN AFRICA** Angola*, Botswana, Malawi, Mozambique, Namibia, South Africa, Zambia*, Zimbabwe	**{O, A}**, SAT 1, SAT 2 and SAT 3**
7	**SOUTH AMERICA** Colombia, Venezuela (Bolivarian Republic of)	**O and A**

*REPORTED ONLY IN OMAN IN 2017

** ONLY IN ANGOLA AND NORTH ZAMBIA AS SPILL-OVER FROM POOL 4

III. IN THIS REPORT

POOL 1- SOUTHEAST ASIA/CENTRAL ASIA/EAST ASIA

China [1] – A FMD outbreak due to serotype O was notified in cattle on December 30th 2019 in Xinjiang.

Myanmar [1] –FMD outbreaks due to serotype A and O were reported in cattle in different areas of the country during November and December 2019.

POOL 2 - SOUTH ASIA

India [2] – The ICAR-Directorate of Foot and Mouth Disease, Mukteswar, India reported the presence of FMDV serotype O in the analyzed cattle samples.

POOL 3 - WEST EURASIA & MIDDLE EAST

Pakistan [3] – FMDV O was detected in the 80 outbreaks notified in three different provinces of the country.

POOL 3 – NORTH AFRICA

No outbreaks were reported in the countries of this area for the reporting month.

POOL 4 - EASTERN AFRICA

Eritrea [4] – FMD serotypes A, O and SAT 2 were detected by the WRLFMD in bovine, ovine and the swine samples collected in the country between 2015 and 2019.

Ethiopia [5] - FMDV serotypes A and O were detected by the National Animal Health Diagnostic and Investigation Center (NAHDIC) Ethiopia during December 2019 in tissues, swabs and the probangs collected from clinically affected cattle.

Kenya [6] – FMDV serotypes O and SAT 1 were detected among the twelve cattle samples examined in December 2019 by the FMD National Reference Laboratory (NRL), Embakasi, Kenya.

POOL 5 - WEST/CENTRAL AFRICA

No outbreaks were reported in the countries of this Pool for the reporting month.

POOL 6 - SOUTHERN AFRICA

Namibia [1] – FMDV serotype SAT 3 was responsible for the outbreaks that occurred in December 2019 in cattle of the Zambezi region.

South Africa [1] – Five new outbreaks due to FMDV serotype SAT 2 were reported during November and December 2019.

POOL 7 - SOUTH AMERICA [1, 7]

No outbreaks are reported for this Pool. FMD in Latin America was last detected in Colombia in October 2018 with outbreaks due to FMDV serotype O, while PANAFTOSA reported historical outbreaks due to serotype A in Venezuela in 2013.

COUNTER

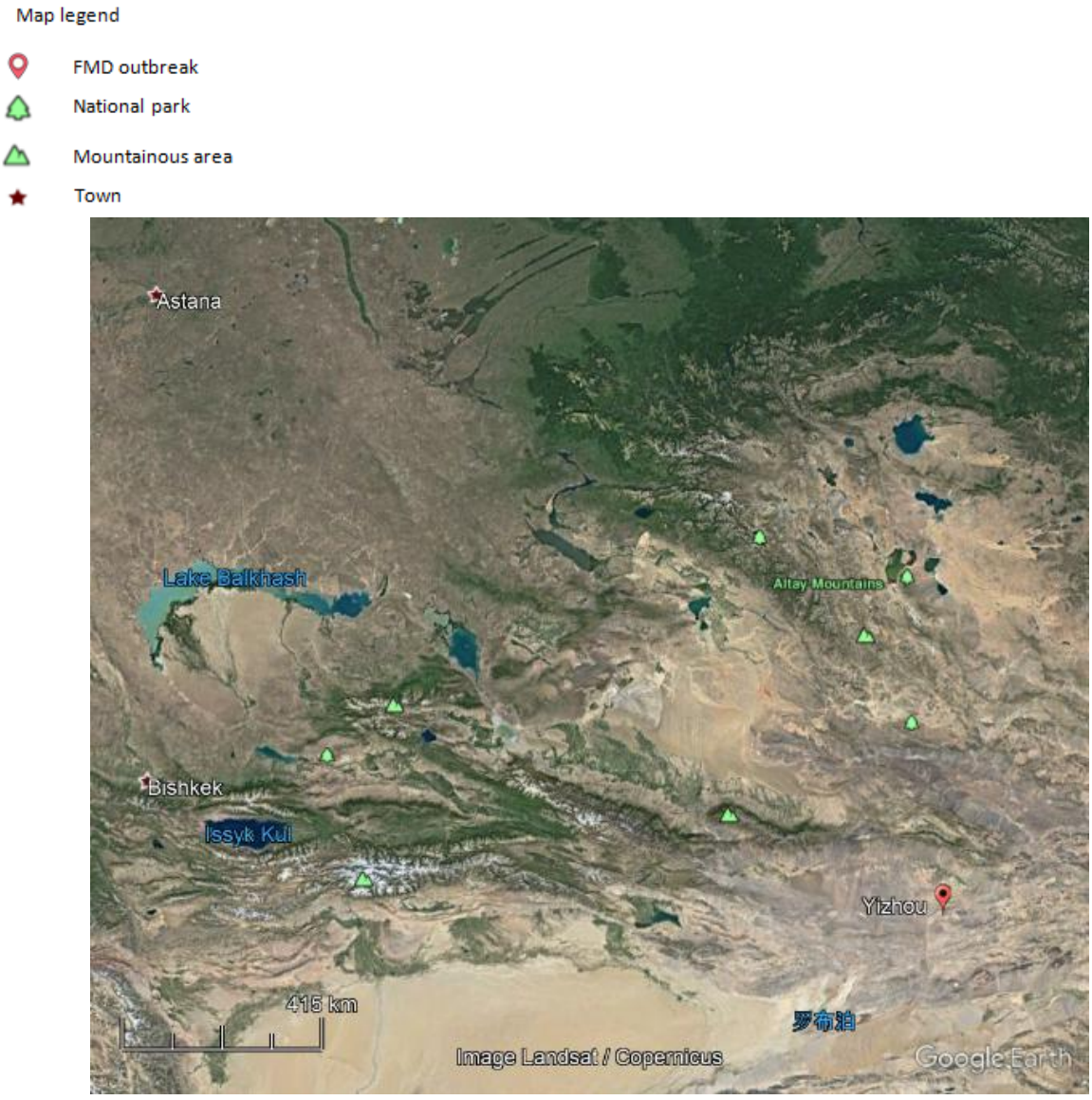
****** 185 MONTHS SINCE THE LAST SEROTYPE C OUTBREAK WAS REPORTED***

IV. DETAILED POOL ANALYSIS

A. POOL 1 – SOUTHEAST ASIA/CENTRAL ASIA/EAST ASIA

OUTBREAKS	
Country	*Description*
FMDV serotype O in China[1]	FMDV outbreaks due to serotype O continue to occur in the country since August 2018 with the last event reported on December 30th 2019 at the Yandun Animal Health Inspection and disinfection station along Highway G30, Yizhou District, Hami, Xinjiang (Map 1). The diagnosis was confirmed by the Lanzhou National Reference Laboratory for Foot and Mouth Disease (OIE Reference Laboratory) using real-time reverse transcriptase/polymerase chain reaction (RRT-PCR) and gene sequencing. The reported source of the outbreak is the legal movement of animals and the apparent morbidity rate registered in the 64 exposed cattle was 3.13% while no mortality was recorded. The animals were killed and disposed of together with the official destruction of animal products, by products and waste and the application of other control measures including zoning and surveillance within the containment and protection zone. Vaccination is not allowed.

Map 1: location of the FMD outbreak due to FMDV serotype O notified in cattle on December 30th 2019 at the Yandun Animal Health Inspection and disinfection station along Highway G30, Yizhou District, Hami, Xinjiang.
Source: WAHIS and Google Earth Pro.



FMDV serotypes A and O in Mynmar[1]	All the five outbreaks due to FMDV serotype A occurred in cattle of different areas of Yangon (Map 2) between November 15th and December 2nd 2019. The origin of the outbreaks was attributed to illegal movement of animals, contact with infected animals and fomites. The apparent morbidity rate registered in the 53 exposed cattle was 28.3%, with no lethal cases. The control measures set up are zoning, traceability and surveillance outside the containment and/or protection zone.
	Another five outbreaks occurred in the country between November 11th and 26th 2019, due to FMDV serotype O in Mon State and Mandalay Region (Map 2) registering an apparent morbidity rate of 25% in the 184 exposed cattle with no lethal cases. The source of the outbreaks was similar to those described for the events due to serotype A as were also the control measures adopted.

Map 2: location of the FMD outbreaks due to serotypes A and O that occurred in cattle of different areas of Myanmar between November 11th and December 2nd 2019.
Source: WAHIS and Google Earth Pro.

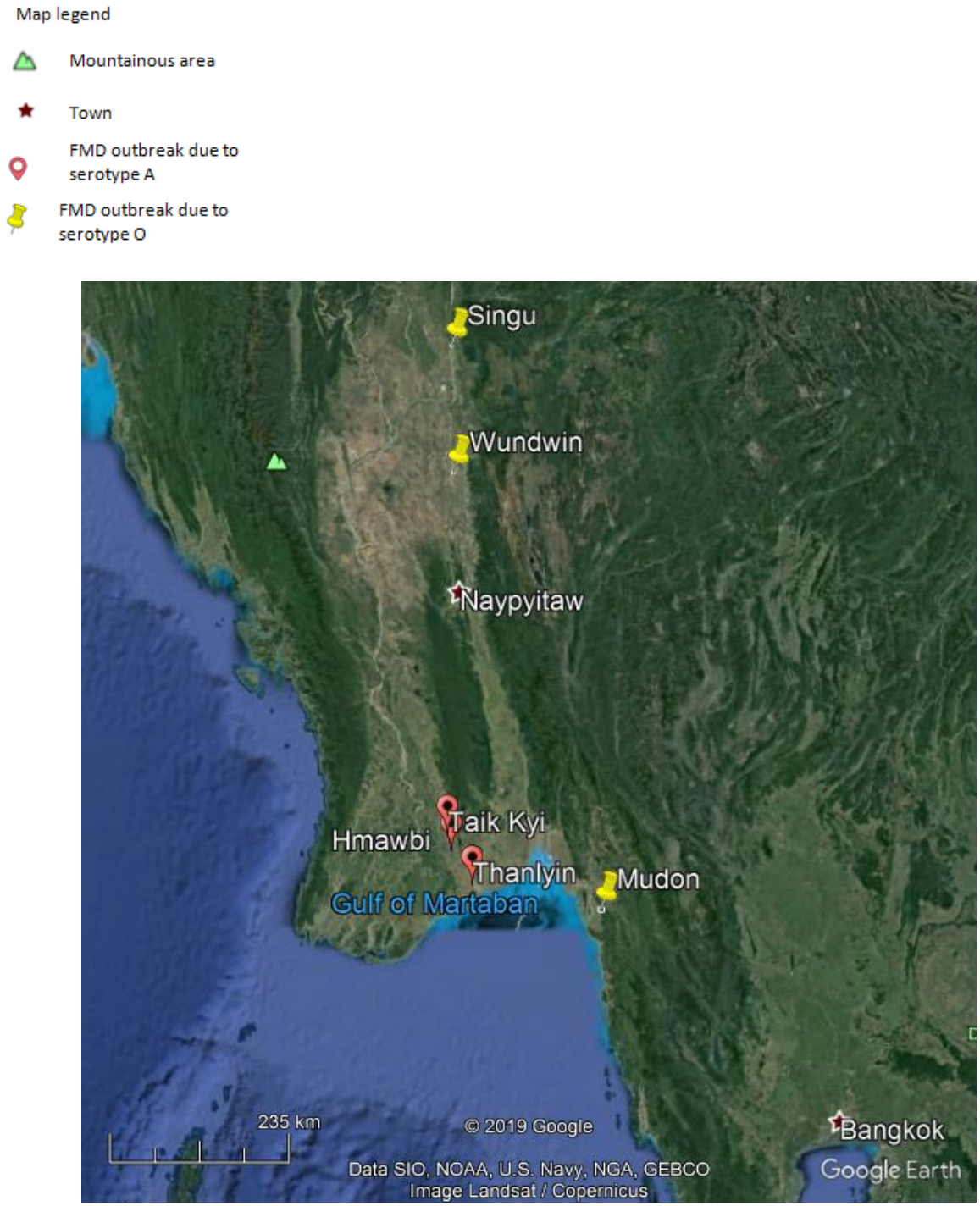
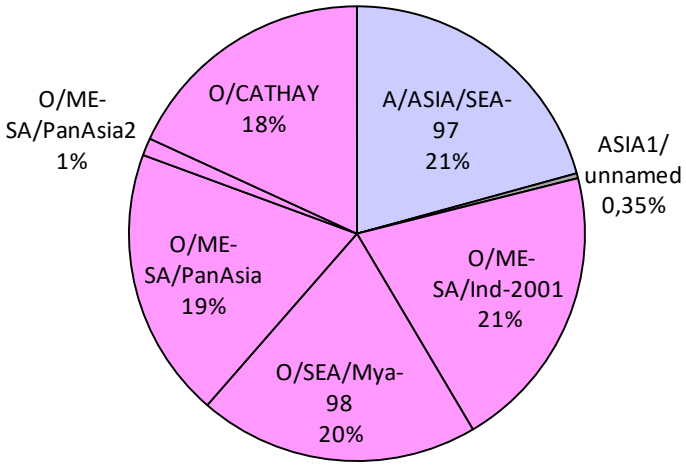
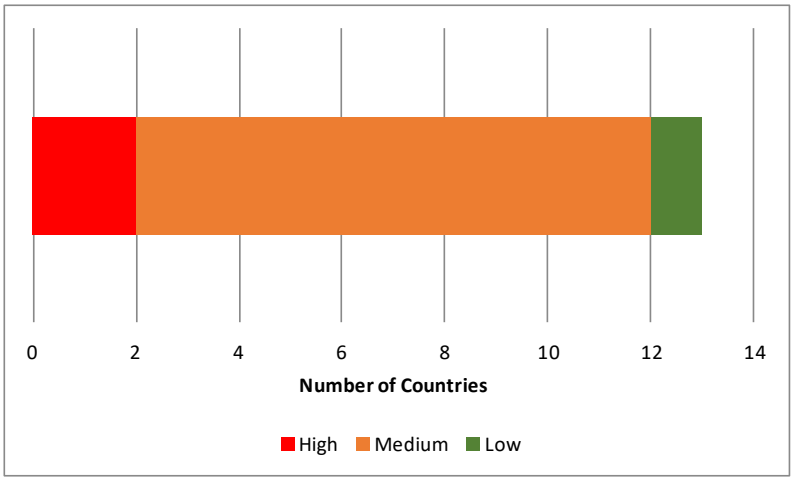


Table 1 and Graph 1: Conjectured circulating FMD viral lineages in Pool 1 (further detail (country-level) in Annex).

Serotype	Viral lineage	Number of countries where strain is believed to circulate in the 13 countries of Pool 1
A	A/ASIA/SEA-97	8
ASIA 1	ASIA1/ unnamed	1
O	O/ME-SA/Ind-2001	8
	O/SEA/Mya-98	6
	O/ME-SA/PanAsia	8
	O/ME-SA/PanAsia2	1
	O/CATHAY	4



Graph 2: Categorization of the level of uncertainty relative to the prevalence of circulating serotypes/strains defined for each country of Pool 1 (see Annex for explanation).



B. POOL 2 – South Asia

SURVEILLANCE (Surv.), VACCINATION (Vacc.) AND POST VACCINATION MONITORING (PVM)		
Country	***Activity***	***Description***
India [2]	***Surv. and PVM***	During December 2019, FMDV serotype O was detected in two cattle samples collected in the state of Karnataka (Map 3). The ICAR-Directorate of Foot and Mouth Disease, Mukteswar, India also examined 2 490 samples for NSP antibodies that were collected within the FMD National Serosurveillance Programme and 18 670 serum samples to assess the antibody level within the FMD control programme.

Map 3: location of where the FMDV serotype O positive samples were collected in India.
Source: ICAR-Directorate of Foot and Mouth Disease, Mukteswar, India and Google Earth Pro.

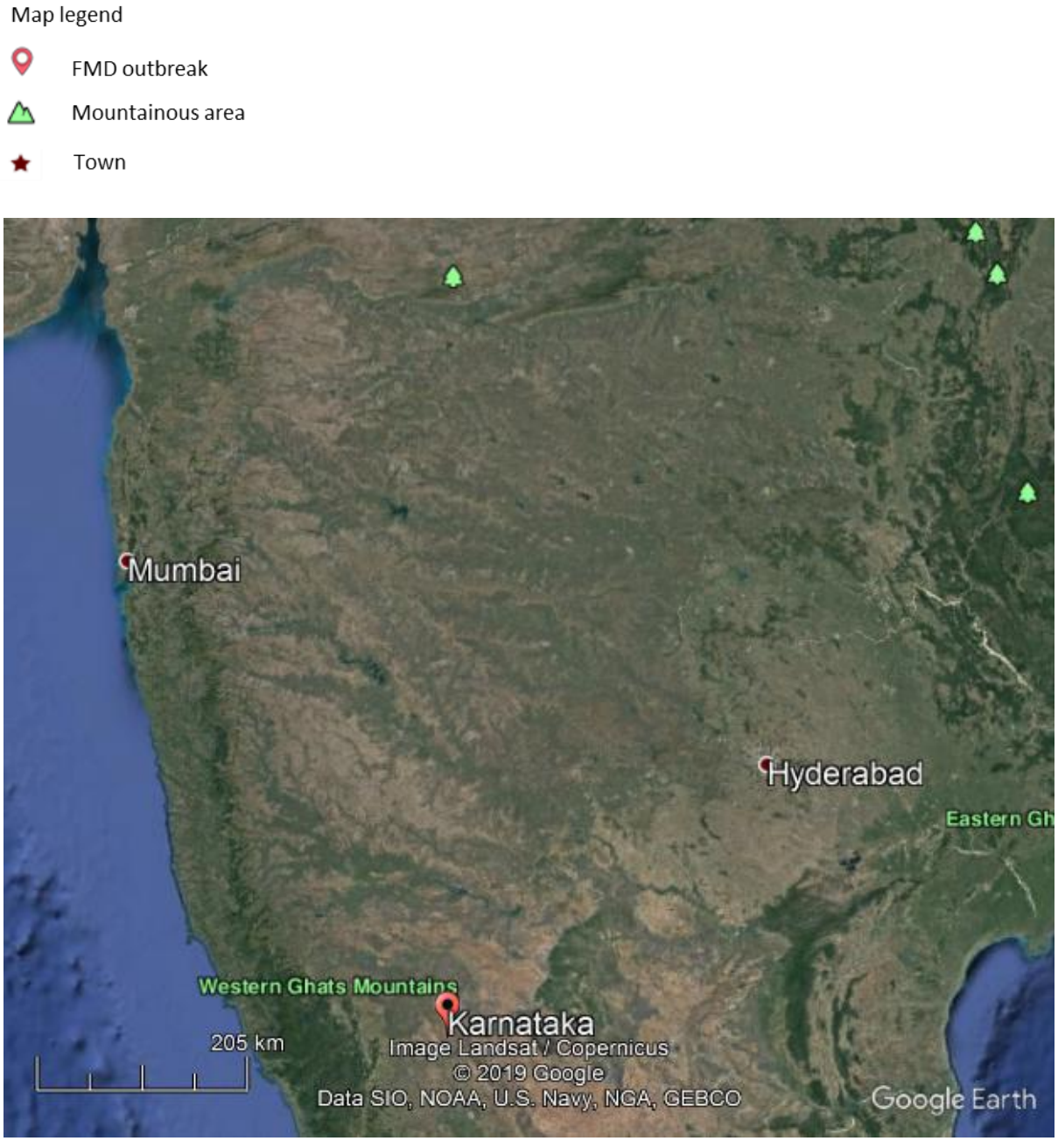
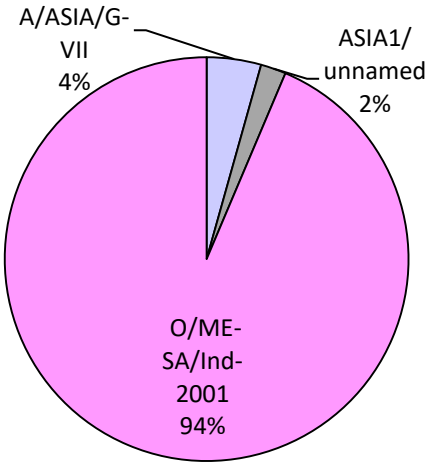
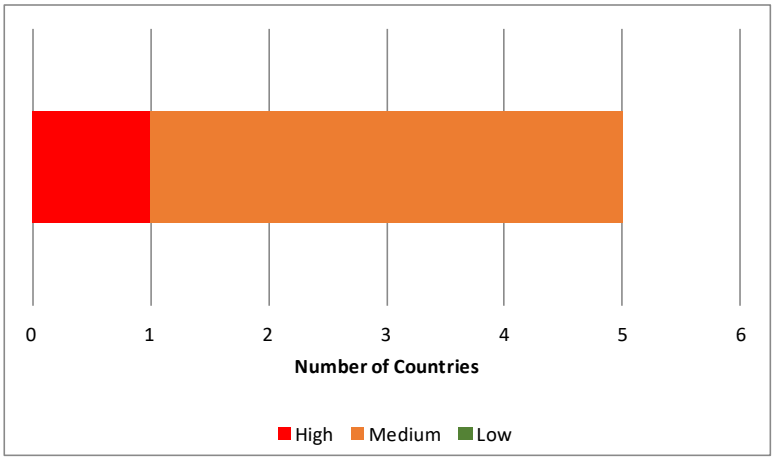


Table 2 and Graph 3: Conjectured circulating FMD viral lineages in Pool 2 (further detail (country-level) in Annex).

Serotype	Viral lineage	Number of countries where strain is believed to circulate in the 5 countries of Pool 2
A	A/ASIA/G-VII	3
Asia 1	ASIA1/ unnamed	1
O	O/ME-SA/Ind-2001	5



Graph 4: Categorization of the level of uncertainty relative to the prevalence of circulating serotypes/strains defined for each country of Pool 2 (see Annex for explanation).



C. POOL 3 – West Eurasia & Middle East

SURVEILLANCE (Surv.), VACCINATION (Vacc.) AND POST VACCINATION MONITORING (PVM)		
Country	***Activity***	***Description***
Pakistan [3]	***Surv. & Vacc.***	FMDV serotype O was detected among the 80 outbreaks notified during December 2019 in three different provinces of the country. The districts in which the outbreaks were reported are represented in Map 4. A summary of the results of the surveillance conducted under the project "The enhancement of FMD control in Pakistan" funded by the Government of Japan and executed by FAO is reported in Table 3 and location of outbreaks is reported in Map 4. Emergency and preventive vaccinations were also carried out in some provinces of the country and a summary of this activity is reported in Table 4 and 5.

Table 3: summary of the outbreaks reported in different provinces of Pakistan during December 2019.
Source –"The enhancement of FMD control in Pakistan" - *Dr. Muhammad Afzal*, Project Coordinator.

Province	District	Number Outbreaks	Number of Outbreaks due to FMD Virus Serotype(s)					
			'O'	'A'	'Asia-1'	'Mixed'	Not Yet Typed	Negative
Punjab	DG Khan	2	1	-	-	1	-	-
	Faisalabad	1	-	-	-	-	1	-
	Jhang	1	-	-	-	-	1	-
	Chiniot	1	-	-	-	-	1	-
	Lodhran	3	1	-	-	-	2	-
	Multan	4	2	-	-	-	-	2
	Khanewal	2	-	-	-	-	-	2
	Sargodha	4	-	-	-	-	4	-
	Jehlum	1	-	-	-	-	-	1
	Attock	3	3	-	-	-	-	-
Sindh	Karachi	38	-	-	-	-	38	-
	Sukkur	13	-	-	-	-	13	-
	Larkana	5	-	-	-	-	5	-
Khyber Pakhtunkhwa	Haripur	2	-	-	-	-	-	2
Total		**80**	**7**	**-**	**-**	**1**	**65**	**7**

Table 4: summary of the emergency vaccination carried out in Pakistan during December 2019.
Source: "The enhancement of FMD control in Pakistan" - *Dr. Muhammad Afzal*, Project Coordinator.

Province	Vaccination (Doses)	Number of Households
Punjab	300	5
Sindh	3 850	39
KP	711	78
Total	**4 861**	**122**

Table 5: summary of the preventive vaccination carried out in Pakistan during December 2019 (Source – "The enhancement of FMD control in Pakistan" - *Dr. Muhammad Afzal*, Project Coordinator).

District	No. of Households	Animals Vaccinated (6 Monthly Dose)		
		Cattles	Buffaloes	Total
Bahawalpur	105 389	884 790	307 910	1 192 730
Rahim Yar Khan	127 528	539 245	451 014	990 259
Bahawalnagar	108 768	638 856	474 689	1 113 545
Cholistan	18 575	419 885	14 715	434 600
Punjab	360 260	2 482 776	1 248 328	3 731 134
Total	**720 520**	**4 965 552**	**2 496 656**	**7 462 268**

Map 4: location of the areas of the FMD outbreaks that were notified in Pakistan during November 2019.
Source: "The enhancement of FMD control in Pakistan" - *Dr. Muhammad Afzal*, Project Coordinator, Google Earth Pro.

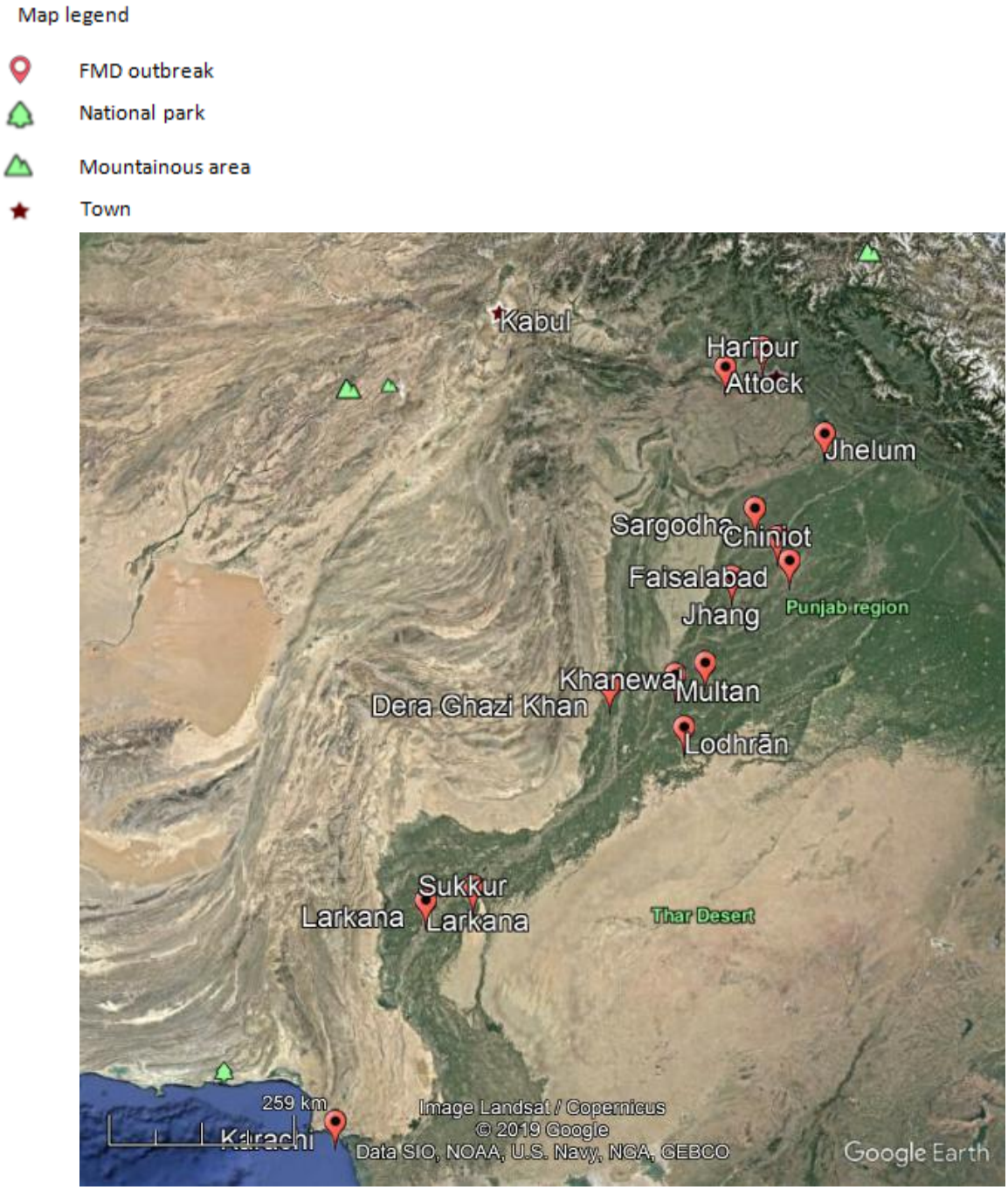
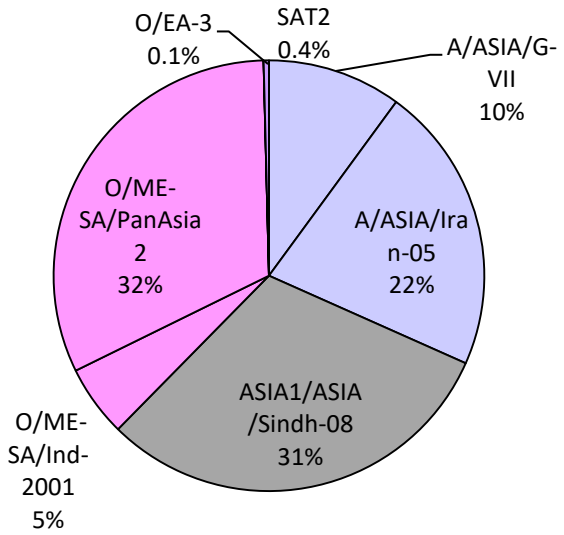
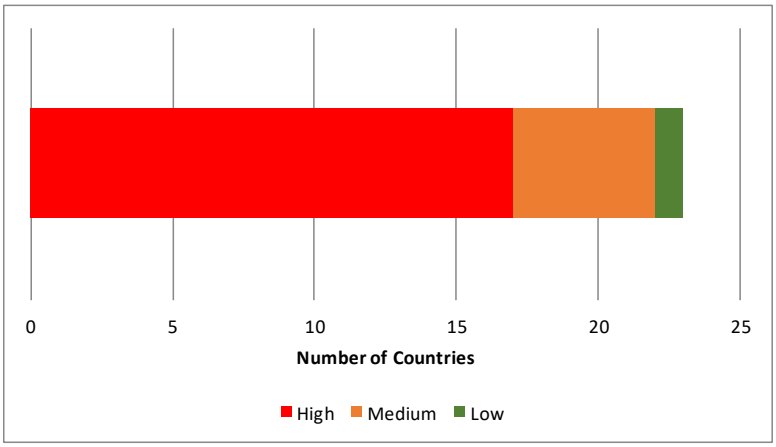


Table 6 and Graph 5: Conjectured circulating FMD viral lineages in Pool 3 - West Eurasia & Middle East (further detail (country-level) in Annex).

Serotype	Viral lineage	Number of countries where strain is believed to circulate in the 24 countries of Pool 3 - West Eurasia
A	A/ASIA/G-VII	17
	A/ASIA/Iran-05	9
ASIA 1	ASIA1/ASIA/Sindh-08	9
O	O/ME-SA/Ind-2001	8
	O/ME-SA/PanAsia2	22
	O/EA-3	2
SAT2	SAT2	1



Graph 6: Categorization of the level of uncertainty relative to the prevalence of circulating serotypes/strains defined for each country of Pool 3 – West Eurasia & Middle East (see Annex for explanation).

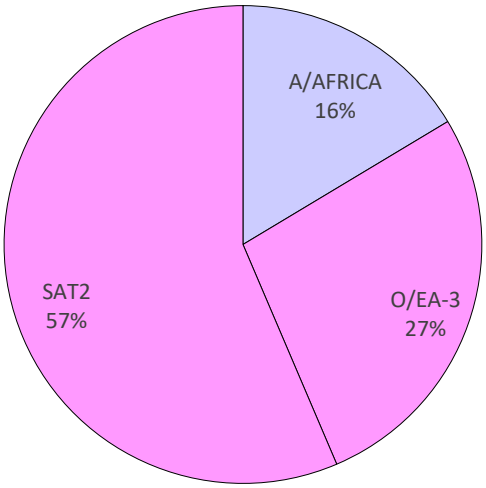


D. POOL 3 – North Africa

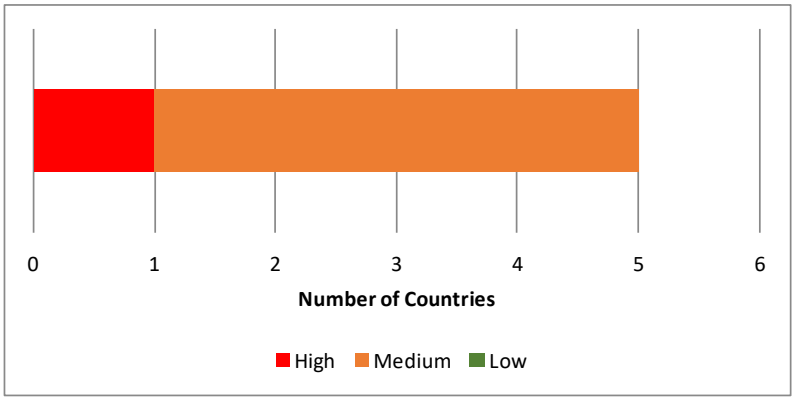
No outbreaks were reported in the countries of this area for the reporting month.

Table 7 and Graph 7: Conjectured circulating FMD viral lineages in Pool 3 - North Africa (further detail (country-level) in Annex).

Serotype	Viral lineage	Number of countries where strain is believed to circulate in the 5 countries of Pool 3 - North Africa
A	A/AFRICA	4
O	O/EA-3	5
SAT 2	SAT 2	2



Graph 8: Categorization of the level of uncertainty relative to the prevalence of circulating serotypes/strains defined for each country of Pool 3 – North Africa (see Annex for explanation).

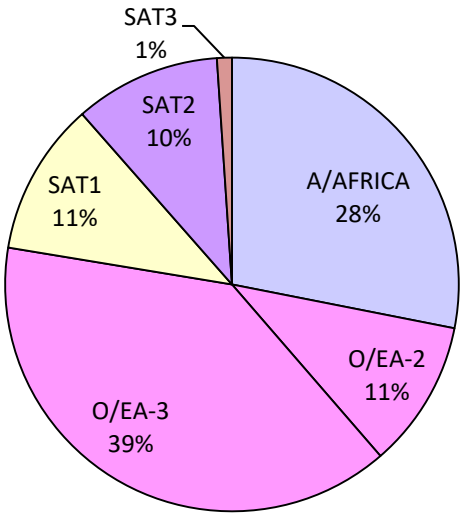


E. POOL 4 – Eastern Africa

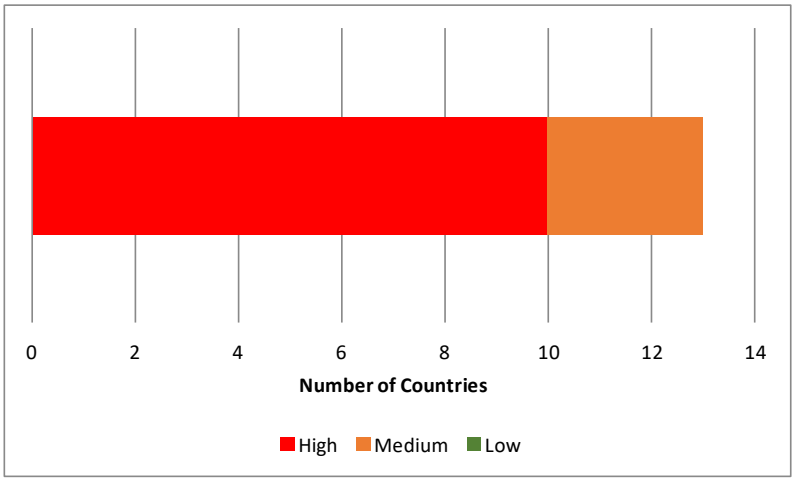
SURVEILLANCE (Surv.), VACCINATION (Vacc.) AND POST VACCINATION MONITORING (PVM)		
Country	*Activity*	*Description*
Eritrea [4]	**Surv.**	The FMDV serotypes detected among the 47 samples (42 bovine, 1 ovine and 4 swine) collected in the country between 2015 and 2019 were A (3.1%), O (18.8%)and SAT 2 (78.1%).
Ethiopia [5]	**Surv,**	The NAHDIC detected FMDV serotypes A and O using antigen detection ELISA in 15 cattle samples (tissue samples, swabs and probangs) collected during December 2019 from cattle with clinical signs of the Oromia Regional State.
Kenya [6]	**Surv.**	The FMD NRL, Embakasi, Kenya reported for December 2019 the detection of FMDV serotypes O in one sample and SAT 1 in eight samples of the 12 bovine samples analyzed.

Table 8 and Graph 9: Conjectured circulating FMD viral lineages in Pool 4 (further detail (country-level) in Annex).

Serotype	Viral lineage	Number of countries where strain is believed to circulate in the 13 countries of Pool 4 - East Africa
A	A/AFRICA	11
O	O-EA2	4
	O EA-3	9
SAT1	SAT1	10
SAT2	SAT2	6
SAT3	SAT3	4



Graph 10: Categorization of the level of uncertainty relative to the prevalence of circulating serotypes/strains defined for each country of Pool 4 (see Annex for explanation).

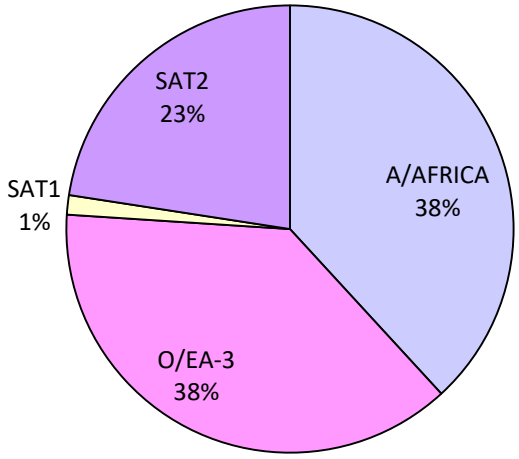


F. POOL 5 – West / Central Africa

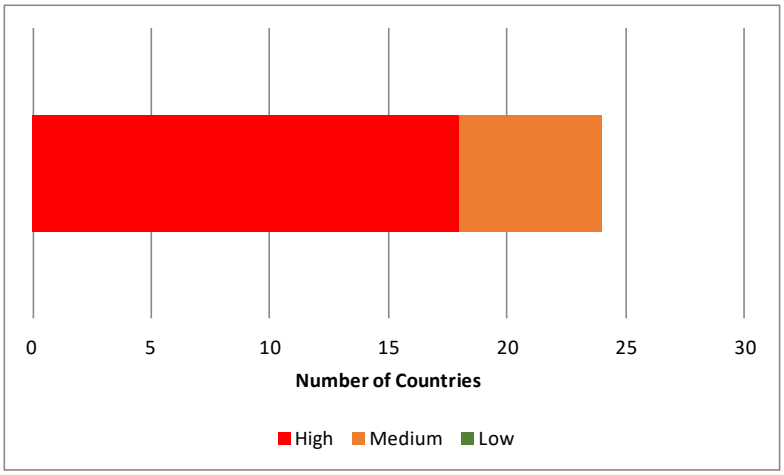
No outbreaks were reported in the countries of this Pool for the reporting month.

Table 9 and Graph 11: Conjectured circulating FMD viral lineages in Pool 5 (further detail (country-level) in Annex).

Serotype	Viral lineage	Number of countries where strain is believed to circulate in the 24 countries of Pool 5 -West Africa
A	A/AFRICA	13
O	O/EA-3	22
SAT1	SAT1	3
SAT2	SAT2	14



Graph 12: Categorization of the level of uncertainty relative to the prevalence of circulating serotypes/strains defined for each country of Pool 5 (see Annex for explanation).



G. POOL 6 – Southern Africa

OUTBREAKS	
Country	*Description*
FMDV serotype SAT 3 in Namibia [1]	The two outbreaks caused by FMDV serotype SAT 3 reported at Silubaba and Mulilo, Zambezi, on December 13th 2019 were due to contact of domestic cattle with wild species resulting in an apparent morbidity rate of 3.3% in the 303 exposed cattle. No mortality was registered and general control measures were set up including movement control and surveillance within the containment and/or protection zone.
FMDV serotype SAT 2 in South Africa [1]	Five new FMD outbreaks due to FMDV serotype SAT 2 were reported on cattle farms during November and December 2019, in three administrative units of the country (Map 5). The outbreaks are occurring in South Africa's suspended FMD free zone with an apparent morbidity of 2.1% in the 2 908 exposed cattle. The origin of the outbreaks is unknown and general control measures are being applied including slaughter with vaccination prohibited.

Map 5: location of outbreaks due to FMDV serotype SAT 2 which are occurring during November and December 2019 in cattle of three administrative units of the country
Source: WAHIS - Google Earth Pro.

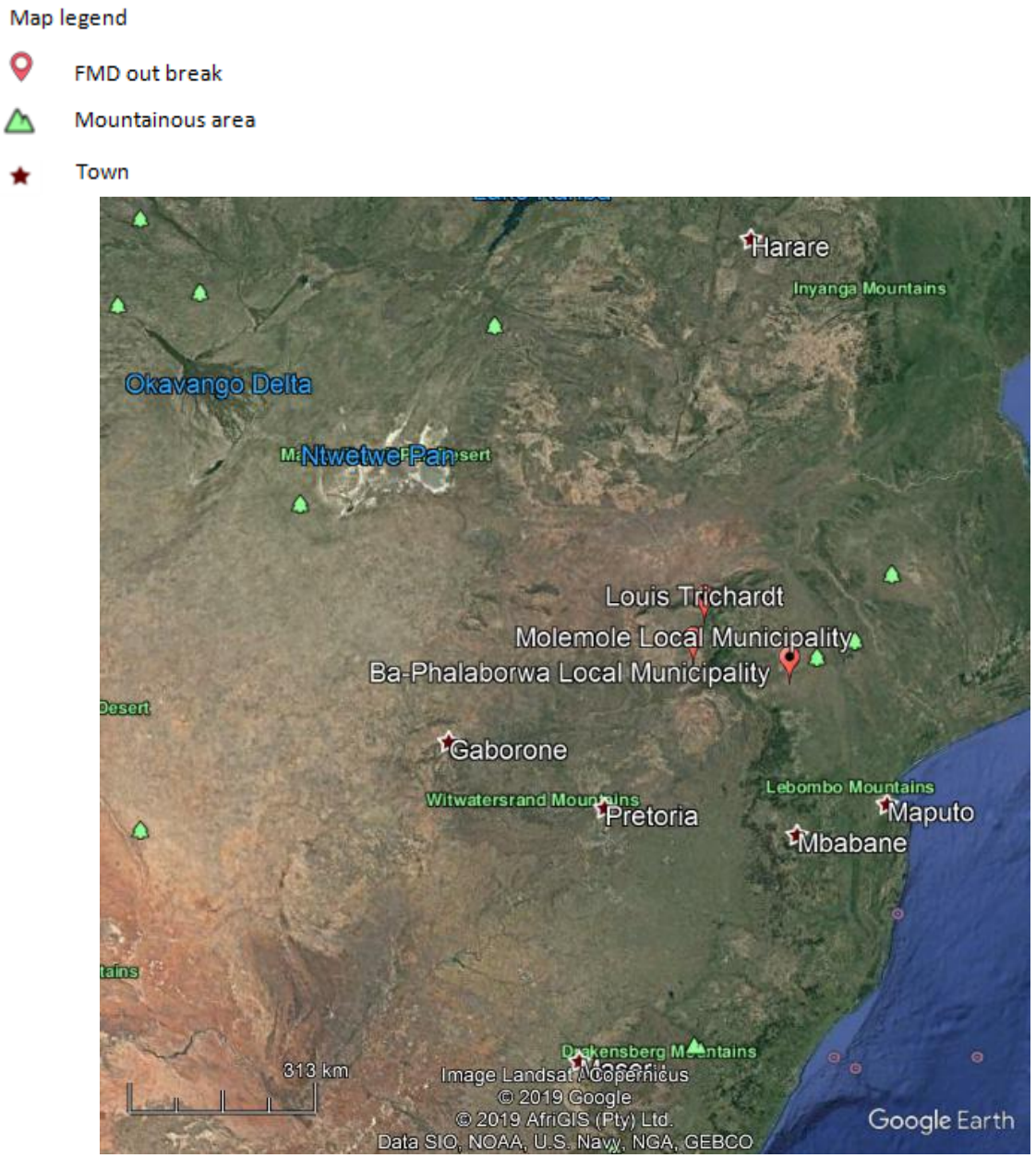
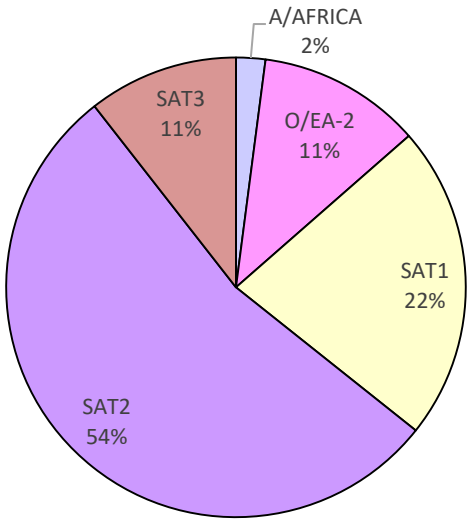
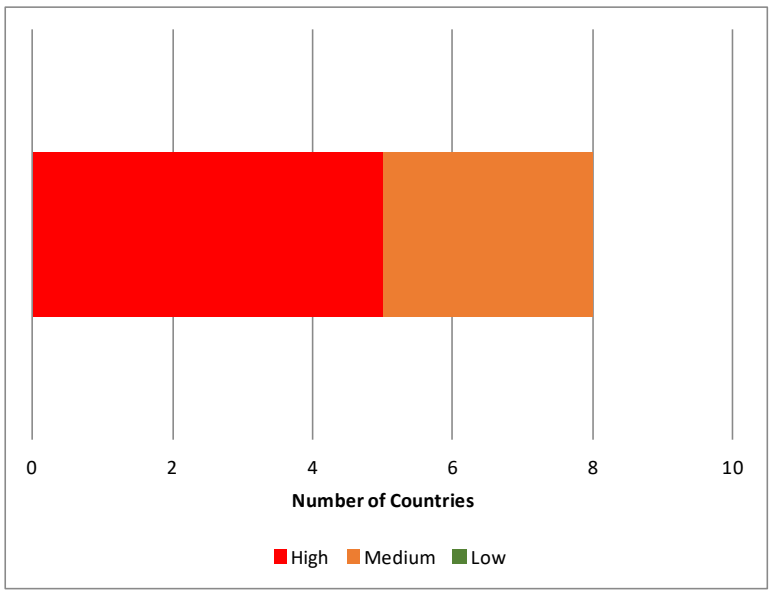


Table 10 and Graph 13: Conjectured circulating FMD viral lineages in Pool 6 (further detail (country-level) in Annex).

Serotype	Viral lineage	Number of countries where strain is believed to circulate in the 8 countries of Pool 6 - Southern Africa
A	A/AFRICA	2
O	O-EA-2	2
SAT1	SAT1	6
SAT2	SAT2	8
SAT3	SAT3	4



Graph 14: Categorization of the level of uncertainty relative to the prevalence of circulating serotypes/strains defined for each country of Pool 6 (see Annex for explanation).

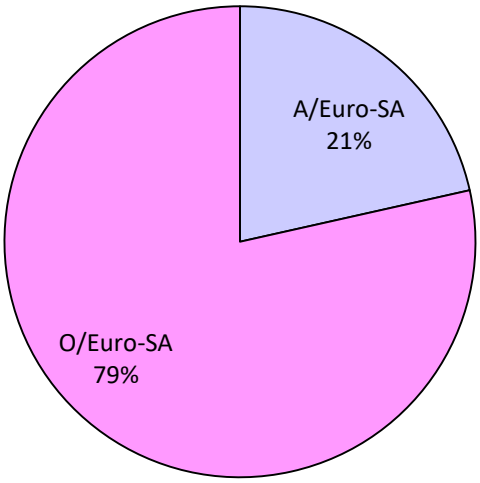


H. POOL 7 – South America

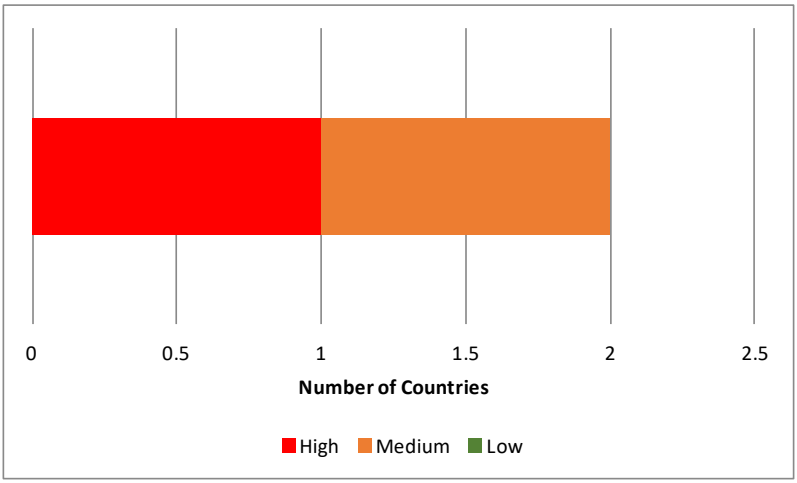
No outbreaks are reported for this Pool during the reporting month.

Table 11 and Graph 15: Conjectured circulating FMD viral lineages in Pool 7 (further detail (country-level) in Annex).

Serotype	Viral lineage	Number of countries where strain is believed to circulate in the 2 countries of Pool 7 -South America
A	A/Euro SA	1
O	O/Euro SA	2



Graph 16: Categorization of the level of uncertainty relative to the prevalence of circulating serotypes/strains defined for each country of Pool 7 (see Annex for explanation).



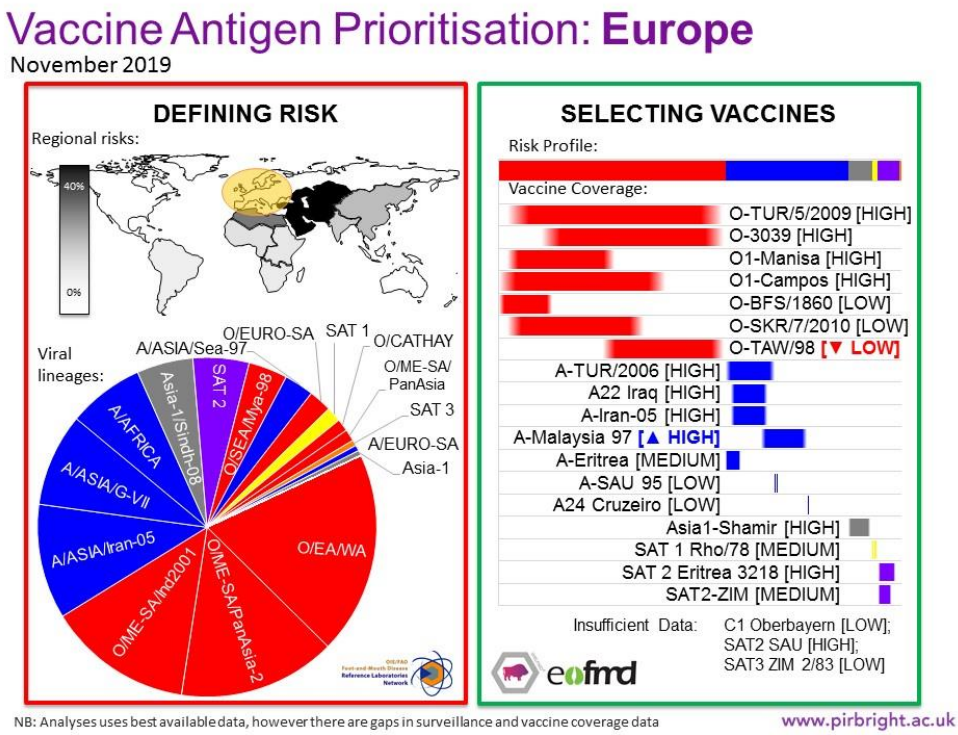
V. OTHER NEWS

[4]The 4th WRLFMD Quarterly Report for the period October – December 2019 contains the recommendations of FMDV vaccines to be included in antigen banks for Europe. The discussion of Table 12 is contained within the report.

Table 12: Recommendations from WRLFMD® on FMD virus strains to be included in FMDV antigen banks (for Europe) Source: WRLFMD.

This report provides recommendations of FMDV vaccines to be included in antigen banks. These outputs are generated with a new tool (called PRAGMATIST) that has been developed in partnership between WRLFMD® and EuFMD. These analyses accommodate the latest epidemiological data collected by the OIE FAO FMD Laboratory Network regarding FMDV lineages that are present in different *source regions* (see Table below), as well as available *in vitro, in vivo* and field data to score the ability of vaccines to protect against these FMDV lineages.

Lineage	West Eurasia	East Asia	North Africa	India and Southern Asia	East Africa	West and Central Africa	Southern Africa	South America
O ME-SA PanAsia-2	35							
O ME-SA PanAsia		10						
O SEA Mya-98		33						
O ME-SA Ind2001	6	20	10	80				
O EA or O WA	3		55		55	70		
O EURO-SA								80
O CATHAY		10.5						
A ASIA Sea-97		25						
A ASIA Iran-05	25.5	0						
A ASIA G-VII	17.5			16				
A AFRICA			25		22	15		
A EURO-SA								20
Asia-1	12.5	1.5		4				
SAT 1			0		8	5	27	
SAT 2	0.5		10		14	10	57	
SAT 3					1		16	
C								



The table defines the relative distribution of FMDV lineages in each of the eight *source regions*, while the figure highlights the importance of these *source regions* for **Europe** (using data collected at the EU-RL Workshop); please contact WRLFMD or EuFMD for assistance to tailor these outputs to other geographical regions. NB: Vaccine-coverage data presented is based on available data and may under-represent the true performance of individual vaccines.

VI. REFERENCES – Superscripts

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14. Foot and Mouth Disease and TADS Investigation Laboratory - Dr Sharmila Chapagain
15. Central Veterinary Research and Development Laboratory (CVDRL), Afghanistan - Dr. Wahidullah, Head of Laboratory.
16. Laboratoire National Vétérinaire (LANAVET), Garoua, Cameroon. - Dr Simon Jumbo Dickmu
17. FMD Research Centre, Virology Research Department, National Veterinary Research Institute, Vom, Plateau State, Nigeria - Dr Ularamu Hussaini
18. ACCRA Veterinary Laboratory (AVL), Ghana - Dr Joseph Adongo Awuni
19. Laboratoire National d'Elevage et de Recherches Vétérinaires (LNERV) – Miss Mariame Diop

VII. Annex

The estimates of the relative prevalence of serotypes and strains presented in the Tables below are based on the best data available to us and we are always trying to improve them. The accuracy of these estimates is only as good as the level of surveillance and reporting permits. Readers with relevant data or information are encouraged to contact EuFMD so that it can be included in the report.

In this report, the N. African countries of Morocco, Algeria, Tunisia and Libya considered together as a separate group, as the epidemiological situation is distinct and of interest to risk managers.

Description of methods

How to interpret the estimates of the relative prevalence of serotypes and strains:

If 100 animals that had been infected with FMD virus in the last 12 months were randomly selected from a country or virus pool:

1. How many animals would be infected with each serotype?
2. Within each serotype, how many would be infected with each virus strain?

Pool-level estimates and assumptions:

As the data required to calculate the relative prevalence of serotypes and strains are not directly available in most countries, they were estimated in 3 steps as follows:

1. First, each country in the pool is assigned a weight according to the number of animals infected with FMD each year:

$$weight_{country\ 1} = \frac{(FMD\ incidence * susceptible\ population)_{country1}}{\sum_{country\ 1}^{country\ n}(FMD\ incidence * susceptible\ population)}$$

   The expected FMD incidence was based on the paper by Sumption *et al* 2008 as follows: i) Low/Sporadic: 0.029 new infections per 1000 animals/year; ii) Medium: 0.458 new infections per 1000 animals/year; iii) High: 1.759 new infections per 1000 animals/year.

   The susceptible livestock population is the sum of sheep, goat, cattle, buffalo and pig populations from FAOStat.

2. For each country, the relative prevalence (RP) of each FMD serotype and strains within serotype is specified for all countries where FMD is believed to circulate endemically. First, the relative prevalence of each serotype is specified by dividing 100 points according to the serotypes that would be represented if 100 animals infected with FMDV in the previous year were randomly selected from the country. Subsequently, the relative prevalence of each serotype is broken down to reflect the distribution of circulating strains within each serotype.

   - If no information is available for a given country, then the circulating serotypes and strains are inferred from the neighbouring countries.
   - If there is only information about presence of serotypes and/or strains, but no data on the relative prevalence, then it is assumed that the serotypes/strains are circulating in equal prevalence.
   - When available, data from the last 24 months are considered, otherwise the most recent data available are used as well as the current situation in the region.
   - In the absence of reporting, a country is considered infected until it (re)gains recognition of freedom from the OIE

3. Data from steps 1 and 2 are combined at pool level according to the following formula:

$$relative\ prevalence_{serotype\ or\ strain} = \sum_{country\ 1}^{country\ n} \left(weight_{country} * RP_{serotype\ or\ strain}\right)$$

Similarly to what is described above are the criteria adopted for the categorization of the level of uncertainty relative to the FMD epidemiological situation defined for each country:

High: There has been little or no reporting of laboratory results (serotype and/or molecular characteristics) from this country within the last 24 months. The serotype/strain distribution is based on inferences from the situation in neighbouring countries;

Medium: There is some information available about the circulating serotypes and/or strains, but from a low number of samples and/or not representative of entire country or different sectors and/or not from the past 24 months;

Low: There is reliable information available about the circulating serotypes and/or strains, obtained from analysis of a large number of samples that represent the country's livestock population.

Legend of icons in the following tables

●	>=95%
◕	>=60%
◑	>=30%
◔	>=5%
○	<5%
	no strain circulating

Table 13: Conjectured circulating FMD viral lineages in each country of Pool 1 (current to December 2019).

			Presumed serotype distribution within country			Presumed viral lineage distribution within country								
Country	**Last Outbreak Repoted/Serotype#**	**FMD incidence rate**	**A**	**Asia1**	**O**	**A/ASIA/SEA-97**	**ASIA1/ unnamed**	**O/ME-SA/Ind-2001**	**O/SEA/Mya-98**	**O/ME-SA/PanAsia**	**O/ME-SA/PanAsia2**	**O/CATHAY**	**Uncertainty on circulating serotypes**	**Reference**
CAMBODIA	Aug 2018/O, Aug 2016/ A	high	◑		◑	◑				◑			medium	4
CHINA	Dec 2019/O, May 2017/A	high	◔		◕	◔		◔	◔	◔		◔	medium	4
CHINA (HONG KONG, SAR)	May 2019/O	high			●							●	medium	4
KOREA, DEMOCRATIC PEOPLE'S REPUBLIC OF	Dec 2016/O	high	◑		◕	◑		◕					high	as per REPUBLIC OF KOREA (SOUTH KOREA)
LAO PEOPLE'S DEMOCRATIC REPUBLIC (LAOS)	Dec 2018/A & O	high	◔		◕	◔			◕	◔			medium	4
MALAYSIA	May 2018/O, August 2016/A	medium			●					●			medium	4
MONGOLIA	Jun 2018/O, Sept 2016/A	medium			●			◑	◑	◑			medium	4
MYANMAR	Dec 2019/A, Nov 2019/O, April 2017/Asia 1,	high	◔	◔	◕	◔	◔	◑			◑		medium	4, 9
REPUBLIC OF KOREA (SOUTH KOREA)	Jan 2019/O, April 2018/A	low/sporadic	◑		◕	◑		◕					low	4
RUSSIAN FEDERATION	March 2019/O, Oct 2016/Asia 1, Jan 2016/ A	low/sporadic			●			◑	◑	◑			medium	4, 16
TAIWAN PROVINCE OF CHINA	Jun 2015/A	low/sporadic			●							●	high	as per HONG KONG
THAILAND	Jan 2019/A, Dec 2018/O	high	◔		◕	◔		◔	◔	◔			medium	4
VIETNAM	Jan 2019/O, November 2017/A and not typed	high	◑		◕	◑		◔	◑	◔		◔	medium	4

Table 14: Conjectured circulating FMD viral lineages in each country of Pool 2 (current to December 2019).

			Presumed serotype distribution within country			Presumed viral lineage distribution within country				
Country	**Last Outbreak Repoted/Serotype#**	**FMD incidence rate**	A	Asia1	O	A/ASIA/G-VII	ASIA1/ unnamed	O/ME-SA/Ind-2001	**Uncertainty on circulating serotypes**	**Reference**
BANGLADESH	Jun 2018/A, ASIA 1 and O	high	◔	◔	◕	◔	◔	◕	high	10
BHUTAN	Jan 2019/O, Dec 2017/A	high	◔		◕	◔		◕	medium	4
INDIA	Dec 2019/O, Apr 2015/A, ASIA 1	high	○		●	○		●	medium	2, 4
NEPAL	June 2019/O, Mar 2018/Asia 1, April 2017/A	high			●			●	medium	4, 14
SRI LANKA	Dec 2018/O	high			●			●	medium	4

Table 15: Conjectured circulating FMD viral lineages in each country of Pool 3 –West Eurasia (current to December 2019).

			Presumed serotype distribution within country			Presumed viral lineage distribution within country									
Country	**Last Outbreak Repoted/Serotype#**	**FMD incidence rate**	A	Asia1	O	sat2	A/ASIA/G-VII	A/ASIA/Iran-05	ASIA1/ASIA/Sindh-08	O/ME-SA/Ind-2001	O/ME-SA/PanAsia2	O/EA-3	SAT2	**Uncertainty on circulating strains**	**reference**
AFGHANISTAN	Oct 2019/O & Asia 1, Juy 2019/A	high	◑	◔	◑			◑	◔		◑			medium	15
ARMENIA	Dec 2015/A	low/sporadic	◔		◕		◔				◕			high	11
AZERBAIJAN	2007/0	low/sporadic	◑	◔	◑		◔	◑	◔		◑			high	as per Iran
BAHRAIN	Mar 2015/O	low/sporadic	◕		◑		◕			◔	◔			high	as per Saudi Arabia
GEORGIA	2001/ASIA 1	low/sporadic	◔		◕		◔				◕			high	as per Turkey
IRAN, ISLAMIC REPUBLIC OF	Dec 2018/A, Asia 1& O,	high	◑	◔	◑		◔	◑	◔		◑			medium	4
IRAQ	Dec 2018/O, Dec 2016/A	high	◑	◔	◑		◔	◑	◔		◑			high	as per Iran
ISRAEL	May 2019/O, June2017/A	low/sporadic	◔		◕		◔				◑	◔		low	4
JORDAN	Mar 2017/O	low/sporadic	◕		◑		◕			◔	◔			high	2, as per Saudi
KUWAIT	April 2016/O	high	◕		◑		◕			◔	◔			high	4 as per Saudi
KYRGYZSTAN	Sep 2014/A, O	low/sporadic	◔	◕	◔			◔	◕		◔			high	as per Pakistan
LEBANON	2010/not typed	low/sporadic	◔		◕		◔				◕			high	as per Turkey
OMAN	Dec 2018/O, May 2015/SAT 2	high			◑	◑				◔	◔		◑	high	4
PAKISTAN	Dec 2019/O, Nov 2019/A & Asia 1	high	◔	◕	◔			◔	◕	◔	◔			medium	3, 4
PALESTINE	Mar 2019/Untyped, Dec 2017/O, Mar 2013/Sat 2	low/sporadic			●							●		medium	4
QATAR	Dec 2018/O, Oct 2017/A	low/sporadic	◕		◑		◕			◔	◔			high	as per Saudi Arabia
SAUDI ARABIA	Dec 2018/O & Jun 2018/A	high	◕		◑		◕			◔	◔			high	4
SYRIAN ARAB REPUBLIC (SYRIA)	2002/ A & O	high	◔		◕		◔				◕			high	as per Turkey
TAJIKISTAN	Nov 2013/ not typed	low/sporadic	◔	◕	◔			◔	◕		◔			high	as per Pakistan
TURKEY	April 2019/O, Oct 2017/A, May 2015/ Asia 1	high	◔		◕		◔				◕			medium	4
TURKMENISTAN	Not available	low/sporadic	◑	◔	◑		◔	◑	◔		◑			high	as per Iran
UNITED ARAB EMIRATES	Jan 2018/O	low/sporadic	◕		◑		◕			◔	◔			high	as per Saudi Arabia
UZBEKISTAN	Not available	low/sporadic	◑	◔	◑		◔	◑	◔		◑			high	as per Iran

Table 16: Conjectured circulating FMD viral lineages in each country of Pool 3 - North Africa (current to December 2019).

			Presumed serotype distribution within country			Presumed viral lineage distribution within country				
Country	**Last Outbreak Repoted/Serotype#**	**FMD incidence rate**	**A**	**O**	**SAT 2**	**A/AFRICA**	**O/EA-3**	**SAT 2**	**Uncertainty on circulating serotypes**	**Reference**
ALGERIA	Mar 2019/O, Nov 2016/A, Jun 2016/Sat 2	medium	◑	◕		◑	◕		medium	4
EGYPT	Nov 2018/Sat 2, Feb 2018/A April 2017/O	high	◔	◔	◕	◔	◔	◕	medium	4
LIBYA	June 2019/O	high	◔	◔	◕	◔	◔	◕	high	12, as per egypt
MOROCCO	July 2019/O	low/sporadic		●			●		medium	4
TUNISIA	Feb 2019/O, April 2017/A	low/sporadic	◔	◕		◑	◕		medium	4

Table 17: Conjectured circulating FMD viral lineages in each country of Pool 4 (current to December 2019).

			Presumed serotype distribution within country					Presumed viral lineage distribution within country							
Country	**Last Outbreak Repoted/Serotype#**	**FMD incidence rate**	**A**	**O**	**sat1**	**sat2**	**sat3**	**A/AFRICA**	**O/EA-2**	**O/EA-3**	**SAT1**	**SAT2**	**SAT3**	**Uncertainty on circulating serotypes**	**Reference**
BURUNDI	Dec 2017 / not available	high	◑	◔	◔	◔		◑		◔	◔	◔		high	as per Tanzania
COMOROS	March 2019/O	high		●					●					high	no data
DJIBOUTI	Not available	high	◔	◕	◔		○	◔		◕	◔		○	high	as per Ethiopia
ERITREA	Oct 2018/not reported	high	◔	◔	◕			◔		◔	◕			high	4
ETHIOPIA	Nov 2019/ O & A &SAT 2, Feb 2018/SAT 1	high	◔	◕	◔		○	◔		◕	◔		○	medium	4, 5
KENYA	Nov 2019/A & SAT 1, Oct 2019/O & SAT 2	high	◔	◕	◔	◔		◔	◕		◔	◔		medium	4, 6
RWANDA	Oct 2018/ A, O , SAT 1 & Sat 2	high	◔	◕	◔	◔		◔	◕		◔	◔		high	as per Kenya
SOMALIA	June 2018/not reported	high	◔	◕	◔		○	◔		◕	◔		○	high	as per Ethiopia
SOUTH SUDAN	June 2017/O & SAT 2, Mar 2018/A Dec 2018/ not sampled	high		●						●				high	4
SUDAN	Dec 2018/ not sampled, May 2017/O	high	◑	◔		◔		◑		◔		◔		medium	4
TANZANIA, UNITED REPUBLIC OF	Dec2018/O, Nov2018/ A & SAT 2, Sep 2018/SAT 1	high	◑	◔	◔	◔		◑		◔	◔	◔		high	4
UGANDA	Feb 2019/A & O, July 2017/SAT1, Jan 2015/SAT 3, July 2015/ SAT 2	high	◑	◑	◔	◔		◑	◑		◔	◔		high	4, as per Kenya
YEMEN	Dec 2016/not sampled	high	◔	◕	◔		○	◔		◕	◔		○	high	as per Ethiopia

Table 18: Conjectured circulating FMD viral lineages in each country of Pool 5 (current to December 2019).

			Presumed serotype distribution within country				Presumed viral lineage distribution within country					
Country	**Last Outbreak Repoted/Serotype#**	**FMD incidence rate**	**A**	**O**	**sat1**	**sat2**	**A/AFRICA**	**O/EA-3**	**SAT1**	**SAT2**	**Uncertainty on circulating serotypes**	**Reference**
BENIN	Dec 2017/O, SAT 1 &SAT 2, Apr 2017/A	high	◔	◔	◔	◔	◔	◔	◔	◔	high	1
BURKINA FASO	Dec 2018/not sampled, Aug2018/O	high	◑	◑		◑	◑	◑		◑	medium	1, as per Mali
CAMEROON	Sep 2019/ A, Nov 2014/O, SAT 2, May 2014/SAT 1	high	◑	◑	◔	◔	◑	◑	◔	◔	high	4, 16
CAPE VERDE	Not available	low/sporadic		●				●			high	as per Senegal
CENTRAL AFRICAN REPUBLIC	Not available	high	◑	◑		◔	◑	◑		◔	high	as per Nigeria
CHAD	Dec 2018/Not sampled	high	◑	◑		◔	◑	◑		◔	high	as per Nigeria
CONGO	Not available	high	◑	◑		◔	◑	◑		◔	high	as per Nigeria
CONGO, DEMOCRATIC REPUBLIC OF	Jun 2018/A, O & Sat 1	high	◑	◑	◑		◑	◑	◑		high	1
COTE D'IVOIRE	Jun 2018/O	high		●				●			high	1, as per Guinea
EQUATORIAL GUINEA	Jun 2015/Disease suspected	high	◑	◑		◔	◑	◑		◔	high	as per Nigeria
GABON	Not available	high	◑	◑		◔	◑	◑		◔	high	as per Nigeria
GAMBIA	Dec 2018/O	high		●				●			medium	1
GHANA	Dec 2018/SAT 2, Sep 2018/ O	high		◑		◑		◑		◑	high	1, 4, 17
GUINEA	Dec 2018/O	high		●				●			medium	1
GUINEA-BISSAU	April 2019/O	high		●				●			high	as per Guinea
LIBERIA	Not available	high		●				●			high	as per Guinea
MALI	Oct 2018/O, Jun 2018/A & SAT	high	◑	◑		◑	◑	◑		◑	high	1
MAURITANIA	Aug 2018/O, Dec 2014/SAT 2	high				●				●	medium	1, 4
NIGER	Dec 2015/O	high	◑	◑		◔	◑	◑		◔	high	as per Nigeria
NIGERIA	Nov 2019/untyped, June 2019/A, Sep 2018/O &Sat 2, Sept 2016/ SAT 1	high	◑	◑		◔	◑	◑		◔	high	1, 4 , 18
SAO TOME AND PRINCIPE	Not available	0									high	no data available
SENEGAL	Nov 2018/A, O & Sat 2, Jun 2018/ Sat 1	high		●				●			medium	4, 19
SIERRA LEONE	Aug 2018/O	high		●				●			medium	as per Senegal
TOGO	Dec 2017/ not sampled, Dec 2016/ O & Sat 1	high	◑	◑		◔	◑	◑		◔	high	1, as per Nigeria

Table 19: Conjectured circulating FMD viral lineages in each country of Pool 6 (current to December 2019).

			Presumed serotype distribution within country					Presumed viral lineage distribution within country						
Country	**Last Outbreak Repoted/Serotype#**	**FMD incidence rate**	**A**	O	SAT1	SAT2	SAT3	A/AFRICA	O/EA-2	SAT1	SAT2	SAT3	**Uncertainty on circulating serotypes**	**Reference**
ANGOLA	April 2016/SAT 2	high		◑	◔	○	◔		◑	◔	○	◔	high	as per Zambia
BOTSWANA	June 2018/SAT 2, Aug 2015/SAT 1	medium				●					●		medium	1, 4
MALAWI	Apr 2019/A, SAT 2, June 2016/SAT 1	medium	◔		◔	◔		◔		◔	◔		high	1, 4
MOZAMBIQUE	May 2019/ Typing pending, Oct 2017/SAT 2, May 2015/ SAT 1	high				◕	○				◕	○	high	1, 4
NAMIBIA	Aug 2019/SAT 3, Aug 2019/typing pending, Sep 2017/SAT 2, May 2015/SAT 1	medium			◑	◑	○			◑	◑	○	high	1, 4
SOUTH AFRICA	Nov 2019/SAT 2, Oct 2017/SAT 1, Dec 2015/SAT 3	medium			○	◕				○	◕		high	4, 20
ZAMBIA	Aug 2019/O, Apr 2019/SAT 2,Feb 2019/ A, May 2017/SAT 3, Jan 2013/SAT 1	medium	○	◑	○	○	◔	○	◑	○	○	◔	medium	1, 4
ZIMBABWE	Jun 2019/SAT 2, Sep 2019/SAT2 Jun 2013/SAT 3	high			◑	◑				◑	◑		medium	1, 4

Table 20: Conjectured circulating FMD viral lineages in each country of Pool 7 (current to December 2019).

			Presumed serotype distribution within country		Presumed viral lineage distribution within country			
Country	**Last Outbreak Repoted/Serotype#**	**FMD incidence rate**	A	O	A/Euro SA	O/Euro-SA	**Uncertainty on circulating serotypes**	**Reference**
VENEZUELA	Oct 2018/O	medium	◑	◑	◑	◑	high	1, 7
COLUMBIA	2011/O, 2013/A	medium		●		●	medium	1

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