Vector-Borne Diseases and One Health:
Perspectives from Vector Surveillance and Transmission Competence

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NIID
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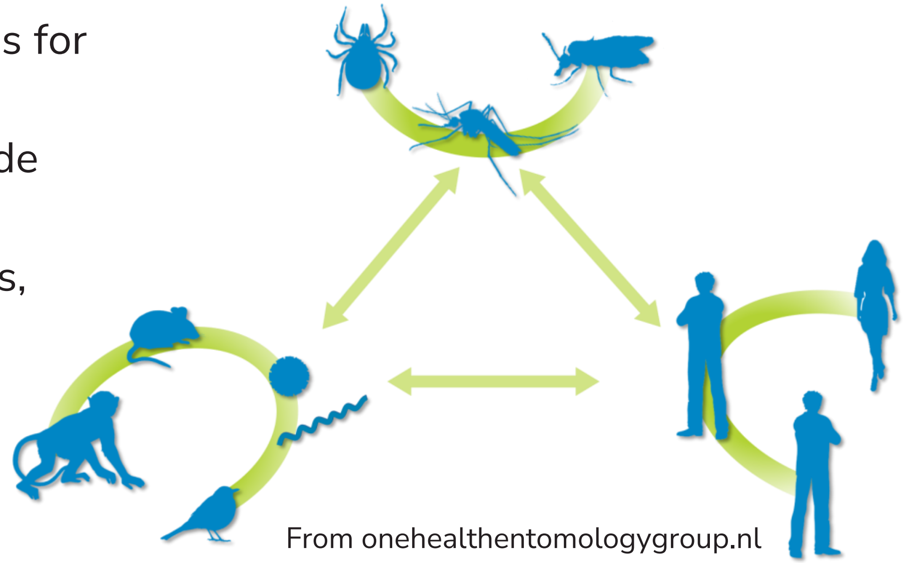
Vector-Borne Diseases and One Health:
Perspectives from Vector Surveillance and Transmission Competence

One Health's Multisectoral and transdisciplinary approach from a wide range of fields;

- **Wildlife ecologists** → analyze reservoir populations, illuminating disease transmission in animals
- **Veterinary professionals** → bridge animal and human health
- **Public health experts** → develop disease prevention strategies
- **Genomics experts** → elucidate the genetic basis for disease emergence and transmission
- **Data scientists and bioinformaticians** → provide insights about disease patterns from "big data"
- **Entomologists** → explore the biology of vectors, offering insights into their behavior
- **etc.**



From onehealthentomologygroup.nl

Vector Surveillance

Monitoring Trends; Informed Control Strategies; Risk Assessment; Early Detection

Vector Competences in Transmitting Diseases

Endemic virus (JEV), exotic virus (LACV)

Vector Surveillance

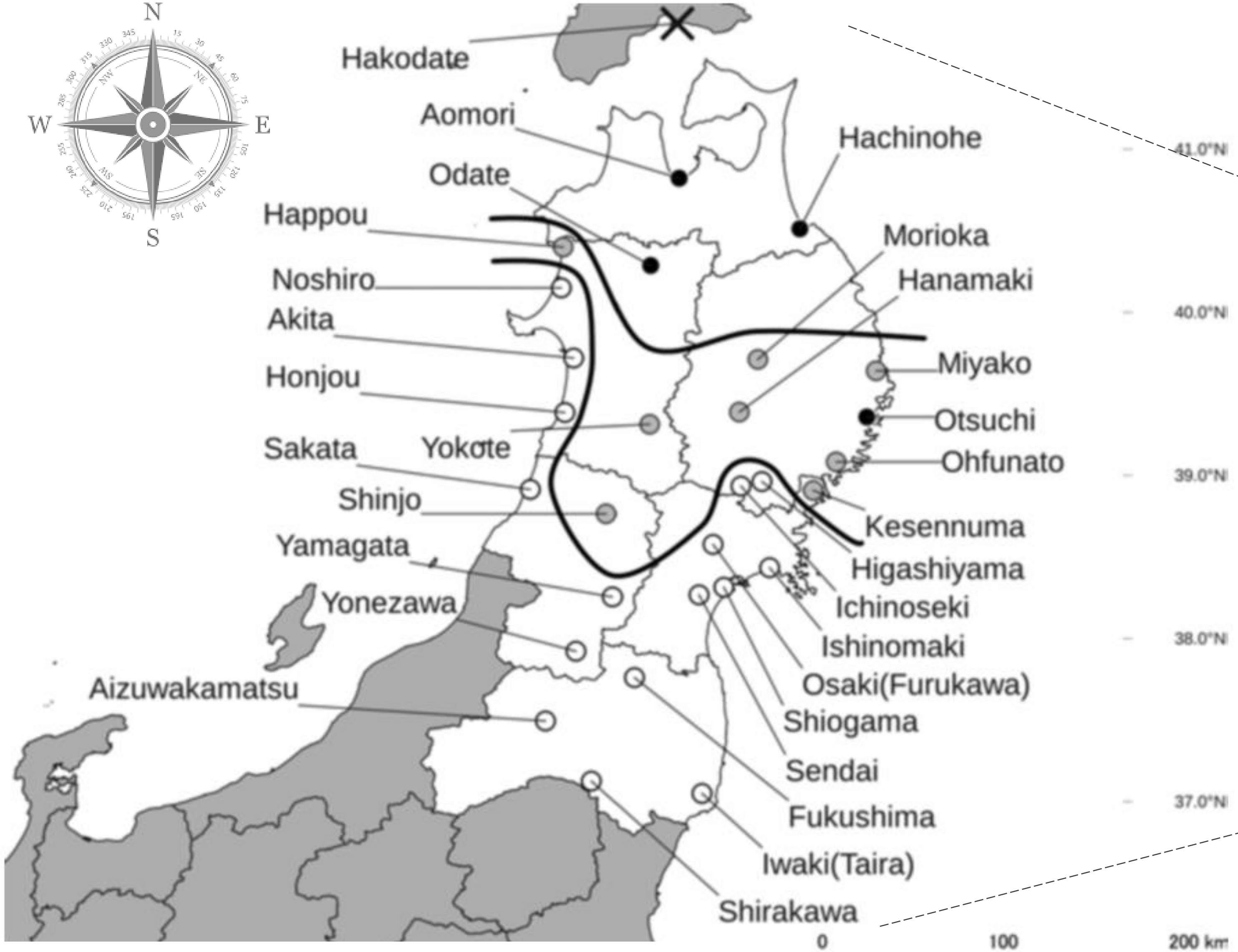
systematic monitoring and collection of data on vector populations, such as that can transmit diseases to humans or animals

→ understand the distribution, abundance, and behavior of vectors in order to predict and prevent disease outbreak

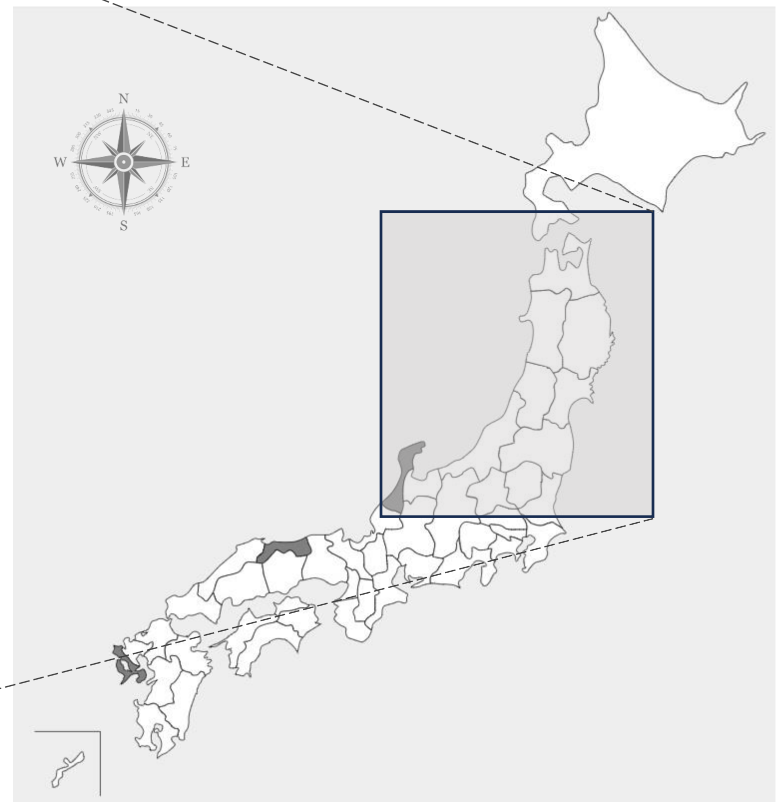
Based on purposes or outcomes, can be classified into:

- **Monitoring Trends:** Tracks changes in vector populations and the effectiveness of control programs over time
- **Informed Control Strategies:** Provides data to guide targeted interventions and control measures
- **Risk Assessment:** Assesses the potential risk of disease transmission to humans or animals
- **Early Detection:** Identifies the presence of any arboviruses or disease-carrying vectors before they cause outbreaks

Monitoring Trends (Tracks changes in vector populations over time) → **impact of climate change**

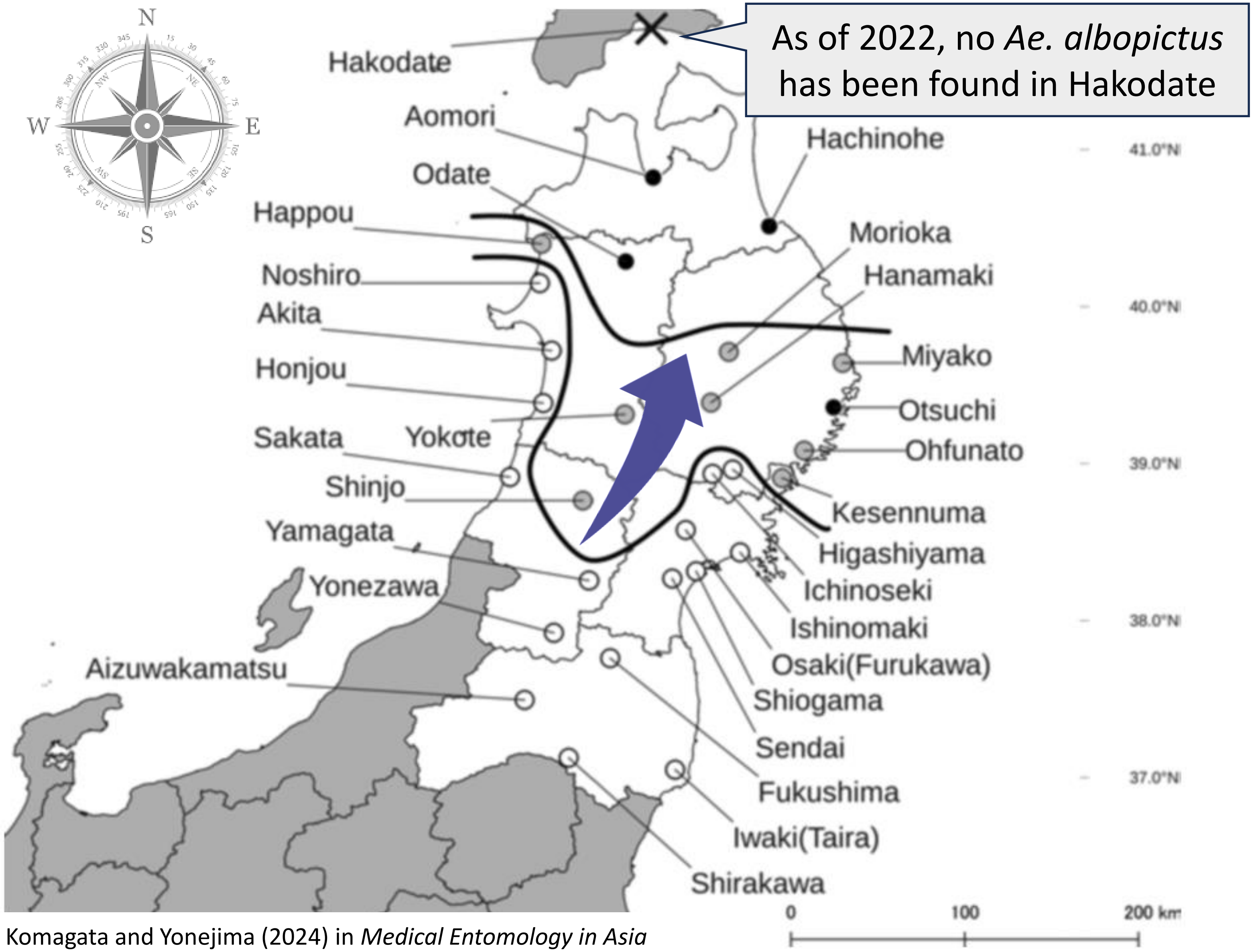


Northern distribution of *Aedes albopictus* in Tohoku district, Honshu Island, Japan



Komagata and Yonejima (2024) in *Medical Entomology in Asia*

Monitoring Trends (Tracks changes in vector populations over time) → **impact of climate change**



Komagata and Yonejima (2024) in *Medical Entomology in Asia*

Northern distribution of *Aedes albopictus* in Tohoku district, Honshu Island, Japan

●: distribution after 2011

●: between the years 2001 and 2010

○: before the year 2000

Lines in bold represent estimated northern boundaries, which are moving further north

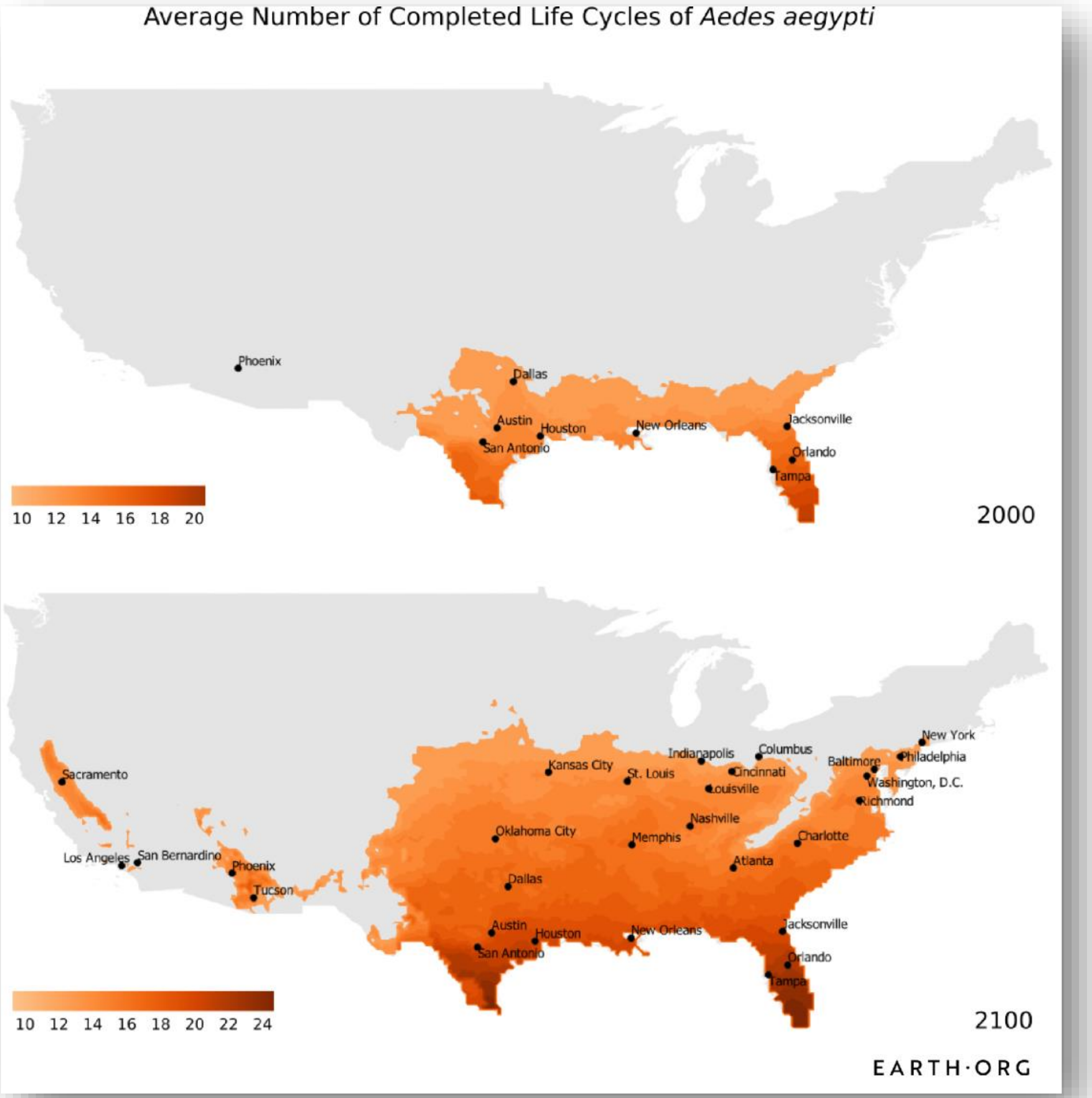
Monitoring Trends (Tracks changes in vector populations over time) → **impact of climate change**

Variations in temperature and precipitation affect the behaviors and distributions of arthropod vectors

Higher temperatures → faster life cycles → more diseases are being spread

Modified precipitation patterns → impact on the reproduction locations and accessibility of water → affect the populations of vectors

Climate change makes it easier for mosquitoes and ticks to thrive in new areas and as people travel more, diseases spread faster



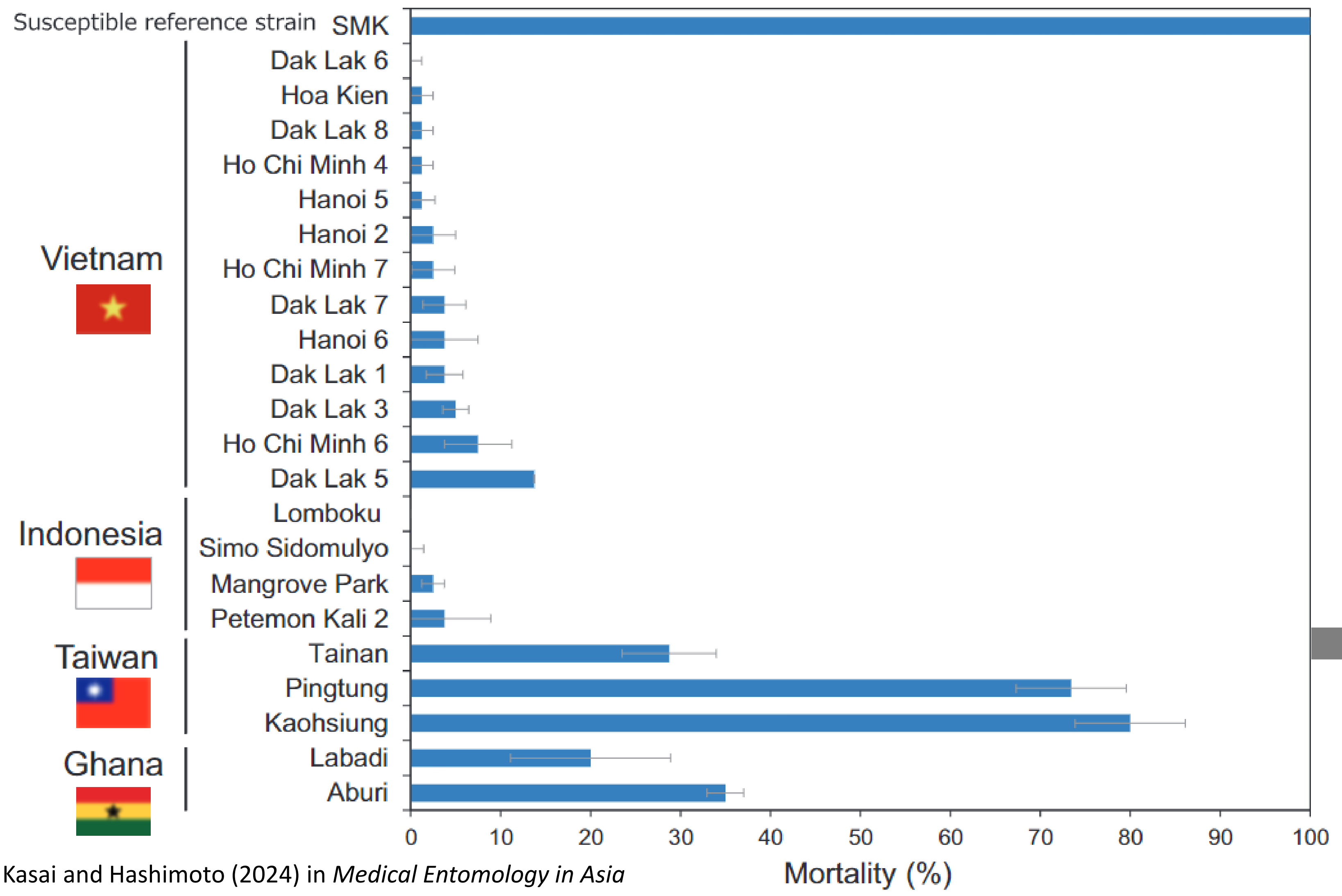
Informed Control Strategies (Provides data to guide targeted interventions) → **status of insecticide resistance**

- Insecticides: Must be **highly toxic to insects** but **safe for humans and animals**
- **Pyrethroids** meet safety requirements and are key in controlling vector arthropods
- Common pyrethroids used for *Ae. aegypti* control in Southeast Asia include deltamethrin, permethrin, alpha-cypermethrin, cyfluthrin, and lambda-cyhalothrin, especially in Malaysia, Indonesia, Singapore, and Thailand

- Resistance: Continuous use can lead to **increased insecticide resistance** in mosquitoes, particularly..

→ This mosquito, which prefers human hosts, has developed resistance due to frequent exposure to insecticides inside houses

Informed Control Strategies (Provides data to guide targeted interventions) → **status of insecticide resistance**

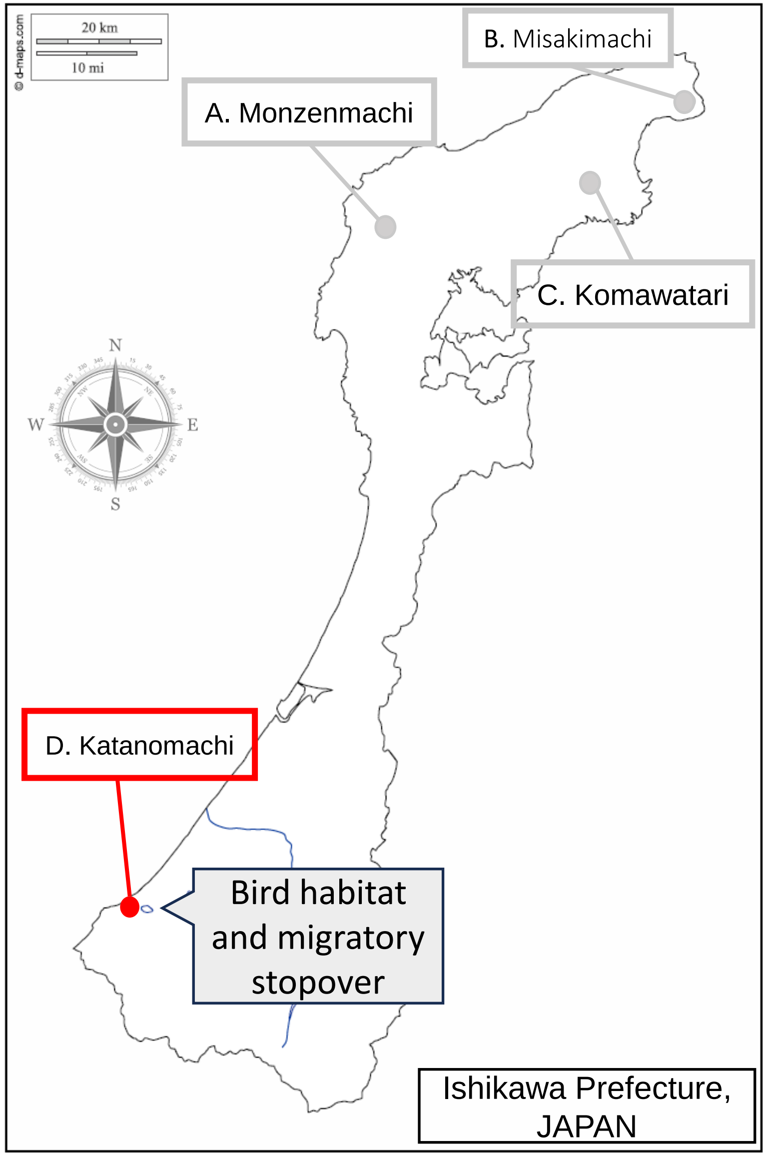


Kasai and Hashimoto (2024) in *Medical Entomology in Asia*

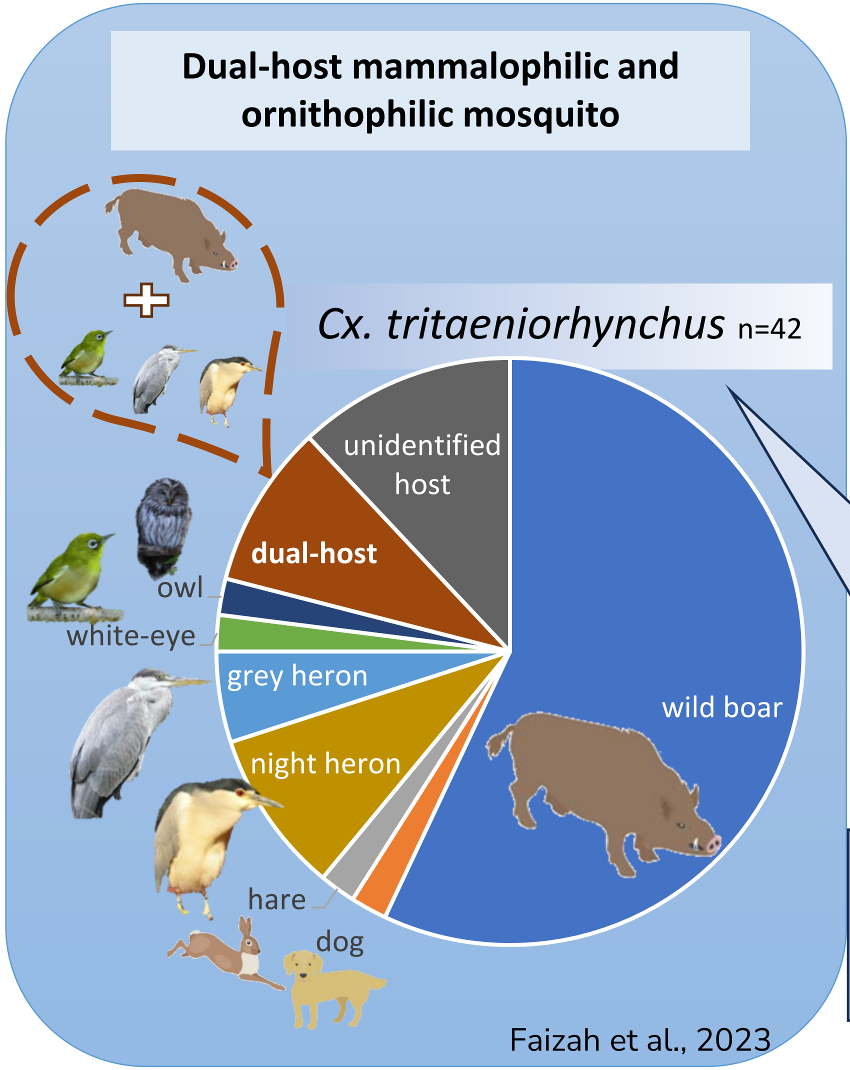
Permethrin (pyrethroids) susceptibility of field-collected populations of *Ae. aegypti*

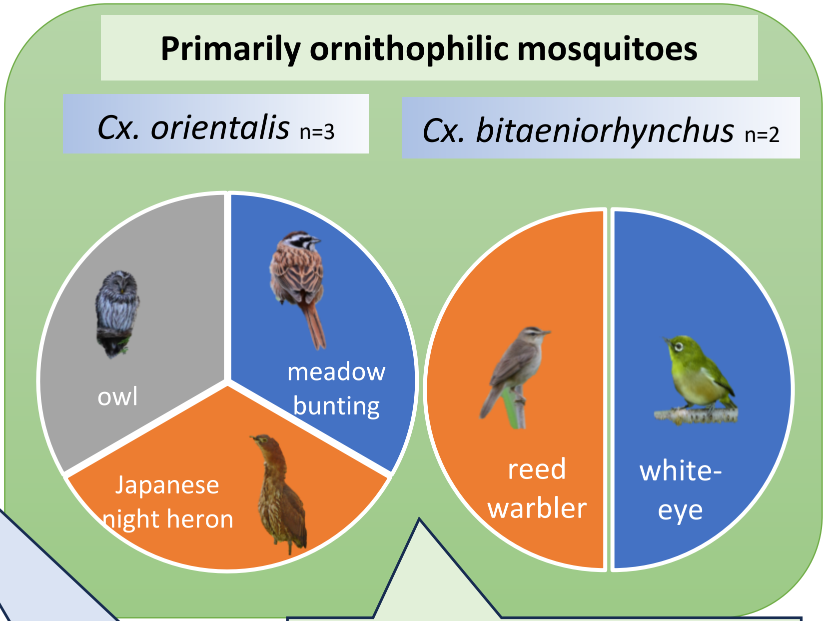
17 populations collected in Vietnam and Indonesia exhibited resistance, with mortality less than 20% at LD99

Risk Assessment (Assesses the potential risk of disease transmission) → **identification of bridge vector**



Blood Meal Source Analysis Results





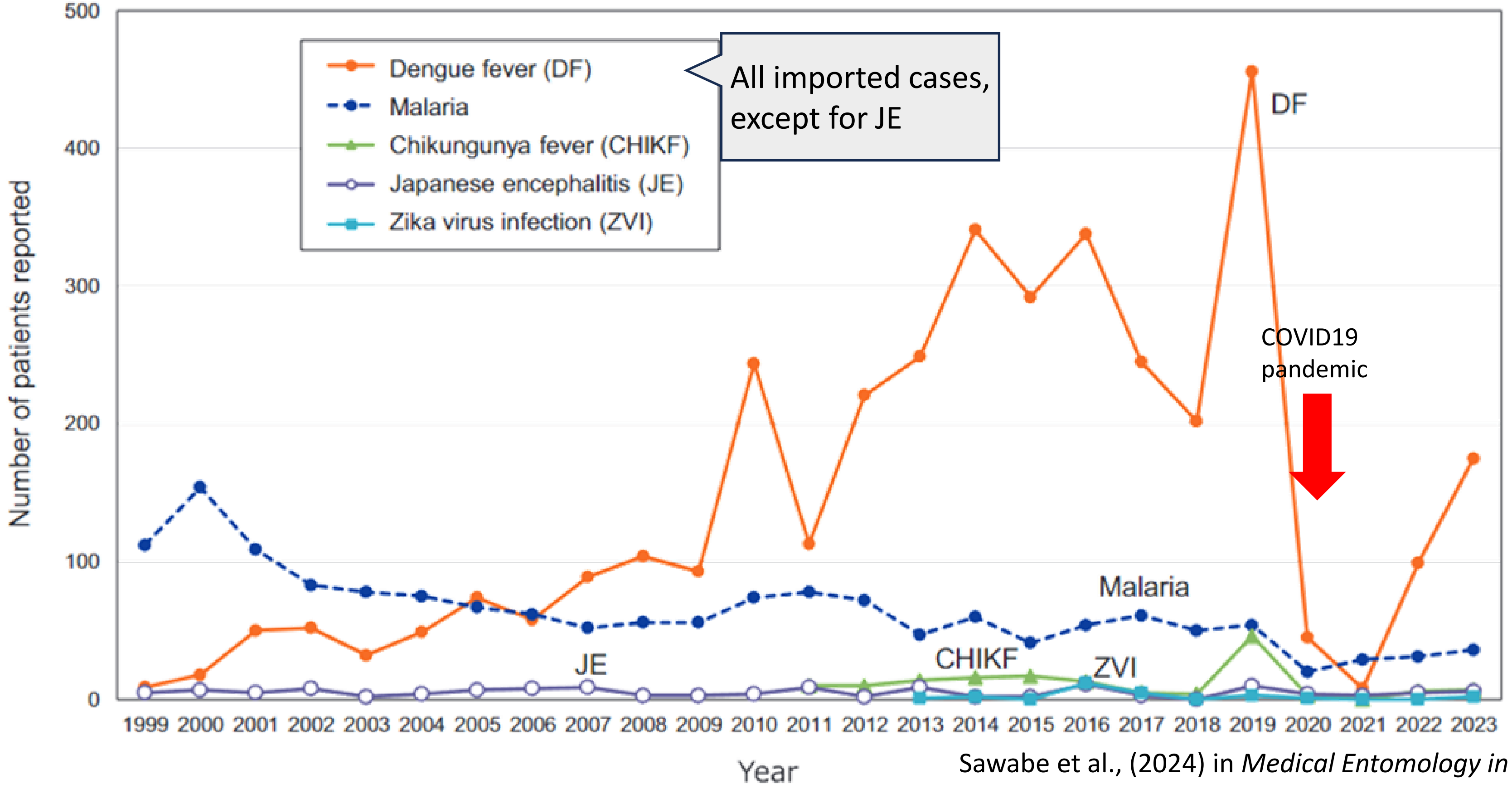
Feed only on birds
including migratory birds

Feed on **both** mammals and birds
Also feed on two different hosts during a single gonotrophic cycle

Bird photos are provided courtesy of Dr. Mizue Inumaru

Early detection (Identifies the presence before it cause outbreaks) → **vector and arbovirus detection**

Major mosquito-borne diseases in Japan



Sawabe et al., (2024) in *Medical Entomology in Asia*

Early detection (Identifies the presence before it cause outbreaks) → **vector and arbovirus detection**

To prevent a large-scale dengue fever epidemic **in Japan**, measures should be taken to stop *Aedes aegypti* mosquitoes from establishing themselves in the country

Original Article

First Report on Invasion of Yellow Fever Mosquito, *Aedes aegypti*, at Narita International Airport, Japan in August 2012

Nayu Sukehiro[1], Nori Kida[1], Masahiro Umezawa[1], Takayuki Murakami[1], Naoko Arai[1], Tsunesada Jinnai[1], Shunichi Inagaki[1], Hidetoshi Tsuchiya[1], Hiroshi Maruyama[1], and Yoshio Tsuda[2]*

[1]Narita Airport Quarantine Station, Chiba 282-0004; and [2]Department of Medical Entomology, National Institute of Infectious Diseases, Tokyo 162-8640, Japan

- **First detection**: *Ae. aegypti* larvae were found for the first time at Narita International Airport
- **Actions taken**: Define buffer zone > Intensive survey > Larvicide treatment > Follow-up survey
- **Conclusion**: *Ae. aegypti* failed to establish a population

RESEARCH ARTICLE

Genetic analysis of *Aedes aegypti* captured at two international airports serving to the Greater Tokyo Area during 2012–2015

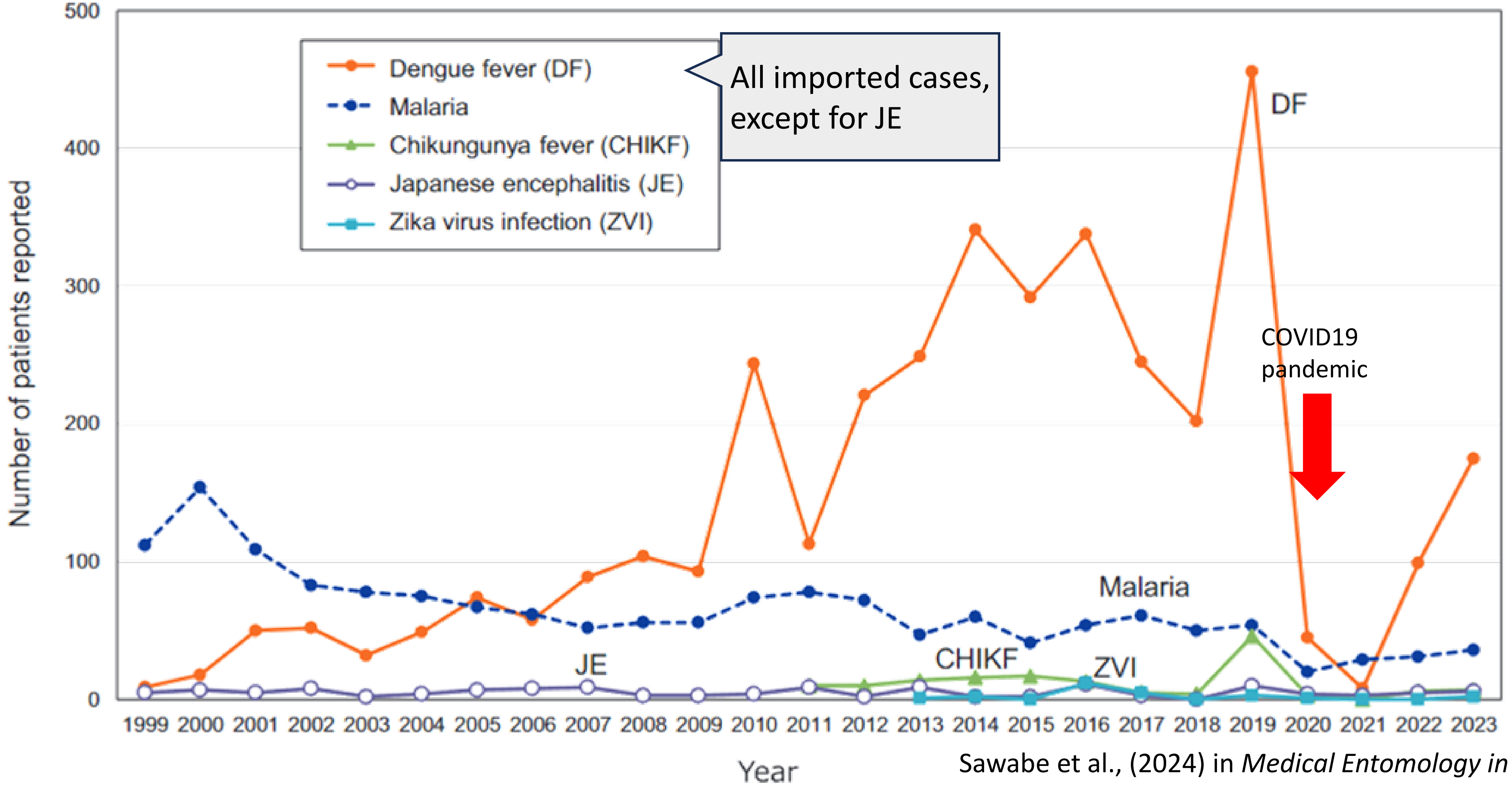
Kentaro Itokawa[1]*, Jinping Hu[2], Nayu Sukehiro[3], Yoshio Tsuda[4], Osamu Komagata[4,5], Shinji Kasai[4], Takashi Tomita[4], Noboru Minakawa[2], Kyoko Sawabe[4]

1 Pathogen Genomics Center, National Institute of Infectious Diseases, Tokyo, Japan, **2** Department of Vector Ecology and Environment, Institute of Tropical Medicine, Nagasaki University, Nagasaki, Japan, **3** Fukuoka Quarantine station, Fukuoka, Japan, **4** Department of Medical Entomology, National Institute of Infectious Diseases, Tokyo, Japan, **5** Antimicrobial Resistance Research Center, National Institute of Infectious Diseases, Tokyo, Japan

- **Detection**: *Ae. aegypti* larvae and adult were found at Haneda and Narita International Airport
- **Research findings**: mosquitoes had different mitochondrial haplotypes, indicating multiple maternal lineages
- **Follow-up survey**: discoveries were infrequent, and intensive follow-up did not reveal any *Ae. aegypti*
- **Conclusion**: little evidence to suggest that *Ae. aegypti* population has established

Early detection (Identifies the presence before it cause outbreaks) → **vector and arbovirus detection**

Major mosquito-borne diseases in Japan

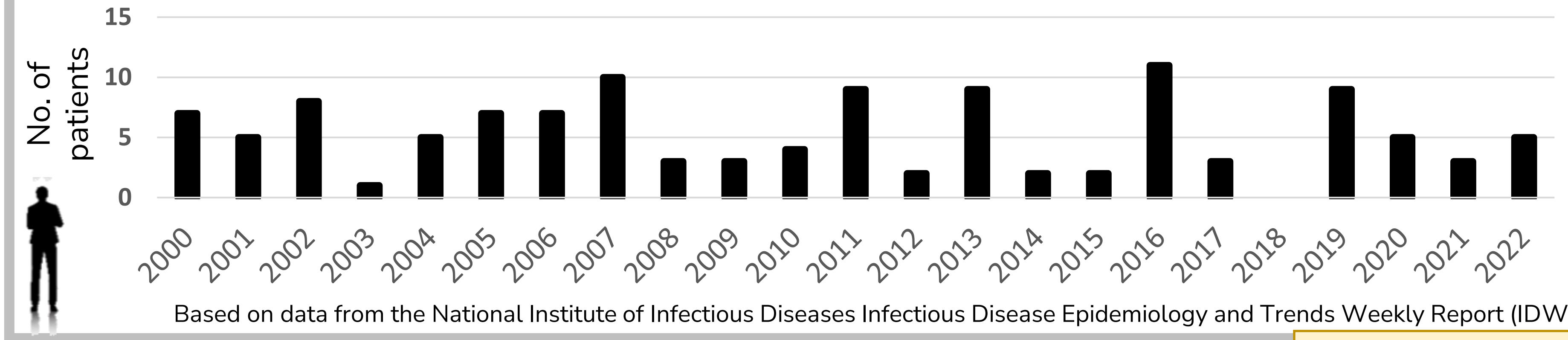


Sawabe et al., (2024) in *Medical Entomology in Asia*

Although the number of patients is low, the causal virus of Japanese encephalitis remains endemic and actively circulating in Japan

Early detection (Identifies the presence before it cause outbreaks) → **vector and arbovirus detection**

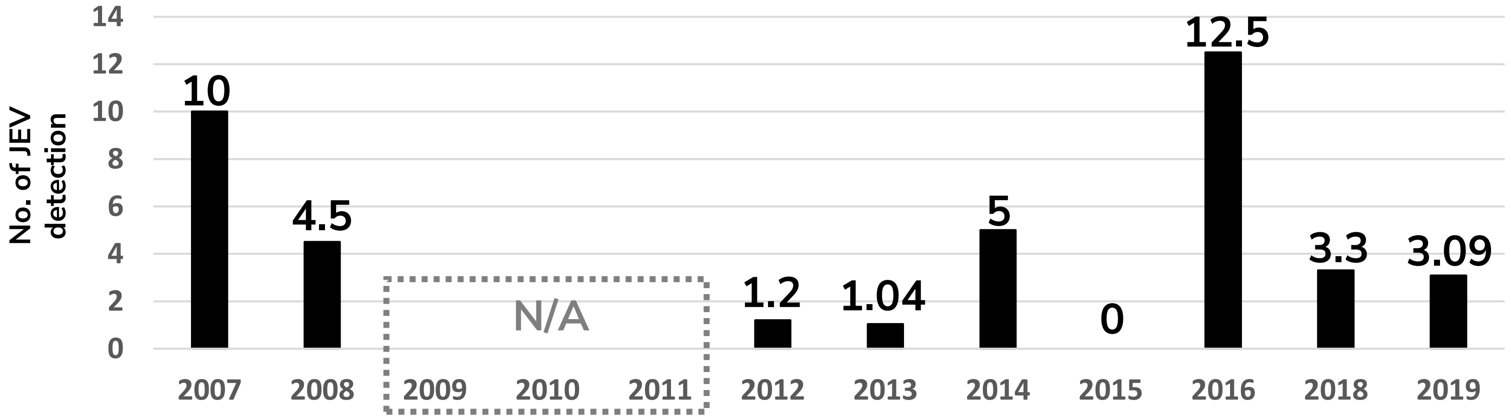
Changes in no. of JE cases in Japan (nationwide)



Based on data from the National Institute of Infectious Diseases Infectious Disease Epidemiology and Trends Weekly Report (IDWR)

Courtesy of Dr. Daisuke Kobayashi

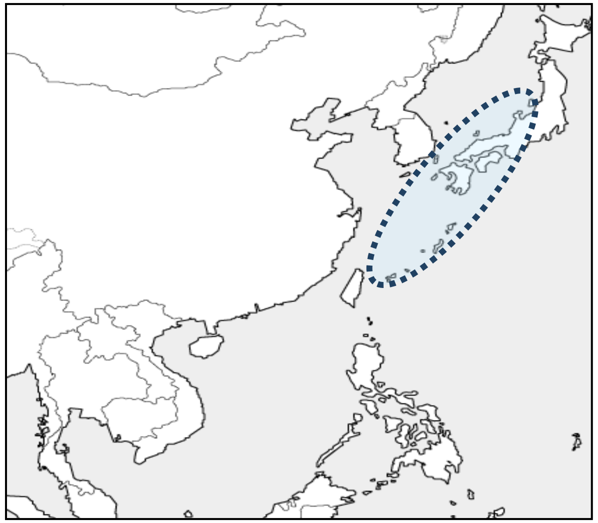
Changes in minimum infection rate (MIR) of JEV per 1,000 *Cx. tritaeniorhynchus* (survey at Isahaya city, Nagasaki Prefecture)



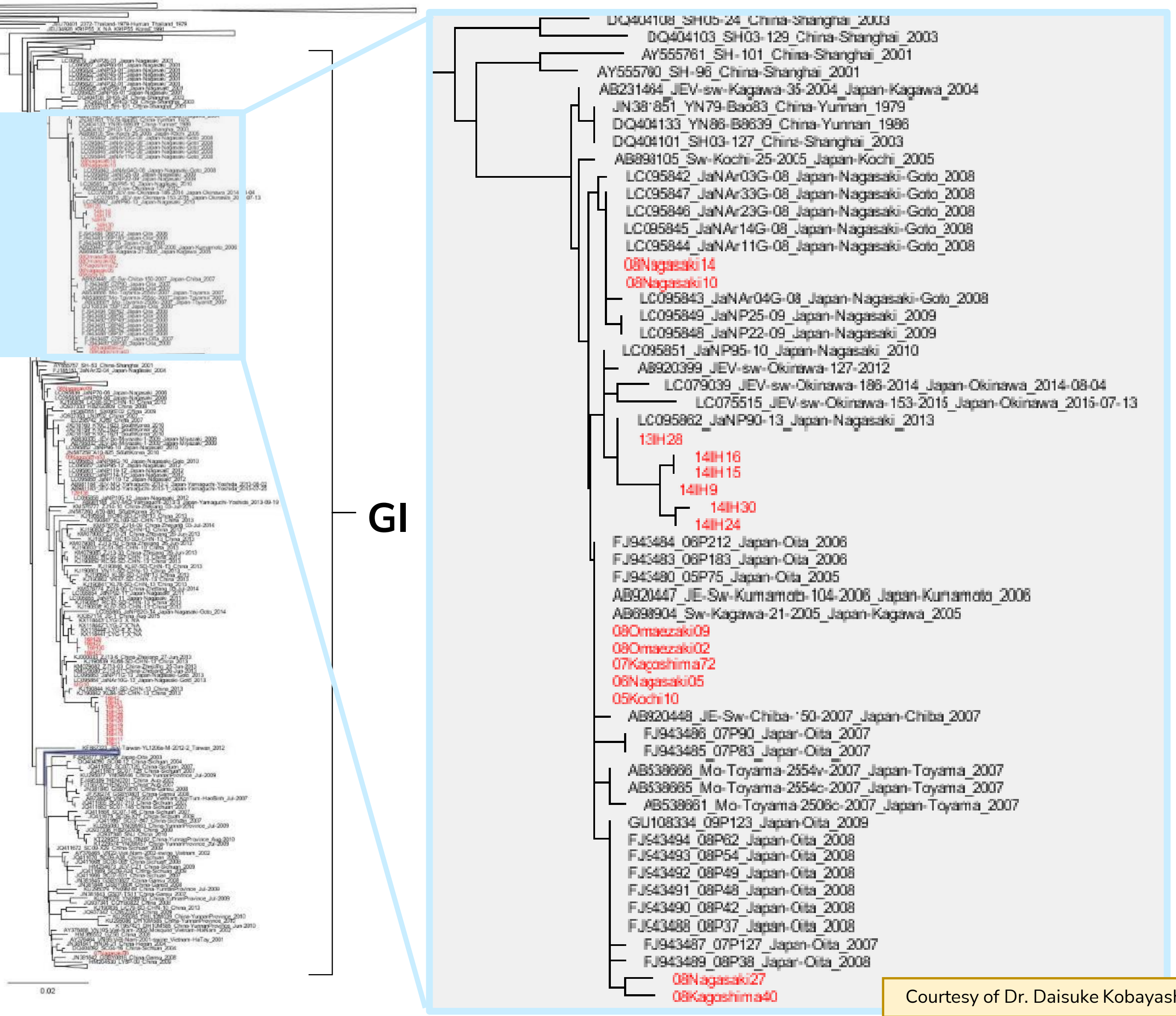
JEV isolates were then phylogenetically analyzed

Early detection (Identifies the presence before it cause outbreaks) → **vector and arbovirus detection**

Native/endemic JEVs in Japan



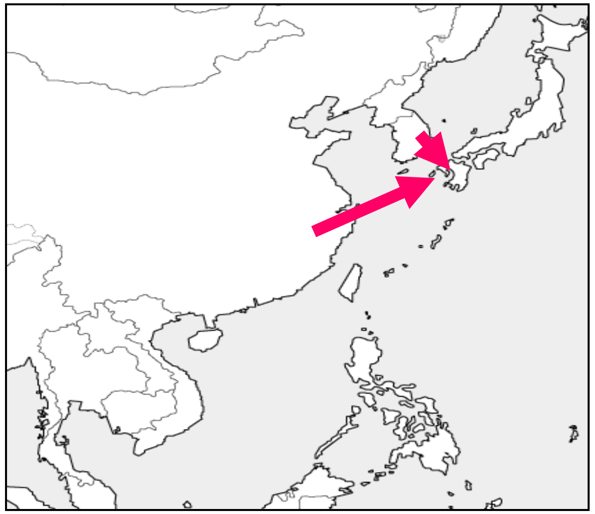
(Murota et al., IASR. 2017)

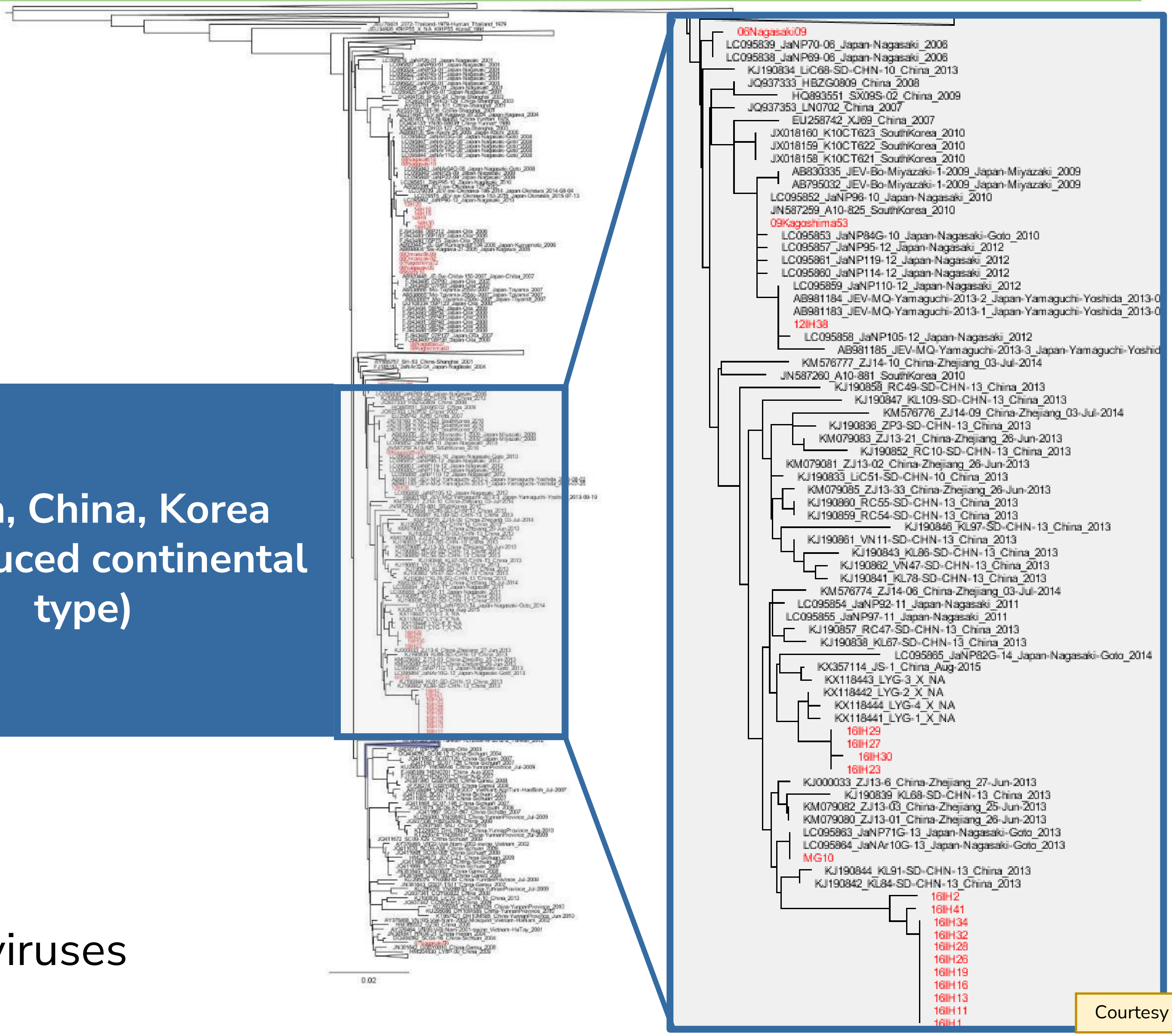


Courtesy of Dr. Daisuke Kobayashi

Early detection (Identifies the presence before it cause outbreaks) → **vector and arbovirus detection**

Some JEV isolates in Japan were from overseas





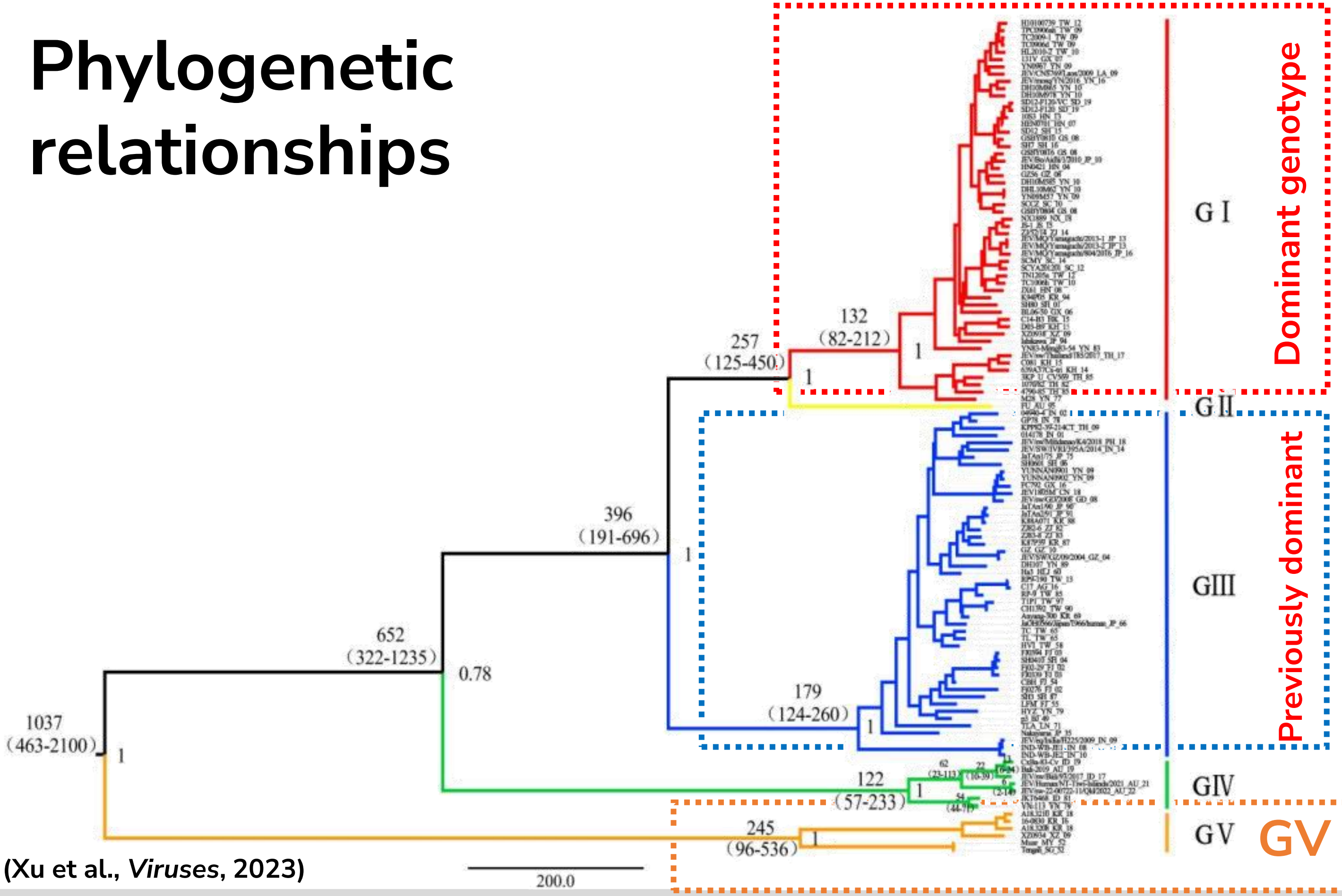
Courtesy of Dr. Daisuke Kobayashi

In Japan, there are both native and introduced Japanese encephalitis viruses

（Murota et al., IASR. 2017）

Early detection (Identifies the presence before it cause outbreaks) → **vector and arbovirus detection**

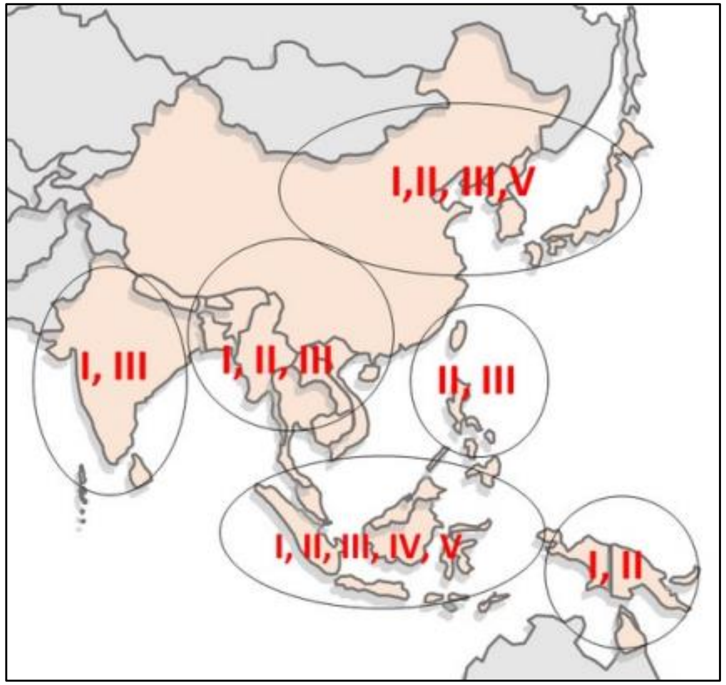
Phylogenetic relationships



(Xu et al., *Viruses*, 2023)

GV re-emergence in East Asia

Distribution of JEV genotypes



(Faizah et al., 2020)

History of JEV GV isolation and detection

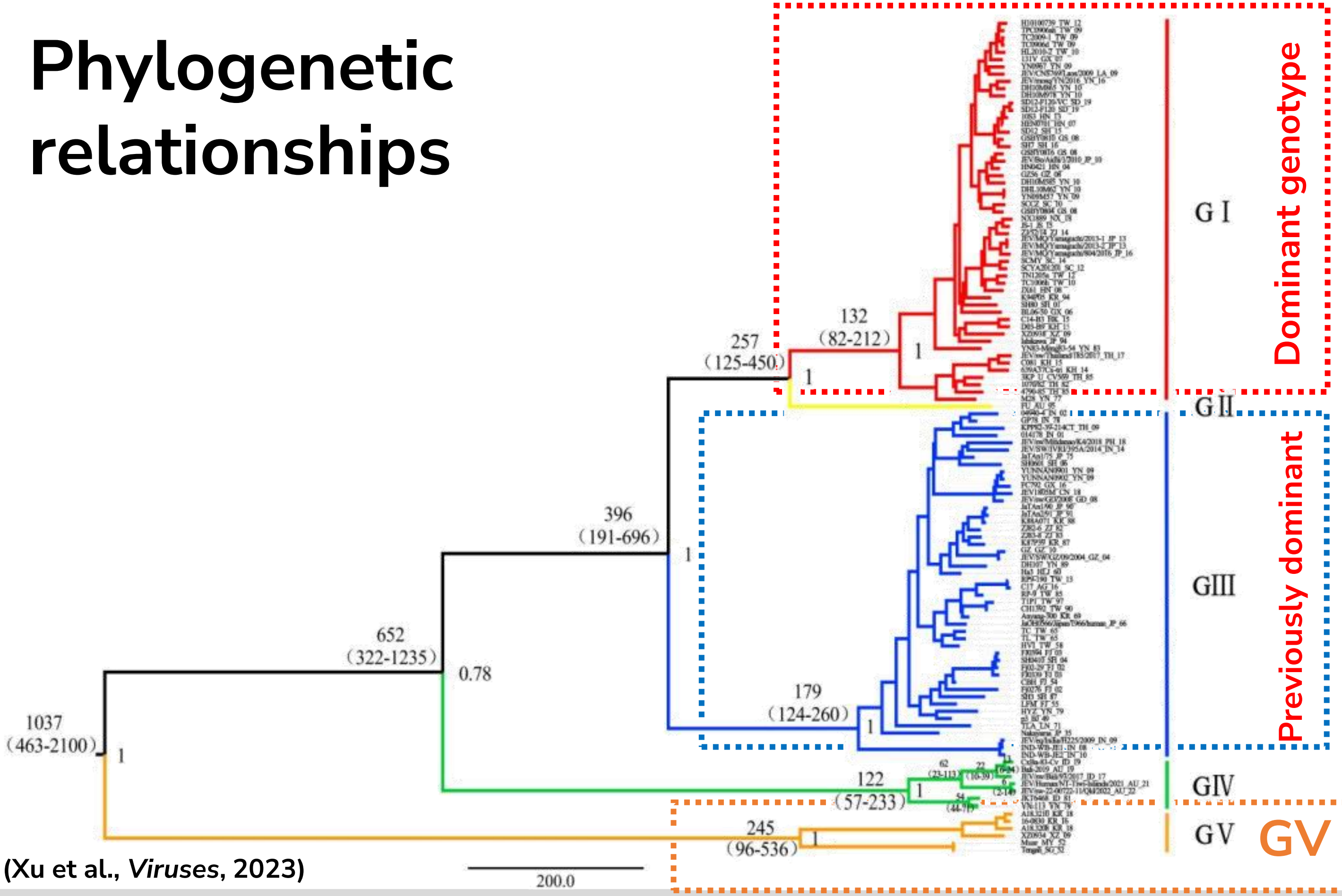
- 1952 — First isolation from human (Malaysia)
- 57 year apart
- 2009 — Isolation from *Cx. tritaeniorhynchus* (Tibet)
- 2010～ — Isolation and detection from multiple mosquito species and human (South Korea)

Year

Courtesy of Dr. Daisuke Kobayashi

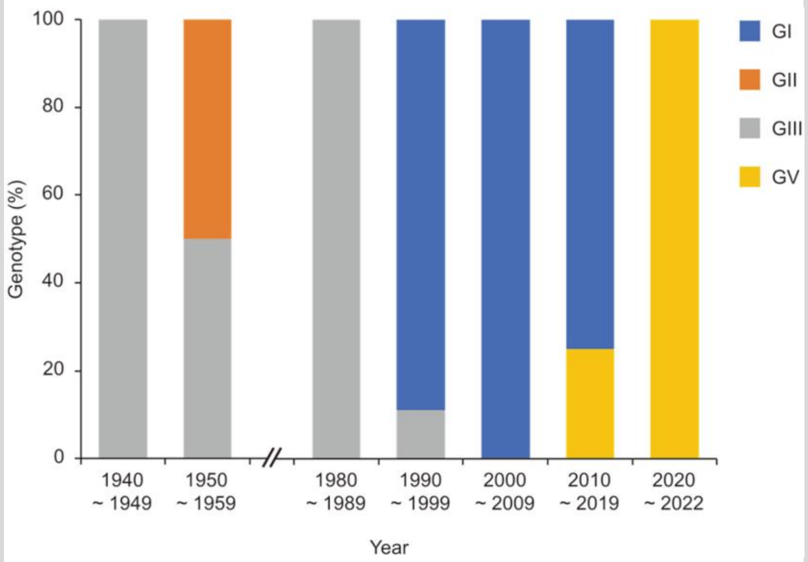
Early detection (Identifies the presence before it cause outbreaks) → **vector and arbovirus detection**

Phylogenetic relationships



(Xu et al., *Viruses*, 2023)

Genotype shift to GV in South Korea?



(Lee et al., 2022)

GV re-emergence in East Asia

History of JEV GV isolation and detection

1952 — First isolation from human (Malaysia)

57 year apart

2009 — Isolation from *Cx. tritaeniorhynchus* (Tibet)

2010〜 — Isolation and detection from multiple mosquito species and human (South Korea)

Year

Courtesy of Dr. Daisuke Kobayashi

Early detection (Identifies the presence before it cause outbreaks) → **vector and arbovirus detection**

List of JEV GV isolates and detected strains

1952-2020 in Malaysia-China-South Korea

Year	GV strain	Locality	Host	Specimen
1952	Muar	Malaysia	Homo sapiens	Brain
2009	XZ0934	Tibet, China	Mosquito	*Cx. tritaeniorhynchus*
2010	10-1827	Daeseondong, Gyeonggi, ROK	Mosquito	*Cx. bitaeniorhynchus*
2012	K12HC959	Hwacheon, ROK	Mosquito	*Cx. orientalis*
	K12AS1148	Ansan, ROK	Mosquito	*Cx. pipiens*
	K12AS1151	Ansan, ROK	Mosquito	*Cx. orientalis*
	K12YJ1174	Yeoju, ROK	Mosquito	*Cx. orientalis*
	K12YJ1182	Yeoju, ROK	Mosquito	*Cx. orientalis*
	K12YJ1203	Yeoju, ROK	Mosquito	*Cx. orientalis*
2013	K13GB57	Gyeongsan-si, ROK	Mosquito	*Cx. tritaeniorhynchus*
2015	K15P38	Gyeonggi-do, ROK	Homo sapiens	Cerebrospinal fluid
2016	16-0830	Yongsan, ROK	Mosquito	*Cx. orientalis*
2018	A18.3208	Camp Hamphreys, ROK	Mosquito	*Cx. bitaeniorhynchus*
	A18.3210	Camp Hamphreys, ROK	Mosquito	*Cx. bitaeniorhynchus*
2020	Sangju-1	Sangju, ROK	Mosquito	*Cx. orientalis*
	Sangju-2	Sangju, ROK	Mosquito	*Cx. orientalis*
	Sangju-3	Sangju, ROK	Mosquito	*Cx. orientalis*
	Sangju-4	Sangju, ROK	Mosquito	*Cx. orientalis*
	Sangju-5	Sangju, ROK	Mosquito	*Cx. orientalis*
	Sangju-6	Sangju, ROK	Mosquito	*Cx. orientalis*
	Sangju-7	Sangju, ROK	Mosquito	*Cx. orientalis*
	Sangju-v1	Sangju, ROK	Mosquito	*Cx. orientalis*
	Sangju-v2	Sangju, ROK	Mosquito	*Cx. orientalis*

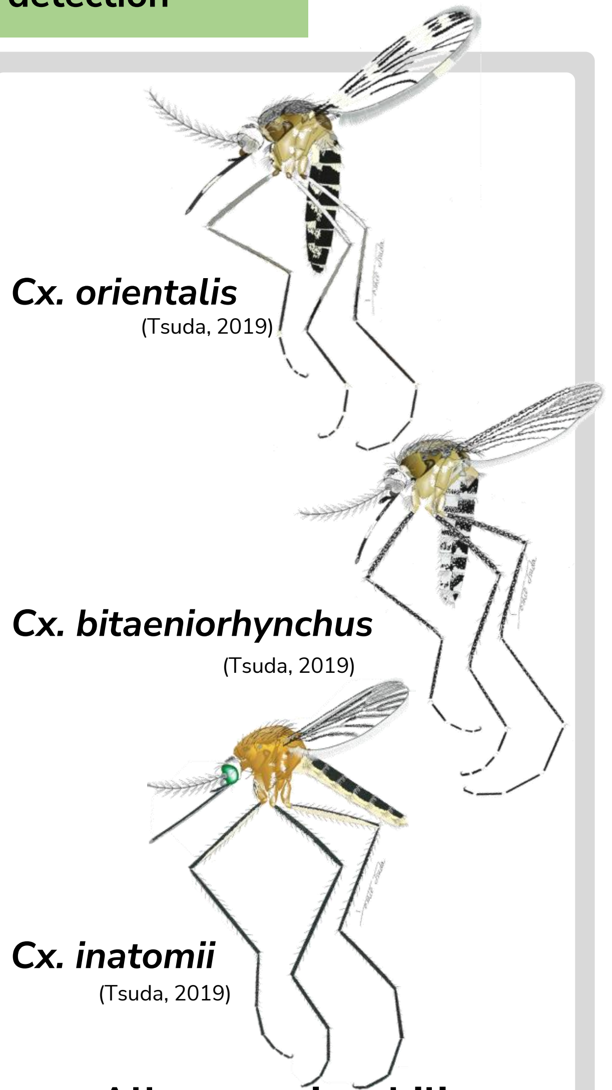
(Lee et al.. 2022)

In 2021-2023 in South Korea

Culex spp.	Year	Total Collected	Total Tested	# of Pools Tested	# Positive Pools (MIR)	JEV Genotype
	2021	7954	2000	71	0	
Cx. bitaeniorhynchus	2022	1400	1400	54	1, (0.07)	GV
	2023	939	939	43	1, (0.11)	GV
	2021	4469	1156	47	0	
Cx. inatomii	2022	4118	3857	131	1, (0.03)	GV
	2023	3281	3281	124	0	
	2021	977	316	17	0	
Cx. orientalis	2022	181	181	20	0	
	2023	67	67	14	1, (1.49)	GV
	2021	4857	1735	66	0	
Cx. pipiens	2022	1800	1800	73	0	
	2023	1394	1394	60	0	
	2021	5735	1925	70	0	
Cx. tritaeniorhynchus	2022	397	397	21	0	
	2023	1190	1190	49	0	

(Lado et al., 2024)

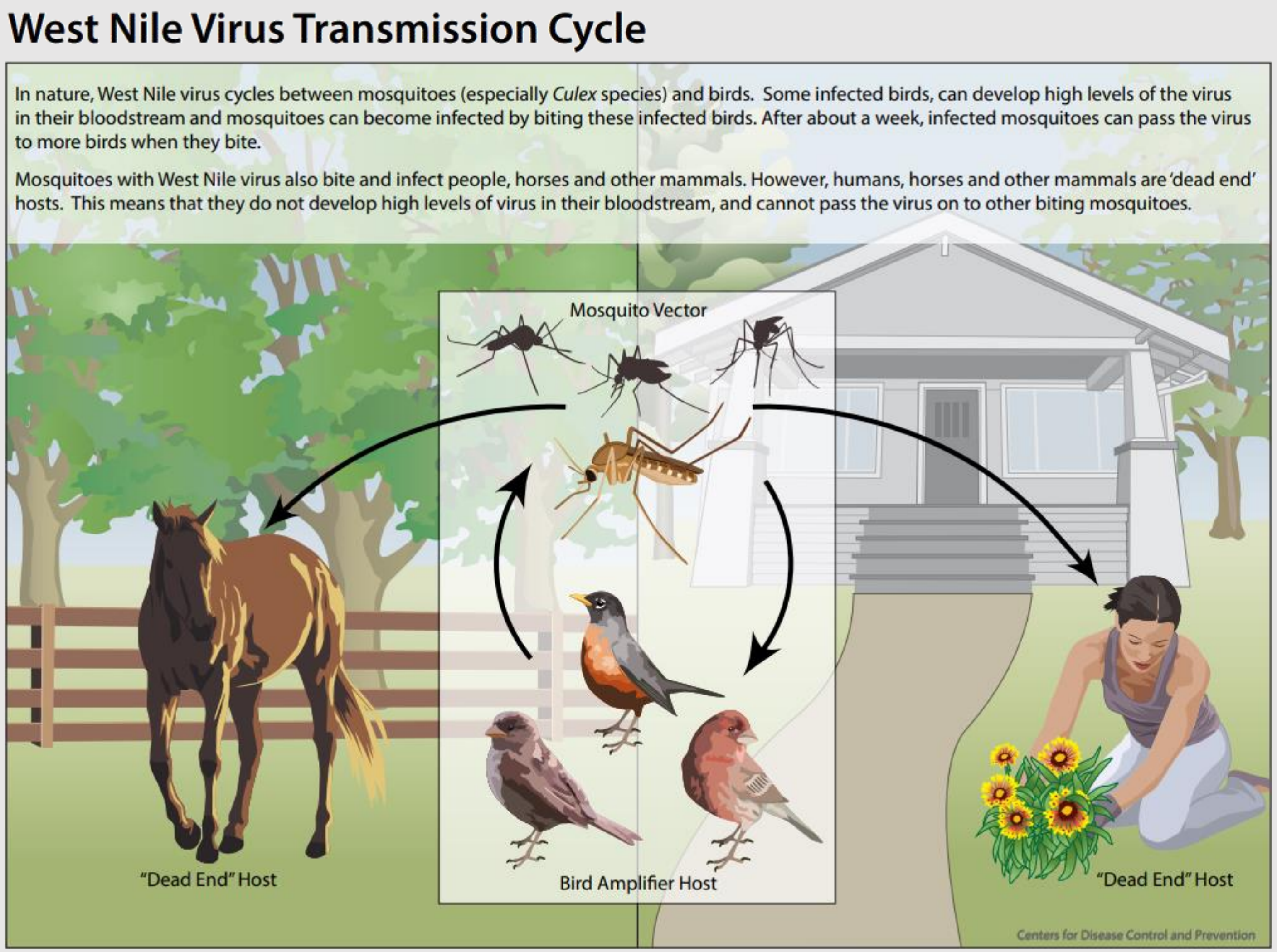
Numerous isolations from other mosquitoes aside from *Cx. tritaeniorhynchus*
→ JEV GV may have a different ecology compared to other genotypes

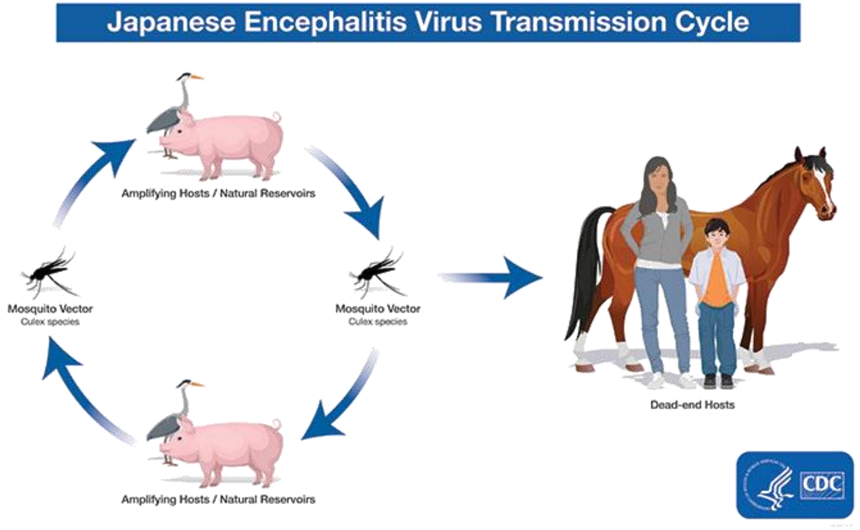


All are ornitophilic (bird-prefer mosquitoes)

Early detection (Identifies the presence before it cause outbreaks) → **vector and arbovirus detection**

JEV GV may have transmission cycle similar to West Nile virus





Unknown points regarding GV:

Does it have the same transmission cycle as other genotypes?

① Vector competence of *Cx. tritaeniorhynchus*

② Proliferation in swine

Conduct in vivo experiments

Courtesy of Dr. Daisuke Kobayashi

Vector Surveillance

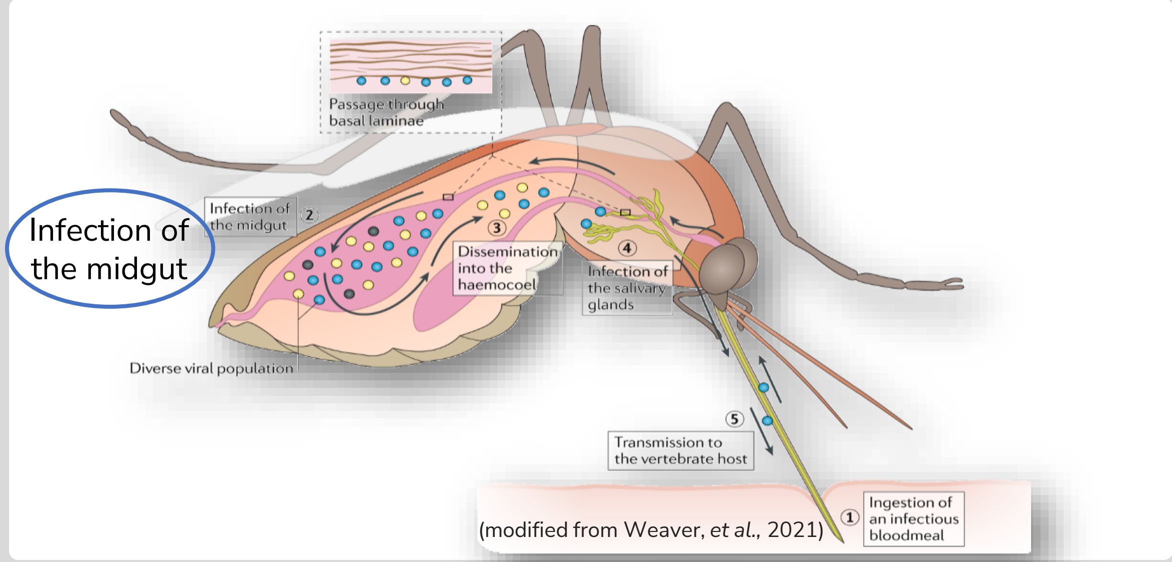
Monitoring Trends; Informed Control Strategies; Risk Assessment; Early Detection

Vector Competences in Transmitting Diseases

Endemic virus (JEV), exotic virus (LACV)

Vector Competences in Transmitting Japanese encephalitis virus (JEV)

Process from blood feeding to virus acquirement



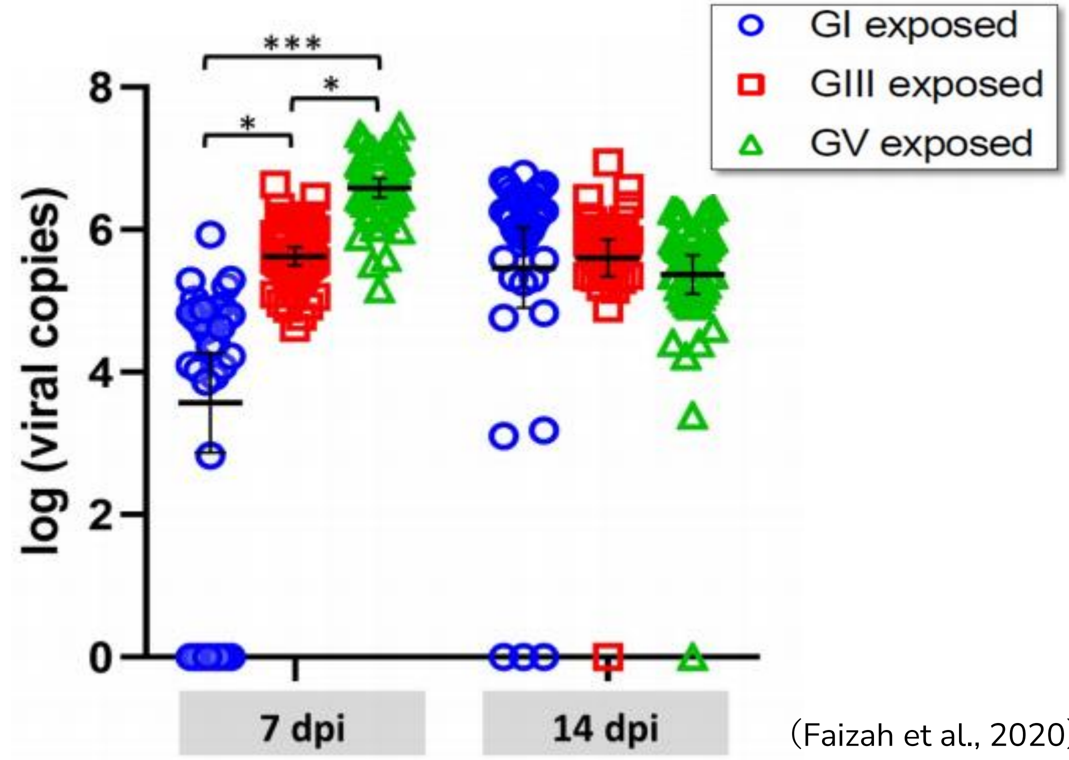
Genotypes and strains used

GI：17I4-1 (2017-Ishikawa)

GIII：JaGAr-01 (1959-Gunma)

GV：Muar (1952-Malaysia)

Abdomen-thorax



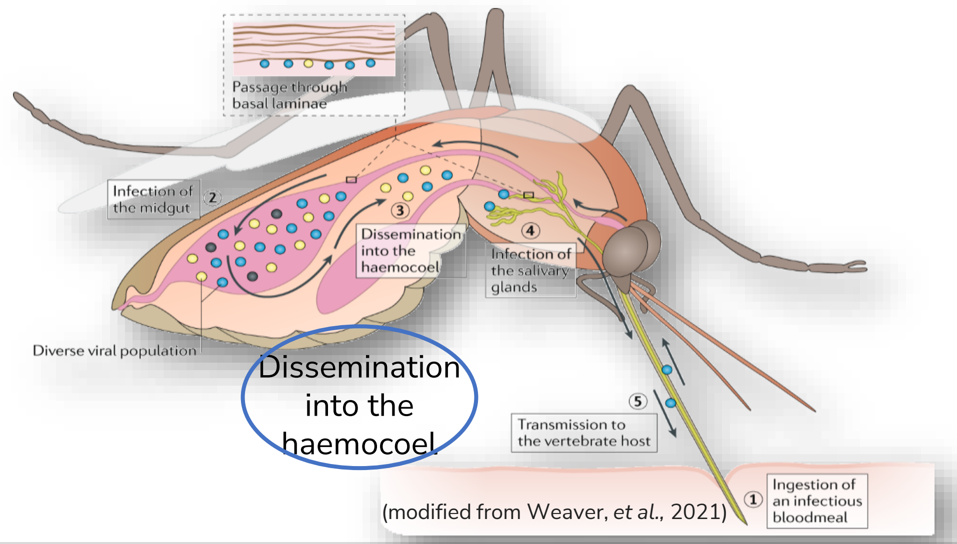
(Faizah et al., 2020)

Cx. tritaeniorhynchus is highly susceptible to JEV GV

Courtesy of Dr. Daisuke Kobayashi

Vector Competences in Transmitting Japanese encephalitis virus (JEV)

Process from blood feeding to virus acquirement



(modified from Weaver, *et al.*, 2021)

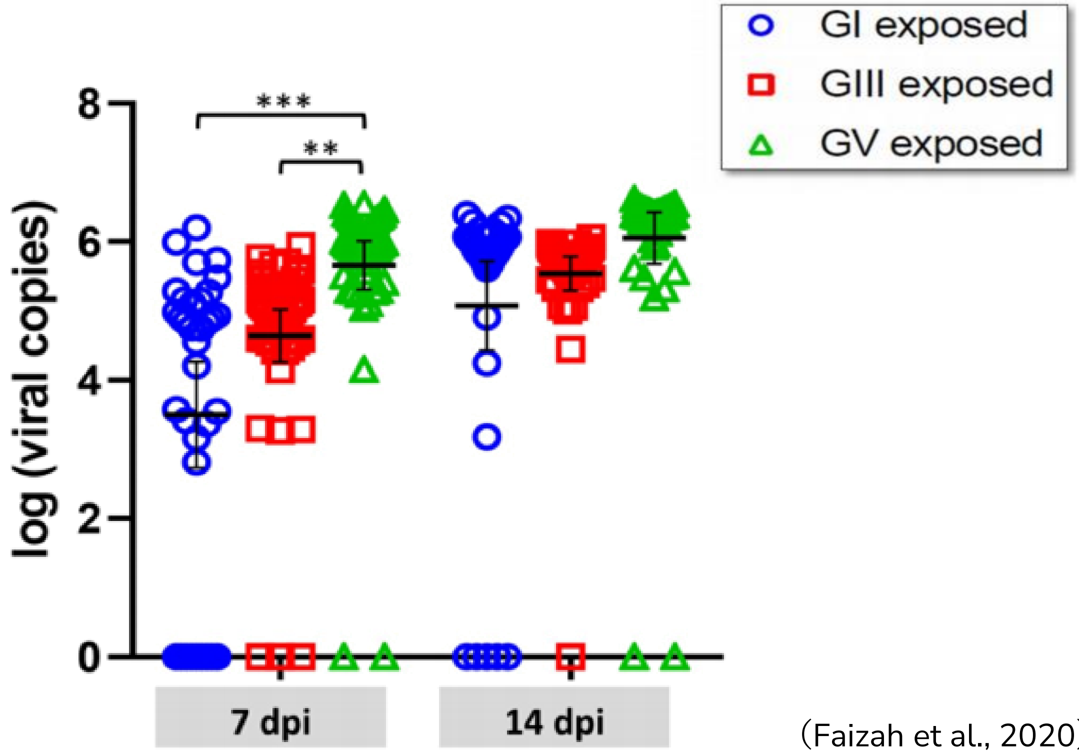
Genotypes and strains used

GI：17I4-1（2017-Ishikawa）

GIII：JaGAr-01（1959-Gunma）

GV：Muar（1952-Malaysia）

Head-wings-legs



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Vector Competences in Transmitting Japanese encephalitis virus (JEV)

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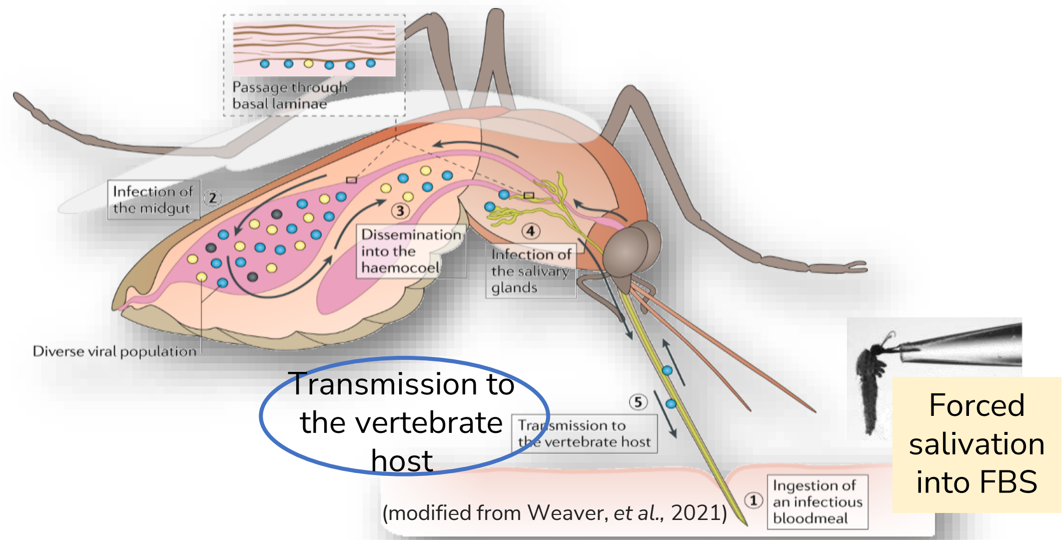


(modified from Weaver, *et al.*, 2021)

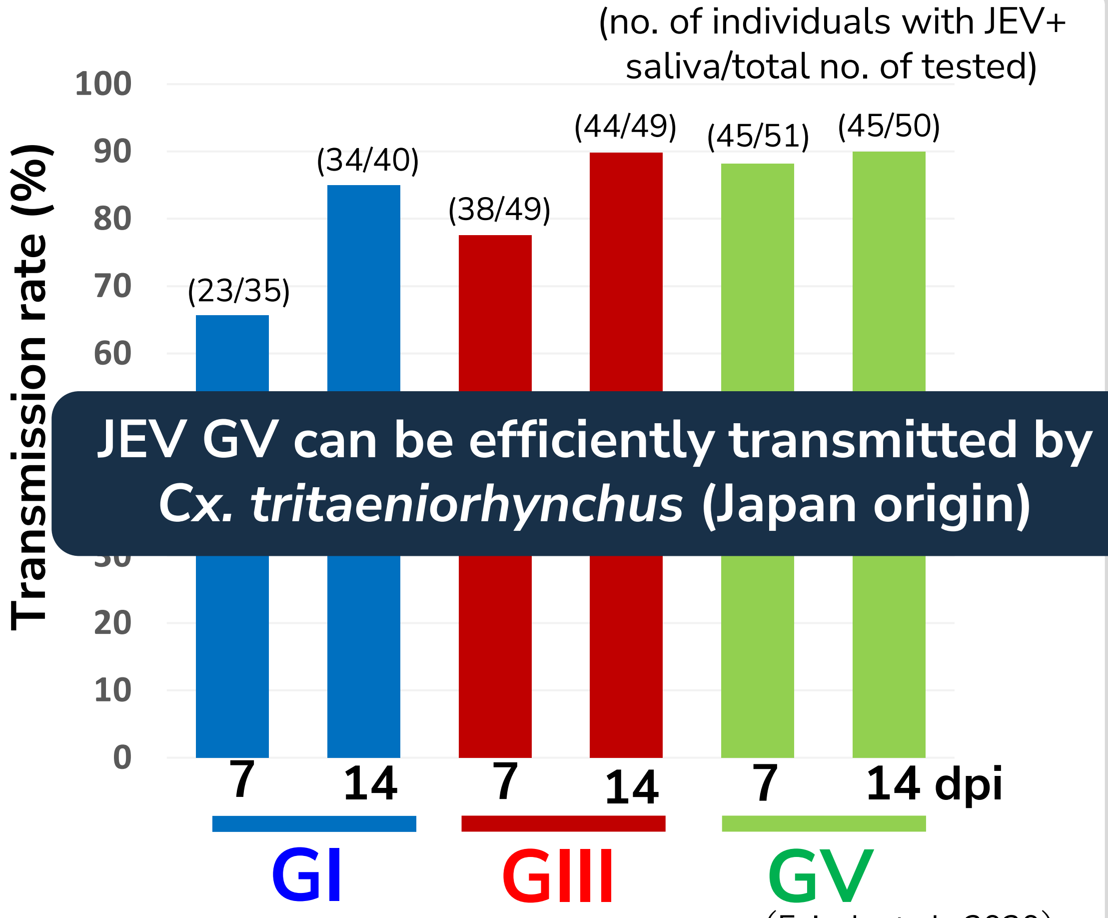
Genotypes and strains used

GI：17I4-1（2017-Ishikawa）

GIII：JaGAr-01（1959-Gunma）

GV：Muar（1952-Malaysia）

Infectious JEV present in saliva



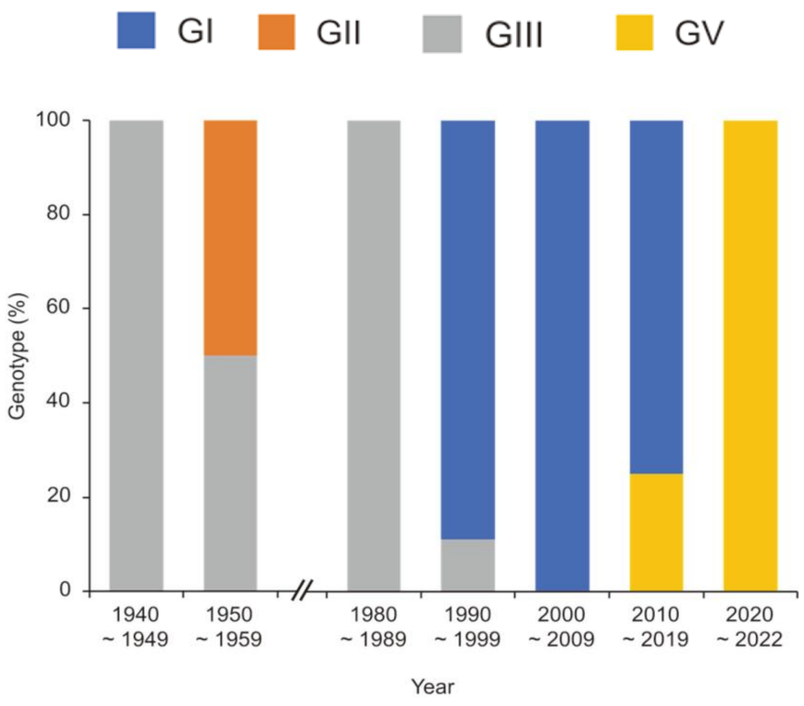
JEV GV can be efficiently transmitted by *Cx. tritaeniorhynchus* (Japan origin)

(Faizah et al., 2020)

Courtesy of Dr. Daisuke Kobayashi

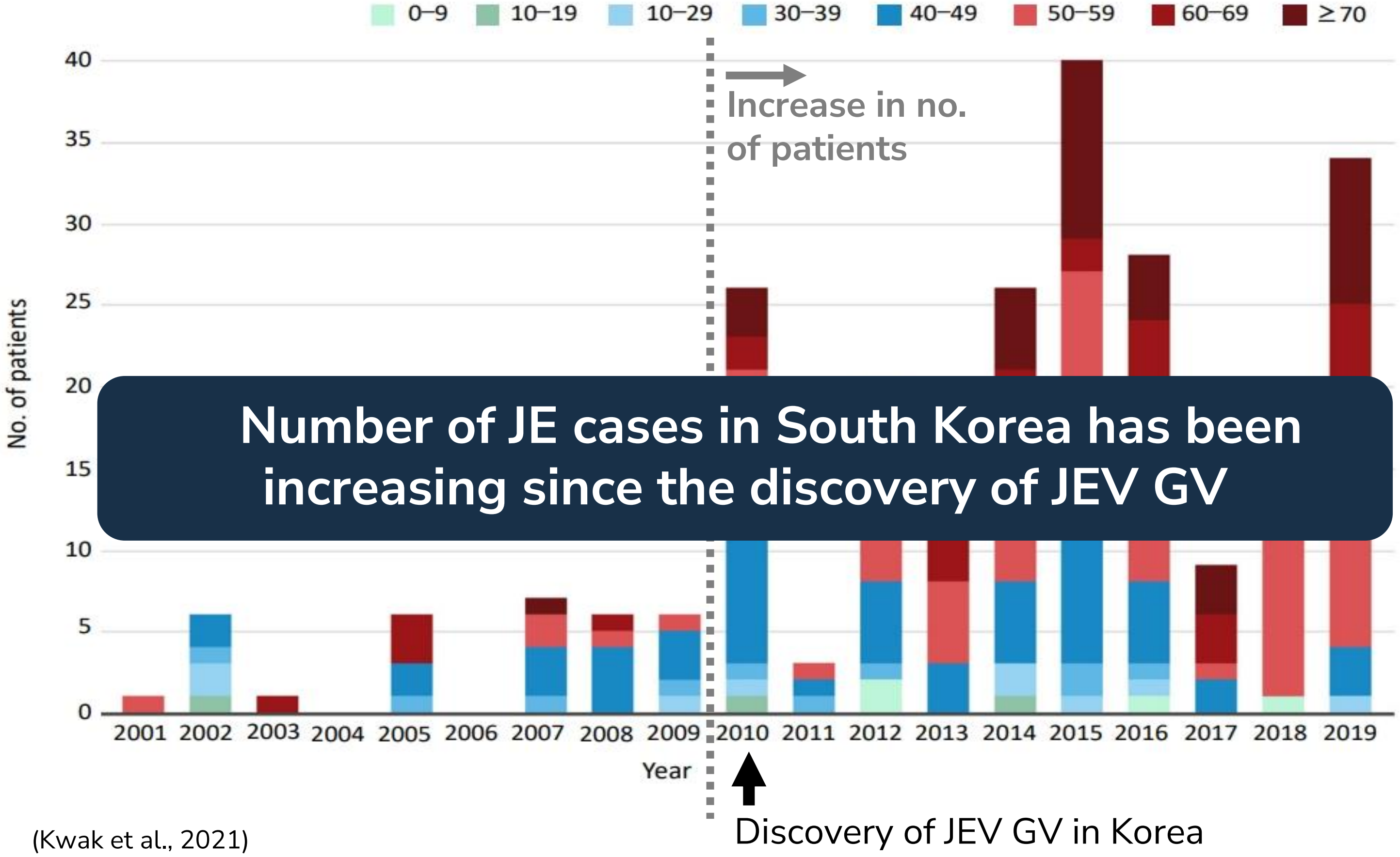
Vector Competences in Transmitting Japanese encephalitis virus (JEV)

Changes of JEV Genotypes in South Korea



(Lee et al., 2022)

Japanese Encephalitis Patients in Korea by Age Group



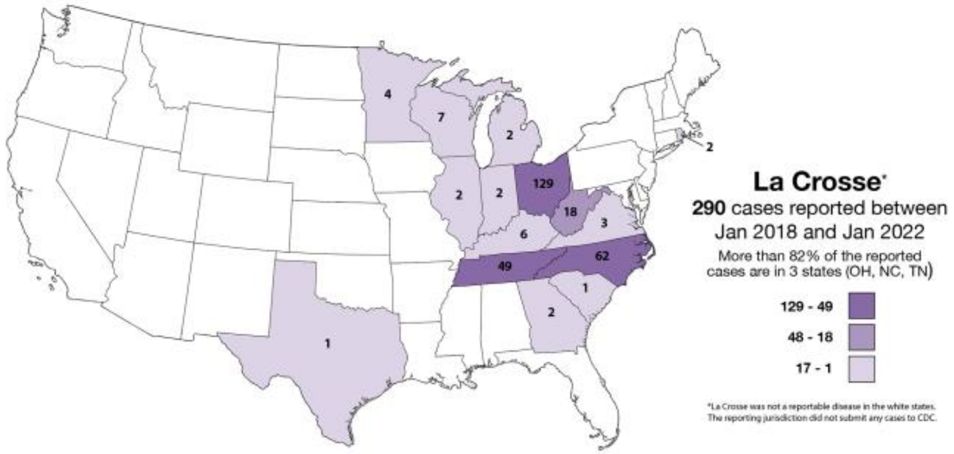
(Kwak et al., 2021)

- **Further study on the JEV GV transmission cycle is required**
- **We need to stay vigilant for any invasion and establishment**

Courtesy of Dr. Daisuke Kobayashi

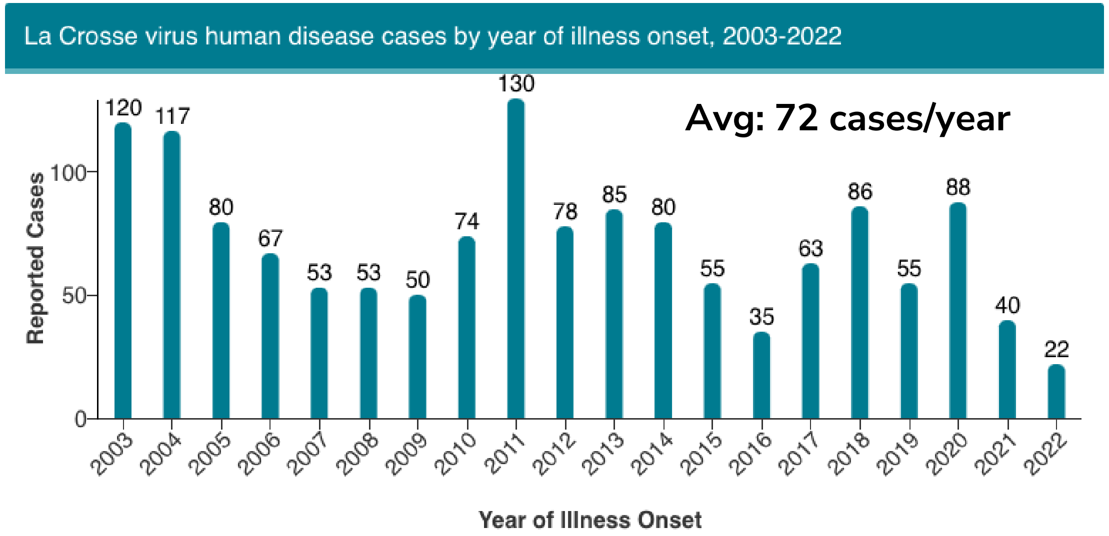
Vector Competences in Transmitting La Crosse virus (LACV)

Distribution of LACV

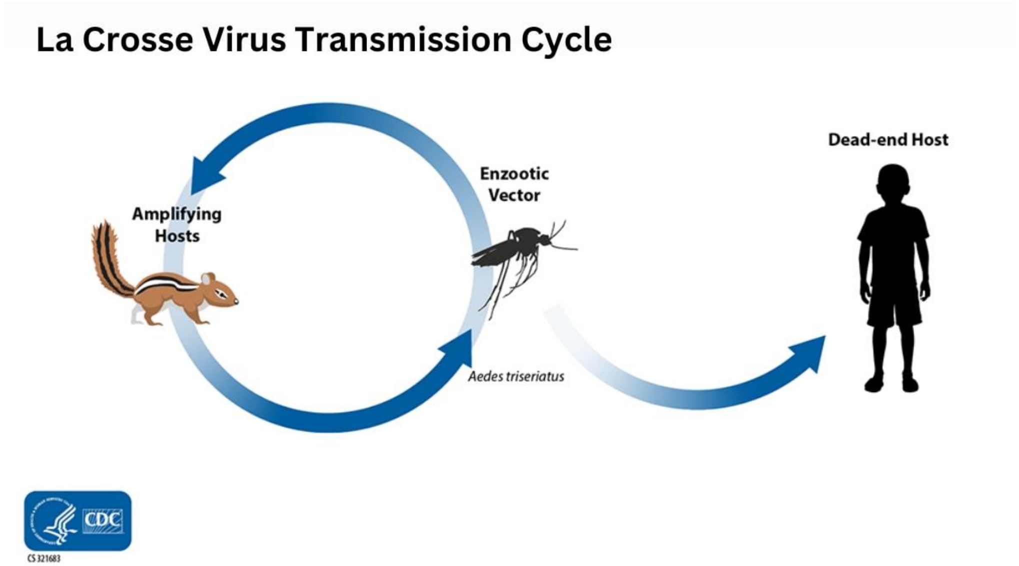


LACV is one of California serogroup viral encephalitis/meningitis, and an Orthobunyavirus

- Causes febrile illnesses in humans: fever, headache, nausea and vomiting, nuchal rigidity, lethargy, seizures and coma
- Viral activity is most intense in **forested areas** where the primary vector, *Ae. triseriatus*, is found

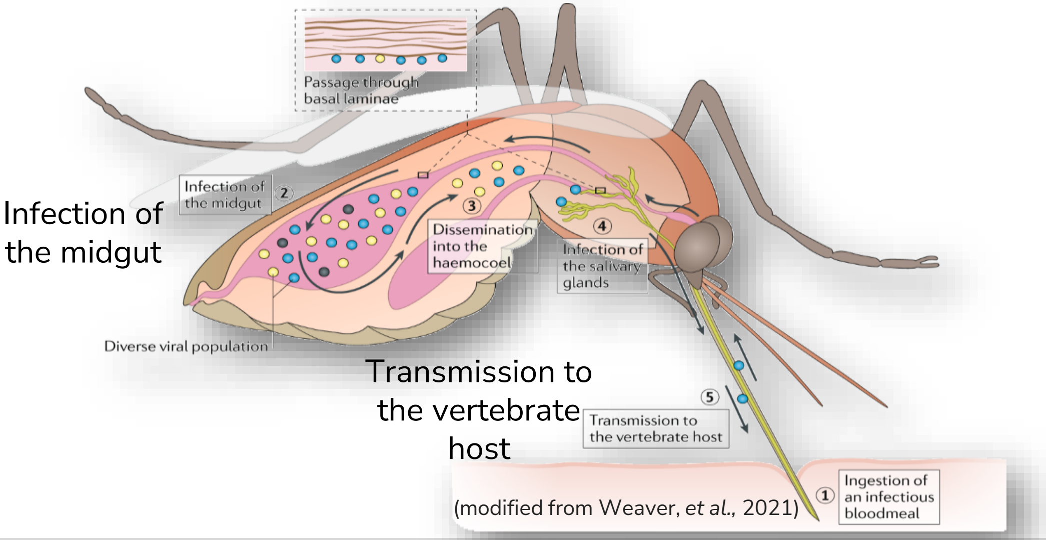


Courtesy of CDC and ArboNET (https://www.cdc.gov/lac/statistics/historic-data.html)



Vector Competences in Transmitting La Crosse virus (LACV)

Process from blood feeding to virus acquirement



(modified from Weaver, *et al.*, 2021)

Strain used: LACV ATCC® VR-1834

Mosquito species tested:

- ***Cx. pipiens* form *molestus***
- ***Ae. albopictus***
- ***Ae. japonicus japonicus***

Vector Competences in Transmitting La Crosse virus (LACV)

EMERGING INFECTIOUS DISEASES

Emerg Infect Dis. 2015 Apr; 21(4): 646–649.
doi: 10.3201/eid2104.140734
PMCID: PMC4378473
PMID: 25811131

Journal Article

La Crosse Virus in *Aedes japonicus japonicus* Mosquitoes in the Appalachian Region, United States

M. Camille Harris,[1] Eric J. Dotseth, Bryan T. Jackson, Steven D. Zink, Paul E. Marek, Laura D. Kramer, Sally L. Paulson, and Dana M. Hawley

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Abstract

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La Crosse virus (LACV), a leading cause of arboviral encephalitis in children in the United States, is emerging in Appalachia. For local arboviral surveillance, mosquitoes were tested. LACV RNA was detected and isolated from *Aedes japonicus* mosquitoes. These invasive mosquitoes may significantly affect LACV range expansion and dynamics.

Local populations of *Aedes j. japonicus* in Japan may transmit LACV if the virus is introduced

Incriminating disease vectors is crucial for disease prevention and mitigation measures

CONCLUSION

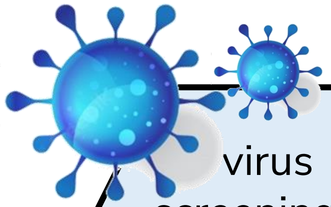
<u>Vector Surveillance</u>

Monitoring Trends → impact of climate change → **Expansion of mosquitoes worldwide→ wider consequences for public health**

Informed Control Strategies → status of insecticide resistance → **continue monitoring and find alternatives for mosquito control**

Risk Assessment → identification of bridge vector → **continue survey for distribution of local vectors**

Early detection → vector and arbovirus detection prior to disease outbreak→ **continue survey for both pathogens and important disease vectors**



virus screening in field-captured individuals

CONCLUSION

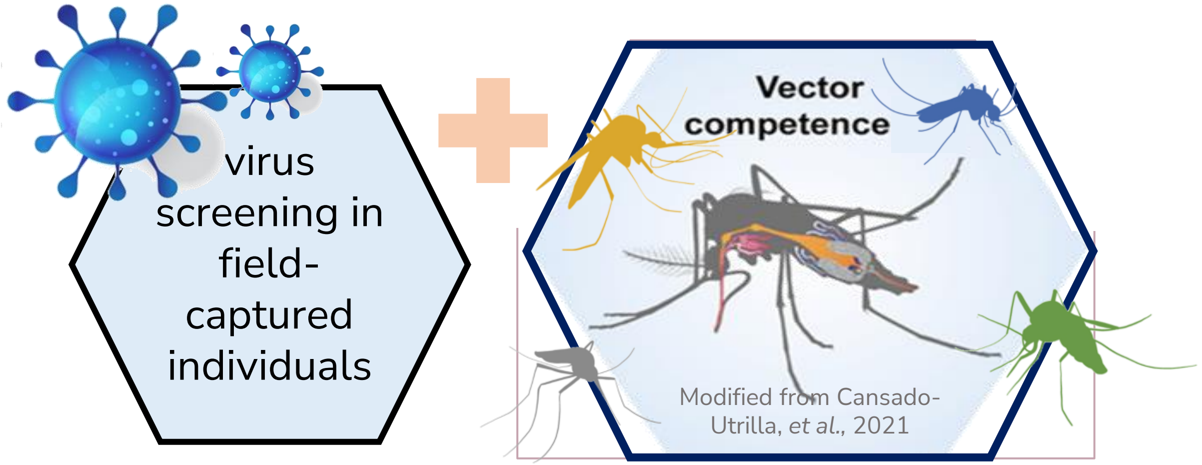
Vector Surveillance

Monitoring Trends; Informed Control Strategies; Risk Assessment; Early Detection

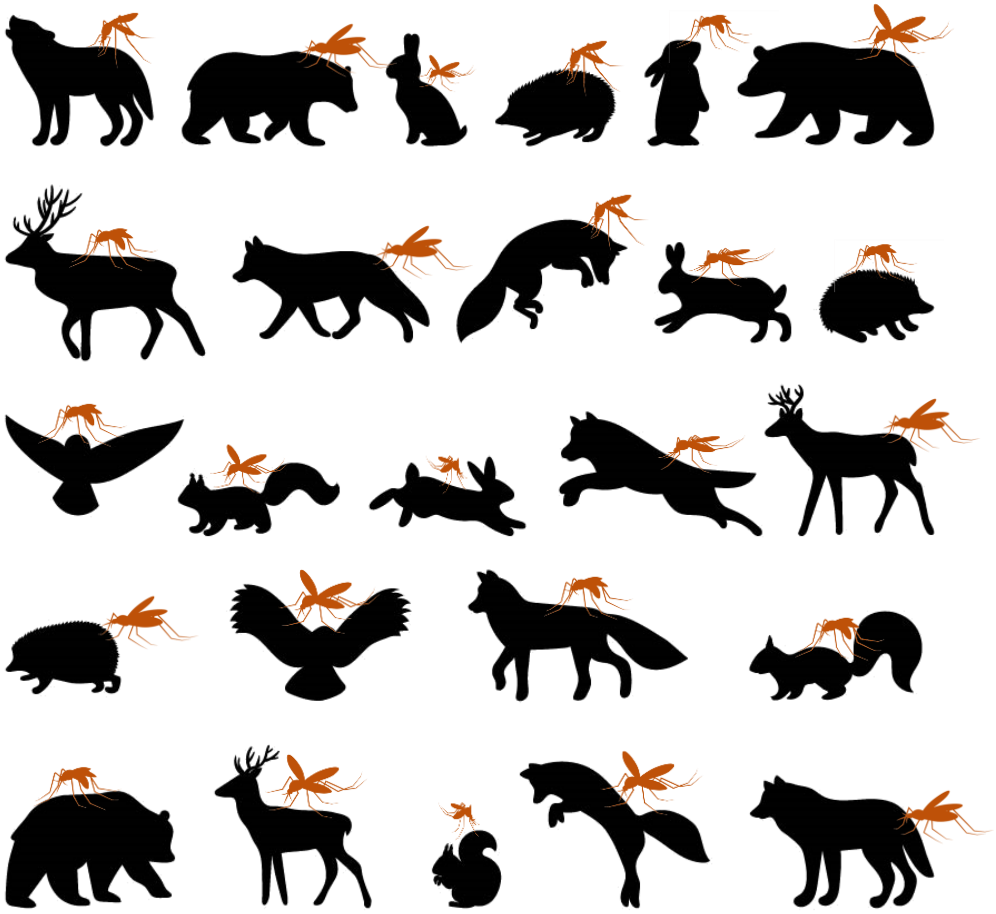
Vector Competences in Transmitting Diseases

Endemic virus (JEV); Mosquito populations from Japan or other countries may transmit JEV (any genotypes) → **continue survey for JEV in locally available vectors**

Exotic virus (LACV); Specific mosquito species originated in Japan may transmit the exotic virus → **identify the risks and routes of invasion**



Modified from Cansado-Utrilla, *et al.*, 2021



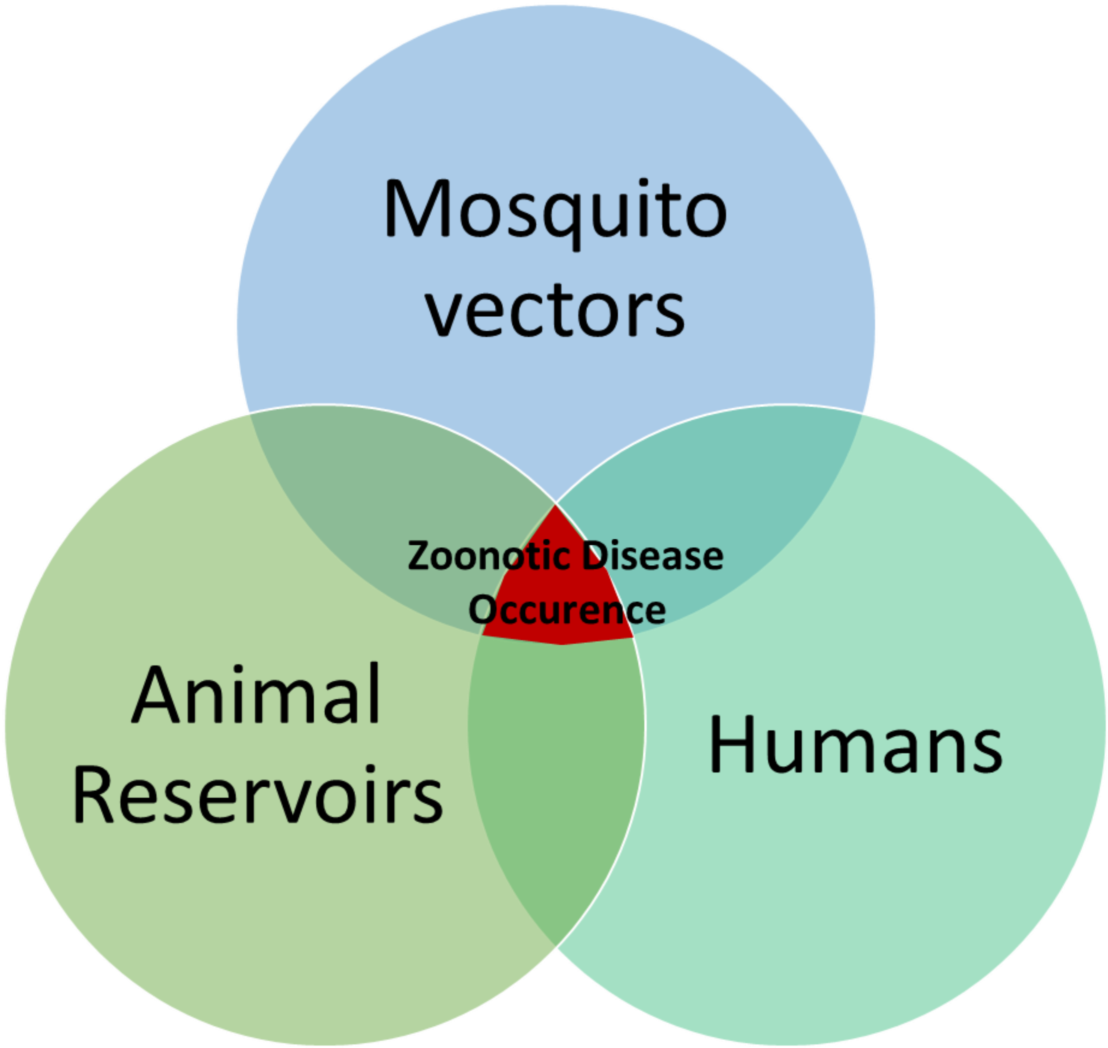
With ongoing *vector control and management strategies*, coupled with *groundbreaking diagnostic tools and cutting-edge researches*, there is a great promise in tackling vector-borne diseases

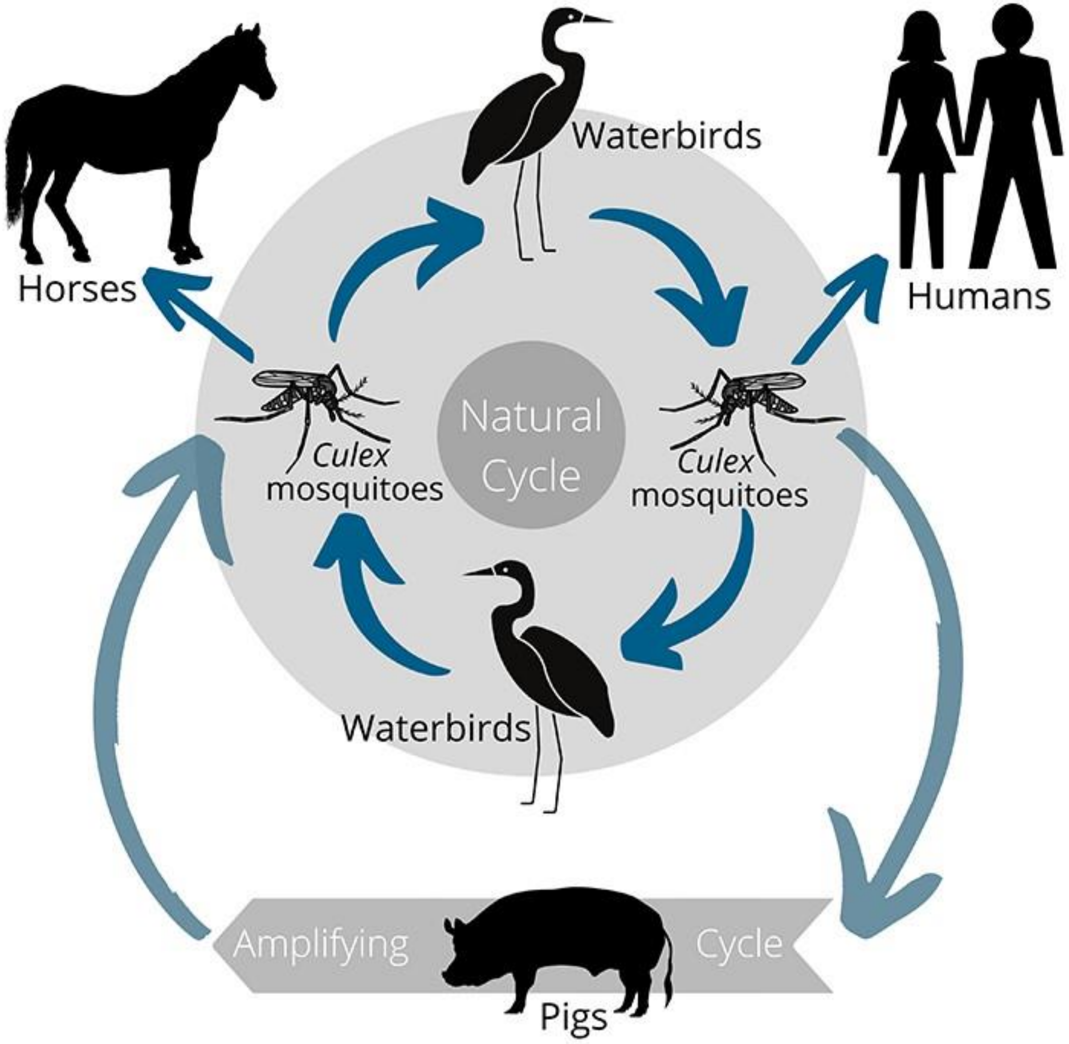
Our challenge is to **work collaboratively, maintaining open communication**, to improve the health of both people and animals

Mosquito-borne zoonoses vector surveillance and control

Associate Professor Stephan Karl, PhD, M. Eng.
Principal Research Fellow, James Cook University
Laboratory Head, PNG Institute of Medical Research

Mosquito-borne zoonotic diseases





Insect-transmitted zoonotic diseases in our region

Zoonoses comprise approximately 60% of all known infectious diseases, while 75% of emerging infectious agents are zoonotic.

VECTORS	ZOONOTIC DISEASES	HOST RESERVOIRS
Mosquitoes	• Japanese Encephalitis Virus • Ross River Virus • Barmah Forest Virus • Murray Valley Virus • West Nile/Kunjin Virus • Zika Virus • Chikungunja Virus • *Plasmodium knowlesi* (malaria) • Etc.	• Pigs, feral pigs, birds • Marsupials, mammals, birds • Marsupials (kangaroos, possums etc.) • Waterbirds • Birds, Waterbirds • primates • primates • primates
Other insects (ticks, fleas etc.)	• Rickettsia spp. (various fevers) • *Babesia spp. (Babesiosis)* • Etc.	• Rodents, deer • *Cattle* • Rodents

Arboviruses of medical and veterinary importance: Asia-Pacific

Virus	Region	1st isolation	Major vector	Reservoir	Disease
Japanese encephalitis	Asia and Australasia	1935	*Culex* spp.	Pigs, waterbirds	Encephalitis
Murray Valley encephalitis	Australasia and Indonesia	1951	*C. annulirostris*	Waterbirds	Encephalitis
West Nile (Kunjin)	Asia and Australasia	1955 (1960)	*Culex* spp.	Birds, waterbirds	Encephalitis, fever
Kokobera	Australasia	1960	*C. annulirostris*	Marsupials	Fever
Edge Hill	Australasia	1961	*Aedes* spp.	Marsupials	Arthlagia/ myalgia?
Sepik	New Guinea	1966	*Ficalbia* spp.	Not known	Fever
Ross River	Australasia, Pacific	All states	*Culex* and *Aedes* spp.	Marsupials	Fever, arthritis, rash
Barmah Forest	Australasia, Pacific	All states	*Culex* and *Aedes* spp.	Marsupials	Fever, arthritis, rash
Dengue (1-4)	Asia and Australasia	1944-1956	*Aedes aegypti*	Humans	Fever, HF
Zika	Asia, Micronesia	1966	*A. aegypti*	Primates, humans	Fever, microcephaly
Chikungunya	Africa, Asia	1953	*Aedes* spp.	Primates, humans	Fever, arthritis, rash

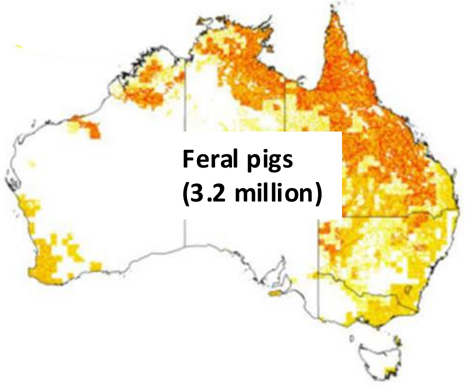
Host Reservoirs, Vectors and their contribution to disease spread

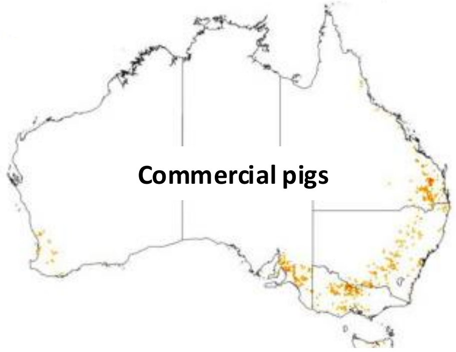
Asian–Australasian Flyway

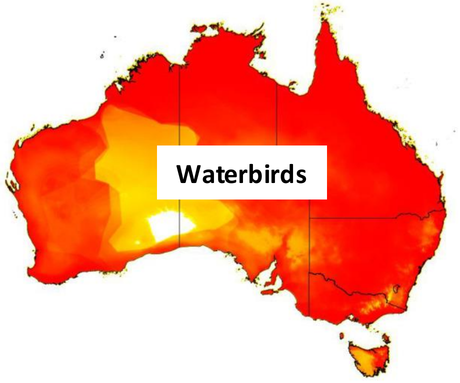
- route for migratory birds across the region
- major driver of zoonotic pathogen spread

Host Reservoirs, Vectors and their contribution to disease spread

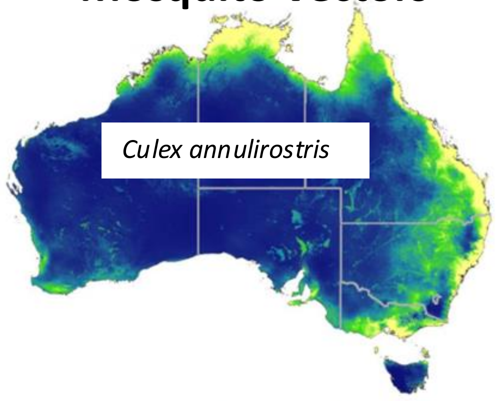
Animal Hosts

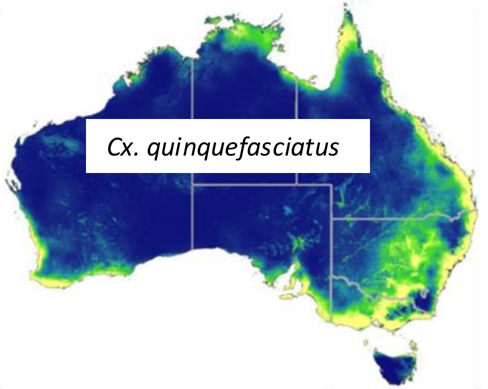


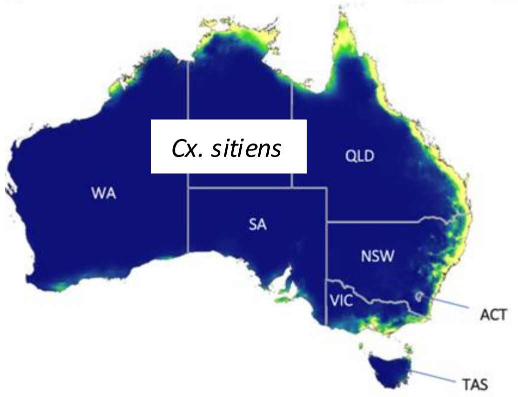


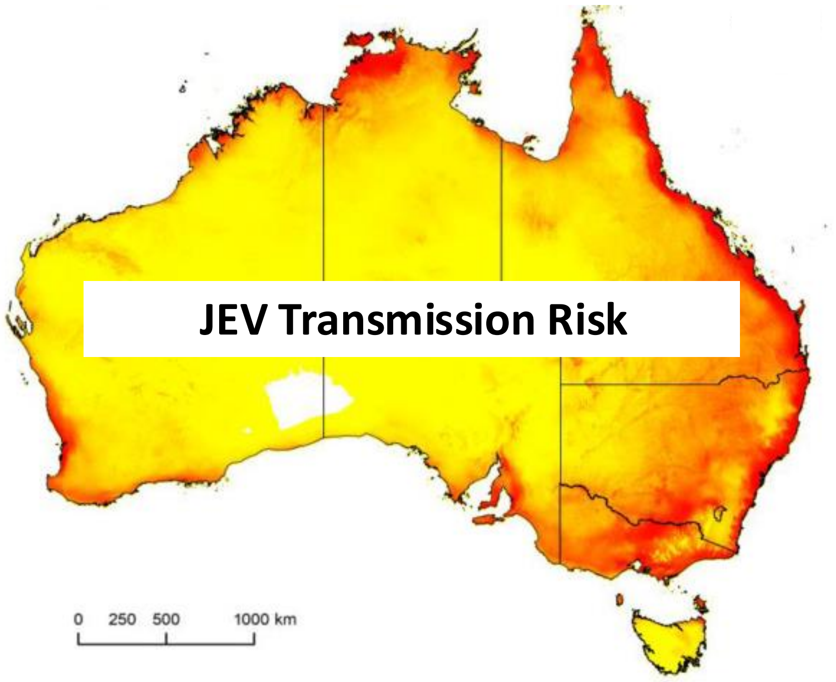


Mosquito Vectors





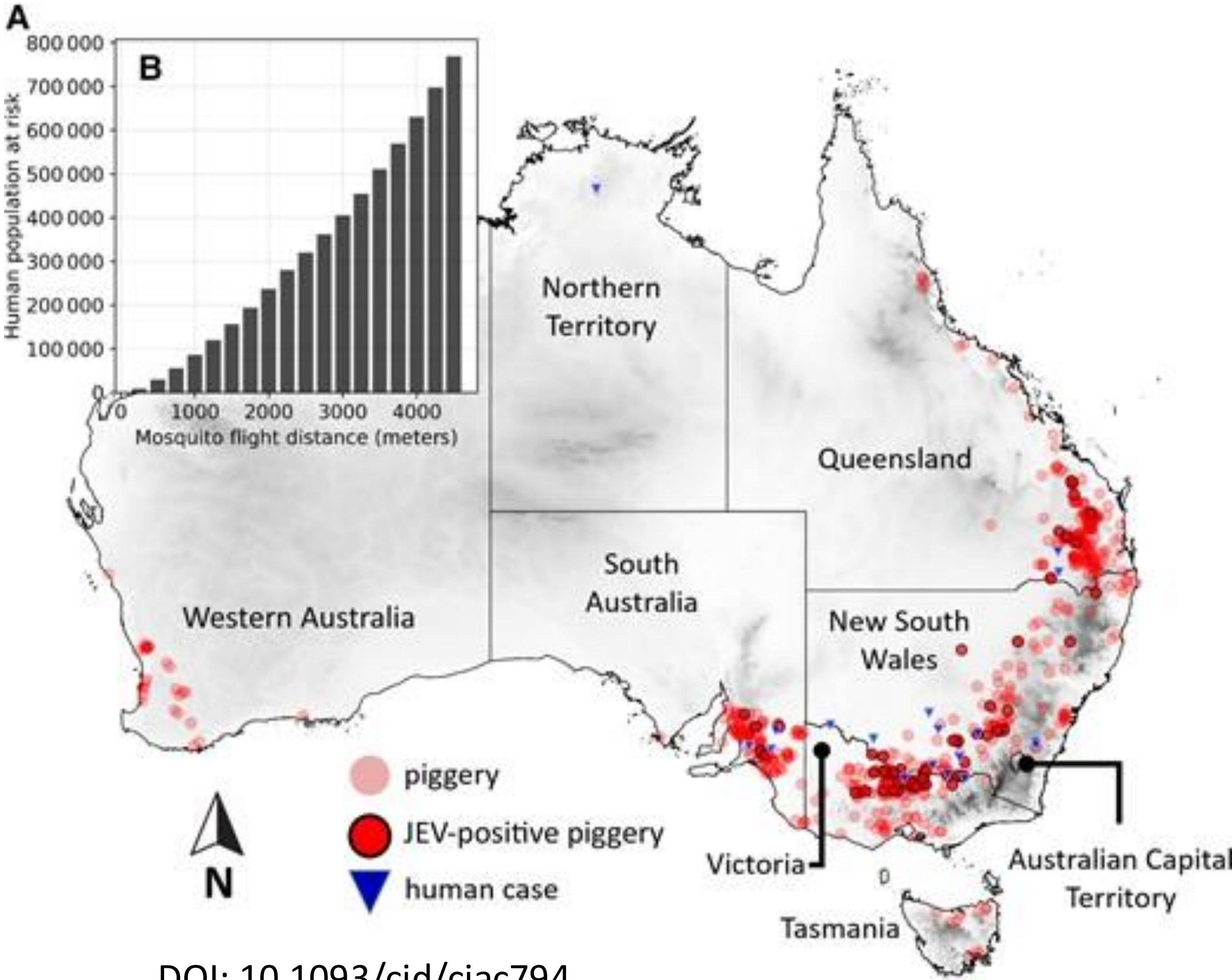




doi: 10.3390/tropicalmed7120393

Host Reservoirs and their contribution to disease spread –JEV in Australia

- In 2022/23, a JEV outbreak caused 46 human cases and seven deaths in Australia
- Most cases occurred in New South Wales, Victoria, South Australia and Queensland
- Many cases co-localized with commercial piggeries
- Outbreak was caused by JEV genotype 4



DOI: 10.1093/cid/ciac794

Why entomological surveillance

- Confirm ongoing local transmission of specific pathogens
- Confirm/incriminate local vectors, their seasonality etc.
- Impact of Climate change on vector distributions
- Incursions of vectors into new territories
- Spread of pyrethroid resistance
- Early detection of pathogen presence
- Inform vector control strategies (selection and impact)

Vector Surveillance at first point of entry

- Prevent incursions of exotic mosquitoes at the border
- involves vector monitoring at Australian airports and sea ports (states and territories); trapping and DNA analysis
- Undertaken by the Department of Agriculture, Water and the Environment (DAWE)
- So far no exotic mosquito species have established in Australia, but incursions of *Aedes aegypti* and *Aedes albopictus* are frequent

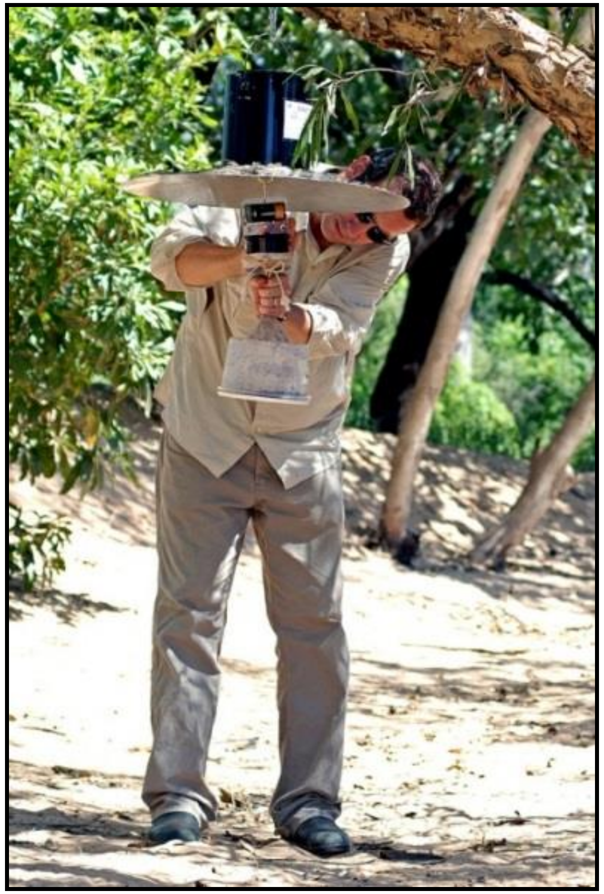
Ocean vessel traffic of dessicant-resisant eggs

Aedes incursions Into Australia

https://pursuit.unimelb.edu.au/articles/tracking-the-movement-of-mosquito-stowaways

Arbovirus Vector Surveillance - Methods that demonstrate virus transmission

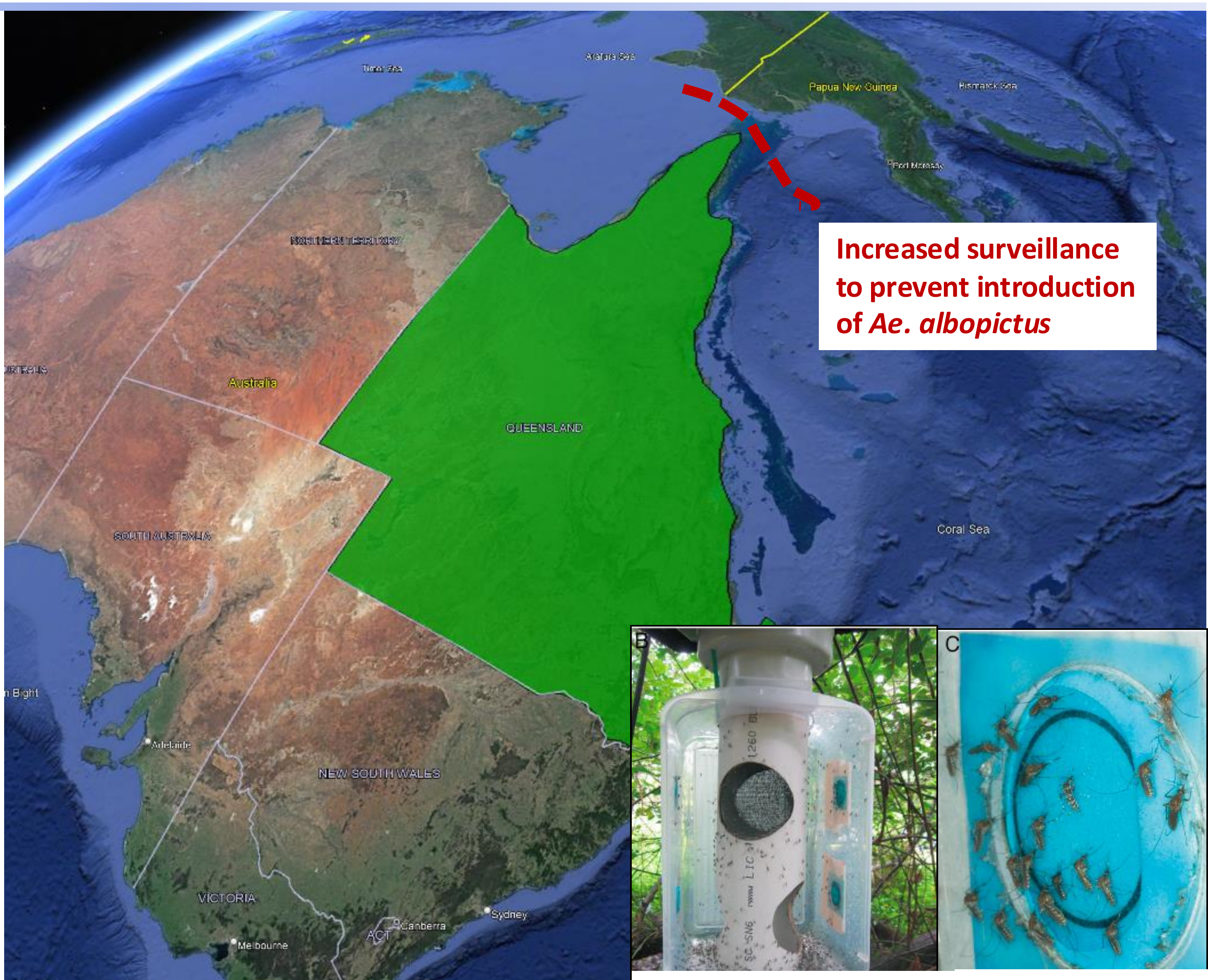
- **Mosquito trapping for l**ong-term measurement allows determination of baseline **abundance** (what is normal) and unusual activity
- Identify species, density and virus infection rates for early predictive data
- Performed over **wet season/summer-spring**
- **Isolation** or **detection** of virus from vectors
- Information about circulating arboviruses, including new/emerging
- Cell culture or PCR of pooled species
- Whole trap grinds and PCR or NGS
- In Australia, mosquito surveillance programs are **state-based**



Queensland

Queensland Peri-Urban Alphavirus Surveillance Program and Queensland Arbovirus Sentinel Surveillance Program

- Seasonal surveillance programs (Q1/Q2) in rural and peri-urban QLD.
- FTA cards inside CO2- baited light traps or passive box traps
- target Murray Valley encephalitis virus, West Nile (Kunjin), JEV, Ross River and Barmah Forest activity.
- partnerships between state entities lead by Queensland Department of Health, including
  - local government councils,
  - Public Health Units,
  - Hospital and Health Services (HHS),
  - Northern Australia Quarantine Strategy (NAQS).
  - Diagnosis at QLD Forensic Services



CO2- baited light trap

FTA card

Queensland

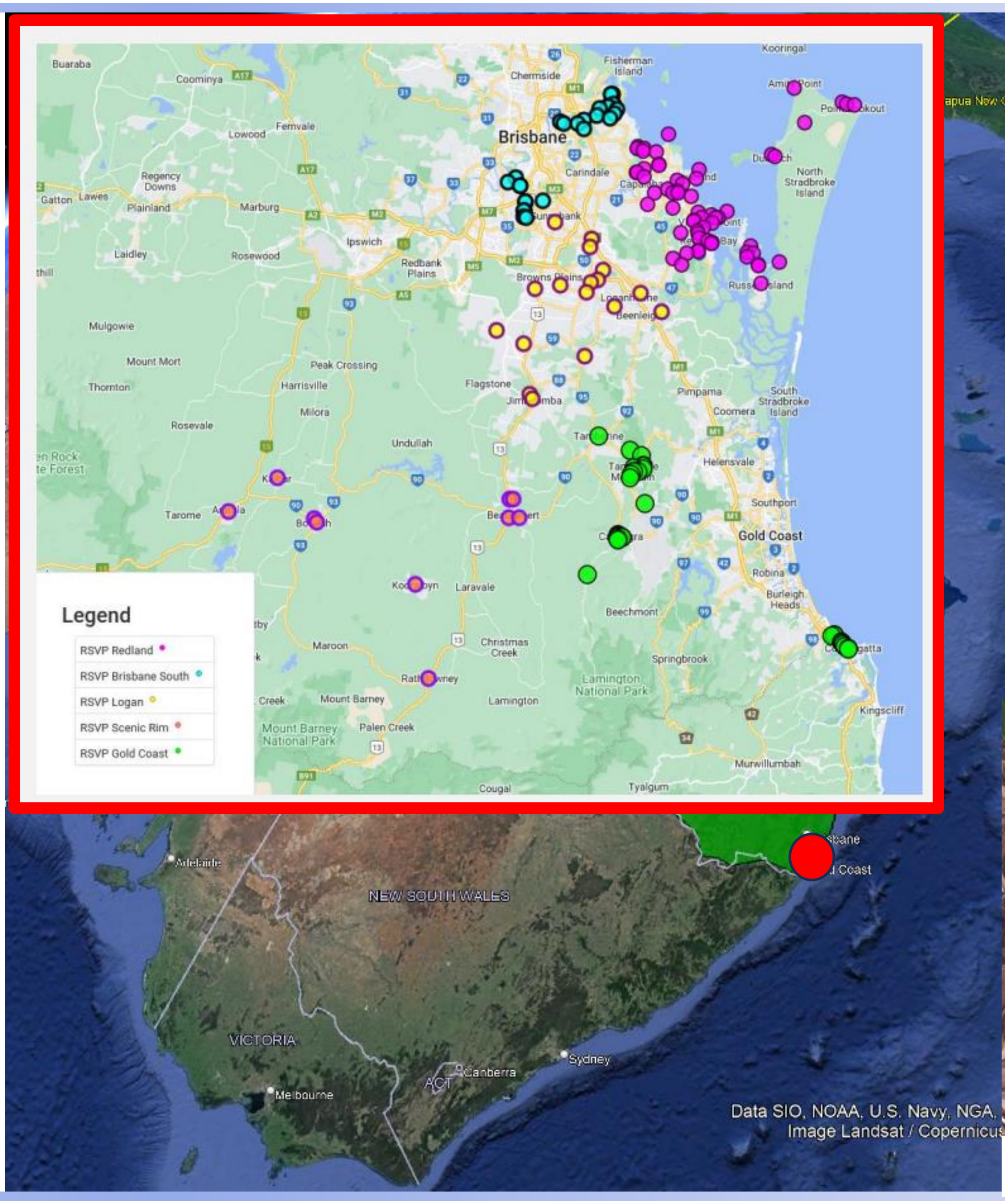
Rapid Surveillance for Vector Presence (RSVP) Program Nov-Dec, and Feb-June

- Ovitraps deployed across southern South QLD by participating businesses
- PCR testing for *Ae. aegypti* & *Ae. albopictus*

Zika Mossie Seeker

- citizen science partnership that links household DIY backyard ovitraps to PCR testing for *Ae. aegypti & Ae. albopictus*

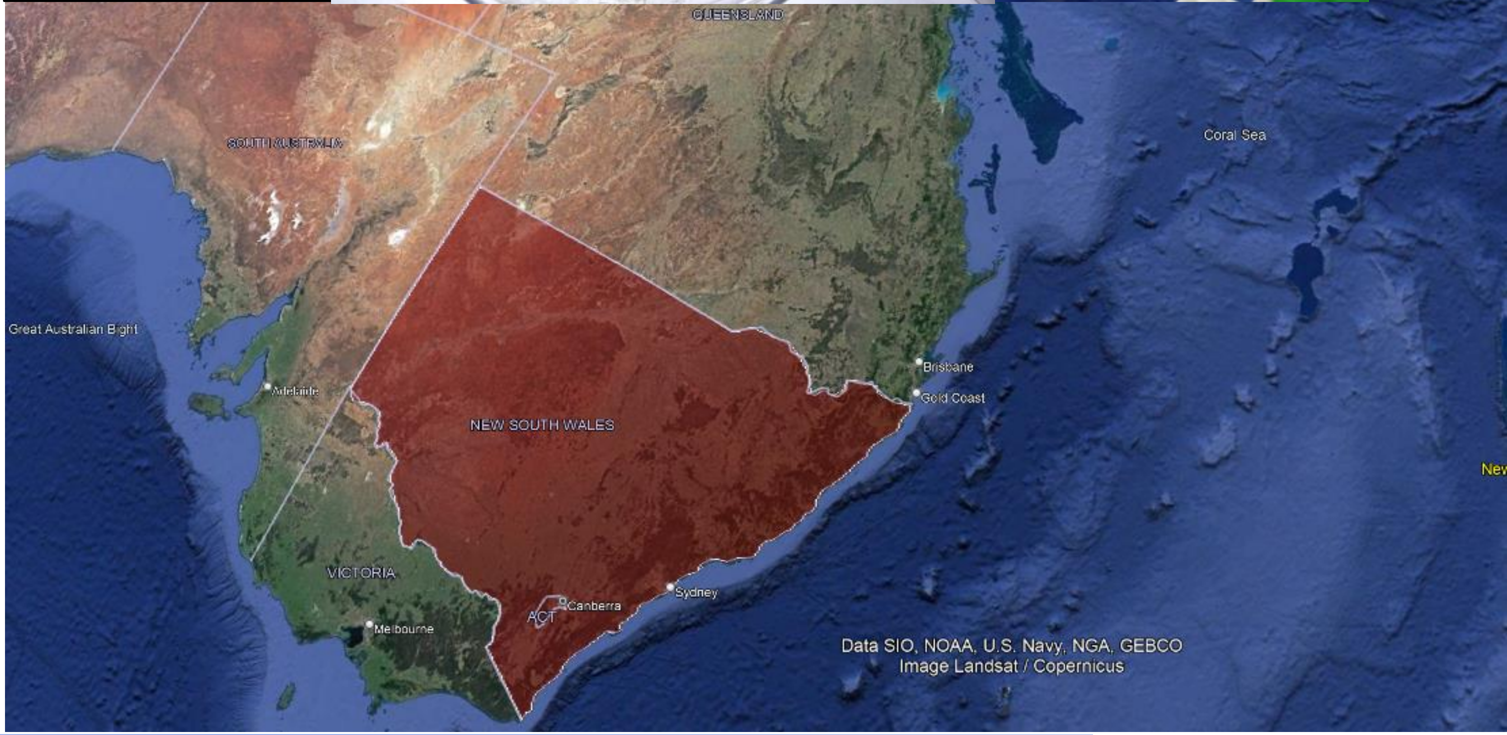
Performance	Round 11 - Dec 2022	Round 12 - May 2023	Round 13 - Nov 2023	Round 14 - April 2024
No. of kits sent out	982	663	556	492
No. of participants	444	389	349	337
No. of suburbs	134	138	128	129
No. of eggs collected	36,497	35,991	47,504	25,201



Ovitrap

New South Wales

- Undertaken by the Institute for Clinical Pathology and Medical Research for NSW Health
- Mosquito populations routinely monitored at >50 locations in NSW (Apr-Nov)
- Tested for Ross River and Barmah Forest Murray Valley, Japanese Encephalitis and Kunjin
- Mosquitoes are analysed for species type and abundance.
- CDC Light Traps baited with $CO2$
- ‘whole trap grinds’



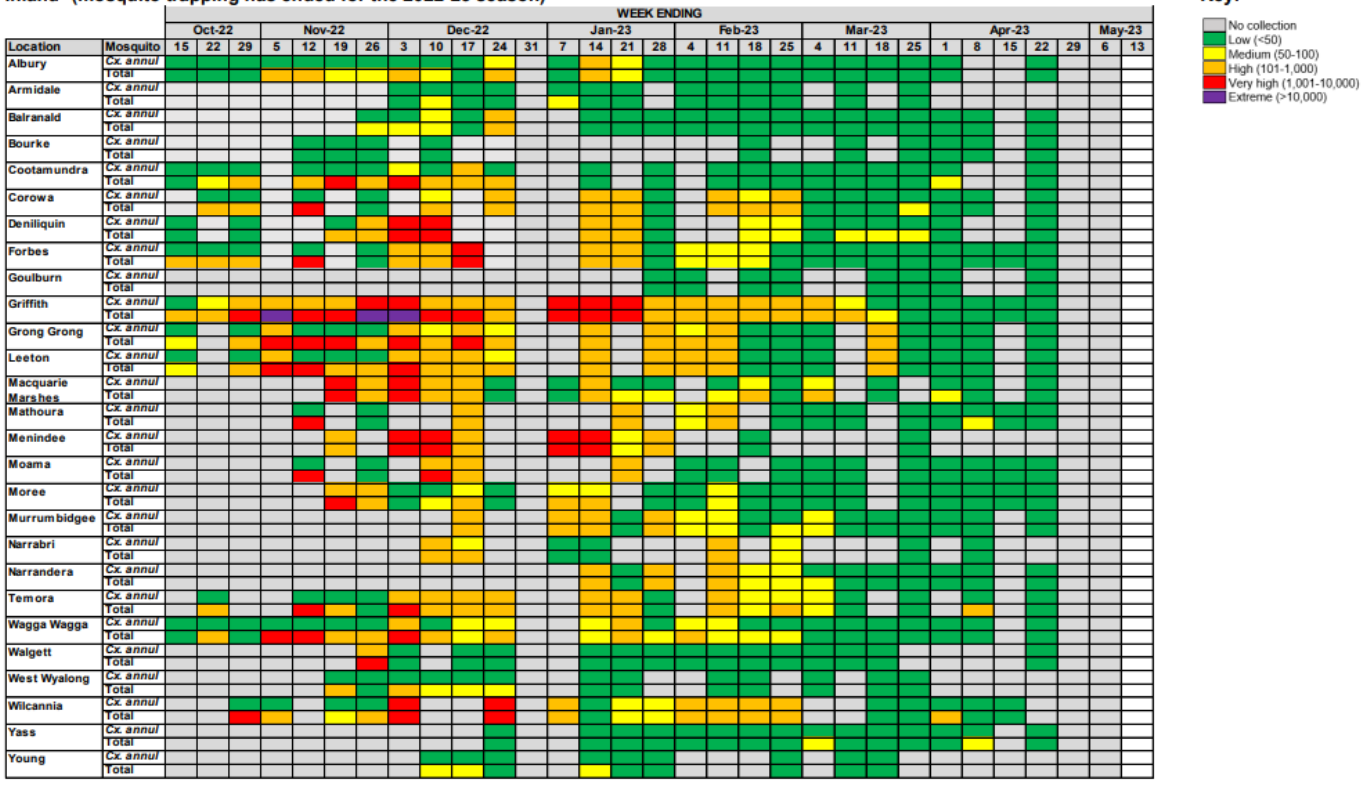
New South Wales

- Data published as ‘weekly reports’ on NSW Health website

Mosquito counts for the 2022-23 surveillance season

“*Cx. annul*” refers to *Culex annulirostris* and “*Ae. vigilax*” refers to *Aedes vigilax*.

Inland (mosquito trapping has ended for the 2022-23 season)



Positive test results in the 2022-2023 surveillance season

Date of sample collection	Location	Virus
12 January 2023	Menindee	Murray Valley encephalitis
12 January 2023	Menindee	Kunjin
19 January 2023	Menindee	Murray Valley encephalitis
20 January 2023	Macquarie Marshes	Murray Valley encephalitis
26 January 2023	Menindee	Murray Valley encephalitis
29 January 2023	Leeton	Murray Valley encephalitis
5 February 2023	Menindee	Murray Valley encephalitis
5 February 2023	Menindee	Kunjin
6 February 2023	Deniliquin	Murray Valley encephalitis
6 February 2023	Forbes	Murray Valley encephalitis
6 February 2023	Hay	Murray Valley encephalitis
6 February 2023	Macquarie Marshes*	Murray Valley encephalitis
12 February 2023	Deniliquin	Murray Valley encephalitis
12 February 2023	Leeton	Murray Valley encephalitis
12 February 2023	Leeton	Kunjin
13 February 2023	Macquarie Marshes	Murray Valley encephalitis
13 February 2023	Macquarie Marshes	Kunjin
14 February 2023	Forbes	Murray Valley encephalitis
19 February 2023	Leeton	Murray Valley encephalitis
19 February 2023	Leeton	Kunjin
21 February 2023	Hay	Murray Valley encephalitis
23 February 2023	West Wyalong	Murray Valley encephalitis
3 March 2023	Deniliquin	Murray Valley encephalitis
5 March 2023	Macquarie Marshes	Kunjin
7 March 2023	Griffith	Murray Valley encephalitis
12 March 2023	Deniliquin	Kunjin
12 March 2023	Menindee	Kunjin
13 March 2023	Leeton	Kunjin
13 March 2023	Moree	Murray Valley encephalitis
13 March 2023	Moree	Kunjin
20 March 2023	Hay	Murray Valley encephalitis
20 March 2023	Hay	Kunjin
26 March 2023	Leeton	Kunjin
2 April 2023	Hay	Kunjin
2 April 2023	Macquarie Marshes	Kunjin
3 April 2023	Griffith	Kunjin
4 April 2023	Forbes	Murray Valley encephalitis
5 April 2023	West Wyalong	Kunjin
17 April 2023	Forbes	Murray Valley encephalitis

*Chickens in Macquarie Marshes had previously seroconverted to Murray Valley encephalitis virus and continue to test positive for antibodies to this virus.

Vector Control

Control measures are only applied when ‘**public health risk is increased** from high mosquito numbers or virus circulating in the mosquito population’

Adult mosquito control (e.g., after flooding):

- interior residual spray (IRS) of case/contact addresses, their nearest neighbours and other high risk properties
- deployment of lethal ovitraps in large arrays
- barrier and/or harbourage spraying

Larval control (preferred over adulticides):

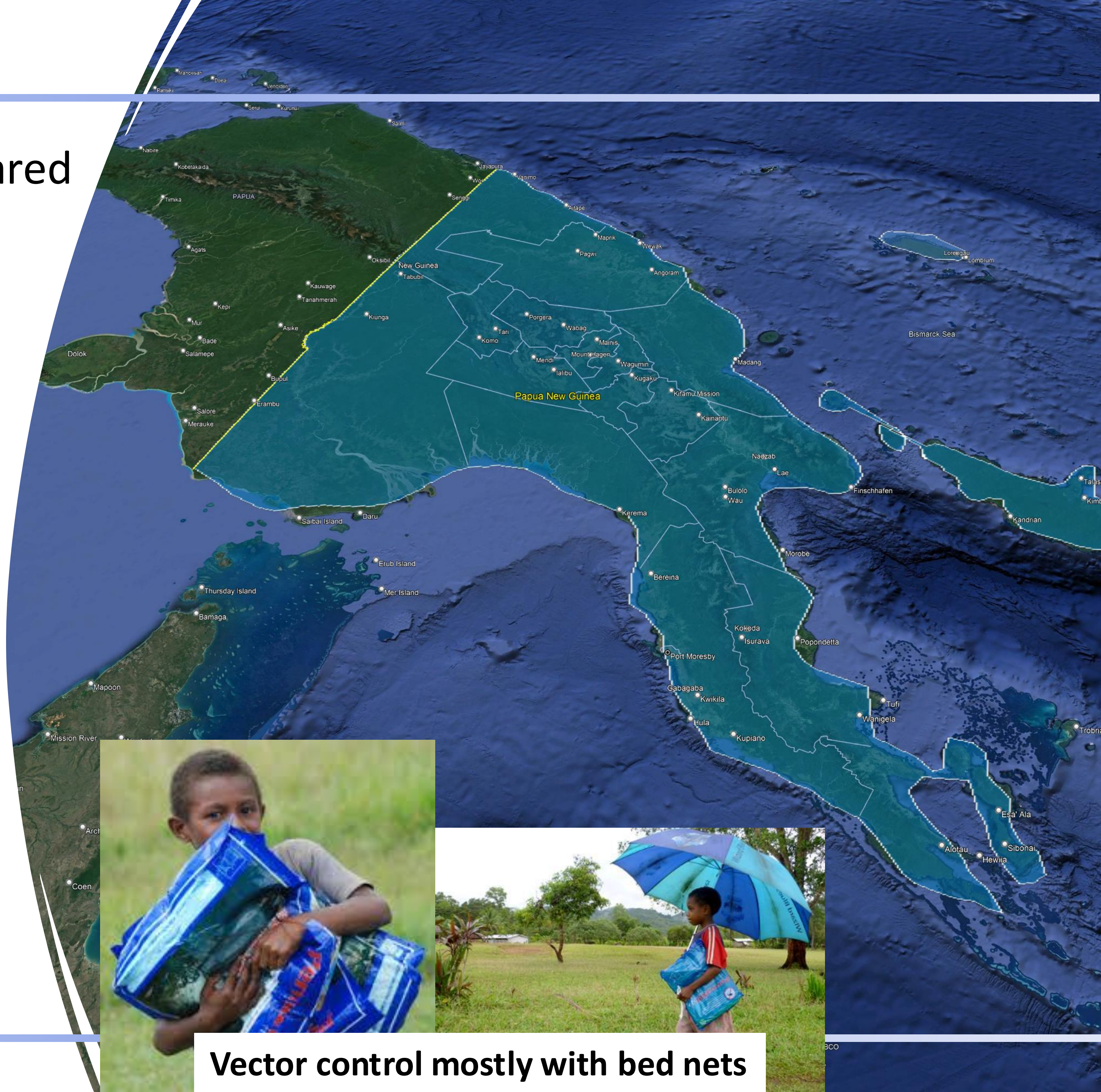
- application of residual chemicals to all appropriate containers capable of holding water
- source reduction – removal or mosquito-proofing of water-bearing containers, environmental management

Wolbachia:

- Wolbachia releases in Cairns have apparently eliminated Dengue with no local cases since 2019.

Papua New Guinea

- different disease distribution as compared to Australia (>1 million malaria cases; arbovirus and other zoonosis burden unknown)
- Resource-limited, developing country setting, no-government or provincial vector surveillance programs
- Global Fund supported insecticide-resistance monitoring for Anopheles (malaria, lymphatic filariasis)
- DFAT-supported Aedes insecticide resistance monitoring
- Other, mainly research-focused vector surveillance activities

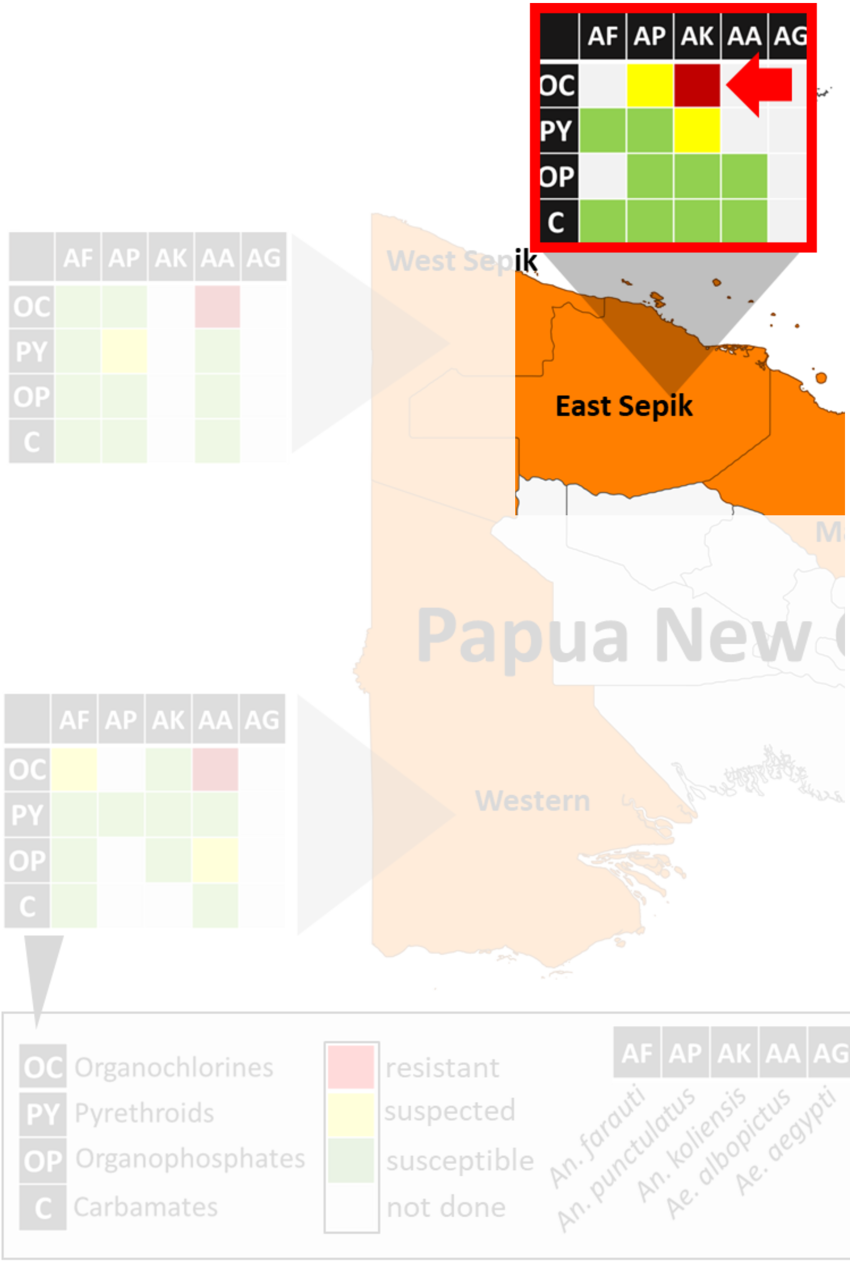


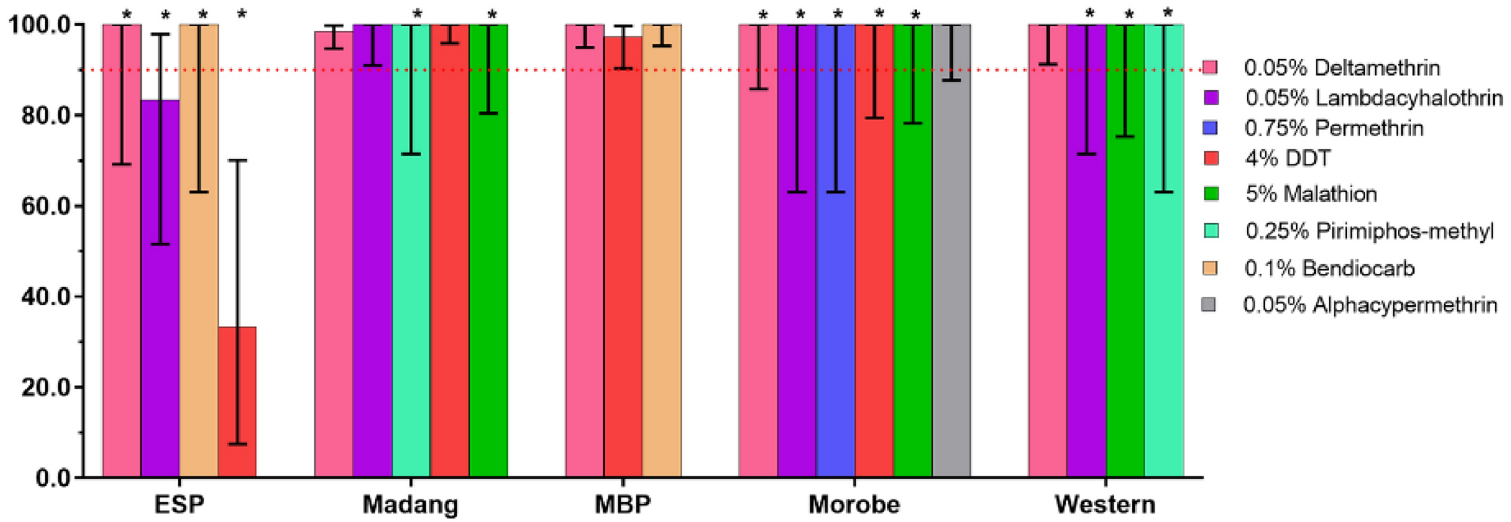
Vector control mostly with bed nets

Host Reservoirs and their contribution to disease spread – Role of pigs in PNG

- In Papua New Guinea, pigs are of cultural significance and smallholder farming exceeds commercial farming; close contact between humans and animals
- The extent of JEV and other zoonotic VBs to contribute to disease burden in PNG is unknown, as there is no national surveillance

Papua New Guinea – Insecticide Resistance Surveillance

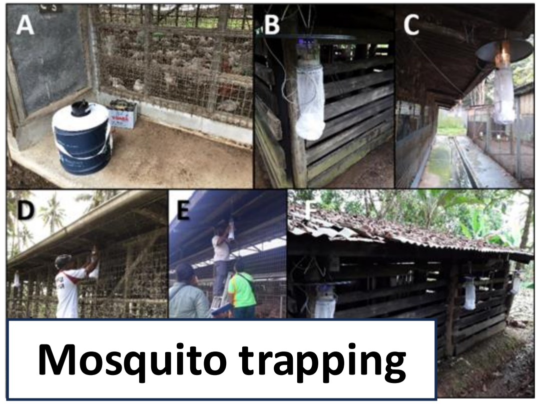


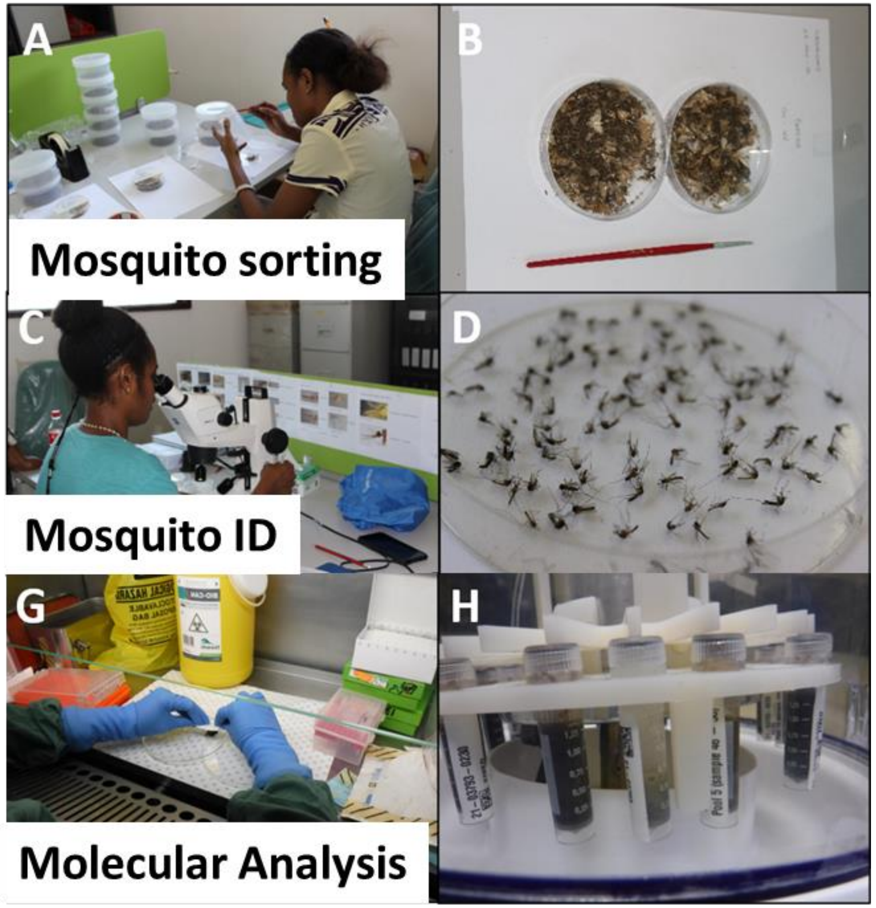


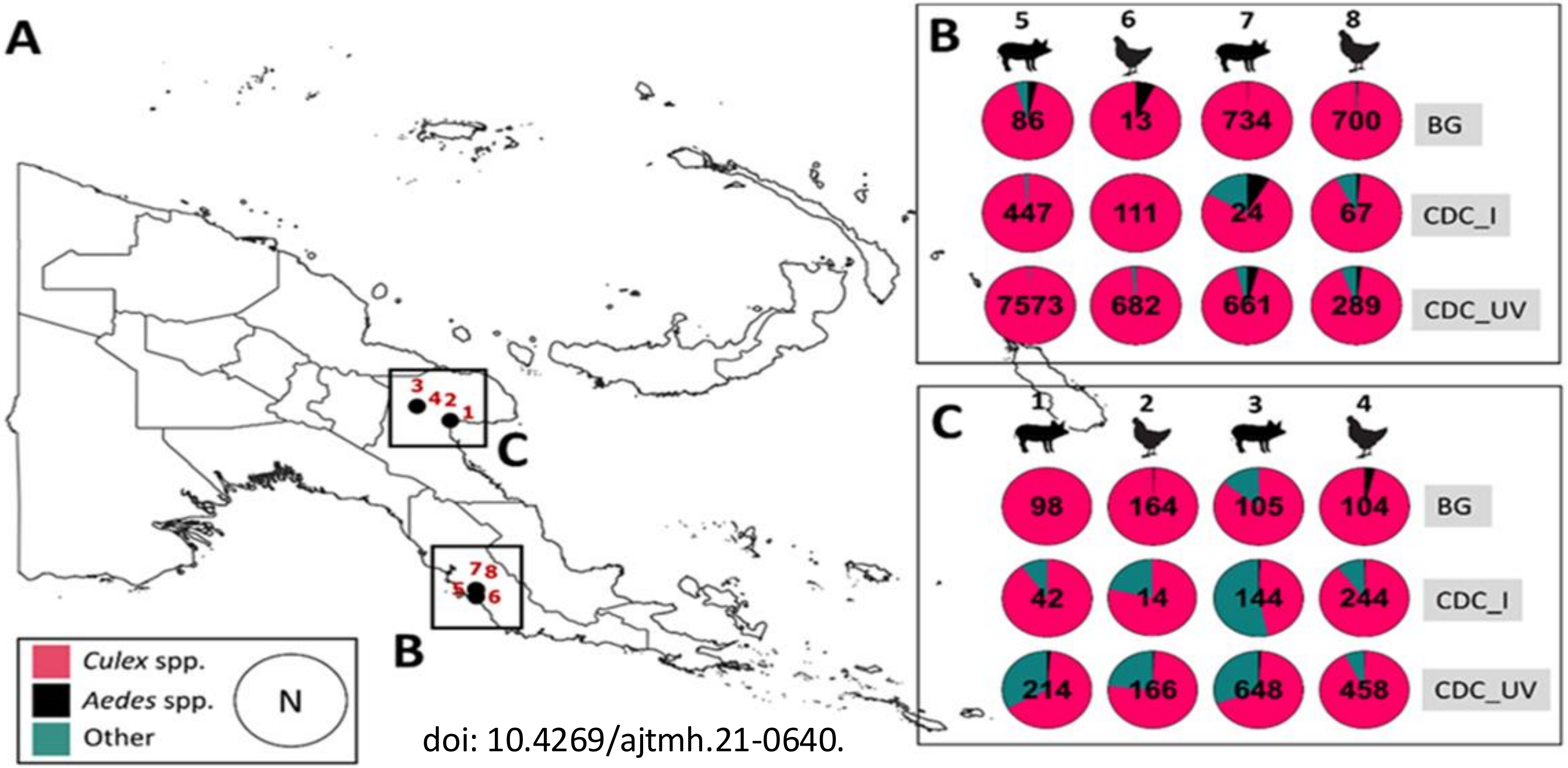
- We sequenced 26 AK from ESP that survived pyrethroid or DDT exposure in the kdr region
- 25/26 samples were kdr negative, i.e. 1014L.
- A single sample 7236-AK was kdr positive for L1014S.

Papua New Guinea – Zoonotic Arbovirus Detection by Xenomonitoring

- Total mosquitoes 29,920, using BG Sentinel, and CDC light traps
- Mosquito pools screened for JEV, MVE, KUN, RR, Kokobera (KOKV), Sepik and Sindbis viruses





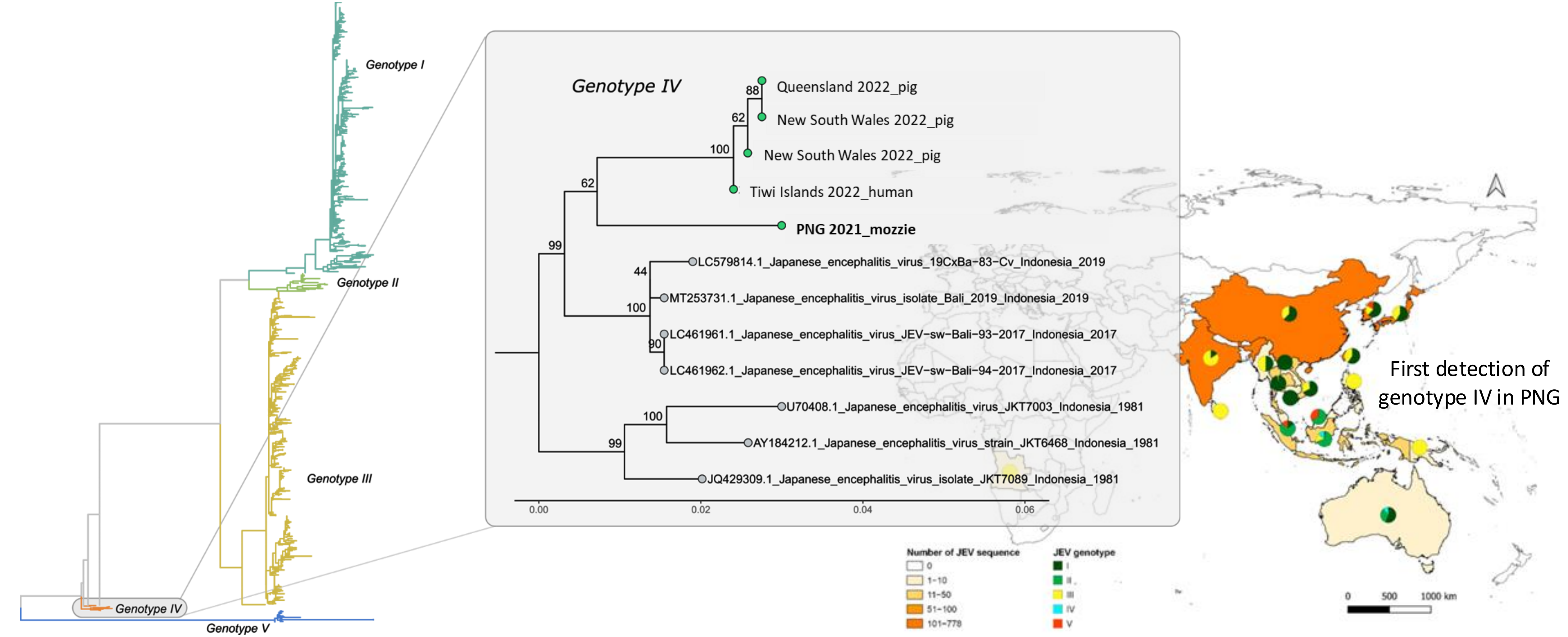


doi: 10.4269/ajtmh.21-0640.

Province	Mosquito species	Virus
Morobe	*Culex gelidus*	JEV (2)
NCD/Central	*Culex annulirostris*	KOKV (1)
NCD/Central	*Culex quinquefasciatus*	KOKV (1)
Western	*Culex pullus*	KOKV (1)
Madang	*Culex quinquefasciatus*	KOKV (2)
TOTAL	**18,951**	**JEV (2), KOKV (5)**

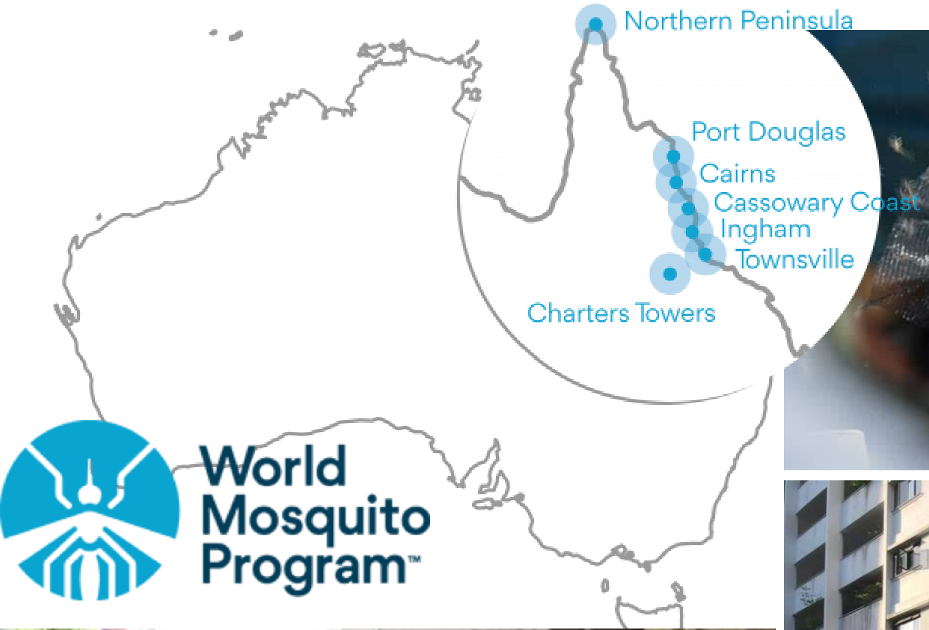
Papua New Guinea – Zoonotic Arbovirus Detection

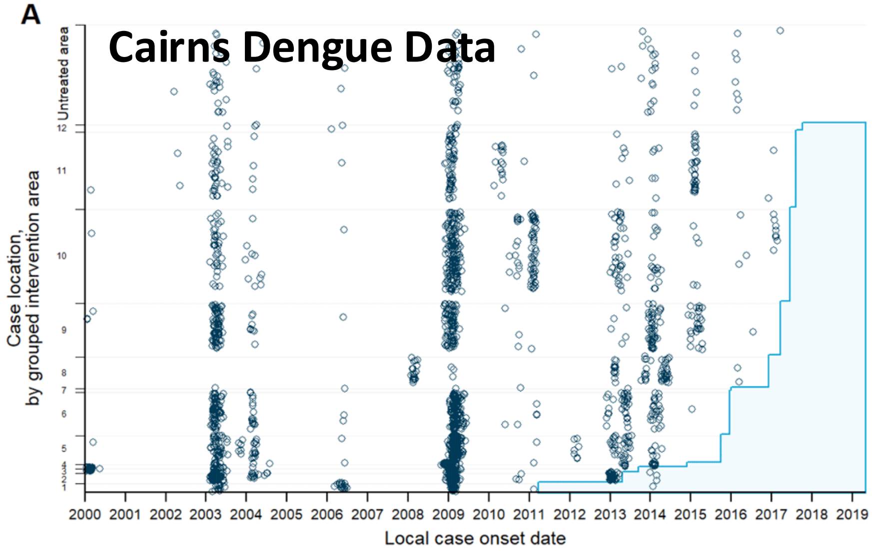
- JEV detected in PNG was closely related to that causing the JEV outbreak in Australia in 2022
- Highlights importance for multinational surveillance collaborations

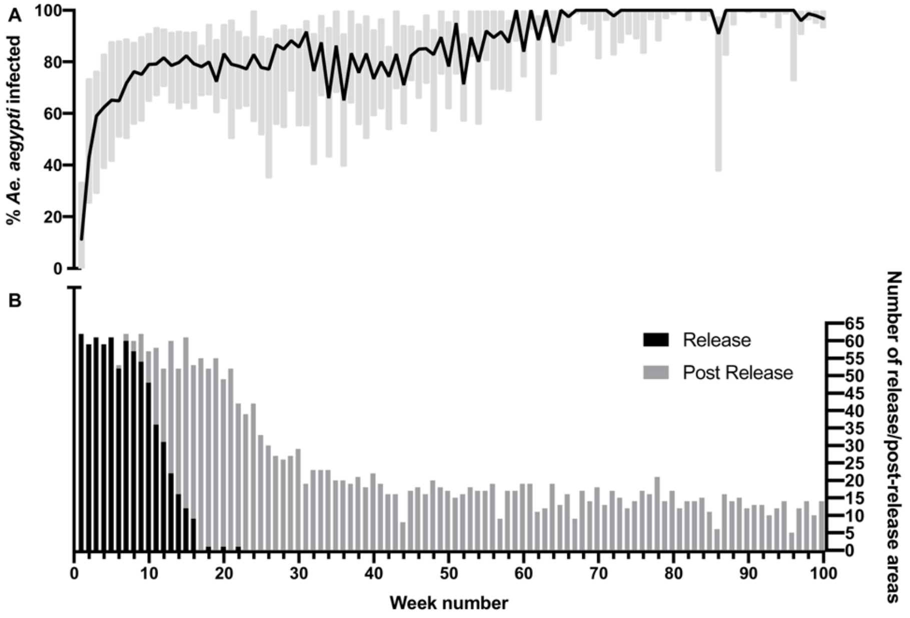


Future of Vector Control

Wolbachia-infected *Aedes aegypti* have established in Queensland, reducing Dengue cases by >95%



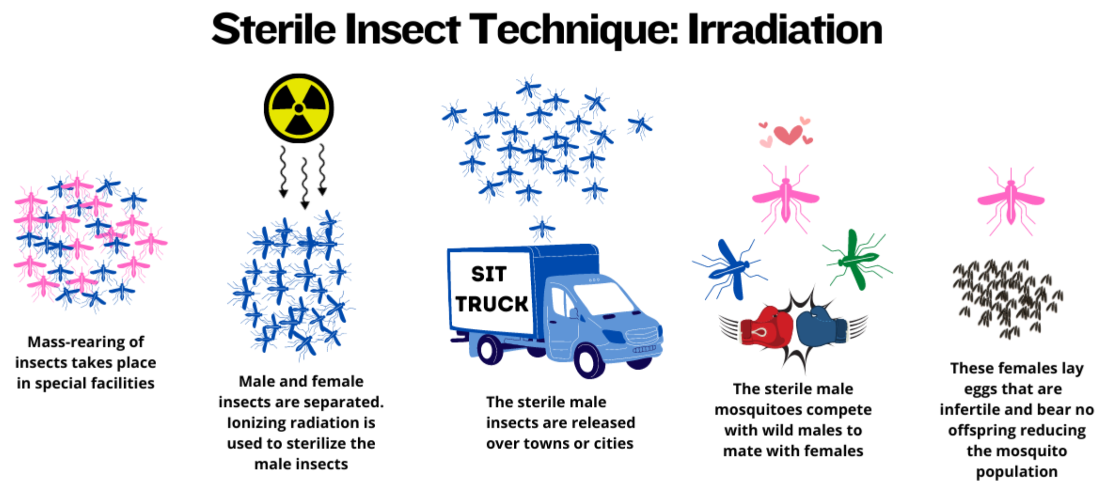


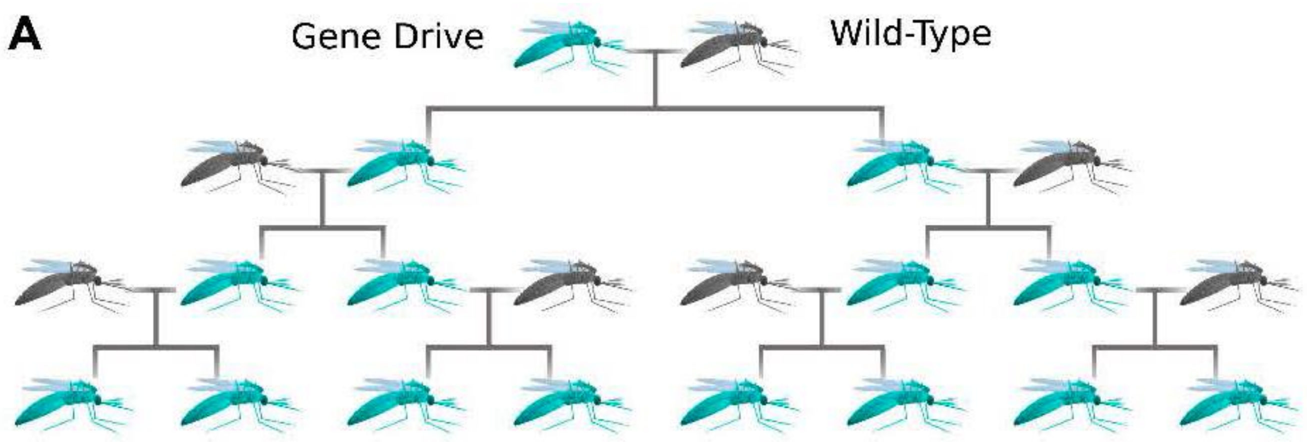


Future of Vector Control

Other ‘future’ vector control technologies include:

- Release of sterile males – will ‘crash’ the mosquito population
- Release of genetically modified males – offspring females antibiotic ‘dependent’, only males survive (Oxitech)
- Gene drive – variety of approaches that spread unfavourable genetic traits through mosquito populations (like sterilizing females or distorting sex ratio)

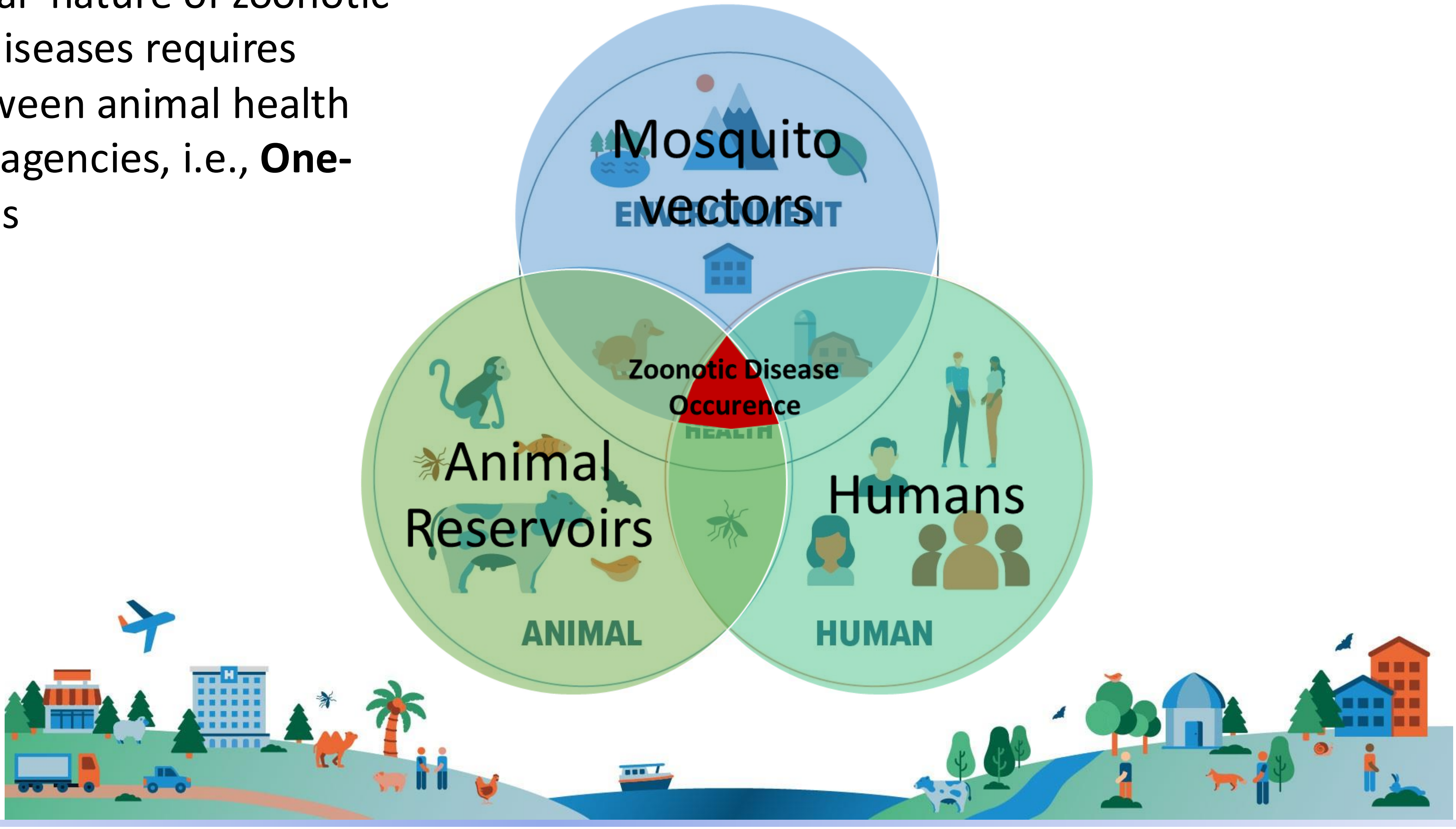




These methods are sill under development and target mostly Aedes vectors. However, they could become available for other vectors (Anopheles, Culex) as well. There are regulatory and ethical considerations for some of these approaches.

Until then….

The ‘multi-sectorial’ nature of zoonotic mosquito-borne diseases requires collaboration between animal health and public health agencies, i.e., **One-Health** approaches



Acknowledgements

Australian Centre for International Agricultural Research

PNG-IMR

Save Tambuim Sik

AITHM

James Cook University Australia

Burnet Institute

Medical Research. Practical Action.

NAQIA

National Agriculture Quarantine and Inspection Authority

Papua New Guinea

Biosecurity

Divine Word University

Sic currite ut comprehendatis

CSIRO

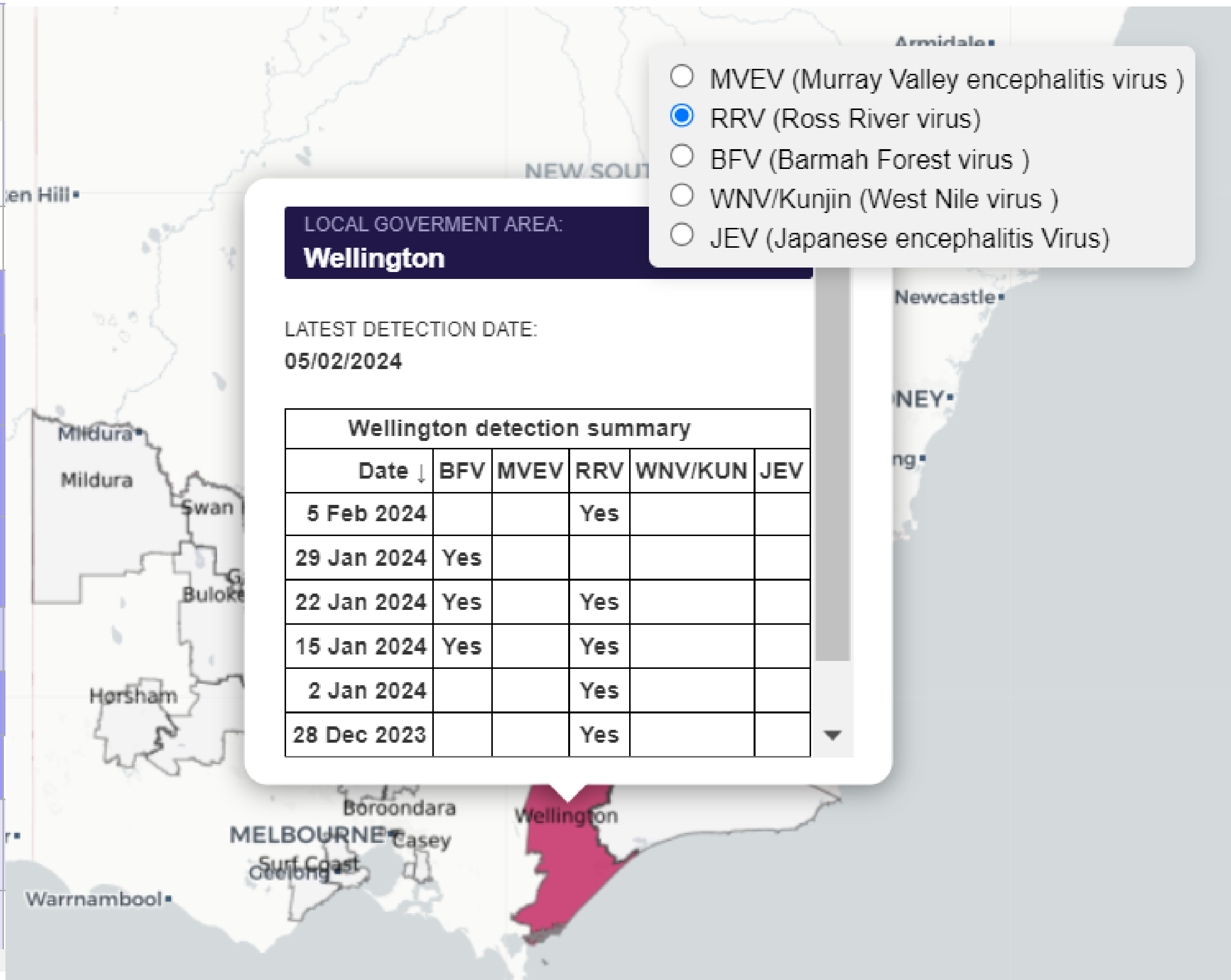
Victoria

- Victorian Arbovirus Disease Control Program is funded by VIC Dept of Health and Human Services
- run by Agriculture Victoria
- approx 25 councils in high-risk areas for mosquito-borne diseases participate (Seasonal: Nov-Mar)
- Dry-ice baited Encephalitis Vector Surveillance (EVS) traps
- Trapped mosquitoes are submitted to the Agriculture Victoria Research laboratory for species identification, counting and viral testing (PCR/ whole trap grinds).

Victoria

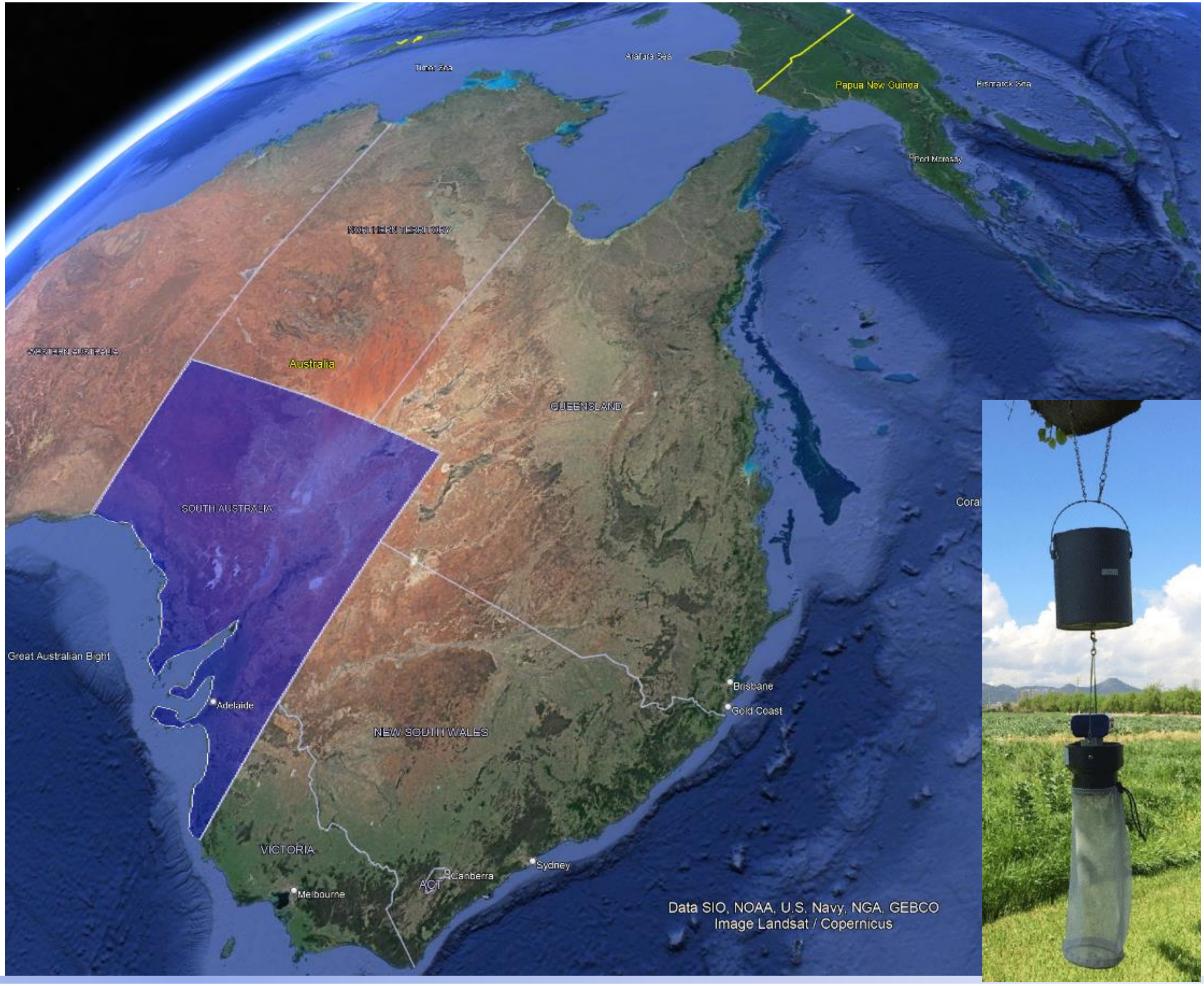
- Weekly results are updated on: https://www.health.vic.gov.au/infectious-diseases/mosquito-surveillance-report

LGA	2024 W16 Apr	2024 W15 Apr	2024 W14 Apr	2024 W13 Mar	2024 W12 Mar	2024 W11 Mar	2024 W10 Mar	2024 W09 Feb	2024 W08 Feb	2024 W07 Feb
East Gippsland	3	2	2	6	5	2	4	7	7	0
Frankston										
Gannawarra	1	4	6		65	3	59	81	10	236
Greater Bendigo	21	5	6	21	28	40	35	62	109	118
Greater Geelong	8	4	2	14	49	28	35	86	200	305
Greater Shepparton	26	32	26	98	175	79	119	363	503	785
Horsham	2	1	1	5	6	13	12	52	48	87
Indigo	4	10	9	44	142	107	110	102	465	279
Loddon		4	2	8	72	92	68	342	820	298
Macedon Ranges	4	0	3	10	6		10	30	29	8
Maribyrnong		14								25



South Australia

- South Australian Arbovirus and Mosquito Monitoring and Control Program (‘Fight the Bite’), run by South Australia Health
- Approx 20 councils participate (Sep-Apr, Monthly along the River Murray, fortnightly in northern Adelaide metro)
- Mosquitoes are processed by the Agriculture Victoria Research laboratory (Species ID, abundance, testing for MVEV, KUNV, RRV, BFV
- Data is reported to SA Health for monitoring and analysis.



South Australia

- Data published as monthly reports and annual reports (detailed) on the South Australia Health website

Recent arbovirus risk indicators

Murray Valley encephalitis virus (MVEV)

MVEV was detected in mosquitoes trapped along the River Murray during January 2023 in the Renmark Paringa, Loxton Waikerie, Berri Barmera, Mid Murray and Murray Bridge council areas.

There was one confirmed human case of MVEV reported in South Australia in May 2023. MVEV was also detected in sentinel chickens in Mannum and Paringa in January 2023, and Clare, Qualco, Swan Reach and Meningie in February 2023.

West Nile virus Kunjin variant (WNV/KUN)

WNV/KUN was detected in trapped mosquitoes in the Loxton Waikerie council and Berri Barmera council areas in February 2023. WNV/KUN was also detected in sentinel chickens at Clare in February 2023, Paringa in April 2023 and Swan Reach in January 2024.

Japanese encephalitis virus (JEV) infection

JEV infection - There was one confirmed human case of JEV infection reported during the 2022/23 season (reported Decembe 2022) who resides in the Riverland region.

Other mosquito-borne viruses

Other viruses being closely monitored are Ross River virus (RRV) and Barmah Forest virus (BFV). Very high detects of RRV and BFV in trapped mosquitoes were reported in South Australia during the 2022/23 season.

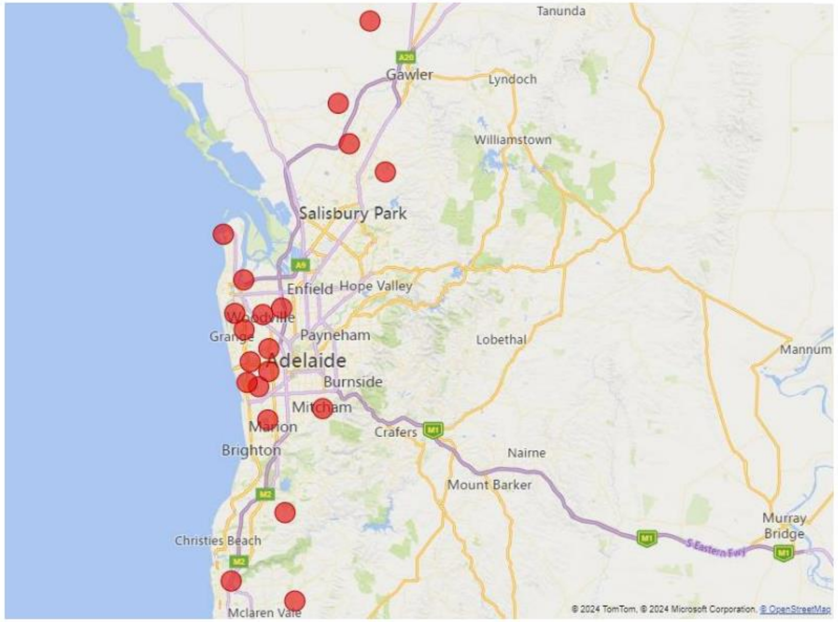
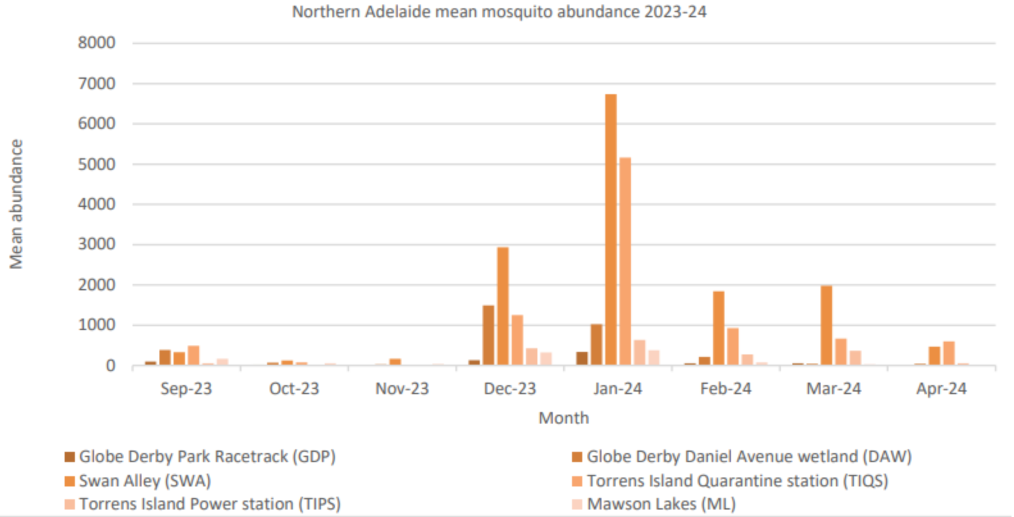


Figure 5 Metropolitan surveillance program trap locations 2023-24.



Member experience on prevention and control for Vector Borne Disease

[Australia]

Michele Byers BVSc.

Department of Agriculture, Fisheries and Forestry.

19 – 20 September 2024

Tokyo, Japan

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Vector Borne Disease situations

- An emergent Vector-borne diseases of concern to Australia
  - Japanese encephalitis (Genotype IV)
    - As of 2022 - suspect endemic in northern Australia – low prevalence in northern Australia
    - Uncertainty about southern Australia but we suspect it could have intermittent transmission when environmental conditions are suitable
    - Impact to southern pig herds in 2022:
      - 3-6% annual output lost on farms (~$350-400,000 per 1000 sows)
      - Major producers impacted, collectively housing a significant proportion of the domestic herd
      - Reduction in national fresh pork supply Aug-Nov 2022
    - Impact to human health (from 1st of January 2021)
      - 45 infected cases – 7/45 fatal.
      - Targeted vaccination strategy
    - No known impact to wildlife health if any

1995 - genotype II
3 human cases, 2 fatal – Torres Strait Islands
Evidence of infection in mosquitoes & pigs

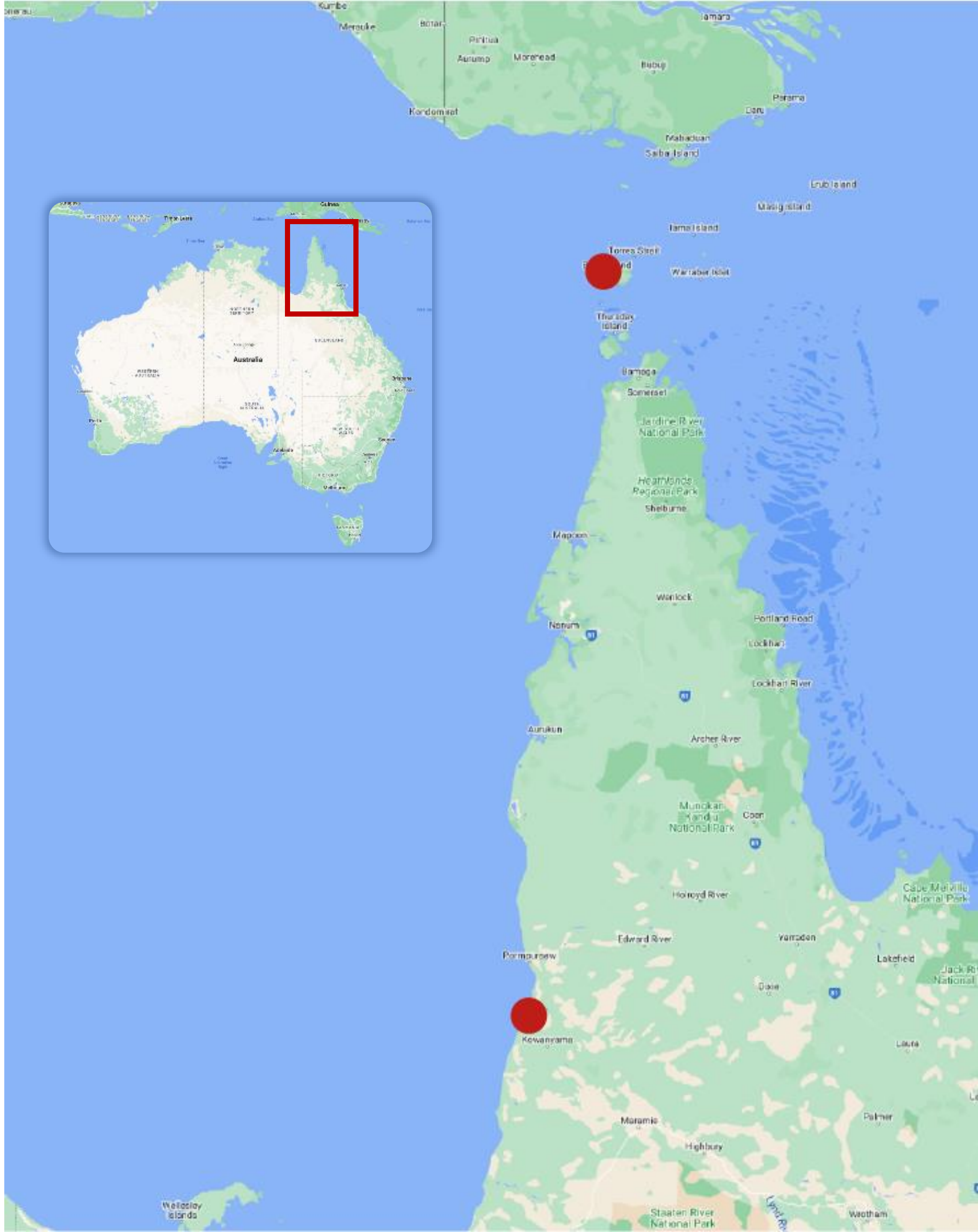
- JE surveillance commenced in multiple animal species in Torres Strait and northern Cape York Peninsula
  - Domestic animal surveys – Torres Strait
  - Feral animal surveys – Torres Strait, Cape York Peninsula
  - Sentinel pigs – Normanton, Old Mapoon, Bamaga airport (NPA) and Badu Island.
  - Wild birds and flying foxes

A DAFF officer taking a blood sample from a domestic pig via the jugular vein

1995 - genotype II
3 human cases, 2 fatal – Torres Strait Islands
Evidence of infection in mosquitoes & pigs

1998 - genotype II
1 human case – Torres Strait Islands
1 human case – Cape York

- Early 2000s – commenced mosquito trapping with QH (TPHU) and later JCU (experimental -> operational)
- Sentinel pigs gradually phased out; ceased completely by 2011 (Public health risk to community)



1995 - genotype II
3 human cases, 2 fatal – Torres Strait Islands
Evidence of infection in mosquitoes & pigs

1998 - genotype II
1 human case – Torres Strait Islands
1 human case – Cape York

Surveillance shows that virus regularly appears in Torres Strait and Cape York Peninsula

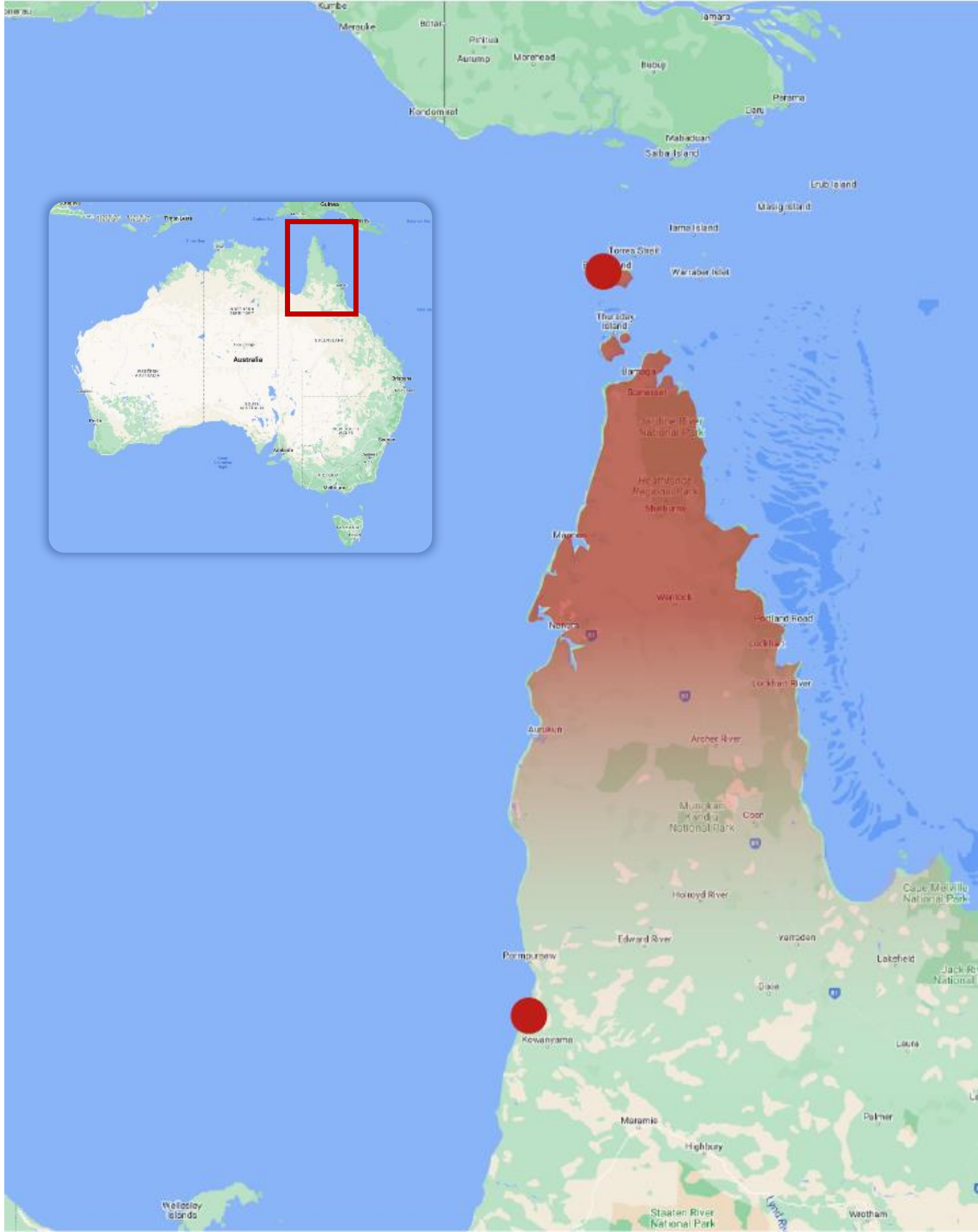
Likely route

Papua New Guinea → Torres Straits → Cape York

Sentinel pigs ceased in 2011

JE serological surveillance (2012-2021)

- Domestic animal surveys
- Feral animal surveys
- Sentinel cattle (2012-20)
- Mosquito trapping (2014 onwards)



1995 - genotype II
3 human cases, 2 fatal – Torres Strait Islands
Evidence of infection in mosquitoes & pigs

1998 - genotype II
1 human case – Torres Strait Islands
1 human case – Cape York

Surveillance shows that virus regularly appears in Torres Straits and Cape York Peninsula

Likely route

Papua New Guinea → Torres Straits → Cape York

March 2021 – genotype IV
1 fatal human case – Tiwi Islands

Unexplained pig deaths

Early January 2022 – Animals with clinical signs appeared in NSW & Queensland

25 February – JEV confirmed (Genotype IV)

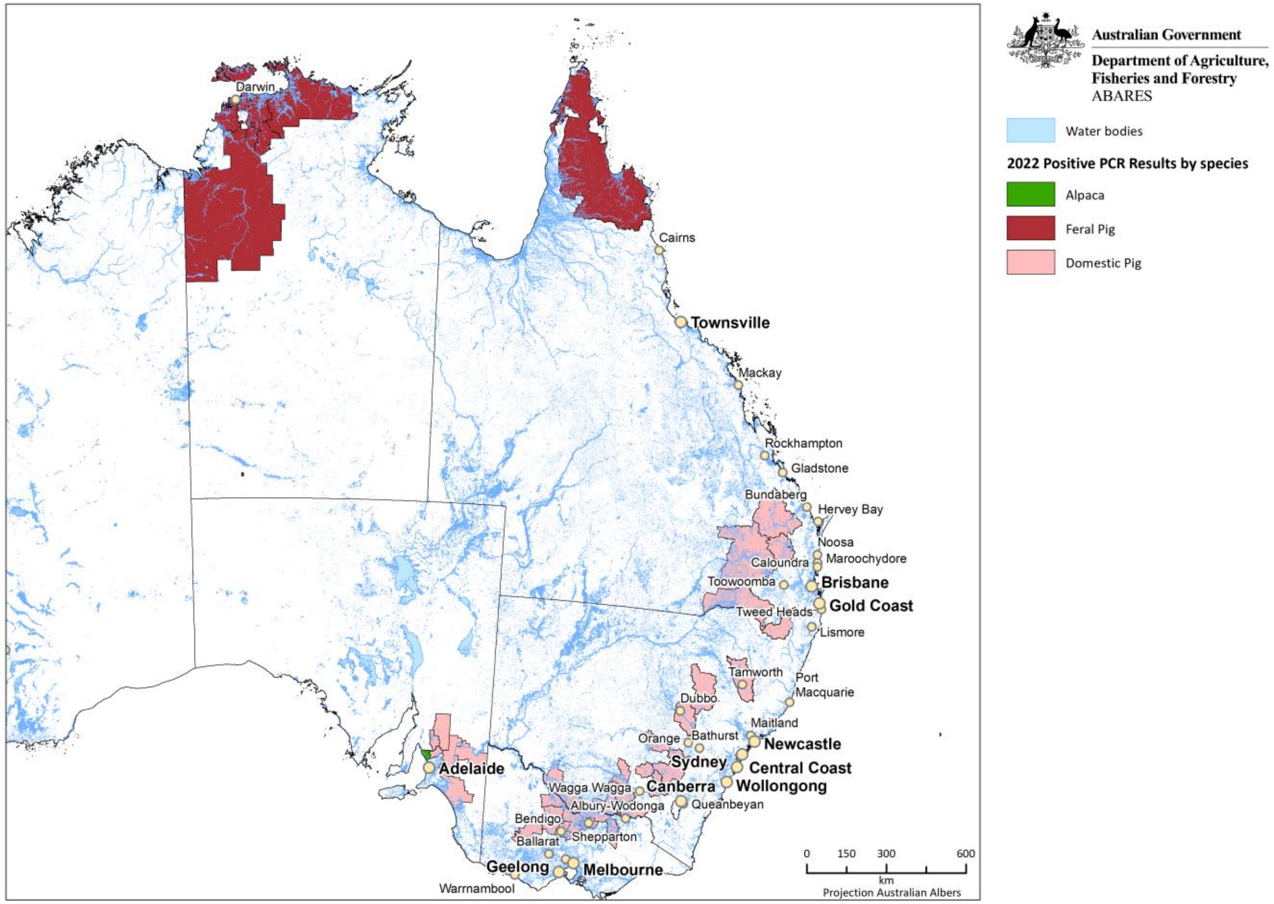
Early March – cases in South Australia

Credit: Bernie Gleeson, SunPork Group

Human cases

First case was reported on 3 March 2022 in Queensland.

Symptoms started at the end of December 2021, but not attributed to JEV at the time



Animals

84 infected piggeries

Positives in feral pigs in the NT, QLD and northern WA

26 horses with probable JE
None have been definitively confirmed
Cases in NSW and Victoria

1 positive alpaca

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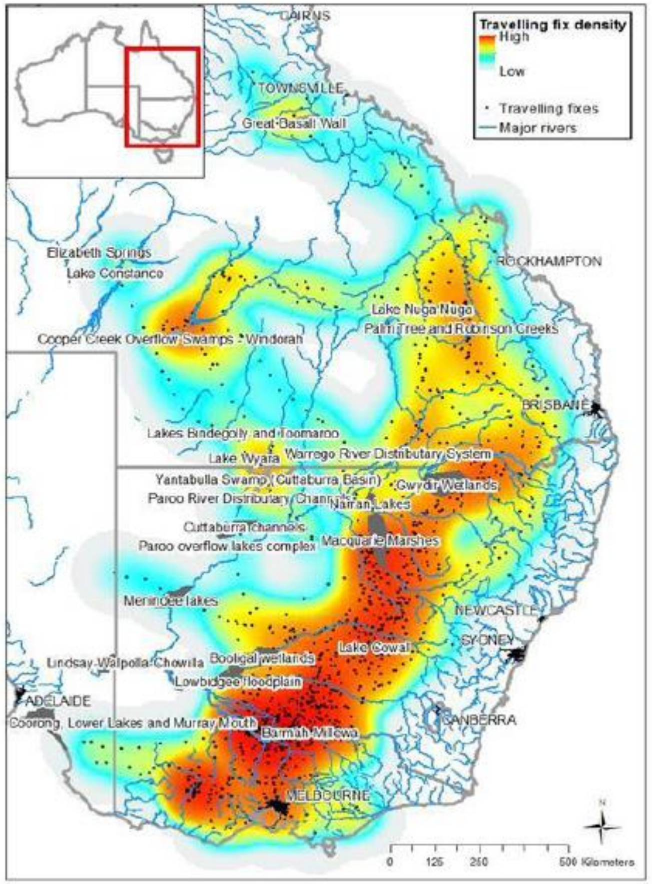
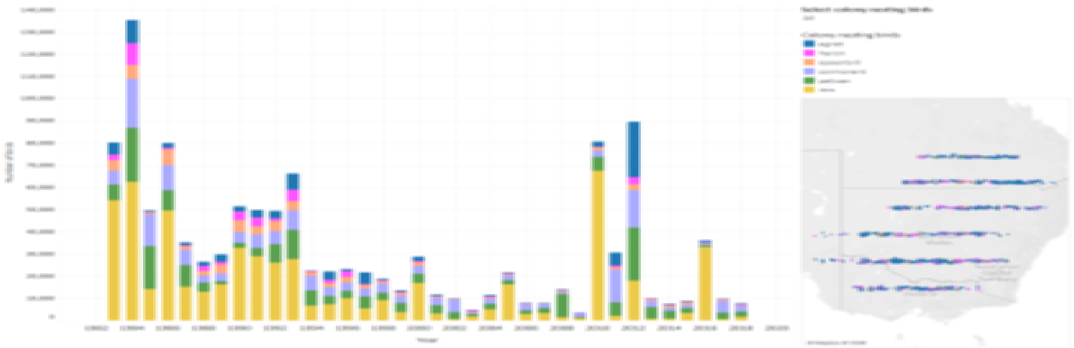
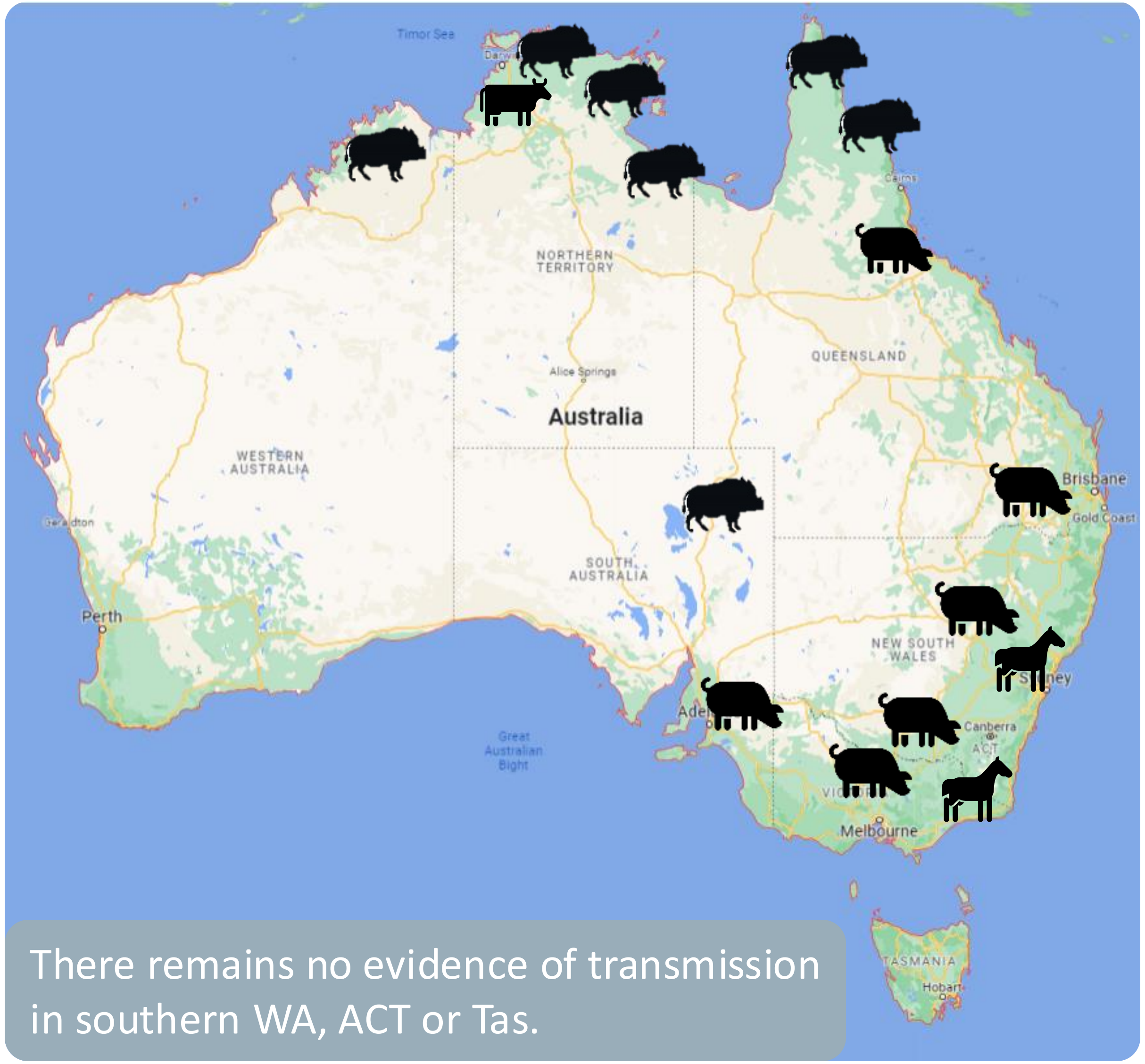
One health aspects

Human cases - 2022	Confirmed	Probable	Deaths
New South Wales	14	0	2
Northern Territory	2	0	1
Queensland	2	3	1
South Australia	6	4	2
Victoria	11	3	1
Total	35	10	7





Summary of JE exposure in animals 2020 - 2022



There remains no evidence of transmission in southern WA, ACT or Tas.

Evidence of JEV in northern Australia
Nov 2020 to Dec 2022

- Feral pigs (PCR, serology)
- Domestic pigs (PCR)
- Cattle (serology)

JEV Exposure **~Sept 2021 to Jun 2022**

- Domestic pigs (PCR)

JEV exposure **~Sept 2021 to Apr 2022**

- Domestic pigs (PCR)
- Alpaca (PCR, serology)
- Horses (serology)

Estimated exposure periods in the south-east aligns with months when mosquitos are expected to have been active.

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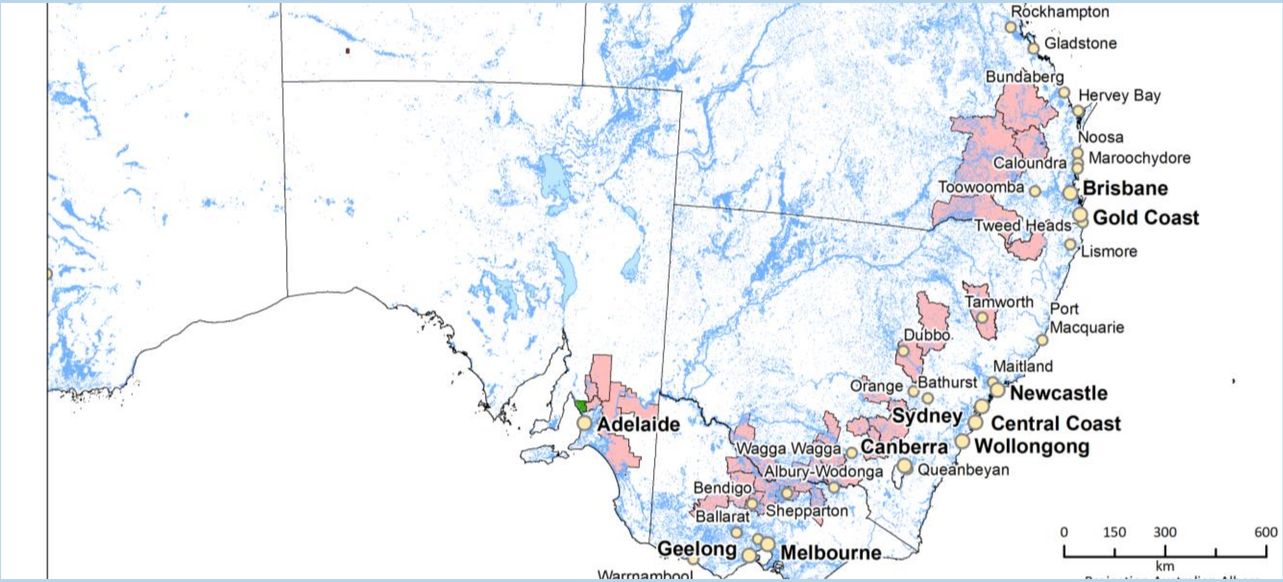
The Murray Darling Basin (MDB)



Recent climatic events impacting the MDB

2017 to February 2020: widespread drought; MDB <6% capacity

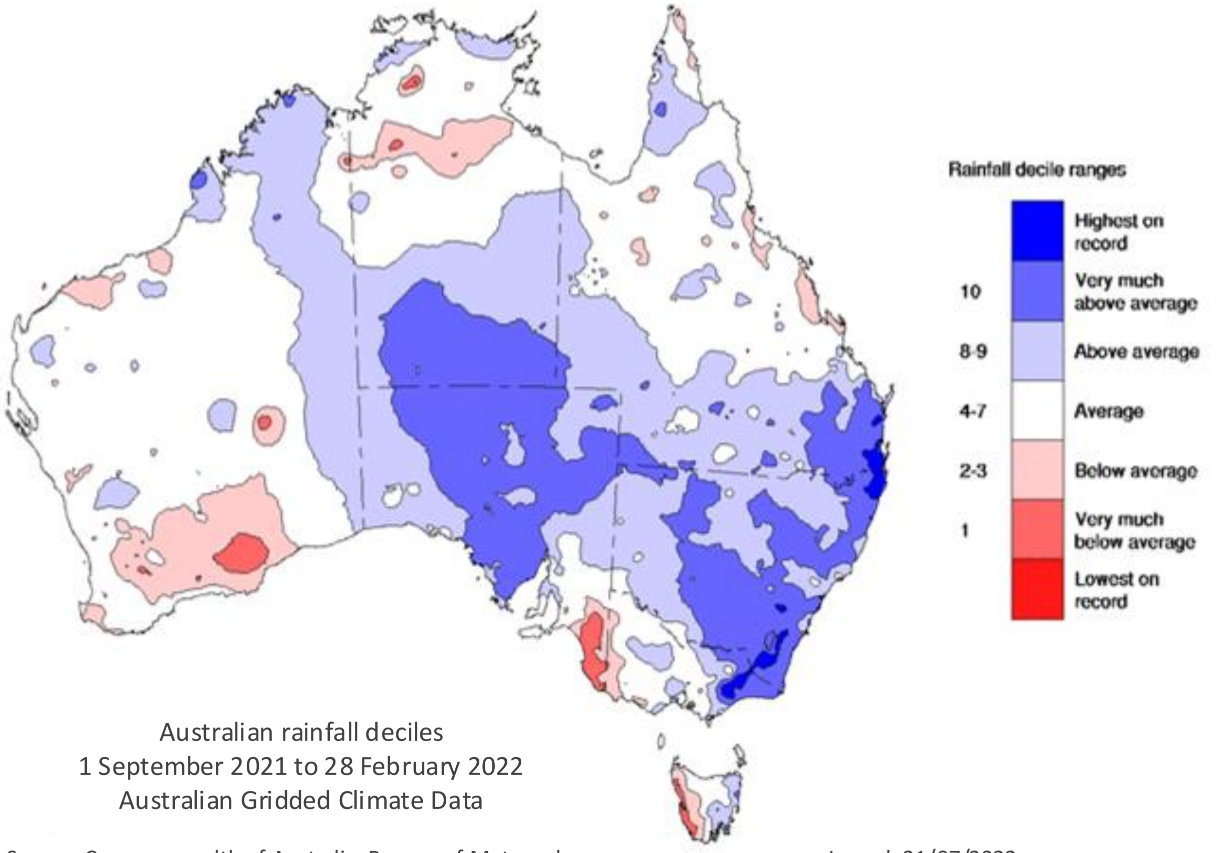
March 2020: drought breaks; flooding over much of eastern Australia

2020-21 summer: above average rainfall

March 2021: flooding in eastern and central Australia

November 2021: Australia's wettest on record; MDB at 90.9% capacity

2021-2022 summer: above average rainfall along the east coast Queensland to Victoria, much of inland NSW, the Eyre Peninsula, South Australia, and central Australia.



Australian rainfall deciles
1 September 2021 to 28 February 2022
Australian Gridded Climate Data

Source: Commonwealth of Australia, Bureau of Meteorology

Issued: 21/07/2022

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NAQS JEV diagnostics – 2022

- JEV samples (Pigs)
  - Serum
    - JEV competitive Ab ELISA (ACDP)
    - MVEV blocking Ab ELISA (ACDP)
    - KUNV blocking Ab ELISA (ACDP)
    - Follow up with Plaque Reduction Neutralisation tests
  - Tonsils
    - JEV PCR (State laboratories)
  - Foetuses
    - Abnormal – mummified or aborted
      - Histopathology + PCR (state labs)

	Molecular testing	Serology: virus-specific ELISA screen (single sampling event)			Serology: PRNT (single sampling event)		
Pig flavivirus category	**PCR**	**JEV**	**MVEV**	**KUNV**	**JEV**	**MVEV**	**KUNV**
Confirmed JEV – PCR evidence	+						
Probable JEV exposure – serological evidence (*)	- OR not tested	+	-	-			
Confirmed JEV exposure – serological evidence	- OR not tested	At least one positive			+ AND titre >fourfold higher than others	+/-	+/-
Probable MVEV exposure – serological evidence (*)	- OR not tested	-	+	-			
Confirmed MVEV exposure – serological evidence	- OR not tested	At least one positive			+/-	+ AND titre >fourfold higher than others	+/-
Probable KUNV exposure – serological evidence (*)	- OR not tested	-	-	+			
Confirmed KUNV exposure – serological evidence	- OR not tested	At least one positive			+/-	+/-	+ AND titre >fourfold higher than others
Inconclusive Flavivirus Exposure	- OR not tested	Two or more positive					
	- OR not tested	Two or more positive			One or more positive but not fourfold difference		
Negative	- OR not tested	All three negative					
	- OR not tested	One or more positive			All three negative		

Response to Vector Borne Diseases

- Surveillance for JEV
  - Mosquito surveillance (Health)
    - Established mosquito or flavivirus surveillance systems in each state
  - Animal Health surveillance
    - General Surveillance system
      - Reliant of clinical animals investigated and reported by veterinary practitioners
    - Targeted Surveillance
      - Some states maintain sentinel chicken surveillance program (Health)
      - Feral animal surveillance
- Responses and control
  - Vector control
  - Vector prevention
  - Vaccination
    - Humans - 2 available vaccines in Australia:
      - Single dose, live attenuated virus vaccine
      - Double dose, inactivated vaccine (29 day interval)
    - Animals – no licensed vaccines available, but research and development work is underway.
- Contingency plans available
  - AusvetPlan Manuals

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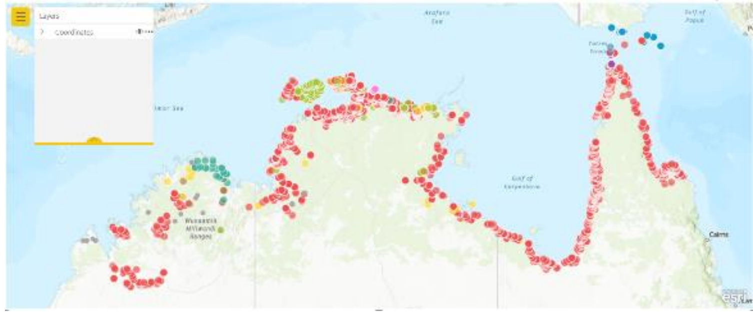
Surveillance strategy - NAQS Feral Animal Surveys



A summary of feral and domestic animals sampled by NAQS (2012-2022 – each colour = different species)

- Targeted surveys for exotic diseases in feral animals
  - Target list of diseases of risk to northern Australia
    - => by unregulated pathways
  - Aerial survey, humane destruction of feral animals
    - Target "back of the pack"
    - Lame, unwell animals
    - Subset of "healthy"
  - External and post-mortem examination – data collected
  - Samples collected
  - Further investigation if unusual PM findings

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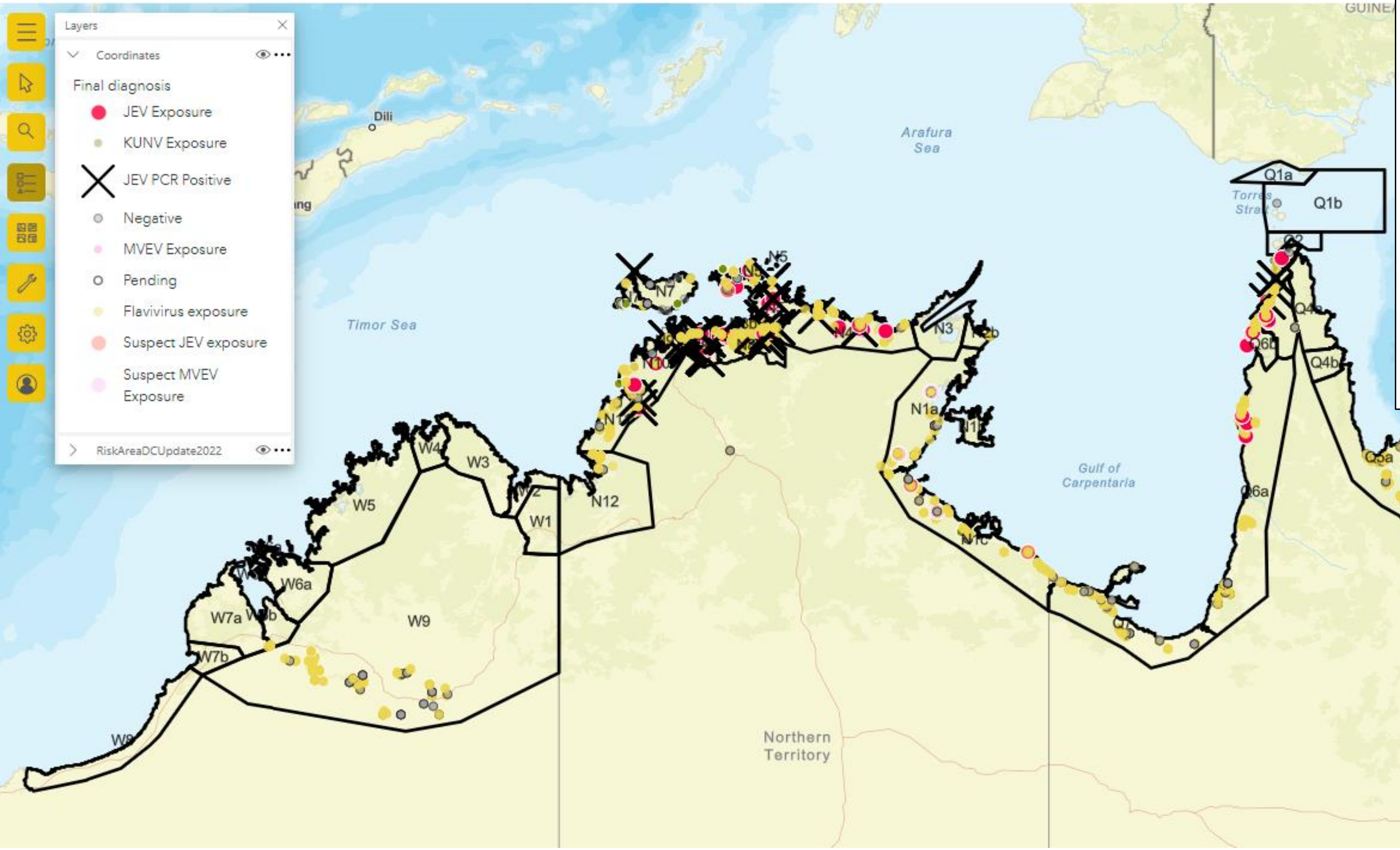

2022:

15 Feral Animal Surveys
5 General Surveillance activities

Total of 1293 animals tested
1260 pigs
31 feral bovids
2 horses

<u>Results</u>
52 JEV PCR Positives
9 JEV serological exposures
22 KUNV serological exposures
2 MVEV serological exposures
900+ Flavivirus exposures

Majority of PCR positives – "healthy"

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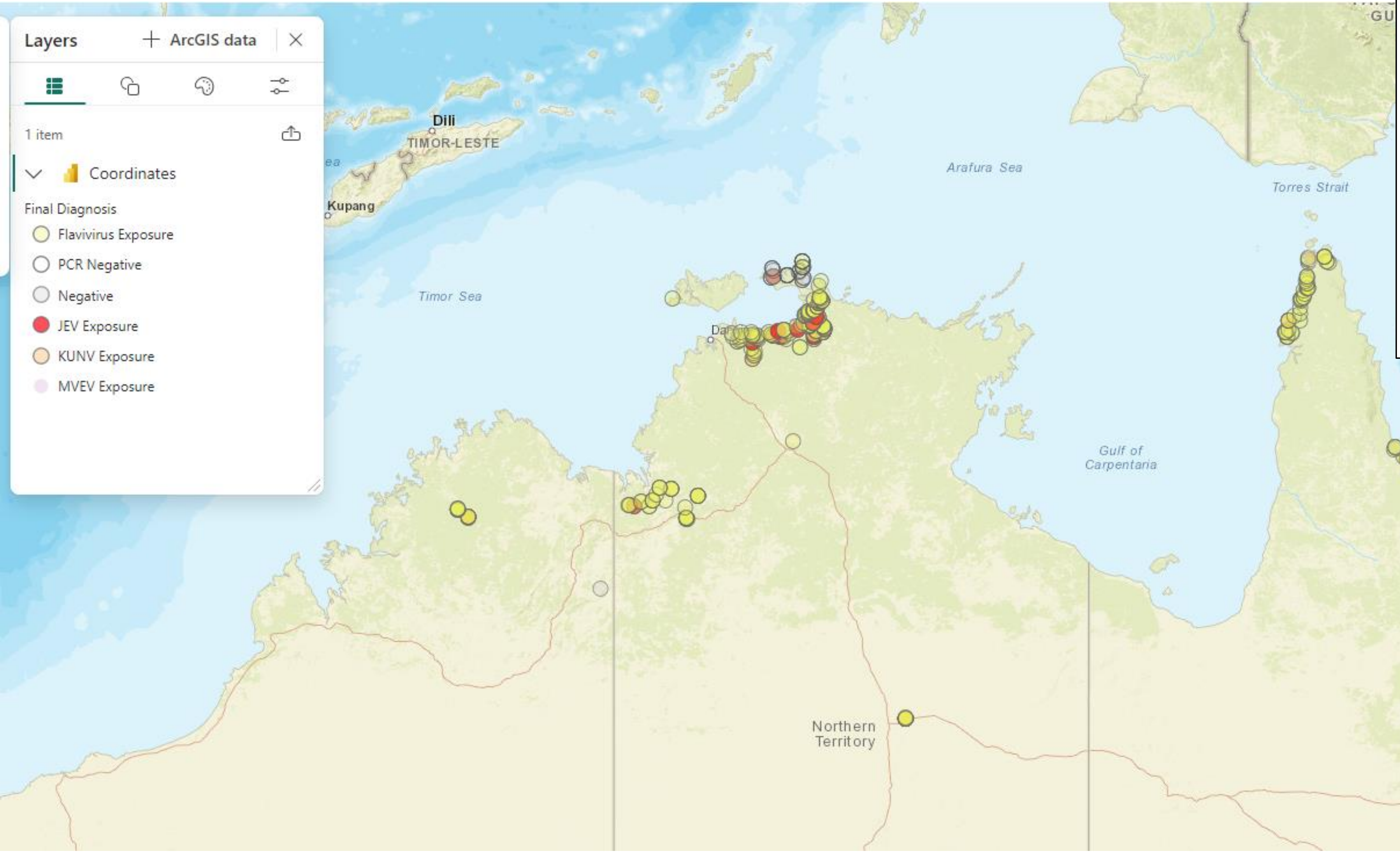

2023:

10 Feral Animal Surveys
3 General Surveillance activities

Total of 495 animals tested
495 pigs

<u>Results</u>
0 JEV PCR Positives
12 JEV serological exposures
6 KUNV serological exposures
4 MVEV serological exposures
400+ Flavivirus exposures

Majority of PCR positives – “healthy”

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Regional workshop on Vector Borne Disease for Asia and the Pacific 2024

2024:

5 Feral Animal Surveys (so far)
3 General Surveillance activities

Total of 275 animals tested
275 pigs

Results
1 JEV PCR Positives
Serology still pending

Majority of PCR positives – "healthy"

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Impact of the actions

- Minimising spillover events into domestic piggeries
  - Aggressive mosquito control interventions in areas around piggeries
- Surveillance challenges
  - Over-reliance on a single system (such as vector-based surveillance) to serve as an early warning tool
  - Solution – establishing data sharing across sectors and jurisdictions is required for multimodal surveillance – targeted and general surveillance.
- Vaccination of at-risk populations
  - Vaccination was made available for at-risk populations based on detections of positive animals.
- No subsequent cases
  - Due to blunted host transmission due to prior exposure
  - Competition with other flaviviruses
  - Host species distribution constantly shifting with water movement

Challenge and possible solutions

- Diagnostic challenges
  - Past surveillance was heavily reliant on serology as primary form.
    - Cross reactions with other viruses in JEV-serocomplex, many that are endemic to Australia, do complicate this approach.
  - PCR on aborted material (from sows) is a useful tool, however potential 3-month lag for timely detection.
  - Solution - PCR on feral pig tonsils was found to be an effective tool for at scale surveillance in feral pigs and has been utilized by NAQS since 2022.
  - Solution - Experimental work underway for the use of chew ropes is being explored as a monitoring tool for pigs within production systems.
- Surveillance challenges
  - Over-reliance on a single system (such as vector-based surveillance) to serve as an early warning tool
  - Solution – establishing data sharing across sectors and jurisdictions is required for multimodal surveillance – targeted and general surveillance.

Collaboration with other sectors under One Health approach

- Animal Health
  - Emergency Animal Disease Response Agreement
    - EAD response and governance in Australia involving the Commonwealth and state/territory governments and animal production industry bodies
  - AUSVETPLAN manuals
    - Roles and responsibilities as well as national disease control policies.
  - Wildlife Health Australia
    - National Program that focuses on wildlife health (inclusive of feral animals)
  - The Australian Government - Department of Agriculture, Fisheries and Forestry
    - DAFF is responsible for managing the impacts of an EAD outbreak on international trade in live animals and/or animal products.
    - In the event of a large, multijurisdictional outbreak, DAFF provides national response coordination including coordinating requests for resource deployment from within Australia or under the International Animal Health Emergency Reserve arrangements.
  - State and Territories
    - Primary responsibility to manage EAD events within their jurisdictions, using their respective biosecurity legislation to impose disease control measures

- Human Health
  - National Health Security Agreement
    - Framework to support a coordinated national response to public health emergencies.
  - The Australia Government – Department of Health and Aged Care
    - DHAC provides national leadership and coordination
  - States and Territories
    - Primary responsibility for responding to a communicable disease notification within their jurisdiction
  - Australian Health Protection Principal Committee (AHPPC)
    - National leadership through cross jurisdictional collaboration in managing health protection incidents and coordinating the national health response to incidents.

Detection bias: JEV is more readily detected in large populations of breeding sows and feral pigs. This gives the appearance that the virus is associated with pigs.

Harness science: Existing relationships with wildlife organisations and their disease experts and ecologists, was invaluable in accessing knowledge and data. Wildlife Health Australia (WHA) provided this insight, particularly around water birds.

Pre-2022, JEV's designation as a vector-borne disease meant focus was on mosquitos, yet broader virus movement dynamics needs to consider wildlife hosts.

One Health collaboration: Pre-existing data sharing arrangements with public health colleagues is essential when faced with an outbreak affecting both pigs and people.

Public coverage: human cases will always get more attention than pig cases.

Communication strategy around the interlinking of health shared across humans/animals/environment

Thank you

Michele Byers

Veterinary Officer

Michele.byers@aff.gov.au

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Expectations for the VBDs workshop (Not Included in the Presentation)

- Please share your expectations for the VBDs workshop
- What specific information about VBDs you expect to obtain from experts
- What disease experience you expect to gain from member countries/territories

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Member experience on prevention and control for Vector Borne Disease

[Bhutan]

Dr Rinzin Pem
Chief Veterinary Officer

19 – 20 September 2024
Tokyo, Japan

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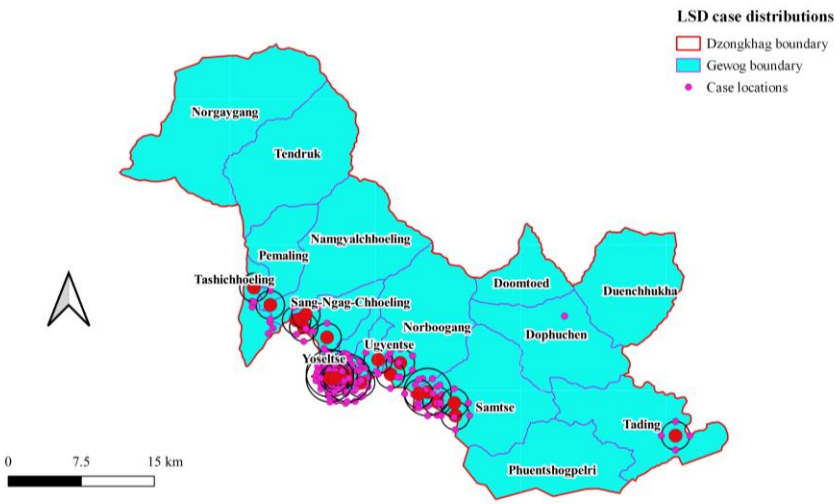
Vector Borne Disease situation

Lumpy Skin Disease

i. Spatial distribution of LSD

First LSD outbreak in 2020 (Affected 1 Dzongkhag; 152 cases, 2 deaths)



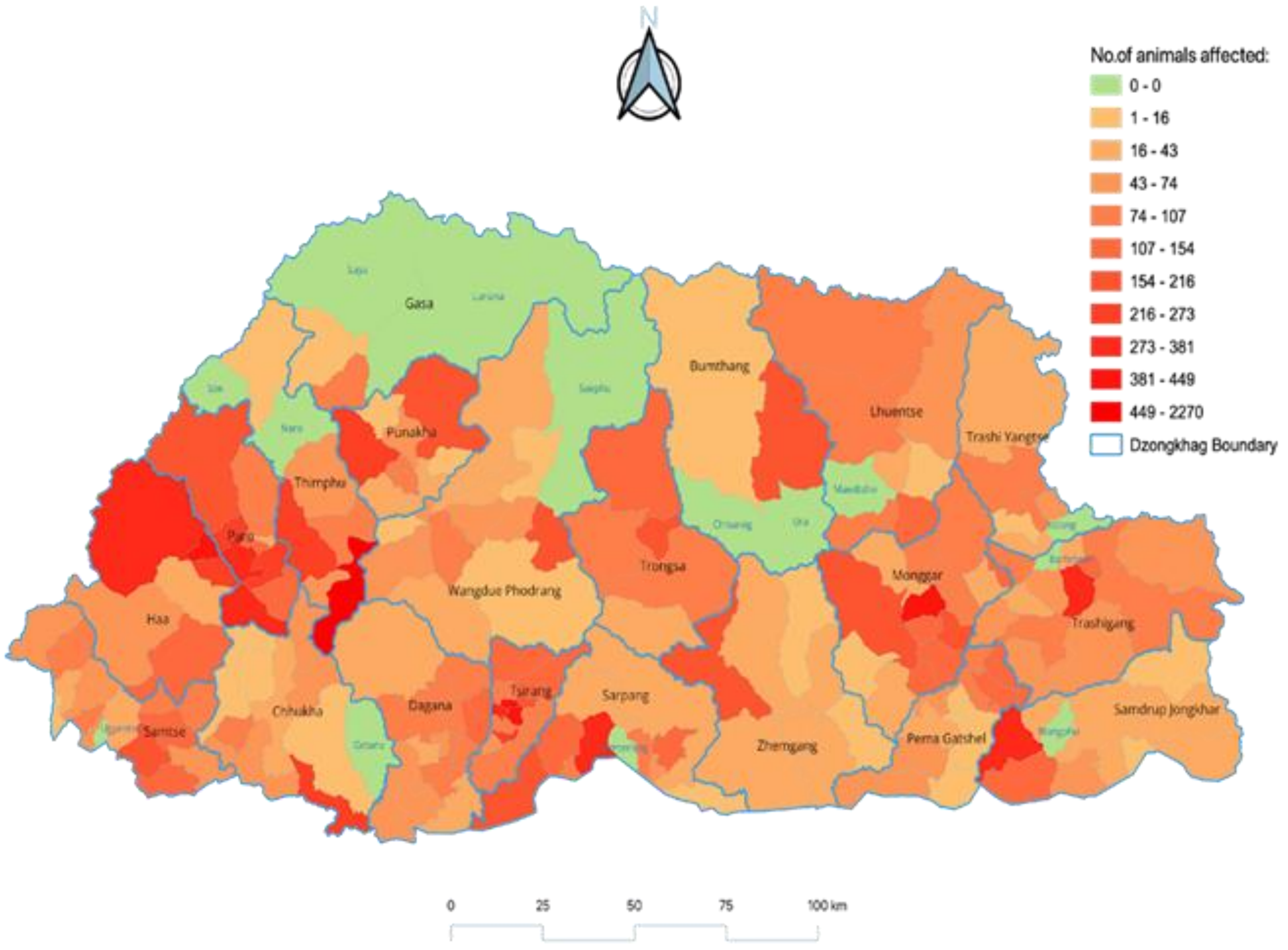
LSD outbreaks in 2022 (Affected 2 Dzongkhags; 25 cases, 0 deaths)

Vector Borne Disease situation

i. Spatial distribution of LSD

LSD outbreaks in 2023

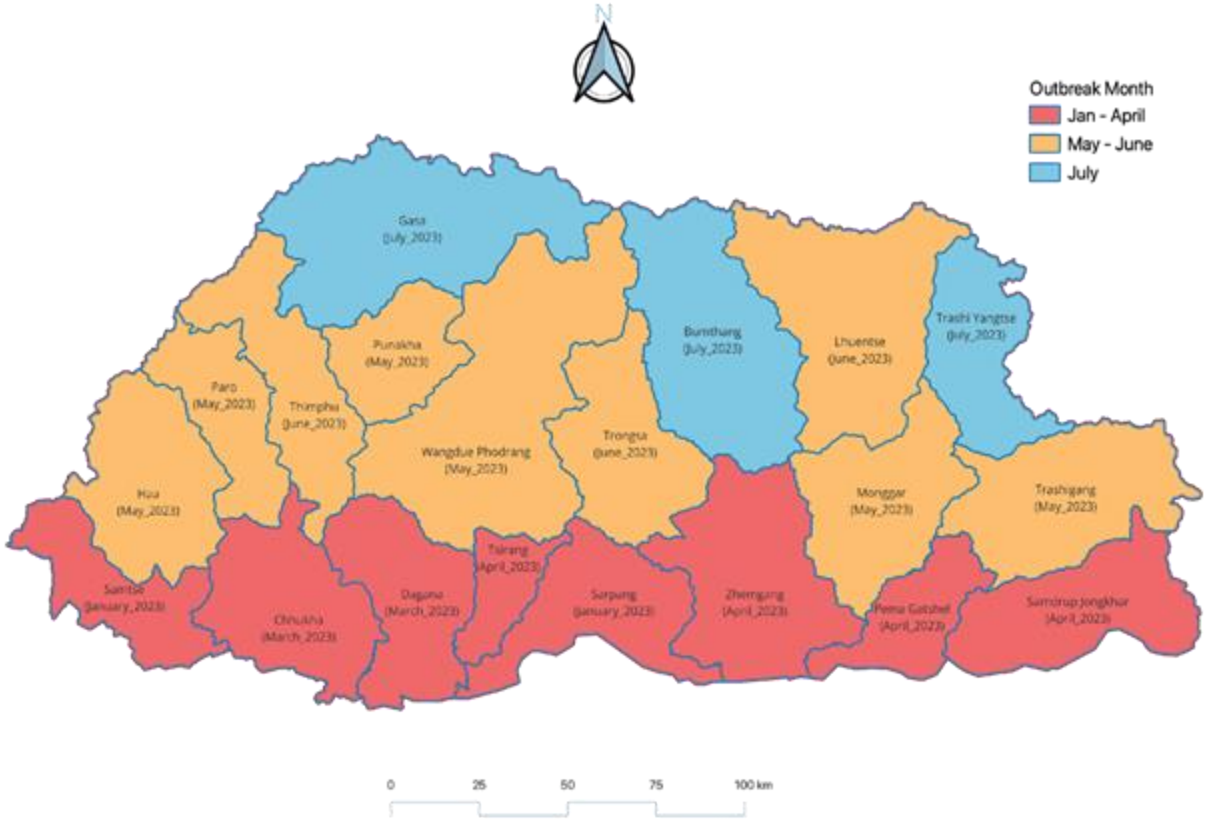
- Started in January (Samtse)
- Last case in September (Thimphu)
- 7815 H/H affected (20 Dzongkhags, 192 geogs)
- 19,907 cases (84% Cattle; 16% Yaks)
- 2,888 deaths (57% Cattle; 43% Yaks)
- CFR: 9.92% in Cattle and 38.66% in Yaks

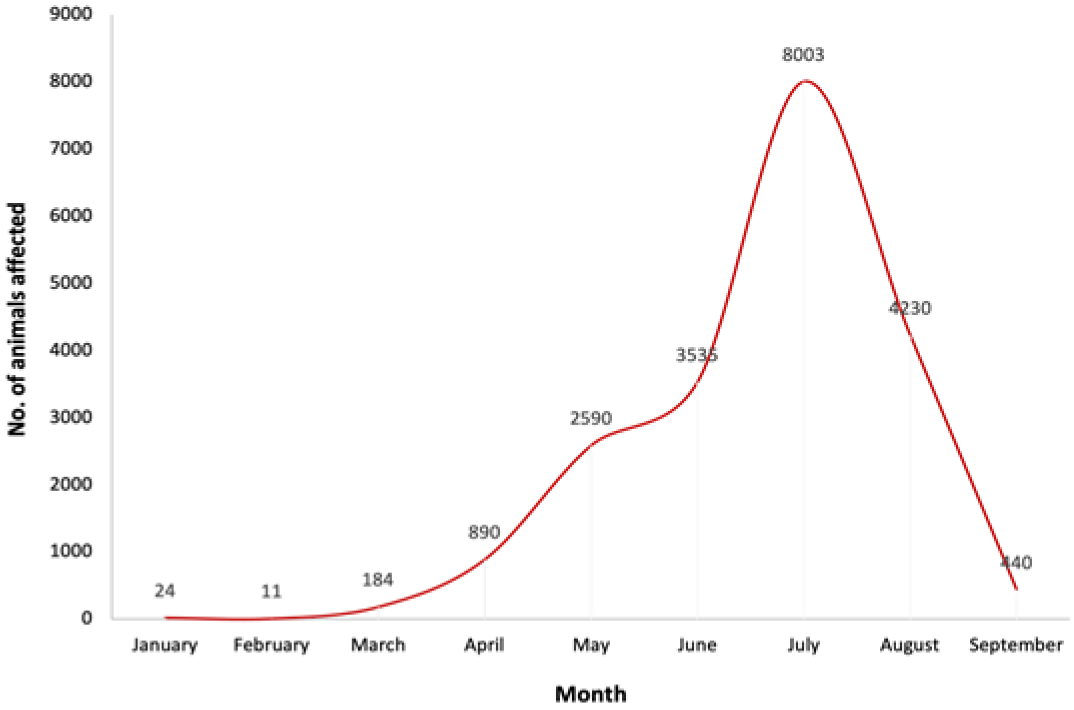


Vector Borne Disease situation

ii. Temporal distribution of LSD

- First outbreak in Sept 2020
- In 2022, outbreak in the month of May
- In 2023, from January till September





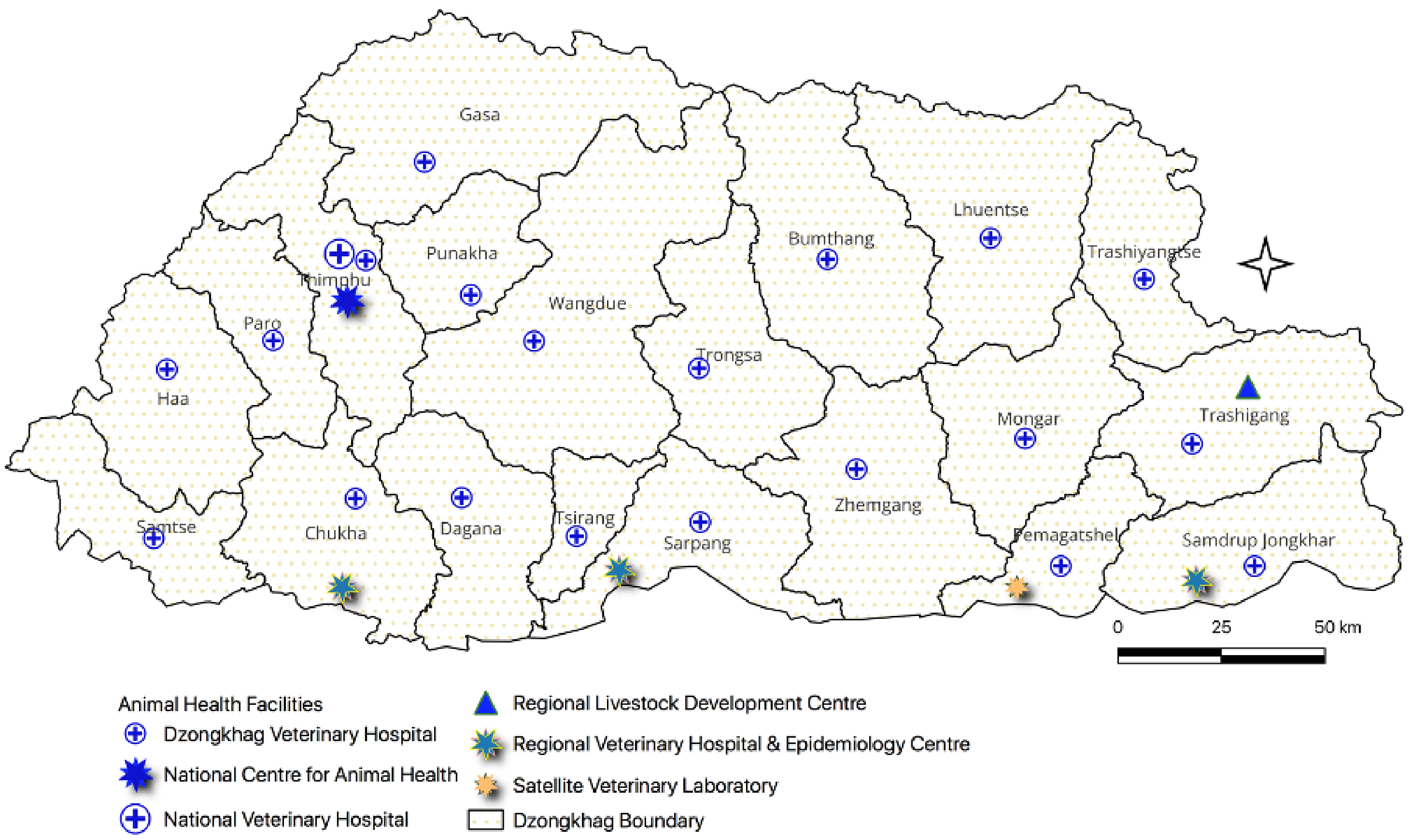
Vector Borne Disease situation

iii. Factors contributing to the change in distribution

- Transboundary nature of LSD; long porous border
- Climate change : increased vector density, habitat, activity and distribution
- Environmental changes
- Inadequate regional collaboration to prevent and control VBDs
- Free-range cattle rearing system
- Poor farm biosecurity: Subsistence farming system
- Traditional practice of seasonal cattle migration

Detection capacity

Network of Animal Health/veterinary facilities in the country



Detection capacity

Laboratory diagnosis capacity for LSD

- Clinical diagnosis in the field
- Real-time PCR for confirmation
- Characterization of virus carried out with support from regional and international laboratories

Response to Vector Borne Diseases

i. Surveillance (animal and vector surveillance)

- Passive surveillance (peace time)
  - ✓ Veterinary Information System
- Active surveillance (outbreak)
  - ✓ Syndromic and lab-based surveillance
  - ✓ Veterinary laboratories: National, Regional and Dzongkhag

Response to Vector Borne Diseases

ii. Responses and control

- ✓ Activation of Rapid Response Teams (RRT): Disease outbreak investigation, Quarantine and movement control, Surveillance teams
- ✓ RRTs perform following tasks:
  - Risk assessment and delineation of zones: infection, protection
  - Ban on movement of live animals and their products and strict regulation
  - Isolation and symptomatic treatment of sick animals and proper disposal of carcasses
  - Active syndromic and laboratory surveillance
  - Heightening farm biosecurity and sanitary measures for vector control
  - Awareness and education for farmers and relevant stakeholders
  - Reporting and information sharing

Response to Vector Borne Diseases

iii. Preventive measures to avoid introduction

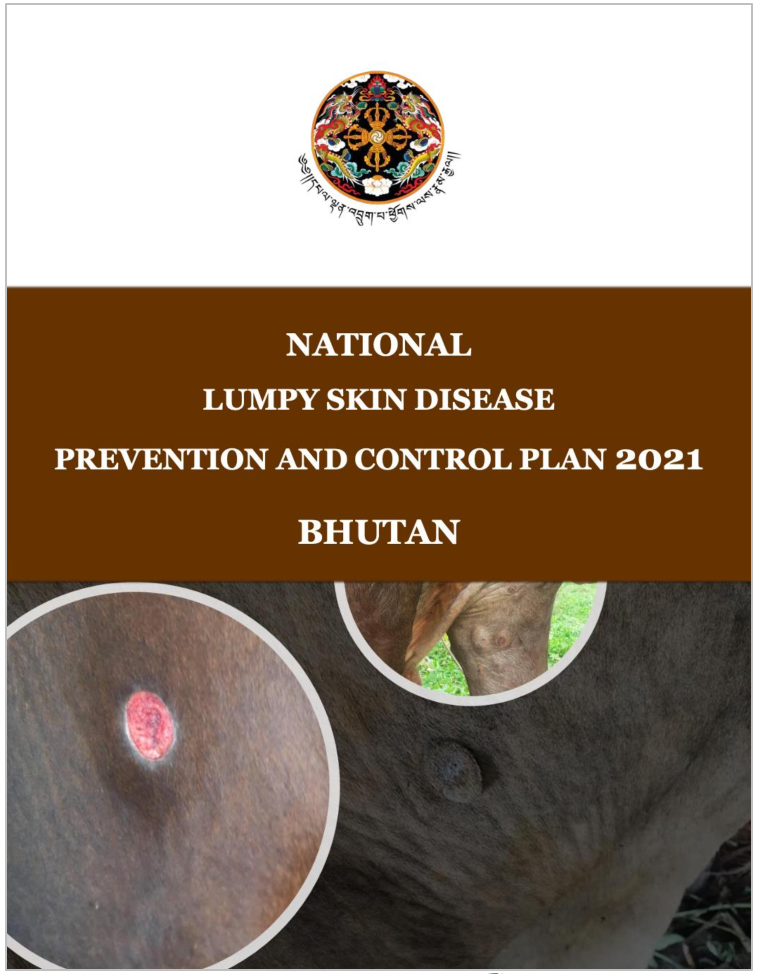
- ✓ Passive surveillance and reporting
- ✓ Heightened vigilance during outbreaks in the neighbouring countries
- ✓ Sending out alerts/notifications
- ✓ Enhanced farm biosecurity
- ✓ Regulatory actions: strict import checks, quarantine measures
- ✓ Awareness and education with specific focus on vector control and good on-farm biosecurity practices

Response to Vector Borne Diseases

iv. Vaccination

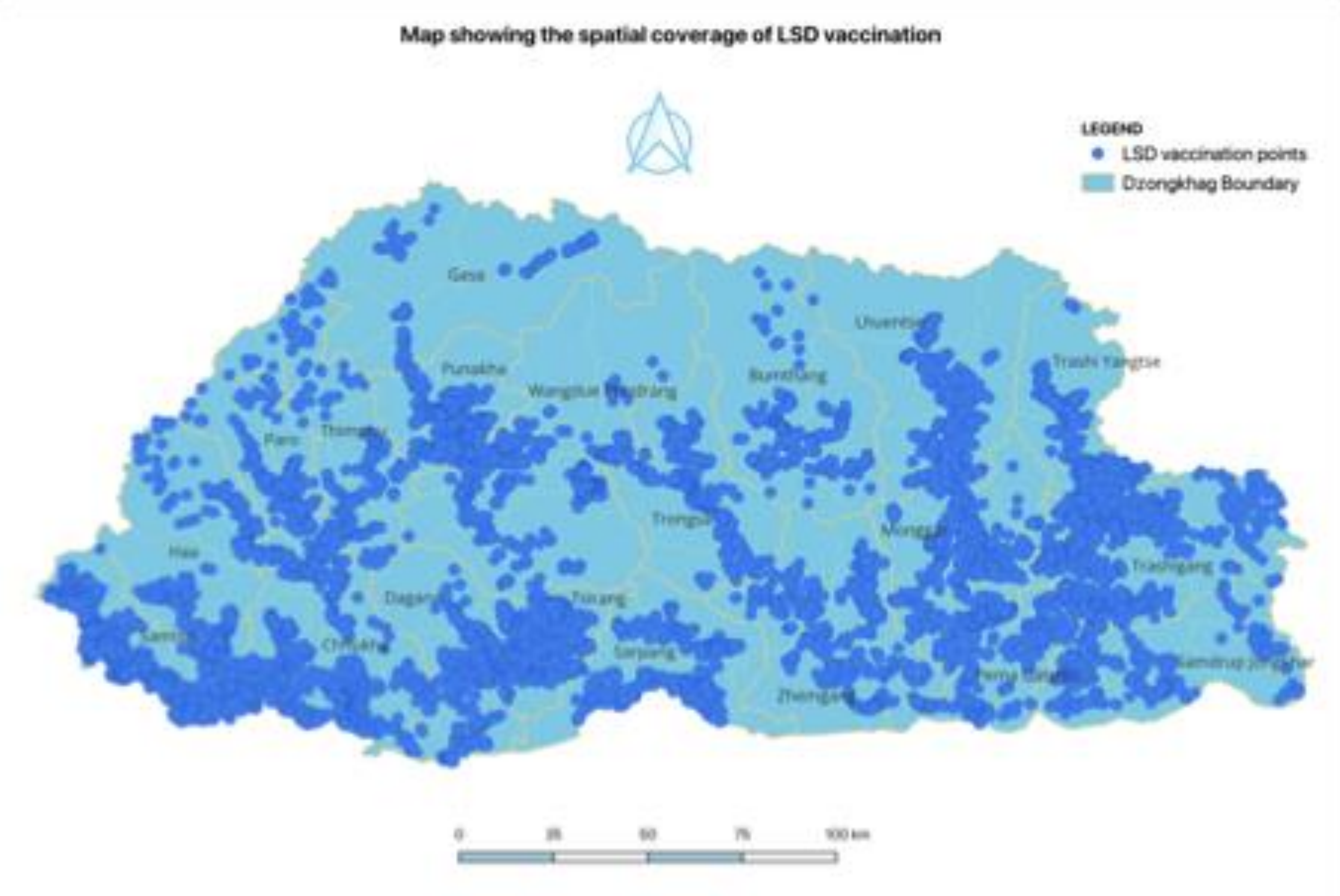
- Key strategy against LSD
- Mass vaccination using homologous vaccine (Neethling strain)
- Targeted Coverage: 100% in high risk areas and at least 70% in other areas

v. Contingency plan



Impact of the actions

- Improved surveillance and diagnostic capacity
- Decrease in incidence of LSD
- Decreased economic losses for livestock farmers as well as the government
- Increased awareness and knowledge
- Improved livelihoods of the farmers



Challenge and possible solutions

Challenge	Possible solutions
Cross-Border Disease Transmission	Strengthen Regional cooperation: Establish cross-border surveillance networks and joint disease surveillance and control initiatives to ensure coordinated efforts
Economic constraints	Advocate for increased funding from government. Promote cost-sharing mechanisms. Explore public-private partnerships.
Unavailablity of vaccines for LSD in the region	Support from Regional/International organizations in facilitating availability of cost-effective vaccines
Lack of compliance on good farming practices, biosecurity measures and non-reporting of cases	Community engagement through awareness campaigns and advocacy programs

Other VBDs of concern

1. Crimean-Congo Hemorrhagic Fever

- CCHF Sero-surveillance in goat population in Southern Bhutan: Antibodies have been found in goat population; further investigation planned to understand the domestic infection cycle and the potential risk of human outbreaks.

2. Japanese Encephalitis

- JEV vectors prevalent in many southern Dzongkhags; Sporadic cases of JE in humans; No surveillance conducted for JE in pig population; No capacity for JE detection in the veterinary labs.

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Last updated: 2024-07-12

Indicator	Japanese encephalitis - number of reported cases																
Location	2023	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007
Bhutan	0	0	0	0	0	1	3	5	5	2	0	27	3	0	0		
Bosnia and Herzegovina			0			0	0	0					0			0	0
Botswana	0	0		0			0	0	0								0

Collaboration with other sectors under One Health approach

- Good collaboration with other sectors under One Health approach for zoonotic diseases and AMR.
- Ongoing collaboration with Royal Centre for Disease Control for CCHF surveillance
- Vision of Bhutan One Health Strategy *"The health and wellbeing of humans and animals including ecosystem are protected and improved through One Health approach"*
- In May 2024, Human Health sector, Animal Health Sector (including wildlife) and Environment Sector collectively prioritized zoonotic diseases of greatest concern at the human-animal-environment interface for One Health collaboration.

Thank you

Dr Rinzin Pem

Chief Veterinary Officer

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Acknowledgements

Department of Livestock, Ministry of Agriculture and Livestock, Bhutan

National Centre for Animal Health, Serbithang, Thimphu, Bhutan

Expectations for the VBDs workshop (Not Included in the Presentation)

- Please share your expectations for the VBDs workshop
  - Better understand epidemiology, transmission dynamics and best practices in VBDs prevention, surveillance and control. And certainly collaborate and network with experts and representatives from member countries.
- What specific information about VBDs you expect to obtain from experts
  - Information on VBDs incidence in light of climate change, globalization, and practical solutions to reduce the impact of VBDs; developments in VBDs diagnostic techniques, best practices in prevention, surveillance and treatment of VBDs.
- What disease experience you expect to gain from member countries/territories
  - Learn contextual adaptive approaches undertaken for VBDs prevention and control; seek success stories of regional cooperation/cross-border cooperation forged to prevent VBDs.

Regional workshop on Vector Borne Disease for Asia and the Pacific 2024

Member experience on prevention and control for Vector Borne Disease

Cambodia

19 – 20 September 2024
Tokyo, Japan

Dr. Ren Theary

Deputy Director of National Animal Health and Production Research Institute,
General Directorate of Animal Health and Production.

World Organisation for Animal Health
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Vector Borne Disease situations

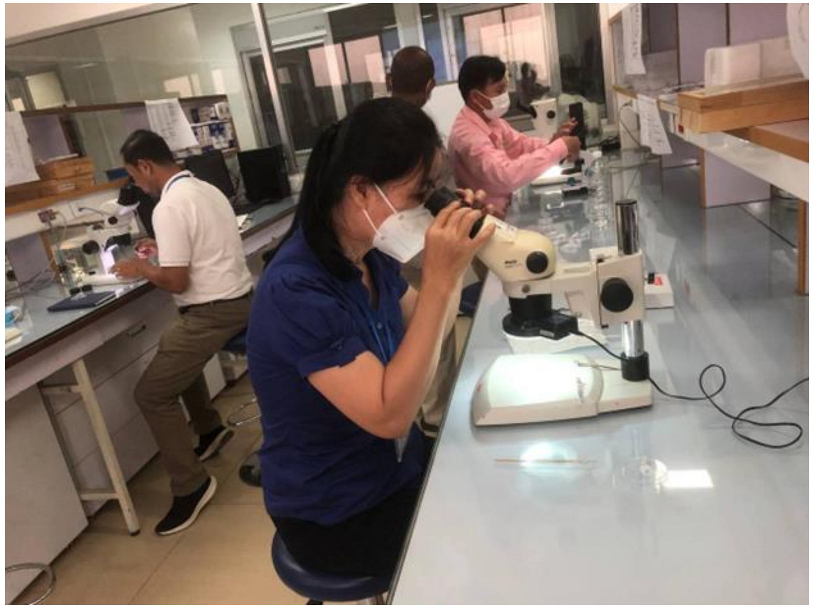
- Brief descriptions of the Vector Borne Disease situations which your country / territory is concerned about (Up to 3 diseases)
- An endemic diseases, zoonotic vector-borne diseases in cattle and dogs
  - ✓ Bacteria: Ehrlichia canis, Rickettsia felis, Mycoplasma haemocanis.
  - ✓ Protozoans: Babesia vogeli, Hepatozoon canis, Anaplasma, Babesia, Dirofilaria immitis and Theilaria.

Detection capacity

- A brief description of surveillance and laboratory diagnosis capacity for Vector Borne Diseases

  - Disease covered: Anaplasma, Borrelia, Babesia, Coxiella, Ehrlichia, Rickettsia, and Theilaria.

  - Type(s) of diagnostic tests
    - ✓ Blood smear examination,
    - ✓ ELISA test
    - ✓ and PCR to more sophisticated methods such as sequencing analysis.



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Response to Vector Borne Diseases

- A brief actions such as:
  - Surveillance (animal and vector surveillance):
    - ✓ Using a taxonomy key to identify of tick species
    - ✓ To carry out a sampling and risk mapping in Cambodia

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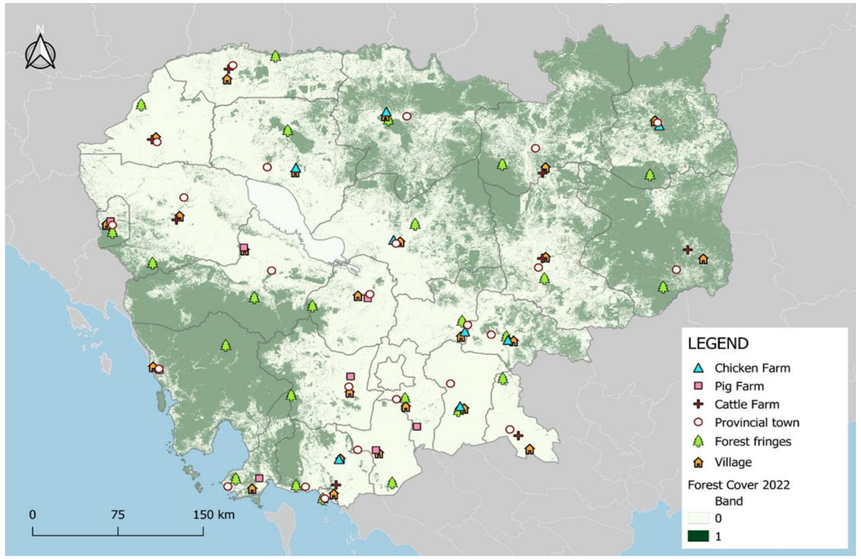
Cross sectional collection:

Sampling of vectors of veterinary importance in each of the provinces of Cambodia in 4 different ecotypes

Species	Total
Provincial Town	
Cat	
Rhipicephalus sanguineus	44
Rhipicephalus spp.	2
Cattle	
Rhipicephalus australis	18
Rhipicephalus microplus	152
Rhipicephalus spp.	30
Dog	
Rhipicephalus australis	1
Rhipicephalus microplus	9
Rhipicephalus sanguineus	1,045
Rhipicephalus spp.	56
Villages	
Cattle	
Rhipicephalus australis	640
Rhipicephalus microplus	827
Rhipicephalus sanguineus	21
Rhipicephalus spp.	843
Dog	
Haemaphysalis canestrinii	1
Rhipicephalus australis	4
Rhipicephalus microplus	3
Rhipicephalus sanguineus	329
Rhipicephalus spp.	220
Goat	
Rhipicephalus australis	5
Rhipicephalus microplus	2
Rhipicephalus spp.	1

Species	Total
Farms	
Cattle	
Rhipicephalus australis	564
Rhipicephalus microplus	1,283
Rhipicephalus spp.	1,144
Pig	
No tick	
Chicken	
No tick	
Forest fringe, Cave, etc	
Wild pig	
Dermacentor auratus	1
Dermacentor filippovea	4
Environment (Vegetation)	
Carios batuensis	117
Dermacentor steini	1
Haemaphysalis hystricis	2
Haemaphysalis papuana	1
Haemaphysalis shimoga	2
Haemaphysalis spp.	52
Haemaphysalis wellingtoni	2
Rhipicephalus spp.	6
Grand Total	**7,432**



- 7,432 ticks were collected
- 4 Genus, 12 Species
- Most abundant species:
  - *Rh. microplus* (cattle)
  - *Rh. sanguineus* (dog)
- More habitat (forest, cave, etc.) or more host types inspected

--> more species?

Response to Vector Borne Diseases

- A brief actions such as:
  - Responses and control: There are 3 mains
    1) To addresses the current state on ticks and TBDs in country
    2) Focuses on the development of new research approaches related to TBPs and TBDs
    3) Identifying the most important challenges and offering recommendations for future research on TBPs and TBDs in the region.
  - Preventive measures to avoid introduction:
    - ✓ Strengthen for tick management that can prevention of tick- borne pathogens and tick-borne diseases
    - ✓ Finding better ways to detect and manage the associated diseases
  - Vaccination (if applicable): There aren't vaccines for prevention of vector borne diseases. For cattle, they used Ivermectin is an anti parasite medication to treat ticks.

Response to Vector Borne Diseases

- A brief actions such as:
  - Contingency plans available: Collaboration with Pasteur Institute to conduct one health project related to ticks and tick-borne diseases in future:
    - ✓ Develop tick DNA sequence database for gene barcoding
    - ✓ Using Maldi-ToF for identification of tick species in country

Impact of the actions

- A brief description of the impact of risk mitigation measures implemented to prevent and control Vector Borne Diseases

✓ Ticks, fleas are the most common vectors transmitting pathogens to cattle and dog

✓ Ticks, as critical vectors of a variety of pathogens, pose a significant public health challenge globally. Ticks are responsible for transmitting a diverse array of pathogens affecting animals and human.

✓ Results:

- 2 species on cattle of genus Rhipicephalus australis and Rh. Microplus
- 5 hard tick species (Dermacentor filippovea, Dermacentor steini, Haemaphysalis canestrinii, Haemaphysalis hystricis, and Haemaphysalis wellingtoni) that can transmit several pathogens including Babesia bigemina and Babesia bovis (bovine babesiosis), Anaplasma marginale (anaplasmosis) and the severe fever with thrombocytopenia syndrome virus.
- 1 soft tick species (Carios batuensis, formerly Ornithodoros batuensis) that can cause of ASF on pig.

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Impact of the actions

- A brief description of the impact of risk mitigation measures implemented to prevent and control Vector Borne Diseases

✓ To prevent and control VBD should be based on actions:

- Using an anti parasite medication with repellent properties for prevention from infected vector-borne pathogens and reduce the risk of exposure to these pathogens.
- Cattle must be keep and give feed in the cage.

Challenge and possible solutions

- A brief description of challenges in implementation of VBD surveillance activities and control programmes and your actions/ideas to overcome these challenges
    - ✓ Lack of understanding, data and information on the epidemiology and entomology of vector-borne diseases
    - ✓ Limitations in current of VBD surveillance and control capacity
    - ✓ Lack of dedicated tick genomic for research extensive size of tick full genome sequencing

Collaboration with other sectors under One Health approach

- Brief description of collaboration experience with other sectors to prevent or control Vector Borne Disease (If any)

- We don't have any project that relevant with vector borne disease surveillance with another sector for One Health approach

Challenge and possible solutions to strengthen the collaboration

- A brief description of challenges to strengthen the collaboration with other sectors and your actions/ideas to overcome these challenges

✓ We got only one project which is the first time that collaboration supported from Pasteur Institute to conduct vector research in Cambodia. The objective are:

1) Develop a national expertise in Veterinary Entomology in Cambodia
2) Develop appropriate scientific surveillance tools for vectors of veterinary importance
3) Sampling and risk mapping in Cambodia

✓ We will continue collaboration for the phase 2 near the future.

Thank you

Dr. Ren Theary

Deputy Director of National Animal Health and Production Research Institute

Email: rentheary2020@gmail.com

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Regional workshop on Vector Borne Disease for Asia and the Pacific 2024

Member experience on prevention and control for Vector Borne Disease [Korea, Republic of]

In-Soon Roh, DVM, PhD
Senior Veterinary Research Officer

19 – 20 September 2024
Tokyo, Japan

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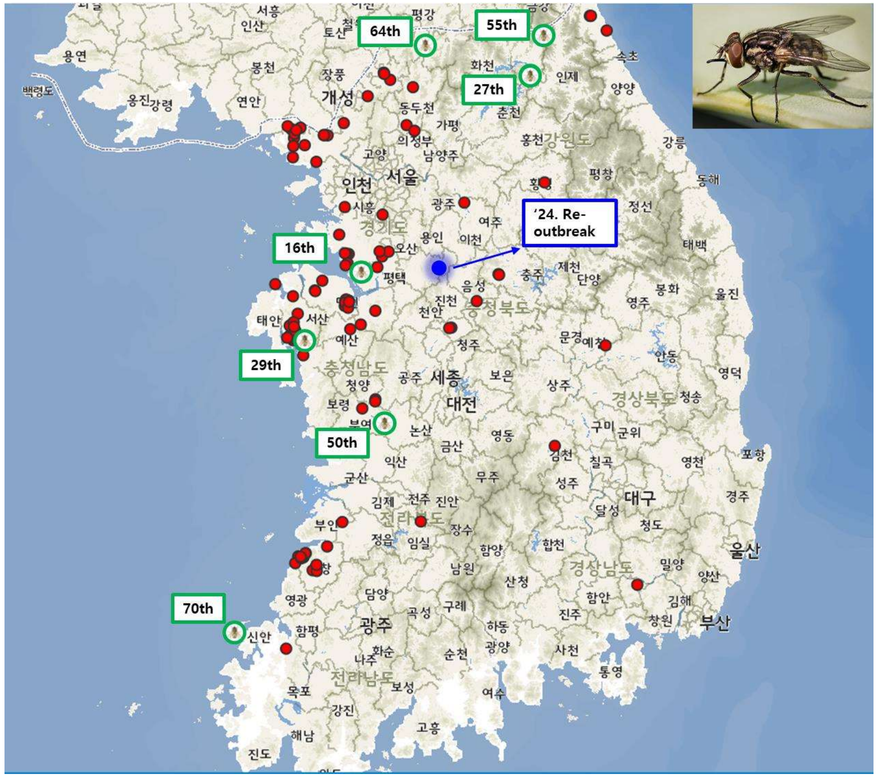
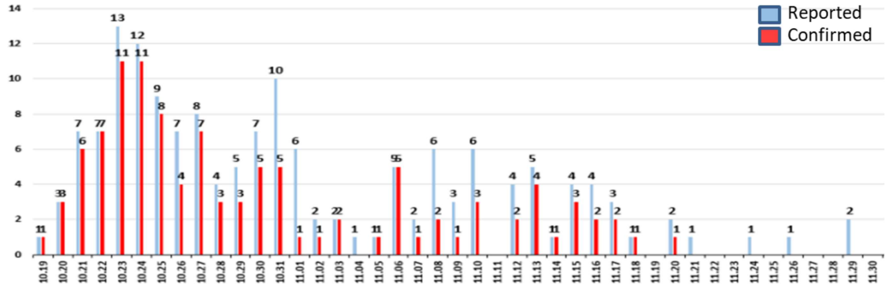
Vector Borne Disease situations

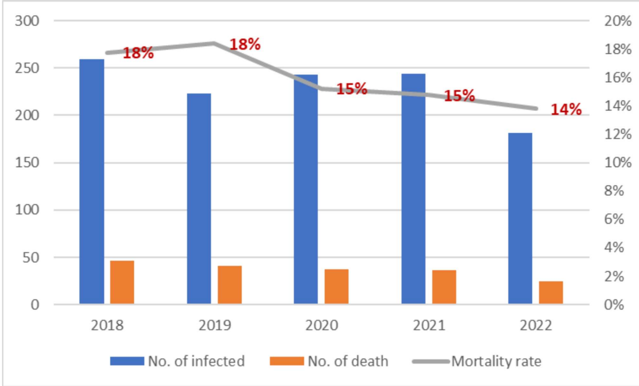
- Lumpy Skin Disease
  - (Emerging disease status)
    - ➲ First outbreak: Octorber 19, 2023, Seosan, Chungnam Province
  - (Spread)
    - ➲ Western border regions (1st) / Northern (2nd) → Inland
    - ➲ 107 cases across multiple provinces (Red dot)
      - Occurrence over a period of 33 days
      - Detection of LSDV in stable flies trapped on outbreak farms (Green circle)
  - (Recent changes)
    - ➲ Outbreak in Gyeonggi Province, August 12, 2024 (Blue dot)

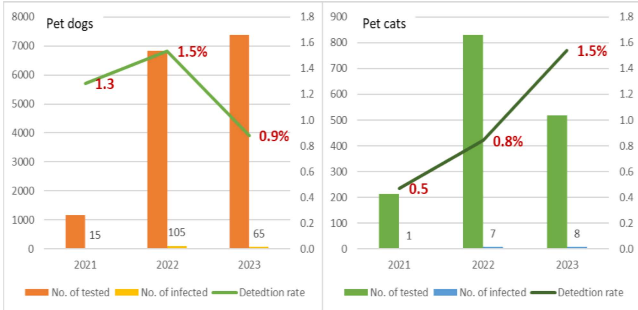


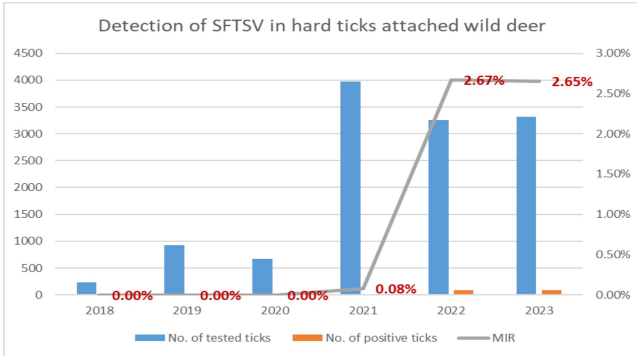


Vector Borne Disease situations

- Severe Fever with Thrombocytopenia Syndrome
  - (Endemic disease status)
    - ➲ Non-notifiable disease in animals, however, category 3 infectious disease in humans
    - ➲ (Mortality) Human (Avg. 16%), Dog (less than 0.1%), livestock (0%)
    - ➲ (Seroprevalence)
      - In livestock in 2014, Goat (12.5%) > Pig (10.4) > Cattle (4.5) > Chicken (2.5)
      - In shelter dogs, 13.8% (2016) → 26.8% (2017) → 47.4% (2021) → 35.1% (2022)
      - In feral cats, 16.3% (2016) → 17.7% (2021) → 20.9% (2022)
    - ➲ (Agent identification)
      - In pet dogs, 1.3% (2021) → 1.5% (2022) → 0.9% (2023)
      - In pet cats, 0.5% (2021) → 0.8% (2022) → 1.5% (2023)
      - In hard ticks (MIR), , 0.08% (2021) → 2.67% (2022) → 2.65% (2023)
  - (Recent changes and factors)
    - ➲ Better diagnosis, and outdoor activities
    - ➲ Changes in tick populations, and an increase in the SFTSV load in ticks







Detection capacity

- Disease covered
  - [1]LSD, BT, AHS, RVF, WN, JE, Schmallenberg , VS (Indiana, New jersey), ASF
  - [2]SFTS, [3]Akabane, Aino, Chuzan, Ibaraki, BEF
  - [4]Anaplasmosis, Babesiosis, Ehrlichiosis, Lyme disease, Q fever
- Types of diagnostic tests

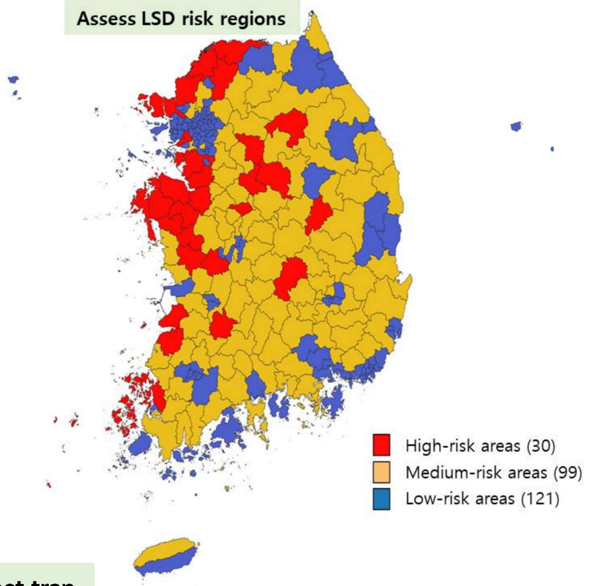
	Method	1	2	3	4
Agent identification	Real-time PCR	✓	✓	✓	✓
	Agarose gel-based PCR	✓	✓	✓	✓
	Agent isolation	✓	✓	✓	
Serological test	ELISA	✓			
	IFA		✓		
	VN	✓	✓	✓	

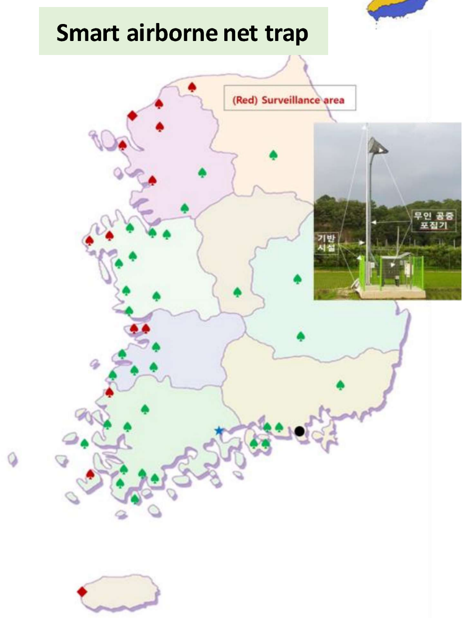
Response to Vector Borne Diseases

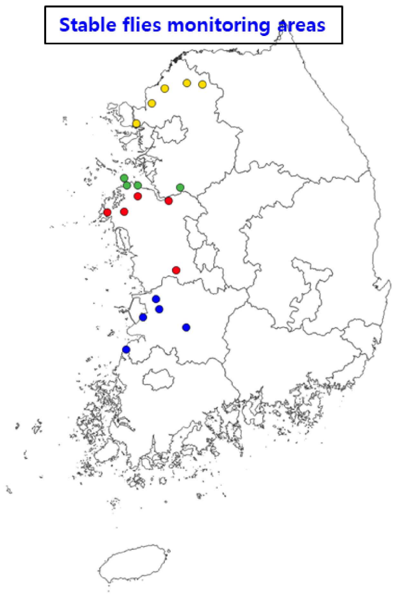
- Surveillance (animal and vector surveillance)
  - (Animal)
    - Active surveillance programs for early detection and proof of absence
      - BT, AHS, Arbovirus simbu group (Akabane, etc.), BEF, Ibaraki, RVF, WN, JE, LSD, VSV, Zika
    - Passive surveillance of suspected animals
  - (Vector) Surveillance in the airports, harbors, and livestock farms, for collecting season
- Responses and control
  - Movement restriction, ban on the movement of live animals
  - Culling (all or infected)
  - Mass vaccination
    - In response to the LSD outbreak, massive vaccination were implemented, resulting in the containment of the disease within 33 days.
  - Vector control, Intensive surveillance, etc.

Response to Vector Borne Diseases (cont.)

- Preventive measures to avoid introduction
  - Risk assessment
  - Enhance border controls
    - Smart airborne net trap (15 areas)
    - Expansion of vector surveillance area (20 farms)
    - Implementation of vector control measures in the airport and port
  - Survey of blood-sucking insect density, etc.
- Contingency plans available
  - Emerging animal diseases response and reporting system
  - Livestock disease and vehicle (livestock, feed) control center







Impact of the actions

- Improved disease detection and surveillance
  - Standardized and well-established diagnostic system
- Establishment of an antigen bank
  - Stockpile vaccines when commercial VBD's vaccines are available
- Development of vector control strategy
  - Expand vector surveillance in the regions affected by the LSD outbreak
  - Enhancement of high-altitude (10m) insect trap surveillance
- Strengthening border control and disease prevention
- Improvement of systems (disease control policy), including SOPs
- Education and Farmer training, Diagnostic training
  - Essential infection and vector control guidelines, notification of suspected animals
- Research and Development
  - New vaccines and treatments, Resistance management

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Collaboration with other sectors under One Health approach

- Project to establish a surveillance system for human-animal SFTS transmission (since 2020)

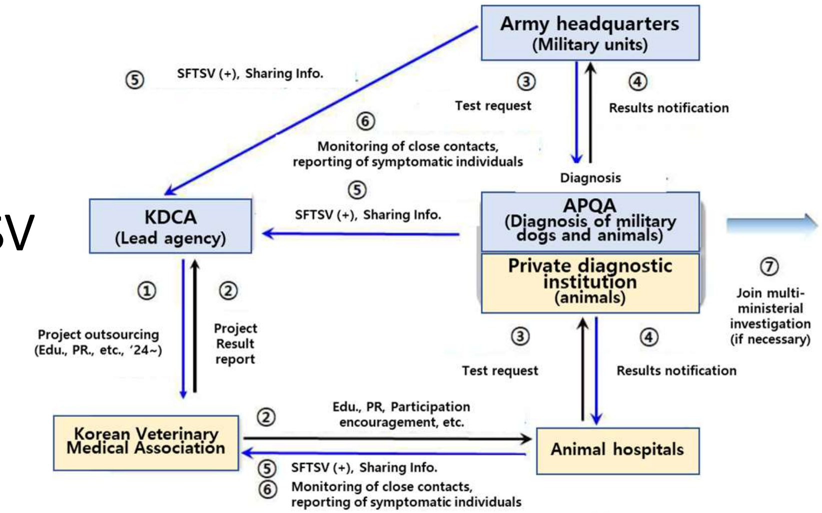
➲ A multi-ministerial project led by four agencies

- (Lead) Korea Disease Control and Prevention Agency (KDCA)
- (Participation) Animal and Plant Quarantine Agency (APQA), National Institute of Wildlife Disease Control and Prevention (NIWDCP), Republic of Korea Army Headquarters

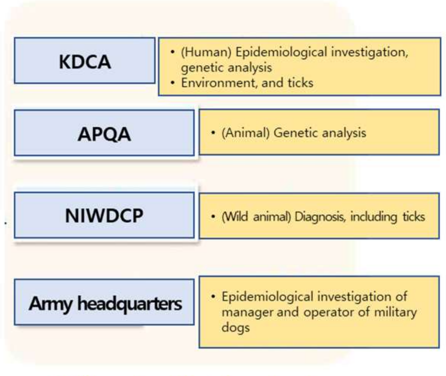
➲ (Objective)

To prevent spillover infections, control and block transmission among high-risk groups for SFTSV

- High-risk groups:
  Pet owners, veterinarians, animal technicians, soldiers, etc.



Surveillance system for human-animal SFTS transmission cases



Collaborative joint investigation system

Challenge and possible solutions to strengthen the collaboration

- A brief description of challenges to strengthen the collaboration with other sectors and your actions/ideas to overcome these challenges
  - Establishment of a joint surveillance framework for vectors (including migratory vectors) among Asia-Pacific countries
  - Information sharing on vector and VBD surveillance status, and prevention and control policies (strategies) for vector-borne disease by country
  - Formation of a network and establishment of a council for vector expert groups
  - Promotion of joint research projects among countries, such as vector surveillance, vaccine and treatment developments

Regional workshop on Vector Borne Disease for Asia and the Pacific 2024

Thank you

In-Soon Roh, DVM, PhD

Senior Veterinary Research Officer

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Expectations for the VBDs workshop (Not Included in the Presentation)

- A request information on the following matters:
  - Given the rising antibody positivity rates, what strategies can be adopted to prevent the circulation of the Bluetongue virus at low titers?
  - What best practices from other countries' SFTS management can be integrated into our national policies?

Member Experience on

Prevention and Control for Vector Borne Disease

[Nepal/South Asia]

Dr. Arjun Aryal

Senior Veterinary Officer

Department of Livestock Service (DLS), Nepal

19 – 20 September 2024

Tokyo, Japan

World Organisation for Animal Health

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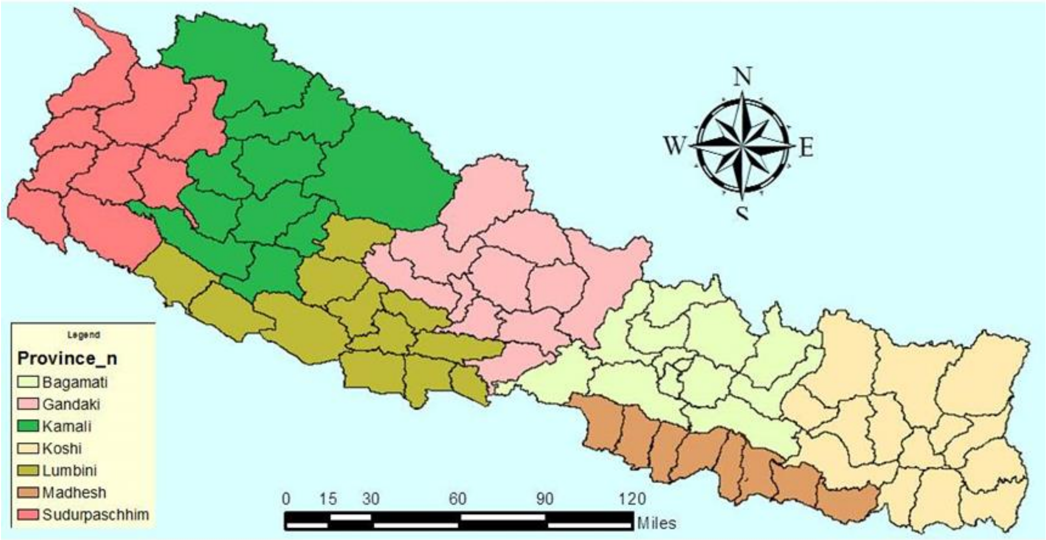
Nepal In Brief

- Population of around 29.16 million.
- Politically, 3 Tiers of Government: 7 provinces, 77 districts and 753 local levels.
- Geographically, divided into 3 eco-zones: Mountains, Hills and Terai.
- Nepal is rich in biodiversity providing house to more than 4% of world's mammals and 8% of world's birds.



Livestock and Fisheries Statistics of Nepal

In lakh

47.50	30.81	145.41	5.01	13.60	652.10	13.2	0.53

GDP
24.12%
Agriculture GDP

24.01%
Livestock in AGDP
1.51 %
Fisheries in AGDP

29.16 M
Total Population

50.4%
Engaged in Agri

3.4 M
Livestock farm families

Source: NSO, 2022

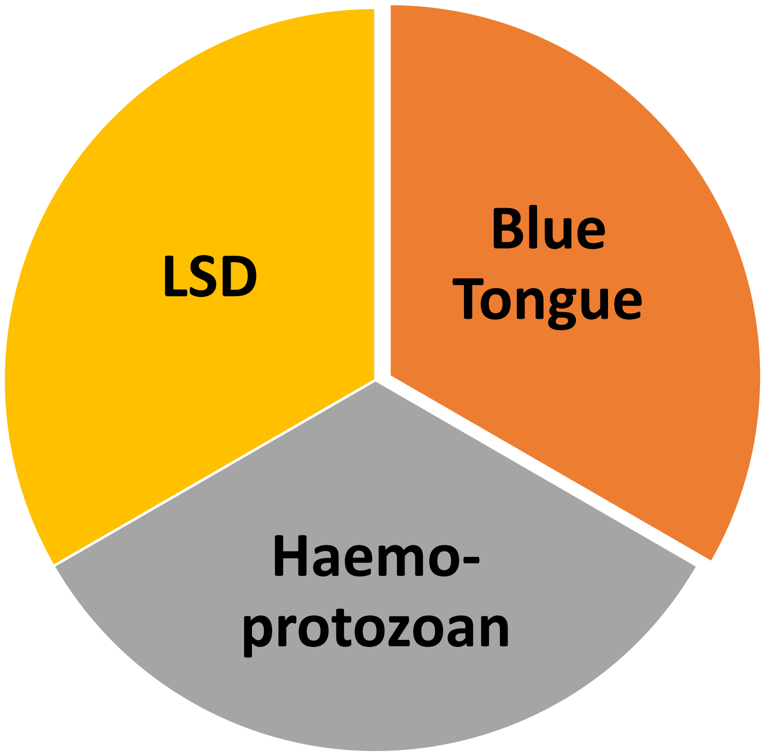
Contribution within LGDP
Dairy: 62.6%
Meat and Fish: 32.4 %
Eggs: 5.0 % %

Vector Borne Disease Situations in Nepal

- LSD, Blue Tongue, Tick born hemoprotozoan (Babesios, Theleriosis, Hepatozoons, Anaplasma, Ehrlichia canis), Trypanosome, Leishmania, Ephemeral fever (Frequent), Scrub Typhus (Reported in human frequently), ASF, CCHF (Regional Threat), JE are the major important Vector-borne Animal Diseases (VBADs) in Nepal (CVL,2023)

- We are in the early stages of understanding patterns of vector-borne disease (VBD) in animals.

- Several VBDs are of importance to international trade and are listed as notifiable diseases. Example: LSD included as National Notifiable disease by 2023.



Vector Borne Disease situations: LSD

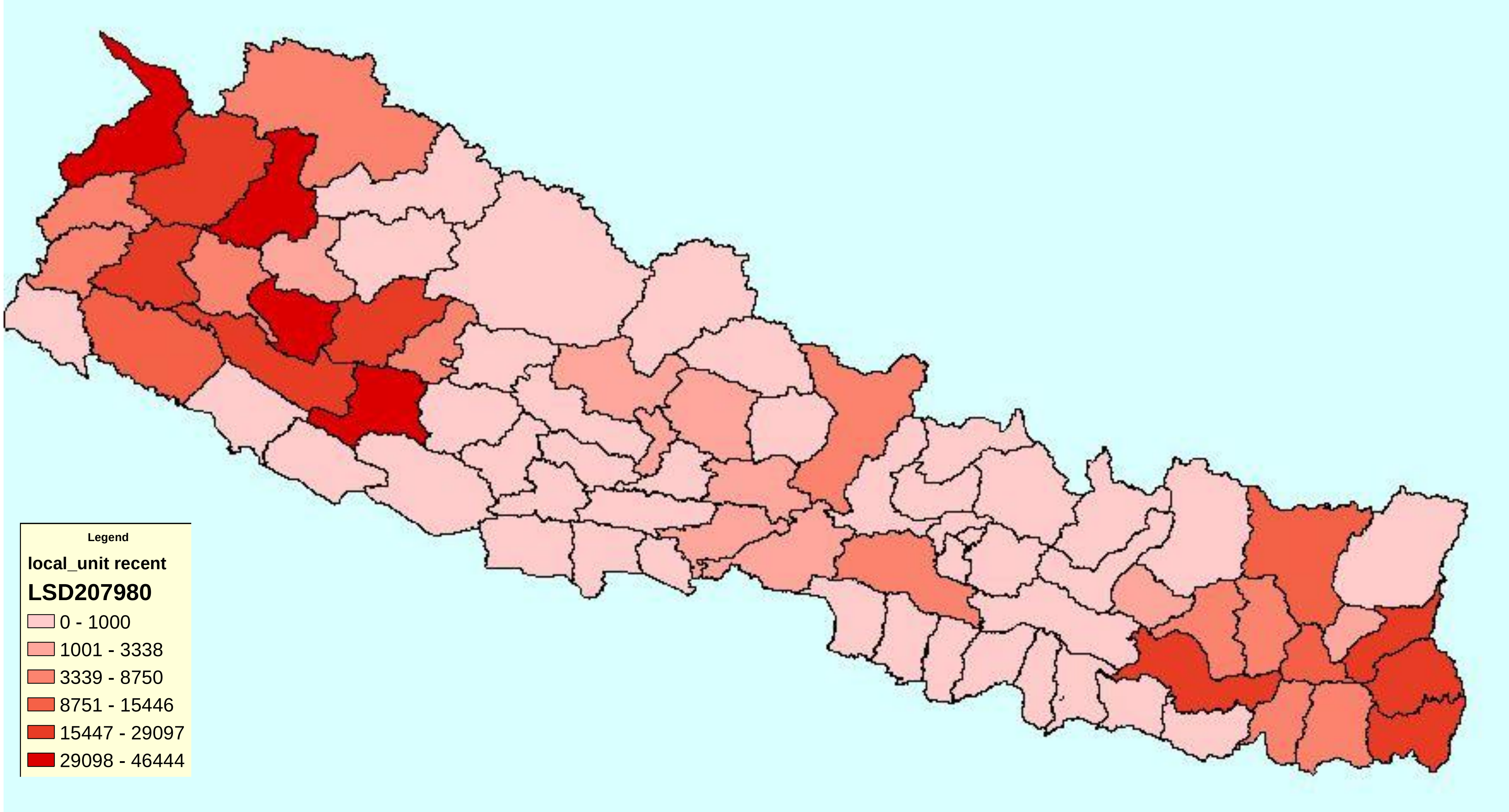
- Nepal experienced the first outbreak in June 2020 in cattle farms in Morang district, a district close to Indian border.
- Created havoc in cattle farming resulting into loss of

  Affected: 1.53 million of cattle (1/3rd of total population)

  Death: 65 thousand cattle
- Since December 2022, LSD took epidemic form in Nepal and by mid 2023, almost all districts of Nepal were affected by LSD causing huge economic losses.
- Vaccination using Neethling strain is the main control strategy being implemented to control LSD outbreaks.

DLS Report, 2023

Spatial distribution of LSD in Nepal



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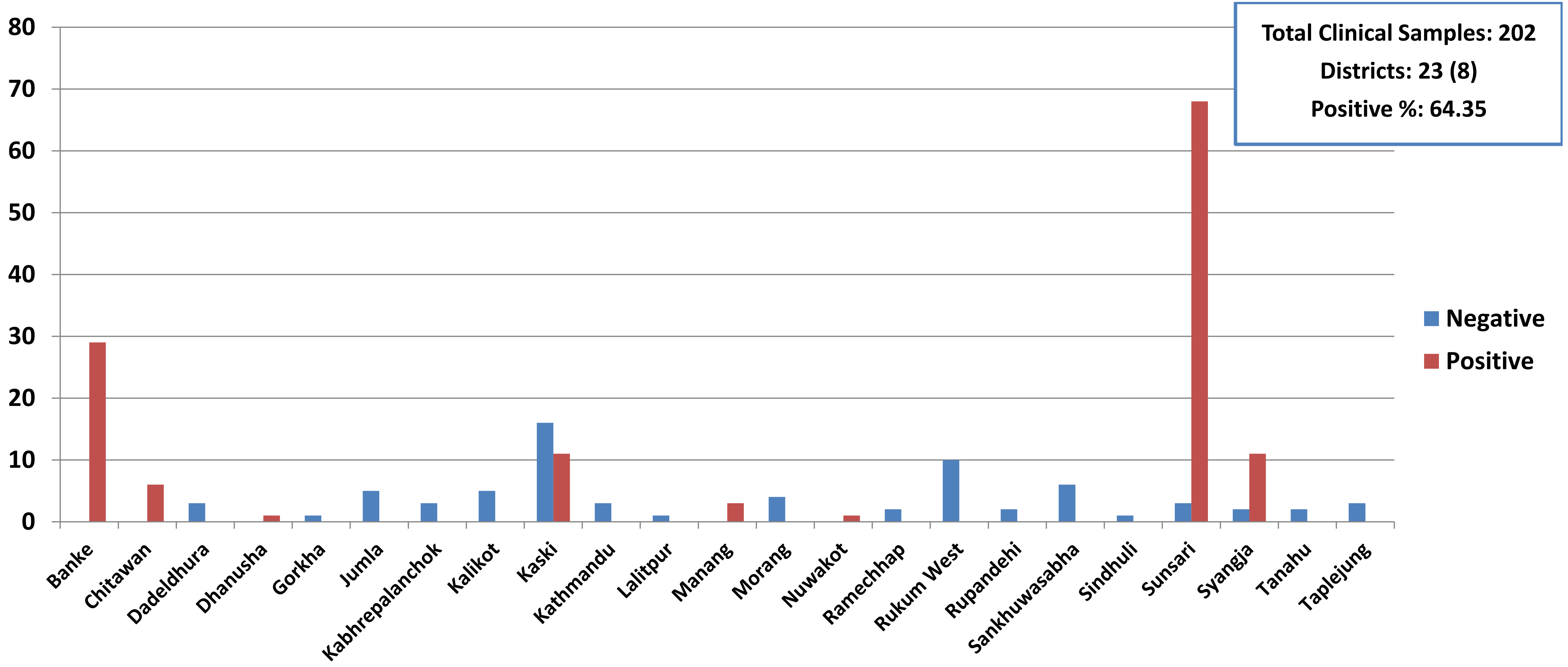
District- wise Distribution of LSDV from Suspected samples in 2024 (2080/81)



DLS Report, 2023

Glimpse of LSD: Minor to Severe Lesions; Adult to Young

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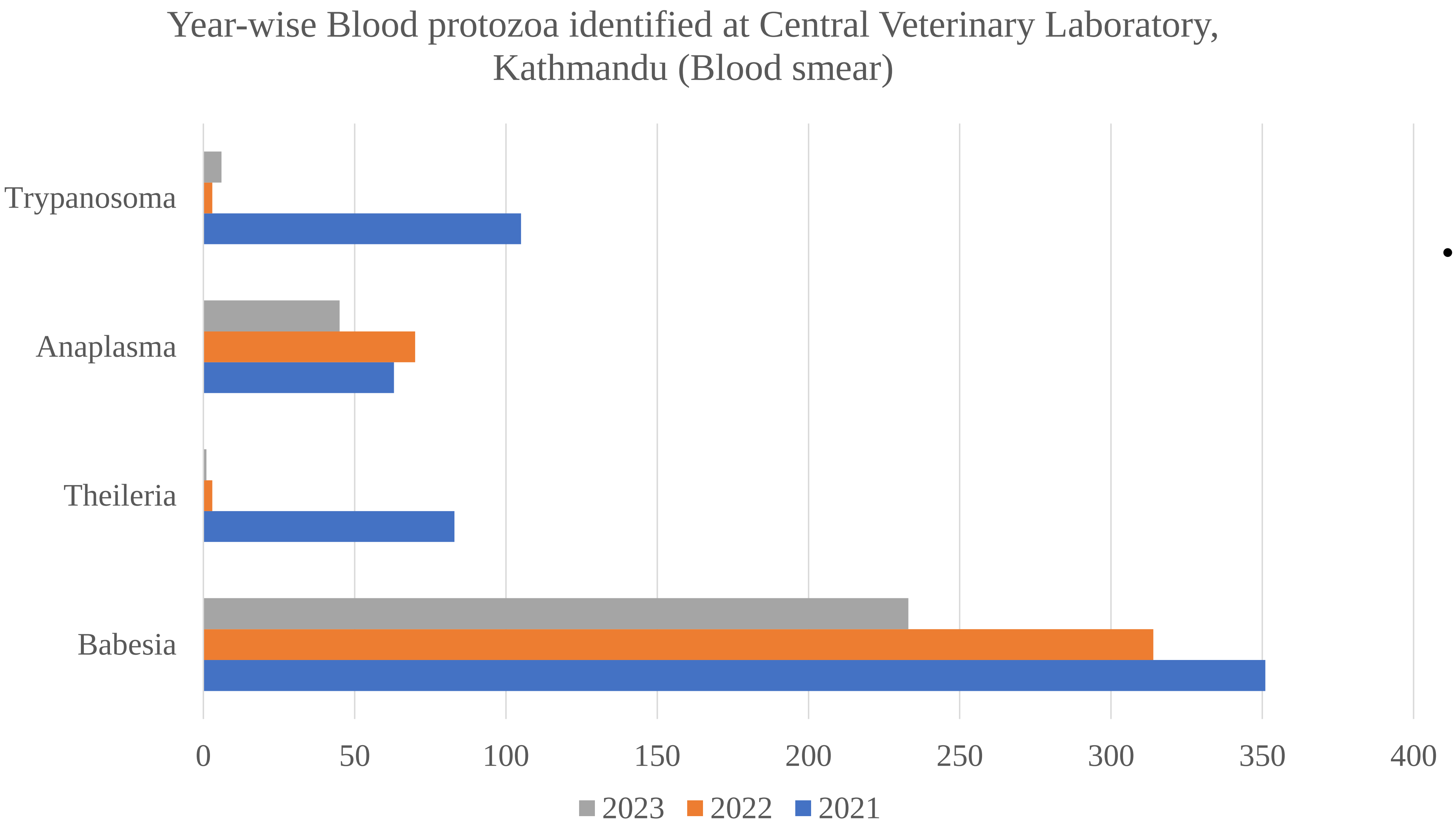
Vector Borne Disease Situations: Blue Tongue Disease

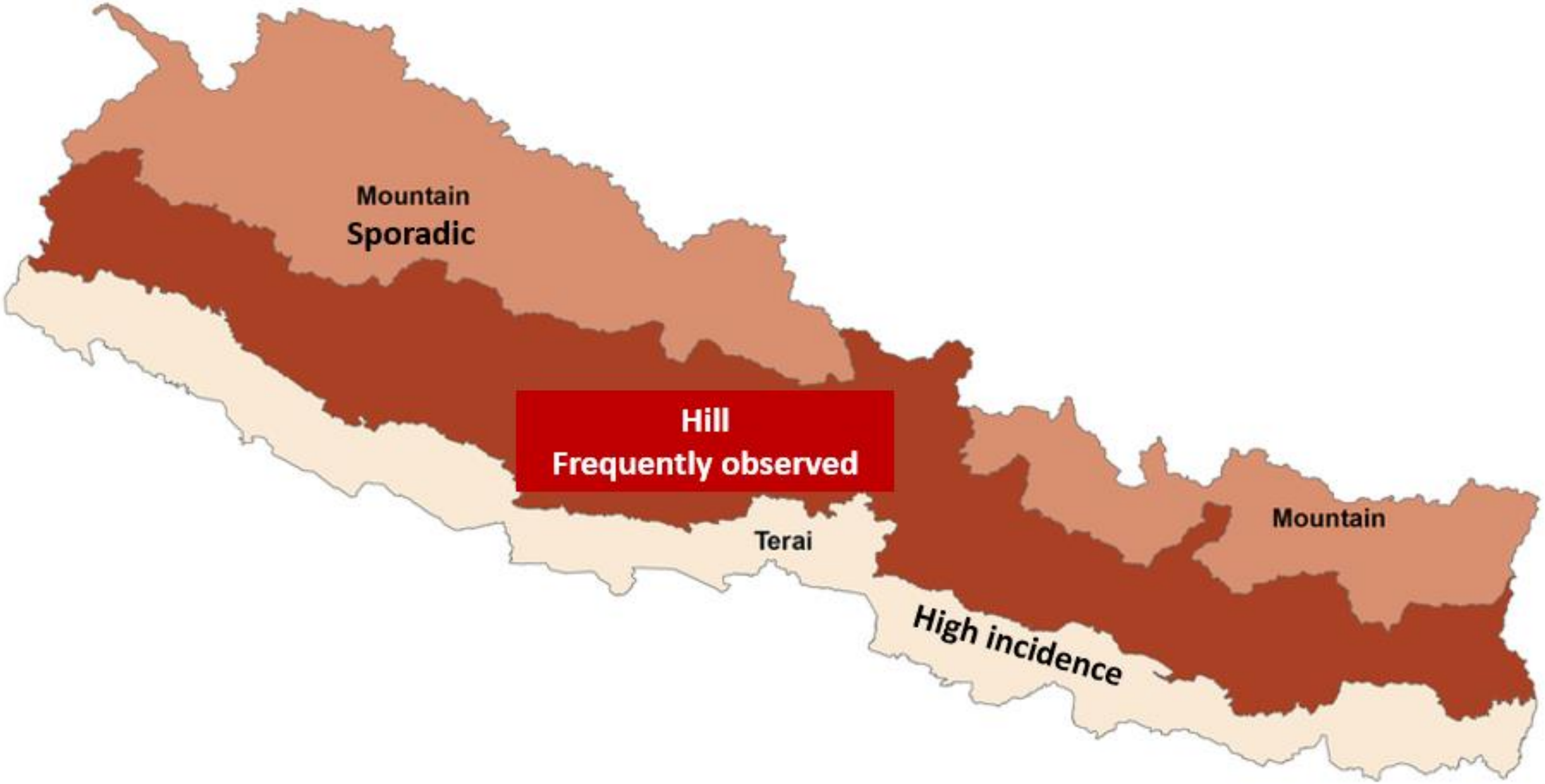
- Sero-prevalacne of BTD in domestic animal is 35.1 % (FMD and TADS lab 2022) and that in sheep and goat was 27.9% (Gaire et al.,2014).
- Bluetongue disease exists in the international border areas of Nepal and its prevalence was widespread among cattle, buffalo, sheep and goat however antigen is not detected yet.
- As vaccines against BT are not available in Nepal, antibodies detected indicated natural exposure to BTV infection.
- History of abortion and breed as factors significantly associated with the seropositivity of BTV.

Vector Borne Disease situations: Haemo-protozoan



- Out of 1928 sample 15.8 % were found to be positive for at least one blood parasites among them Babesiosis stand highest. (CVL,2023)

Vector Borne Disease Situations: Haemo-protozoans in three ecological zones



DLS Report, 2023

Detection capacity

Disease	Tests	Laboratory
LSD	Clinical Diagnosis, ELISA, PCR	Central Veterinary Laboratory
Blue Tongue	Rapid test, ELISA, PCR	FMD and TADS Laboratory
Haemo-Protozoan	Blood Smear, Hematology, ELISA	District Veterinary Hospital Regional Veterinary Laboratory Central Veterinary Laboratory Central Referral Veterinary Hospital

CVL Diagnostic Test Performed

Molecular Section

Avian Diseases
- AI (Subtype M gene, H5, H7, H9, N1, N2, N6, N8, N9)
- ND
- IBD

Swine Diseases
- PRRS- NA/EU
- ASF
- CSF
- Salmonella
- Erysipelas
- Nipah

Abortive Panel
- Brucella
- Coxiella
- Leptospira
- Listeria
- Campylobacter
- Cryptosporidium

Pox Panel
- LSDV
- Pseudo cow pox
- Bovine Papular Stomatitis
- ORF
- Goat pox
- Sheep Pox
- Cow pox

Small Ruminant Diseases
- PPR
- CCPP
- Pasteurella
- Capripox
- Enterotoxaemia

Equnie Disease
- Glanders

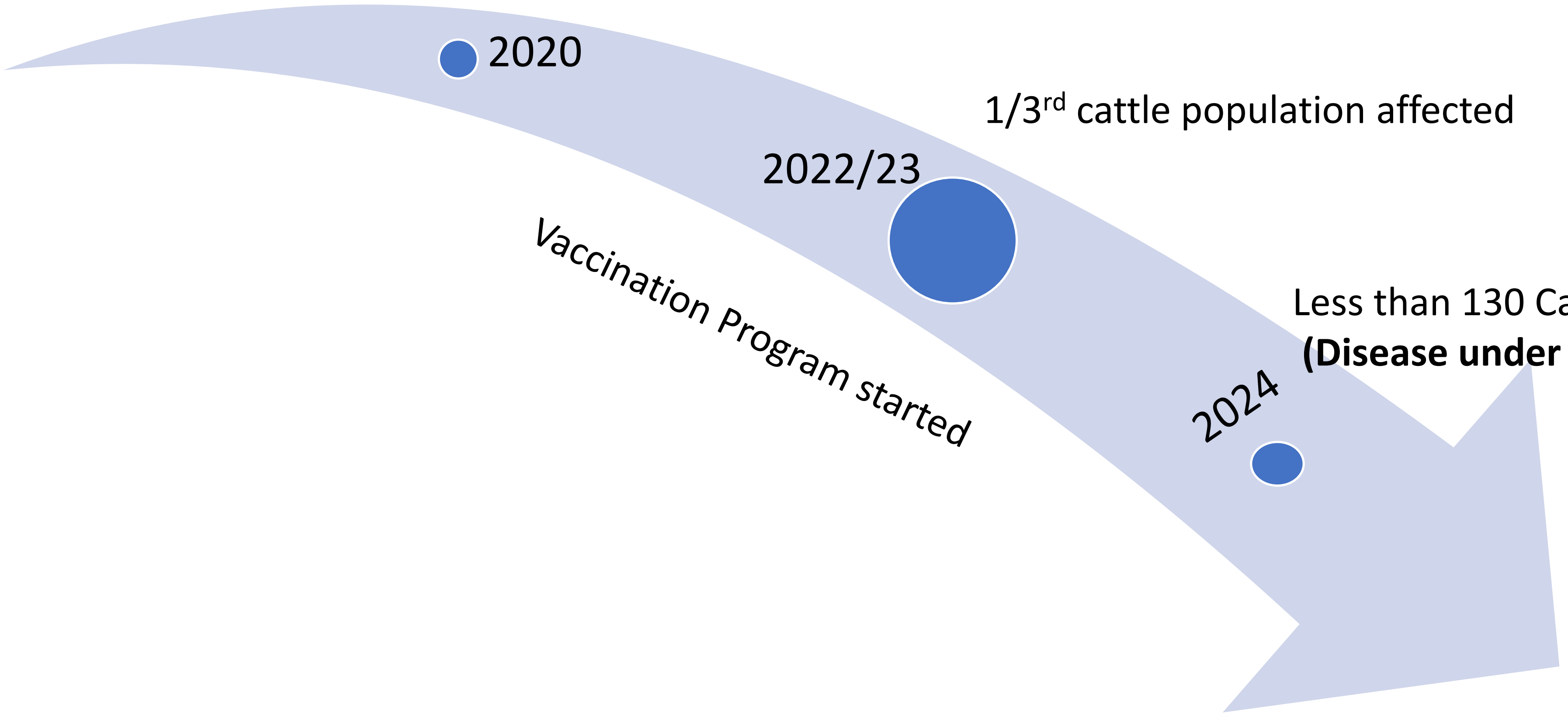
Large Ruminant
- LSD, HS

Others
- Rabies
- Anthrax
- Brucella

Response to Vector Borne Diseases

	Lumpy Skin disease	Blue Tongue	Haemo-protozoan
Surveillance (animal and vector surveillance)	Both active and Passive surveillances in cattle in place, Vector surveillance yet to be started	Only passive surveillance is in place, limited vector surveillance.	Only passive surveillance is in place, limited vector surveillance.
Responses and control	Sporadic outbreak in 2024	Endemic by Serology (Clinical condition Not diagnosed)	Endemic
Preventive measures to avoid introduction	Quarantine and Biosecurity, Movement Control	Quarantine and Biosecurity	Tick control program, Chemoprophylaxis
Vaccination	Free biannual vaccination (Imported)	Not in practice	Not in practice
Contingency plans available	No	No	No

Impact of the actions (LSD Vaccination with Neethling strain)



DLS Report, 2023

Impact of the Actions (Blue Tongue and Haemo-protozoans)

Disease	Action	Impact
Blue tongue	Active sero-surveillance, Awareness	Early Diagnosis and preventive measure applied
Haemo-protozoan	Diagnostic facility Tick control program	Loss mitigation of farmers due to early detection

Challenges in Implementation of VBD Surveillance Activities and Control Programmes

- Climate change and vector distribution, Nepal stand 5th on most vulnerable country on climate change.
- Emergence of Vector born TADs
- Landscape and weather on vector distribution: Not done till now in Nepal
- Limited capacity: Human resources, Funding and Infrastructure
- Inadequate institutional coordination and collaboration: Among three tiers of Government and among One Health stakeholders
- Limited cross-border collaboration for disease control.

Actions/ideas to overcome these challenges (Way forward)

- Intergovernmental Collaboration, Coordination and Communication
- Increased regional collaboration for the control of priority Vector Borne Diseases.
- Enlisting important vector born prioritize diseases and National disease control program.
- Vector surveillance in relation to climate change
- Introduction Of Vector Tolerance Breed
- Same vector share common room for transmission of human and animal disease. So control and surveillance of vector should be done jointly.
- Chemotherapy and chemoprophylaxis
- Lobbing to Increase funding and government focus on control and prevention of vector born animal disease.

Collaboration with other sectors under One Health approach

- Vector Control: Search and Destroy for larvae and fogging for adult mosquito: (Dengue) It might have also decrease the incidence of LSD, as the same vector is involved in the transmission.

Challenge and Possible Solutions to strengthen the Collaboration

Challenges	Possible Solutions
Poor Biosecurity	▪ Trainings and awareness programs
Inadequate institutional coordination and collaboration among three tiers of government (Federal, Provincial and Local) for control of Vectors	▪ Strong and harmonized coordination among national, federal, and local governments for vector surveillance from policy level (Guideline should be endorsed on time).
Inadequate Vector mapping/Surveillance System	▪ Strengthen quarantine system on open border with neighbors ▪ Vector surveillance in relation to climate change
Limited Capacity: lab capacity, sample flow and diagnostic ability, Human resources, Funding and Infrastructure	▪ Capacity enhancement through national and international collaboration. ▪ Increased regional collaboration for the control of priority VBD ▪ Political lobby for increased funding.
Climate Change	▪ Awareness activities, international coordination.

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Thank you

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Photo source: Minni Creations

World Organisation for Animal Health
Founded in 1924

中华人民共和国农业农村部
Ministry of Agriculture and Rural Affairs of the People's Republic of China

WOAH Regional Workshop on Vector Borne diseases in Asia and the Pacific

19-20 September 2024

Provisional Programme

DAY 1		
Time	Topic	Speaker
08:30 – 09:00	Registration of participants	WOAH RRAP
OPENING SESSION (MC: WOAH-Shohei + Kevin)		
09:00 – 09:30	Opening remarks by WOAH Opening remarks by Host Country	Dr Hirofumi Kugita, WOAH RRAP Dr Masatsugu Okita, Host Country
	Housekeeping & Introduction of participants	WOAH RRAP Shohei, All
09:30 – 09:40	***Group photo***	
09:40 – 09:50	Meeting introduction and objectives (inc. recap of previous meeting)	WOAH RRAP Shohei and ACDP Caitlin
Technical session I: Setting the scene - General Updates on Vector Borne Diseases **Chair: Dr Mika Haruna**		
09:50 – 10:10	WOAH standards related to VBDs: animal and vector surveillance	Dr Mauro Meske, WOAH HQ
10:10 – 10:50	Updates on recent trends of VBDs Globally and in Asia Pacific - VBDs reported to WOAH (2023-2024) - Arbovirus infections of livestock animals in Asia: what we know and don't know	Dr Mauro Meske, WOAH HQ Dr Tohru Yanase, NIAH, Japan
10:50 – 11:00	Q&A time	
11:00 – 11:20	***Refreshments break***	
Technical Session II: Updates on selected VBD of regional importance – distribution, surveillance and diagnosis **Chair: Dr Paul Bingham (NZ) and Dr Ichwan Yuniarto (Indonesia) (TBC)** (*) Remote, (**) Pre-recorded		
11:20 – 11:35	Bluetongue (BT)	Dr Stacey Lynch, ACDP
11:35 - 11:50	Epizootic hemorrhagic disease (EHD) (Emergence of orbiviruses in Europe over the last 25 years and management consequences)	Dr Stéphan Zientara(**), ANSES, France
11:50 - 12:05	Lumpy Skin Disease (LSD)	Dr Antoinette Van Schalkwyk(*), Onderstepoort Veterinary Institute, South Africa
12:05 – 12:20	Bovine Babesiosis	Dr Thillaiampalam Sivakumar(*), Obihiro University, Japan
12:20 – 12:30	Q&A time	
12:30 – 13:30	***Lunch***	
13:30 – 13:45	Japanese Encephalitis	Dr Dong-Kun Yang, APQA, RO Korea
13:45 – 14:00	West Nile Fever	Dr Federica Monaco(*), IZS Teramo, Italy
14:00 – 14:15	Leishmaniosis	Dr Fabrizio Vitale(**), IZSSi, Italy
14:15 – 14:30	Q&A time	
14:30 – 15:00	***Tea/coffee break***	

Technical session III: Members report; situational updates and experiences on VBD control Chair: Dr Stacey Lynch (Expert), Karma (TBC)		
15:00 – 15:10	Summary from pre-meeting questionnaire	WOAH Interns
15:10 – 16:10	Presentation on experiences of Members (15 min) • Nepal (Dr Arjun Aryal) • Thailand (Dr Peerada Siriwatcharawong) • Bhutan (Dr Rinzin Pem) • New Caledonia (Dr Lussiez Coralie)	Member representatives
16:10 – 17:30	Q&A and interactive discussion using Mentimeter	
17:30	End of Day 1	
18:00 – 20:00	***Dinner hosted by WOAH***	

DAY 2		
Time	Topic	Speaker
09:00 – 09:10	Summary from Day 1 (including housekeeping)	WOAH Intern
Technical session IV: VBDs and One Health **Chair: Dr Dong-Kun Yang (Expert) and Dr Sumathy Puvanendiran (Sri Lanka) (TBC)**		
09:10 – 09:30	Zoonotic and human related diseases and their control	Dr Ken Maeda National Institute of Infectious Diseases, Japan
09:30 – 09:50	Climate change, wildlife and zoonoses	Drs Kouichi Goka & Manabu Onuma, National Institute for Environmental Studies, Japan
09:50 - 10:10	Vector-Borne Diseases and One Health: Perspectives from Vector Surveillance and Transmission Competence	Dr Astri Nur Faizah, National Institute of Infectious Diseases, Japan
10:10 – 10 30	Mosquito-borne zoonoses vector surveillance and control	Dr Stephan Karl, James Cook University, Australia
10:30 – 10 50	Q&A time	
10:50 – 11:10	***Tea/coffee break***	
Technical session V: Members report; VBDs control under One Health **Chair: Dr Stephan Karl (Expert) and Dr Bhushan Tyagi (India) (TBC)**		
11:10 – 12:10	Presentation on experiences of Members (15 min x 4 selected Members) • Australia (Dr Michele Byers) • Pakistan (Dr Farhan Ahmad Atif) • Korea RO (Dr Roh In-Soon) • Cambodia (Dr Ren Theary)	Members representatives
12:10 – 12:30	Q&A time	
12:30 – 13:30	***Lunch***	
13:30-14:30	**Small group exercises – To develop and strengthen One Health coordination in the country / territory for VBD** eg: (i) Key partners and stakeholders for One Health coordination (ii) Challenges and gaps for better One Health coordination (iii) Opportunities and solutions / way forward	Facilitators: Caitlin (Main) Mauro, Karma, Jacqueline, Joy, Maho
14:30-15:00	Each group to present discussion points	
15:00-15:30	***Tea/coffee break***	

Technical session VI: Regional priorities and objectives Facilitator: Caitlin Holley		
15:30 – 16:30	**<u>World Cafe on setting regional priorities and goals</u>** (i) What priority issues exist for controlling VBDs in the region? eg: – trade, clinical disease, zoonotic/human health? (ii) How to develop the lab capacity for surveillance and diagnosis? (iii) How to coordinate at the regional level better – among members and with different sectors? (iv) How to implement Vector surveillance and control better - role of animal health sector?	(i) Dr Münstermann, Karma, (ii) Dr Lynch, Dr Yang, Maho (iii) Dr Astri Nur Faizah, Joy (iv) Dr Stephan Karl, Jacqueline
16:30 – 17:00	Summary of world cafe	Each station facilitators
Summary and conclusions **Chair: Dr Hirofumi Kugita, WOAH RRAP**		
17:00-17:20	Summary of workshop Workshop evaluation	WOAH Intern
17:20-17:30	Closing remarks	WOAH

Member experience on prevention and control for Vector Borne Disease [New Caledonia]

DVM Coralie LUSSIEZ

Head of the biosecurity department of the Veterinary, Food and Phytosanitary Service (SIVAP)
Direction of Veterinary, Food and Rural Affairs (DAVAR)
WOAH Delegate

19 – 20 September 2024

Tokyo, Japan

World Organisation for Animal Health
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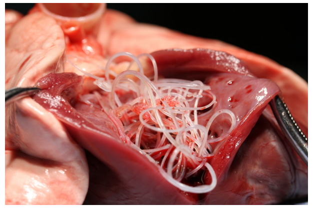
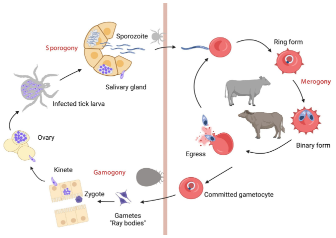
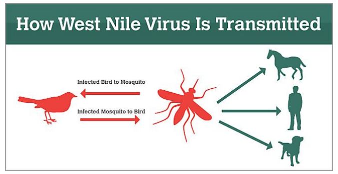
Vector Borne Disease situations



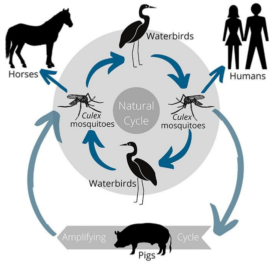
- Brief descriptions of the Vector Borne Disease situations which your country / territory is concerned about



  - __Animal health__ :
    - **Dirofilariasis** (*Dirofilaria immitis*) very important disease for dogs (less for cats) (estimated prevalence : 60%). Each dog has to receive a prevention treatment each year and if not, the mortality rate within 3 to 7 years is high. It is also a zoonotic disease, but very few human cases.
    - **Bovine babesiosis** (*Babesia bovis*) introduction in 2007 with an import of vaccinated bovines (certification mistake). Eradication program which allowed to recover a free status for all the country except one specific zone where the access to the animal is very complicated due to customary land issues. Maintenance of sanitary police measures and surveillance to prevent the spread of disease.



  - __Human health__ :
    - **Dengue virus** present since a long time with a prevalence of 10% and several hospitalization cases or mortality. But thanks to the introduction of the bacteria *wholbachia* in 2019, it has almost disappeared (no more epidemic), with only few imported cases.
    - New Caledonia is free from **West-Nile virus** and **Japanese encephalitis virus** but health authorities are worried about these disease and surveillance is implemented



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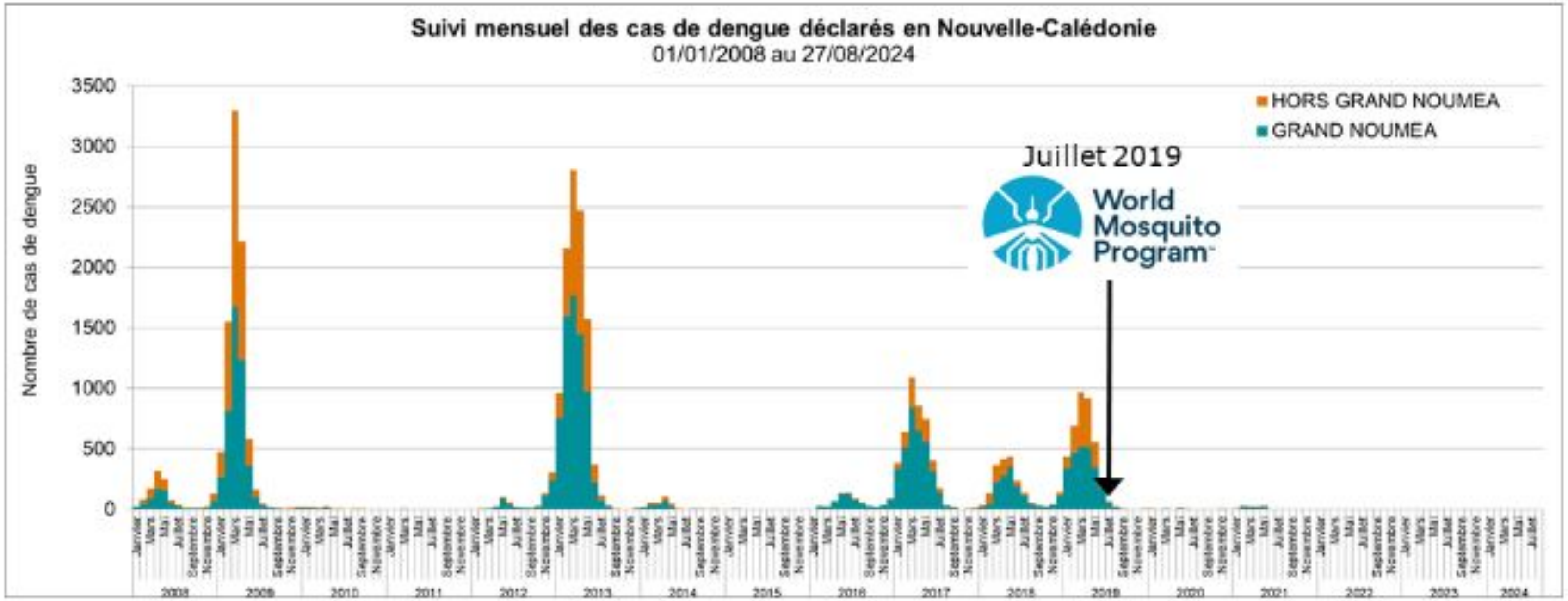
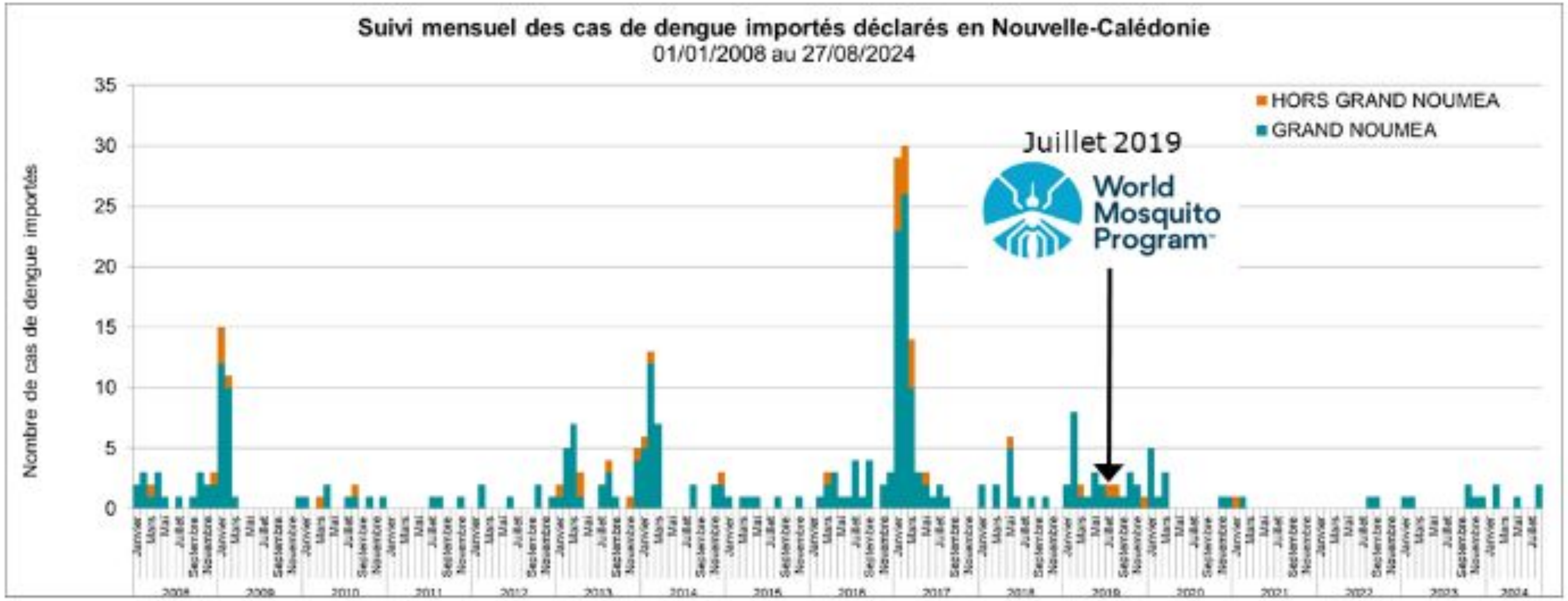
Re

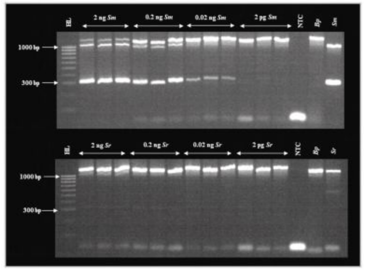

BABESIOSE BOVINE 2008
Répartition des zones
de Séquestration et de Protection
N


Suivi mensuel des cas de dengue déclarés en Nouvelle-Calédonie
01/01/2008 au 27/08/2024
Nombre de cas de dengue
HORS GRAND NOUMEA
GRAND NOUMEA
Juillet 2019
World Mosquito Program


Suivi mensuel des cas de dengue importés déclarés en Nouvelle-Calédonie
01/01/2008 au 27/08/2024
Nombre de cas de dengue importés
HORS GRAND NOUMEA
GRAND NOUMEA
Juillet 2019
World Mosquito Program

Detection capacity

- A brief description of surveillance and laboratory diagnosis capacity for Vector Borne Diseases
  - Surveillance, diagnostic capacity and type of diagnostic tests :
    - **Animal health** :
      - **Dirofilariasis** : no specific surveillance, only testing on unmonitored animals to see if preventive treatment can be implemented. Rapid serological test (snap tests) realized directly by the vet.
      - **Bovine babesiosis :** Notifiable disease with specific surveillance, especially in the contaminated area with blood samples of all the registered animals every months + passive surveillance on all the country. Serology ELISA and quantitative PCR (public vet laboratory) on blood or brain.
    - **Human health** :
      - **Dengue virus :** notifiable disease. Monitoring of dengue-like syndromes through the New Caledonia sentinel network and Notification of suspected cases through the mandatory reporting form. Serology ELISA or RT-PCR following the clinical history (human laboratory of the public hospital) on blood, urine, cerebrospinal fluid…
      - **West-Nile virus and Japanese encephalitis virus :** Test for potentially suspicious human cases but difficult because often asymptomatic or mild symptoms. Vector monitoring in areas identified as at risk (migratory birds...) with biomolecular tests. Survey in animal health. Serology ELISA at the public vet laboratory (careful with some false WNV positives on horses with dengue or zika antibodies), possible molecular xenomonitoring MX on vectors, but not routinely (budget).



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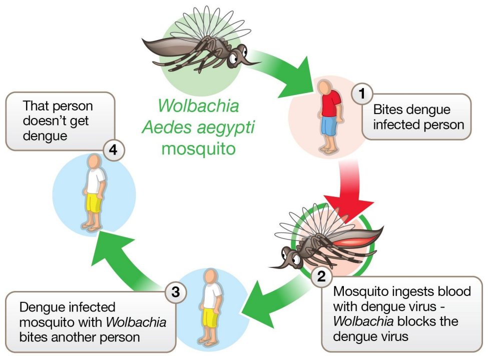
Response to Vector Borne Diseases



- A brief actions such as:
  - **Surveillance (animal and vector surveillance) :**
    - trapping and identification of mosquitoes or other vectors on specific sites like entry point (port and airport for example). Possible molecular xenomonitoring (MX) on specific actions.
    - Investigation of all outbreaks in the animal population thanks to the private vet network and identification of vectors if new one are detected on animals (like ticks)
  - **Responses and control**
    - Prevention treatments for dogs
    - Mosquito repellent spraying until 2020 during the resurgence period
    - Introduction of wolbachia bacteria in mosquitoes
    - Ticks treatments on bovines, killing if a new case of bovine babesiosis is detected, sanitary police measures (with isolation, killing and/or treatments) if a new VBD is detected
  - **Preventive measures to avoid introduction**
    - imposed insecticide treatments for imports of at risk live plants, systematic treatment of planes
    - Specific import conditions for concerned live animals
    - Quarantine station
  - **Vaccination (if applicable)**
    - not applicable for the concerned disease
  - **Contingency plans :** general one is available

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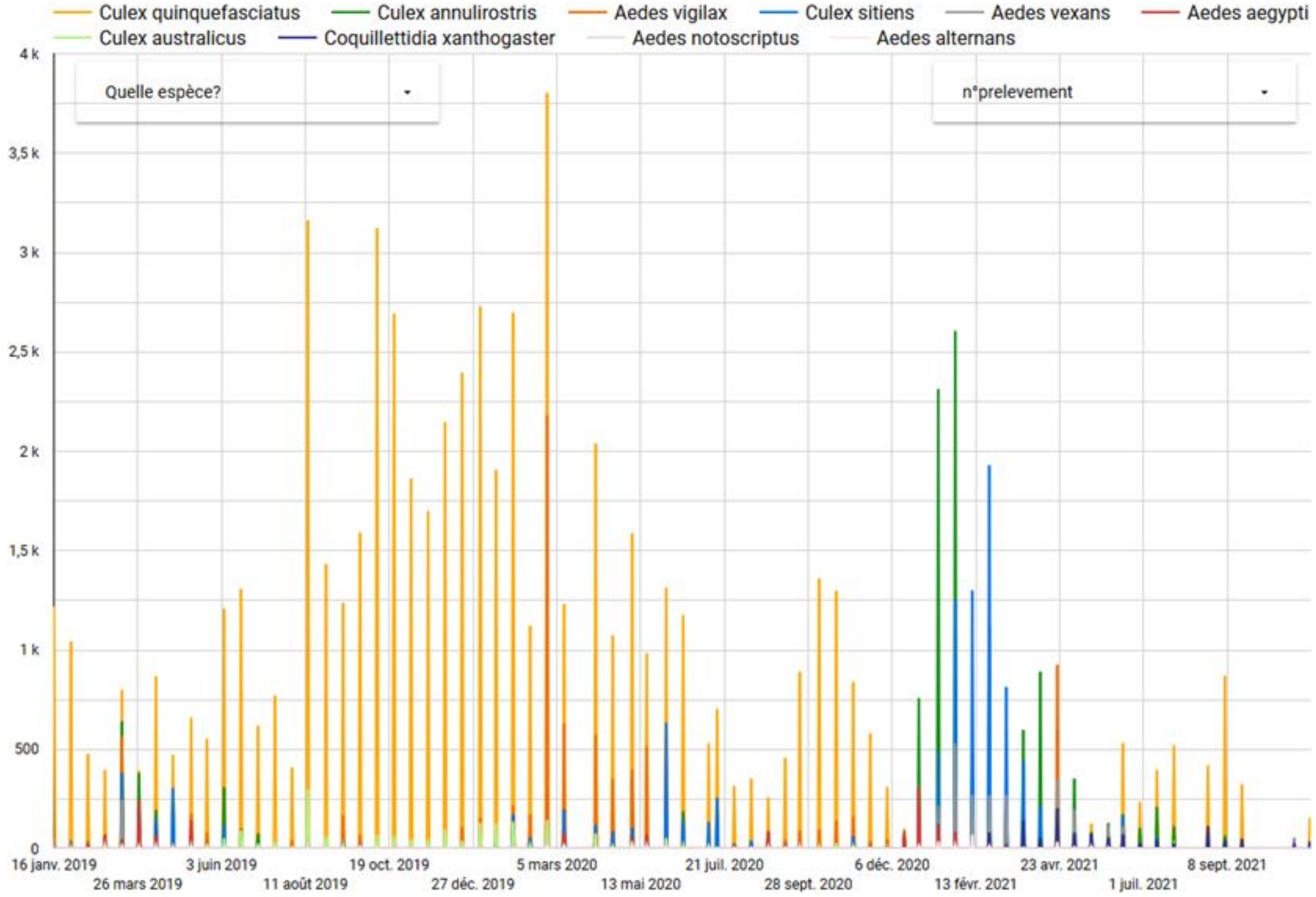

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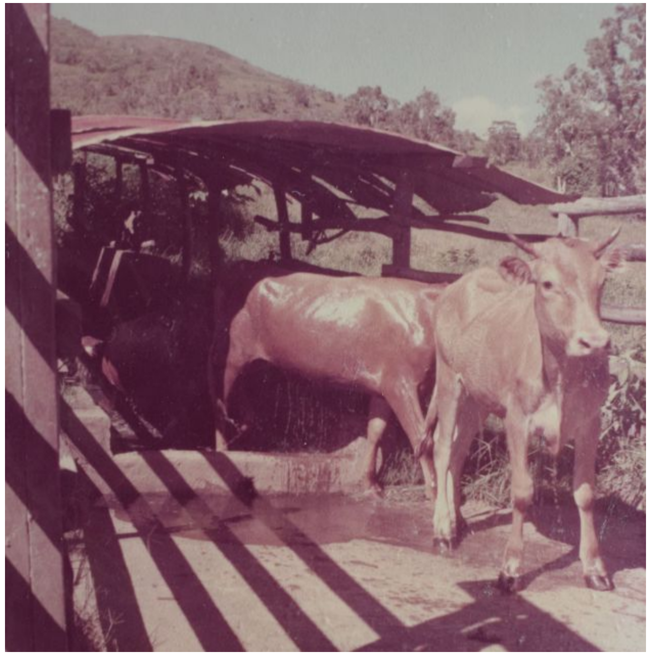
Impact of the actions

- A brief description of the impact of risk mitigation measures implemented to prevent and control Vector Borne Diseases

  - Example of wolbachia bacteria for dengue
  - Example of bovine babesiosis gestion with imidocarb and acaricides
  - Example of canine dirofiliariasis with preventive treatment



Challenge and possible solutions

A brief description of challenges in implementation of VBD surveillance activities and control programmes and your actions/ideas to overcome these challenges

- **Dirofilariasis** : problem of the marketing authorization respect, follow-up of the treatment by the owners, all the stray dogs without treatment… → awareness campaign for vets and owners
- **Bovine babesiosis :** Access difficulties to customary lands with feral cattle → political support of the veterinary services (awareness campaign)
- **Vector surveillance (principaly mosquitoes) :**
  - difficult accessing areas
  - Seasonal fluctuations of mosquitoes populations, requiring long-term monitoring
  - Heterogeneous distribution of mosquitoes populations
  - data exploitation
  - Lack of human and financial resources → political support of the veterinary services (awareness campaign)

Collaboration with other sectors under One Health approach

- Brief description of collaboration experience with other sectors to prevent or control Vector Borne Disease (If any)

  - One health network in place with information sharing about literature monitoring
  - Integrating some human VBDs in animal health survey
  - Coordination with research organisms to work on adapted surveillance programs
  - Co-writing of contingency plans

Challenge and possible solutions to strengthen the collaboration

- A brief description of challenges to strengthen the collaboration with other sectors and your actions/ideas to overcome these challenges

- Formalization of the New-Caledonia one health network with monthly meeting
- More information sharing
- More shared zoonoses simulation exercises
- Pooling resources in entomology
- Develop molecular xenomonitoring for vector surveillance with specific traps
- National bridging workshop with WOAH
- Organizing WOAH zoonoses workshops with animal and human health sectors

Thank you

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Expectations for the VBDs workshop (Not Included in the Presentation)

- Please share your expectations for the VBDs workshop
- What specific information about VBDs you expect to obtain from experts
- What disease experience you expect to gain from member countries/territories

Improve VBDs surveillance through animal health

Obtain more information about possible collaboration with human health sector and research

Develop environmental surveillance

Improve vector knowledge and vector control

Regional workshop on Vector Borne Disease for Asia and the Pacific 2024

TOWARDS ONE HEALTH PARADIGM FOR THE CONTROL OF CRIMEAN-CONGO HEMORRHAGIC FEVER IN PAKISTAN

19–20 September, 2024
Tokyo, Japan

DR. FARHAN AHMAD ATIF
Associate Professor (Medicine)
Officer Incharge, Deptt. of Clinical Sciences
College of Veterinary and Animal Sciences, Jhang;
University of Veterinary and Animal Sciences, Lahore;
Pakistan

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Vector-borne diseases (VBDs)

- Approximately 80% population of the world is at risk of acquiring one or more VBDs (WHO, 2024)

- One million deaths occur each year, worldwide (WHO, 2014)

- Climate Change: (Yasmeen et al., 2022)

▪ Global warming
▪ Increased temperature
▪ Increased humidity levels
▪ The above mentioned climatic factors are contributing for the increase of VBDs

PAKISTAN

- Livestock is the principal subsector of agriculture, contribute 60.84% to agriculture.
- Livestock contribute 14.63% to the national gross domestic product (GDP) of Pakistan.
- Over eight million village families are associated with livestock production, deriving 35-40% income from Livestock.

Photo Source: www.getwallpapers. com; Economic survey of Pakistan (2023-24) worldometers.info/world-population/

TOP 20 LARGEST COUNTRIES BY POPULATION (LIVE)

1	India	1,453,185,511
2	China	1,418,757,521
3	U.S.A.	345,748,800
4	Indonesia	283,876,681
5	Pakistan	251,954,605
6	Nigeria	233,518,970
7	Brazil	212,140,472
8	Bangladesh	173,931,521
9	Russia	144,676,355
10	Ethiopia	132,649,414
11	Mexico	131,049,995
12	Japan	123,639,359
13	Egypt	116,855,398
14	Philippines	116,007,851
15	D.R. Congo	109,889,123
16	Vietnam	101,094,095
17	Iran	91,715,602
18	Turkey	87,510,725
19	Germany	84,468,717
20	Thailand	71,659,600

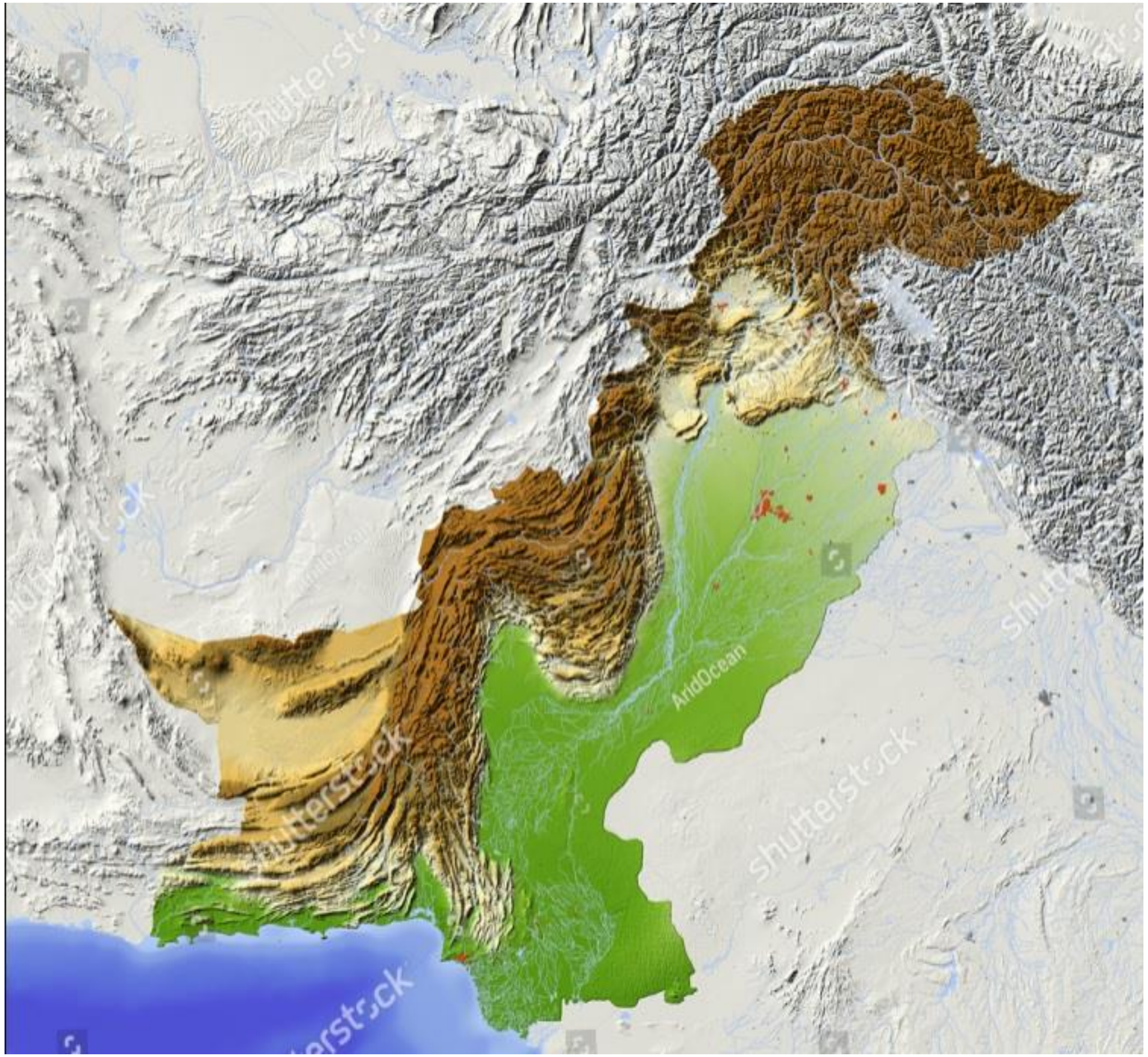
Source: https://www.worldometers.info/world-population/

Global ranking:

- **2nd** buffalo producer
- **3rd** largest goat meat producer
- **4th** largest rice (Basmati) exporter
- **4th** Irrigated land area
- **5th** largest milk producer
- **5th** Populous country

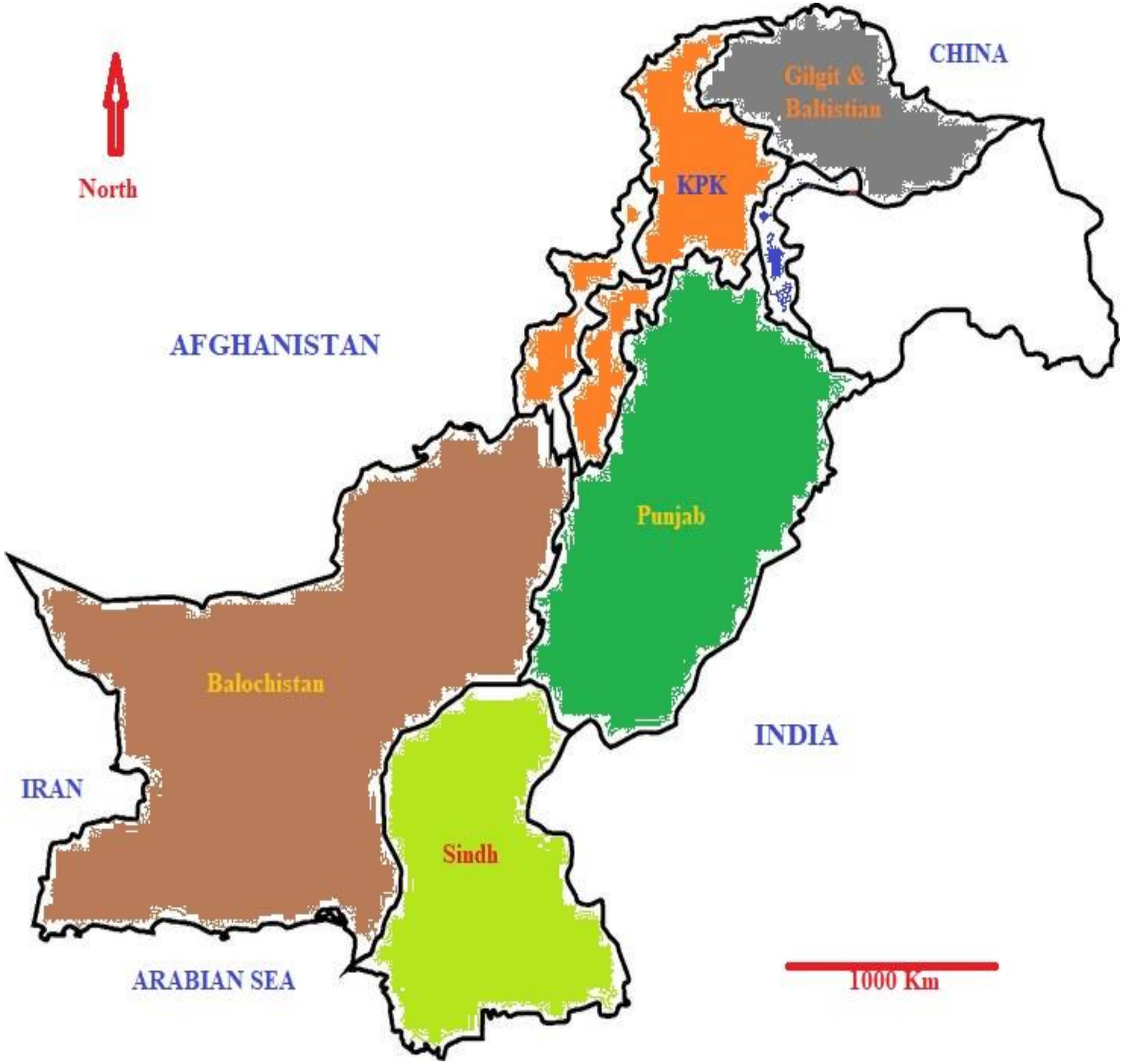
- **33rd** Largest country

(Worldmeters, Wikipedia and FAO; Photo source: https://www.dreamstime.com/



Zoonotic diseases in Pakistan

- Salmonellosis
- Rabies
- Anthrax
- *E. coli*
- Hepatitis E
- Leptospirosis
- Brucellosis
- Bovine TB
- Plague
- Glanders
- (CDC 2017; Yasmeen et al., 2022)



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Vector-Borne Diseases in Pakistan

- Dengue
- Chikungunya
- Malaria
- Crimean-Congo hemorrhagic fever (CCHF)
- Leishmaniasis
- West Nile Virus
- Rift Valley Fever
- (CDC 2017; NIH, 2020; Yasmeen et al., 2022)

Vector-borne diseases of animals in Pakistan

- Anaplasmosis
- Babesiosis
- Theileriosis
- Surra (*Trypanosoma evansi*)
- Lumpy Skin Disease (LSD)
- Blue Tongue

Crimean-Congo Hemorrhagic Fever (CCHF)

- Order: Bunyavirales
- Family: Nairoviridae
- Genus: *Orthonairovirus*
- CCHF virus (Bente et al., 2013).

- *Hyalomma* spp. are reservoir as well as main vector (Bente et al., 2013).

- *Hyalomma marginatum* is the most efficient vector (Maltezou et al., 2010).

- Mild CCHFV infections can be **asymptomatic (88%),** however severe infections are potentially life threatening (Formentry 2019; Frank et al., 2024).

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Photo Source: https://www.aopnews.com/wp-content/uploads/2019/08/tick.jpg

Global distribution of CCHF

- Most widespread tick-borne disease
- 10,000-15,000 cases/year

(Formenty, 2019)

- WHO notifiable disease
- Eastern and Southern Europe
- Mediterranean
- Northwestern China
- Central Asia
- Africa
- Middle East
- South Asia

(Hawman and Feldmann, 2023).

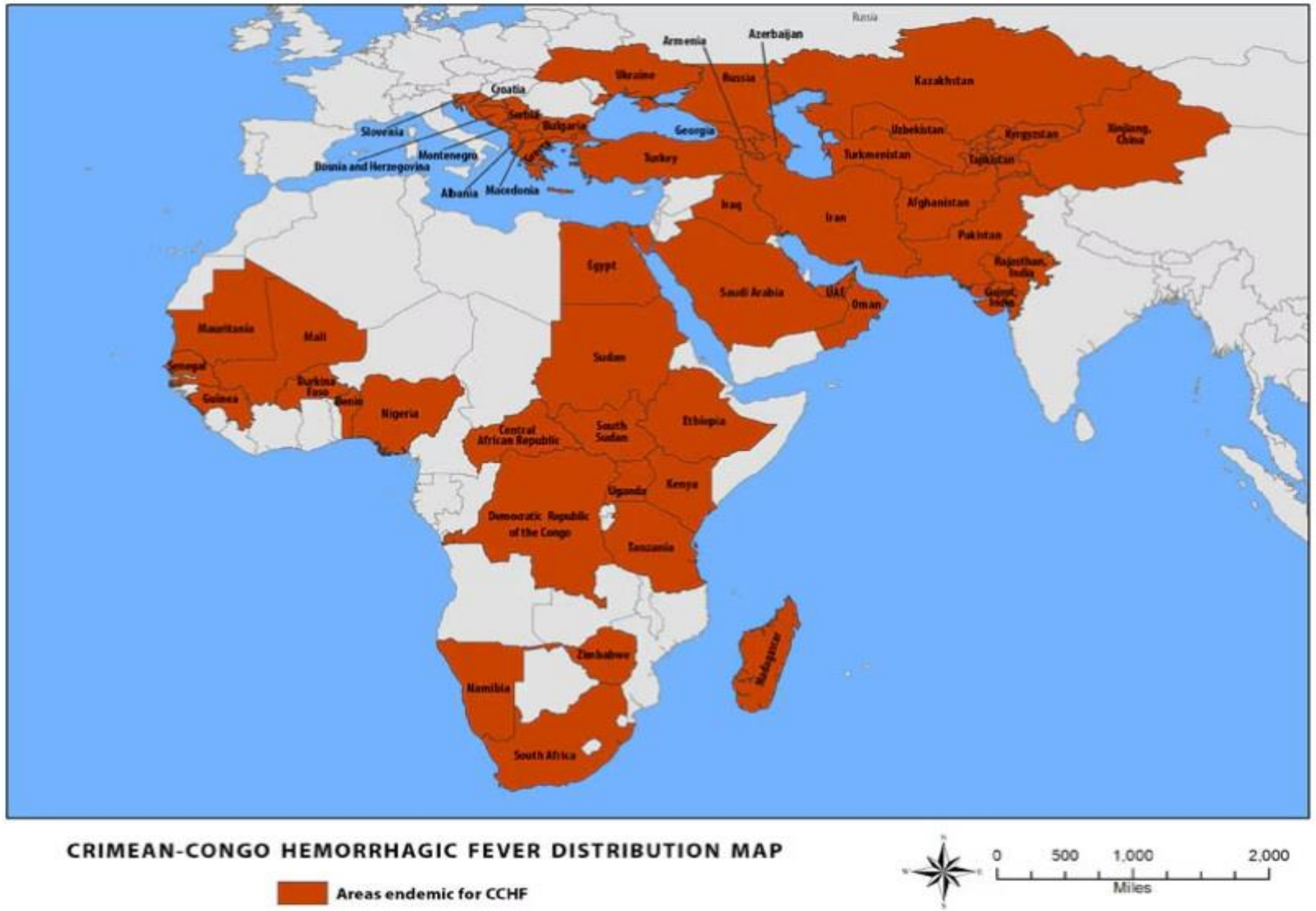

Photo source: Centers for Disease Control and Prevention

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Source: www.guideoftheworld.com

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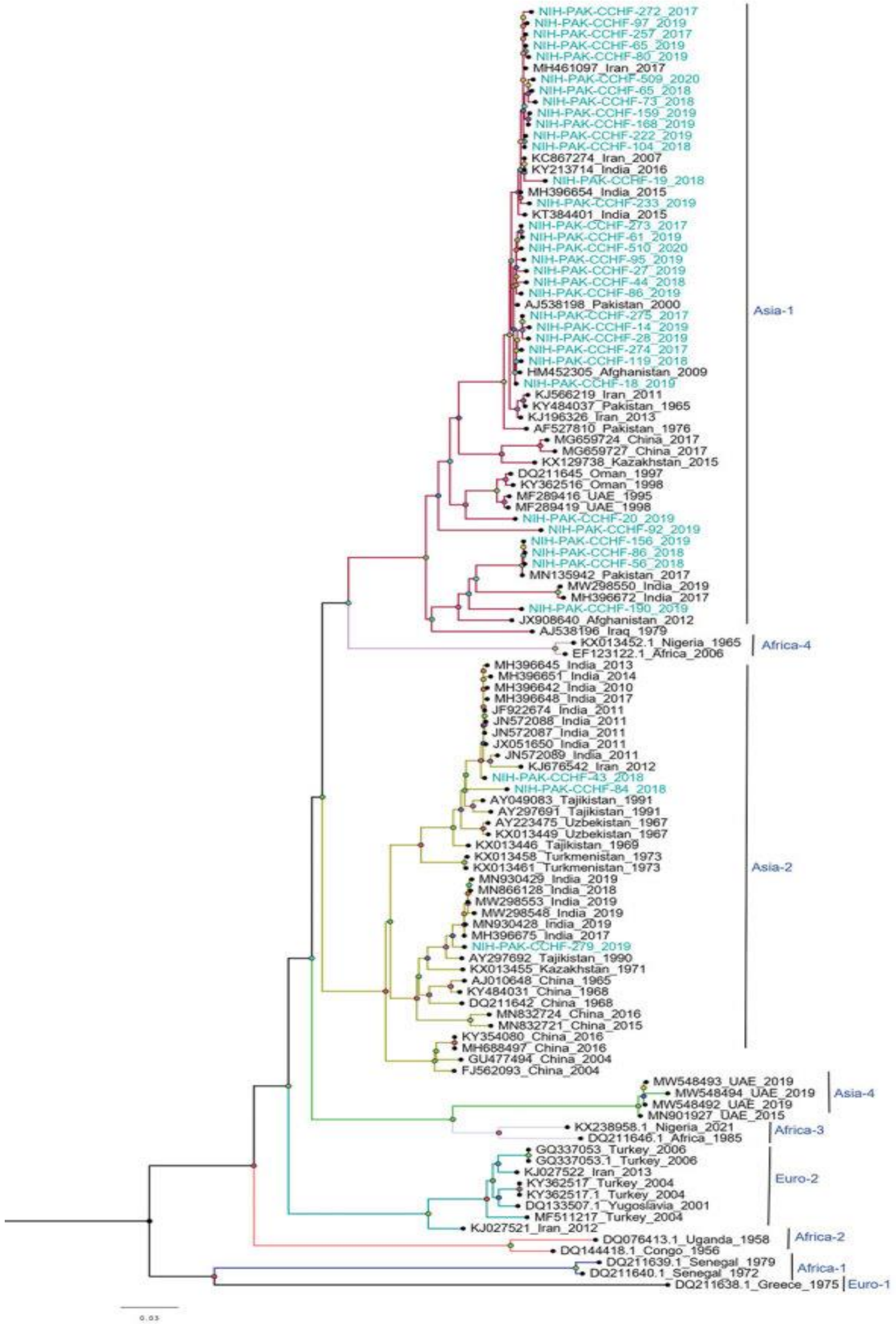
History

- **1100-1200** -- (early 12^{th} century), noticed in countries of Tajikistan and Uzbekistan
- **1944** – World War-II, Soviet Union soldier (about n=200) develop hemorrhagic fever in Crimean Peninsula, called as Crimean Hemorrhagic Fever
- **1956** -- Congo hemorrhagic fever virus (Democratic Republic of the Congo)
- **1967** -- Serologically indistinguishable
- **1970** -- Crimean-Congo hemorrhagic fever (CCHF)

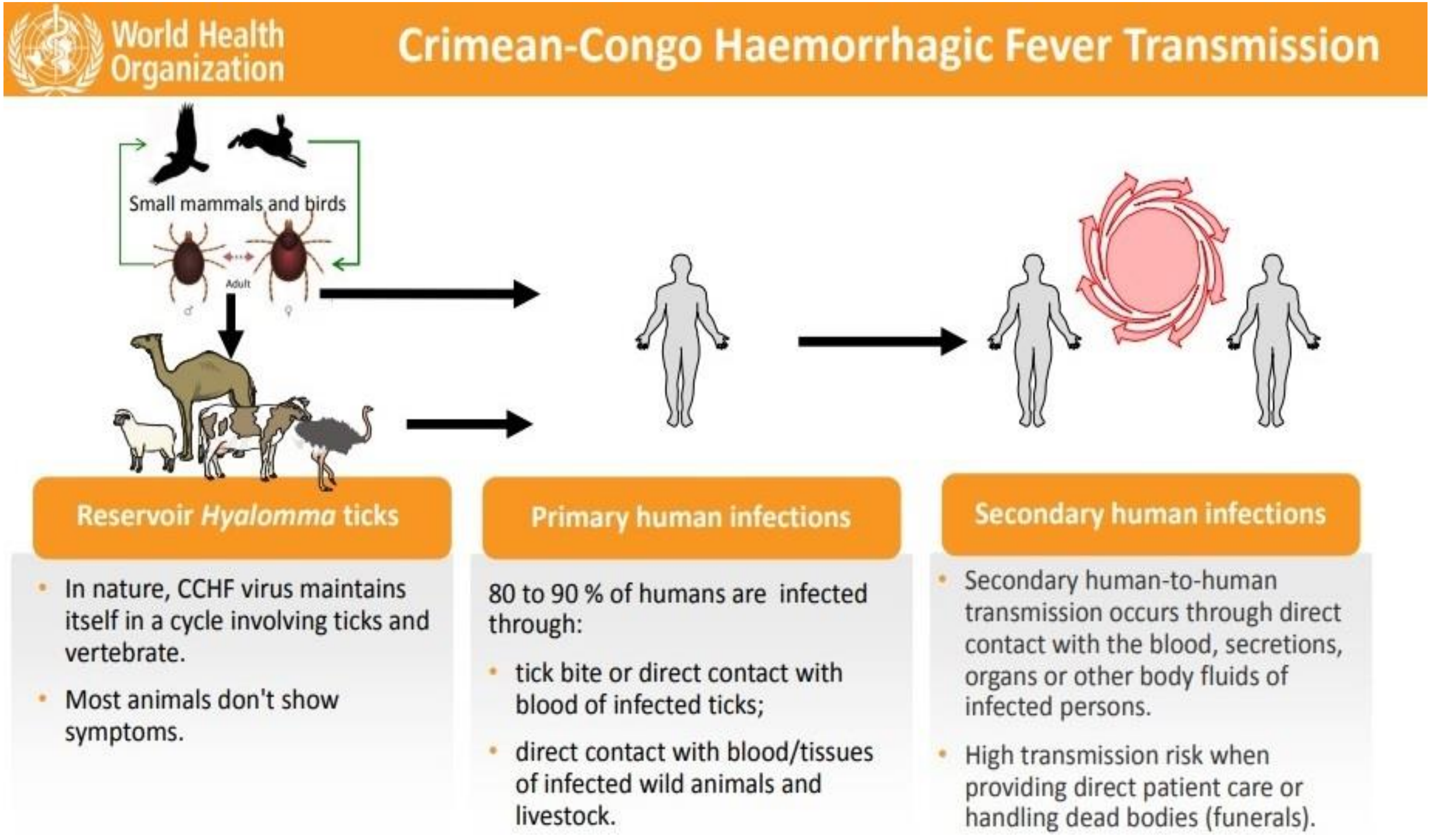
(Whitehouse 2004; Hoogstraal et al., 1979).

CCHF

- Negative sense RNA virus
- Segmented genome
  - Small (S) segments
  - – Responsible for regional diversity
  - Medium (M) segments
  - Large (L) segments
- Clade-I: Africa 1–3
- Clade-II: Asia 1 and 2
- Clade-III: Europe 1 and 2
- Clade-IV: Asia 1 and 2 (Pakistan)
- Clade-V (Europe 1)
- Clade-VI (Europe 2)



(Chinikar et al., 2013; Di Nardo et al., 2001 ; Phylogenetic tree (Umair et al., 2024).



Source: Formenty P. Introduction to Crimean-Congo haemorrhagic fever. 2019 . https://cdn.who.int

Transmission

- Detected in most of the patients with the history of tick bite (60 to 69%) (Bakir et al., 2005).
- The majority of cases --- people involved in livestock industry (Umair et al., 2024)

Human-to-human:

✓Close contact

✓Infected blood, secretions and organs

✓Bodily fluids of infected individual (Formenty et al., 2019)

Hospital-acquired infections (Nosocomial):

(i) Improper sterilization of equipment (ii) reuse of needles

(iii) needle prick (iv) contamination of medical supplies

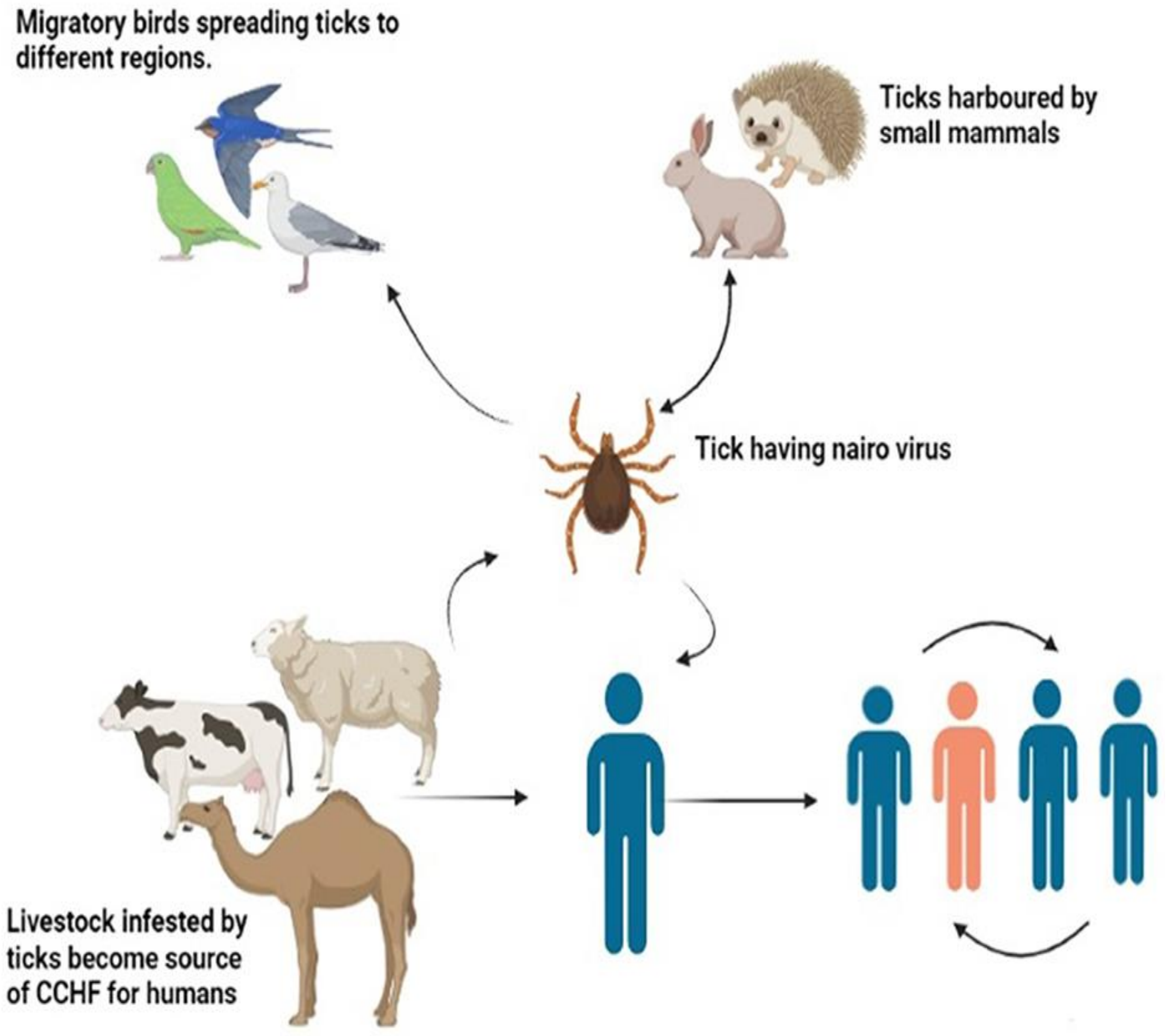
(Pshenichnaya et al., 2015; Tsergouli et al., 2020; Gaina et al., 2023)

Transmission

- Ticks become life infected (Papa et al., 2015).
- Transstadial (Turell et al, 2020)
- Transovarial (Bhowmick et al., 2022)
- Co-feeding transmission
- Male ticks change hosts to seek female ticks

- The hemorrhagic phase: a high risk for accidental infection

(Turell et al, 2020 ; Aslam et al., 2023)



[Photo source: Aslam et al., 2023]

Epidemiology

- Vertebrates are the amplifying hosts (Mohamed et al., 2008)

- The *Argasid* (soft ticks) are not the vectors (vertically or horizontally) (Papa et al., 2015).

- Mortality in humans is 3-30% (Ergönü, 2006)

- The case/ fatality in humans (up to 40%) (WHO, 2022)

- 1 out of 8 develop a severe form of the disease (NIAID, 2024).

Scenario in Pakistan

- 1976: Detected in 1976 at Rawalpindi Hospital, Pakistan (Burney et al., 1980)
- 356 cases in Pakistan (Alam et al., 2013).

Sr. No.	Province	Prevalence
1	Balochistan	38%
2	Punjab	23%
3	Khyber Pakhtunkhwa (KPK)	19%
4	Sindh	14%
5	capital city Islamabad	6%

Epidemiology of CCHF in Pakistan

Vector seasons is linked to Vector-borne diseases

Higher CCHF incidence in vector season in Pakistan

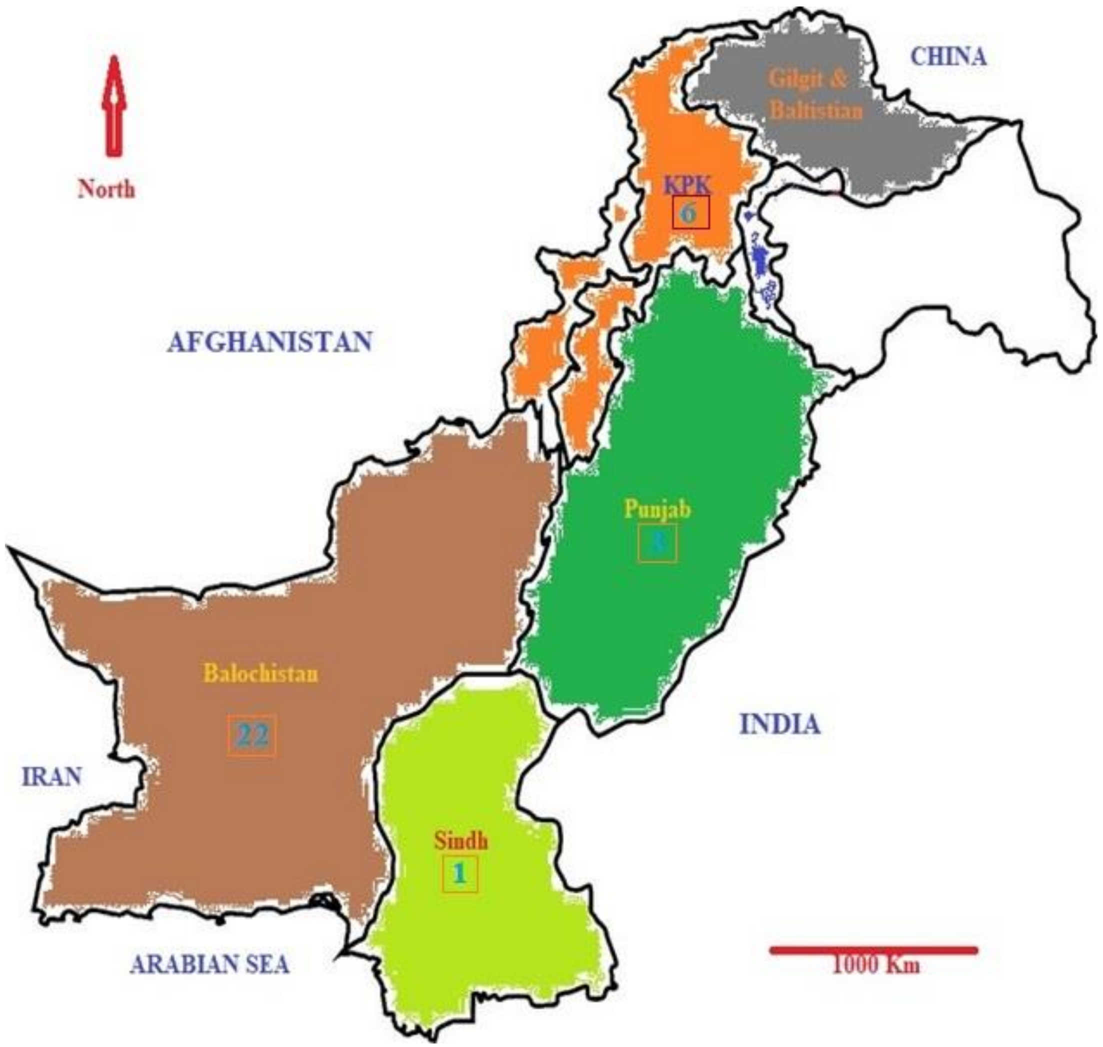
March to May

August to October (NIH, 2016).

- Male (82%) and female (18%)
- Case fatality rate (CFR) **~35%**

(Umair et al., 2024)

CCHF Scenario in Pakistan (2024)



CCHF surveillance

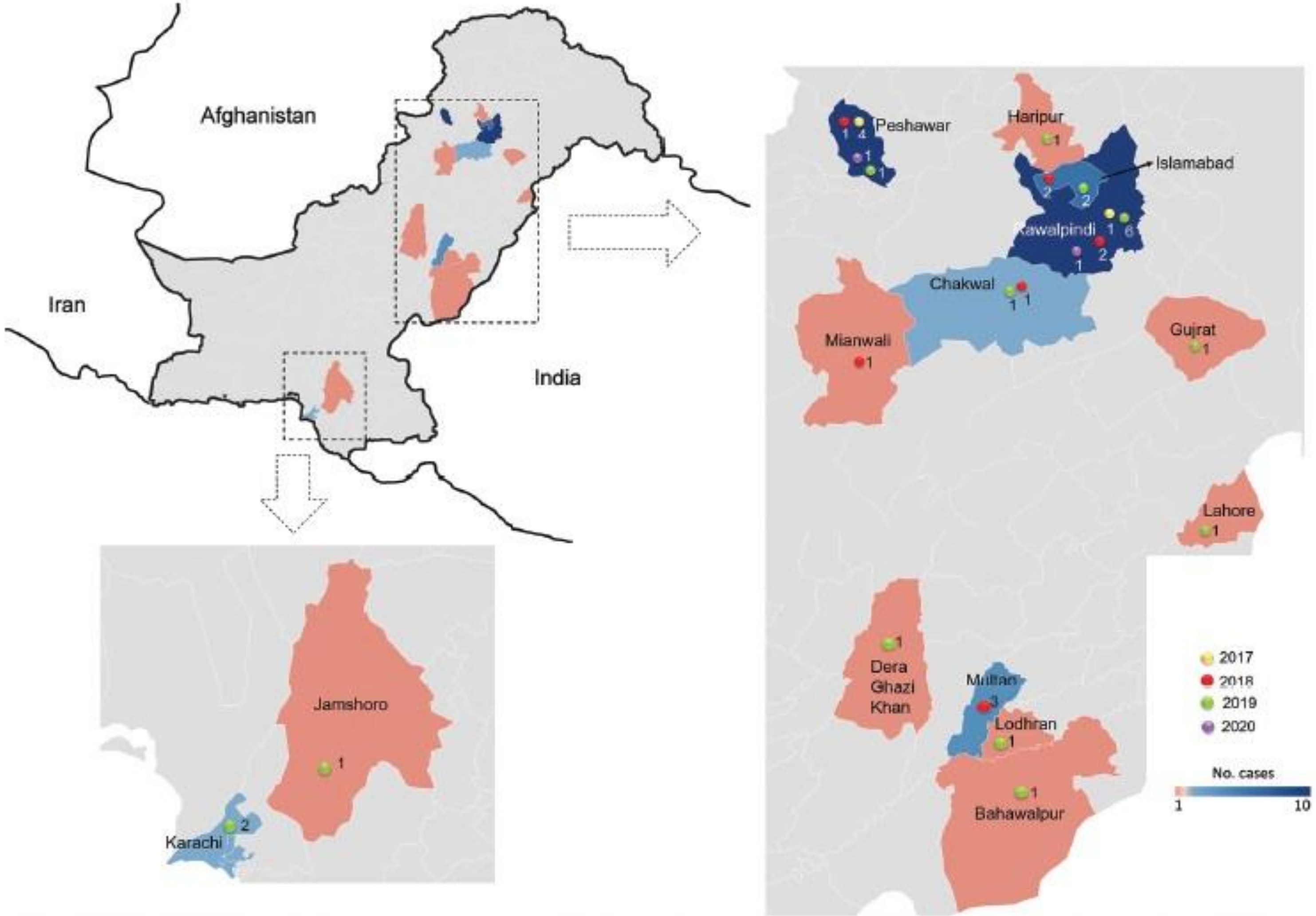


Figure 1. Locations of Crimean-Congo hemorrhagic fever cases in study of virus diversity and reassortment, Pakistan, 2017–2020. Main maps indicate the 2 regions in Pakistan with positive cases. Shading indicates provinces that had 1–10 cases. Inset map shows Pakistan and borders with Afghanistan, India, and Iran.

Umair et al., 2024

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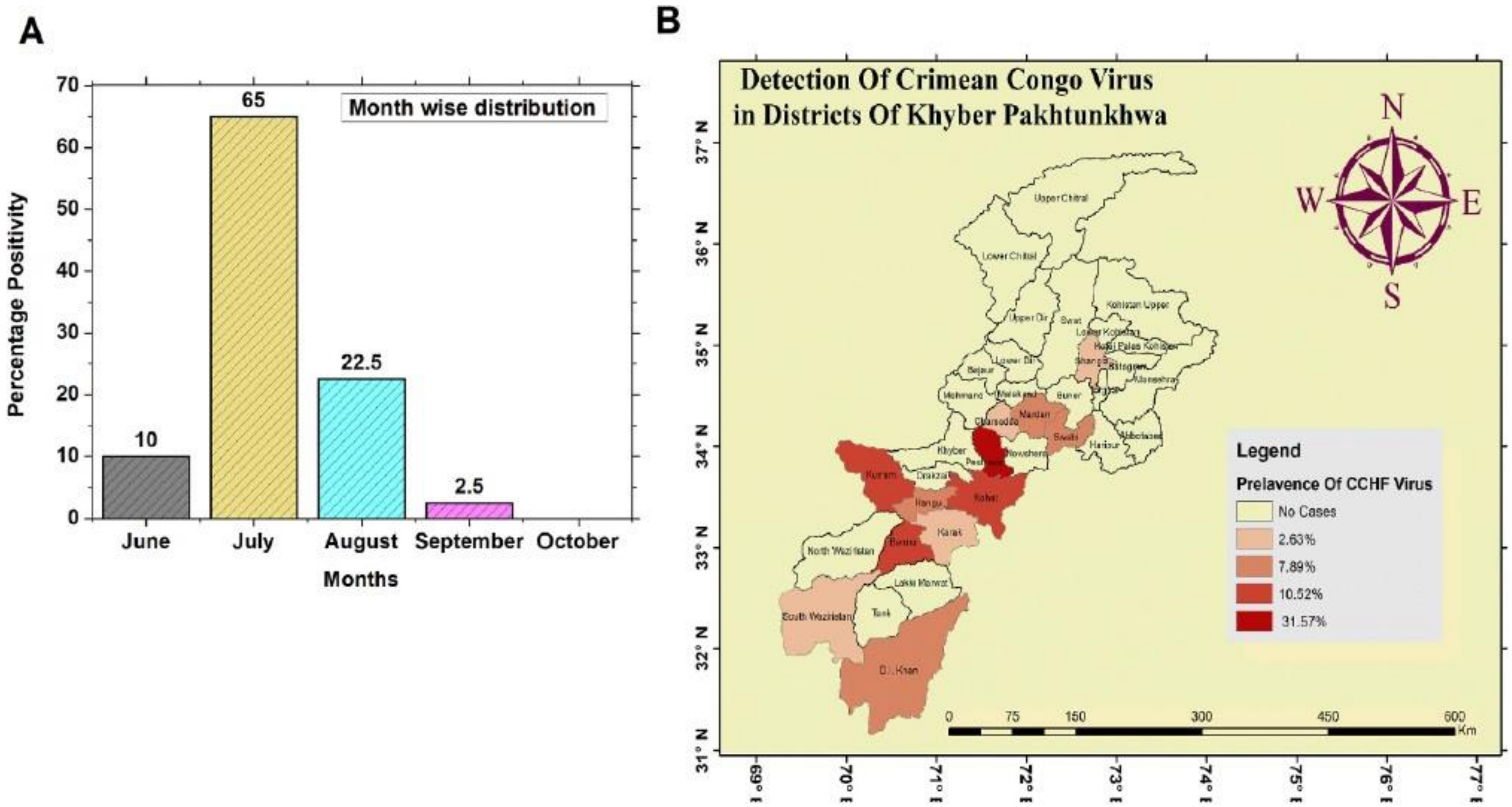
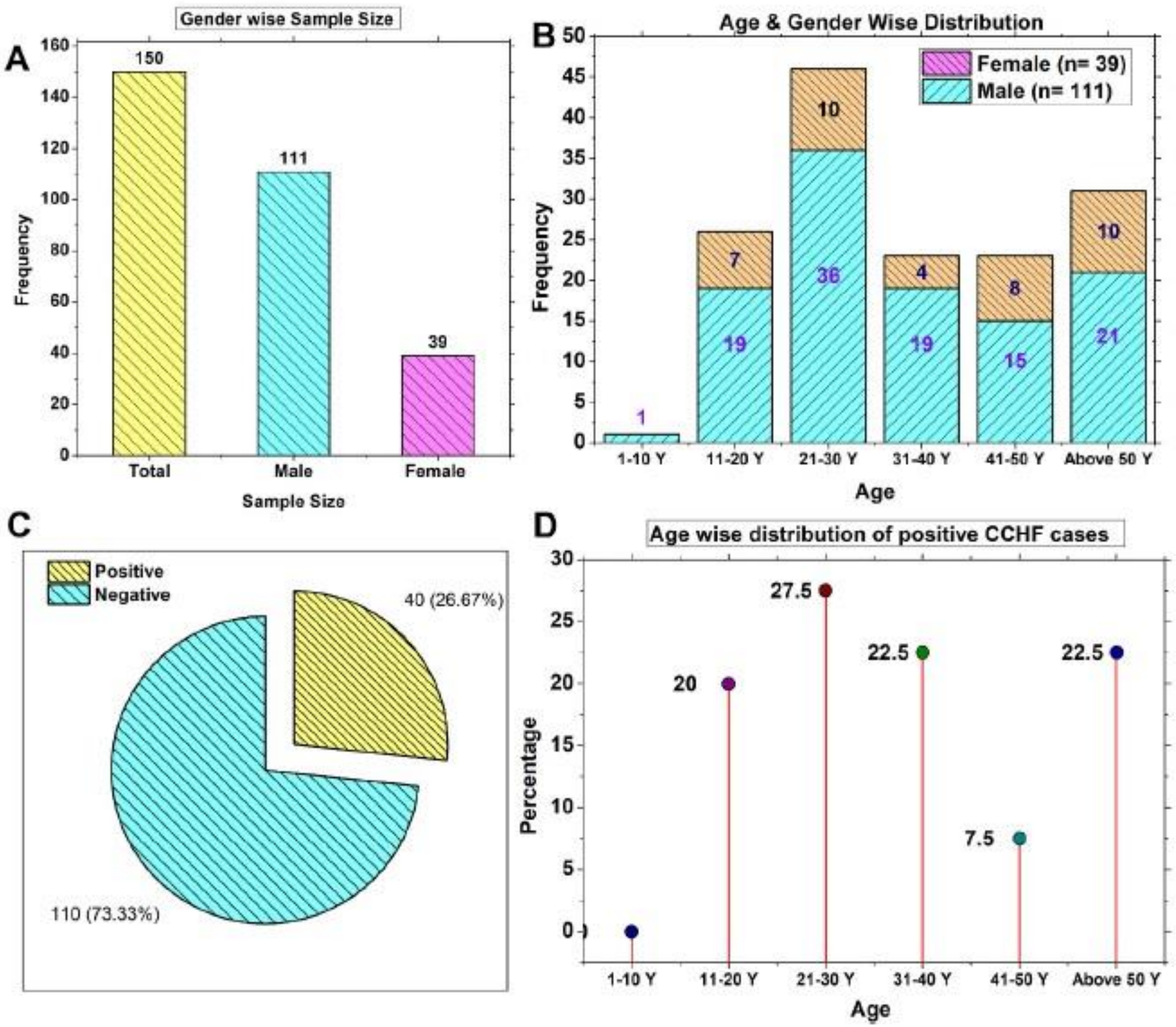


Fig. 2 (A–B). (A) Month-wise detection of CCHFV-positive cases on PCR from June 2022 to September 2022; (B): District wise heat map of the CCHFV positive cases.

Zia et al, 2024

CCHF in Khyber Pakhtunkhwa Province (Pakistan)



Zia et al., 2024

Table 2. Univariate analyses of 1,838 livestock samples positive for Crimean-Congo hemorrhagic fever virus by ELISA, Pakistan, 2017–2018

Category	No. positive/no. tested	Prevalence, % (95% CI)	Odds ratio (95% CI)	p value
Species				<0.001
Camel	272/480	56.7 (52.1–61.2)	5.6 (4.2–7.6)	
Cattle	81/183	44.3 (36.9–51.8)	3.4 (2.3–5.0)	
Sheep	138/424	32.6 (28.1–37.2)	2.1 (1.5–2.8)	
Buffalo	92/311	29.6 (24.6–35.0)	1.8 (1.3–2.5)	
Goat	83/440	18.9 (15.3–22.8)	1.0	
Province				<0.001
Balochistan	213/359	59.3 (54.1–64.5)	7.6 (5.4–10.6)	
Khyber Pakhtunkhwa	230/439	52.4 (47.6–57.1)	5.7 (4.1–7.9)	
Punjab	159/644	24.7 (21.4–28.2)	1.7 (1.2–2.40)	
Sindh	64/396	16.2 (12.7–20.2)	1.0	
Sex				0.377
F	552/1,504	36.7 (34.3–39.2)	1.1 (0.9–1.4)	
M	114/334	34.1 (29.1–39.5)	1.0	
Age, y				<0.001
≤5	332/1,121	29.6 (27–32.4)	1.0	
>5	334/717	46.6 (42.9–50.3)	2.1 (1.7–2.5)	

Zohaib et al., 2020

Detection capacity

Pakistan

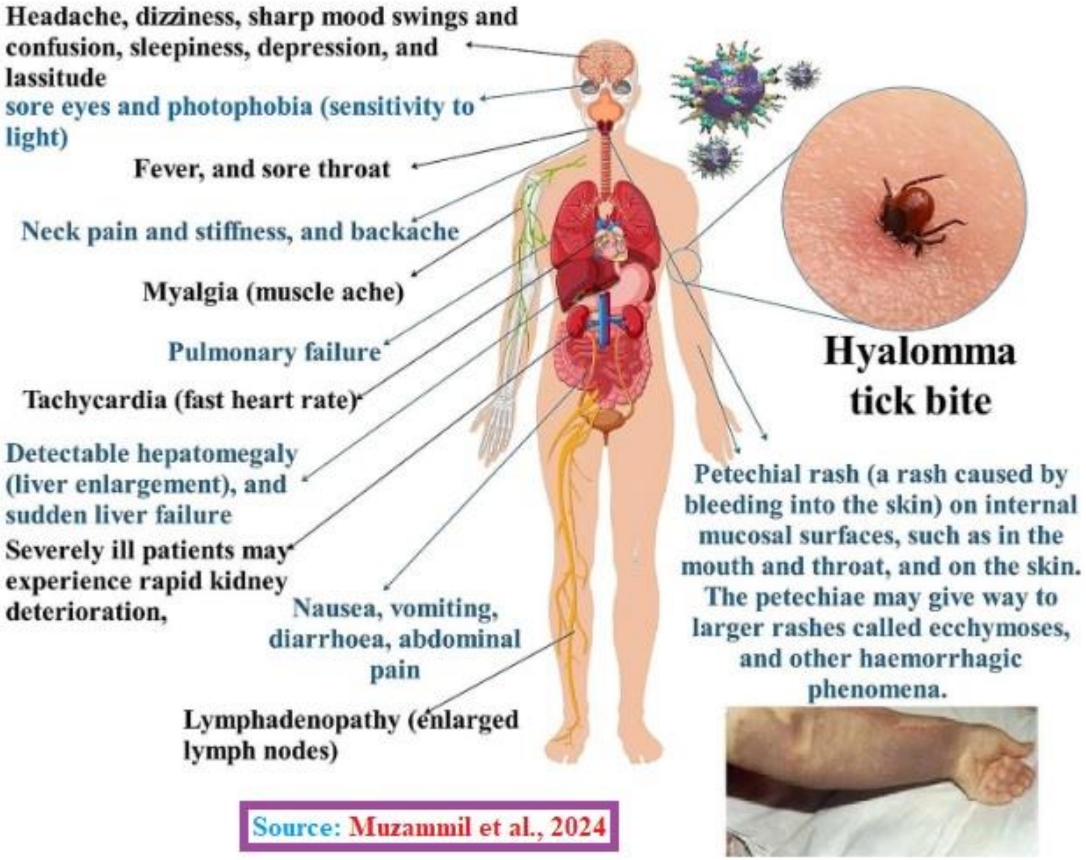
- **Humans:** Clinical signs observed
  - Fever
  - Hemorrhage
  - Myalgia
- Other signs:
  - Nausea
  - Vomiting
  - Headache

(Umair et al., 2024)

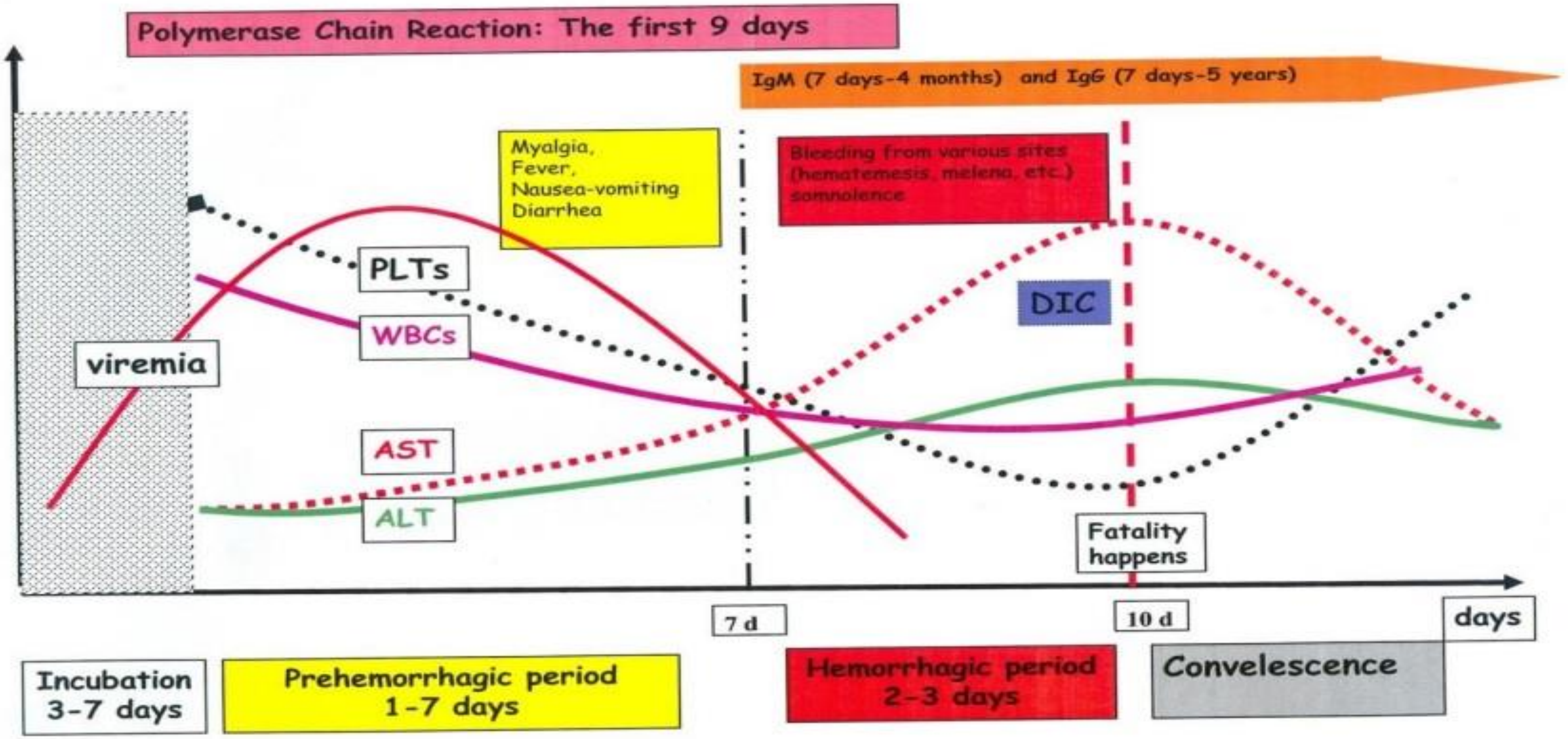
- **Animals:**

Remain a symptomatic

From: Recent Advances in Crimean-Congo Hemorrhagic Fever Virus Detection, Treatment, and Vaccination: Overview of Current Status and Challenges



Symptoms of CCHFV The duration of the incubation time is determined by the manner of viral acquisition. The incubation time after a tick bite usually is one to three days, with a maximum of nine days. After contact with contaminated blood or tissues, the incubation period is generally five to six days, with a known maximum of 13 days



Ergonul O. *Lancet ID* 2006; 6: 203-214

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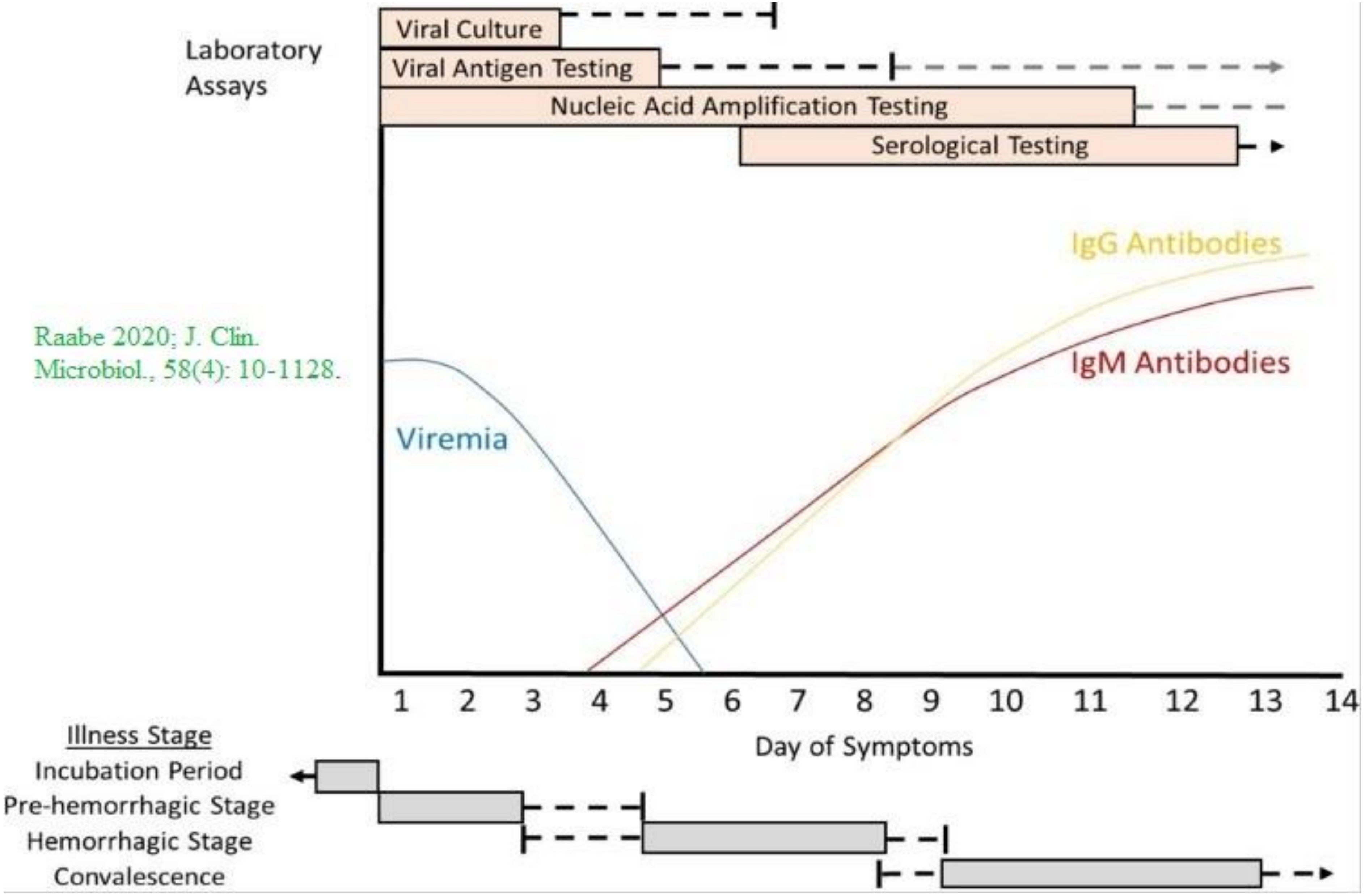


Raabe 2020; J. Clin. Microbiol., 58(4): 10-1128.

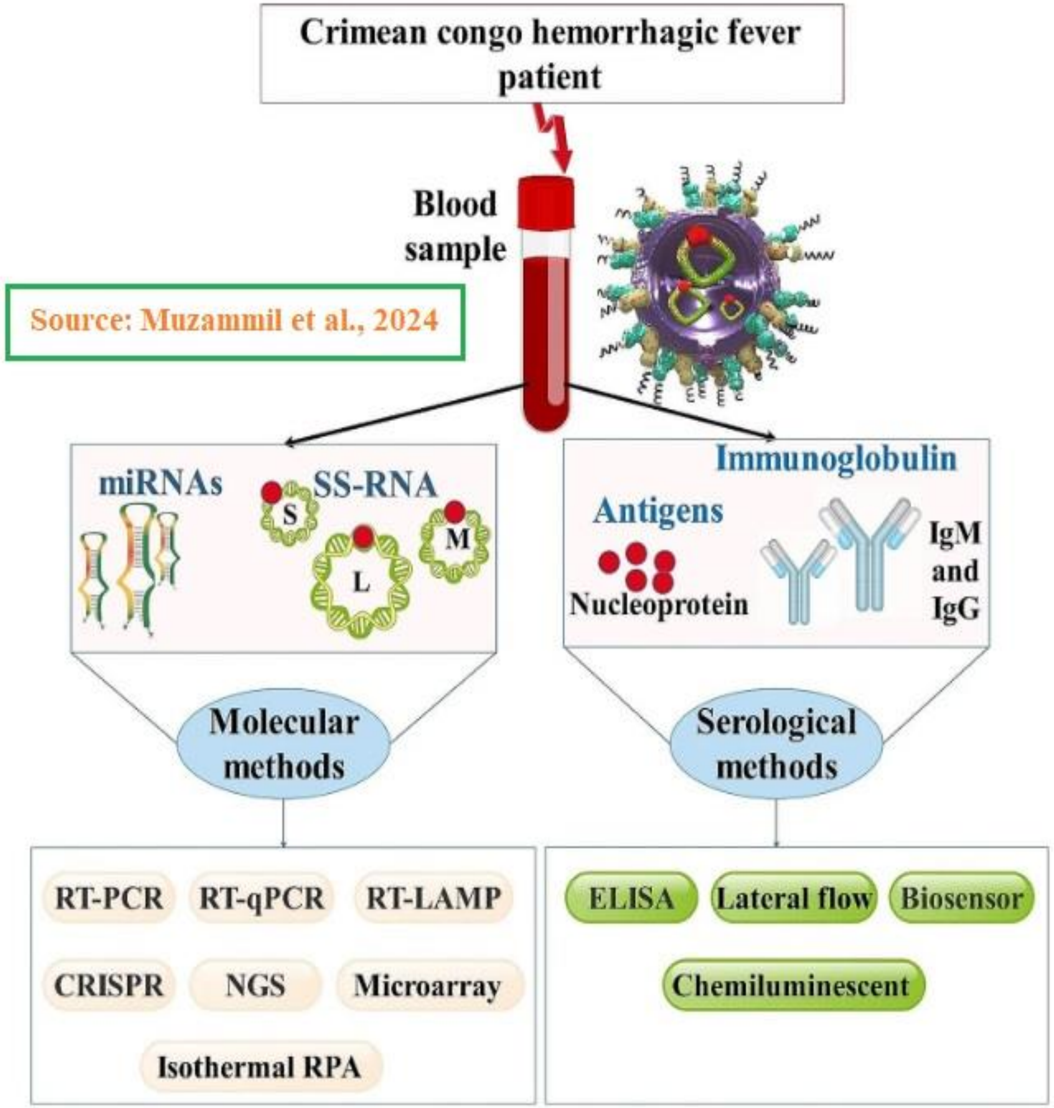
Case definition

Suspected	Probable case	Confirmed case
✓ **Sudden onset** of fever [> 38.5ºC; 3-9 days) in endemic region ✓ In contact with sheep or other livestock ✓ Fever do not respond to antibiotic or antimalarial treatment	✓ Acute history of febrile illness 10 days or less, AND ✓ Thrombocytopenia <50,000/mm AND ✓ Petechial or purpuric rash, epistaxis, haematemesis, haemoptysis, blood in stools, ecchymosis, gum bleeding, other haemorrhagic symptom AND ✓ No known predisposing host factors for haemorrhagic manifestations and ≥1 haemorrhagic sign or thrombocytopenia.	✓ Confirmation of presence of IgG or IgM antibodies in serum by ELISA (enzyme-linked immunoassay) or any similar method. ✓ Detection of viral nucleic acid by PCR in specimen or isolation of virus. [NIH, 2013, Pakistan]

Detection of CCHF in humans

- **ELISA:** A two-step sandwich enzyme-linked immunosorbent assay
- VectoCrimean-CHF-IgG kit; Vector BEST Company, Novosibirsk, Russia, https://vector-best.ru
- **PCR:** Extraction from blood samples (QIAamp Viral RNA Mini Kit (QIAGEN, https://www.qiagen.com).
- Real-time PCR using a RealStar CCHFV RT-PCR Kit (Altona Diagnostics, https://www.altona-diagnostics.com).
- Crimean-congo Haemorrhagic Fever RT-qPCR Kit — Zet Biotech (www.zetbiotech.com)

Source: Muzammil et al., 2024



Detection of CCHF in animals

- The double antigen (DA) ELISA , ID Screen® CCHF Double Antigen Multi-species ELISA kit (IDvet, Grabels, France).

- **Detection:** Cattle, sheep, goats & other animal

species as well as humans* (*Research use)

https://www.innovative-diagnostics.com

- Specificity (99.8%–100%)

- Sensitivity (96.8%–99.8%)

Ranking of zoonotic diseases in Pakistan

APPENDIX D: Numerical Weights for the Criteria Selected for Ranking Zoonotic Diseases in Pakistan (short-term goal)

1. Impact of Disease (criterion weight = 0.406486361)

Question: Does the disease have a significant impact on human or animal populations? CFR ≥10% or evidence of associated long term disability (human indicator) Loss of production (animal indicator)?

Answer: (score)

- ☐ Yes for both humans and animals (2)
- ☐ Yes to either humans or animals (1)
- ☐ No to both humans and animals (0)

2. Burden and Epidemic Potential (criterion weight = 0.232295915)

Question: Is the disease prevalence ≥5% and/or has it caused any epidemic/outbreak among humans or animals in the last 10 years in Pakistan?

Answer: (score)

- ☐ Yes to both (prevalence and epidemic) (2)
- ☐ Yes to one (prevalence or epidemic) (1)
- ☐ No to both (0)

3. Country Capacity (criterion weight = 0.175892772)

Question: Does the country have capacity in terms of (i) prevention (vaccine), (ii) detection (lab testing and reporting (case based, indicator/routine, event) and (iii) control (treatment, culling, stamping out, quarantine)?

Answer:	Human	Animal
☐ Yes to all	3	3
☐ Yes to two	2	2
☐ Yes to one	1	1
☐ No to all	0	0

4. Bioterrorism Potential (criterion weight = 0.070575586)

Question: Is the disease listed as a bioterrorism agent according to the WHO guidance document?[69]

Answer: (score)

- ☐ Yes (1)
- ☐ No (0)

5. Coordination (criterion weight = 0.114749366)

Question: Does any mechanism exist for sharing of epidemiology or laboratory data among relevant stakeholders (Ministry of Health and Ministry of Agriculture)?

Answer: (score)

- ☐ Yes, both formal mechanism in place and data is shared (3)
- ☐ Yes, formal mechanism in place, but data is not shared (2)
- ☐ No formal mechanism in place, but data is informally shared (1)
- ☐ No mechanism in place and no data is shared (0)

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- CDC, 2017

APPENDIX C: Final Results of the One Health Zoonotic Disease Prioritization Workshop in Pakistan

Zoonotic diseases considered for prioritization in Pakistan: Final results of prioritization and normalized weights for 33 zoonotic diseases. The top prioritized zoonotic diseases selected by the voting members representing all ministries active in zoonotic disease work are shown in **bold**.

Rank	Disease	Raw Score	Normalized Final Score
1	**Zoonotic influenza viruses (including avian and swine)**	**0.912053614**	**1**
2	***Brucella spp.***	**0.855935172**	**0.938470237**
3	***Bacillus anthracis* (Anthrax)**	**0.854536581**	**0.936936785**
4	**Rabies virus**	**0.735662988**	**0.806600596**
5	**Crimean-Congo Hemorrhagic Fever virus**	**0.679494972**	**0.745016478**
6	***Salmonella spp.***	**0.652691991**	**0.715628973**
7	*Yersinia pestis (plague)*	0.594323795	0.65163252
8	*Cryptosporidium spp.*	0.579603923	0.635493259
9	Leishmaniasis	0.579603923	0.635493259
10	*Burkolderia mallei* (Glanders)	0.535692871	0.587348006
11	West Nile virus	0.522634318	0.573030259
12	*Chlamydia psittaci*	0.506377409	0.555205748

- CDC, 2017

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Response to CCHF

- Prioritization and diseases ranking
- Dissemination of awareness

- **Alert threshold**
- One probable case

- **Outbreak threshold**

One confirmed case of CCHF is an outbreak [NIH, 2013, Pakistan]

Response to CCHF

Human treatment of CCHF in Pakistan

- General supportive therapy
- Rehydration and electrolyte balance
- Red blood cells (RBCs), platelets, and fresh frozen plasma transfusions
- Intensive monitoring to guide volume and blood component
- Analgesics and antipyretics
-

- [NIH, Pakistan, 2013]

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Treatment of probable case

- Oral Ribavirin, immediately
- Oral Ribavirin: 2 gm loading dose
- 4 gm/day in 4 divided doses (8 hourly) for 6 days
- 2 gm/day in 4 divided doses for 6 days.

[NIH, 2013, Pakistan]

Response to CCHF in Pakistan

- **Antiviral**
- Favipiravir and interferon-alpha have shown results in drug trials.

- Ribavirin: Pregnancy should be absolutely prevented (whether female or male partner is victim) within six months of completing a course of Ribavirin.

- **Response**
- Animal surveillance
- Screening of contact person or care givers

NIH, 2013, Pakistan

Monitoring contacts

- All suspected contacts should be monitored for 14 days by **taking temperature twice daily.**

- They should have baseline blood tests

- Start Ribavirin **only** if sick (i.e.)

(i) Temperature equal to or more than 38.5ºC

(ii) Severe headache

(iii) Myalgia (muscle pains)

[NIH, 2013, Pakistan]

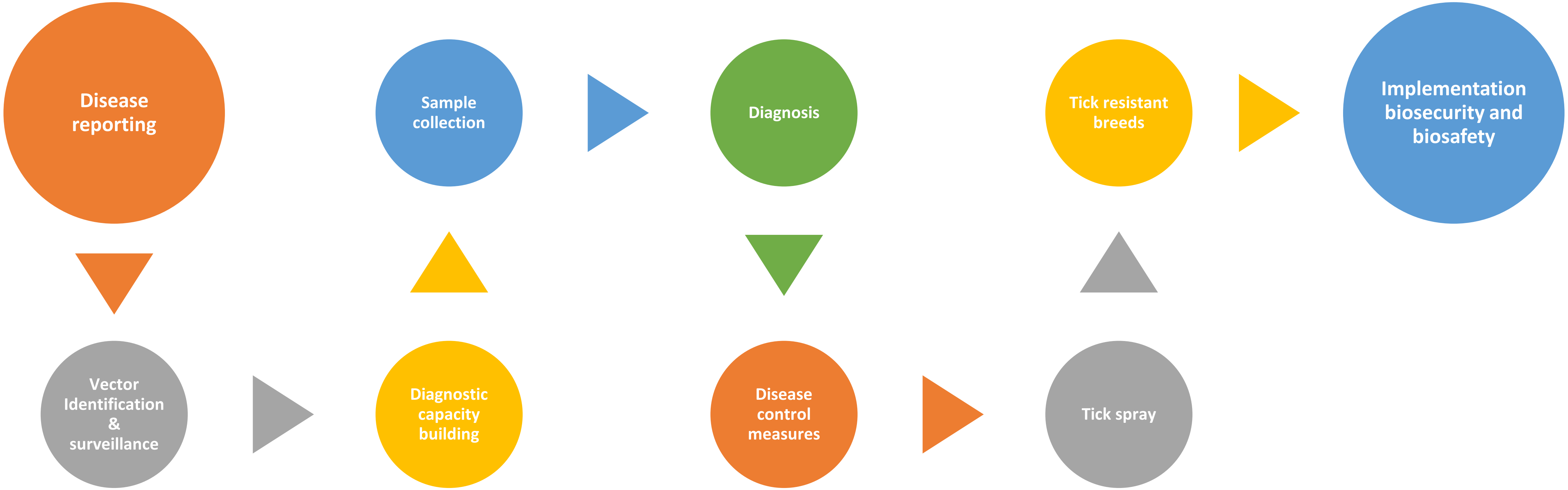
Disinfection

- ❑Thermo Scientific™ RNase AWAY™ -- disinfection of laboratory working area
- ❑Heating to 56°C (30 minutes), gamma irradiation, UV light, acidifying (<6)

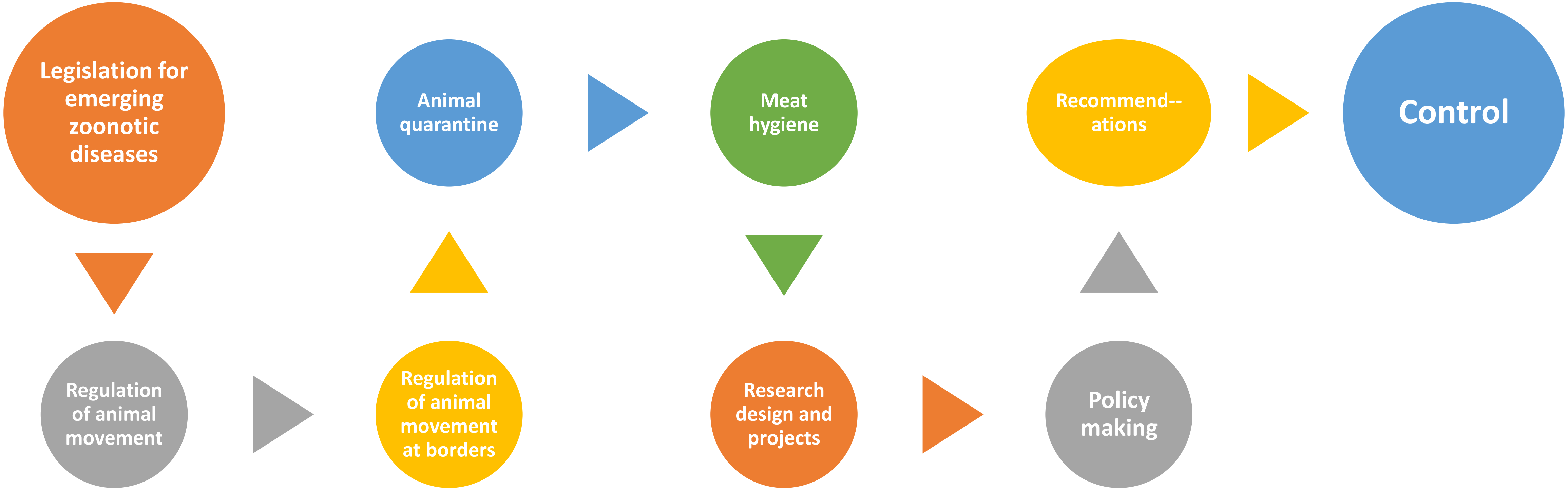
- **Other disinfectants:**
- 1% hypochlorite,
- 2% glutaraldehyde,
- Formalin
- Paraformaldehyde
- 1% sodium hypochlorite
- Hydrogen peroxide
- Peracetic acid

(Appannanavar and Mishra et al., 2011; Escadafal et al., 2012; Bartolini et al, 2019).

Roles of Animal Health Professionals in One Health



Roles of Animal Health Professionals in One Health

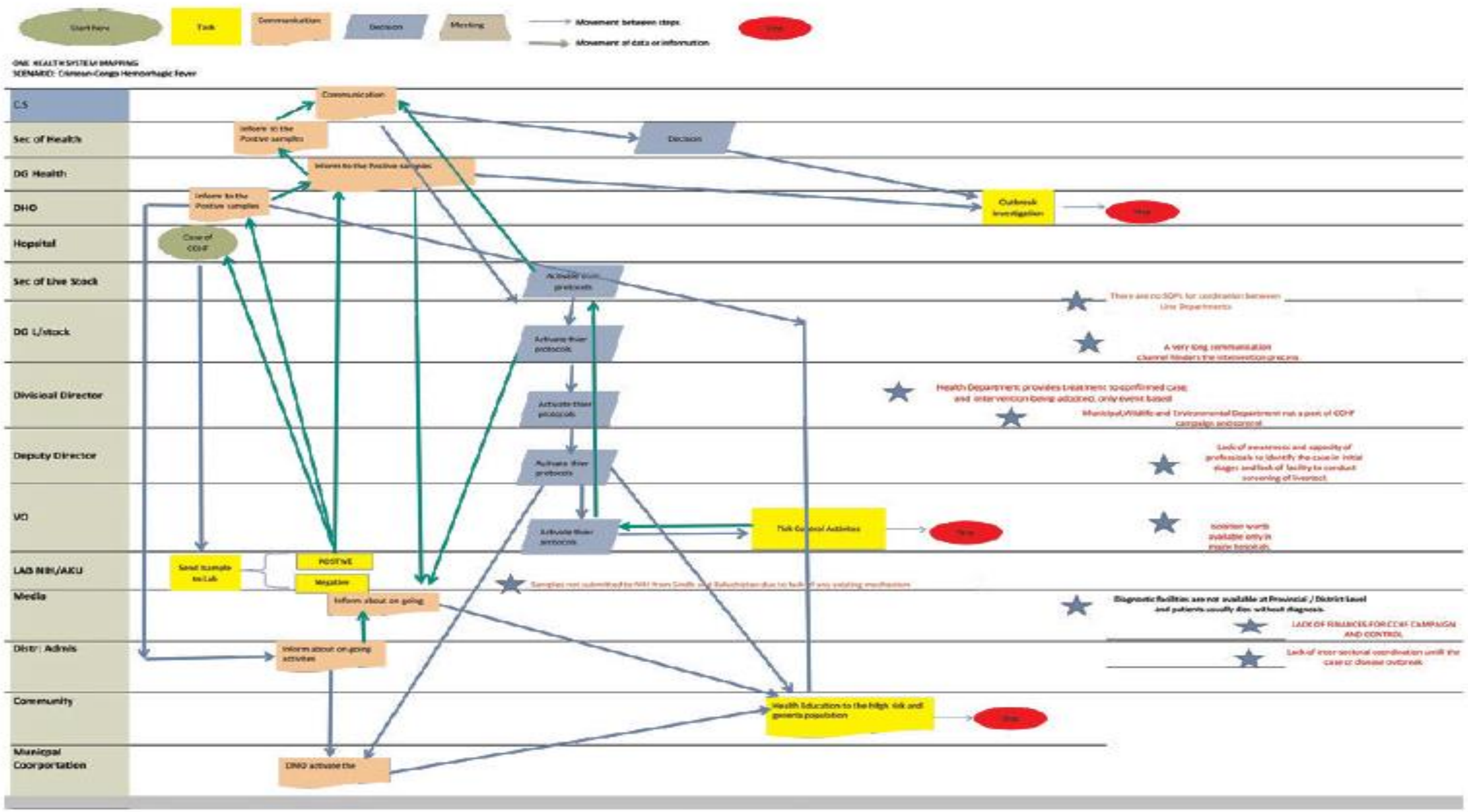


Health Sector and CCHF

Trainings:

- Field Epidemiology and Laboratory Training Program (FELTP)
- NIH & NARC/PARC, Pakistan conducted specialized training on CCHF (e.g.) and biosafety
- Training by provincial departments on vertical programs on sample collection and transportation

Map 5. Crimean-Congo Hemorrhagic Fever Outbreak Scenario



Description of Integrated Map: Crimean-Congo Hemorrhagic Fever (CCHF), as a result of OH SMART Step 4

Source: CDC: https://stacks.cdc.gov/view/cdc/84617

Impact of the actions

- Increase in awareness
- Availability of out break response plan
- Focal persons designated
- Reference laboratories designated
- One Health Hub setup established
- Availability of information/literature
- Zoonotic priority list generated
- Capacity building on biosafety & biosecurity
- Capacity building in sample collection
- Diagnostic capacity building
- Improvement in patient management
- Animal surveillance
- Vector surveillance
- Contact tracing
- Reduced mortality
- Reduced number of cases
- Improved outcome
- Research activities (National and international).
- Whole genome sequencing was conducted for local isolates.

Challenge and possible solutions for CCHF control

Already burden of diseases on health care system

1. Dengue
2. Plague
3. Hepatitis
4. Influenza virus
5. Malaria
6. Salmonella
7. Vibrio Cholera
8. Lyme disease
9. Respiratory syncytial virus
10. Skin cancer
11. TB
12. Others

Challenges

Disease in neighboring countries

- Turkey, Iran, Afghanistan, India, China, Iran, Kazakhstan, Iraq, U.A.E and Saudi Arabia etc.
-
- **In Pakistan:** Every year **~08 million animals** are Slaughtered (**sheep, goats, cattle, buffaloes** and **camels)** during Eid-ul-Azha (Islamic festival).

Mallhi et al., 2016

- Photo source: https://www.youtube.com/watch?v=oq3PFB5mWjo

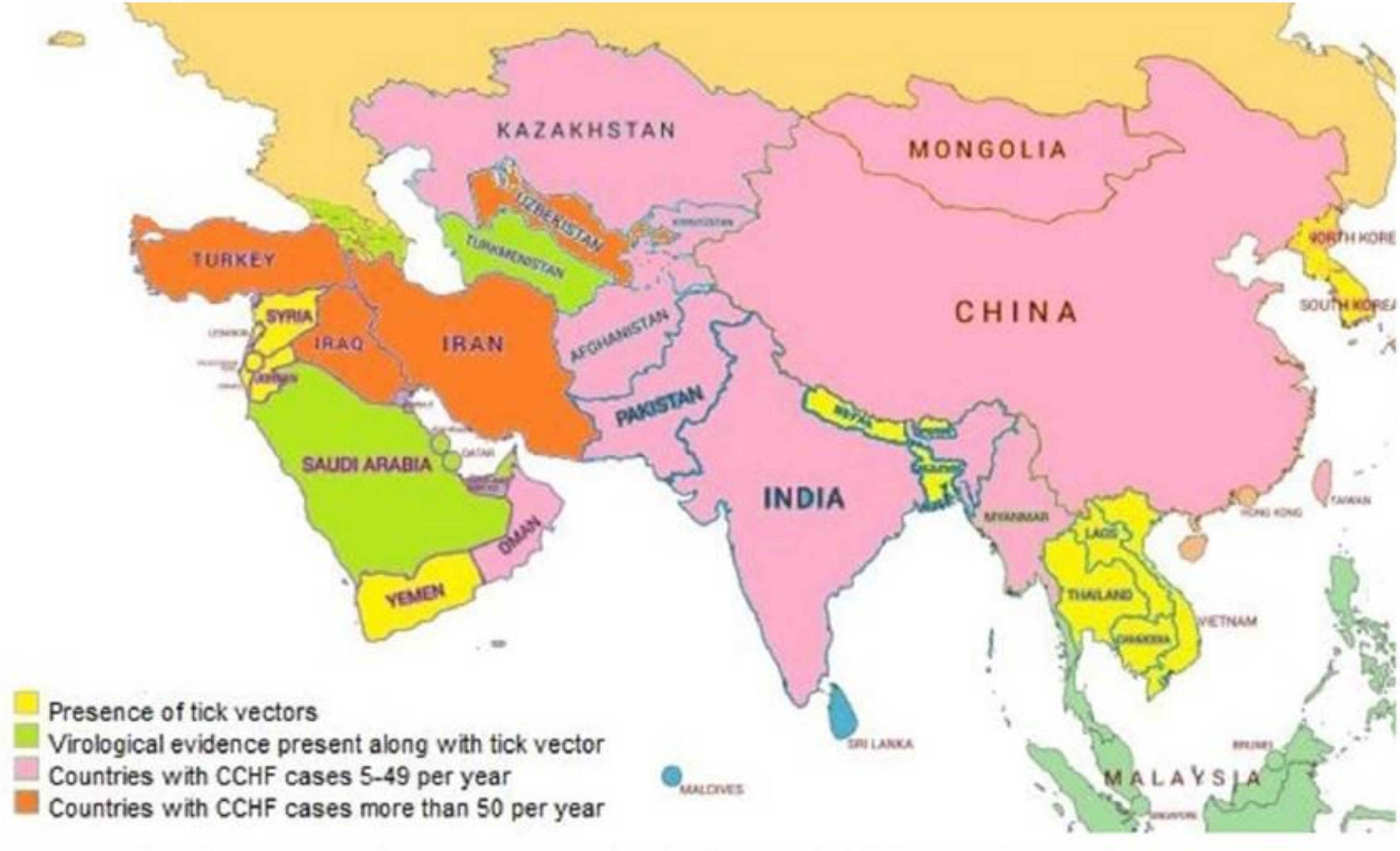


FIGURE 2
Distribution pattern of CCHF in Asian and Middle East countries.

- Aslam et al., 2023

Challenges to control CCHF in Pakistan

- Lack of coordination
- Lack of legislation
- *Political upheavals*
- Lack of funding
- Lower-middle income country
- Lack of awareness
- *Afghan war* and refugees issue in past
- Lagging --- healthcare and robust surveillance
- Low no. of physicians per patient
- *Nomadic trends* (esp. Balochistan province, Pakistan)

Challenges

- Lack of diagnostic capacity
- Lack of lab. infrastructure
- Biosecurity
- Biosafety
- Sanitation
- Population density
- Urbanization
- Deforestation
- Loss of ecosystem diversity
- Floods
- Infectious waste management
- Un-hygienic slaughter house practices
- Lack of developed *One Health* system
- Contaminated drinking water
- Equipments
- Technical assistance (RNA virus-storage issue)
- Lack of vaccination
- Consumables
- Diagnostic kits, PCR reagents

Challenges and possible solutions

SOLUTIONS

- National level One Health Hub
- Need to develop a National One Health Strategic Framework
- ***"One Health" Approach***
- Medical professionals
- Veterinarians
- Epidemiologists
- Microbiologists
- Entomologists
- Parasitologists

Solutions

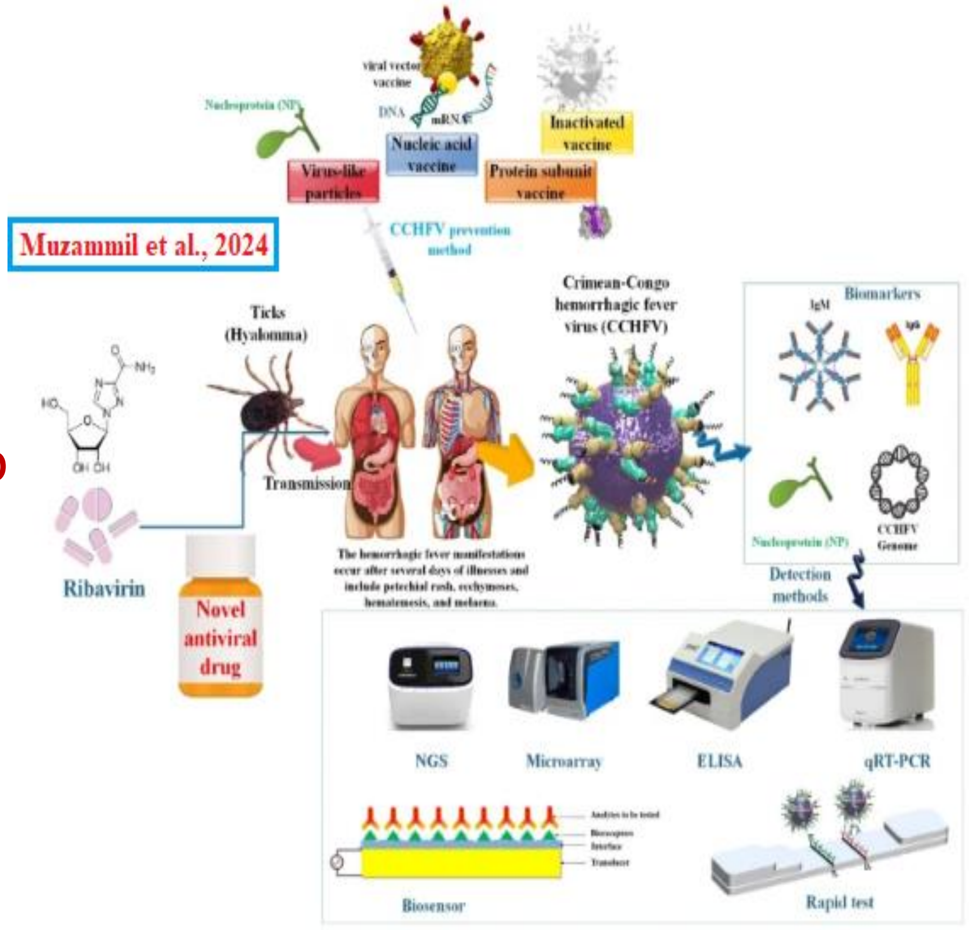
- Awareness

  Schools, public, workers, doctors, Veterinarians, hospitals, laboratory personnel and high risk groups
- Need to update the diseases prioritization and ranking list
- Avoid tick bite
- Use light colour clothes at susceptible place
- Use of PPEs at high risk places
- Animal movement
- Border management
- Quarantine
- GIS mapping and identification of hotspots

  Capacity building/training
- Establishment of Labs. at district level
- Common slaughtering compound/station
- Need to improve the slaughtering practices
- Rearing of tick resistant animal breeds
- Monitor and strengthen; Integrated Disease Surveillance and Response System (IDSRS), Pakistan
- Disease surveillance program for human, animals, rodents and ticks
- Early diagnosis
- Early treatment
- Biosafety and biosecurity (PPE) improvement
- Acaricidal application on animals
- Implementation/enforcement of plan

Future strategies to control CCHF

- Drug development
- Development of multi-epitope vaccine
- Inexpensive and accurate diagnostics using biosenso
- Treatment trial as well as to prevent Disseminated Intravascular Coagulation (DIC)
- Studies on disease pathogenesis
- Biological control of vectors
- International collaboration
- Funding for research grants
- Funding for trainings, mobility, post-doc opportunities and capacity building



Collaboration with other sectors under One Health approach

- **National**
- Ministry of National Health Services, Regulations and Coordination (MoNHSRC)
- National Institute of Health (NIH)
- Ministry of National Food Security and Research (MoNFSR)
- National Agriculture Research Centre (NARC)
- National Veterinary Laboratories (NVL)
- Field Epidemiology and Laboratory Training Program (FELTP)
- Provincial Department of Health (DoH)
- Livestock and Dairy Development Departments (L&DD)

Collaboration with other sectors under One Health approach

- **International**

- Food and Agriculture Organization of the United Nations (FAO)

FAO supporting "One Health Assessment Tool Development for Pakistan" (22-23rd August, 2024).

- Public Health England (PHE)
- U.S. Centers for Disease Control and Prevention (CDC)
- U.S. Department of Agriculture (USDA)
- World Health Organization (WHO), Islamabad
- World Organization for Animal Health (WOAH/OIE)
- Japan International Cooperation Agency (JICA) – No information

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Challenge and possible solutions to strengthen the collaboration

Solutions

- Prioritization
- Commitment
- Volunteer approach
- Establish common interest
- Planning
- Networking
- Collaboration
- Frequent meetings
- Monitoring and evaluation
- Feedback
- Corrective actions
- Research
- Publication
- Training
- Research funding
- Faculty and student exchange

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Sr. No.	Province	Area	Prevalence/Result	Sample source	Sampling strategy	Method	Year/duration	Reference
1.	All Pakistan (All provinces) Pakistan	The 14 districts of Pakistan (Karachi, Jamshoro, Peshawar, Haripu, Islamabad, Rawalpindi, Chakwal, Mianwali, Gujrat, Lahore, DG Khan, Multan, Lodhran and Bahawalpur)	▪ Positive: 75/795 ▪ Male (82%) ▪ Female (18%) ▪ Age: 35 years (average) ▪ **Clinical signs:** Fever (100%), Hemorrhage (65%) Myalgia (41%) ▪ Case fatality (5%) ▪ Asia-1 genotype	**Human**	Event-based surveillance data	RT PCR	2017-2020	Umair et al., 2024
2.	Balochistan Province Pakistan	Balochistan	▪ **Cases:** Illness with high-grade fever (38.5°C) for >3 to <10 days with signs of hemorrhagic or purpuric rash, nosebleeding, blood in vomit/sputum/stool or other hemorrhagic symptoms. ▪ Positive: 1418/2542 ▪ Male (89%) ▪ Case fatality (5% to 13%)	**Humans**	A descriptive approach **event-based surveillance data**	RT PCR	2000-2021	Naseer et al., 2024

Sr. No.	Province/ Region	Area/ districts	Prevalence/Result	Sample Source	Sampling strategy	Method	Year/Duration	Reference
3.	Khyber Pakhtunkhwa (KPK) Province (Pakistan)	**Peshawar**, Bannu, Kohat, Karak, D. I Khan, Mardan, Charssada, Swabi, Shangla, Kurram, Hangu, South Waziristan and Hayat Abad Medical complex	▪ **Prevalence:** 26.67% ▪ **Peshawar** 31.57 % ▪ **Age:** 21-30 Years (30.6%)	**Human** (n=150) 21–40 yrs.	Convenient/ random	RT PCR	June 2022 to September 2022	Zia et al., 2024
4.	Sindh Province (Pakistan)	Sindh Province	▪ **Prevalence:** 4.2 per Million ▪ (Karachi, n=68 cases). ▪ The 0.4 per million from all Sindh ▪ CCHF were most common (44%) among the general population that had **visited livestock markets**	**Human**	Descriptive epidemiology	RT PCR	2016-2020	Syed et al., 2024

Sr. No.	Province/ Region	Area/ districts	Prevalence/findings/result	Sample type	Sampling strategy	Method	Year/Duration	Reference
5	Punjab Province (Pakistan)	Dhok Shah Gul Hassan (Union Council kot Qazi), Tehsil Lawa, village of Kharra Tehsil, district Chakwal	▪ **Cases (n=03)** ▪ Female, 45 yrs. age and his husband 55 yrs. ▪ (13.5 Yrs. boy) ▪ Ticks cattle, ***Hy. anatolicum*** **(positive)**	**Human Serum (Antigen)** and **Ticks from animals**	Case report	ELISA (IgG) Antigen, Kit	March 2016 to July 2016	Yaqub et al., 2018
6.	Punjab Province (Pakistan)	Sargodha	**Prevalence:** 2/94 (2.1%) **Male** (79.8%) **Female** (20.2%)	**Human (Milkmen)**	Cross sectional	IFA/ELISA (IgG and IgM) **antibodies**	August 2016 to March 2017	Ayube et al., 2018.

Sr. No.	Province	Area/ districts	Prevalence/result	Sample type	Sampling strategy	Method (Gene target)	Duration	Reference
7.	Punjab Province (Pakistan)	**Districts (n=10)** Chakwal Mianwali Rawalpindi Attock Jehlum Lahore Rajanpur Dera Ghazi Khan, Bahawalpur and Rahim Yar Khan	Ticks (12.13%) **Area:** **Chakwal (24.13%)** Mianwali (23.68%) Rawalpindi (23.07%) Attock (20.0%) Rajanpur (10.52%) Lahore (8.33%) **Ticks:** ***H. antolicum* (39.6%)** *H. marginatum* (30.18%), *H. rufipes* (13.2%), *H. impressum* (3.77%), *H. dromedarii* (1.88%), *R. microplus* (5.66%), *R. sanguineus* (5.66%).	**Hard ticks (n=2183)** from sheep, goats, cattle and buffaloes	Cross sectional	ELISA, RT PCR (partial S-segment) and sequencing	January 2017 to December 2019	Shahid et al., 2021
8.	All provinces (Pakistan)	All Pakistan	**Human:** 51 (2.7%) by ELISA and IFA **Animals:** 36.2% (666/1838) by ELISA (ID vet)	**Humans & livestock**	Cross sectional	by ELISA and IFA	2015–2017	Zohaib et al., 2020
9.	Punjab Province (Pakistan)	**Faisalabad** Basic health Care units, diagnostic laboratories, and hospitals	Sero-prevalence (7.58%)	**Human** Blood donors, pregnant females, minor health issues (hypertension and diabetes monitoring.	Cross sectional	Microneutralization assays	2019	Chen et al., 2024

Factors of CCHF in Pakistan

- Majority of the population of Pakistan is associated with livestock
- In 90 % cases, patient in contact with animals
- **Risk group:** Livestock associated persons, butchers, Lab. & health care staff and slaughter house worker at higher risk.
- **Neighboring countries:**
  Turkey, Iran, Afghanistan, Russia — CCHF is endemic
- Unregulated animal and border movement
- Nomadic lifestyle (esp. in Balochistan)
- Pakistan is located in Sub-Tropical region (linked to higher TTBDs.)

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My Laboratory

Summary of Control of CCHF in Pakistan

- Pakistan is committed to control but it is the matter of whole region.
- International collaboration, training, support and technical assistance is required.
- Political situation in Central and South Asia is the key determinant.
- Human and animal movements across international borders is a major factor.
- Need to establish reference diagnostic laboratories at district level.
- Need for legislation, awareness, meat hygiene and biosecurity measures.
- Priority and disease ranking need to be optimized.
- Need for fully developed One Health frame work.
- Need for Vector and animal surveillance.
- Vector season play a key role in disease with various routes of transmission.
- Research is required on pathogenesis, inexpensive diagnosis (biosensor), drug, biological and vaccine development.

Lesson from history

- عن أسامة بن زيد رضي الله عنهما مرفوعاً: «إذا سمعتم الطاعونَ بأرض فلا تدخلوها وإذا وقع بأرض وأنتم فيها فلا تخرجوا منها».

Translation: **Usāmah ibn Zayd (may Allah be pleased with him) reported that the Prophet (may Allah's peace and blessings be upon him) said: "If you get news of the outbreak of a plague in a land, do not enter it, and if it breaks out in a land in which you are, do not leave it." [Authentic hadith] - [Narrated by Bukhari & Muslim].**

Restriction of movements is the key to control outbreak

https://hadeethenc.com/en/browse/hadith/5737

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Thank you

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Member experience on prevention and control for Vector Borne Disease [Thailand]

Peerada Siriwatcharawong
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19 – 20 September 2024
Tokyo, Japan

World Organisation for Animal Health
Founded as OIE

Vector Borne Disease situations in Thailand

outbreaks of two diseases

Lumpy Skin Disease

The first outbreak was in March 2021
In 2023, the **14 outbreaks** occurred in Central, Northern, and Nort Eastern Thailand.
In 2024, LSD is under control through vaccination.

Potential source of outbreak:

- live cattle/animal market
- Insect vector
- Animal movement

African Horse Sickness

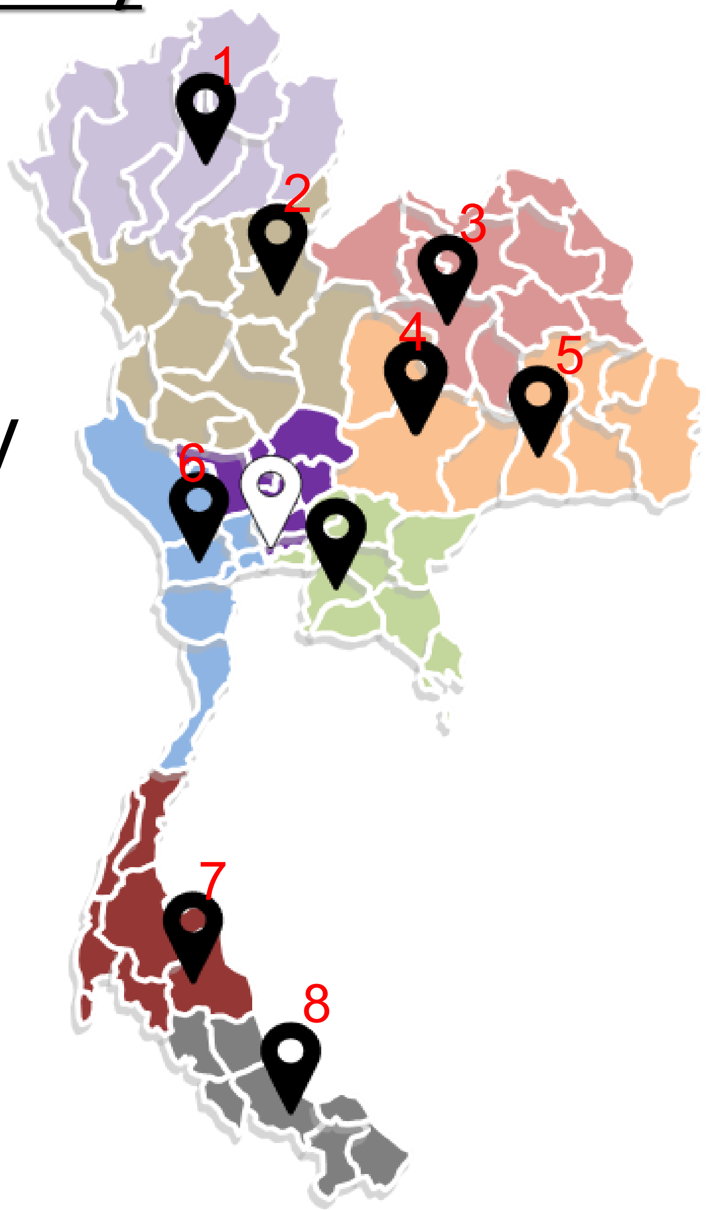
The first outbreak was on March 27, 2020.
Thailand could eradicate AHSV and declared **AHS-free country** in 2023.

- First case in Pakchong district, Nakorn Ratchasima province
- Potential source of outbreak: imported zebras during 2019-2020 could be suspected
- Disease spread illegal animal movement : feed/hay truck movement

Both diseases have significantly impacted cattle and horse farmers in Thailand

Detection capacity

DLD Veterinary Laboratory network



VRDC & NIAH

1 Veterinary Research and Development Center Upper Northern Region

2 Veterinary Research and Development Center Lower Northern Region

3 Veterinary Research and Development Center Upper Northeastern Region

4 Veterinary Research and Development Center Lower Northeastern Region

5 Veterinary Research and Development Center Eastern Region

6 Veterinary Research and Development Center Western Region

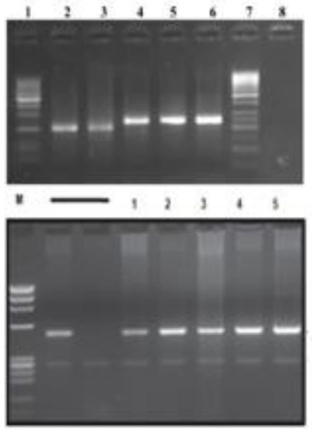
7 Veterinary Research and Development Center Upper Southern Region

8 Veterinary Research and Development Center Lower Southern Region

National Institute of Animal Health

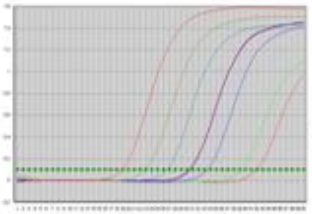
Detection capacity

Disease covered	Type(s) of diagnostic tests
African Horse Sickness (AHS)	Real-time RT-PCR
	ELISA (commercial kit)
	Virus Isolation & Sequencing
Lumpy Skin Disease (LSD)	Real-time PCR
	ELISA (commercial kit)
	Virus Isolation & Sequencing
West Nile virus	RT-PCR & Sequencing
Japanese encephalitis virus	RT-PCR & Sequencing
Yellow fever (Flavivirus)	RT-PCR & Sequencing

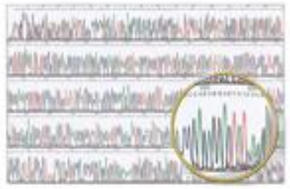


PCR/RT-PCR

Nested-PCR/
Nested-RT PCR



Real-time PCR/
Real-time RT-PCR



Genome
sequencing

Response to Vector Borne Diseases

<u>Key activities undertaken</u>

- Surveillance:
  - active (clinical) animal surveillance and vector surveillance
- Vaccination
- Movement control
- Vector control

Recent outbreak in Thailand – serotype 1 had caused the outbreak; the first time that this serotype has been outside of Africa. First that south-east Asia has ever experienced.

Thai Livestock Department can control African Horse Sickness outbreak

By **Pattaya Mail** May 30, 2020

1405 0

Share on Facebook | Tweet on Twitter | Like 1 | Post

The Livestock Development Department gave 8,000-dose vaccination for horses in a radius of 50 kilometers from outbreak epicenters in the 12 provinces and 7 adjacent provinces.

Horse kept in net after being vaccinated in Thailand

Response to Vector Borne Diseases

Vector surveillance for AHS in 2020

- Vector surveillance had been conducted at the high risk area located at central region of Thailand where the outbreak of African horse sickness (AHS) was occurred
- Three horse farms in each three districts were chosen for vector surveillance (totally 9 horse farms)
- Three to five light trap-UV fluorescence were placed in each farm from dusk to dawn
- Two major species of *Culicoides* found in horse farms were *C. oxystoma* and *C. imicola*
- DNA of AHSV was not found in *Culicoides* sample collected from each farm by real-time PCR

Impact of the actions

Home › Activity › OIE (World Organisation for Animal Health) has announced Thailand's reinstatement of status...

Activity | News Alert | Regulation | ปศุสัตว์

OIE (World Organisation for Animal Health) has announced Thailand's reinstatement of status to a member recognised as free from AHS (African horse sickness)

April 17, 2023

The Scientific Commission for Animal Diseases considered the application of Thailand in accordance with Resolution No. 15 of the 2020 Adapted Procedure and concluded that Thailand fulfills the requirements of Article 12.1.5. of the Terrestrial Code for recovery of its previous "AHS-free country" status with effect from 10 March 2023.

List of AHS free Members

According to **Resolution No. 16** (89th General Session, May 2022)

Members recognised as **free from AHS** according to the provisions of Chapter 12.1. of the *Terrestrial Code*:

Challenges with implementing diagnostic tests and disease surveillance

Inadequate of Expertise in Vaccine Development and EIDs Diagnosis

- Insufficient specialized training
- Inadequate investment & skilled researchers
- Gaps in updates on advanced diagnostics

Budget Constraints and **Sustainability** Issues

- Insufficient procurement of essential diagnostic equipment and materials
- Disruption of surveillance system sustainability
- Impact on the training and experts' retention

Impact of **Staff Turnover** on Diagnostic Capacity

- Disruption in diagnostic continuity
- Loss of institutional knowledge
- Need for ongoing training and maintenance of diagnostic standards

Collaboration with other sectors under One Health approach

National Committee for AHS management

Approved by Ministry of Agriculture and Cooperatives

- Technical Subcommittee
- Vector control and research Subcommittee
- AHS control in Zebra Subcommittee

DLD, DNP, and ZPO team for surveillance in zebra,

- Key to success
- Multisectoral collaboration
  - Academic
  - Private sector
  - Other government agencies: DNP

Challenge and possible solutions to strengthen the collaboration

Challenges to strengthen the collaboration with other sectors

- There is still a lack of activities to continuously foster concrete collaboration across all sectors
- The budget is limited.

Actions/ideas to overcome these challenges

- Organize meetings and continuous training for responsible parties and stakeholders to ensure preparedness and to strengthen relationships between agencies

Thank you

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