

A Data-Driven Risk-Based Enterprise for Operational Decision

Willy Valdivia
CEO

Willy.Valdivia@orionbio.com



orion
Integrated Biosciences



CROSS-BORDER THREAT SCREENING
AND SUPPLY CHAIN DEFENSE

Summary of this Briefing

1. Challenge

- Many Biothreats to U.S. Health, Trade and Security System (Humans, Animals & Plants)

2. There is an Urgent Need to Determine the Risk of Incoming Commodities

- Travel and Trade are the main drivers of pest and disease spread (**Policy of Exclusion**)
- Ports of Entry (POEs) are constrained and dynamic environments
- Travel and Trade are Seasonal Flows Subject to Internal and External Influences

3. Main Objective

- Develop a Data-Driven, Risk-Based System from Global Awareness

4. Approach and Progress: The Agricultural and Food Supply Chain

- Smart Data Collection and Integration
- Data Analytics and Visualization

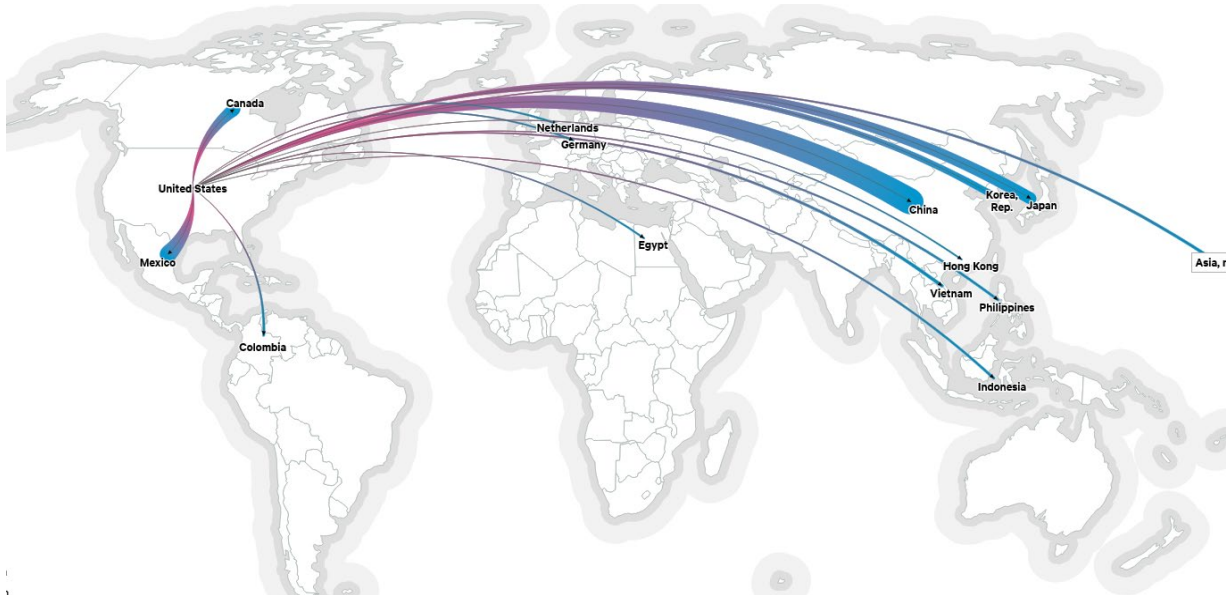
5. Future Work

- Human Machine Teaming (HMT) for Decision Making
- A Biosurveillance Data Exchange System

U.S. Agricultural and Food Supply Chain: Exports

AFS is a critical infrastructure with National Security Implications

FACs are imported from more than 134 countries: 90% of seafood, 40% vegetables



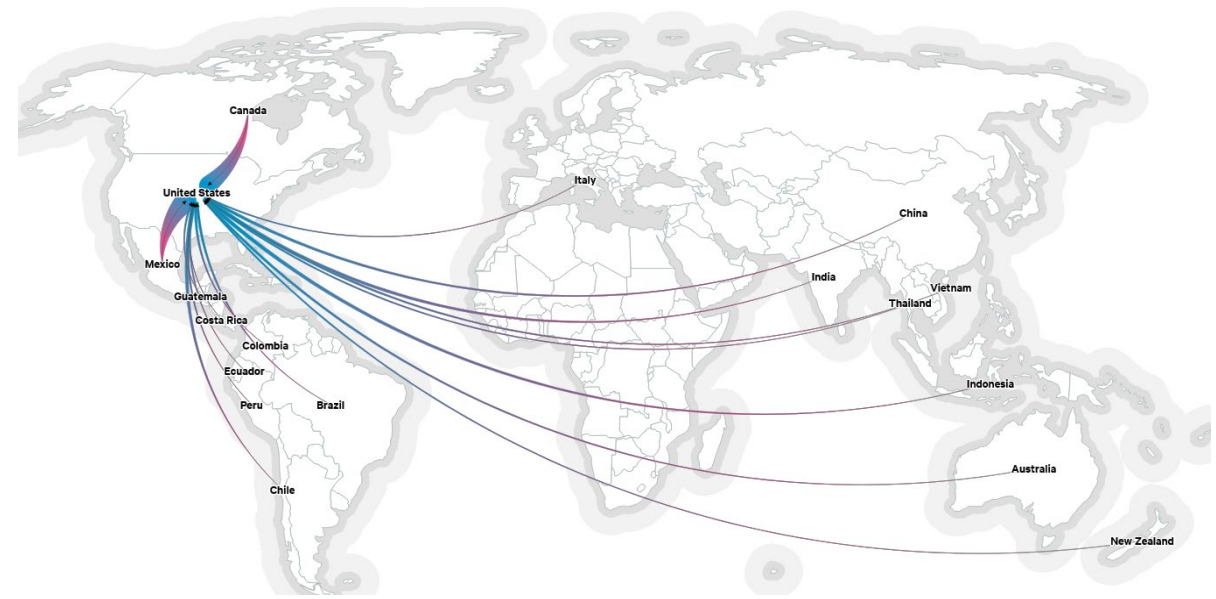
Exports

\$131 B

Value



5.4% GDP

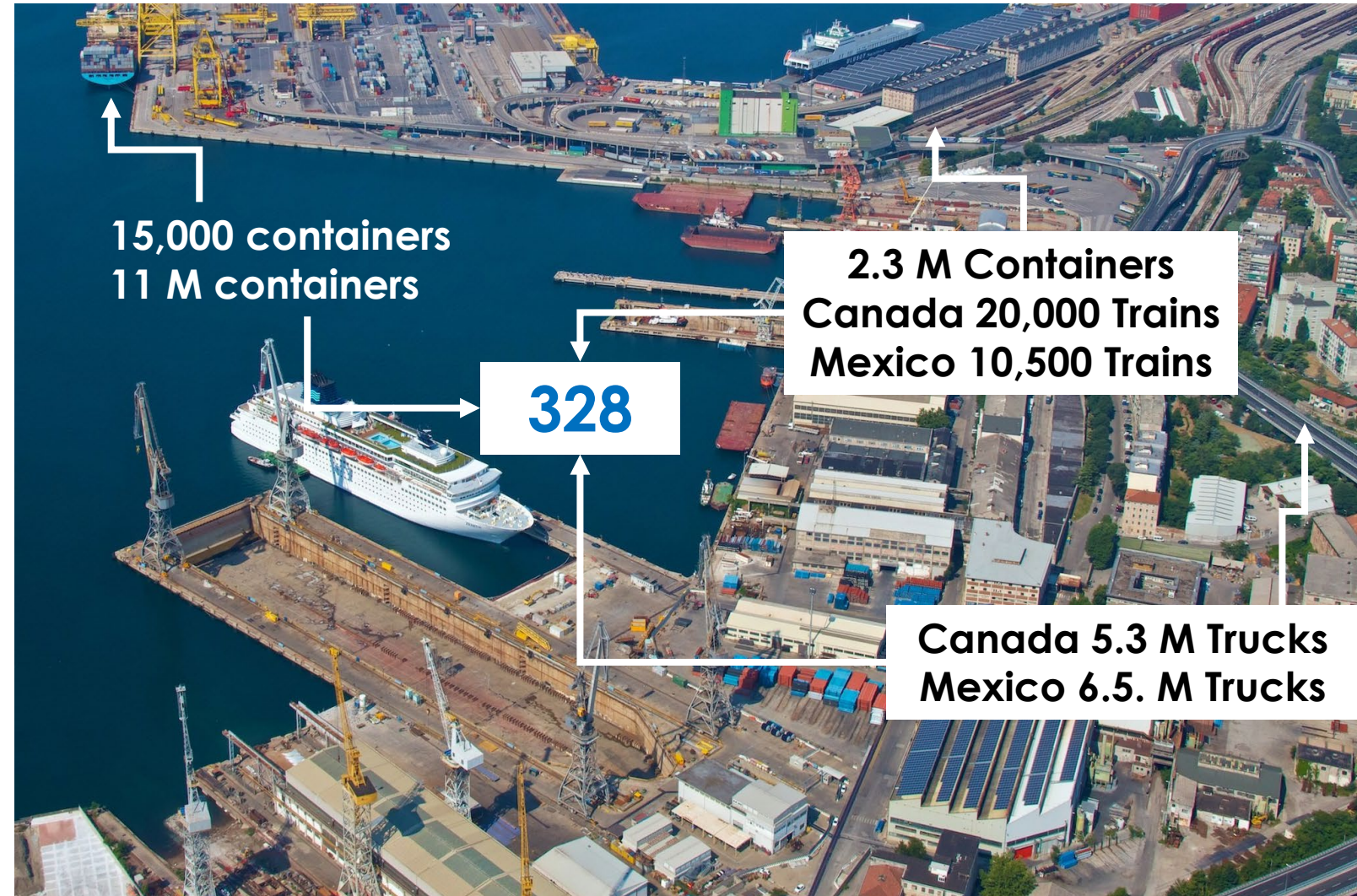
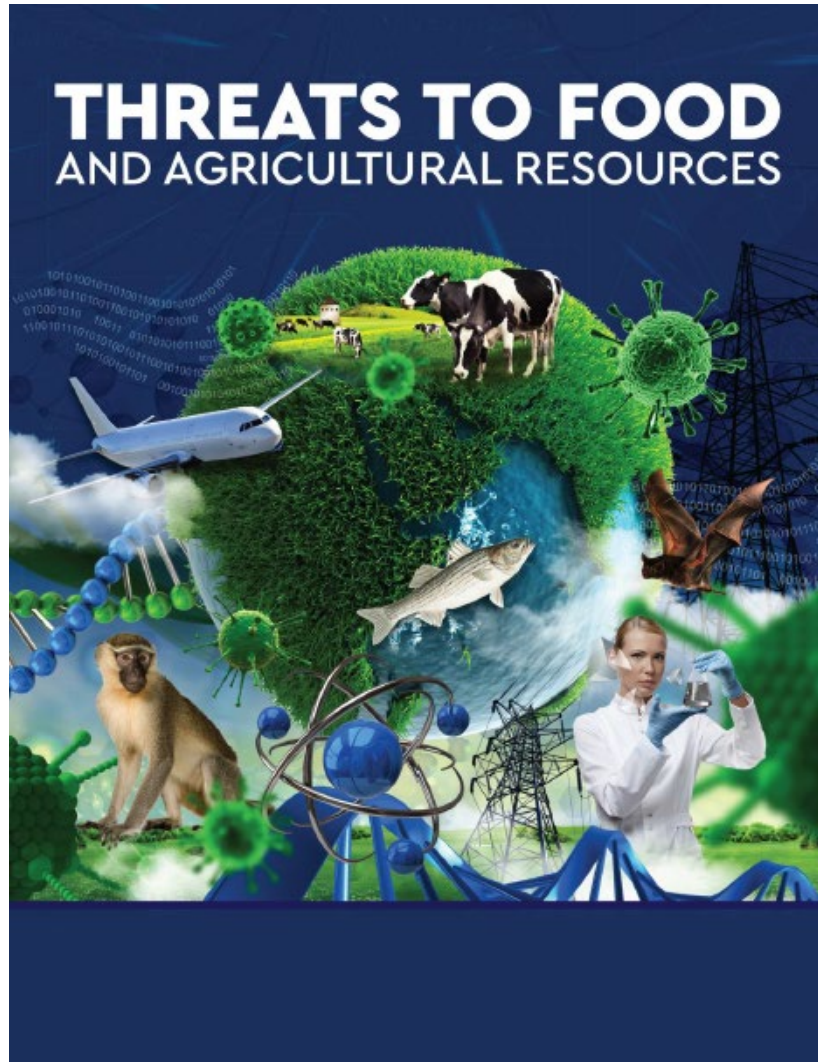


Imports

\$151 B



Threats to U.S. Food and Agricultural Supply Chain



Our Approach

DATA COLLECTION

RISK-BASED ANALYTICS

HSE MISSION



Known and Unknown Transboundary Infectious Diseases as Hybrid Threats
 Valdivia-Granda, W.A. *Frontiers in Public Health* (2021)



Autonomous Data-Driven and Risk-Based Enterprise

Risk = Threat x Vulnerability x Consequence

100 data sources X billions of records X millions of containers x millions of passenger = impossible



Analysts Based

Haystack →



Autonomous Based

A Data-Driven Risk Scoring Approach

What is the disease of concern?

- What variant of the disease or pest (virulent, pesticide-resistant, AMR, GMO)?

Where is the disease or pest occurring (lat-lon)?

What is the mitigation capability of the country where the disease is occurring?

- What are the socioeconomic indicators of the affected country?
- How many researchers and institutions work on the disease

Is the disease officially reported by the country or detected indirectly by other means?

Is the U.S. importing commodities (animals or plants/ wild vs. domestic) from an affected country?

What is the entry pathway for U.S. imports of the commodity? (vessel, plane, train, truck)

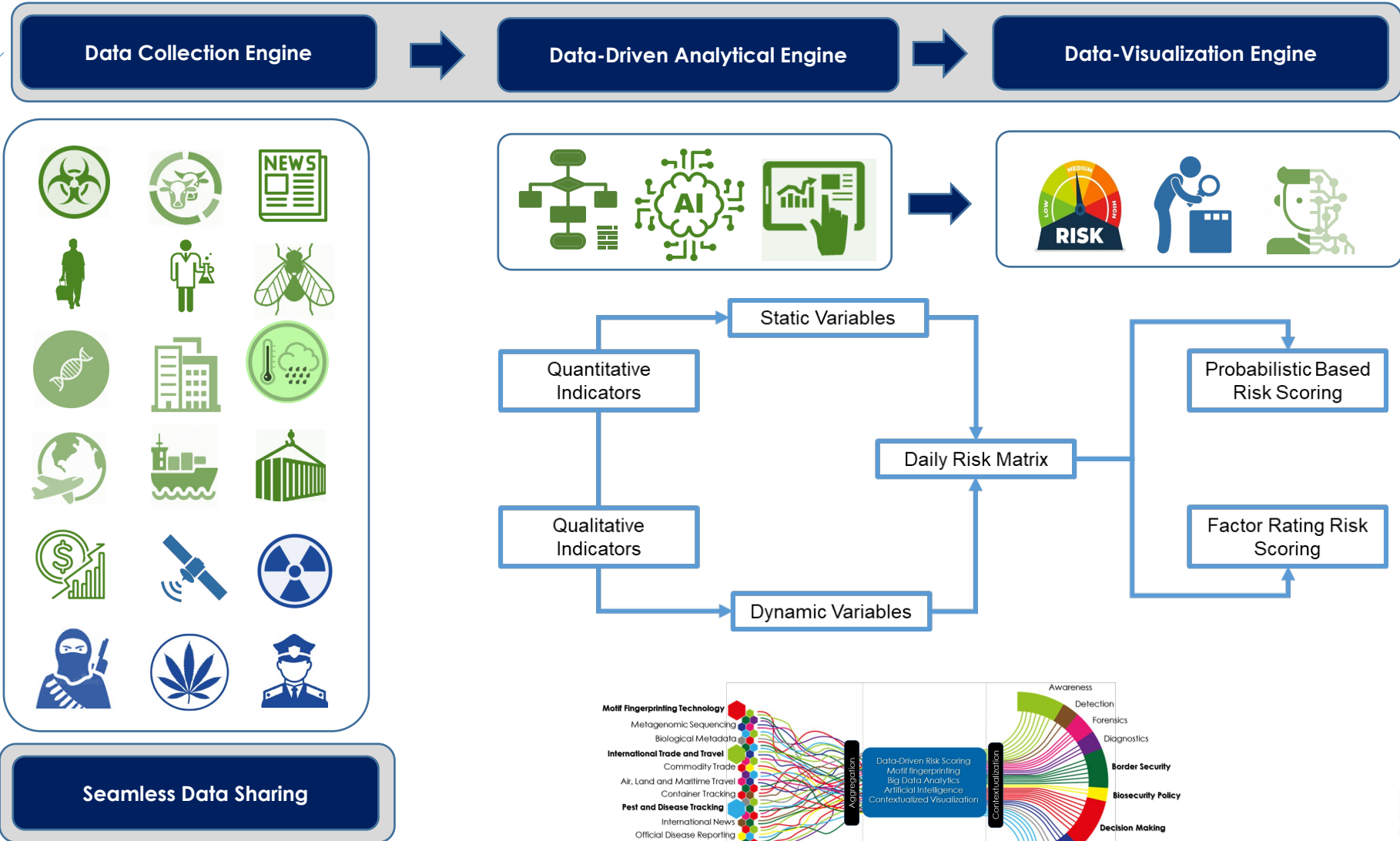
- Where is the POE?
- What is the vessel ID arriving in the U.S.?
- What is the container ID number or bill of lading?

Can a passenger transport the commodity or related product to the U.S.?

What is the quantitative value of the risk of the commodity and POE?



A Data-Driven Risk Scoring Approach



Smart Data Integration (billions records/hundreds sources)

144 32 1.2M 850K 10



HOME > SURVEILLANCE > COUNTRYMETRIC

admin

+ Add CountryMetric

By region By country By disease By week of the year

2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022

DATE OF THE YEAR	REGION	COUNTRY	DISEASE	YEAR	WEEK OF THE YEAR	PROJECTED CONFLICT RISK	INFORM RISK	HEALTH CONDITIONS	FOOD SECURITY	RESEARCHERS	INSTITUTIONS	LOCALITIES AFFECTED
Jan. 1, 2022, midnight	Asia	Malaysia	Rabies	2022	52	1,2	3,1	0,9	1,7	3	1	1
Jan. 1, 2022, midnight	Asia	Thailand	Lumpy skin disease	2022	52	5,5	4,1	1,8	3,3	0	0	6
Jan. 1, 2022, midnight	Europe	Russian Federation	Lumpy skin disease	2022	52	9,7	4,4	1,2	1,8	0	0	3
Jan. 1, 2022, midnight	Europe	Sweden	Influenza - Avian	2022	52	0,3	1,5	0,3	1,4	7647	306	2
Jan. 1, 2022, midnight	Europe	Poland	Influenza - Avian	2022	52	0,5	1,8	0,3	1,2	739	14	1
Jan. 1, 2022, midnight	Europe	Moldova, Republic of	Influenza - Avian	2022	52	0,3	2,6	1,5	3,7	0	0	1
Jan. 1, 2022, midnight	Europe	Germany	Influenza - Avian	2022	52	1,8	2,1	0,1	1	5860	492	1
			Classical									

CountryMatrix: Weekly consolidated environment

1 2 3 4 ... 1038 1039

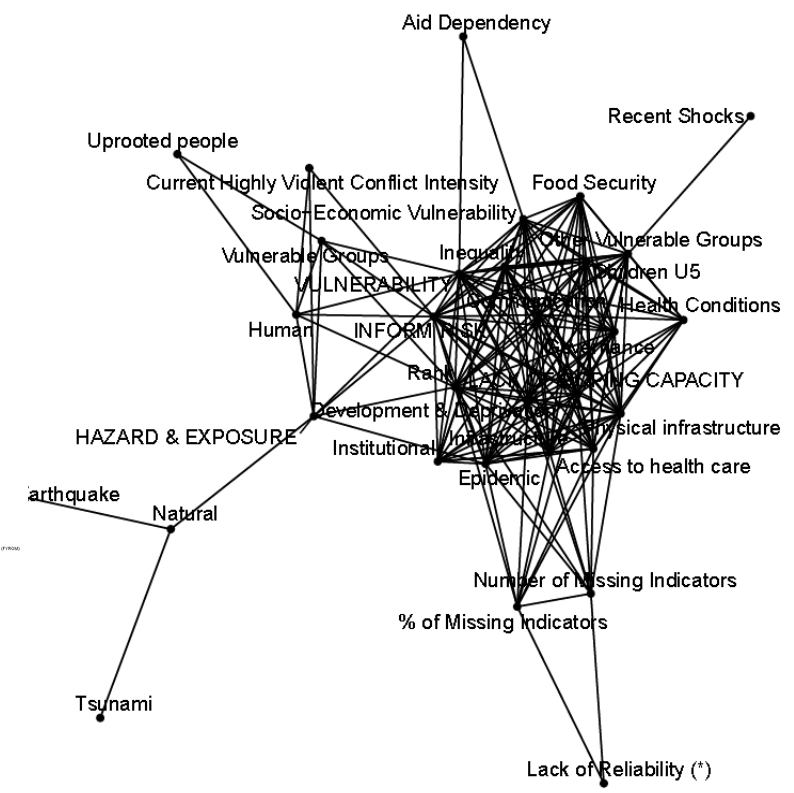
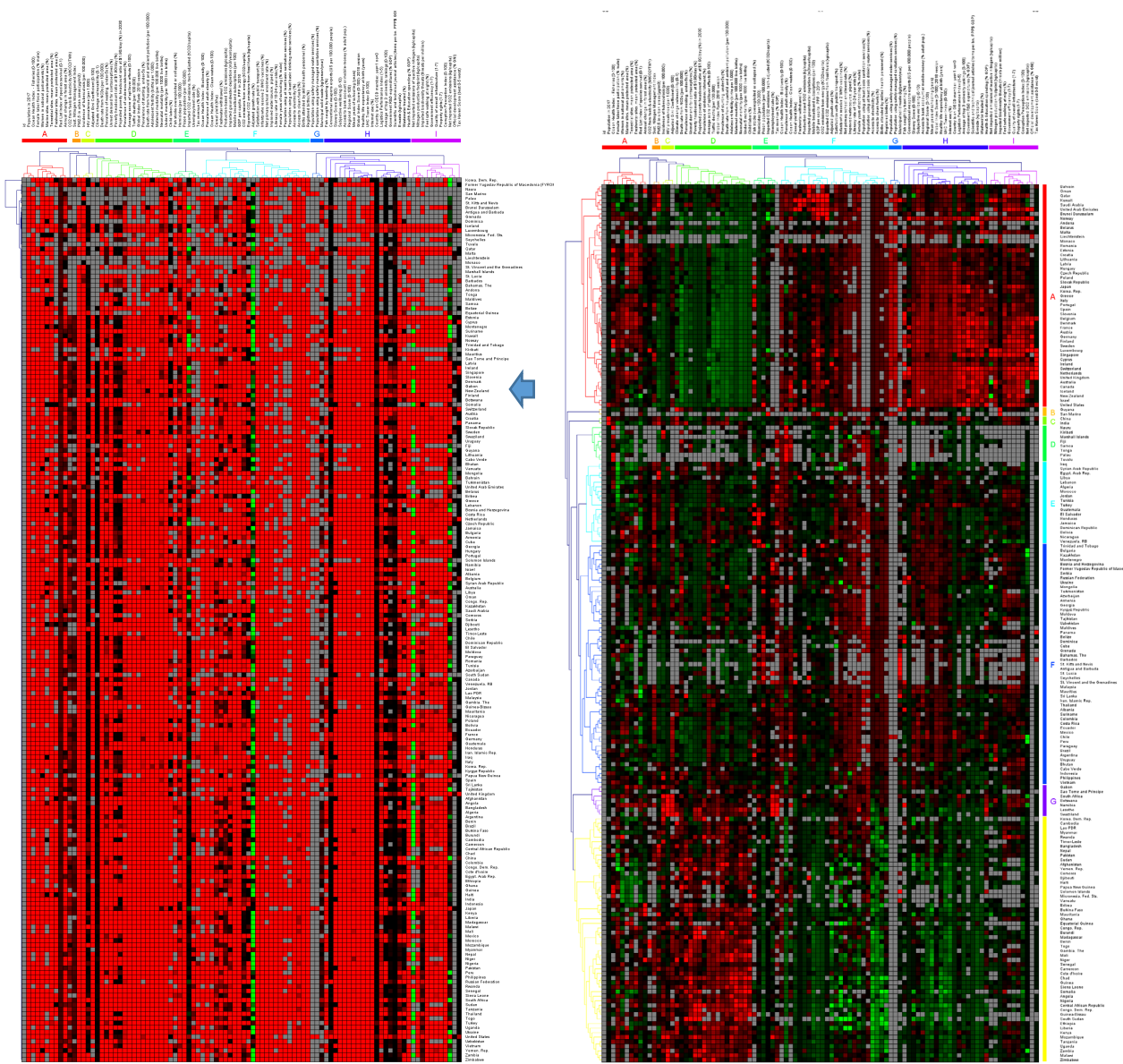
25959 CountryMetric

What Country? What SEI Status and Capability?

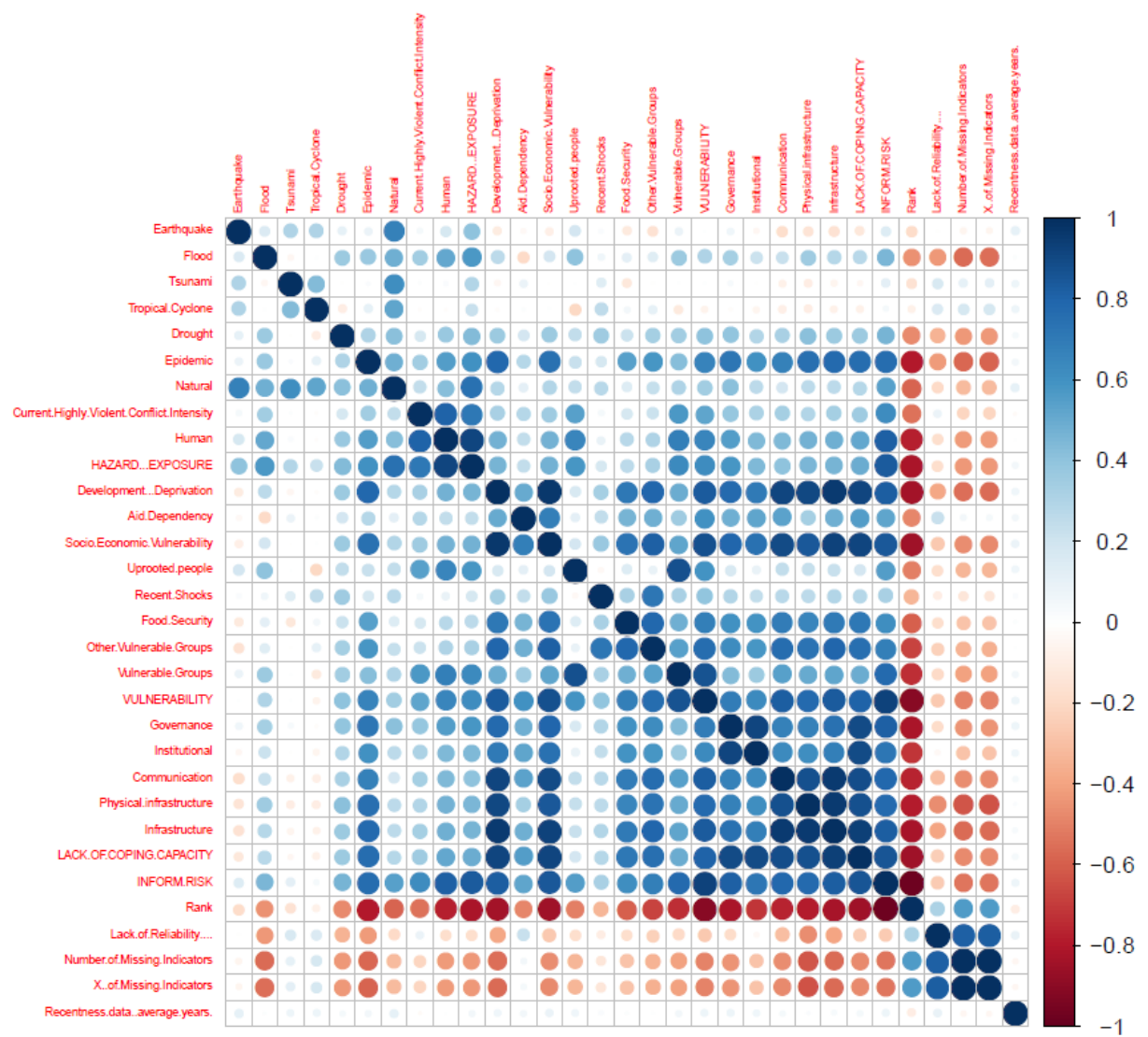
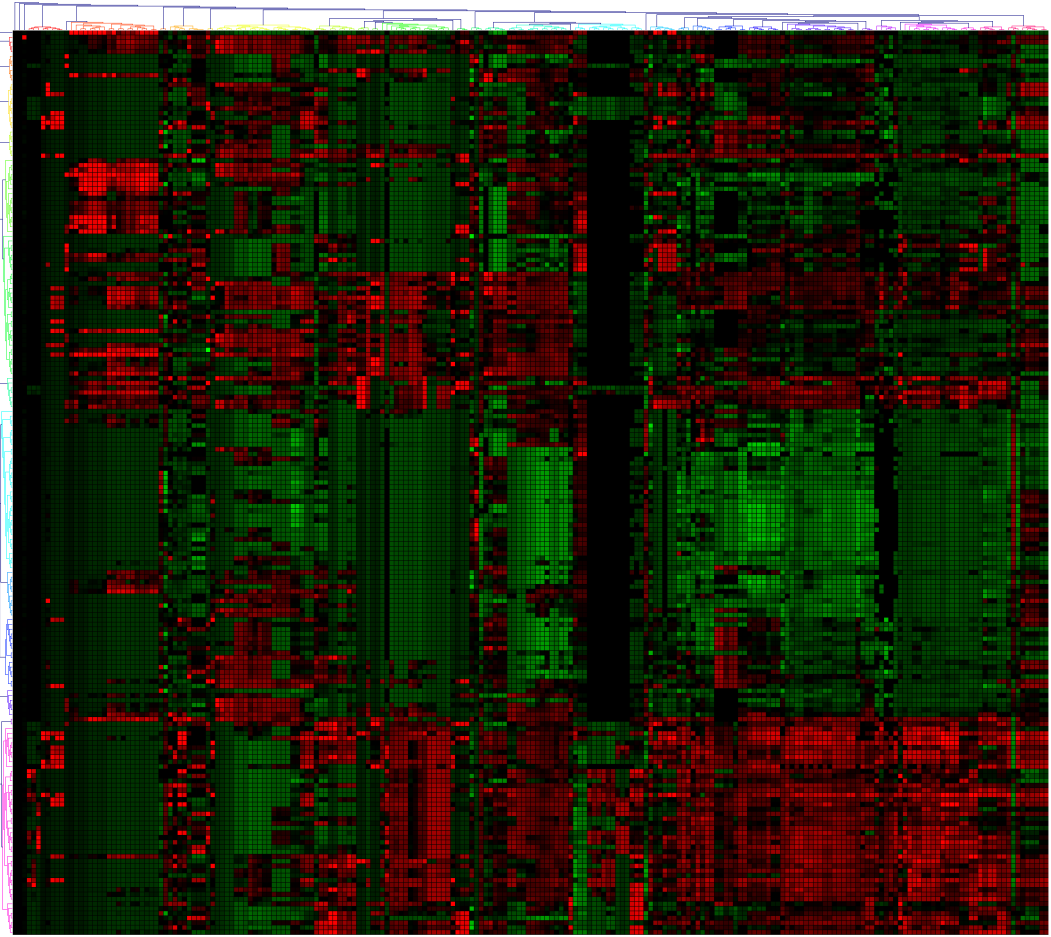
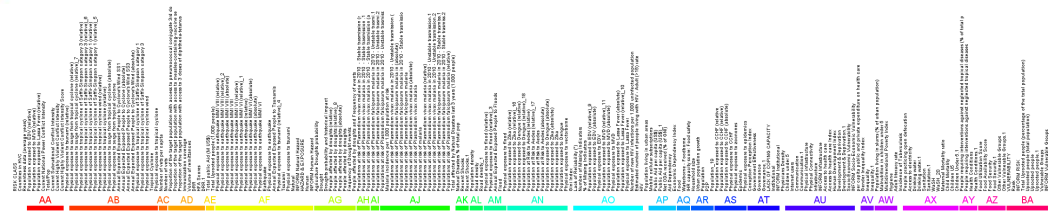
- Global Health Security Index
- Global Health Observatory
- Health Care Index
- Bloomberg Global Health Index
- Human Development Health Index
- Ocean Health Index
- Global Health Data Exchange

HIGH

LOW



What Country? What SEI and Capability?



Smart Data Integration (billions records/hundreds sources)

DATE OF THE YEAR	REGION	COUNTRY	DISEASE	YEAR	WEEK OF THE YEAR	PROJECTED CONFLICT RISK	INFORM RISK	HEALTH CONDITIONS	FOOD SECURITY	RESEARCHERS	INSTITUTIONS	LOCALITIES AFFECTED
June 12, 2018, midnight	Asia	China	Influenza - Avian	2018	24	8	4,1	0,5	2,4	179596	7337	1
Dec. 20, 2018, midnight	Asia	China	African swine fever	2018	51	8	4,1	0,5	2,4	84	3	1
May 20, 2018, midnight	Asia	China	Foot and mouth disease	2018	21	8	4,1	0,5	2,4	1321	36	1
Sept. 17, 2018, midnight	Asia	China	African swine fever	2018	38	8	4,1	0,5	2,4	84	3	2
Oct. 17, 2018, midnight	Asia	China	African swine fever	2018	42	8	4,1	0,5	2,4	84	3	1
Aug. 14, 2018, midnight	Asia	China	African swine fever	2018	33	8	4,1	0,5	2,4	84	3	1



What Disease? What variant? What impact?

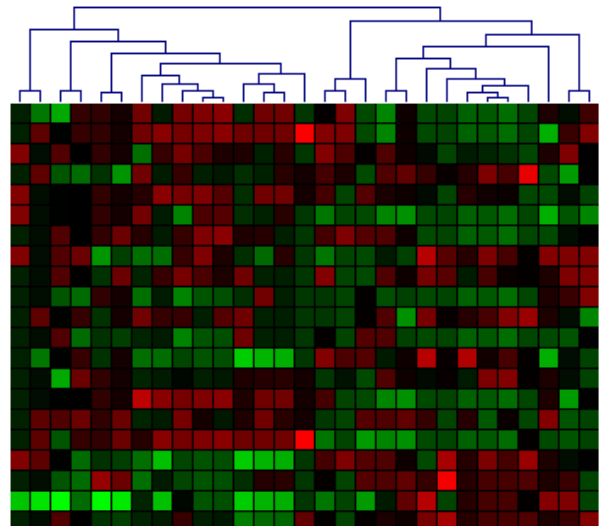
- Understanding of fundamental immunology
- Host-Pathogen interaction
- Potential for silent spread
- Potential for zoning
- Speed of spread
- Risk of spread to susceptible populations
- Agri-terrorism potential
- Economic direct impact (including cumulative costs (e.g. Enzootic vs Epizootic))
- Economic indirect impact (social, market)
- Impact on international trade due to existing regulations
- Impact on EC trade due to existing regulations
- Duration of animal welfare impact
- Disease impact on production
- Proportion of animal affected suffering pain/ injury/ distress as a result of the disease
- Impact on security of food supply
- Wildlife reservoir and potential spread
- Vector reservoir and potential spread
- Variability of the agent
- Number of livestock species involved
- Persistence of the infectious agent in the environment
- Impact of occurrence on food safety
- Spread in humans
- Likelihood of occurrence
- Impact of occurrence on human health
- Transmissibility (spread from animal to human)
- Bioterrorism potential
- Appropriate diagnostics
- Appropriate vaccines
- Appropriate pharmaceuticals

Disease Name	Disease Knowledge	Impact Animal Health	Impact Human Health	Impact Wider Society	Impact Trade
African Swine Fever	2	1	6	5	1
Anthrax	3	2	4	4	5
Avian Influenza	5	2	1	4	4
Bluetongue	2	3	6	5	3
Bovine Tuberculosis	5	3	5	5	4

Disease Name	Disease Knowledge	Impact Animal Health	Impact Human Health	Impact Wider Society	Impact Trade
African Swine Fever	2	1	6	5	1
Anthrax	3	2	4	4	5
Avian Influenza	5	2	1	4	4
Bluetongue	2	3	6	5	3
Bovine Tuberculosis	5	3	5	5	4

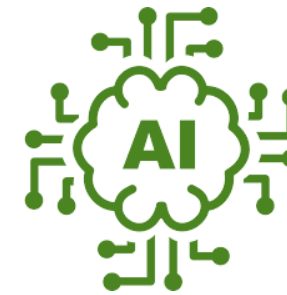
32 indicators

59 diseases



- African Horse Sickness_Total
- African Swine Fever_Total
- African Trypanosomiasis (scores for Non Tse-Tse transmitted)_Total
- Anthrax_Total
- Avian Influenza_Total
- BHV-1 (IBR)_Total
- Bluetongue_Total
- Bovine Spongiform Encephalopathy_Total
- Bovine Tuberculosis_Total
- BRSV_Total
- Brucellosis (Gap analysis scoring for cattle brucellosis)_Total
- BVDV_Total
- Campylobacter_Total
- Chlamydiosis (C. Abortus)_Total
- Classical Swine Fever_Total
- Coccidiosis (poultry)_Total
- Contagious Bovine Pleuro Pneumonia_Total
- Crimean-Congo Haemorrhagic fever_Total
- Cryptosporidiosis_Total
- Cysticercosis_Total
- E. coli_Total

- CDC & HHS
- USDA
- Feed Risk Consortium Meeting Report
- Holding Time Calculation for Feed Ingredients
- AFIA Handling Imported Feed Ingredients
- Feed Ingredient Safety Decision Tree Matrix
- Non-animal Origin Feed Ingredients and the Transmission of Viral Pathogens of Swine



Smart Data Integration (billions records/hundreds sources)



144 32 1.2M 850K 10

HOME > SURVEILLANCE > COUNTRYMETRIC

By region By country By disease By week of the year

< All dates January 2018 February 2018 March 2018 April 2018 May 2018 June 2018 July 2018 August 2018 September 2018 October 2018 November 2018 December 2018

DATE OF THE YEAR	REGION	COUNTRY	DISEASE	YEAR	WEEK OF THE YEAR	PROJECTED CONFLICT RISK	INFORM RISK	HEALTH CONDITIONS	FOOD SECURITY	RESEARCHERS	INSTITUTIONS	LOCALITIES AFFECTED
June 12, 2018, midnight	Asia	China	Influenza - Avian	2018	24	8	4,1	0,5	2,4	179596	7337	1
Dec. 20, 2018, midnight	Asia	China	African swine fever	2018	51	8	4,1	0,5	2,4	84	3	1
May 20, 2018, midnight	Asia	China	Foot and mouth disease	2018	21	8	4,1	0,5	2,4	1321	36	1
Sept. 17, 2018, midnight	Asia	China	African swine fever	2018	38	8	4,1	0,5	2,4	84	3	2
Oct. 17, 2018, midnight	Asia	China	African swine fever	2018	42	8	4,1	0,5	2,4	84	3	1
Aug. 14, 2018, midnight	Asia	China	African swine fever	2018	33	8	4,1	0,5	2,4	84	3	1

CountryMatrix: Weekly consolidated environment

1 2 3 4 ... 73 74

1831 CountryMetric

Smart Data Integration (billions records/hundreds sources)



HOME > BIOSURVEILLANCE > COUNTRYMETRIC

admin

By region By country By disease By week of the year

+ Add CountryMetric

< All dates January 2018 February 2018 March 2018 April 2018 May 2018 June 2018 July 2018 August 2018 September 2018 October 2018 November 2018 December 2018

FOOD SECURITY	RESEARCHERS	INSTITUTIONS	LOCALITIES AFFECTED	TRADED COMMODITY	INCOMING CARGO	BILL OF LANDING	INCOMING VESSELS	RESPONSIVENESS DAYS	DOMESTIC CASE	DOMESTIC DEATHS	WILD CASE
2,4	179596	7337	1	0	60819	22477	84	19	1050	1050	0
2,4	84	3	1	0	57021	31508	128	21	27	27	0
2,4	1321	36	1	0	51281	17444	101	12	16	11	0
2,4	84	3	2	0	47463	23075	107	13	79	78	0
2,4	84	3	1	0	45845	24477	120	15	7	4	0
2,4	84	3	1	0	44256	22223	87	12	30	30	0

CountryMatrix: Weekly consolidated environment

1 2 3 4 ... 73 74

1831 CountryMetric

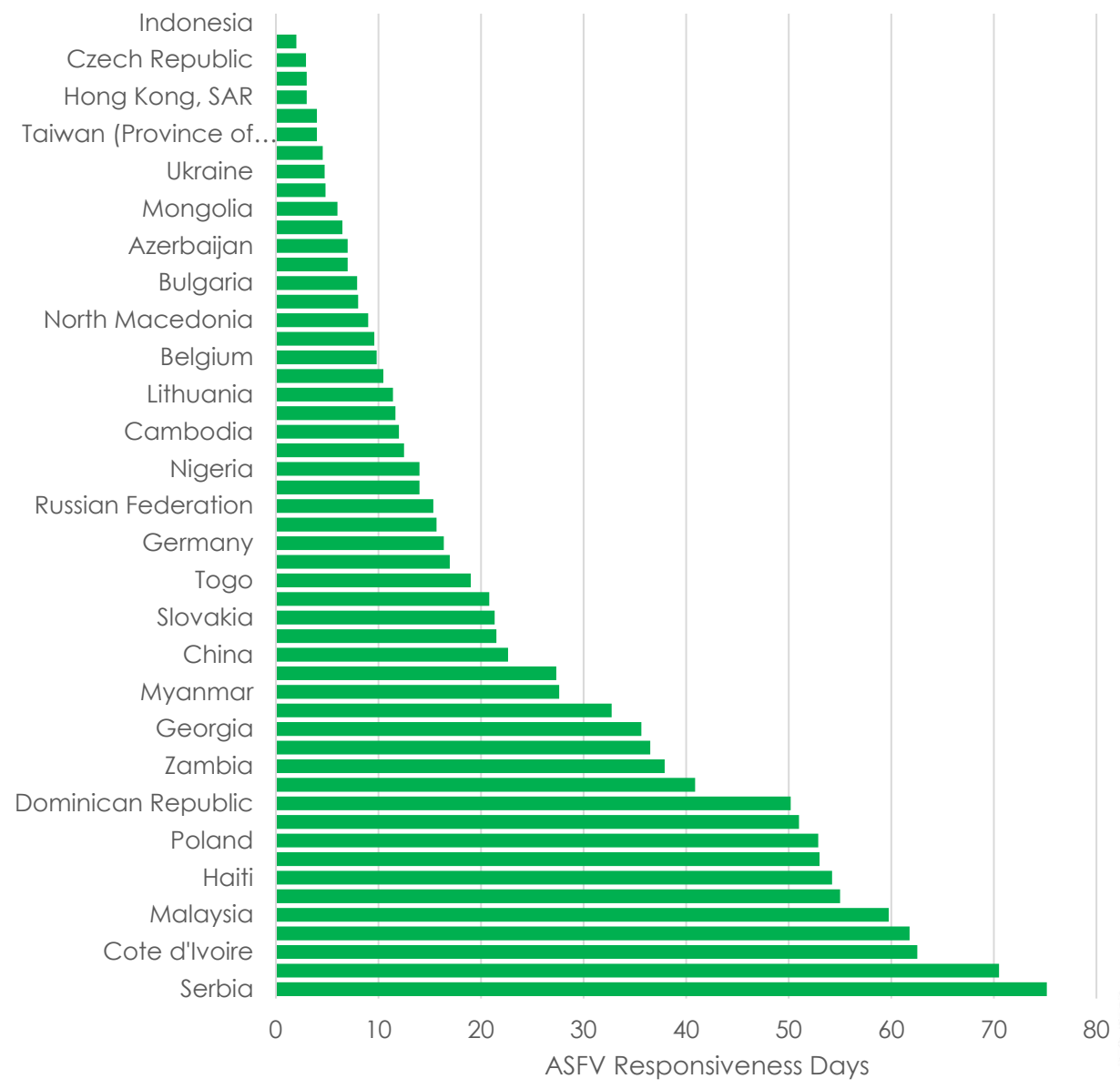
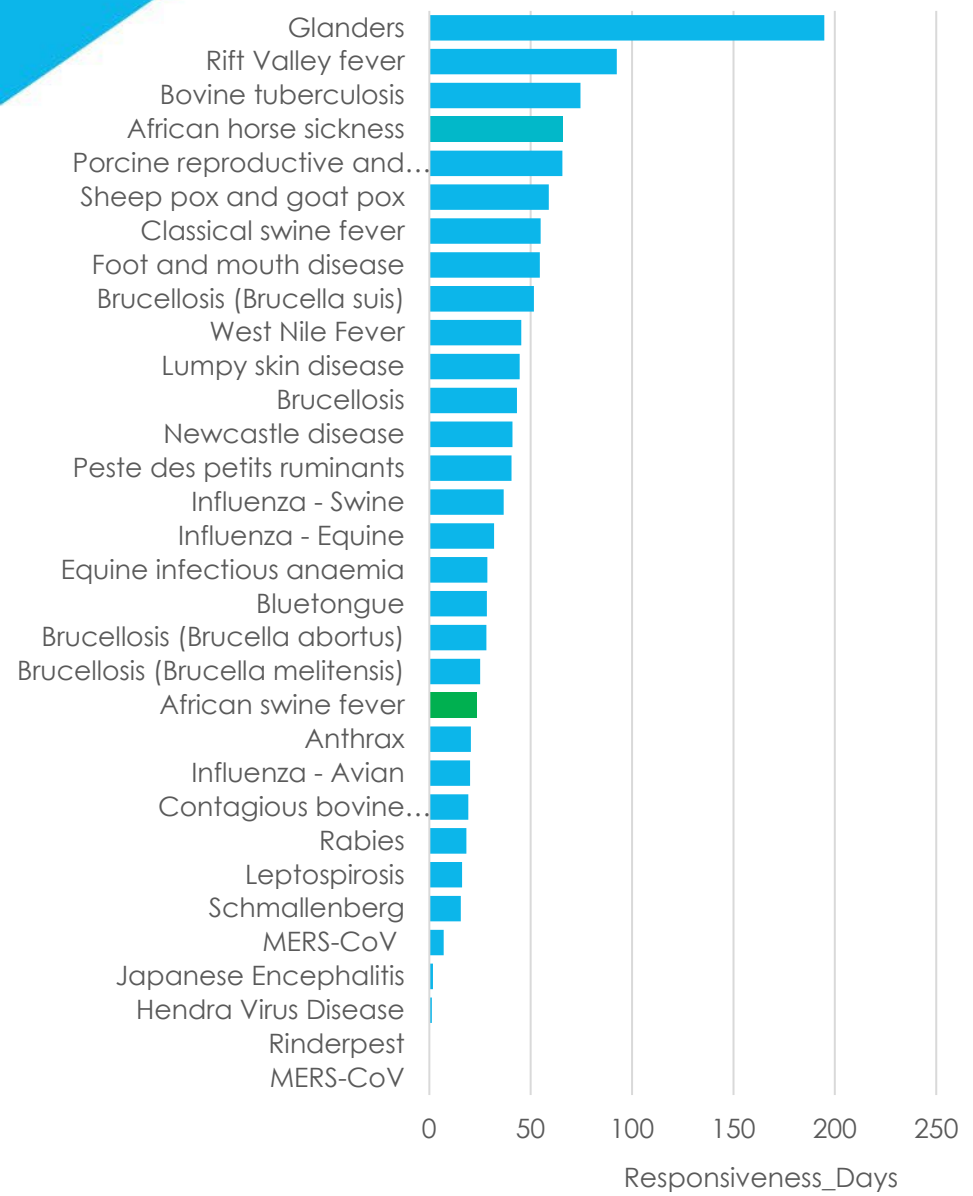
9000

23

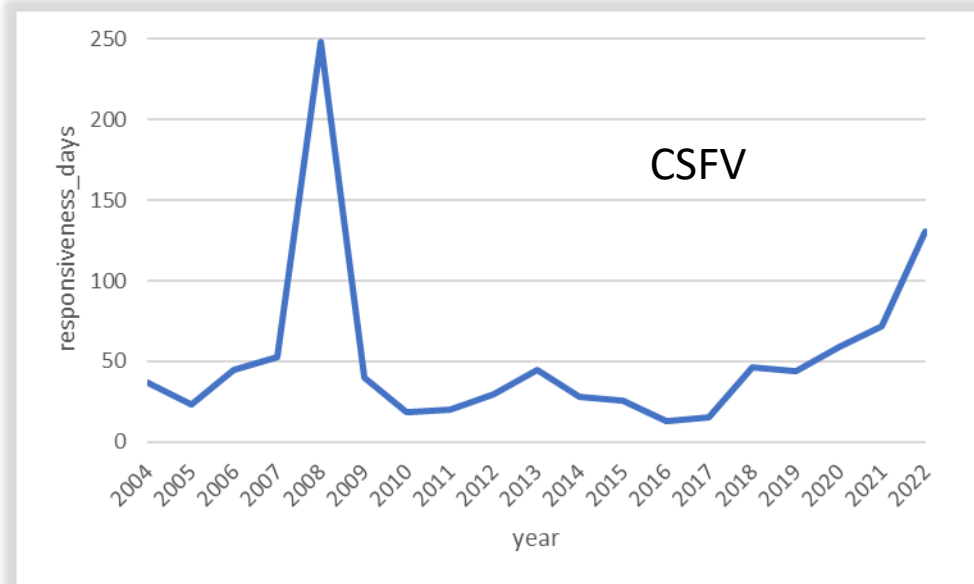
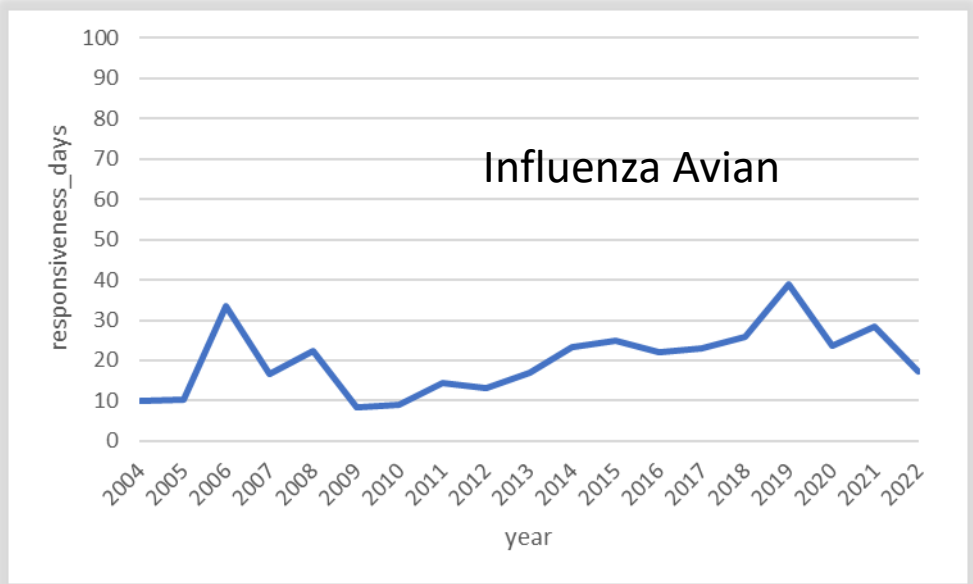
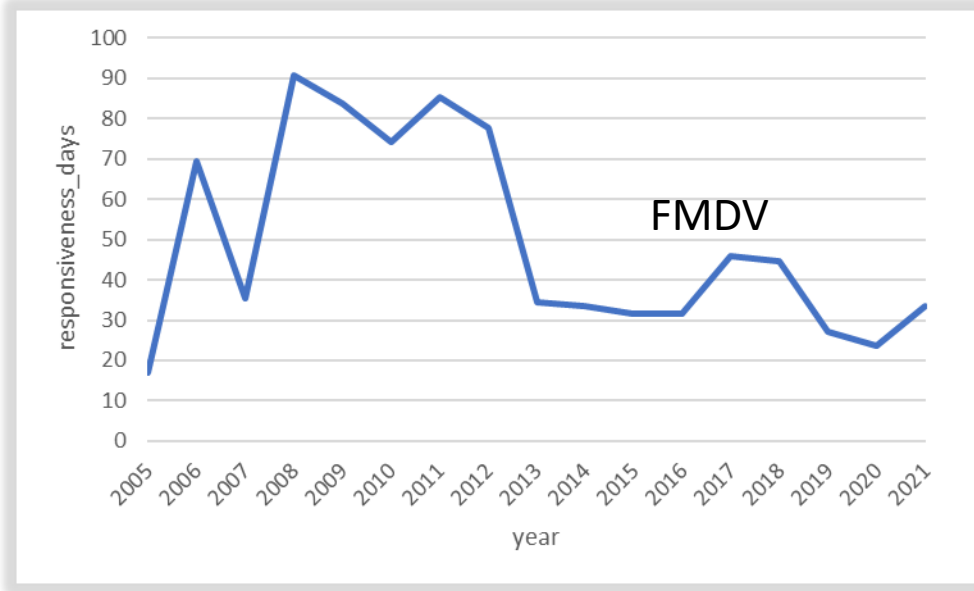
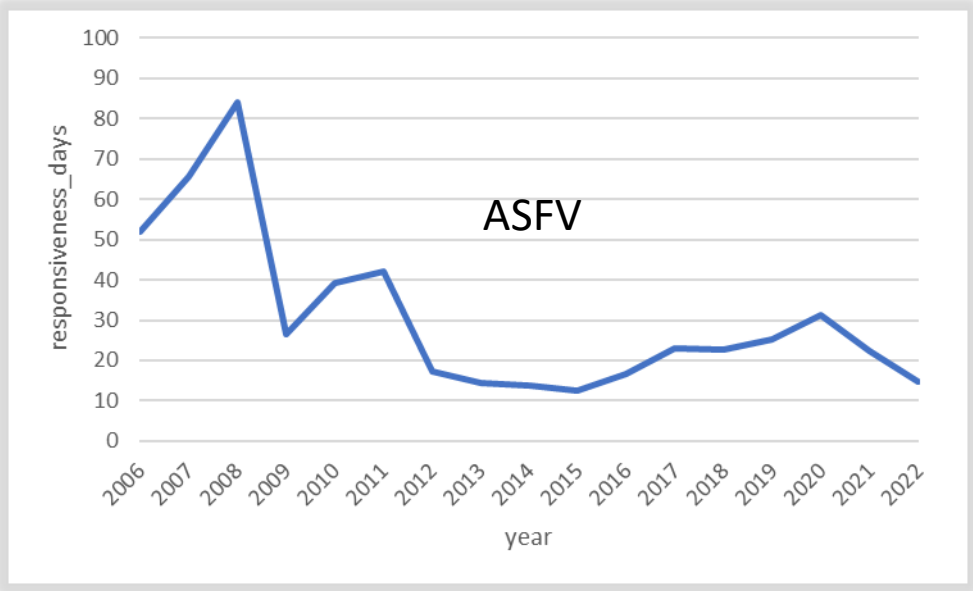
10

184

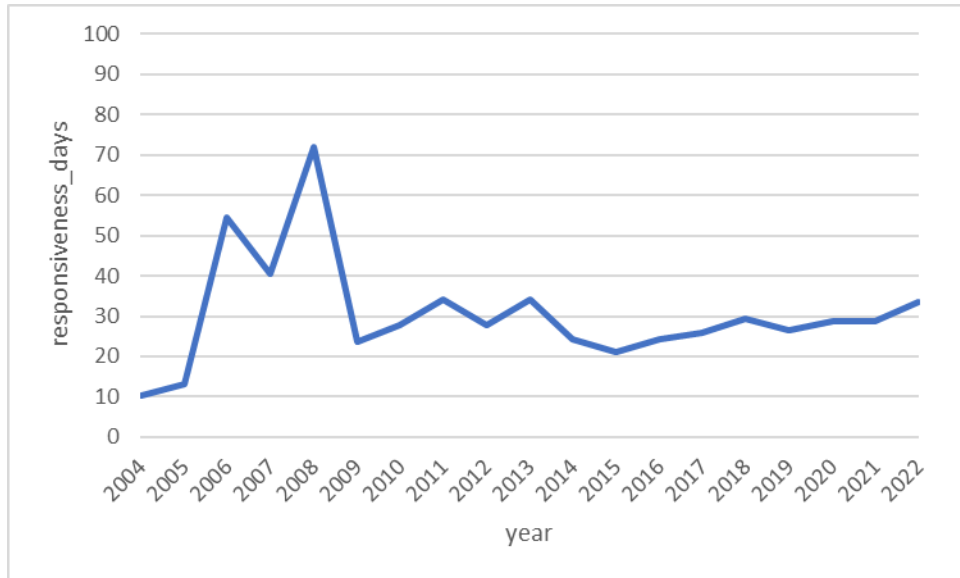
What capability for what disease?



Responsiveness in Reporting Diseases



Responsiveness in Reporting Diseases



Is the reporting capability of a country improving?
Dynamic indicator

Is the reporting capability the same for different diseases?
Dynamic indicator

Does a no-reporting country mean that it is free of disease?
Dynamic indicator

Reporting more diseases is a problem for the country?
Dynamic indicator

What factors drive is disease reporting?
Dynamic and Static indicator

What is the difference between OSINT?

- What is the sensitivity?
- What is the accuracy?
- What is reliability?
- What is the **disinformation** value?



Neighbor Based Risk (BioMon and BioNews)



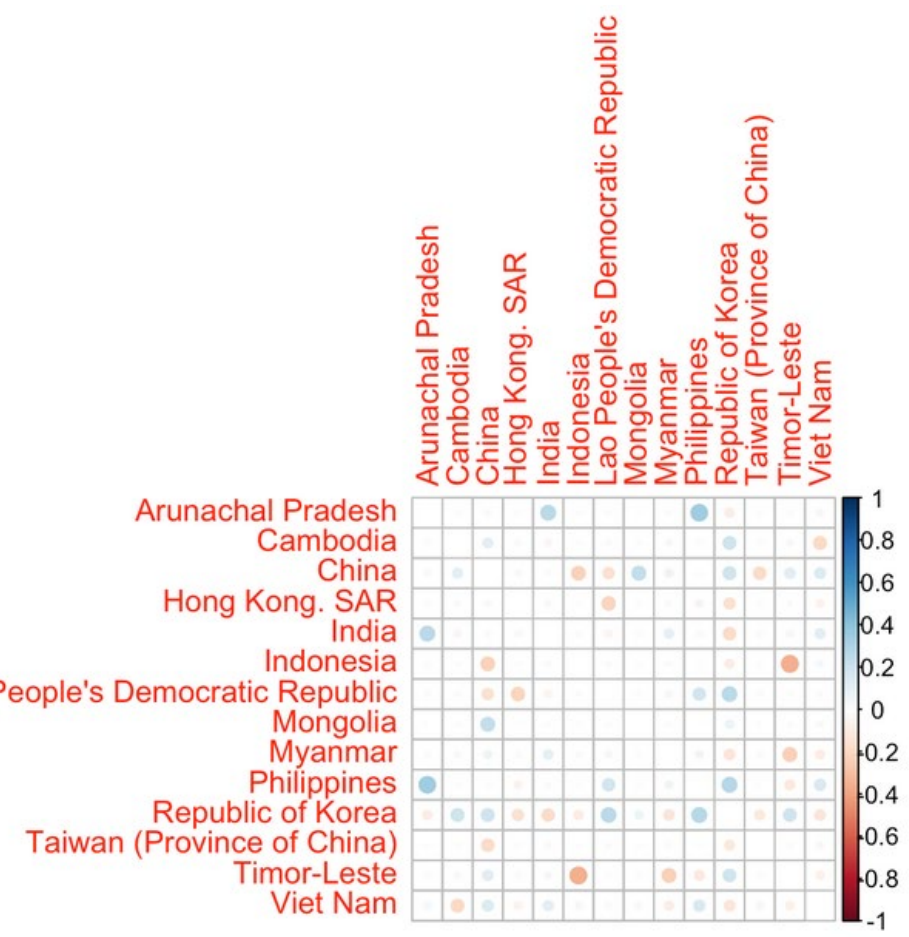
ASFV might have been circulating in Thailand for nearly two years in **the Nakhon Pathom province (red region in map).**

Provinces affected are:

- Bangkok,
- Buri Ram,
- Chumphon,
- Khon Kaen,
- Mae Hong Son,
- Maha Sarakham,
- Nong Bua Lamphu,
- Nakhon Si Thammarat,
- Nakhon Pathom
- Phang Nga,
- Prachuap Khiri Khan,
- Suphan Buri,
- Si Sa Ket,

The percentage of positive cases of ASFV in confiscated pork products is approximately 8.5% (343/4,010). ASFV-positive pork products can be characterized as the ASFV GII-CVR II-IGR I.

The Thai ASFV isolates in products have a high homology with currently circulated Asian isolates especially Chinese strains and a Vietnamese strain.



Risk Level using a Probabilistic Approach

Weighted Average Approach to Animal Disease Risk Assessment

Select parameters

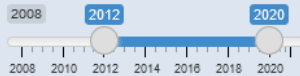
Select a disease:

African swine fever

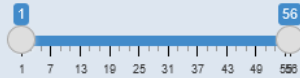
Select a country:

- Romania
- Ukraine
- Poland
- Hungary
- Belgium
- China
- Lithuania
- Italy
- Slovakia
- Viet Nam
- Croatia

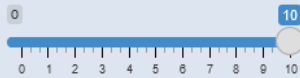
Choose years



Choose weeks



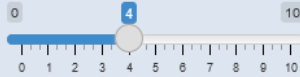
Weight for domestic case



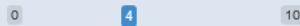
Weight for wild case



Weight for total incoming cargo



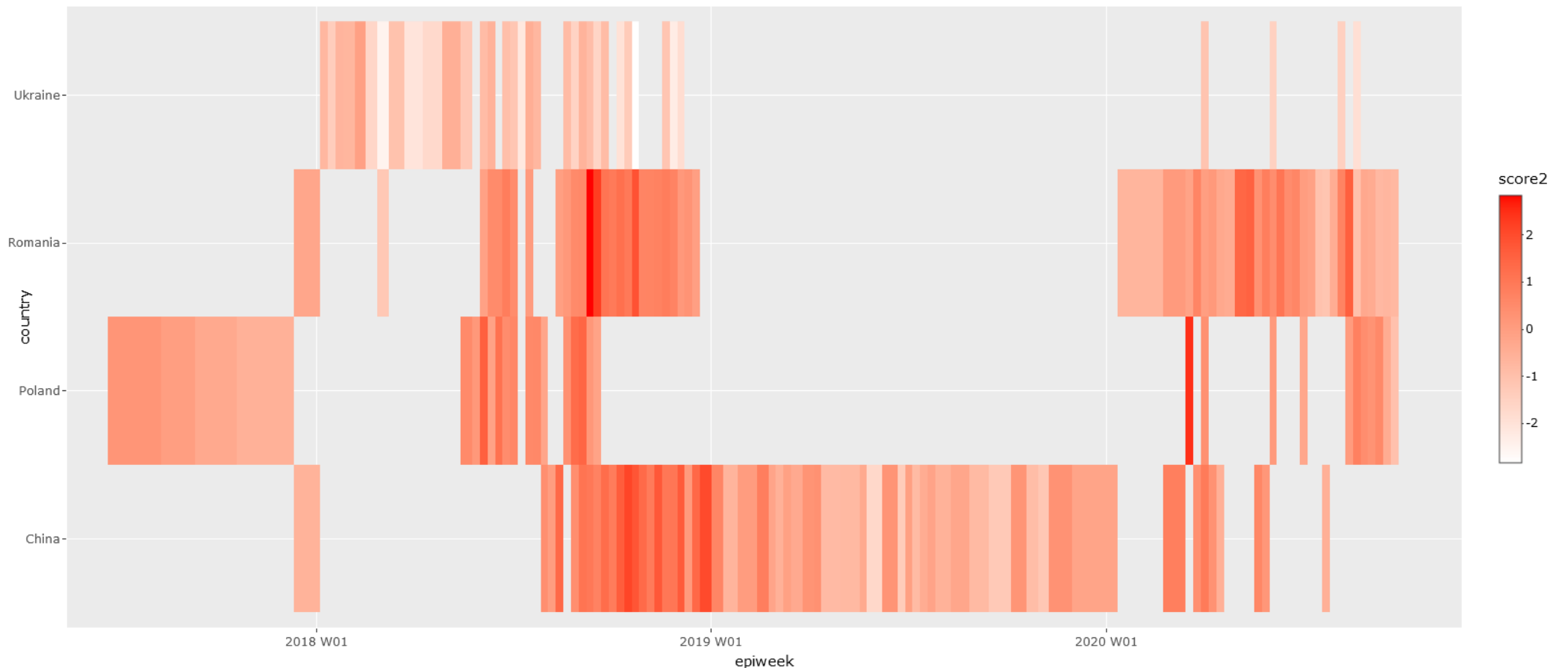
Weight for total vessel



- Data table view
- World map view
- Country scatter plots
- Country violin plots
- Country tile plots
- Country tile plots for cargo
- Country tile plots for domestic case
- Principal Component Risk - 1
- Principal Component Risk - 2
- Factor Analysis

Commodity Info

Risk score over the years



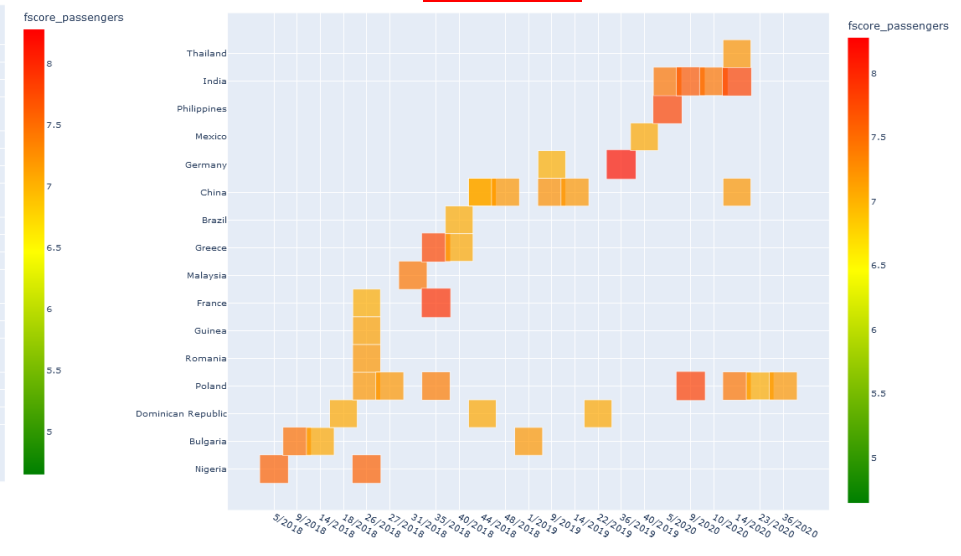
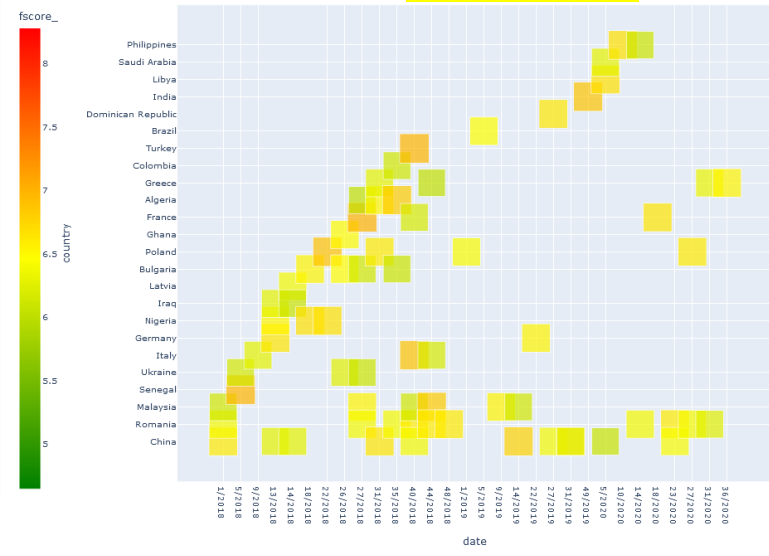
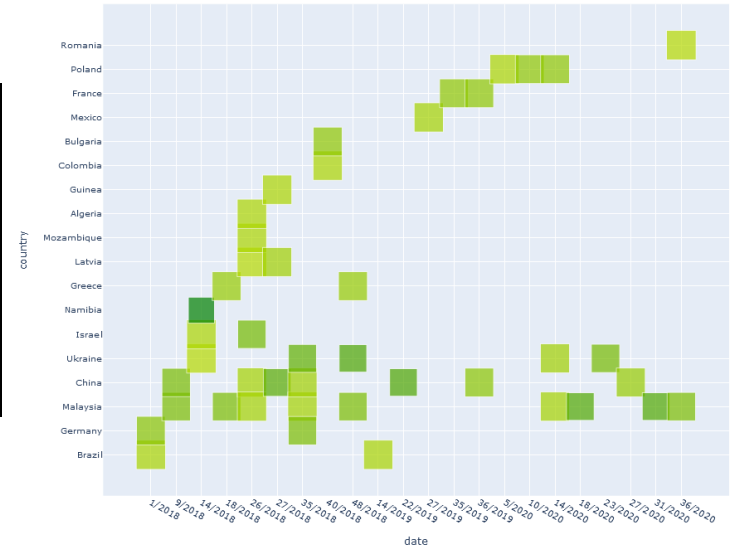
Risk Level using Factor Rating Approach

LOW

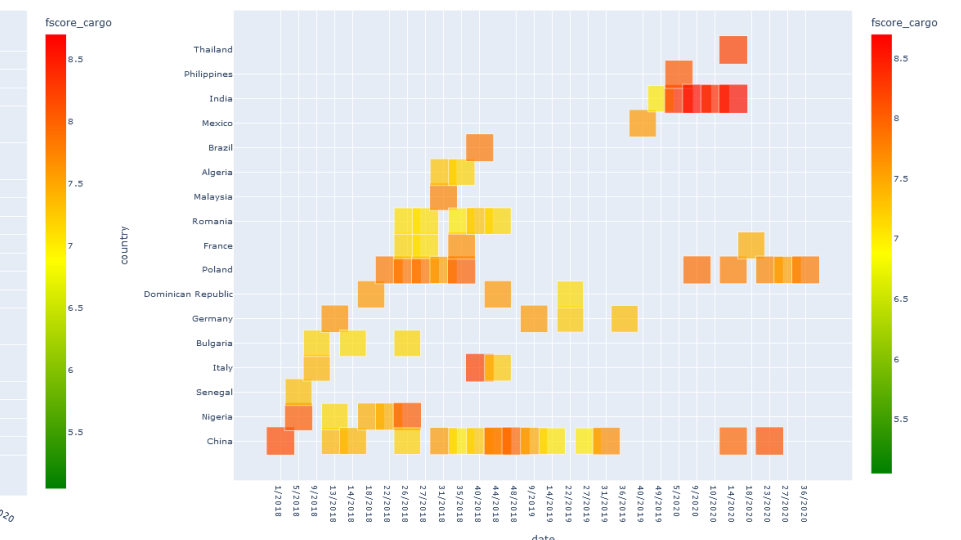
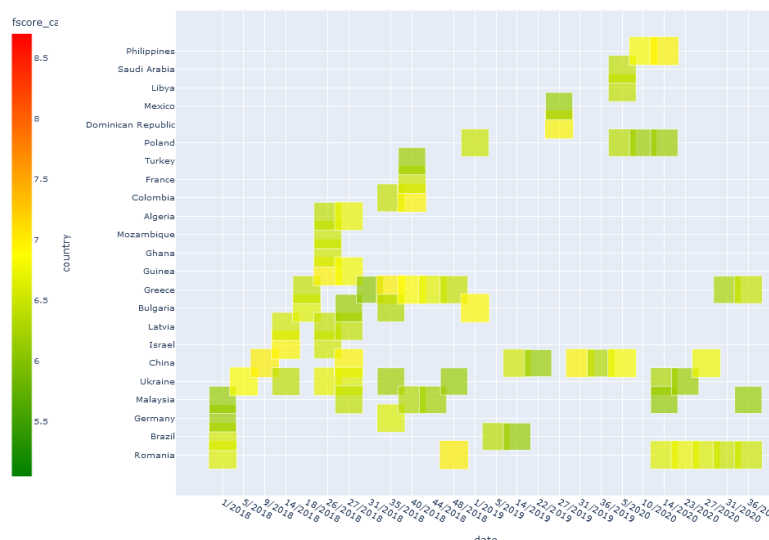
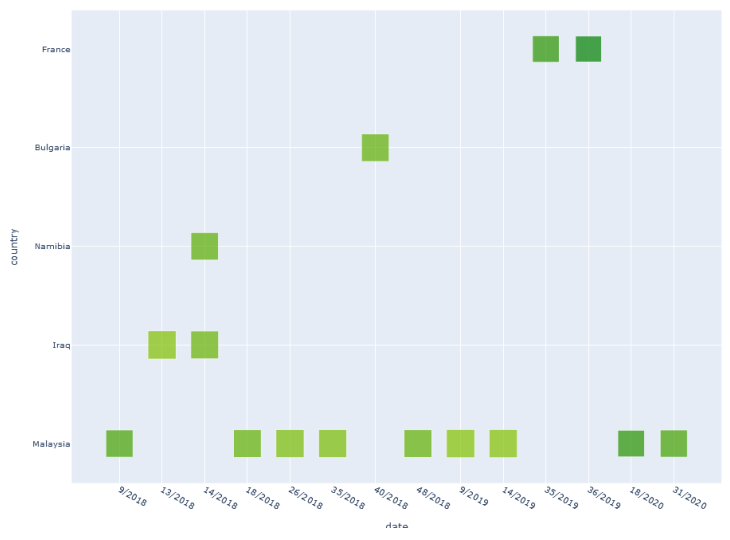
MEDIUM

HIGH

PASSENGERS



CONTAINERS



Data Collection

Data Collection Engine



Seamless Data Sharing

HOME > BIOSURVEILLANCE > GTRA

Search [] By product category [] By product [] By origin country [] By country [] SEARCH 1980 results (40013 total) + Add GTRA

2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022

PRODUCT	PRODUCT CATEGORY	COUNTRY	ORIGIN COUNTRY	RISK	HAZARD	REPORTING DATE
Biscuits	cereals and bakery products	Croatia	Bosnia and Herzegovina	undecided	Acrylamide in biscuits from Bosnia and Herzegovina	Oct. 28, 2022, midnight
dried fenugreek leaves	herbs and spices	Germany	India	undecided	Chlorpyrifos in fenugreek leaves from India	Oct. 28, 2022, midnight
fitness bars	cereals and bakery products	Germany	Germany	undecided	2-Chlorethanol in fitness bars from Germany	Oct. 28, 2022, midnight
wine leaves in brine	fruits and vegetables	Germany	Turkey	serious	Ethirimol and hexythiazox in wine leaves in brine from Turkey	Oct. 28, 2022, midnight
BOVINE MEAT	meat and meat products (other than poultry)	Spain	Brazil	undecided	Ruptura de la cadena de frío en carne de ternera congelada de Brasil / Poor temperature control for frozen bovine meat from Brazil	Oct. 28, 2022, midnight
semilla de sésamo / sesame seed	nuts, nut products and seeds	Spain	Nigeria	serious	Presencia de salmonella en semillas de sésamo de Nigeria / Presence of salmonella in sesame seed from Nigeria	Oct. 28, 2022, midnight
margarine	fats and oils	Germany	Belgium	undecided	MOSH and MOAH in margarine from Belgium	Oct. 28, 2022, midnight
Cordyceps sinensis	other food product / mixed	Spain	United States	undecided	Presencia de nuevo alimento no autorizado (Cordyceps sinensis) procedente de EEUU / Unauthorised novel food (Cordyceps sinensis) from USA	Oct. 28, 2022, midnight
Halva with pistachios	confectionery	Germany	Turkey	serious	Salmonella spp. in halva from Turkey	Oct. 28, 2022, midnight
Carne fresca de anatra / Fresh duck meat	poultry meat and poultry meat products	Italy	Poland	undecided	Salmonella Newport in carne fresca (cosce) di anatra dalla Polonia / Salmonella Newport in fresh duck meat (legs) from Poland	Oct. 28, 2022, midnight

GO 1 2 3 4 ... 1599 1600 39980 GTRA

GTRA: 27 countries AG products rejections

HOME > BIOSURVEILLANCE > TRADE MON

pork SEARCH 1760 results (7644685 total) + Add Trade Mon

VESSEL NAME	CONTAINER NUMBER	ESTIMATED ARRIVAL DATE	ACTUAL ARRIVAL DATE	FOREIGN PORT OF LADING	PORT OF UNLADING	DESCRIPTION TEXT	HARMONIZED NUMBER	HARMONIZED VALUE	SHIPPER PARTY NAME
JPO AQUARIUS	MSCU7414143	April 10, 2018, midnight	April 22, 2018, midnight	South Riding Point, Bahamas	Port Everglades, Florida	PORK LOINS - PORK LOINS CAN - DUBRETON CAED: NDR 1			INTERRA INTERNATIONAL LLC
MSC VALENCIA	MNBU3372031	Feb. 26, 2018, midnight	Feb. 27, 2018, midnight	Bremerhaven, Federal Republic of Germany	New York/Newark Area, Newark, New Jersey	= 020329 FROZEN PORK LOIN BACKRIBS 16-20 SHIPPING MARKS: 17378 NET WEIGHT: 50582,70 LBS GROSS WEIGHT: 52853,76 LBS NET WEIGHT: 22943,93 KGS GROSS WEIGHT: 23974,06 KGS CARTONS: 1147 PCC SEAL: PCC0104590 HS CODE			PINI POLONIA SP Z O O
MSC VIDISHA R.	TEMU9377583	Feb. 24, 2018, midnight	Feb. 23, 2018, midnight	Anvers, Belgium	Philadelphia, Pennsylvania	= BLOCKS ON 20 PALLETS OF PORK LIVER (NET WEIGHT 21267 KG) HS CODE 05119985 FDA REG. 15781 798280			BHJ A/S
						MBL: SUDU58BUEIA0788X HARMLESS CHEMICALS (DESICCATED PORK LIVER POWDER UNDEFATTED) (HTS 3001.90.31) THE REGULATED WOOD PACKING MATERIAL HAS BEEN TREATED IN ACCORDANCE WITH THE USDA REQUIREMENTS FREIGHT COLLECT 180 PACKAGES ON 20			

1 2 3 4 ... 190 191 4760 Trade Mon

TraMON: Incoming containers and vessels

Real Time Harmonized Trade Code Mapping

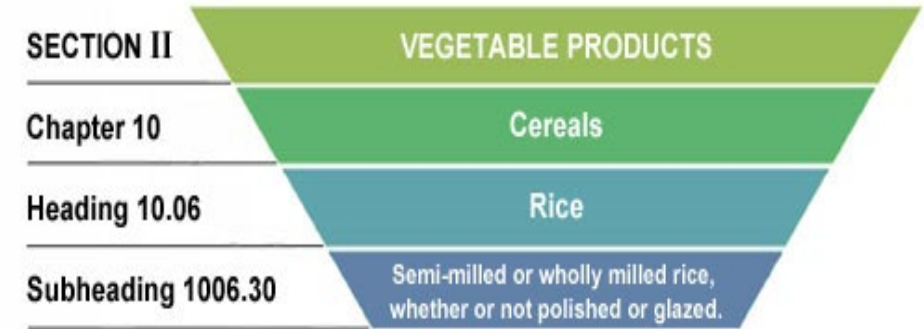
HC Internationally standardized system for commodity description WCO-USHS

Section (21) – roman numerals

Chapters (99)

Headings (1,244)

Sub-heading (5,224)



By Hsmind - Own work, CC BY-SA 4.0, <https://commons.wikimedia.org/w/index.php?curid=47027264>

- 020319 PROSCIUTTO COTTO
- 020319 SPICY SALAME NAPOLI

- 160241 BARBECUE SHOULDERHAM
- 160241 HONEY-ROASTED HAM
- 160241 BARBECUE PREMIUM SMOKED HAM (PORK MEAT
- 160100 FROZEN PROCESSED PORK SWINE MEAT

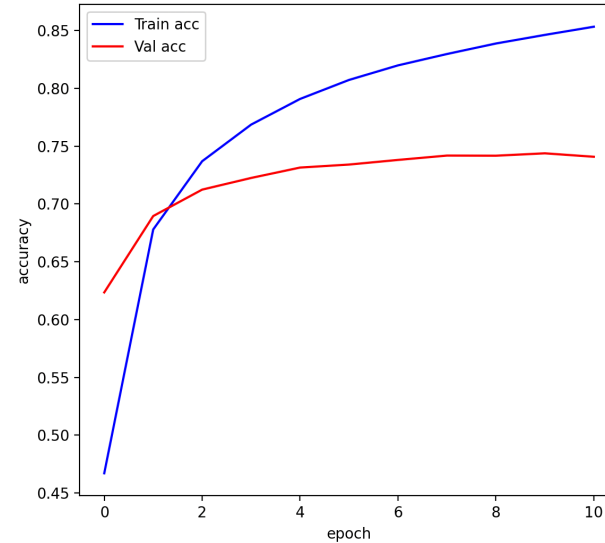
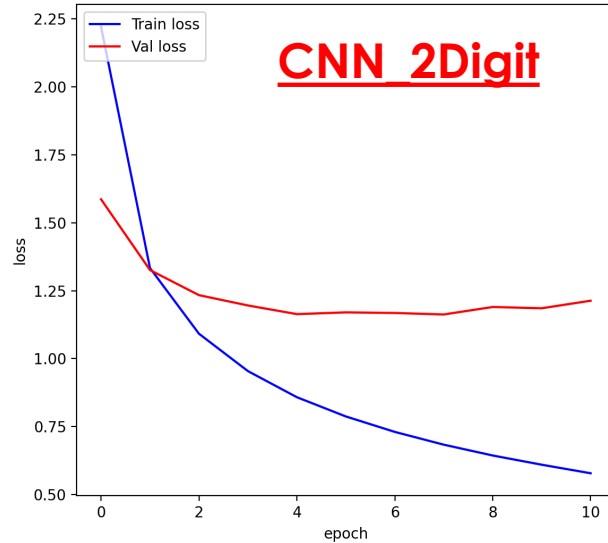
- 392490 SANDWICH BOXBARBECUE

- 841981 GRILL - PANINI



Convolutional Neural Network – 2 Digits (Chapter)

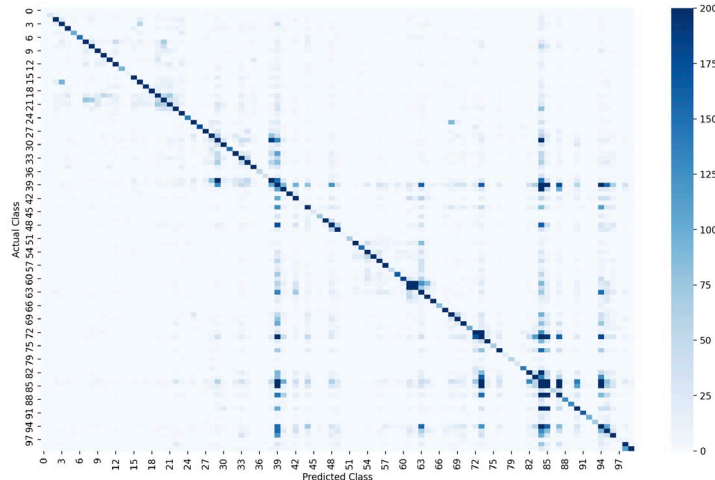
Training-Validation Loss and Accuracy



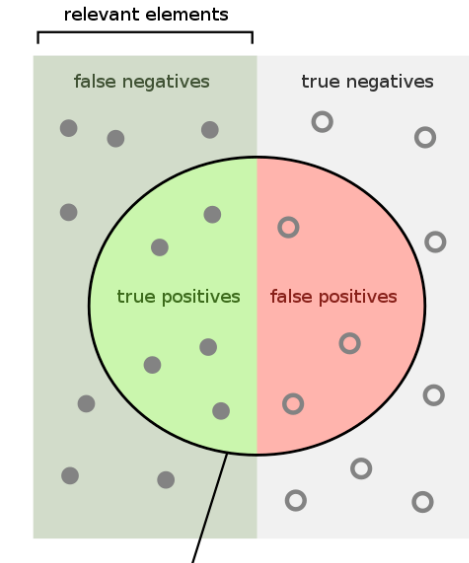
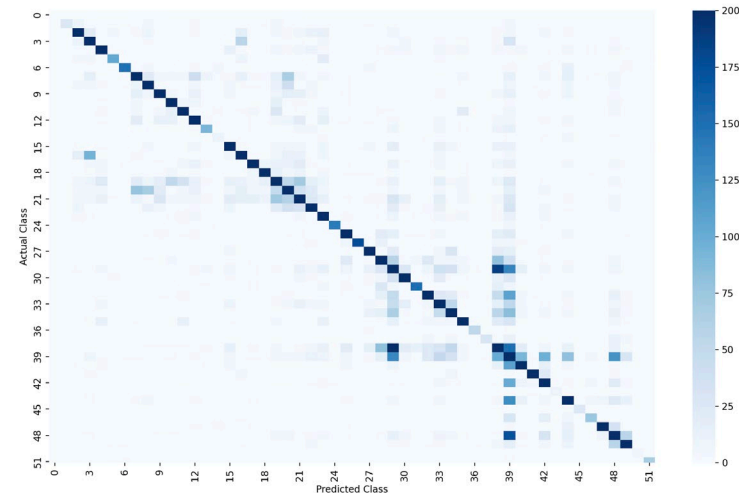
Accuracy, F1, Recall, Precision

TOP 3 Accuracy: 0.8577221077492198
TOP 5 Accuracy: 0.8942209208449312
Top1 F1 : 0.7405863229547942
Top3 F1 : 0.8536179350091065
Top5 F1 : 0.8887046536636672
Top1 recall : 0.7418874790634904
Top3 recall : 0.8577221077492199
Top5 recall : 0.8942209208449314
Top1 precision : 0.7459810474042535
Top3 precision : 0.8701725671469738
Top5 precision : 0.9099284197549273

All-Class Confusion Matrix



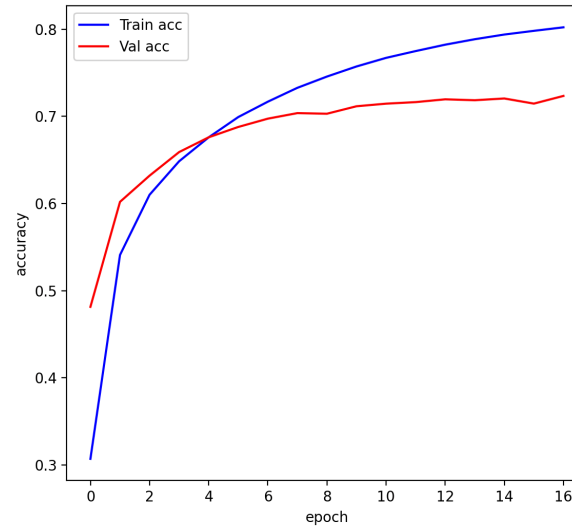
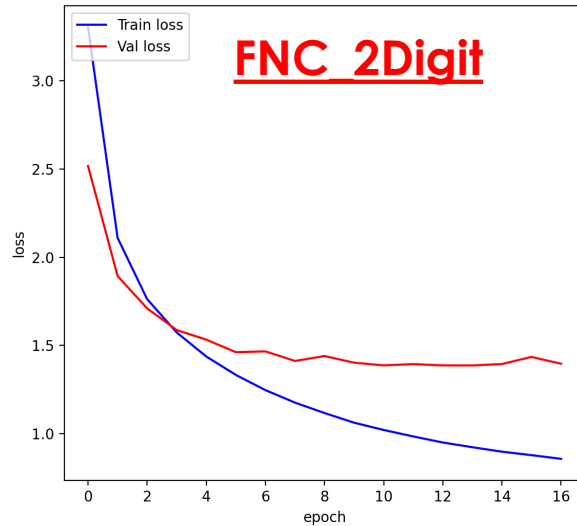
~Classes 1-50 Confusion Matrix



Fully Connected Network – 2 Digits (Chapter)

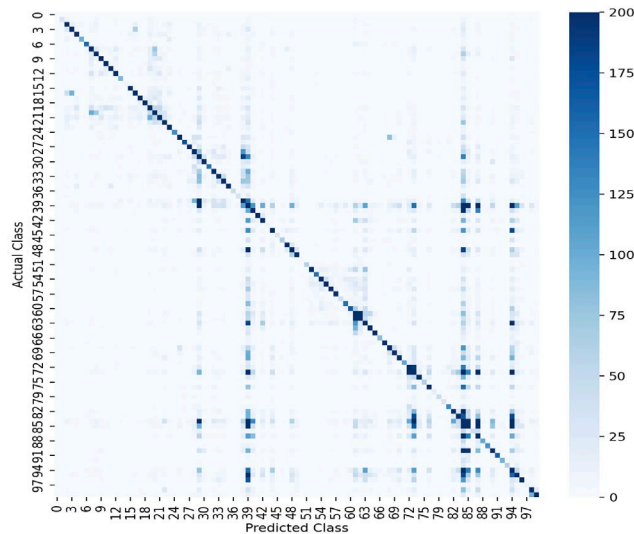
Training-Validation Loss and Accuracy

Accuracy, F1, Recall, Precision

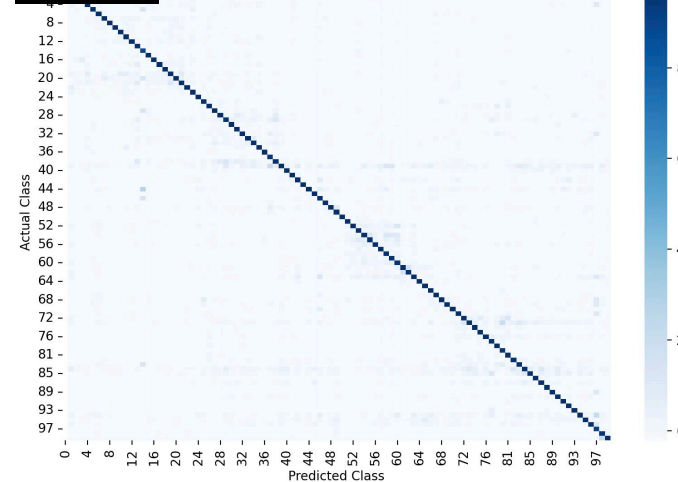


TOP 3 Accuracy: 0.8472267408933715
TOP 5 Accuracy: 0.8884249719842389
Top1 F1 : 0.71456249003822
Top3 F1 : 0.8424166383947359
Top5 F1 : 0.8827400471185965
Top1 recall : 0.7169142898456422
Top3 recall : 0.8472267408933715
Top5 recall : 0.888424971984239
Top1 precision : 0.7230564511963369
Top3 precision : 0.8653904959586458
Top5 precision : 0.9126538469351211

All-Class Confusion Matrix

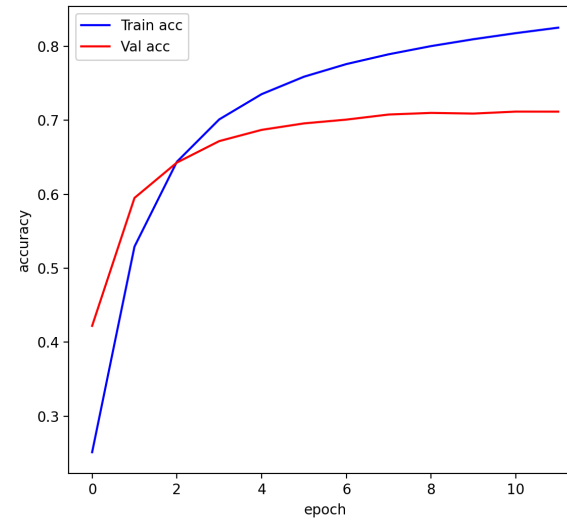
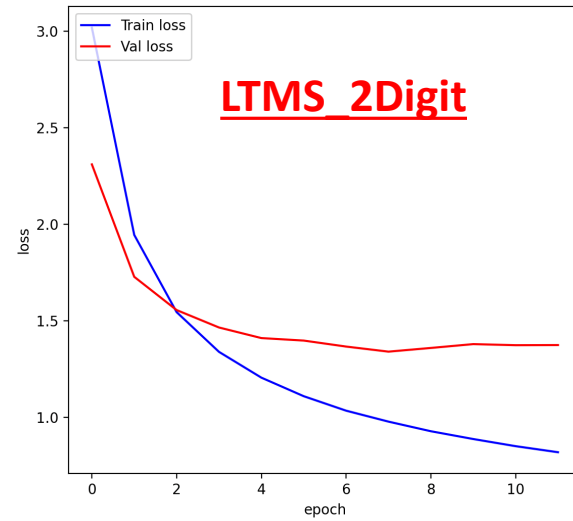


Column Normalized Confusion Matrix



Long Short-Term Memory – 2 Digits (Chapter)

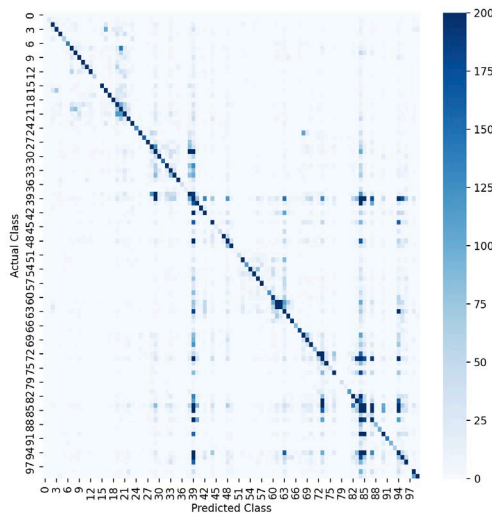
Training-Validation Loss and Accuracy



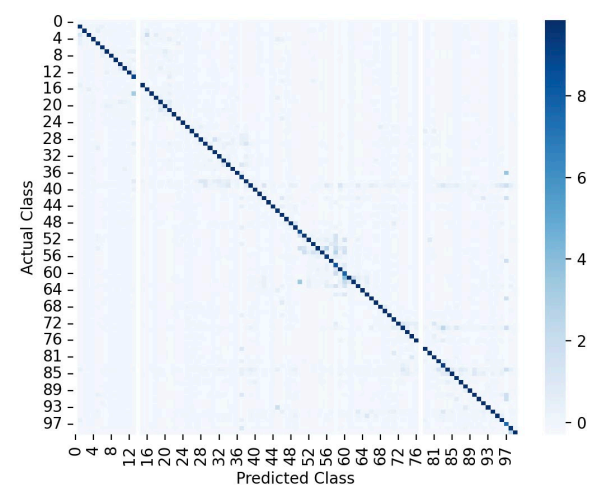
Accuracy, F1, Recall, Precision

TOP 3 Accuracy: 0.8283085710154358
 TOP 5 Accuracy: 0.8699345696417597
 Top1 F1 : 0.7055735123299153
 Top3 F1 : 0.8220353161791367
 Top5 F1 : 0.8618198946127362
 Top1 recall : 0.7077082504910289
 Top3 recall : 0.8283085710154358
 Top5 recall : 0.8699345696417597
 Top1 precision : 0.7146320936905665
 Top3 precision : 0.8540623524264326
 Top5 precision : 0.9021738524825664

All-Class Confusion Matrix



Normalized Confusion Matrix



XGBoost — 2 Digits (Chapters)

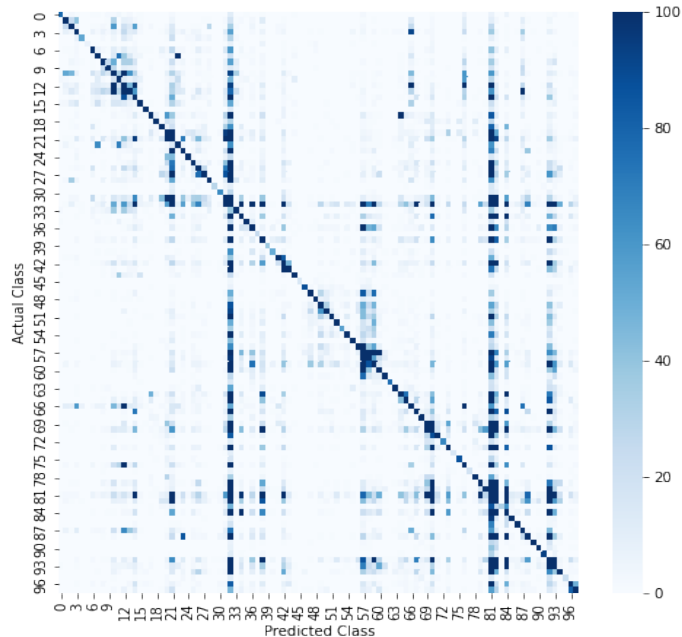
All samples

```
accuracy_score(preds, y_test)
```

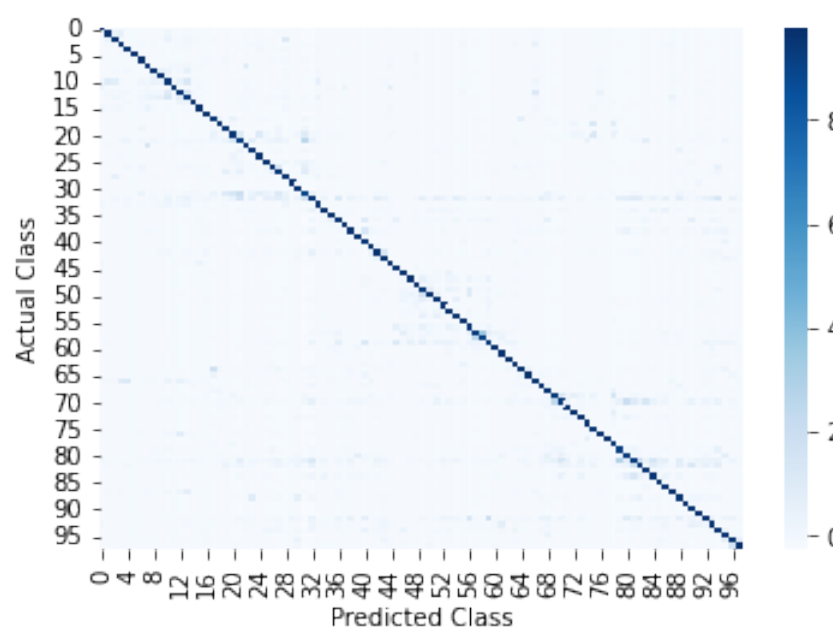
0.5813516155474802

accuracy			0.58	228127
macro avg	0.70	0.49	0.56	228127
weighted avg	0.60	0.58	0.58	228127

All-Class Confusion Matrix



Normalized Confusion Matrix



Sampled Predictions

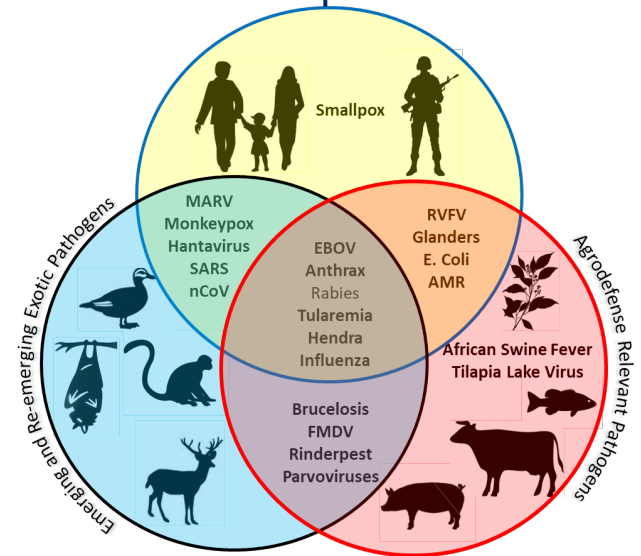
	Actual	Predicted
0	68	68
1	56	61
2	8	8
3	20	84
4	66	66
5	39	82
6	84	84
7	61	61
8	87	95
9	61	61
10	64	95
11	63	39
12	64	64
13	73	73
14	39	94
15	8	8
16	39	61
17	84	87
18	61	61
19	84	84



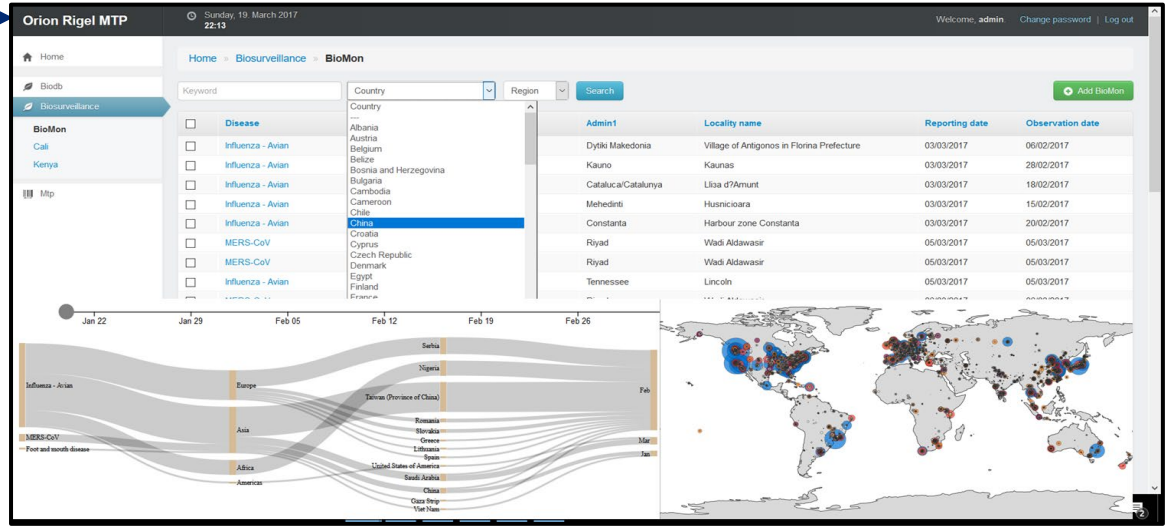
RIGEL Biodefense Enterprise for Global Situational Awareness



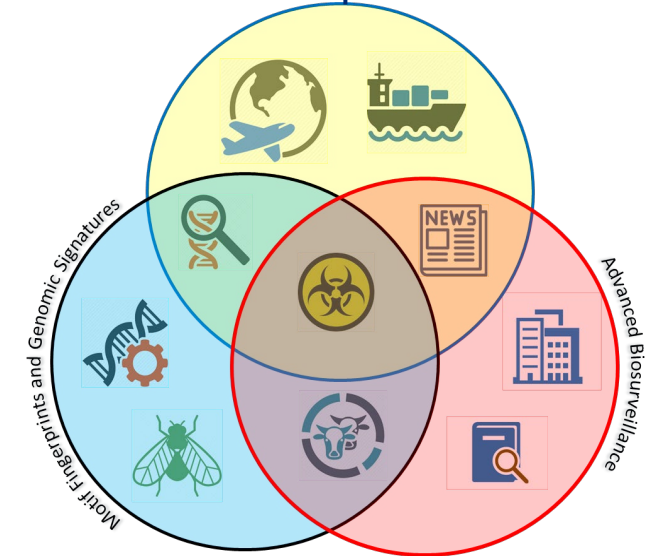
Collection of Complex Biological Samples



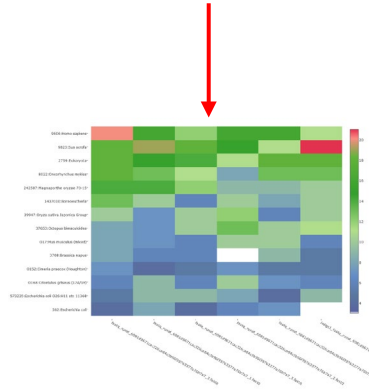
Differentiating Infected from Vaccinated



Real time Genomic-based Biosurveillance



Powerful Analytics



A Data-Driven Risk Scoring Approach

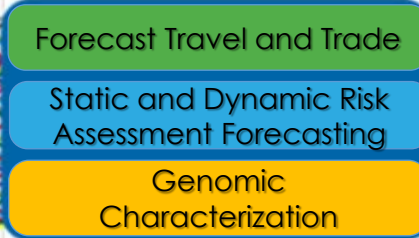
DATA COLLECTION & GENERATION



Integration

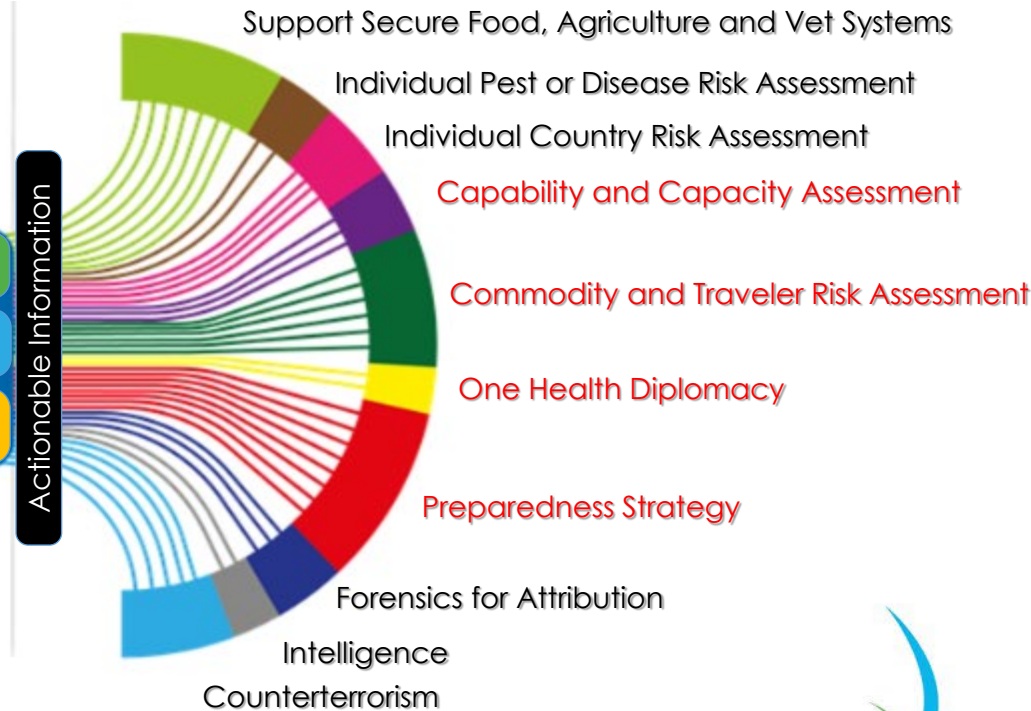
ANALYTICS & MODELING

Big Data Analytics
 KNN-Machine Learning
 Artificial Intelligence
 Contextualized Visualization



Security

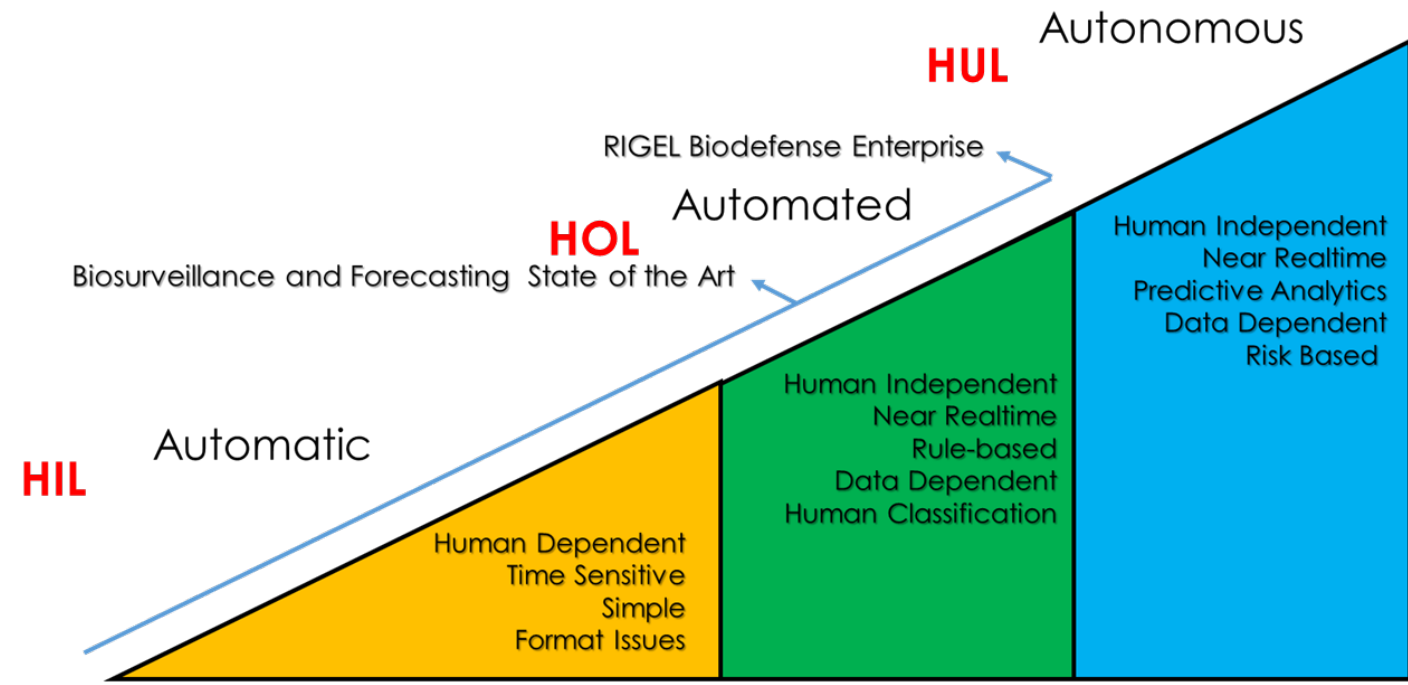
MISSION SUPPORT



Actionable Information

*Known and Unknown Transboundary Infectious Diseases as Hybrid Threats
 Valdivia-Granda, W.A. Frontiers in Public Health (2021)*

The Future



Acknowledgments



A Data-Driven Risk-Based Enterprise for Operational Decision

Willy Valdivia
CEO

Willy.Valdivia@orionbio.com

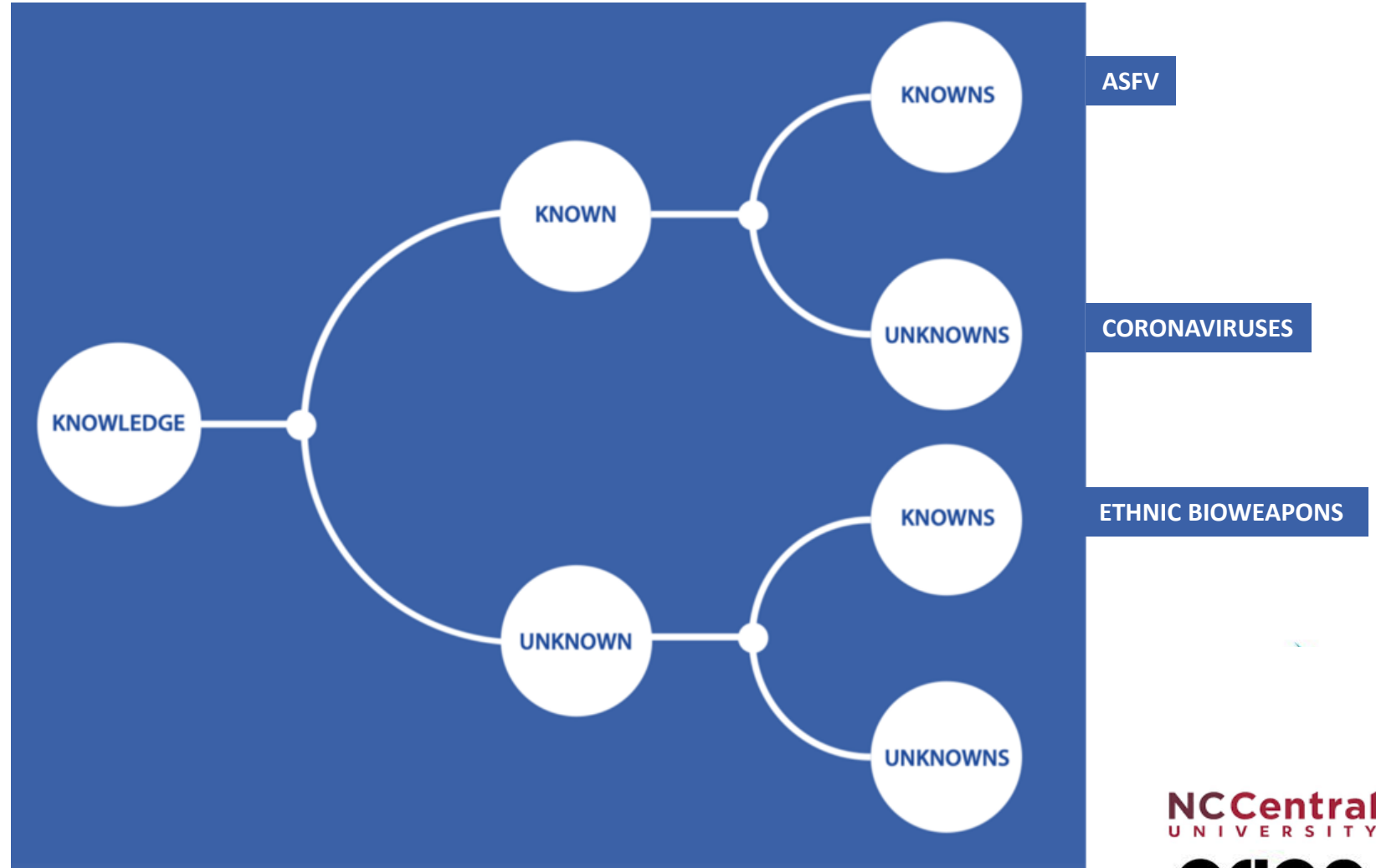
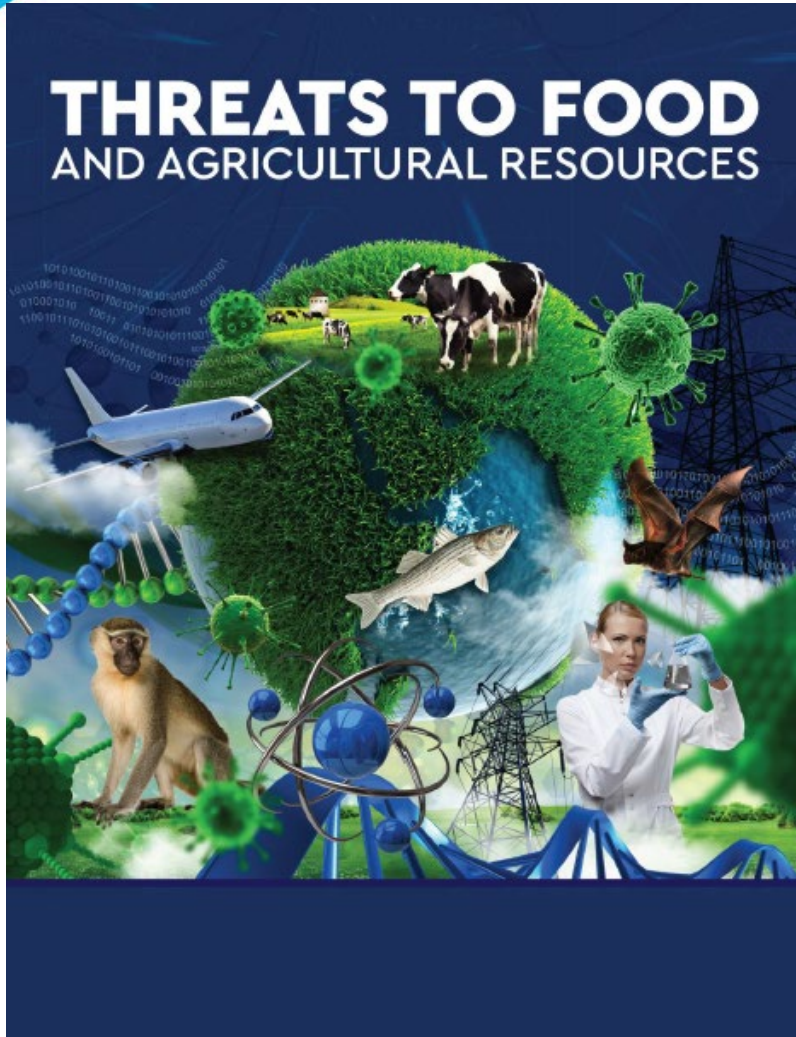


orion
Integrated Biosciences



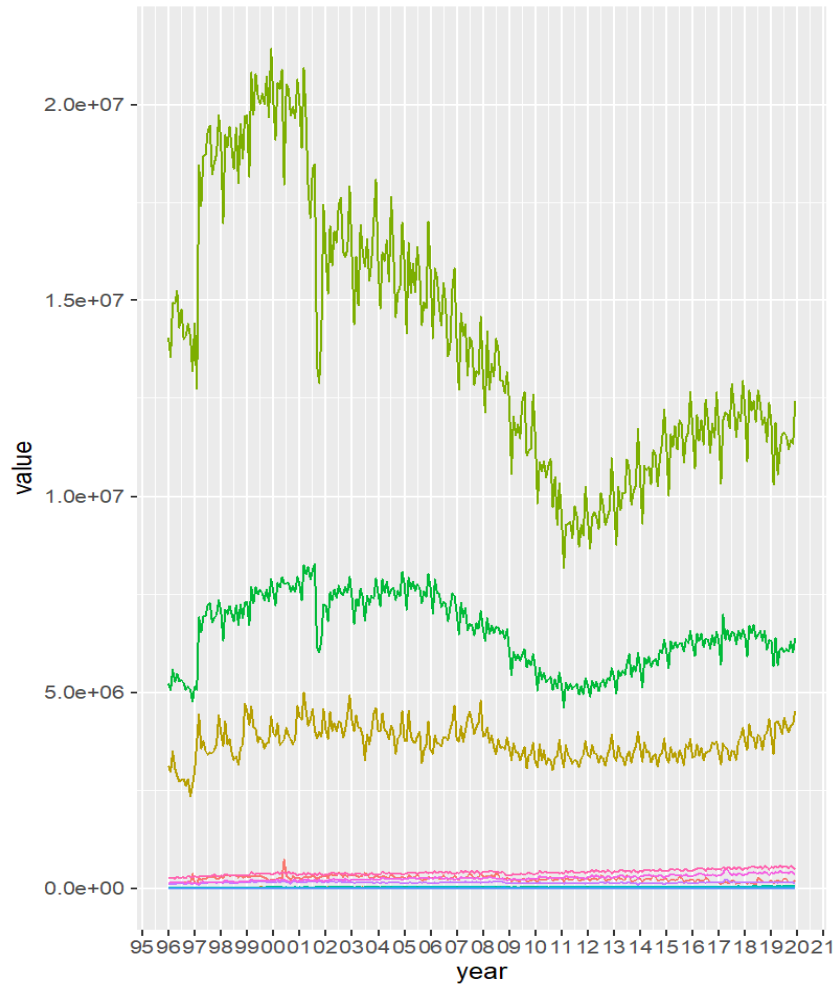
CROSS-BORDER THREAT SCREENING
AND SUPPLY CHAIN DEFENSE

Biological Agents: Catastrophic or existential threats

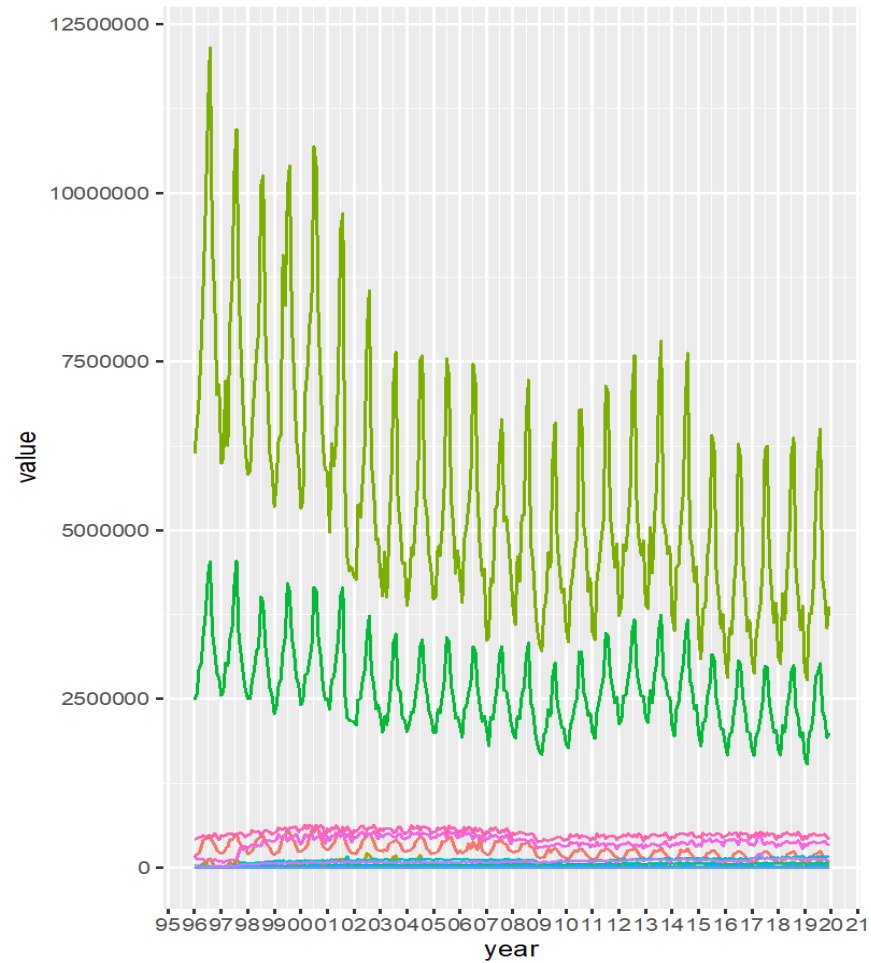


Overall Crossings of POEs Canada-Mexico Border

US-Mexico Border Crossings



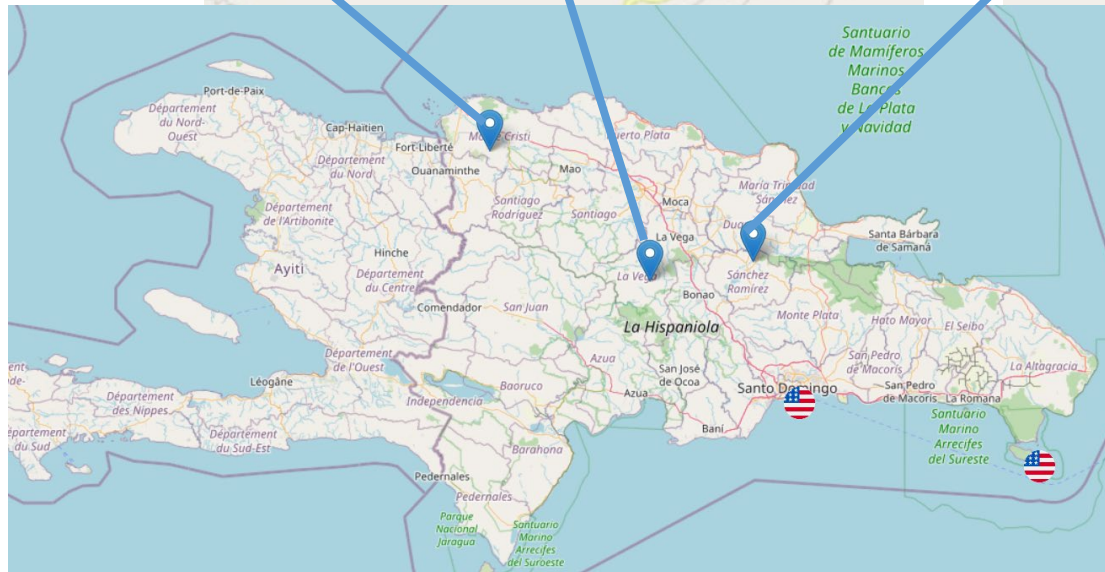
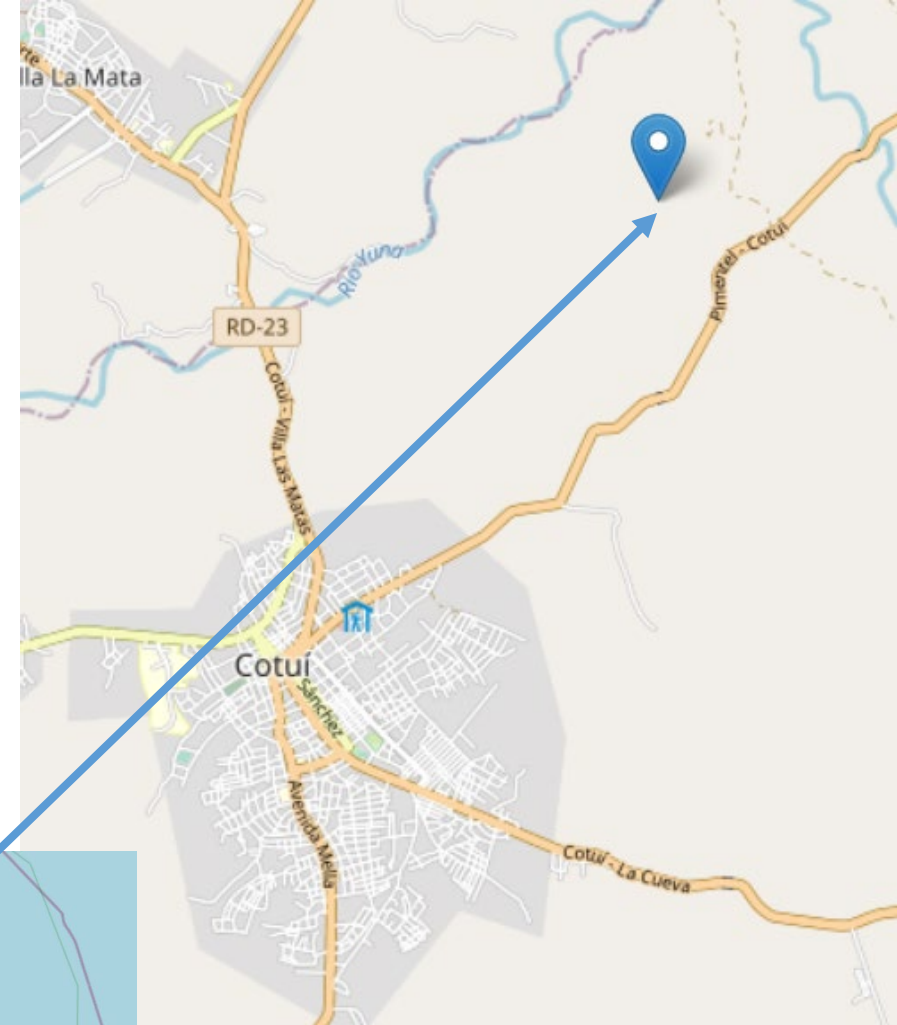
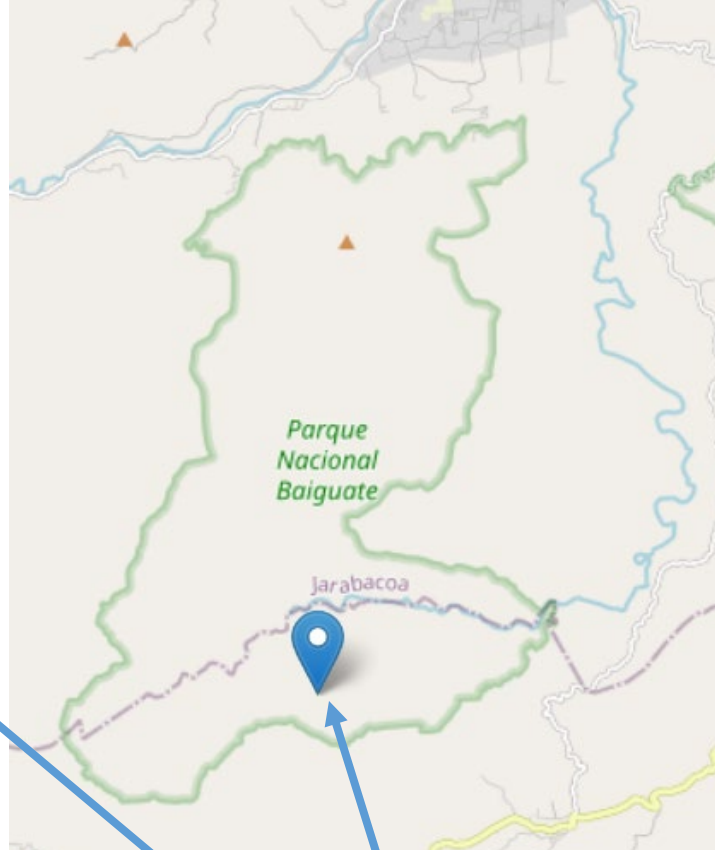
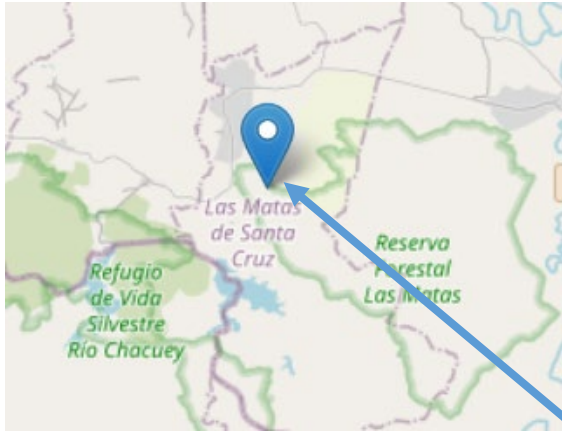
US-Canada Border Crossings



measure

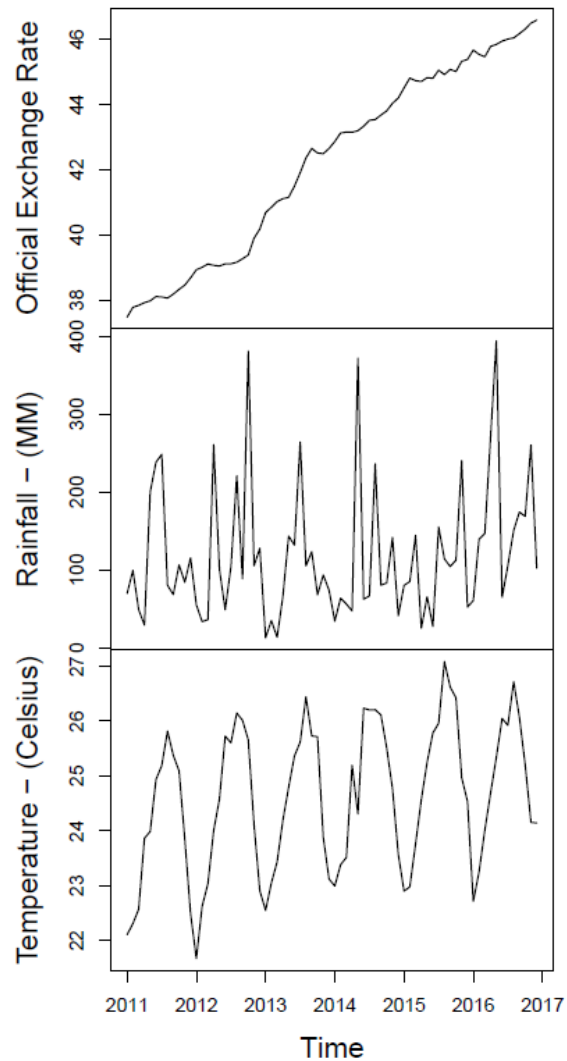
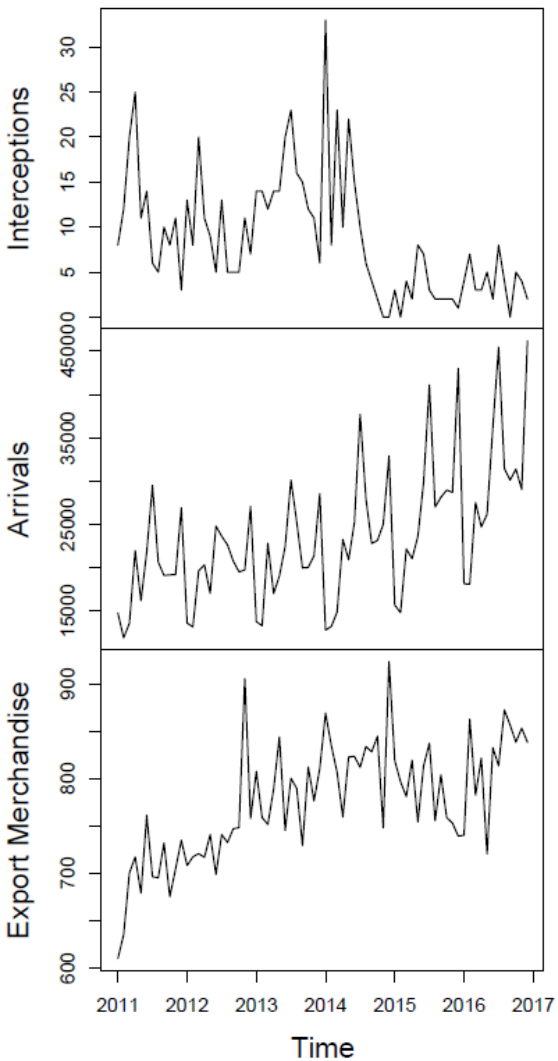
- Bus Passengers
- Buses
- Pedestrians
- Personal Vehicle Passengers
- Personal Vehicles
- Rail Containers Empty
- Rail Containers Full
- Train Passengers
- Trains
- Truck Containers Empty
- Truck Containers Full
- Trucks

BIOMON

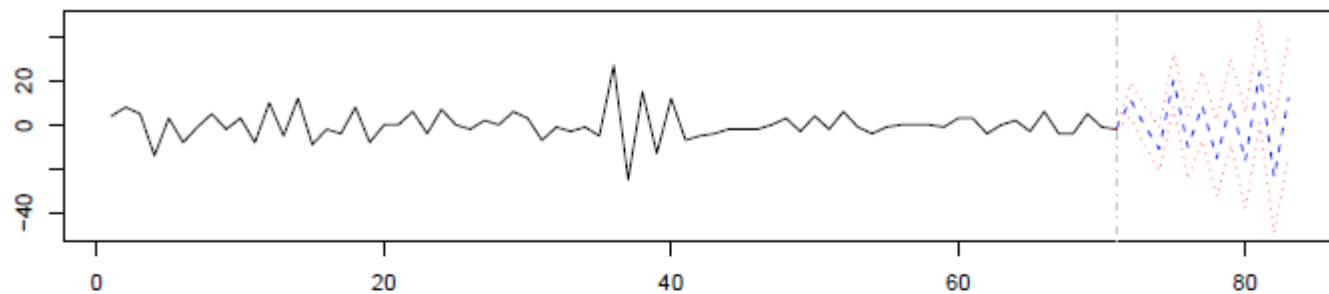


Official Reporting
3 locations

Dominican Republic

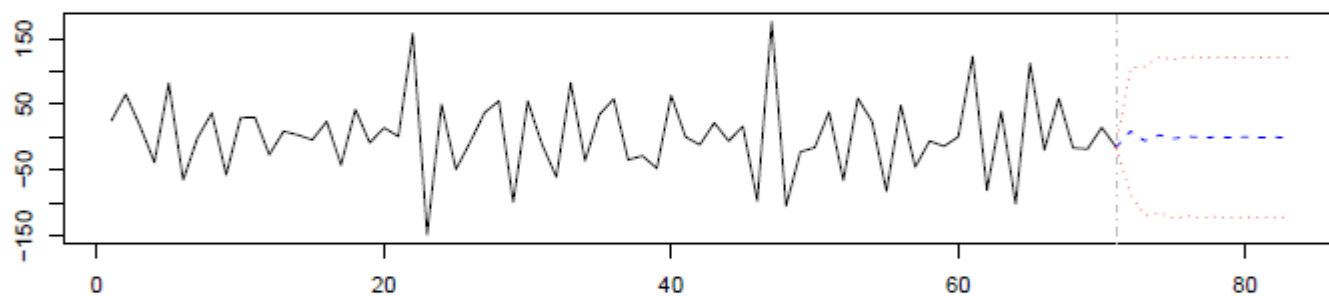


Forecast of series Interceptions



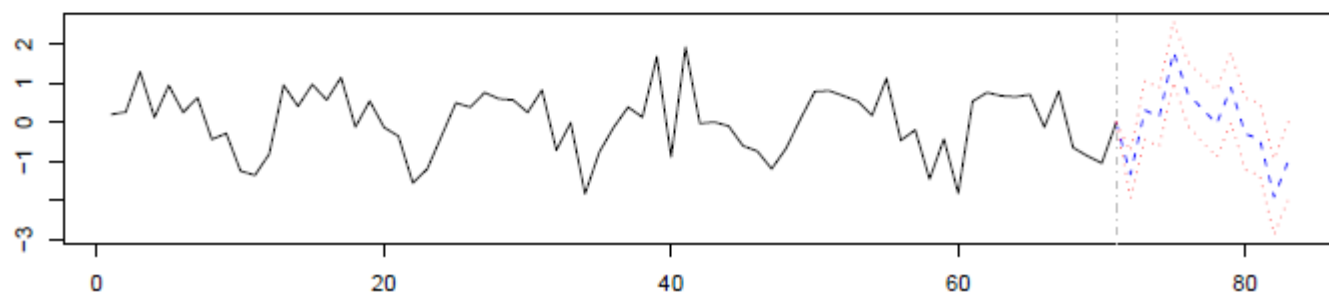
Dominican Republic

Forecast of series Export.Merchandise



Dominican Republic

Forecast of series Temperature....Celsius.



The Future: Trade Transaction Forecast

Forecasting Tools for Border Crossing

Select parameters

Select a border state:
CA

Select a border crossing method
Personal Vehicles
Bus Passengers
Personal Vehicle Passengers
Pedestrians
Trucks
Truck Containers Empty
Train Passengers
Rail Containers Full
Personal Vehicles

