

PPR: SPREAD OF THE DISEASE FROM “STABLE” AREAS

Global Workshop on the World Animal Health Information System (WAHIS) for recently appointed
National Focal Points for Animal Disease Notification to the OIE
Shenzhen, China, 13th March 2018

Tizzani Paolo – Veterinary epidemiologist



WORLD ORGANISATION FOR ANIMAL HEALTH
Protecting animals, preserving our future

Introduction



- One of the priority diseases in the FAO – OIE (GF-TADs)
- The Global Strategy for the eradication of PPR by 2030 was adopted in March 2015
- PPR present for many years in Central African countries, the Middle East and South-West Asia

Introduction

- Since 2007, the disease has spread further Africa: Morocco (2008), Algeria (2011) and Tunisia (2011),
- Asia: China (2007), Bhutan (2010), Tajikistan (2013)
- Europe: Georgia (2016).

OIE Member Countries' official status 2015 for PPR

- > The World Animal Health Information System
- > WAHIS-Wild Interface
- > World Animal Health
- > The WAHIS+ project
- > Official disease status
 - > Official recognition policy and procedures
 - > FMD
 - > Rinderpest
 - > BSE
 - > CBPP
 - > African horse sickness
 - > [Peste des petits ruminants](#)
 - > Classical Swine Fever
- > Self-declared disease status
- > Avian Influenza Portal
- > FMD Portal
- > BSE Portal
- > BSE situation in the world and annual incidence rate
- > Rabies Portal
- > PPR Portal

- + List of PPR free Member Countries
- + Suspension/reinstatement of status
- + Questionnaire for PPR free status
- + Form for annual reconfirmation

- + Questionnaire for PPR official control programme
- + Form for annual reconfirmation of PPR official control programme

GENERAL INFORMATION

- + Disease cards


List of PPR free Member Countries


According to [Resolution No. 28](#) (85th General Session of World Assembly, May 2017)

+ PPR free Member Countries

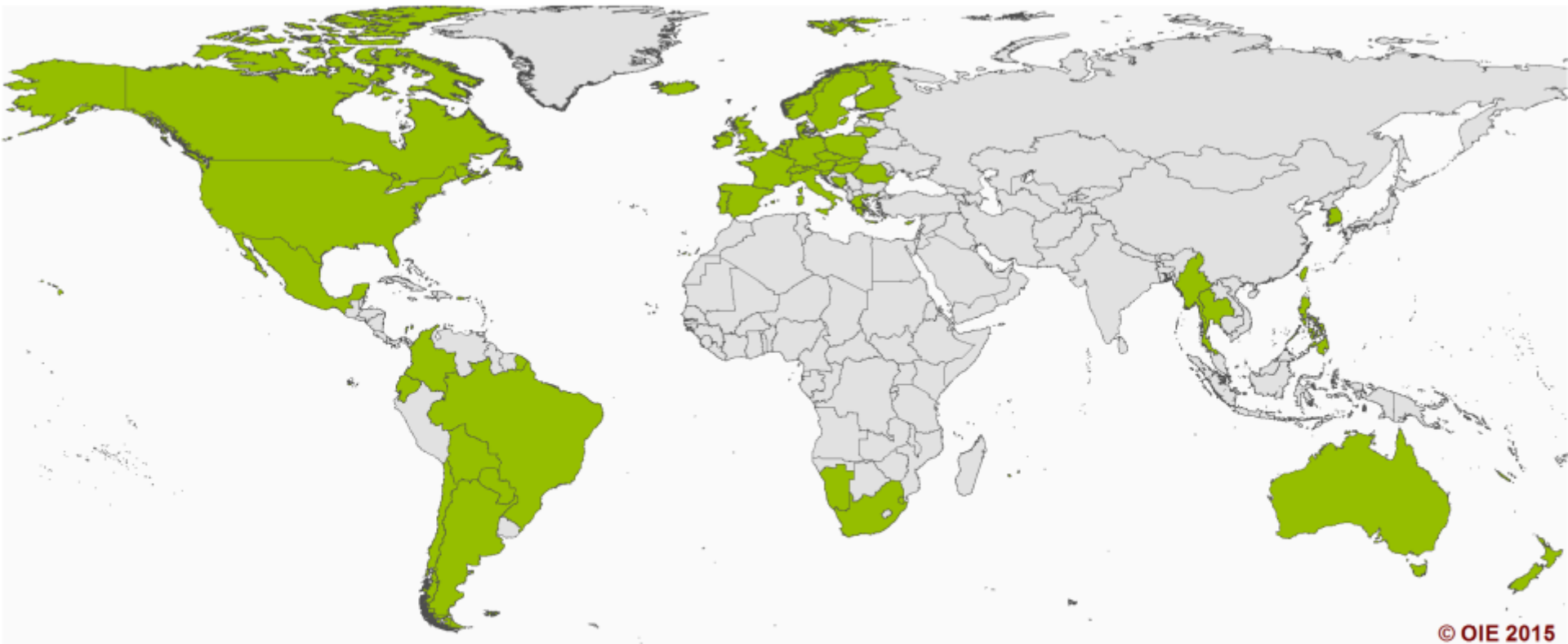
Member Countries recognised as **free from PPR** according to the provisions of Chapter 14.7. of the [Terrestrial Code](#) :

Argentina	Denmark	Lithuania	Romania
Australia	Ecuador	Luxembourg	Singapore
Austria	Estonia	Malta	Slovakia
Belgium	Finland	Mauritius	Slovenia
Bolivia	France	Mexico	South Africa
Bosnia and Herzegovina	Germany	Myanmar(1)	Spain
Botswana	Greece	New Caledonia	Swaziland
Brazil	Hungary	New Zealand	Sweden
Canada	Iceland	Norway	Switzerland
Chile	Ireland	Paraguay	Thailand
Chinese Taipei	Italy	Philippines	The Netherlands
Colombia	Korea (Rep. of)	Poland	United Kingdom
Cyprus	Latvia	Portugal	United States of America
Czech Republic	Liechtenstein		

> OIE world conferences 

> Documentary database 

OIE Member Countries' official status 2015 for PPR

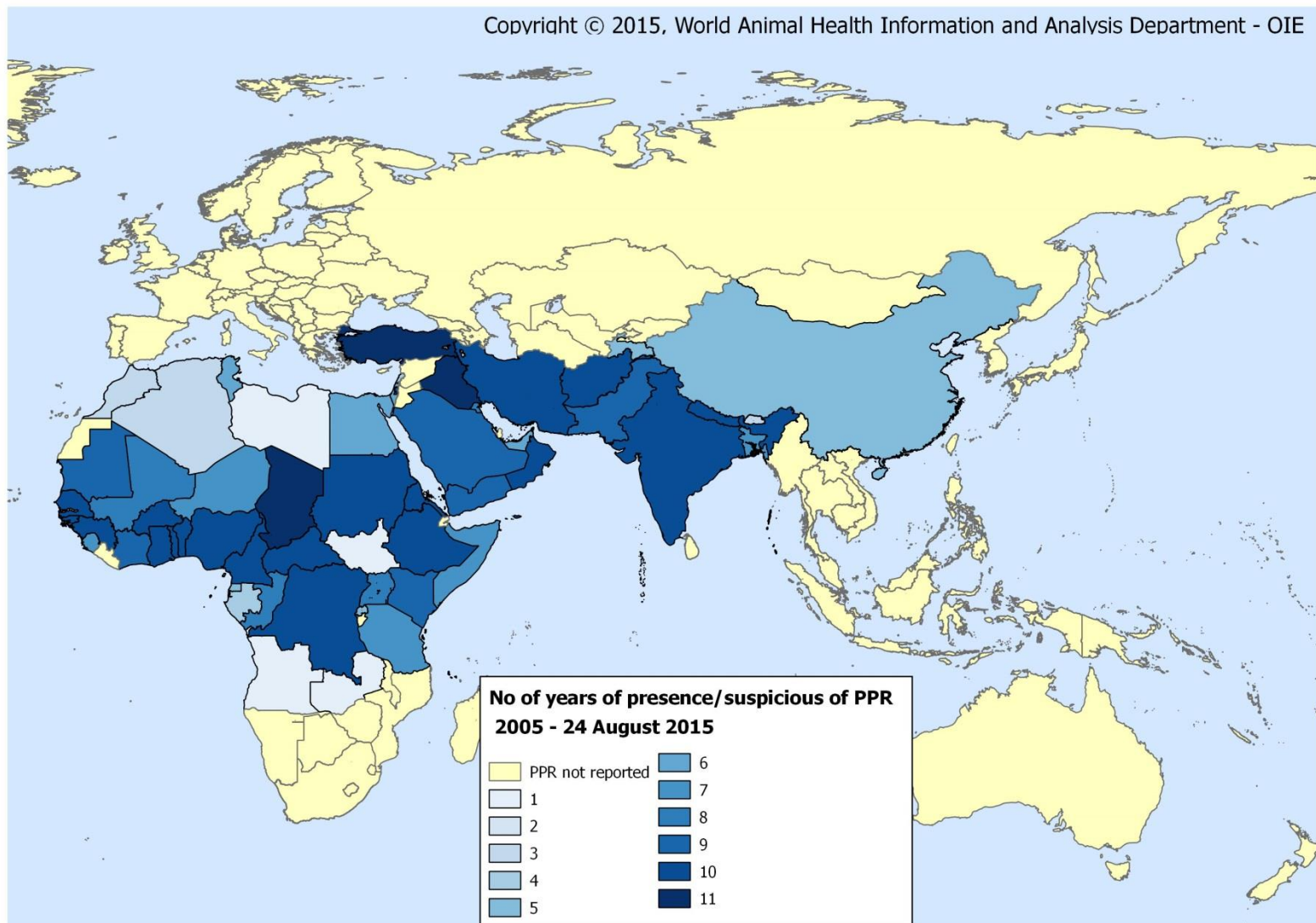


© OIE 2015

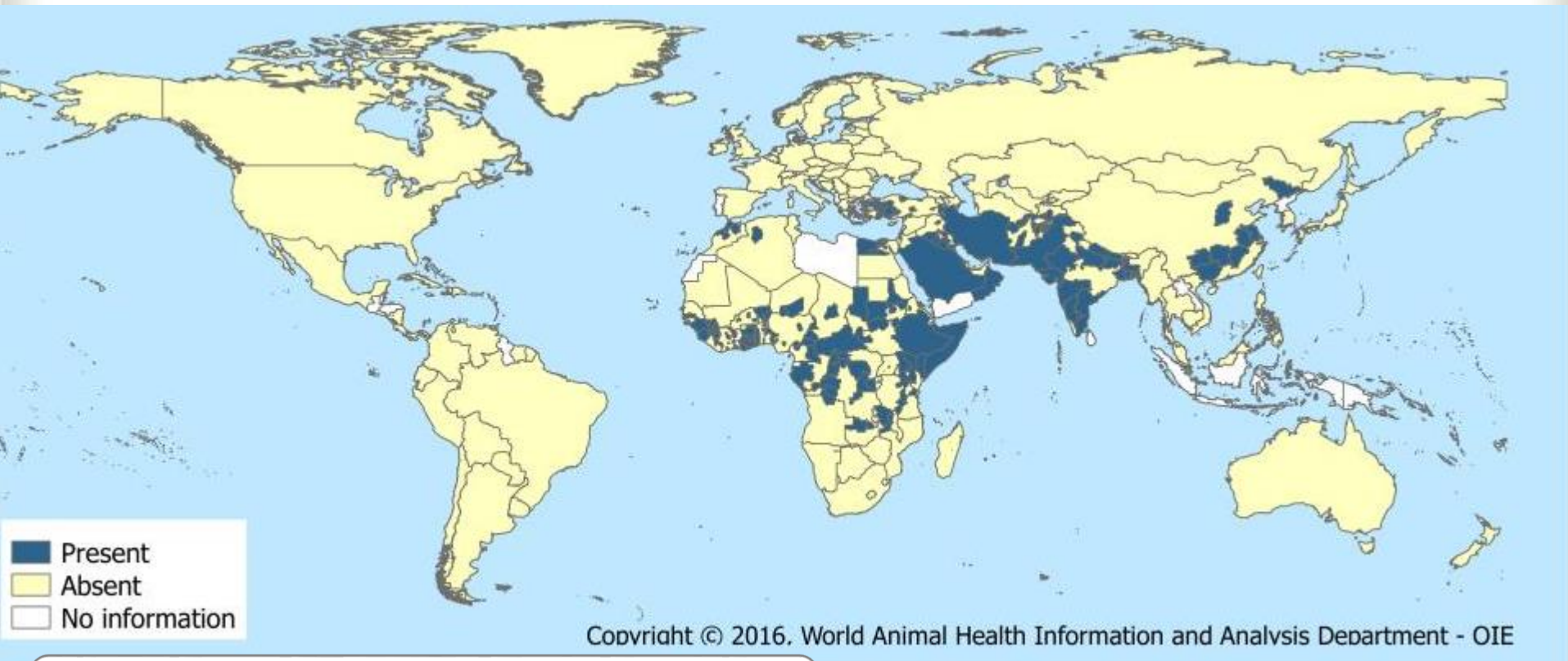
- Member Countries/zones recognised as free from PPR
- Countries with no OIE official status for PPR

Distribution of infection with peste des petits ruminants virus in the period between 2005 and 2015

Copyright © 2015, World Animal Health Information and Analysis Department - OIE



Distribution of PPR in 2015 and early 2016



28% countries/territories

Analysis of WAHIS data

Global level



Geographical range of PPR increased in recent years?

Methodology



Presence of PPR: temporal trend since 2005

Evolution of the epidemiological situation in the period
2005 – 2015 by mean of



Occurrence trend



Percentage of countries/territories reporting the disease
present

% of the reporting countries/territories for each semester between 2005 and 2015 that notified PPR present

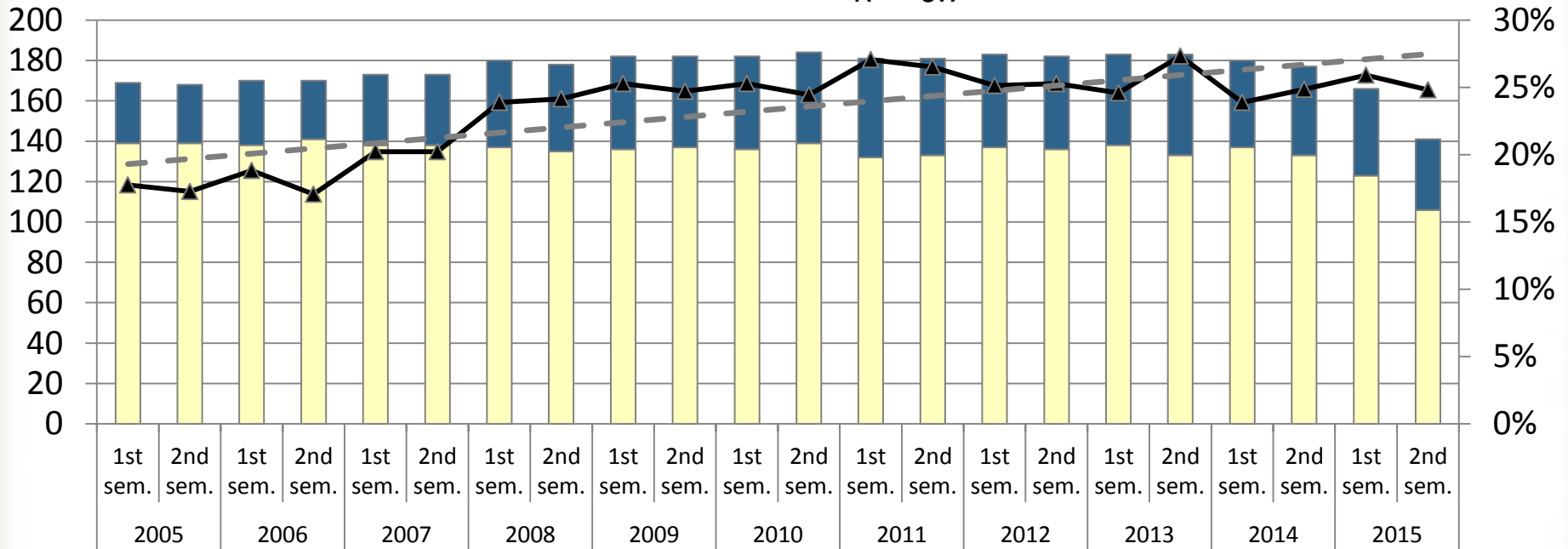


Number of countries

% affected countries

$$y = 0.0045x + 0.1846$$

$$R^2 = 0.7$$



- Countries reporting the disease absent
- Countries reporting the disease present
- ▲ % affected reporting countries

Increasing trend

Methodology



Presence of PPR: spatial trend since 2005

Evolution of the epidemiological situation in the period
2005 – 2015 by mean of



Spatial trend



Spread of the disease from the stable areas to new areas

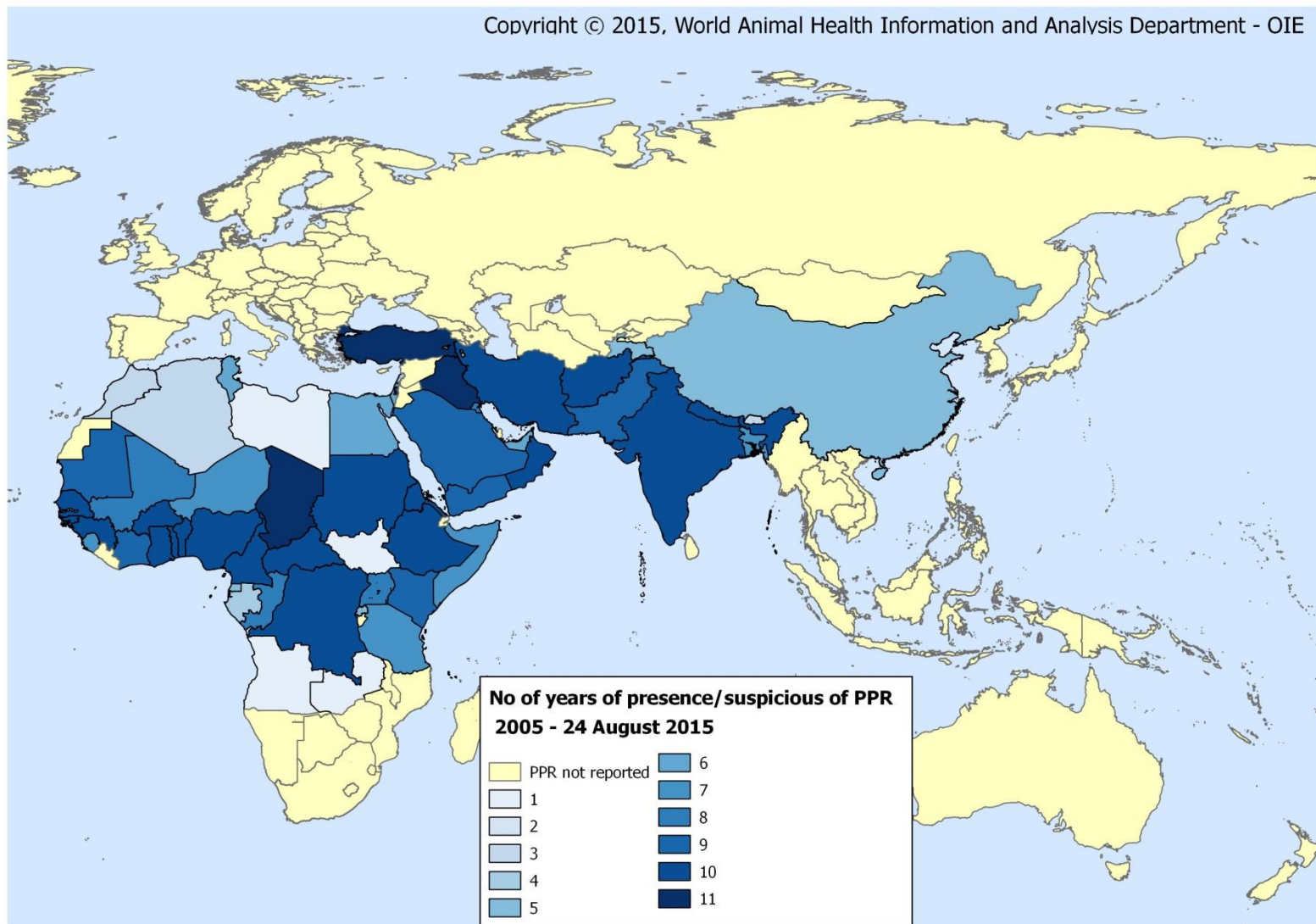


Geostatistical approach

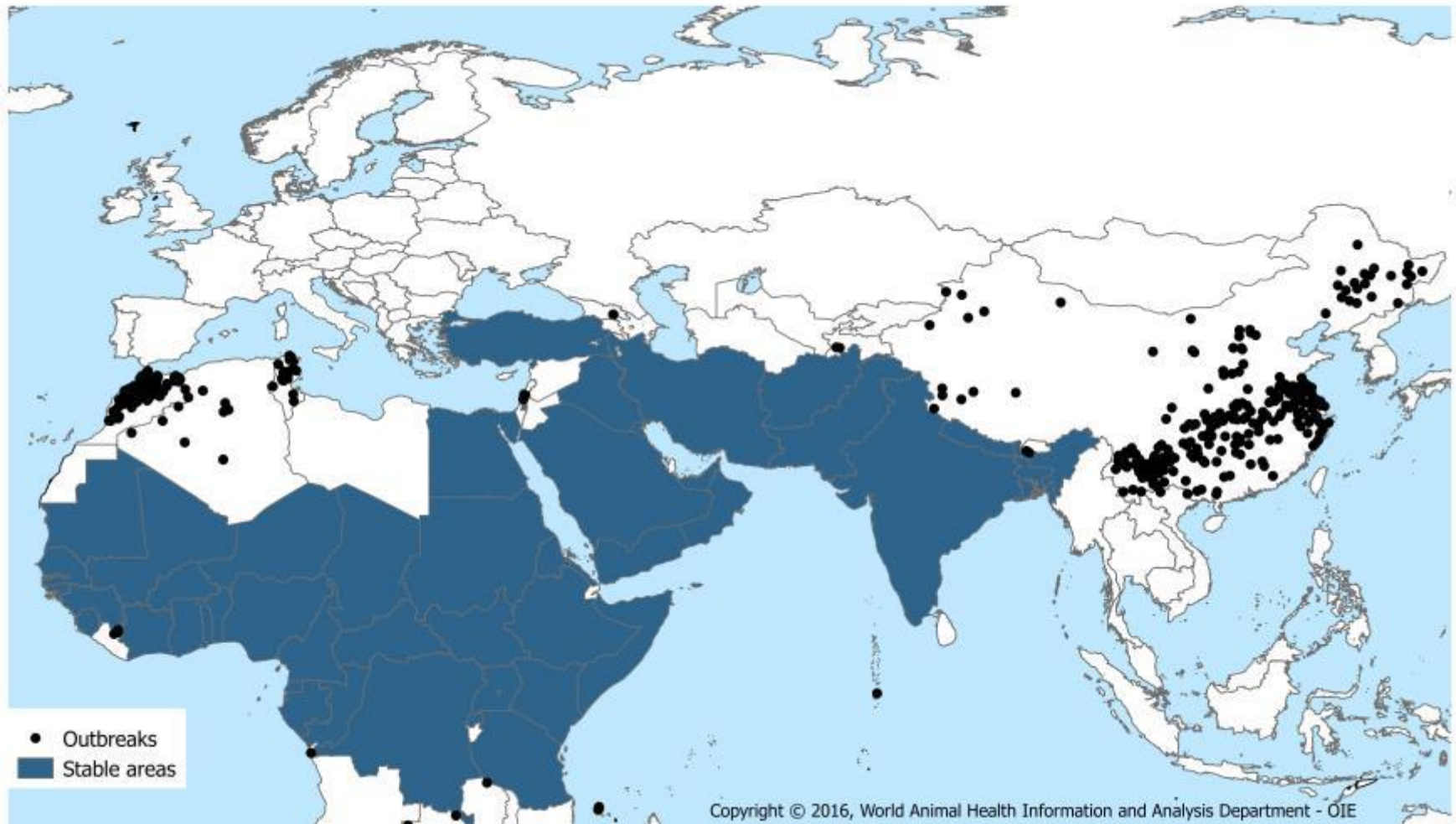


Distribution of infection with peste des petits ruminants virus in the period between 2005 and 2015

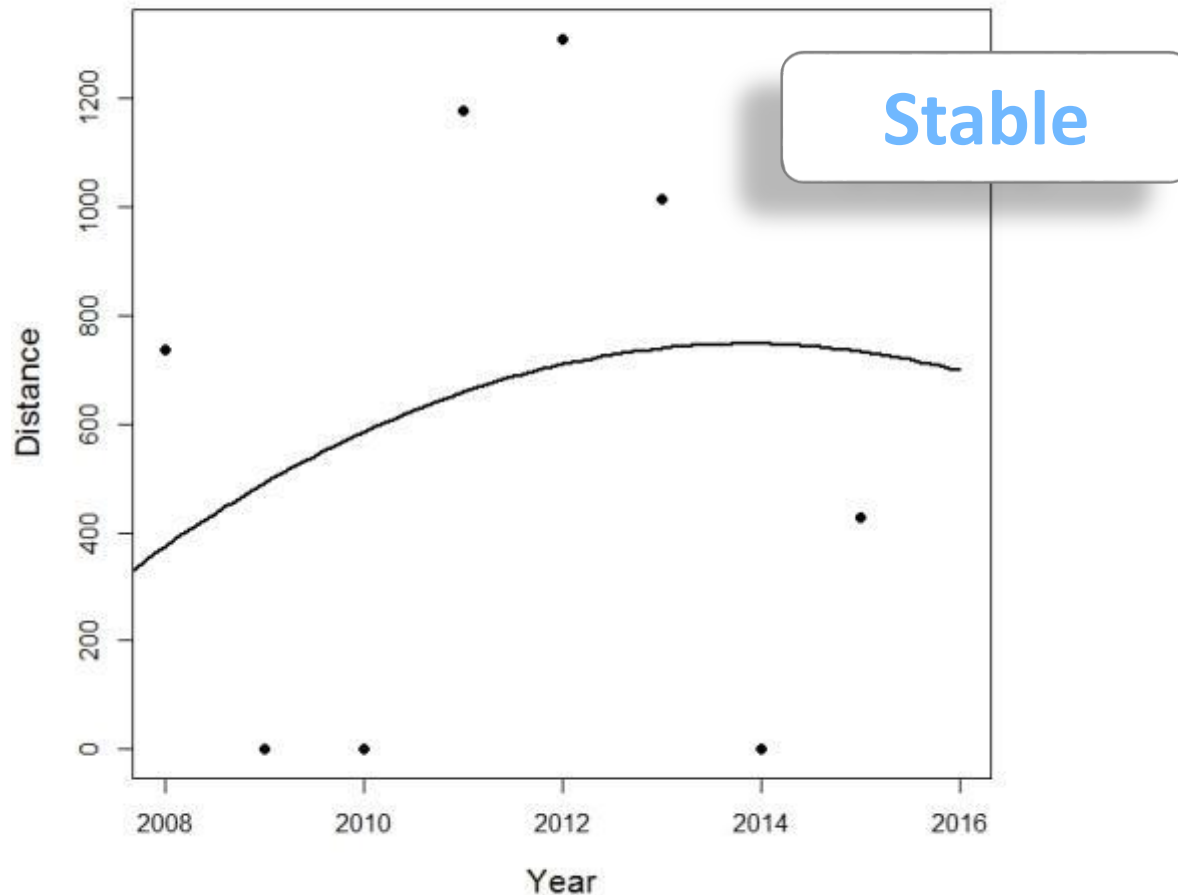
Copyright © 2015, World Animal Health Information and Analysis Department - OIE



Spatial distribution of the PPR outbreaks used for the spread analysis

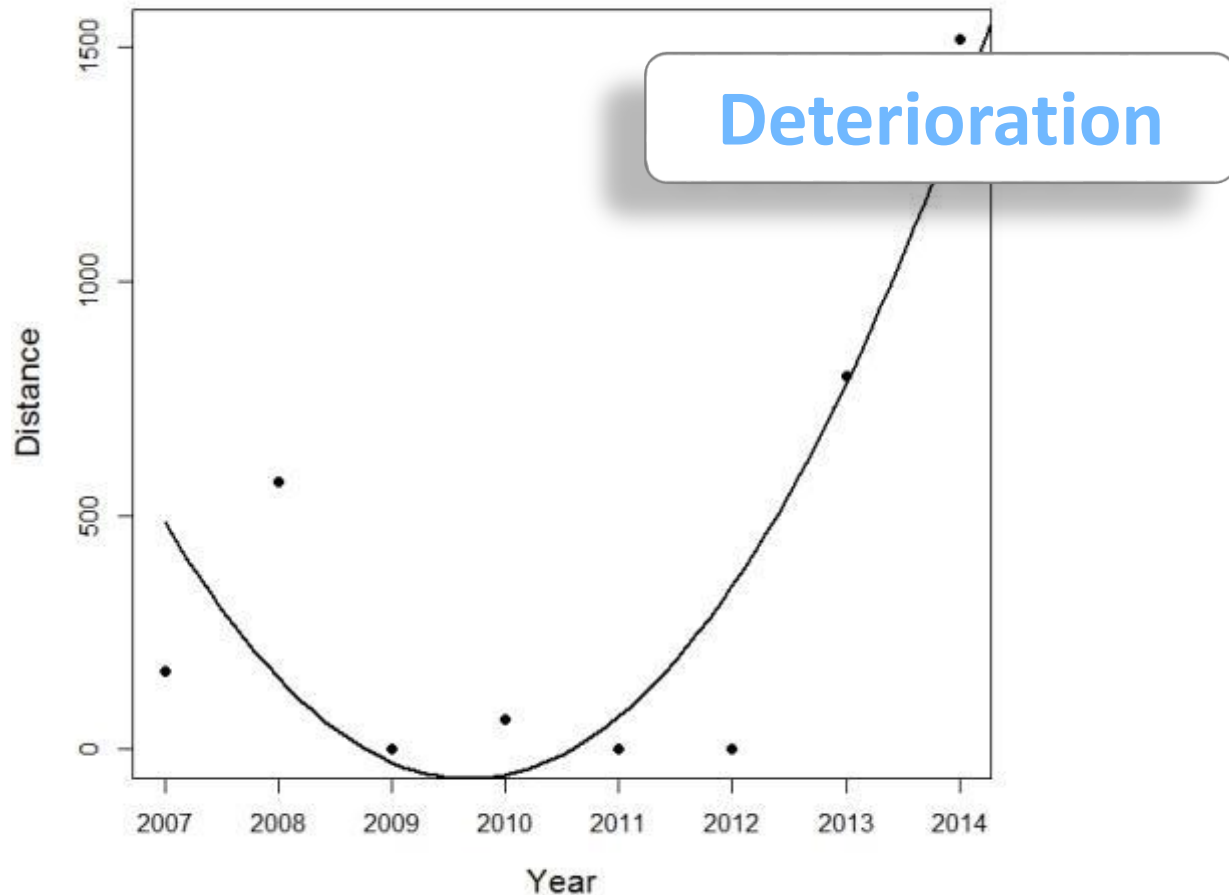


Regional spatial trends of the outbreaks in Africa



P-value n.s.
R²=0.3

Regional spatial trends of the outbreaks in Asia



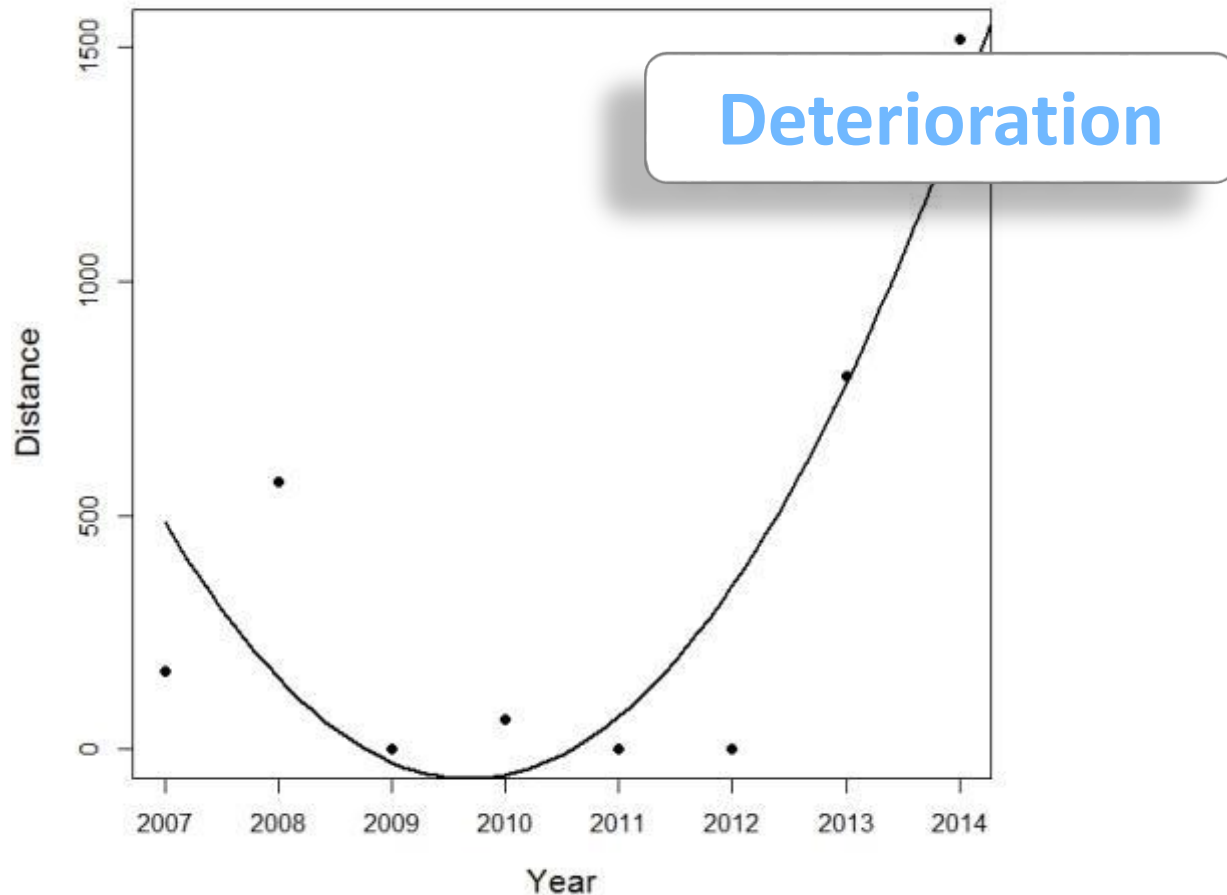
P-value<0.05

*R*²=0.7

Conclusion

- The **global spread of PPR** beyond its traditional range is alarming, above all for the outbreaks that border free countries
- **Big regional differences** between Africa and Asia
- Results of the analysis indicate the **epidemiological picture at T0** (reference condition for the Global Strategy for the control and eradication of PPR)

Regional spatial trends of the outbreaks in Asia



P-value<0.05

*R*²=0.7

Analysis of WAHIS data Regional level

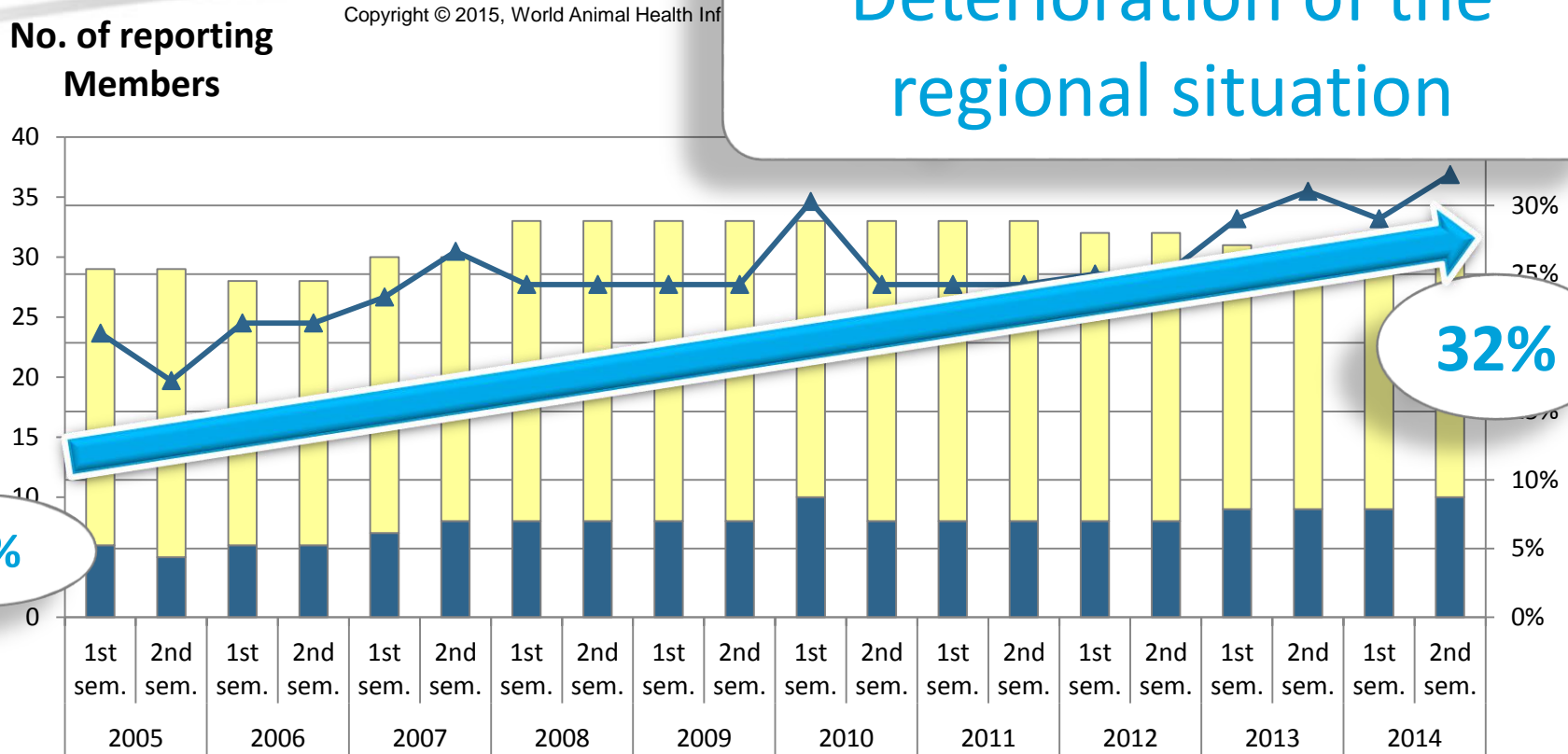


The spread of PPR in Asia in recent years:
analysis of temporal, spatio-temporal and
economic trends

1. Temporal Trends

% of Members in Asia, the Far East and Oceania reporting infection with PPR virus, between 2005 and 2014

Deterioration of the regional situation



21%

32%

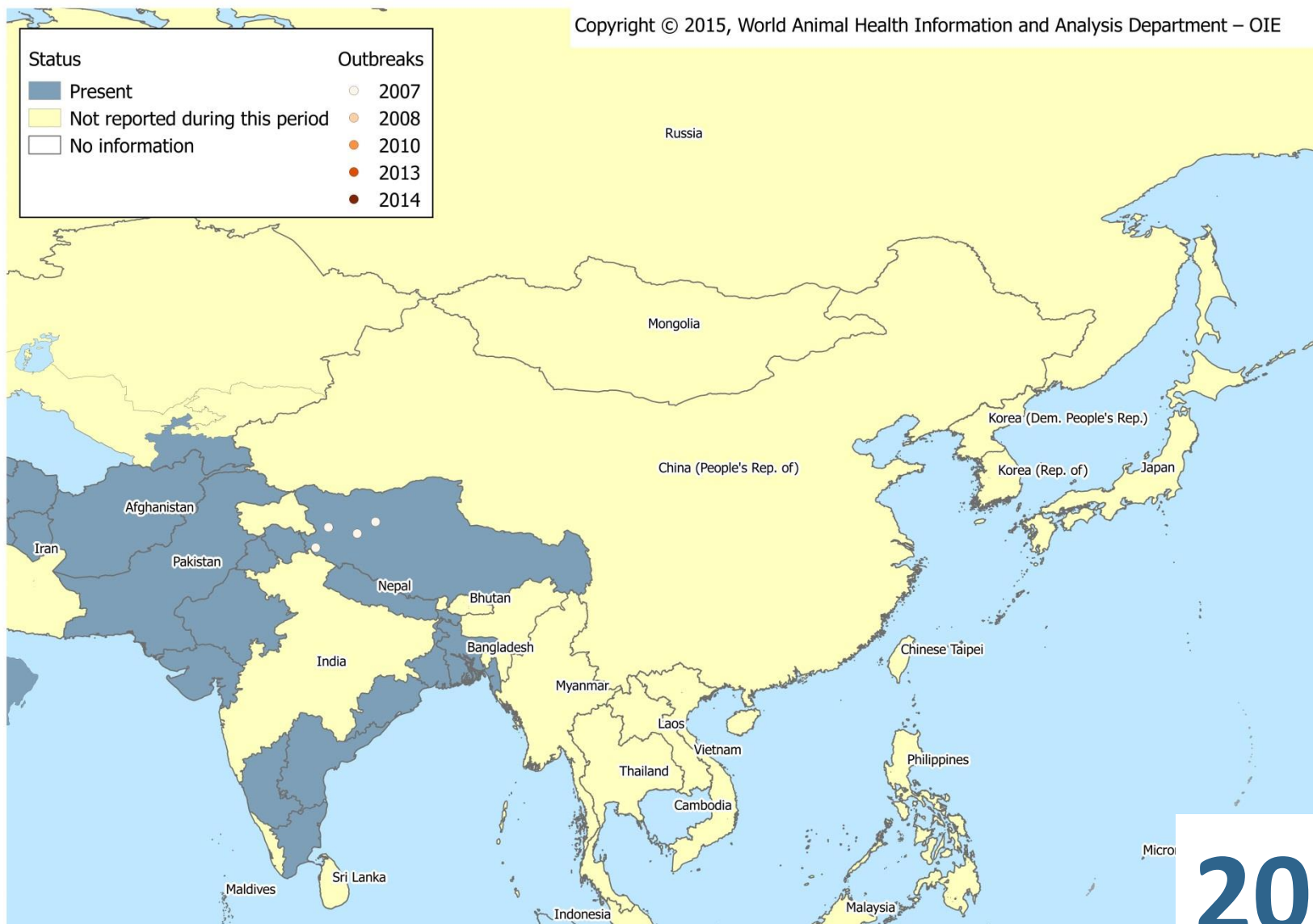
- Members reporting the disease absent
- Members reporting the disease present
- % Affected reporting Members

Spearman's rank correlation test underlines ($S = 48.29$, $p\text{-value} = 0.02$; $\rho = 0.7$)

2. Spatio-temporal Trends

Distribution of infection with PPR virus reported between 2007 and 2014, in Asia, the Far East and Oceania

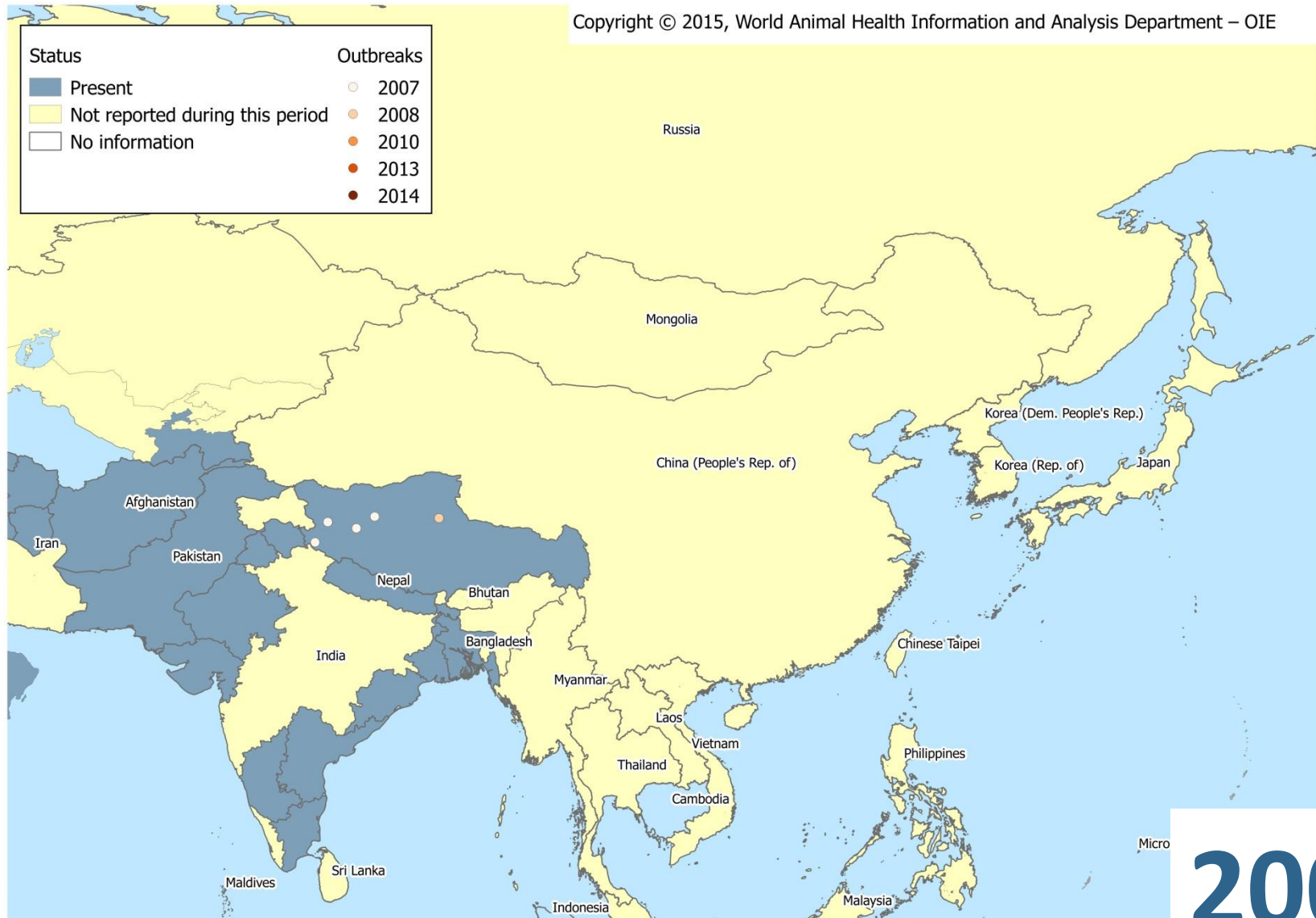
Copyright © 2015, World Animal Health Information and Analysis Department – OIE



2007

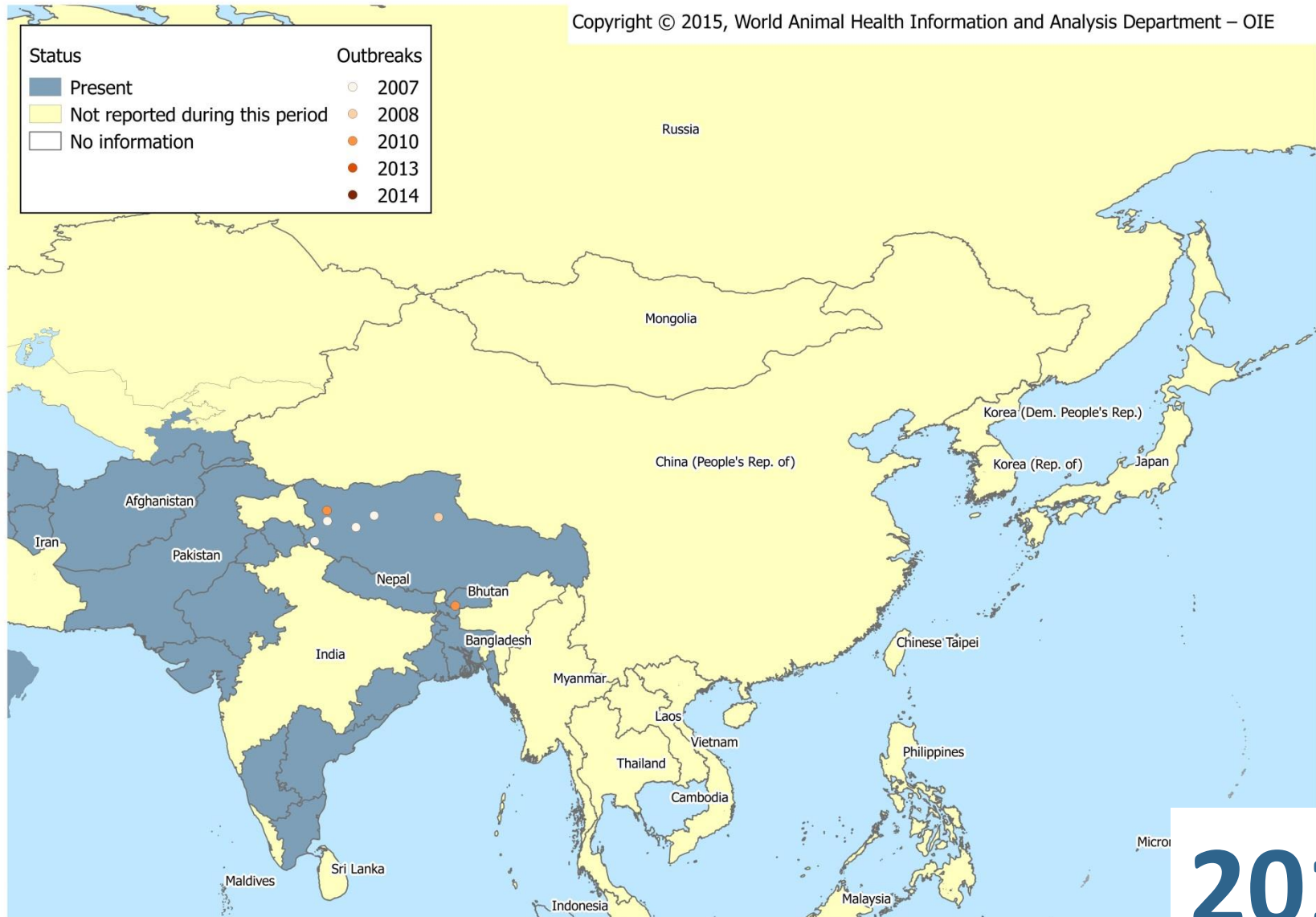
Distribution of infection with PPR virus reported between 2007 and 2014, in Asia, the Far East and Oceania

Copyright © 2015, World Animal Health Information and Analysis Department – OIE



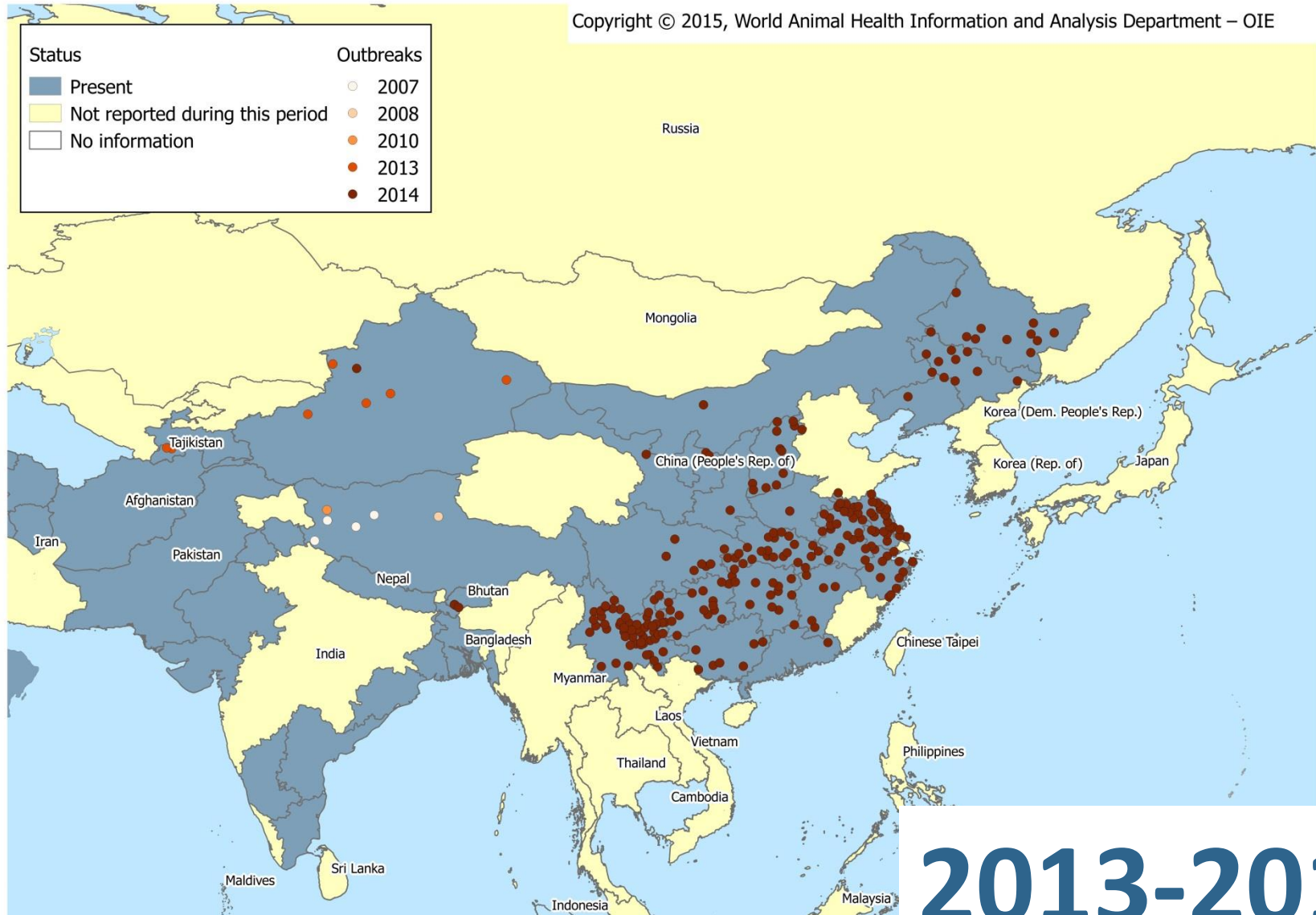
2008

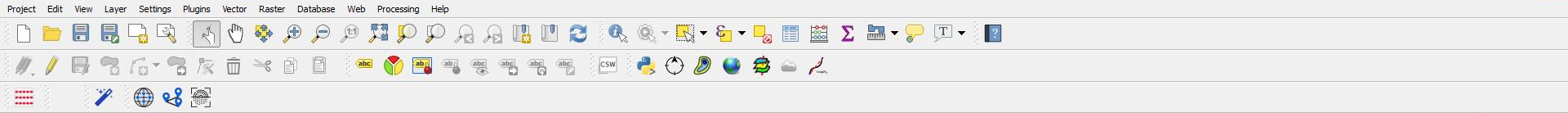
Distribution of infection with PPR virus reported between 2007 and 2014, in Asia, the Far East and Oceania



2010

Distribution of infection with PPR virus reported between 2007 and 2014, in Asia, the Far East and Oceania



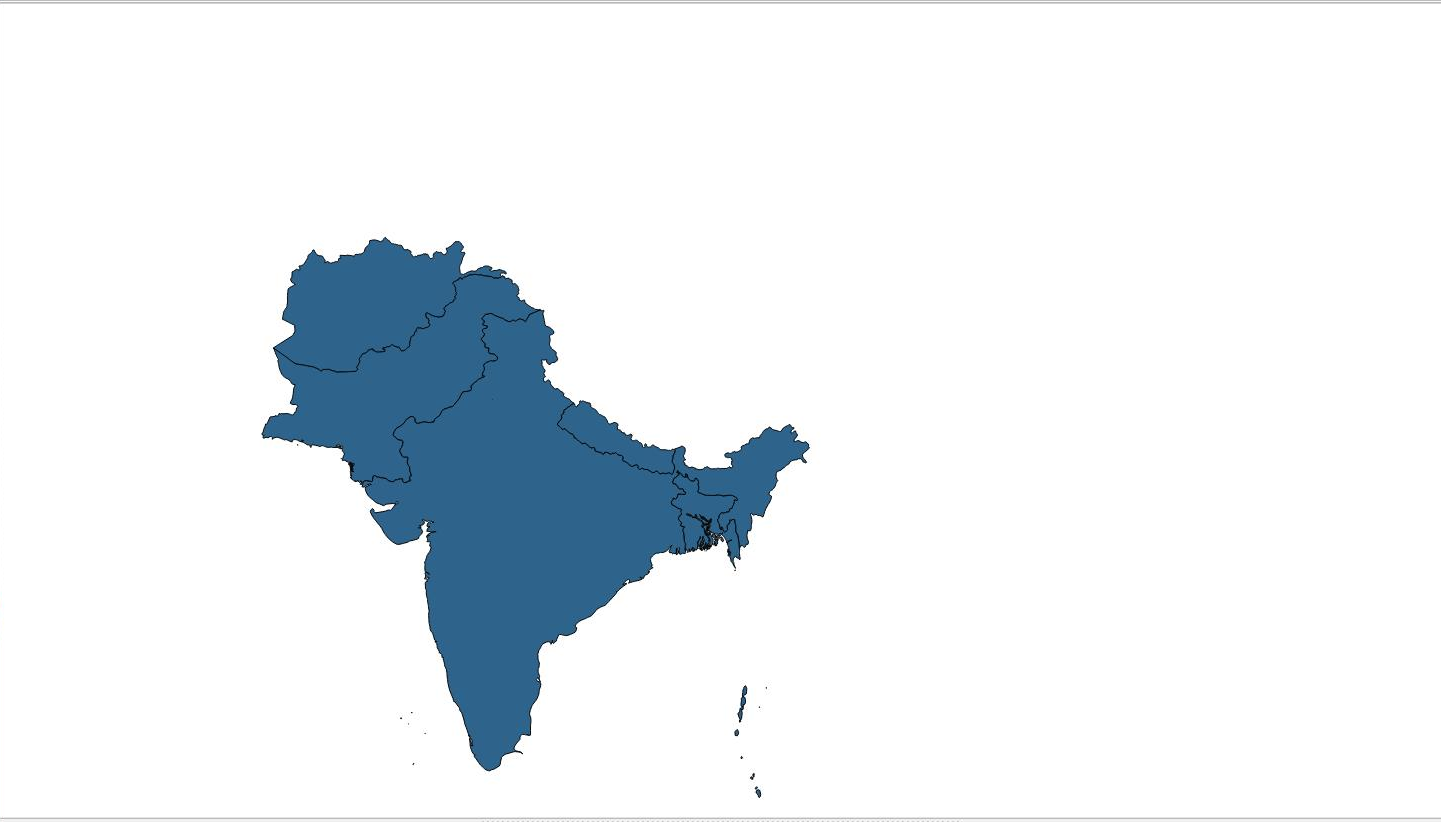


Browser Panel

- Project home
- Home
- Favourites
- C:/
- D:/
- E:/
- F:/
- H:/
- I:/
- S:/
- X:/
- Y:/
- DB2
- MSSQL
- Oracle
- PostGIS
- SpatiaLite
- ArcGISFeatureServer
- ArcGISMapServer
- OWS
- WCS
- WFS
- WMS

Layers Panel

- Endemic_Asi...
- Endemic_Asi...**
- IN_MiddleEas...



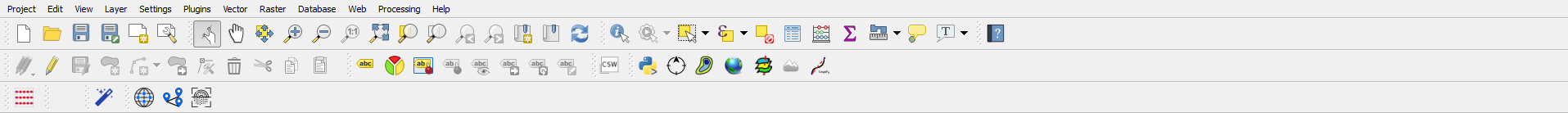
Processing Toolbox

Search...

- Recently used algorithms
 - Mean coordinate(s)
 - Clip
 - Interpolate (Nearest Neighbor)
 - Kriging with model selection
 - Kernel density estimation
 - Interpolate (Inverse distance wei...
- AniMove [4 georalgorithms]
- GDAL/OGR [45 georalgorithms]
- GRASS commands [160 georalgorithms]
- GRASS GIS 7 commands [148 gealgo...
- Models [0 georalgorithms]
- Orfeo Toolbox (Image analysis) [83 g...
- QGIS georalgorithms [103 gealgorith...
- R scripts [2 georalgorithms]
- Scripts [0 georalgorithms]

Log Messages Panel

General	Plugins	Python warning	Processing	OGR
2018-03-09T18:08:50	1	Data source is invalid		
2018-03-09T18:09:25	1	Data source is invalid		

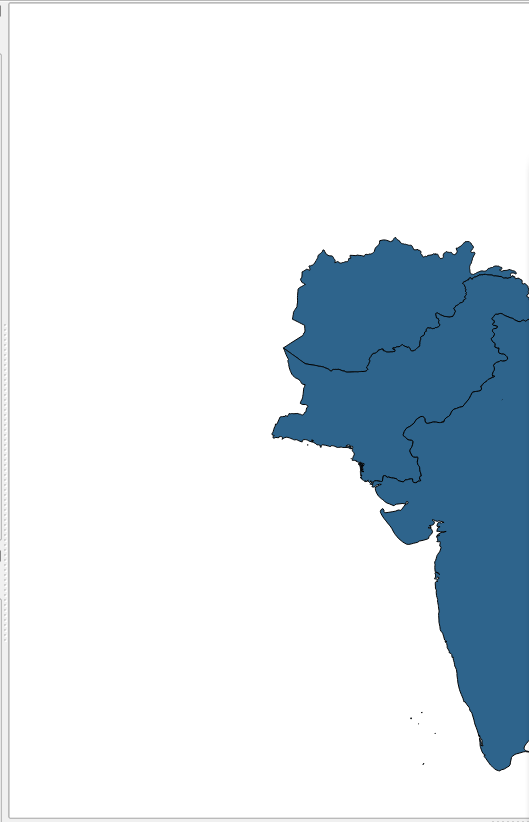


Browser Panel

- Project home
- Home
- Favourites
- C:/
- D:/
- E:/
- F:/
- H:/
- I:/
- S:/
- X:/
- Y:/
- DB2
- MSSQL
- Oracle
- PostGIS
- SpatiaLite
- ArcGISFeatureServer
- ArcGISMapServer
- OWS
- WCS
- WFS
- WMS

Layers Panel

- Endemic_Asi...
- Endemic_Asi...**
- IN_MiddleEas...



General Plugins Python warning Processing OGR

2018-03-09T18:08:50 1 Data source is invalid
 2018-03-09T18:09:25 1 Data source is invalid

Processing Toolbox

Search...

Recently used algorithms

- Mean coordinate(s)
- Clip
- Interpolate (Nearest Neighbor)
- Kriging with model selection
- Kernel density estimation
- Interpolate (Inverse distance weighting)

Endemic_Asia_UTM46N :: Features total: 5, filtered: 5, selected: 0

	I_2_name	I_3_name	area	createdon	endemic_ar	endemic_1	endemic_2	endemic_3	endemic_4	endemic_5	dist
1	Afghanistan	Afganistán	645560.26	2015-03-03			21	21	95,45%	Yes	1
2	Pakistan	Pakistán	871952.60	2015-03-03			21	21	95,45%	Yes	1
3	Bangladesh	Bangladesh	136505.81	2015-03-03			17	17	77,27%	Yes	1
4	Inde	India	3153589.38	2015-03-03			21	21	95,45%	Yes	1
5	Népal	Nepal	147723.11	2015-03-03			22	22	100,00%	Yes	1

Show All Features

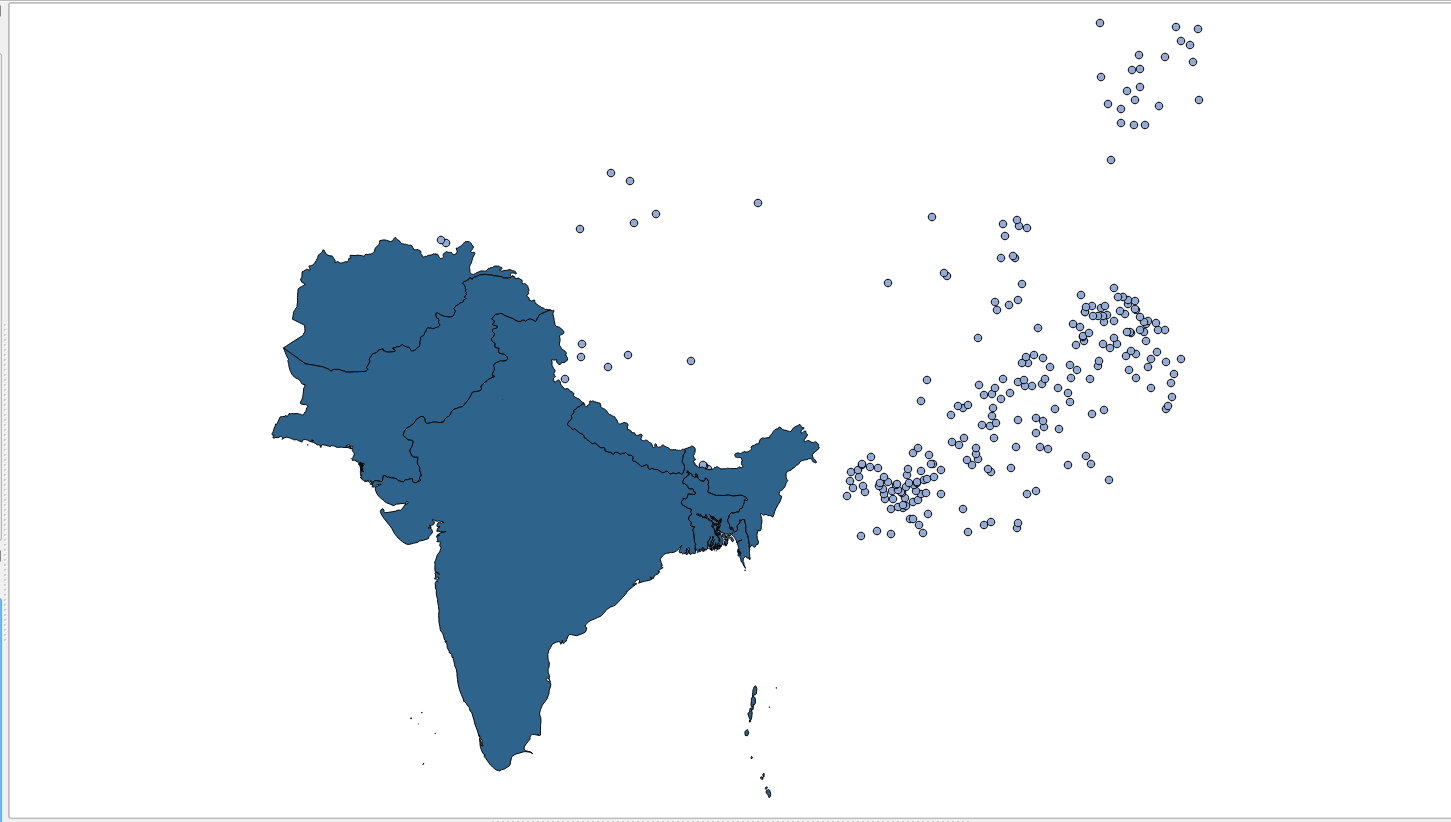


Browser Panel

- Project home
- Home
- Favourites
- C:/
- D:/
- E:/
- F:/
- H:/
- I:/
- S:/
- X:/
- Y:/
- DB2
- MSSQL
- Oracle
- PostGIS
- SpatiaLite
- ArcGISFeatureServer
- ArcGISMapServer
- OWS
- WCS
- WFS
- WMS

Layers Panel

- Endemic_Asi...
- Endemic_Asi...
- IN_MiddleEas...



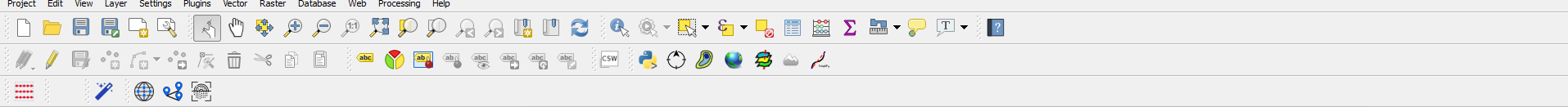
Processing Toolbox

Search...

- Recently used algorithms
 - Mean coordinate(s)
 - Clip
 - Interpolate (Nearest Neighbor)
 - Kriging with model selection
 - Kernel density estimation
 - Interpolate (Inverse distance wei...
 - AniMove [4 geosalgorithms]
 - GDAL/OGR [45 geosalgorithms]
 - GRASS commands [160 geosalgorithms]
 - GRASS GIS 7 commands [148 gealgo...
 - Models [0 geosalgorithms]
 - Orfeo Toolbox (Image analysis) [83 g...
 - QGIS geosalgorithms [103 geosalgorith...
 - R scripts [2 geosalgorithms]
 - Scripts [0 geosalgorithms]

Log Messages Panel

General	Plugins	Python warning	Processing	OGR
2018-03-09T18:08:50	1	Data source is invalid		
2018-03-09T18:09:25	1	Data source is invalid		

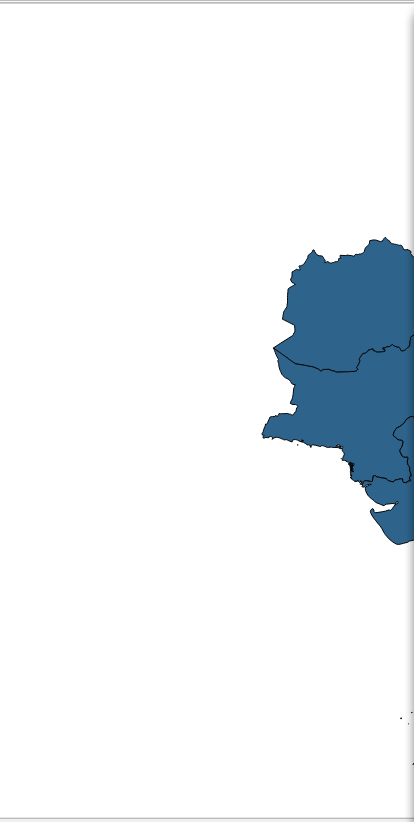


Browser Panel

- Project home
- Home
- Favourites
- C:/
- D:/
- E:/
- F:/
- H:/
- I:/
- S:/
- X:/
- Y:/
- DB2
- MSSQL
- Oracle
- PostGIS
- SpatiaLite
- ArcGISFeatureServer
- ArcGISMapServer
- OWS
- WCS
- WFS
- WMS

Layers Panel

- Endemic_Asi...
- Endemic_Asi...
- IN_MiddleEas...



IN_MiddleEast_Asia_right_UTM46N :: Features total: 261, filtered: 261, selected: 0

	Disease	Country	Code	Latitude	Longitude	OBSStartDat	Year
1	Peste des petits ...	China, People's R...	CHN	22.280000000000...	109.96999999999...	09/04/2014	2014
2	Peste des petits ...	China, People's R...	CHN	22.340000000000...	106.84999999999...	27/03/2014	2014
3	Peste des petits ...	China, People's R...	CHN	22.530000000000...	103.93999999999...	03/04/2014	2014
4	Peste des petits ...	China, People's R...	CHN	22.559999999999...	99.930000000000...	27/04/2014	2014
5	Peste des petits ...	China, People's R...	CHN	22.579999999999...	110.04999999999...	25/04/2014	2014
6	Peste des petits ...	China, People's R...	CHN	22.590000000000...	101.85999999999...	27/04/2014	2014
7	Peste des petits ...	China, People's R...	CHN	22.640000000000...	107.90000000000...	25/04/2014	2014
8	Peste des petits ...	China, People's R...	CHN	22.789999999999...	100.98000000000...	27/04/2014	2014
9	Peste des petits ...	China, People's R...	CHN	22.820000000000...	108.37000000000...	12/05/2014	2014
10	Peste des petits ...	China, People's R...	CHN	22.980000000000...	103.68999999999...	27/04/2014	2014
11	Peste des petits ...	China, People's R...	CHN	23.379999999999...	103.15999999999...	14/04/2014	2014
12	Peste des petits ...	China, People's R...	CHN	23.399999999999...	103.35999999999...	03/04/2014	2014
13	Peste des petits ...	China, People's R...	CHN	23.609999999999...	104.34000000000...	27/04/2014	2014
14	Peste des petits ...	China, People's R...	CHN	23.739999999999...	106.67000000000...	01/04/2014	2014
15	Peste des petits ...	China, People's R...	CHN	24.070000000000...	101.98999999999...	27/04/2014	2014
16	Peste des petits ...	China, People's R...	CHN	24.109999999999...	102.76000000000...	27/04/2014	2014
17	Peste des petits ...	China, People's R...	CHN	24.170000000000...	102.40999999999...	14/04/2014	2014
18	Peste des petits ...	China, People's R...	CHN	24.170000000000...	110.81000000000...	30/04/2014	2014
19	Peste des petits ...	China, People's R...	CHN	24.190000000000...	102.93000000000...	14/04/2014	2014
20	Peste des petits ...	China, People's R...	CHN	24.270000000000...	116.07999999999...	15/05/2014	2014
21	Peste des petits ...	China, People's R...	CHN	24.289999999999...	102.76000000000...	27/04/2014	2014
22	Peste des petits ...	China, People's R...	CHN	24.309999999999...	111.43999999999...	08/04/2014	2014
23	Peste des petits ...	China, People's R...	CHN	24.410000000000...	103.40999999999...	03/04/2014	2014
	Peste des petits ...	China, People's R...	CHN	24.530000000000...	103.76000000000...	03/04/2014	2014

Show All Features

Processing Toolbox

Recently used algorithms

- Interpolate (Inverse distance we...
- GDAL/OGR [45 geotools]
- [GDAL] Analysis
- Interpolate (Inverse distanc...
- Proximity (raster distance)
- GRASS commands [160 geotools]
- Miscellaneous (m. *)
- m.cogo - A simple utility for c...
- r.grow.distance - Generates a...
- r.ros - Generates three, or fo...
- Vector (v. *)
- v.buffer.distance - Creates a...
- v.distance - Finds the nearest...
- v.distance.toastr - Finds the ...
- v.surf.idw - Surface interpolat...
- GRASS GIS 7 commands [148 geotool...
- Miscellaneous (m. *)
- m.cogo - A simple utility for c...
- Raster (r. *)
- r.grow.distance - Generates a...
- Vector (v. *)
- v.buffer.distance - Creates a...
- v.surf.idw - Surface interpolat...
- QGIS geotools [103 geotools]
- Vector analysis tools
- Distance matrix
- Distance to nearest hub
- Vector geometry tools
- Fixed distance buffer
- Variable distance buffer

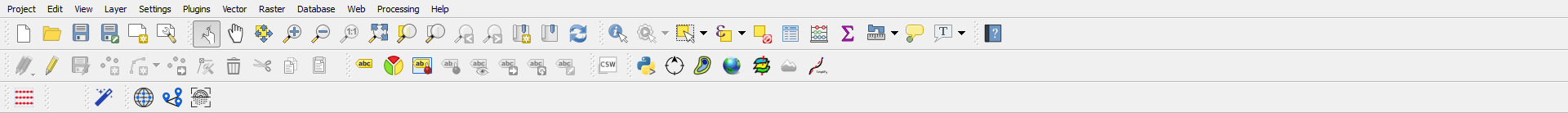
Advanced interface

Log Messages Panel

General | Plugins | Python warning | Processing | OGR

2018-03-09T18:08:50 1 Data source is invalid ()

2018-03-09T18:09:25 1 Data source is invalid ()

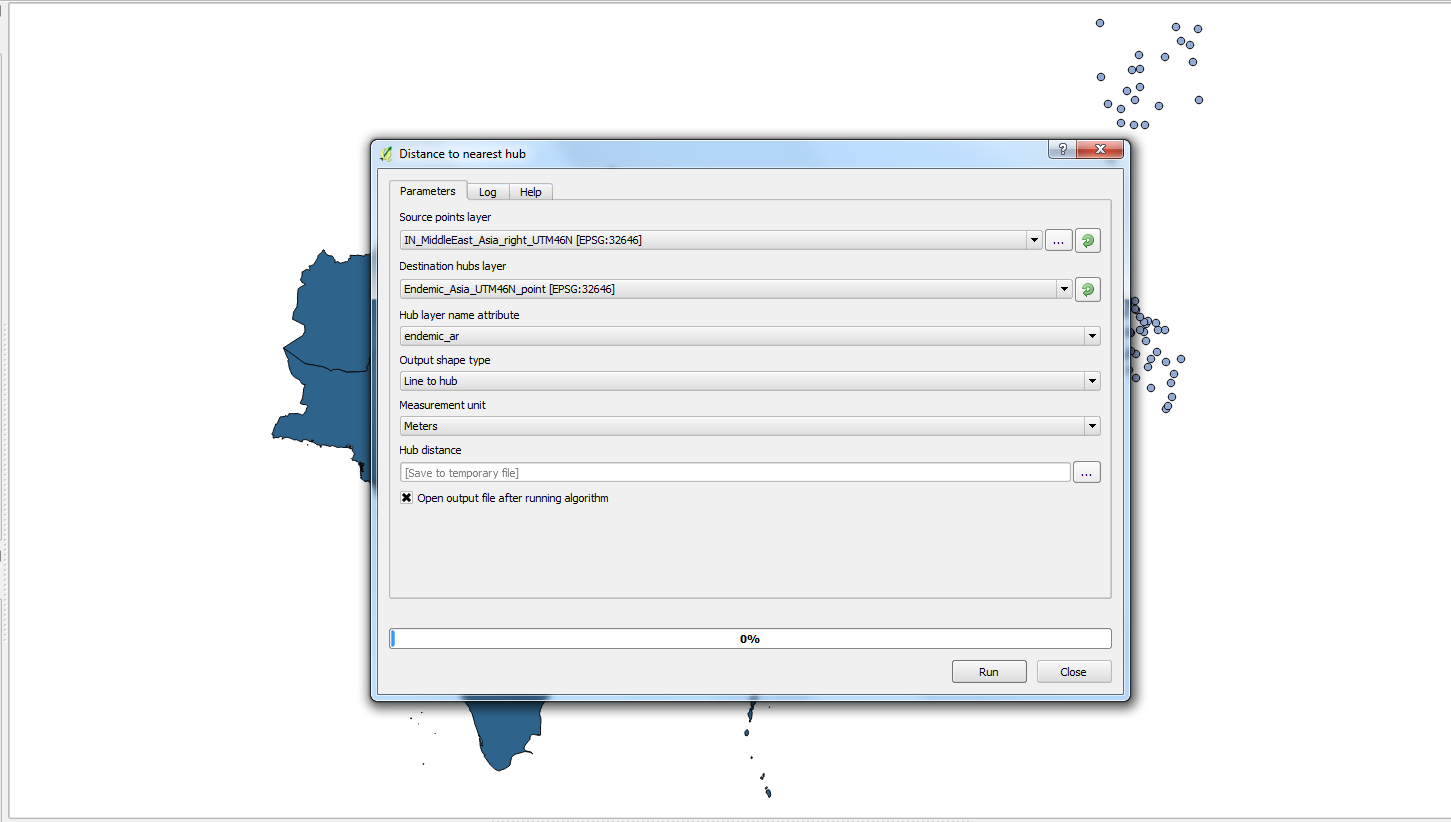


Browser Panel

- Project home
- Home
- Favourites
- C:/
- D:/
- E:/
- F:/
- H:/
- I:/
- S:/
- X:/
- Y:/
- DB2
- MSSQL
- Orade
- PostGIS
- SpabLite
- ArcGISFeatureServer
- ArcGISMapServer
- OWS
- WCS
- WFS
- WMS

Layers Panel

- Endemic_Asi...
- Endemic_Asi...
- IN_MiddleEas...



Distance to nearest hub

Parameters | Log | Help

Source points layer
IN_MiddleEast_Asia_right_UTM46N [EPSG:32646]

Destination hubs layer
Endemic_Asia_UTM46N_point [EPSG:32646]

Hub layer name attribute
endemic_ar

Output shape type
Line to hub

Measurement unit
Meters

Hub distance
[Save to temporary file]

Open output file after running algorithm

0%

Run Close

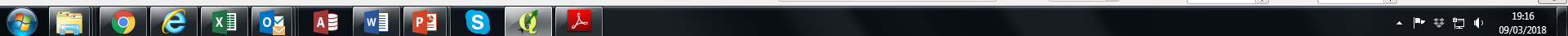
Processing Toolbox

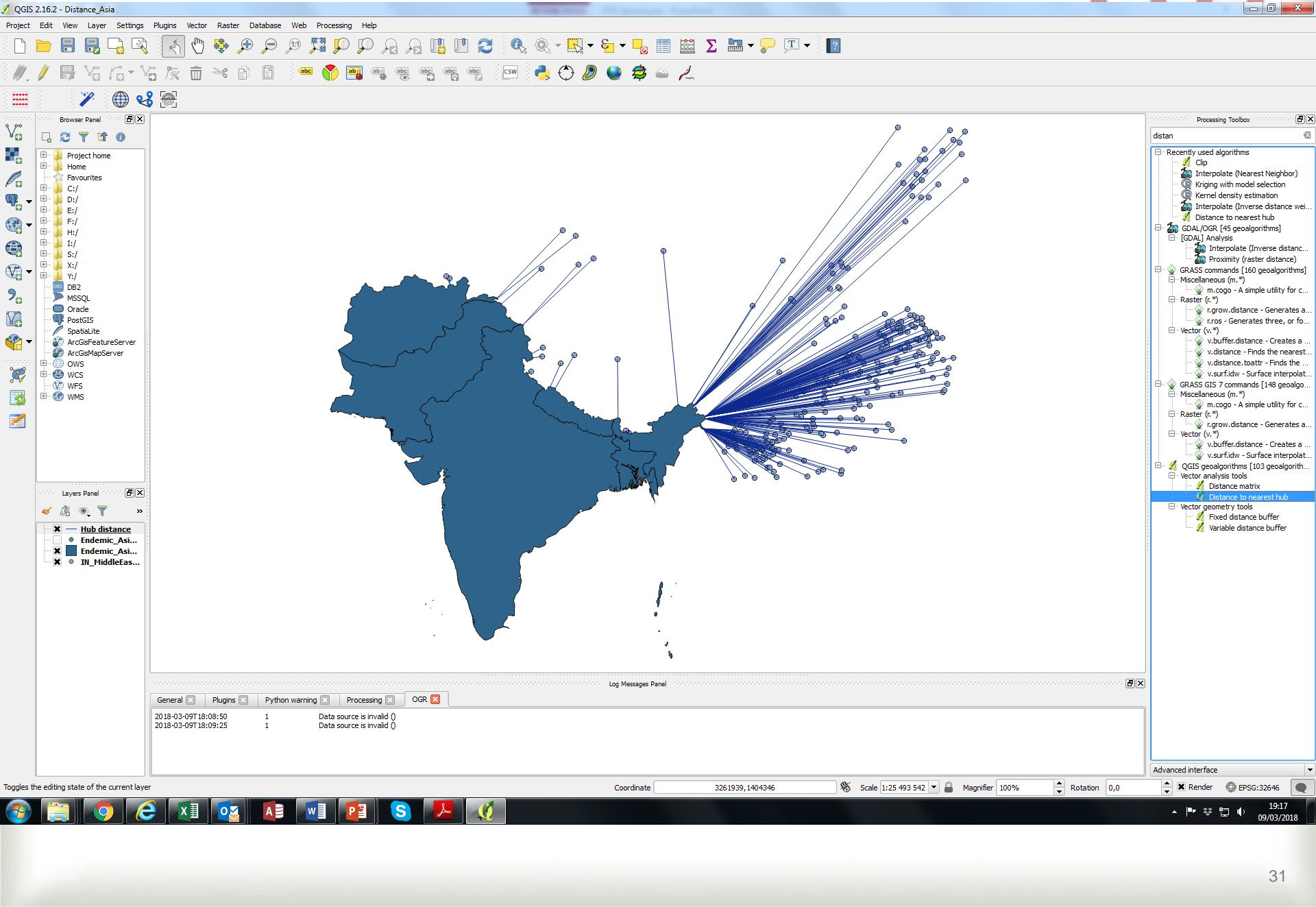
Recently used algorithms

- Interpolate (Inverse distance wei...
- GDAL/OGR [45 geosalgorithms]
- [GDAL] Analysis
 - Interpolate (Inverse distanc...
 - Proximity (raster distance)
- GRASS commands [160 geosalgorithms]
- Miscellaneous (m. *)
 - m.cogo - A simple utility for c...
 - r.grow.distance - Generates a...
 - r.ros - Generates three, or fo...
- Vector (v. *)
 - v.buffer.distance - Creates a ...
 - v.distance - Finds the nearest...
 - v.distance.toatr - Finds the ...
 - v.surf.idw - Surface interpolat...
- GRASS GIS 7 commands [148 geosalgo...
- Miscellaneous (m. *)
 - m.cogo - A simple utility for c...
- Raster (r. *)
 - r.grow.distance - Generates a...
 - v.surf.idw - Surface interpolat...
- Vector (v. *)
 - v.buffer.distance - Creates a ...
 - v.surf.idw - Surface interpolat...
- QGIS geosalgorithms [103 geosalgorith...
- Distance matrix
- Distance to nearest hub
- Vector analysis tools
- Vector geometry tools
 - Fixed distance buffer
 - Variable distance buffer

Log Messages Panel

General	Plugins	Python warning	Processing	OGR
2018-03-09T18:08:50	1	Data source is invalid		
2018-03-09T18:09:25	1	Data source is invalid		





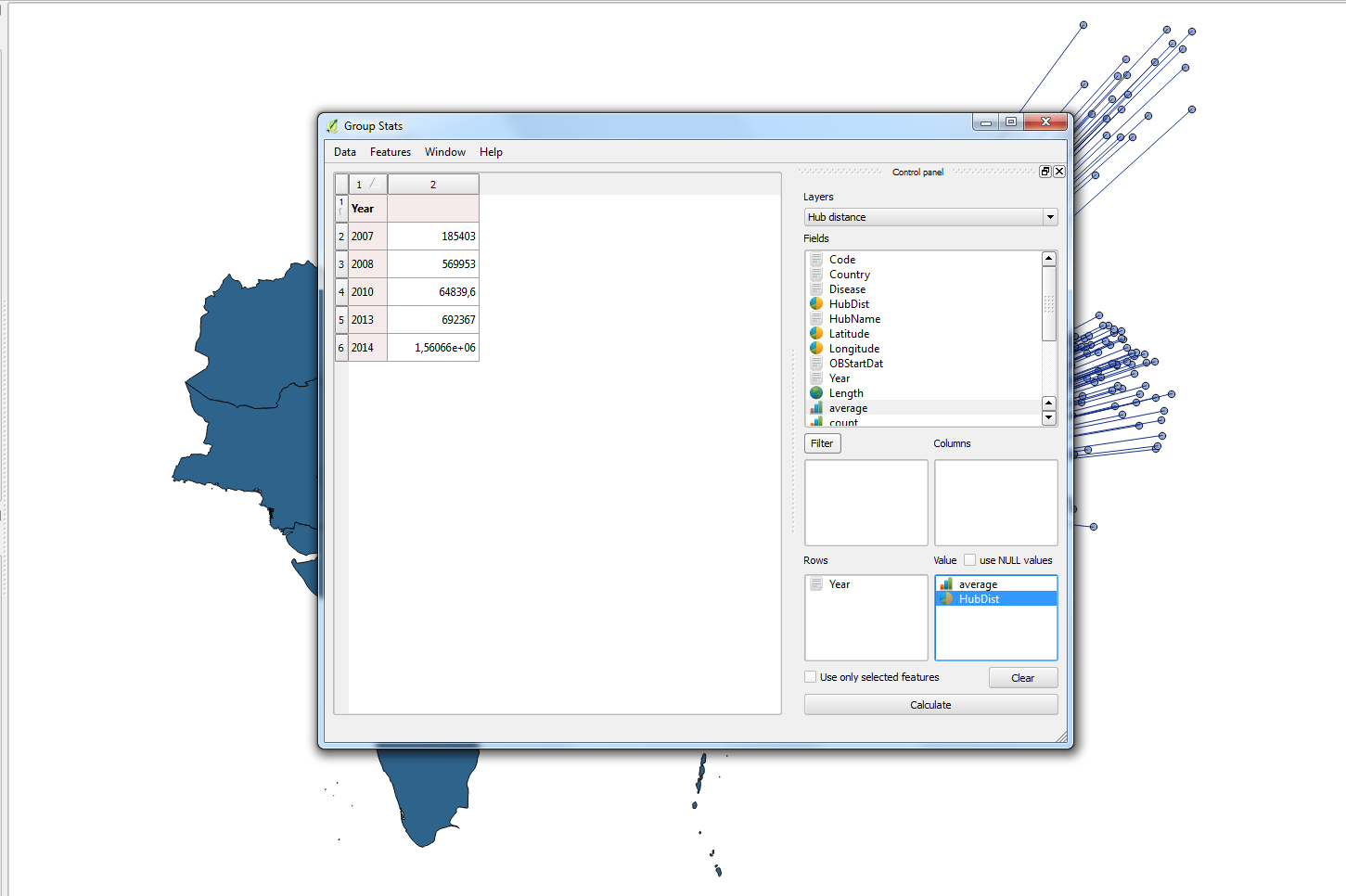


Browser Panel

- Project home
- Home
- Favourites
- C:/
- D:/
- E:/
- F:/
- H:/
- I:/
- S:/
- X:/
- Y:/
- DB2
- MSSQL
- Oracle
- PostGIS
- Spaialite
- ArcGisFeatureServer
- ArcGisMapServer
- OWS
- WCS
- WFS
- WMS

Layers Panel

- Hub distance
- Endemic_Asi...
- Endemic_Asi...
- IN_MiddleEas...



Group Stats

Data Features Window Help

1	2
Year	
2007	185403
2008	569953
2010	64839.6
2013	692367
2014	1,56066e+06

Control panel

Layers: Hub distance

Fields:

- Code
- Country
- Disease
- HubDist
- HubName
- Latitude
- Longitude
- OBStartDat
- Year
- Length
- average
- count

Filter: [Empty]

Columns: [Empty]

Rows: Year

Value: use NULL values

Use only selected features:

Calculate

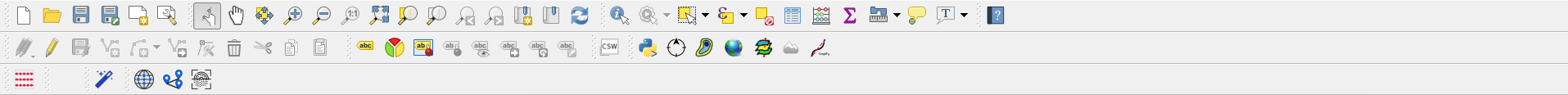
Processing Toolbox

Recently used algorithms

- Clip
- Interpolate (Nearest Neighbor)
- Kriging with model selection
- Kernel density estimation
- Interpolate (Inverse distance weighted)
- Distance to nearest hub
- GDAL/OGR [45 geotools]
- [GDAL] Analysis
 - Interpolate (Inverse distance weighted)
 - Proximity (raster distance)
- GRASS commands [160 geotools]
- Miscellaneous (m.*)
 - m.cogo - A simple utility for c...
- Raster (r.*)
 - r.grow.distance - Generates a...
 - r.ros - Generates three, or fo...
- Vector (v.*)
 - v.buffer.distance - Creates a...
 - v.distance - Finds the nearest...
 - v.distance.toattr - Finds the ...
 - v.surf.idw - Surface interpolat...
- GRASS GIS 7 commands [148 geotool...]
- Miscellaneous (m.*)
 - m.cogo - A simple utility for c...
- Raster (r.*)
 - r.grow.distance - Generates a...
- Vector (v.*)
 - v.buffer.distance - Creates a...
 - v.surf.idw - Surface interpolat...
- QGIS geotools [103 geotoolh...
- Vector analysis tools
 - Distance matrix
 - Distance to nearest hub
- Vector geometry tools
 - Fixed distance buffer
 - Variable distance buffer

Advanced interface





Browser Panel

- Project home
- Home
- Favourites
- C:/
- D:/
- E:/
- F:/
- H:/
- I:/
- S:/
- X:/
- Y:/
- DB2
- MSSQL
- Oracle
- PostGIS
- SpatiaLite
- ArcGISFeatureServer
- ArcGISMapServer
- OWS
- WCS
- WFS
- WMS

Layers Panel

- Hub distance
- Endemic_Asi...
- Endemic_Asi...
- IN_MiddleEas...



Hub distance :: Features total: 261, filtered: 261, selected: 0

	Disease	Country	Code	Latitude	Longitude	OBSStartDat	Year	HubName	HubDist
1	Peste des petits ...	China, People's R...	CHN	22.280000000000...	109.96999999999...	09/04/2014	2014	NULL	1424743.030908...
2	Peste des petits ...	China, People's R...	CHN	22.340000000000...	106.84999999999...	27/03/2014	2014	NULL	1126573.685110...
3	Peste des petits ...	China, People's R...	CHN	22.530000000000...	103.93999999999...	03/04/2014	2014	NULL	859381.1824615...
4	Peste des petits ...	China, People's R...	CHN	22.559999999999...	99.930000000000...	27/04/2014	2014	NULL	577596.1191994...
5	Peste des petits ...	China, People's R...	CHN	22.579999999999...	110.04999999999...	25/04/2014	2014	NULL	1418495.892756...
6	Peste des petits ...	China, People's R...	CHN	22.590000000000...	101.85999999999...	27/04/2014	2014	NULL	693580.3899220...
7	Peste des petits ...	China, People's R...	CHN	22.640000000000...	107.90000000000...	25/04/2014	2014	NULL	1208253.212556...
8	Peste des petits ...	China, People's R...	CHN	22.789999999999...	100.98000000000...	27/04/2014	2014	NULL	616937.5962471...
9	Peste des petits ...	China, People's R...	CHN	22.820000000000...	108.37000000000...	12/05/2014	2014	NULL	1244206.903662...
10	Peste des petits ...	China, People's R...	CHN	22.980000000000...	103.68999999999...	27/04/2014	2014	NULL	808343.0278351...
11	Peste des petits ...	China, People's R...	CHN	23.379999999999...	103.15999999999...	14/04/2014	2014	NULL	737486.6568851...
12	Peste des petits ...	China, People's R...	CHN	23.399999999999...	103.35999999999...	03/04/2014	2014	NULL	753258.2458634...
13	Peste des petits ...	China, People's R...	CHN	23.609999999999...	104.34000000000...	27/04/2014	2014	NULL	827304.6419761...
14	Peste des petits ...	China, People's R...	CHN	23.739999999999...	106.67000000000...	01/04/2014	2014	NULL	1038370.905982...
15	Peste des petits ...	China, People's R...	CHN	24.070000000000...	101.98999999999...	27/04/2014	2014	NULL	594323.7105006...
16	Peste des petits ...	China, People's R...	CHN	24.109999999999...	102.76000000000...	27/04/2014	2014	NULL	658069.0482462...
17	Peste des petits ...	China, People's R...	CHN	24.170000000000...	102.40999999999...	14/04/2014	2014	NULL	623950.6604107...
18	Peste des petits ...	China, People's R...	CHN	24.170000000000...	110.81000000000...	30/04/2014	2014	NULL	1432137.367624...
19	Peste des petits ...	China, People's R...	CHN	24.190000000000...	102.93000000000...	14/04/2014	2014	NULL	668549.9011541...
20	Peste des petits ...	China, People's R...	CHN	24.270000000000...	116.07999999999...	15/05/2014	2014	NULL	1966069.743306...
21	Peste des petits ...	China, People's R...	CHN	24.289999999999...	102.76000000000...	27/04/2014	2014	NULL	647814.7836583...
22	Peste des petits ...	China, People's R...	CHN	24.309999999999...	111.43999999999...	08/04/2014	2014	NULL	1489630.035683...
23	Peste des petits ...	China, People's R...	CHN	24.410000000000...	103.40999999999...	03/04/2014	2014	NULL	700134.2071530...
24	Peste des petits ...	China, People's R...	CHN	24.530000000000...	103.76000000000...	03/04/2014	2014	NULL	727600.1617890...

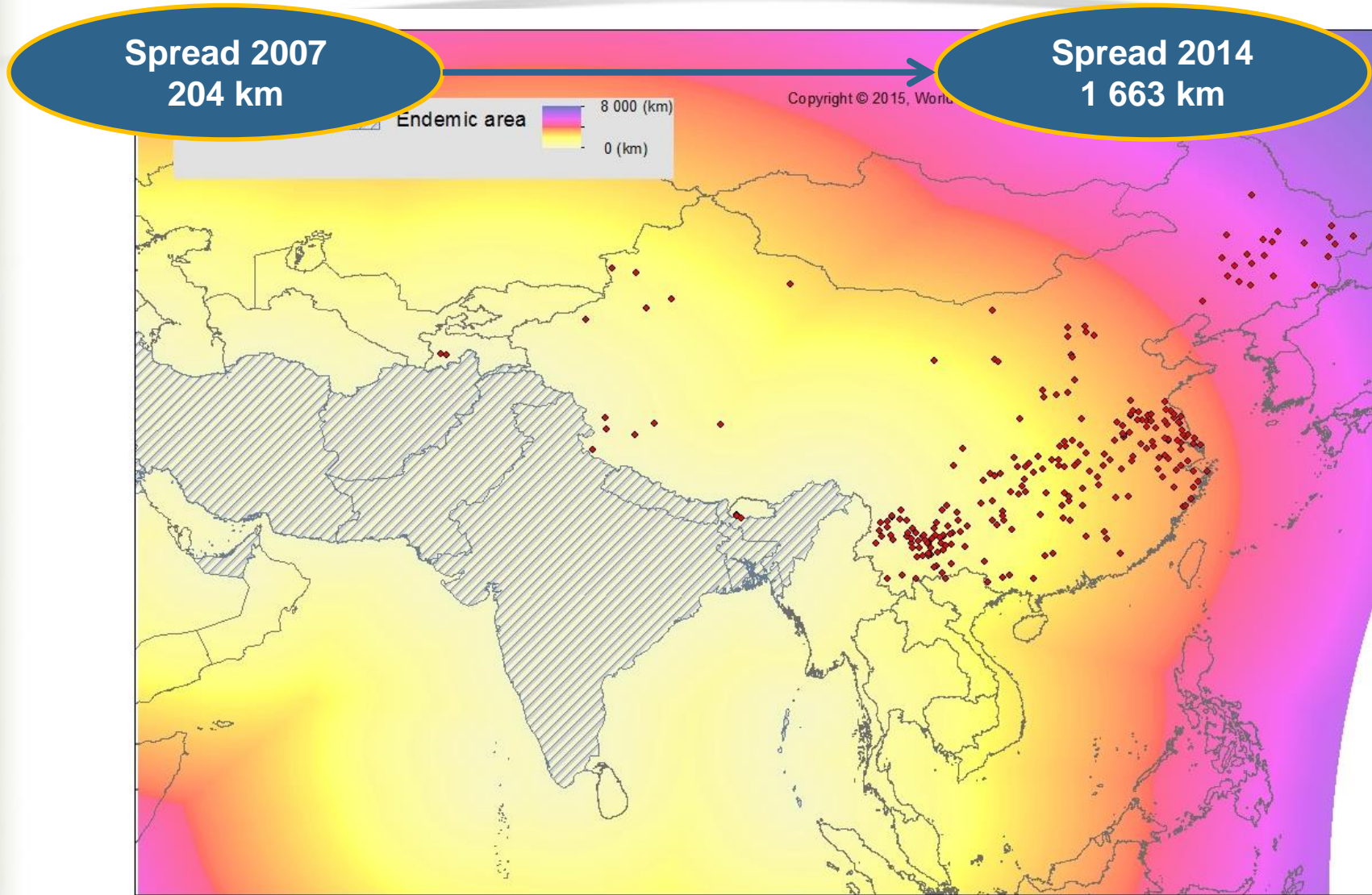
Show All Features

Processing Toolbox

Recently used algorithms

- Clip
- Interpolate (Nearest Neighbor)
- Kriging with model selection
- Kernel density estimation
- Interpolate (Inverse distance wei...)
- Distance to nearest hub
- GDAL/OGR [45 geosalgorithms]
- [GDAL] Analysis
 - Interpolate (Inverse distanc...
 - Proximity (raster distance)
- GRASS commands [160 geosalgorithms]
- Miscellaneous (m.*)
 - m.cogo - A simple utility for c...
- Raster (r.*)
 - r.grow.distance - Generates a...
 - r.ros - Generates three, or fo...
- Vector (v.*)
 - v.buffer.distance - Creates a...
 - v.distance - Finds the nearest...
 - v.distance.toattr - Finds the ...
 - v.surf.idw - Surface interpolat...
- GRASS GIS 7 commands [148 geosalg...
- Miscellaneous (m.*)
 - m.cogo - A simple utility for c...
- Raster (r.*)
 - r.grow.distance - Generates a...
- Vector (v.*)
 - v.buffer.distance - Creates a...
 - v.distance - Finds the nearest...
 - v.surf.idw - Surface interpolat...
- QGIS geosalgorithms [103 geosalgri...
- Vector analysis tools
 - Distance matrix
 - Distance to nearest hub
- Vector geometry tools
 - Fixed distance buffer
 - Variable distance buffer

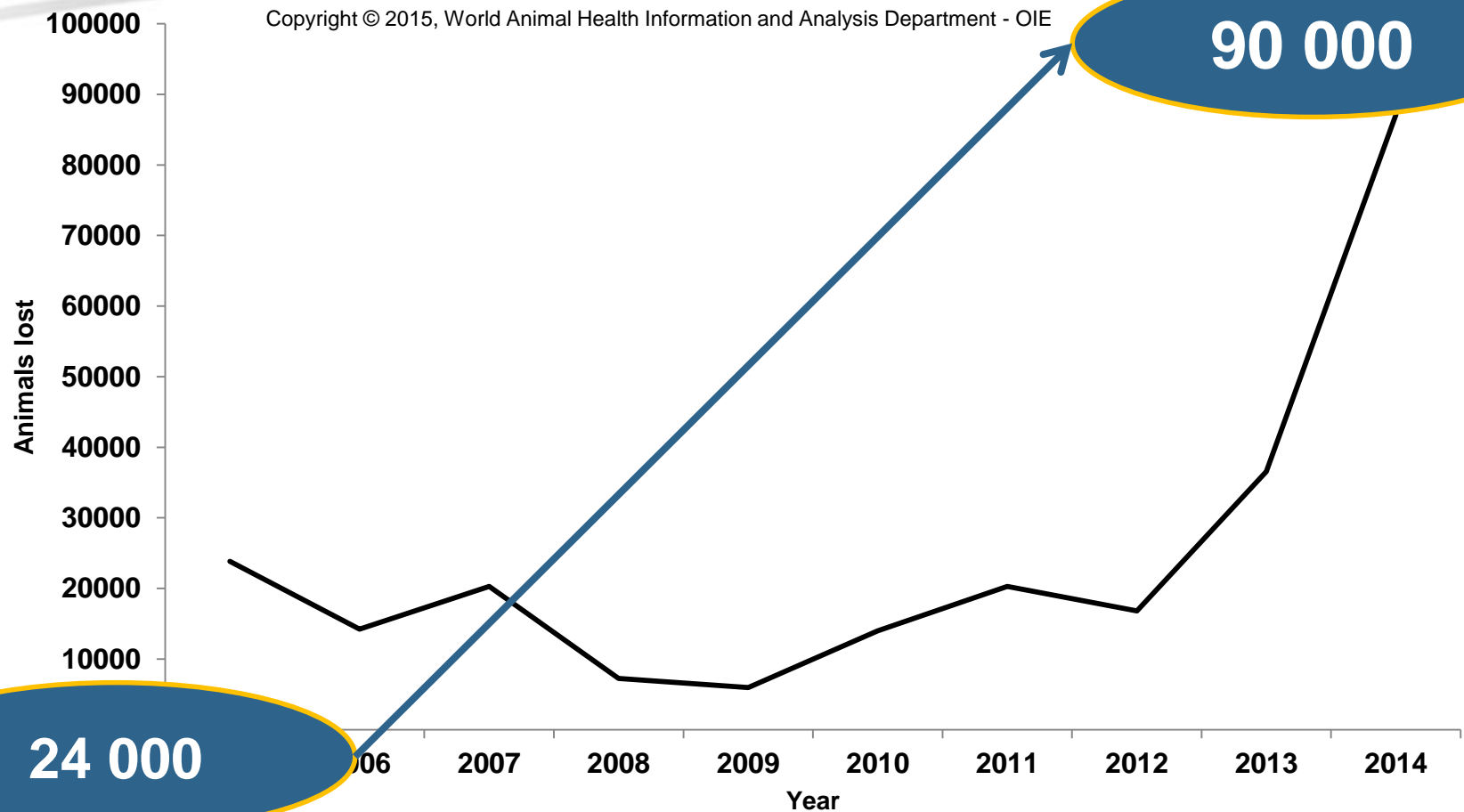
Distance of each outbreak from the PPR endemic areas (closest areas in yellow and the farthest ones in violet)



Spearman's rank correlation, $S = 6.56$, p -value < 0.01 , $\rho = 0.9$

3. Economics Trends

Direct economic losses due to infection with PPR virus between 2007 and 2014, as of 24 August, in Asia, the Far East and Oceania



+ 275%

Conclusions



- The spread of PPR in the last 7 years is quite **alarming**
- All the indicators evaluated (temporal, spatio-temporal, economic) show a **deterioration** of the epidemiological situation
- A definitive eradication will necessarily entail better **collaboration and communication** (transparency and accuracy) between Members, better **control of transboundary animal movements** and use of **vaccination** when relevant

Thank you for your attention!



WORLD ORGANISATION FOR ANIMAL HEALTH
Protecting animals, preserving our future