

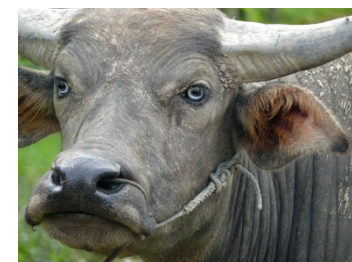
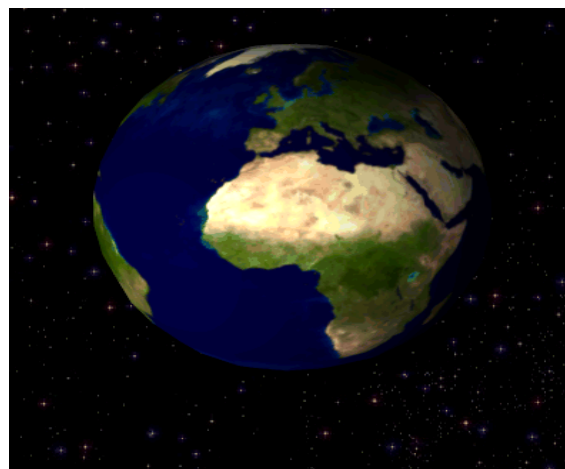
# FMD : Global Surveillance

## OIE/FAO FMD Reference Laboratory Network



**EuFMD Executive- Chania- 14<sup>th</sup> February 2013**

**The World Reference Laboratory for FMD**



[Dr Jef M. Hammond WRLFMD®](#)

The Pirbright Institute, Ash Road, Pirbright, Surrey, GU24 0NF,  
UNITED KINGDOM



# FMD Reference Laboratories at Pirbright

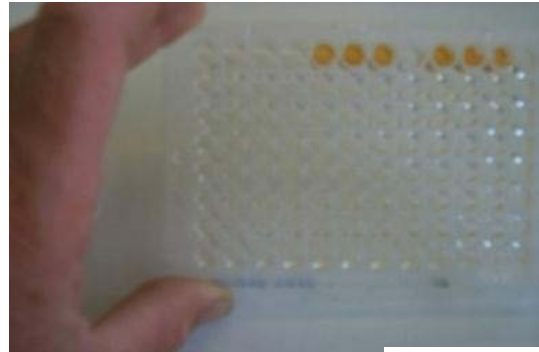
- **European Community Reference Laboratories for FMD**
  - Support and diagnosis for EU Member States
- **OIE Reference Laboratory for FMD**
  - support of safeguarding and promoting international trade
- **World Reference Laboratory for FMD designated by FAO**
  - WRLFMD
  - Global surveillance and threat recognition
  - Reference Laboratory Network of OIE/FAO FMD Labs



# World Reference Laboratory for FMD- WRLFMD®

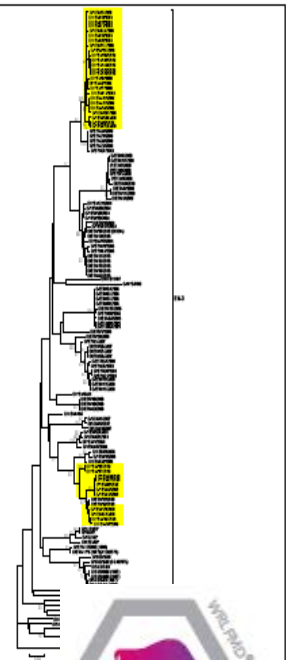
FAO, OIE, EU and National Responsibilities

- 24/7 Diagnostic Service
- **Global surveillance**
- Strain characterisation
- **Vaccine matching (Bulgaria, South Korea, Egypt)**
- Extensive library of isolates
- Test improvement & Development, validation,
- Quality assurance
- Reagent supply
- Training
- **Advice & Reports**



Yemen Arab Republic: 38 type O FMD viruses isolated during the previous reporting period we analysed and shown to belong to the EA-3 toptotype. 25 of the viruses, collected in 2009, were closely related to Ethiopian viruses also collected in 2009. Six viruses from 2008 and five from 2009 belonged to a different sub-lineage of EA-3 and were most closely related to viruses from Ethiopia in 2008 and Yemen in 2006.

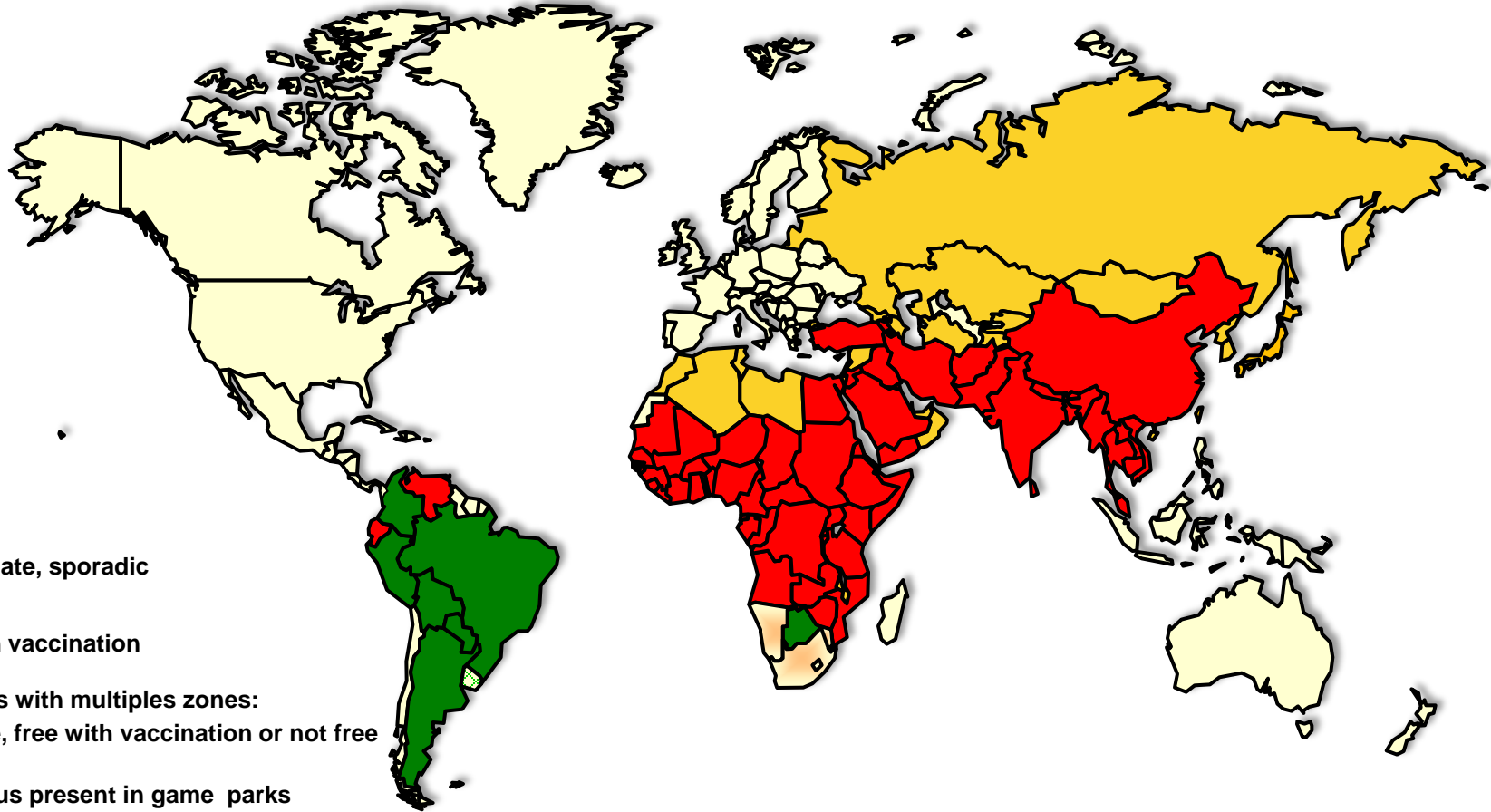
Batch: WRLFMD/2009/00015; received: 16/03/2009



WRLFMD Quarterly Report  
April-June

World Reference Laboratory Report

# Global Surveillance



-  Endemic
-  Intermediate, sporadic
-  Free with vaccination
-  Countries with multiples zones:  
FMD-free, free with vaccination or not free
-  Free. Virus present in game parks
-  Free

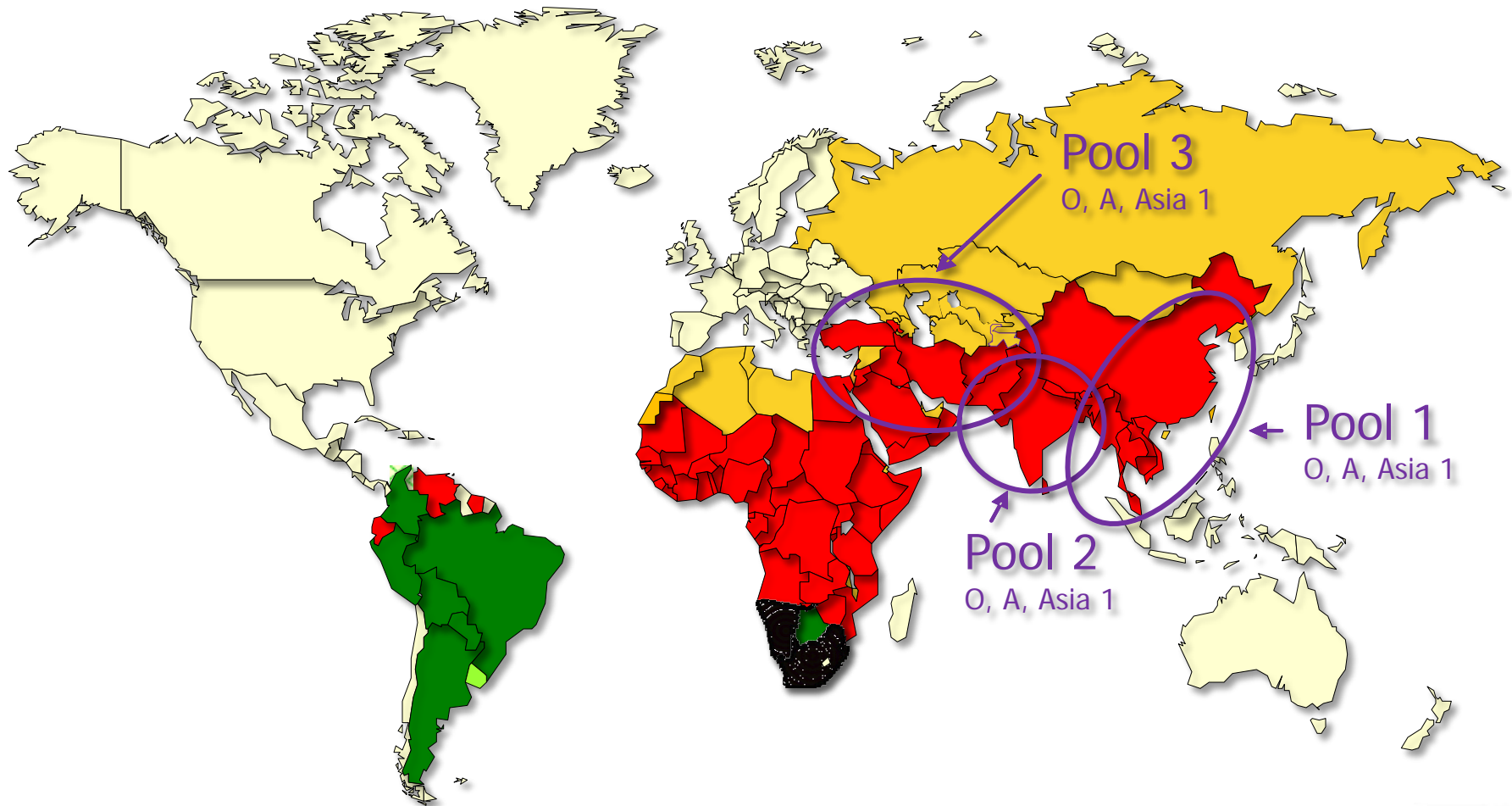


# Visualization of Regional Virus Pools as an Aid to Global Control

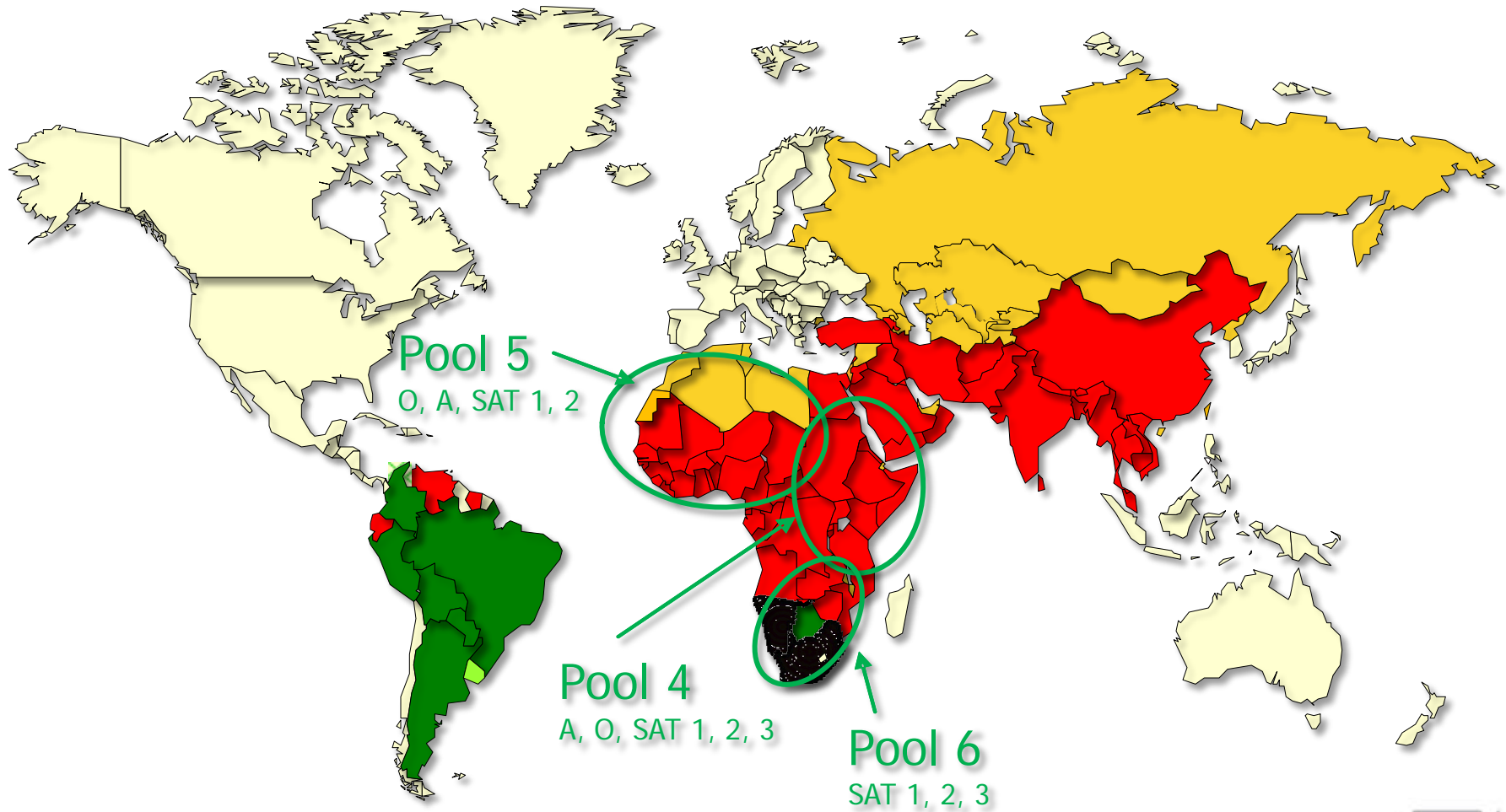
Divides the Globe into 7 pools each with

- Multiple serotypes but topotypes mainly confined to that pool
- Each pool may need tailored vaccines and strategies

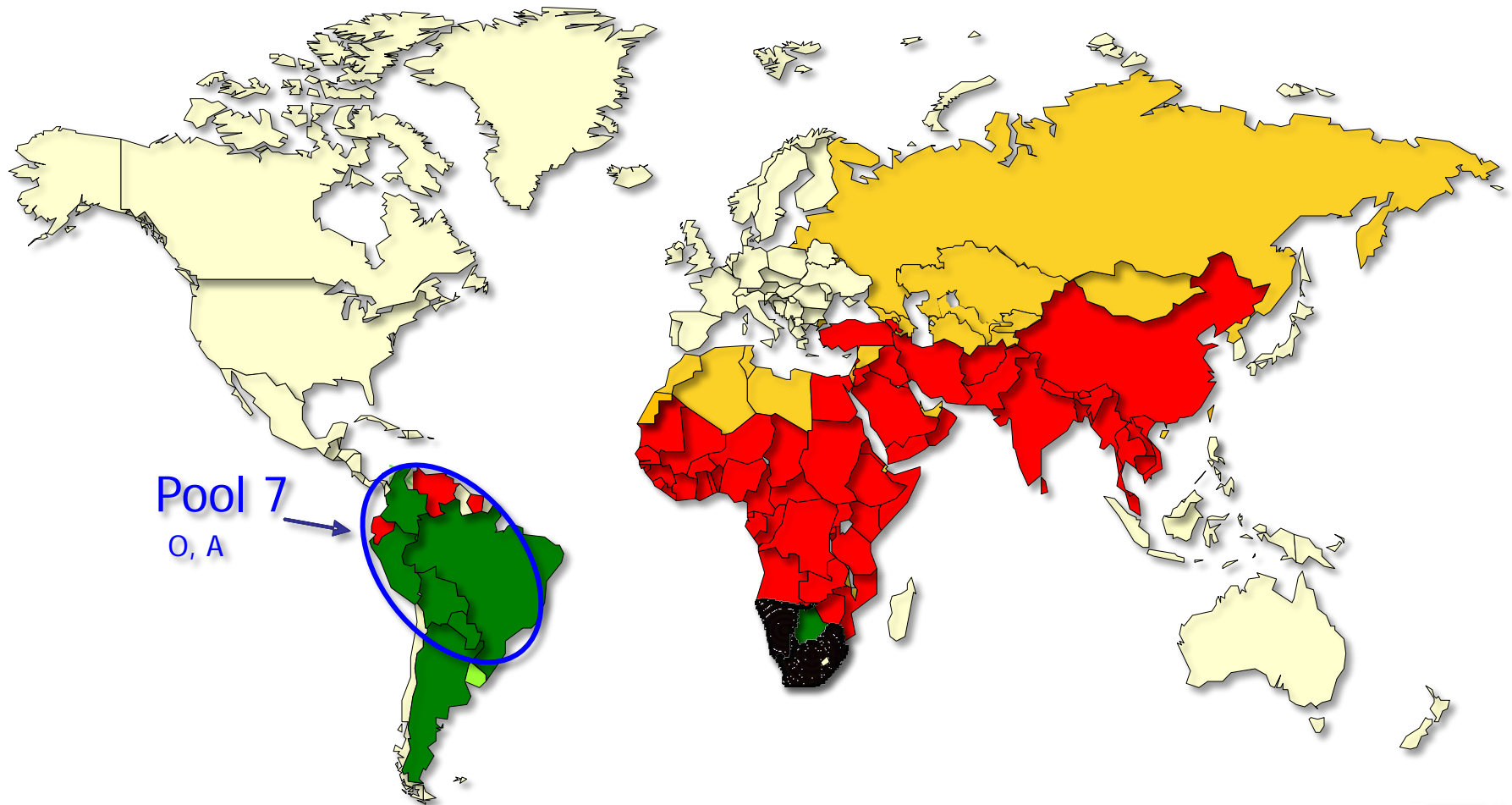
# The conjectured status of FMD showing approximate distribution of regional virus pools.



# The conjectured status of FMD showing approximate distribution of regional virus pools.



# The conjectured status of FMD showing approximate distribution of regional virus pools.



Pool 7  
O, A



# Enhanced Surveillance: OIE/FAO Lab network

- WRLFMD: Pirbright, UK
- RRLSEA: Pakchong, Thailand
- LVRI: Lanzhou, China
- FGI ARRIAH: Vladimir, Russia
- PDFMD: Mukteswar, India
- RRLSSA: Gabarone, Botswana
- FMD-Laboratory: Embakasi, Kenya
- PANAFTOSA: Rio de Janeiro, Brazil
- LFADLCT: Argentina
- ARC-OVI: Onderstepoort, RSA
- PIADC: Plum Island, USA
- CODA-CERVA-VAR: Ukkel, Belgium



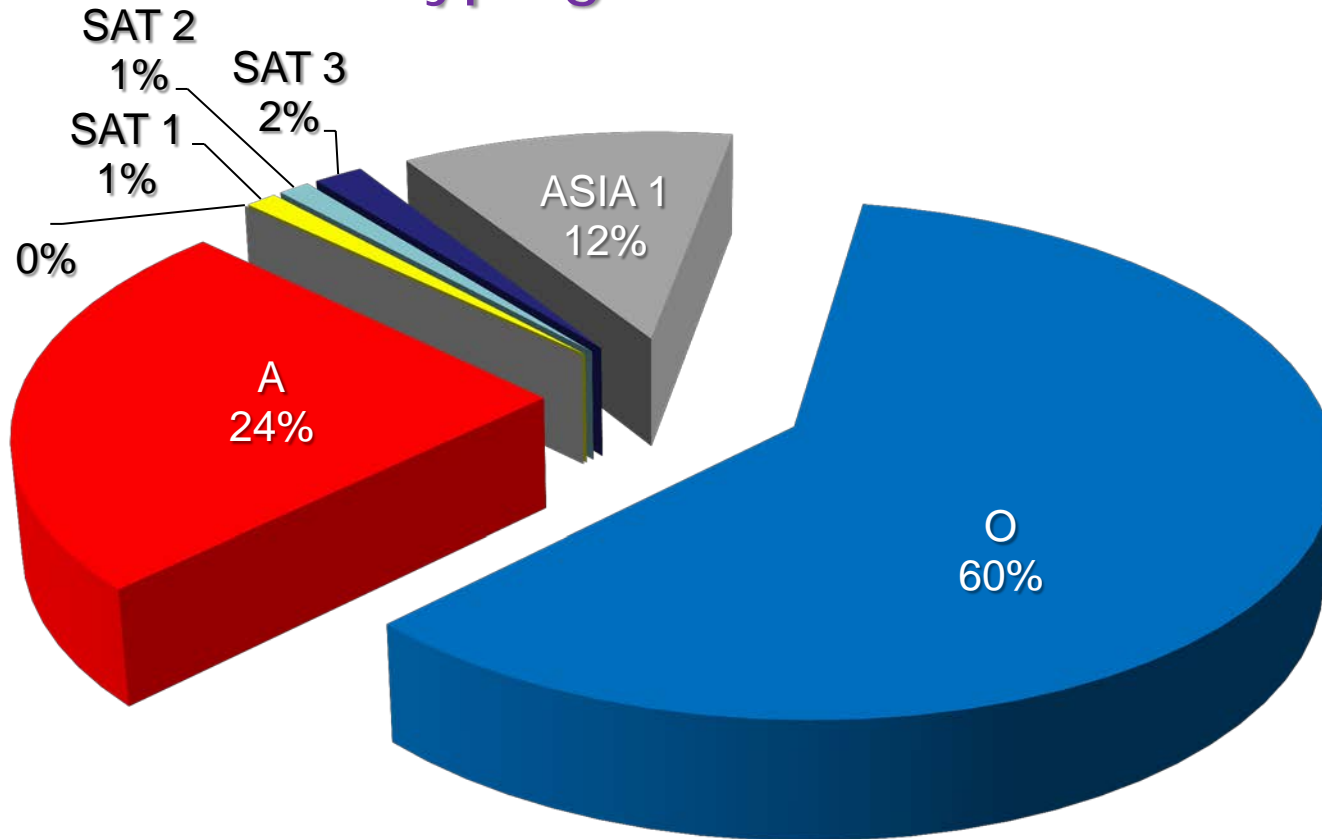
Approximately ~2400  
samples tested during 2011

OIE/FAO FMD Reference Laboratory Network

Annual Report 2011

*Editor: Dr Jef Hammond, IAH, Pirbright, UK.*

# Serotyping results for 2011

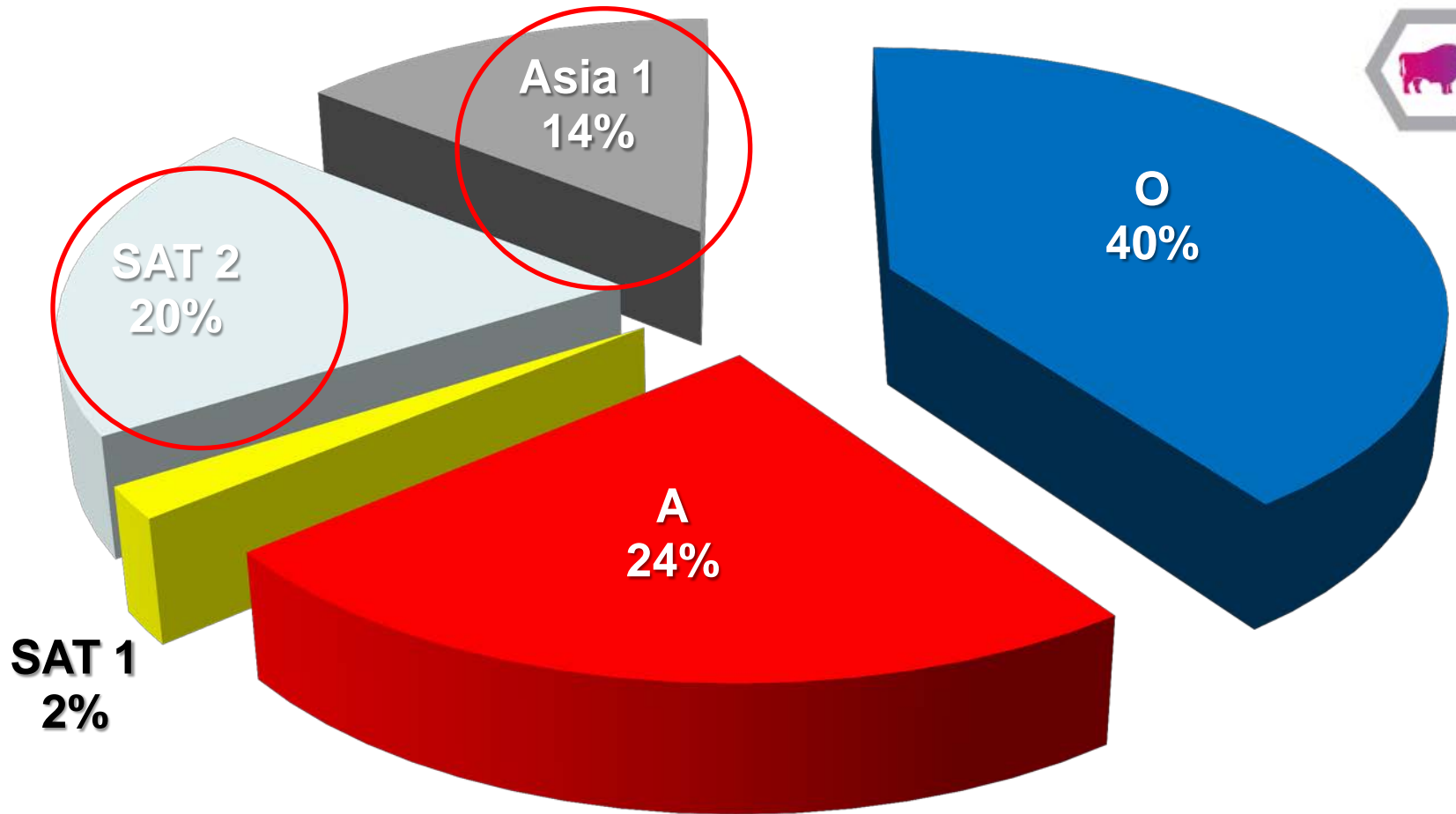


The network labs received **>2,400** samples in 2011 from **34 countries**  
**60%** were **serotype O**



**Increased Asia 1 activity**.....**Serotype C was not detected**

# WRLFMD® Serotyping results for 2012



≥ 750 samples from **27 countries**  
**40%** were **serotype O**

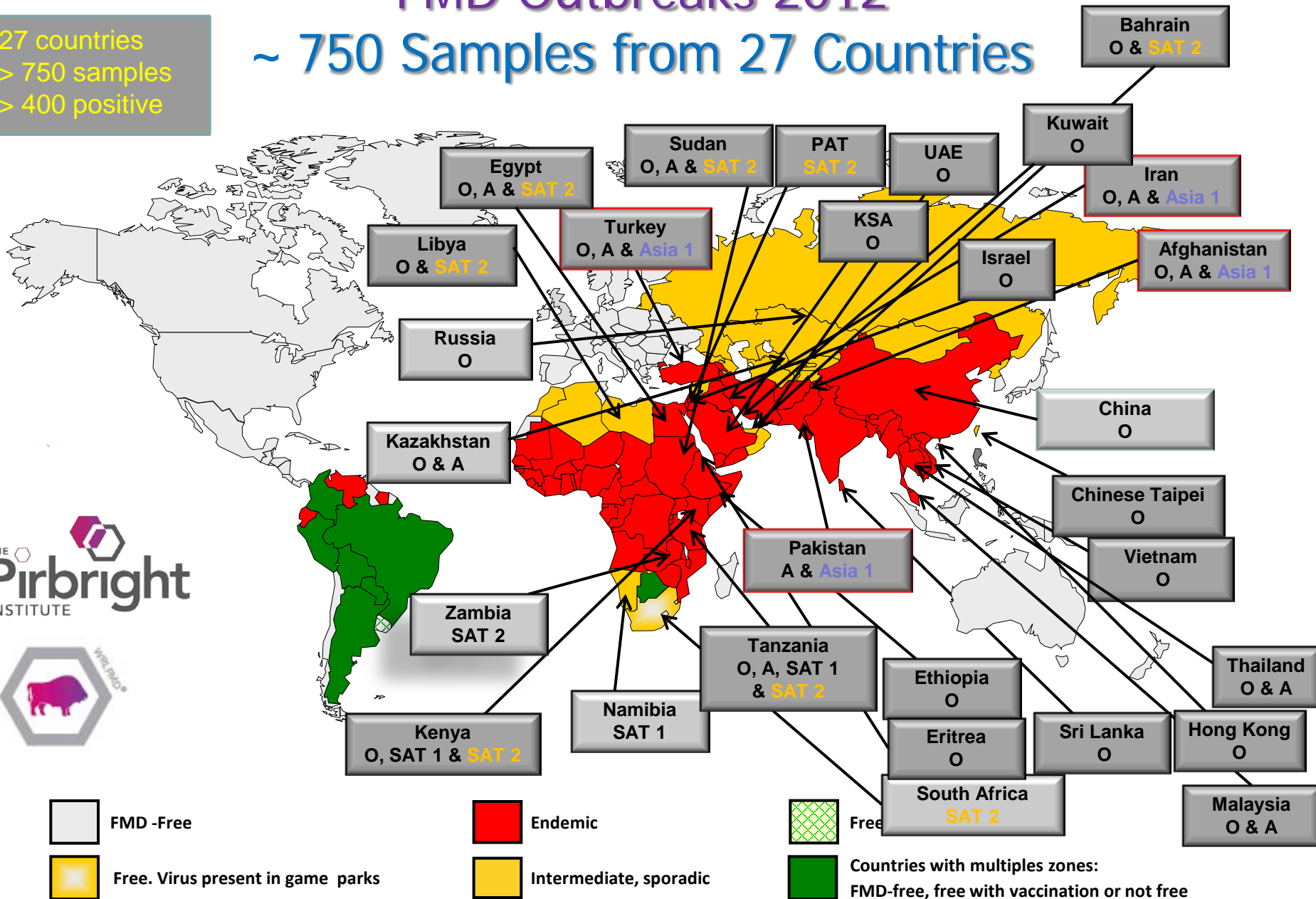
↑ **Increased Asia 1 activity**  
↑ **Increased SAT 2 activity**

**Still No Serotype C** (not reported since 2004)

# FMD Outbreaks 2012

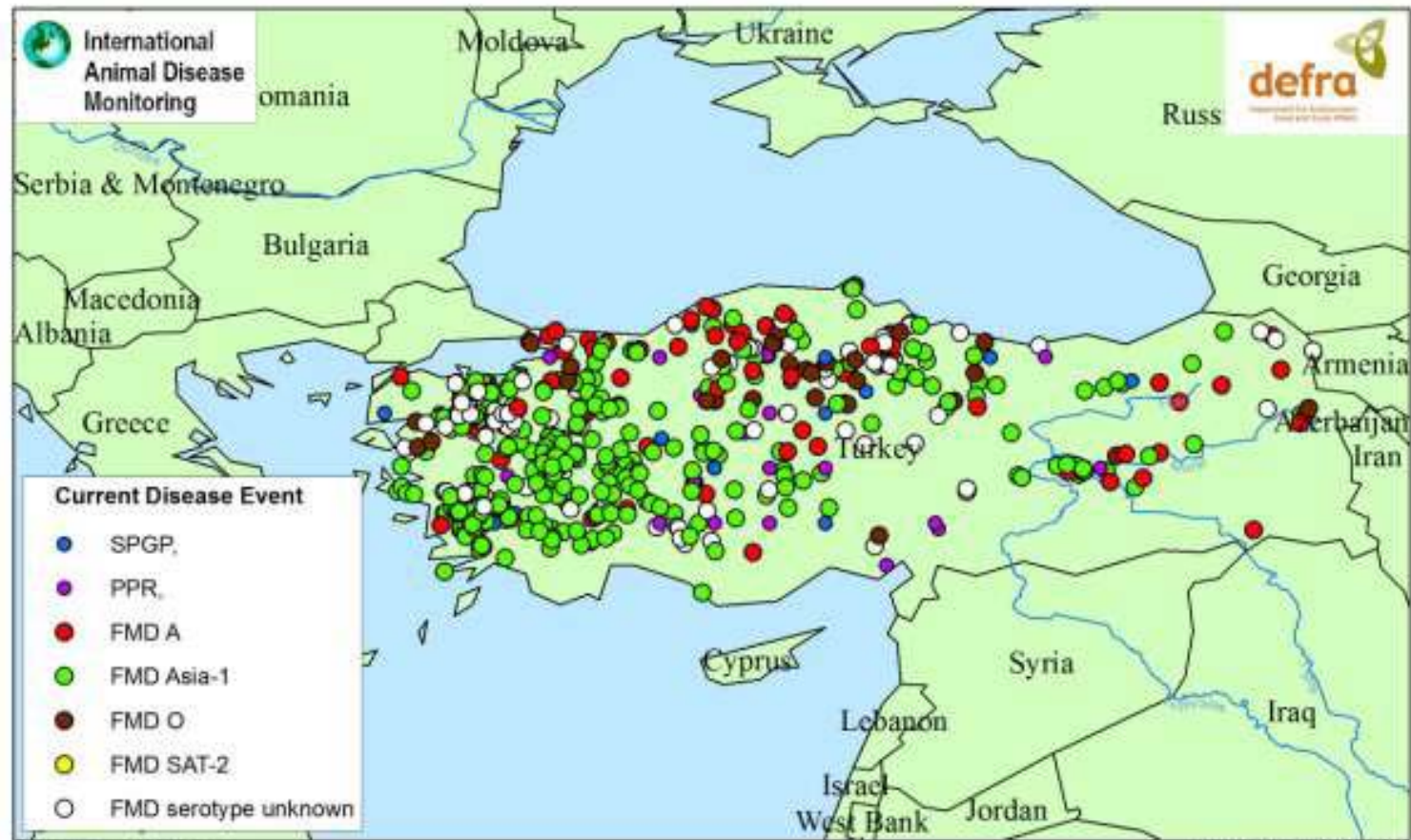
## ~ 750 Samples from 27 Countries

27 countries  
> 750 samples  
> 400 positive



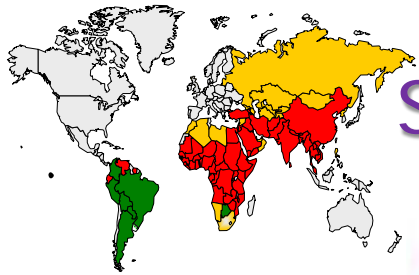
# Turkey 2012- Distribution >1000 Outbreaks

The majority of these have been Asia-1.



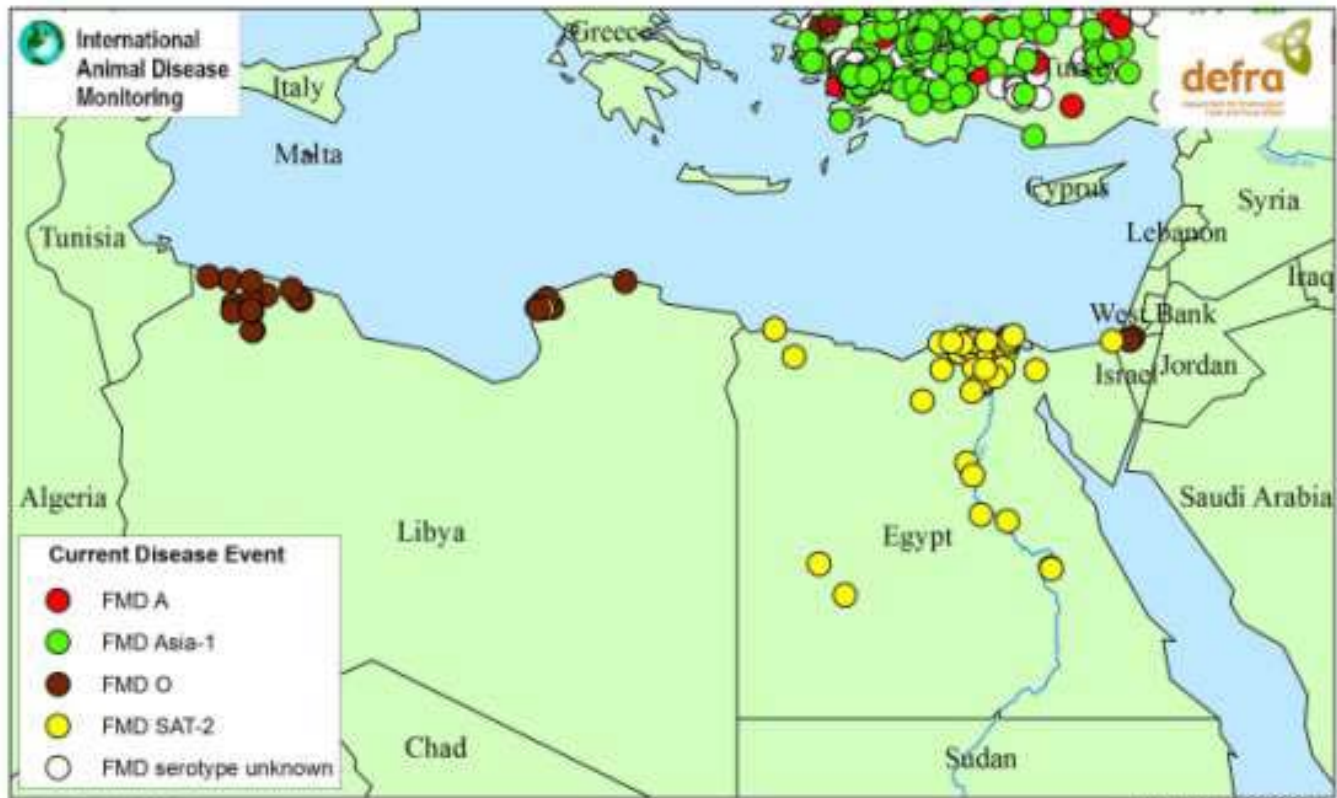
Recent Foot and Mouth Disease outbreaks in Turkey in 2012

0 87.5 175 350 525 700 Kilometers



# FMD Outbreaks 2012

## SAT 2 in North Africa and Middle East



Actual Scale 1:12,500,000

Recent Foot and Mouth Disease outbreaks in North Africa in 2011/2

Map prepared by IDM



# FMD Outbreaks 2012

## Vaccination against SAT 2 in Egypt

August 2012

Vaccination with monovalent SAT2 – 1<sup>st</sup> round with locally produced vaccine

**Total= 827,954 in 21 governorates .**

cattle **431,568**

Buffaloes **211,352**

sheep **159,398**

goat **25,636**

4 million cattle

3 million buffalo

2<sup>nd</sup> round vaccination with monovalent locally produced SAT2 vaccine = **148,741**

cattle **114,439**

buffaloes **31,946**

sheep **1,289**

goat **1,067**

Information provided by **Dr Soheir Hassan Abd El Kader**

Under Secretary of central administration of preventive medicine

General Organization for Veterinary Services

Ministry of Agriculture

Cairo, Egypt



# Egypt- Recent FMD Outbreaks

Egypt has at least 3 serotypes of FMDV and a number of topotypes

1. O/ME-SA/Egy-72 (2006-2009)
2. O/ME-SA/PanAsia 2 (Egy-09) (2009 & 2011)
3. A/Africa/G-VII (Ken-05) (2006 & 2009)
4. A/Asia/Iran-05 (Bar-08) (2010-2011)
5. A/Africa/G-IV (ISM-12) (2012)
6. SAT2/VII/Alx-12 (2012)
7. SAT2/VII/Ghb-12 (2012)



# Recent Observations- SAT 2 in Sudan 2010

## Report on FMDV SAT 2 in Sudan in 2010

Batch: WRLFMD/2012/00028

◆ indicates viruses in this batch

Software: MEGA 5.0

Analysis

Analysis ----- Phylogeny Reconstruction

Scope ----- All Selected Taxa

Statistical Method ----- Neighbor-joining

Phylogeny Test

Test of Phylogeny ----- Bootstrap method

No. of Bootstrap Replications ----- 1000

Substitution Model

Substitutions Type ----- Nucleotide

Model/Method ----- Kimura 2-parameter model

Substitutions to Include ----- d: Transitions + Transversions

Rates and Patterns

Rates among Sites ----- Uniform rates

Pattern among Lineages ----- Same (Homogeneous)

Data Subset to Use

Gaps/Missing Data Treatment ----- Pairwise deletion

Codons Included ----- 1st+2nd+3rd+Non-Coding

No. of Sites : 651

No Of Bootstrap Reps = 1000

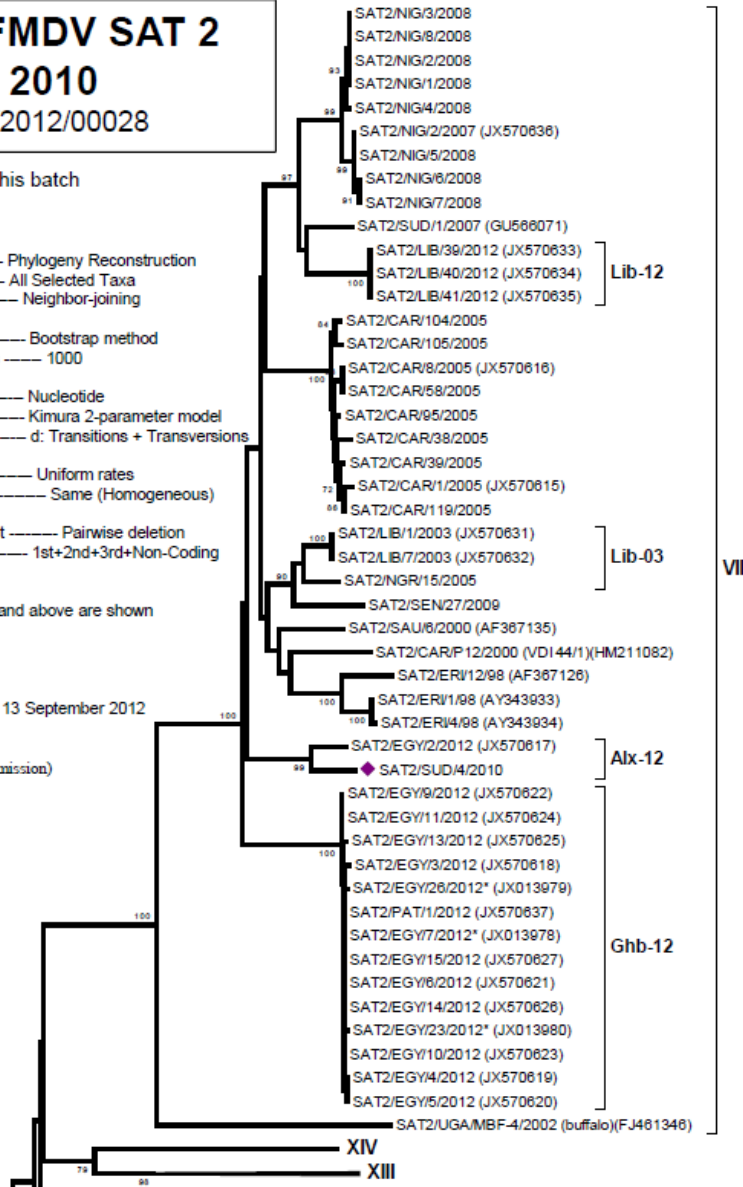
Only bootstrap values of 70% and above are shown

\*, not a WRLFMD Ref. No.

N.J. Knowles & J. Wadsworth, 13 September 2012

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VII

Ghb-12

XIV

XIII



# Recent Observations- SAT 2 in Sudan 2010

## Report on FMDV SAT 2 in Sudan in 2010

Batch: WRLFMD/2012/00028

◆ indicates viruses in this batch

Software: MEGA 5.0

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Analysis ----- Phylogeny Reconstruction

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Pattern among Lineages ----- Same (Homogeneous)

Data Subset to Use

Gaps/Missing Data Treatment ----- Pairwise deletion

Codons Included ----- 1st+2nd+3rd+Non-Coding

No. of Sites : 651

No Of Bootstrap Reps = 1000

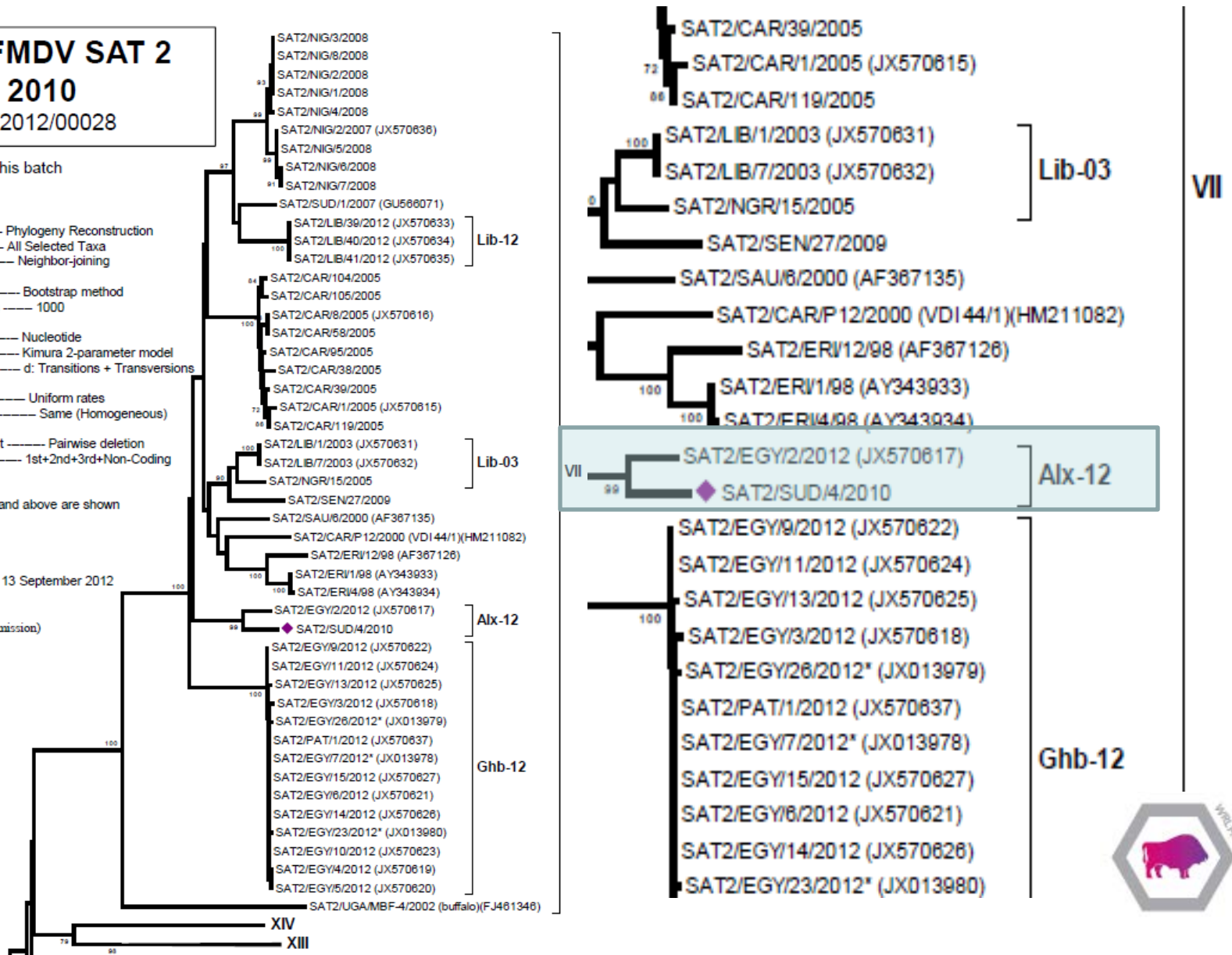
Only bootstrap values of 70% and above are shown

\*, not a WRLFMD Ref. No.

N.J. Knowles & J. Wadsworth, 13 September 2012

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# Recent Observations- A in Sudan 2011

## Report on FMDV A in Sudan in 2011

Batch: WRLFMD/2012/00028

◆ indicates viruses in this batch

Software: MEGA 5.0

Analysis

Analysis ..... Phylogeny Reconstruction

Scope ..... All Selected Taxa

Statistical Method ..... Neighbor-joining

Phylogeny Test

Test of Phylogeny ..... Bootstrap method

No. of Bootstrap Replications ..... 1000

Substitution Model

Substitutions Type ..... Nucleotide

Model/Method ..... Kimura 2-parameter model

Substitutions to Include ..... d: Transitions + Transversions

Rates and Patterns

Rates among Sites ..... Uniform rates

Pattern among Lineages ..... Same (Homogeneous)

Data Subset to Use

Gaps/Missing Data Treatment ..... Pairwise deletion

Codons Included ..... 1st+2nd+3rd+Non-Coding

No. of Sites : 639

No Of Bootstrap Reps = 1000

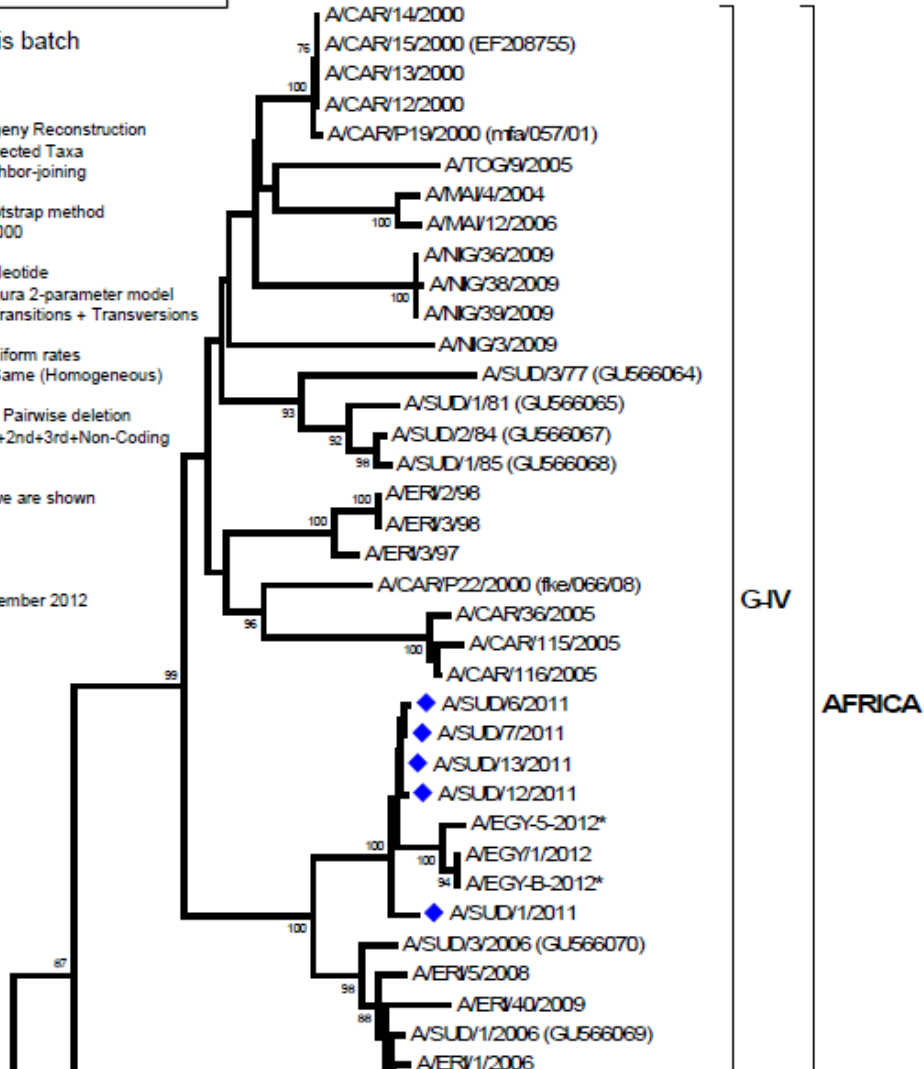
Only bootstrap values of 70% and above are shown

\*, not a WRLFMD Ref. No.

N.J. Knowles & J. Wadsworth, 03 September 2012

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# Recent Observations- A in Sudan 2011

## Report on FMDV A in Sudan in 2011

Batch: WRLFMD

◆ indicates viruses in

Software: MEGA 5.0

Analysis

Analysis ..... Ph

Scope ..... All

Statistical Method ..... N

Phylogeny Test

Test of Phylogeny ..... I

No. of Bootstrap Replications ..... 1000

Substitution Model

Substitutions Type ..... I

Model/Method ..... I

Substitutions to Include ..... I

Rates and Patterns

Rates among Sites ..... I

Pattern among Lineages ..... I

Data Subset to Use

Gaps/Missing Data Treatment ..... I

Codons Included ..... I

No. of Sites : 639

No Of Bootstrap Reps = 1000

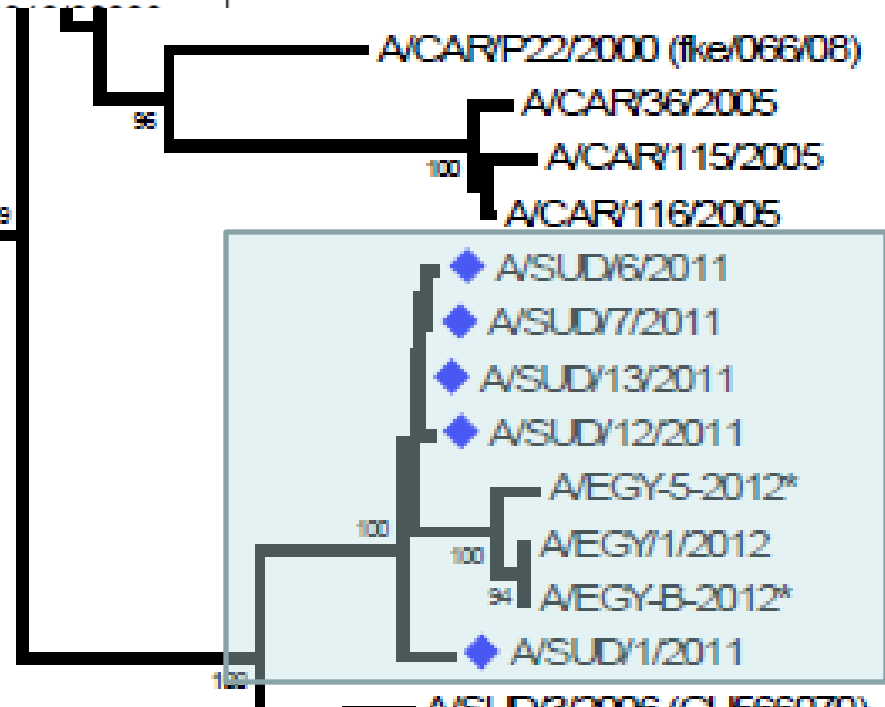
Only bootstrap values of 70% and a

\*, not a WRLFMD Ref. No.

N.J. Knowles & J. Wadsworth, 03 S

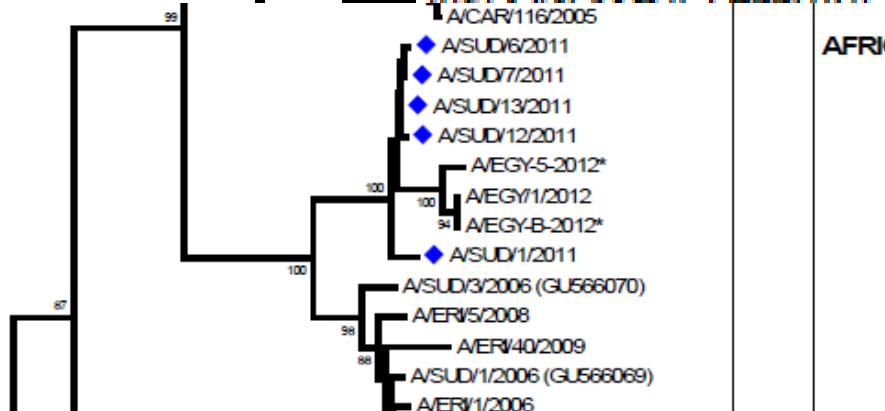
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G-IV

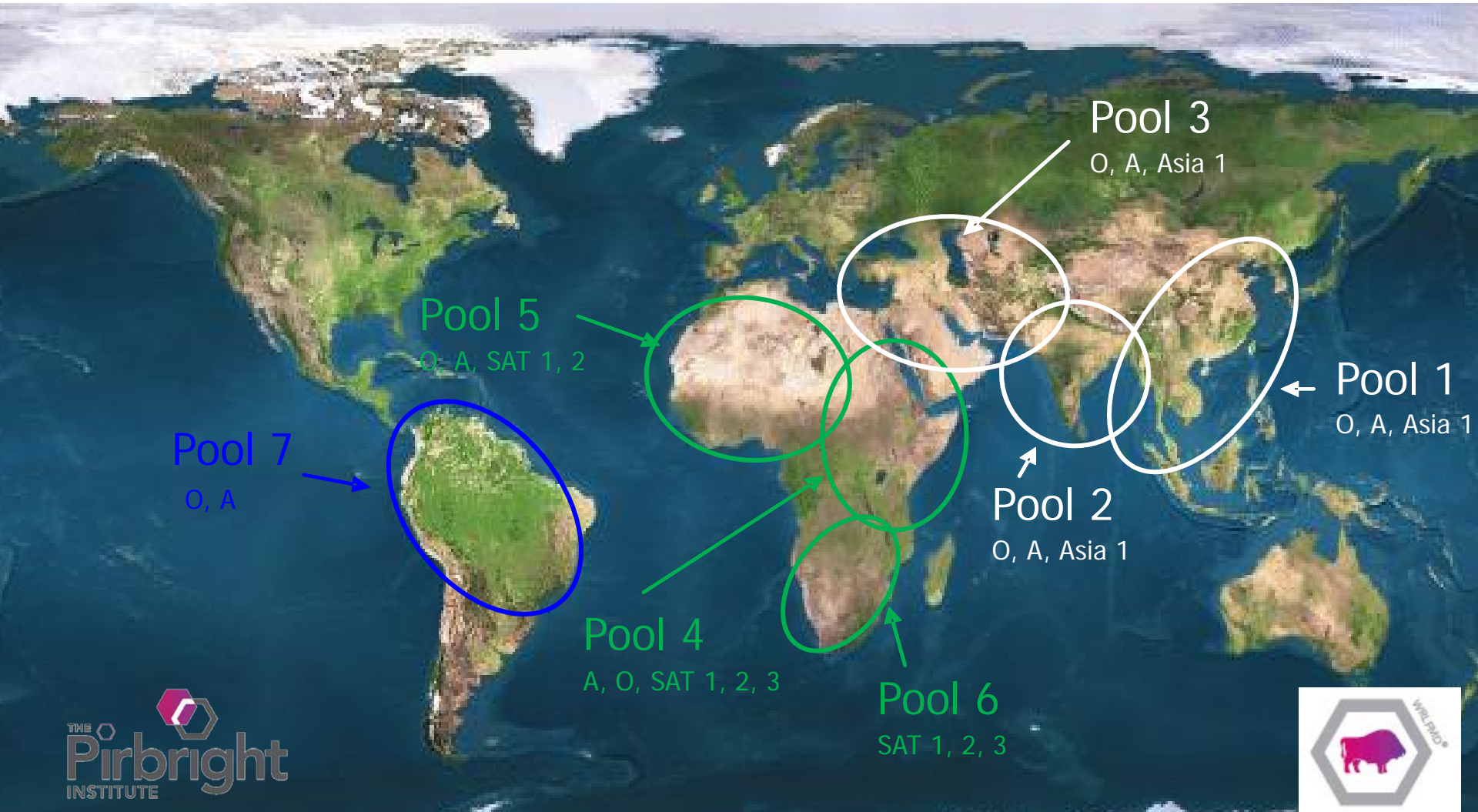
AFRICA



AFRICA

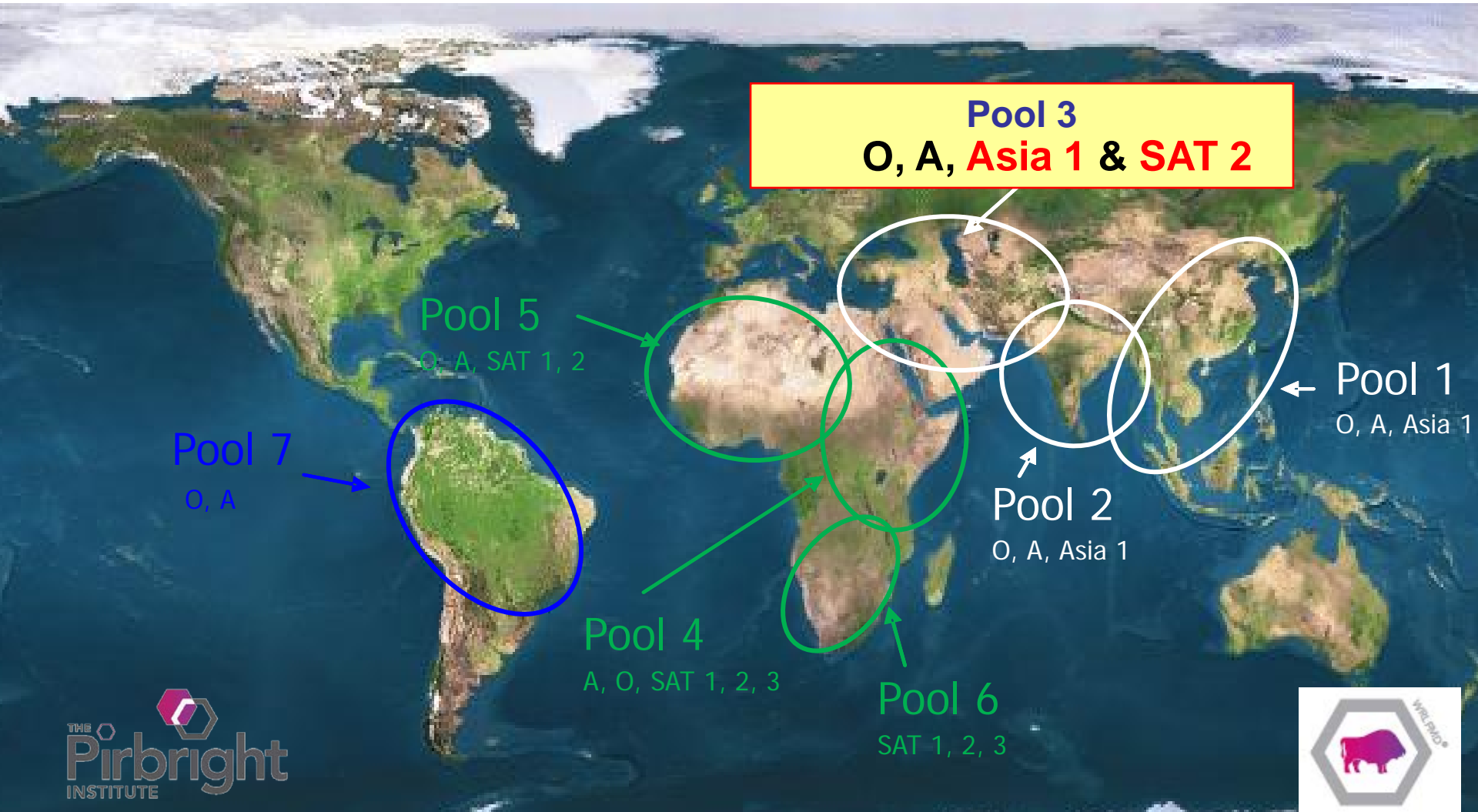


# WRLFMD® Regional Analysis- 2012



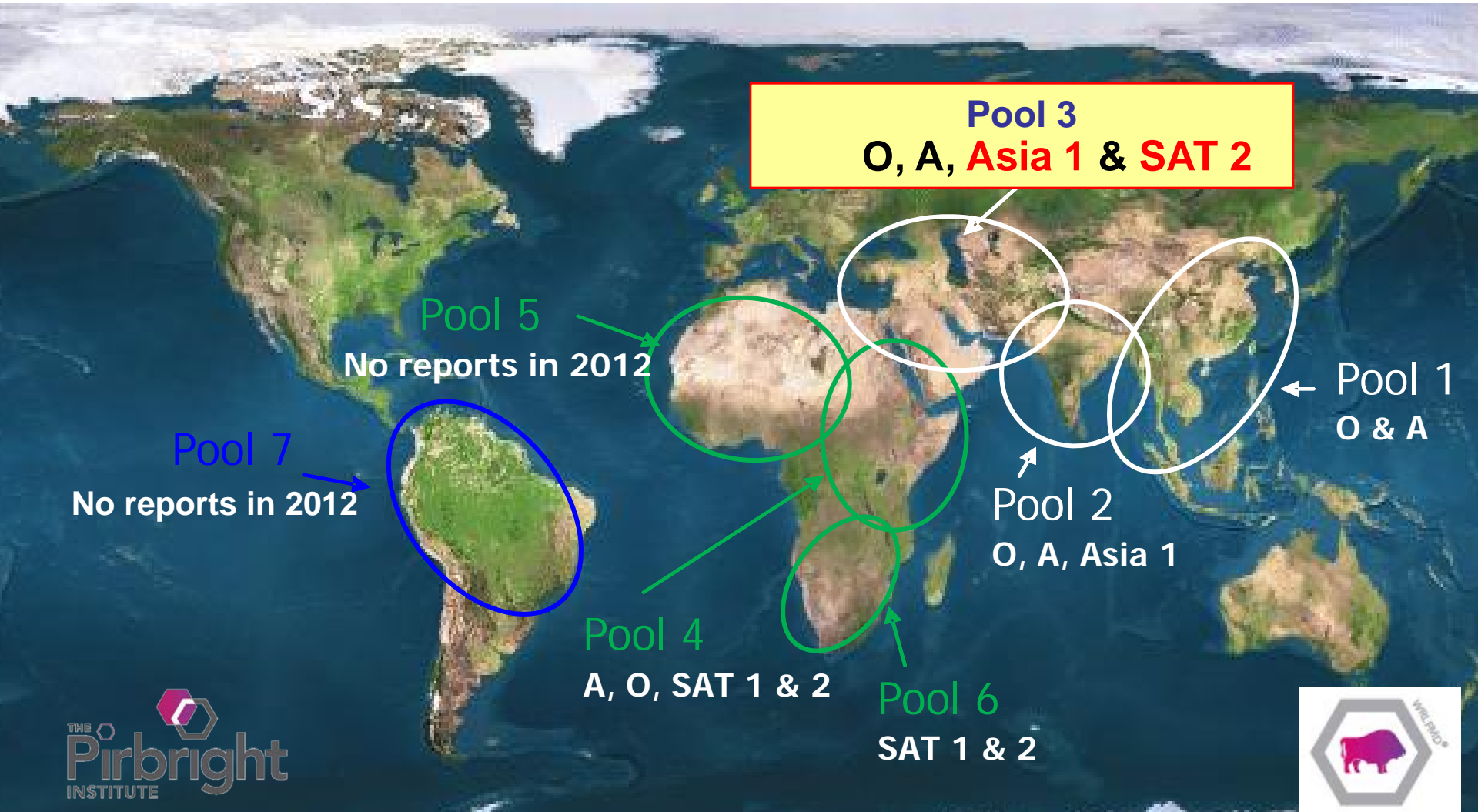
# WRLFMD® Regional Analysis- 2012

## Asia 1 and SAT 2 on the move



# WRLFMD® Regional Analysis- 2012

## What Else?



# Current FMD Threat Analysis: from reported incidence



## Serotype O- widespread circulation

- FMDV type O
- ME-SA topotype
- PanAsia-2 lineage
- FMDV type O
- SEA topotype
- Mya-98 lineage

Resurgence PanAsia 1 in Vietnam

## Serotype A- widespread circulation

- FMDV type A
- ASIA topotype
- Iran-05 lineage
- FMDV type A
- ASIA topotype
- other

## Serotype Asia 1 – limited circulation- BUT risk of further spread

- Reports from 6 countries in 2011 and 6 in 2012
- Pirbright Vaccine trial carried out for EU-
- High potency vaccine protected animals challenged with current isolate

## Serotypes SAT – restricted circulation




- Have not established outside of Africa
- But recent spread of SAT 2 into North Africa and Middle East being monitored

Serotype C - No reports of serotype C since 2004



# Current FMD Threat Analysis: Vaccine matching 2012

- Vaccine matching carried out on representative isolates from each submission
- 2dm VNT carried out with a variety of Merial, Intervet (MSD) and ARRIAH bovine vaccinal reference sera
- **~ 1200 individual tests carried out in 2012 by WRLFMD**
- Results presented as traffic light system

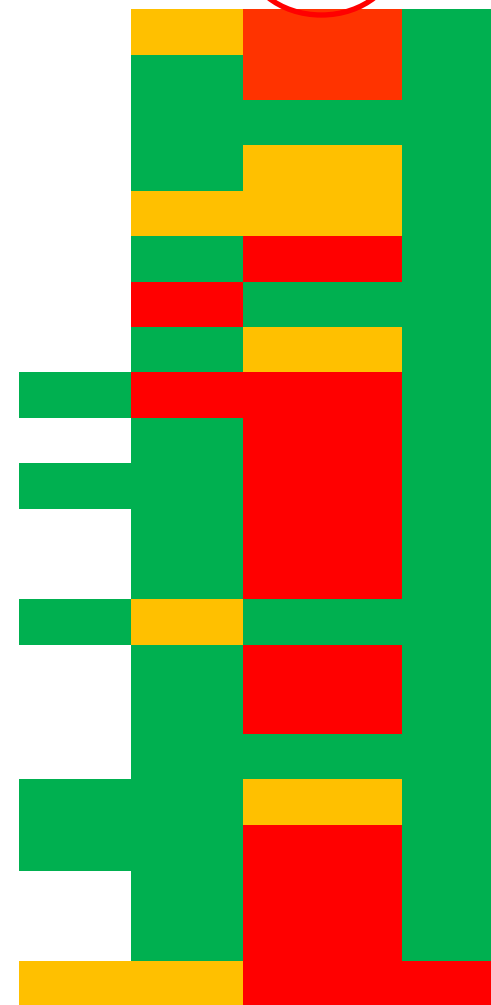
Result	WRLFMD® Pirbright vaccine matching by 2dm VNT
	Good match
	Some matches
	No match



# Current FMD Threat Analysis: Vaccine matching 2012

## Serotype O vaccine matching

Country of Origin	Serotype	Topotype	Lineage/strain	Sub Lineage	O 3039	O 4625	O Manisa	O PA2
Afghanistan	O	ME-SA	PanAsia-2	ANT-10	Yellow	Green	Red	Green
Bahrain	O	ME-SA	PanAsia-2	ANT-10	Green	Green	Red	Green
Congo	O	ME-SA	PanAsia	-	Green	Green	Green	Green
Egypt	O	ME-SA	PanAsia-2	-	Green	Yellow	Yellow	Green
Ethiopia	O	EA-3	-	-	Yellow	Yellow	Yellow	Green
Iran	O	ME-SA	PanAsia-2	ANT-10	Green	Green	Red	Green
	O	ME-SA	PanAsia-2	FAR-09	Red	Green	Green	Green
Israel	O	ME-SA	PanAsia-2	ANT-10	Green	Yellow	Yellow	Green
Japan	O	SEA	Mya 98	-	Green	Red	Red	Green
Kenya	O	EA-2	-	-	Green	Green	Red	Green
Kuwait	O	ME-SA	PanAsia-2	ANT-10	Green	Green	Red	Green
Libya	O	ME-SA	PanAsia-2	ANT-10	Green	Green	Red	Green
	O	EA-3	-	-	Green	Green	Red	Green
Malaysia	O	SEA	Mya-98	-	Green	Yellow	Green	Green
Kingdom Saudi Arabia	O	ME-SA	PanAsia-2	ANT-10	Green	Green	Red	Green
Sudan	O	EA-3	-	-	Green	Green	Red	Green
Thailand	O	SEA	Mya-98	-	Green	Yellow	Yellow	Green
	O	ME-SA	PanAsia	-	Green	Green	Red	Green
Turkey	O	ME-SA	PanAsia-2	ANT-10	Green	Green	Red	Green
UAE	O	ME-SA	PanAsia-2	ANT-10	Green	Green	Red	Green
Vietnam	O	ME-SA	PanAsia	-	Yellow	Yellow	Red	Green



# Current FMD Threat Analysis: Vaccine matching 2012

## Pool 1 Eastern Asia

### Serotype O vaccine matching

Country of Origin	Serotype	Topotype	Lineage/strain	Sub Lineage	O 3039	O 4625	O Manisa	O PA2
Malaysia	O	SEA	Mya-98	-	Green	Yellow	Green	Green
Thailand	O	SEA	Mya-98	-	Green	Green	Yellow	Green
	O	ME-SA	PanAsia	-	Green	Red	Red	Red
Vietnam	O	ME-SA	PanAsia	-	Yellow	Red	Red	Red

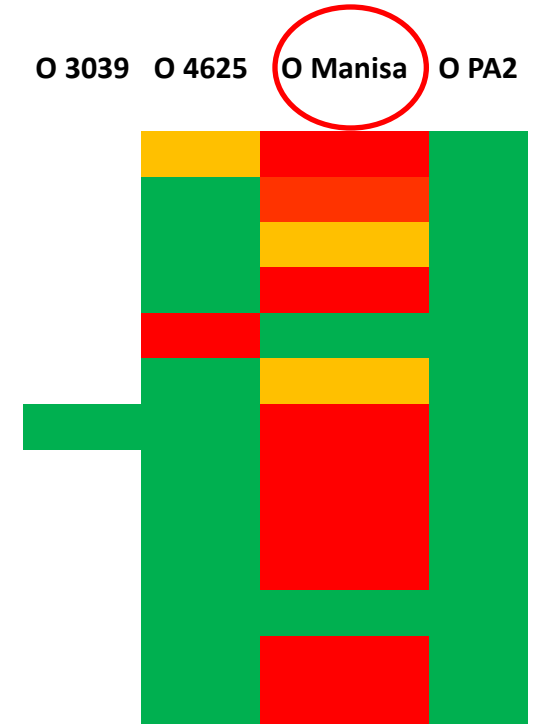


# Current FMD Threat Analysis: Vaccine matching 2012

## Pools 3 Eur-Asia (and 4 Eastern Africa)

### Serotype O vaccine matching

Country of Origin	Serotype	Topotype	Lineage/strain	Sub Lineage	O 3039	O 4625	O Manisa	O PA2
Afghanistan	O	ME-SA	PanAsia-2	ANT-10	Yellow	Red	Red	Green
Bahrain	O	ME-SA	PanAsia-2	ANT-10	Green	Orange	Red	Green
Egypt	O	ME-SA	PanAsia-2	-	Green	Yellow	Red	Green
Iran	O	ME-SA	PanAsia-2	ANT-10	Green	Red	Red	Green
	O	ME-SA	PanAsia-2	FAR-09	Red	Green	Green	Green
Israel	O	ME-SA	PanAsia-2	ANT-10	Green	Yellow	Red	Green
Kuwait	O	ME-SA	PanAsia-2	ANT-10	Green	Red	Red	Green
Libya	O	ME-SA	PanAsia-2	ANT-10	Green	Red	Red	Green
	O	EA-3	-	-	Green	Red	Red	Green
Kingdom Saudi Arabia	O	ME-SA	PanAsia-2	ANT-10	Green	Red	Red	Green
Sudan	O	EA-3	-	-	Green	Red	Red	Green
Turkey	O	ME-SA	PanAsia-2	ANT-10	Green	Red	Red	Green
UAE	O	ME-SA	PanAsia-2	ANT-10	Green	Red	Red	Green

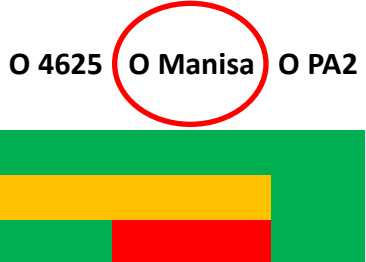


# Current FMD Threat Analysis: Vaccine matching 2012

## Pool 4 Eastern Africa

### Serotype O vaccine matching

Country of Origin	Serotype	Topotype	Lineage/strain	Sub Lineage	O 3039	O 4625	O Manisa	O PA2
Congo	O	ME-SA	PanAsia	-				
Ethiopia	O	EA-3	-	-				
Kenya	O	EA-2	-	-				

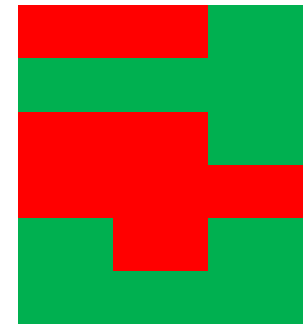


# Current FMD Threat Analysis: Vaccine matching 2012

## Pool 2/3 Eur-Asia

### Serotype A vaccine matching

Country of Origin	Serotype	Topotype	Lineage/strain	Sub Lineage	A	A	A	A	A
					Eri 98	Saudi 95	A22	Iran 05	Tur 06
Afghanistan	A	Asia	Iran-05	HER-10					
Iran	A	Asia	Iran-05	SIS-10					
	A	Asia	Iran-05	HER-10					
	A	Asia	Iran-05	AFG-07					
Pakistan	A	Asia	Iran-05	HER-10					
Turkey	A	Asia	Iran-05	SIS-10					



	Good match
	Some matches
	No match

# Current FMD Threat Analysis: Vaccine matching 2012

## Pool 4 Eastern Africa

### Serotype A vaccine matching

Country of Origin	Serotype	Topotype	Lineage/ strain	Sub Lineage	A	A	A	A	A
					Eri 98	Saudi 95	A22	Iran 05	Tur 06
Congo	A	Africa	G-I	-	Good match	No match	Good match	Some matches	Good match
Egypt	A	Africa	G-IV	-	No match	No match	No match	No match	Good match
Yemen	A	Asia	Iran-05	BAR-08	No match	No match	No match	No match	Good match
Sudan	A	Africa	G-IV	-	Some matches	No match	No match	No match	Good match

	Good match
	Some matches
	No match

# Current FMD Threat Analysis: Vaccine matching 2012

## Pool 1 Eastern Asia

### Serotype A vaccine matching

Country of Origin	Serotype	Topotype	Lineage/strain	Sub Lineage	A	A	A	A	A
					Eri 98	Saudi 95	A22	Iran 05	Tur 06
Malaysia	A	Asia	Sea-97	-					
Thailand	A	Asia	Sea-97	-					



	Good match
	Some matches
	No match



# Current FMD Threat Analysis: Vaccine matching 2012

## Pool 2/3 Eur-Asia

### Serotype Asia 1 vaccine Matching


Country of Origin	Serotype	Topotype	Lineage/strain	Asia 1 India	Asia 1 Shamir	Asia 1 Shamir >6PD50
Afghanistan	Asia 1	Asia	Sindh-08	[Red]	[Green]	[Green]
Iran	Asia 1	Asia	Sindh-08		[Yellow]	[Green]
Pakistan	Asia 1	Asia	Sindh-08		[Green]	[Green]
Turkey	Asia 1	Asia	Sindh-08		[Green]	[Green]

[Green]	Good match
[Yellow]	Some matches
[Red]	No match

# Current FMD Threat Analysis: Vaccine matching 2012

## SAT Serotypes Vaccine Matching

### Pool 4 Eastern Africa




Country of Origin	Serotype	Topotype	SAT 1 Rho
Kenya	SAT 1	I (NWZ)	

### Pool 3 Eur-Asia Pool 4 Eastern Africa

Bahrain	SAT 2	IV
Egypt	SAT 2	VII
Kenya	SAT 2	IV
Libya	SAT 2	VII
PAT	SAT 2	VII
Sudan	SAT 2	VII
Tanzania	SAT 2	IV

SAT 2 Zim SAT 2 Eri



	Good match
	Some matches
	No match

# Vaccine Recommendations (National & European Antigen Banks)

## HIGH PRIORITY

O Manisa\*  
O PanAsia -2\*  
O BFS or Campos  
A-Iran-05  
A24 Cruzeiro  
A22 Iraq  
Asia 1 Shamir\*  
SAT 2 Saudi Arabia (or equivalent - SAT 2 Eritrea)

\* or additional  
strain

## MEDIUM PRIORITY

A Argentina 01  
A Iran 96  
A Iran 99  
A Eritrea  
A Iran 87 or A Saudi Arabia 23/86 (or equivalent)  
A Malaysia 97 (or Thai equivalent such as A/Sak/97)\*  
O Taiwan 97 (pig-adapted strain or Philippine equivalent)\*  
SAT 1 South Africa  
SAT 2 Zimbabwe

## LOW PRIORITY

A15 Bangkok related strain  
A Kenya  
A87 Argentina related strain  
SAT 1 Kenya  
SAT 2 Kenya  
SAT 3 Zimbabwe  
C Noville

Within category: not in order of importance



OIE/FAO  
Foot-and-Mouth Disease  
Reference Laboratories  
Network



## Report of the 8<sup>th</sup> OIE/FAO FMD Reference Laboratory Network Meeting 1<sup>st</sup> -2<sup>nd</sup> November 2012

Jerez De La Frontera, Spain.

Dr. Jef Hammond, The Pirbright Institute, Pirbright, UK





## Issues Raised During the Meeting

- FMD global problem
  - Some obvious information gaps but improving the information exchange between the network members through more face to face meetings
  - Still need more 'real time' information from India and China.
  - Much of the work reported by the network still comes through Pirbright WRLFMD
  - How can we improve submissions to and facilitate sample exchange with other network labs in 2013?
  - How will the network integrate with the OIE/FAO global control plan?
- Vaccine matching comes up time and time again as a problem area
  - *Methodologies*
  - *Interpretation*
  - *Delivery of results and advice to decision makers*
  - *We need to address this as a network of experts*



## Draft Workplan for 2013

- Prepare network report for 2012 – all information to Jef Hammond by 16<sup>th</sup> January 2013
- Continue with workplan items from 2012
- Vaccination and assessing herd immunity
  - Continue progress with PVM working group and prepare draft document for network review-Samia Metwally- FAO and Susanne Munstermann-OIE
- Extend vaccine matching review at both global and regional levels
  - *Literature*
  - *Methodologies*
  - *Interpretation*
  - Rossana Allende PAHO/Yanmin Li Pirbright and others tbd
- Carry out vaccine matching PTS in 2013- Yanmin Li and Jef Hammond Pirbright
- Support and progress Open FMD initiative- All



# WRLFMD Summary

[www.wrlfmd.org](http://www.wrlfmd.org)

- A major combined effort both National and Global is needed for control
- Accurate & Timely disease information is vital
- The FMD Reference Laboratory Network provides the Engine Room for the Global Control Initiative

**Pirbright designated global coordinating lab for OIE/FAO GCP**



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