



World Organisation
for Animal Health
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Australian
Aid 



Fourth LSD coordination meeting
For South-East Asia
28-29 November, 2023 Thailand

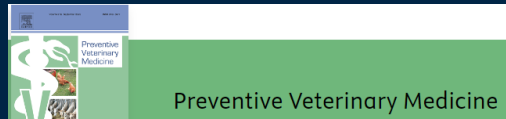
Update on Global and Regional lumpy skin disease situation

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Faculty of Veterinary Medicine
Chiang Mai University, Thailand



The First Lumpy Skin Disease Outbreak in Thailand (2021): Epidemiological Features and Spatio-Temporal Analysis

Spatio-temporal patterns of lumpy skin disease outbreaks in dairy farms in northeastern Thailand



Forecasting of daily new lumpy skin disease cases in Thailand at different stages of the epidemic using fuzzy logic time series, NNAR, and ARIMA methods



Modelling epidemic growth models for lumpy skin disease cases in Thailand using nationwide outbreak data, 2021-2022



Lumpy Skin Disease Outbreaks in Africa, Europe, and Asia (2005-2022): Multiple Change Point Analysis and Time Series Forecast

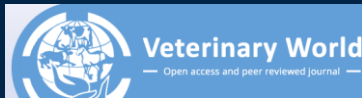
Estimating the Transmission Kernel for Lumpy Skin Disease Virus from Data on Outbreaks in Thailand in 2021



Identifying the patterns and sizes of the first lumpy skin disease outbreak clusters in Northern Thailand with a high degree of dairy farm aggregation using spatio-temporal models



Molecular Characterization and Phylogenetic Analysis of Lumpy Skin Disease Virus Collected from Outbreaks in Northern Thailand in 2021



The first study on the impact of lumpy skin disease outbreaks on monthly milk production on dairy farms in Khon Kaen, Thailand



Development of in-house ELISA for detection of antibodies against lumpy skin disease virus in cattle and assessment of its performance using a bayesian approach

10 Publications
1 Project with WOA

Presentation outline

01

LSD outbreak
situation

02

Spatial distribution
of LSD

03

Impact of LSD

04

LSD transmission

05

LSD control
measures

06

Conclusion

Resources and references

- **WAHIS data**
- **WOAH regional meeting on LSD**
- **WOAH-CMU project (data analysis, field study)**
- **Country reports**
- **Research Publications**

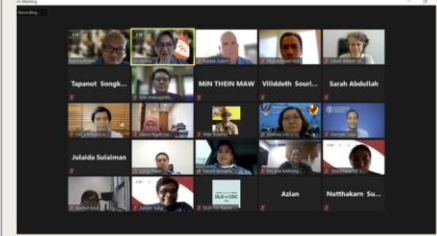


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WAHIS

LSD

**Lumpy skin disease
(LSD) coordination
meeting for South
East Asia**



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for Animal Health
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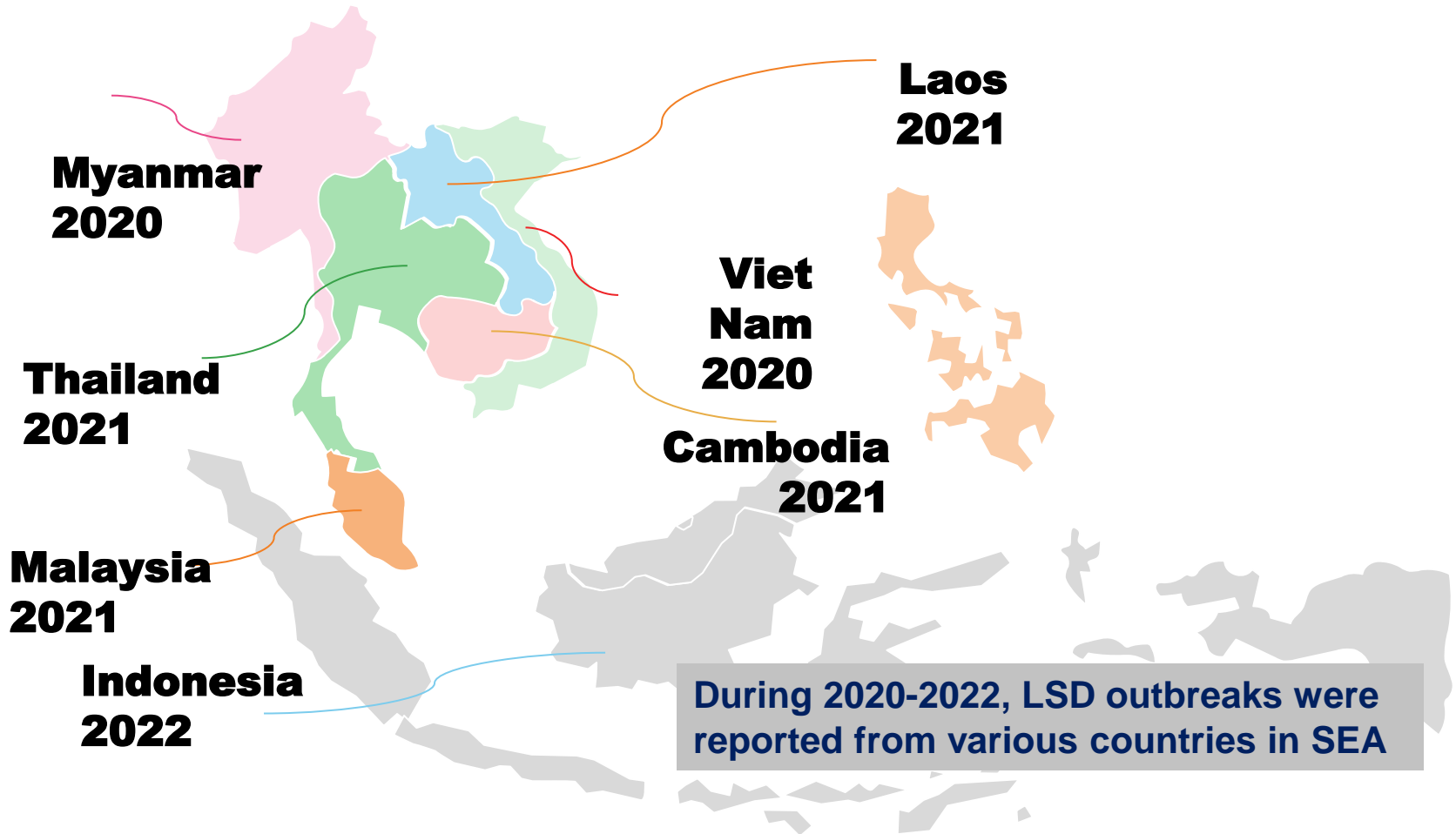


01

LSD outbreak situation



LSD spread map



**Myanmar
2020**

**Laos
2021**

**Viet
Nam
2020**

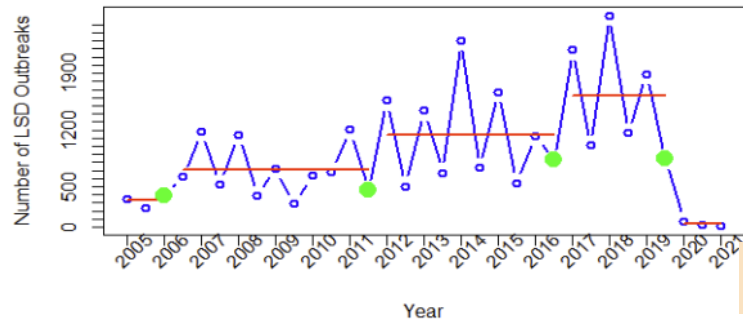
**Cambodia
2021**

**Thailand
2021**

**Malaysia
2021**

**Indonesia
2022**

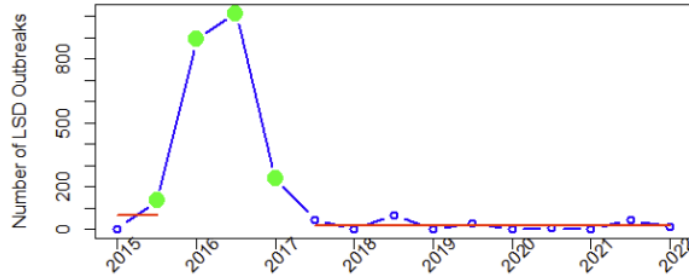
During 2020-2022, LSD outbreaks were reported from various countries in SEA



- **WAHIS: the number of LSD outbreak reports from 2005-2022.**
- **Six month report**

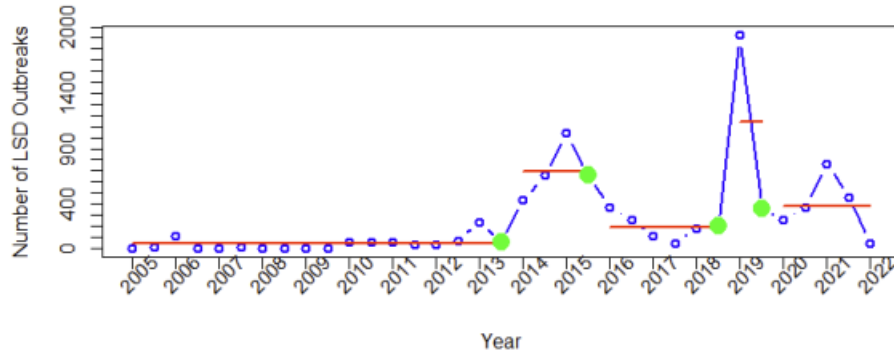
Africa

Increasing trend from 2005 until 2019, followed a sharp drop.



Europe

Low number of outbreaks since the second semester of 2017



Asia

High number of outbreaks in 2021

The most updated data : online data from WAHIS website



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WAHIS

HOME >> QUANTITATIVE DATA DASHBOARD

Quantitative data

Visualize data Export data Export interpretation

Data contained on the official reports (immediate notifications and follow-up reports, six-monthly reports and annual reports) submitted by the relevant Veterinary Services through OIE-WAHIS. For visualization of detailed information, please go to the specific "Reports" section. Please note, this dashboard is refreshed every 1-2 hours.

World region	Country	Animal type	Disease
	Animal category	Year	

Please select at least one filter to view the data

Issue is currently ongoing and may impact your user experience and data quality. If you noticed any issues, please contact the support desk. Currently the dashboard is refreshed every 24h.

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Q lumpy x

Lumpy skin disease virus (Inf. with)

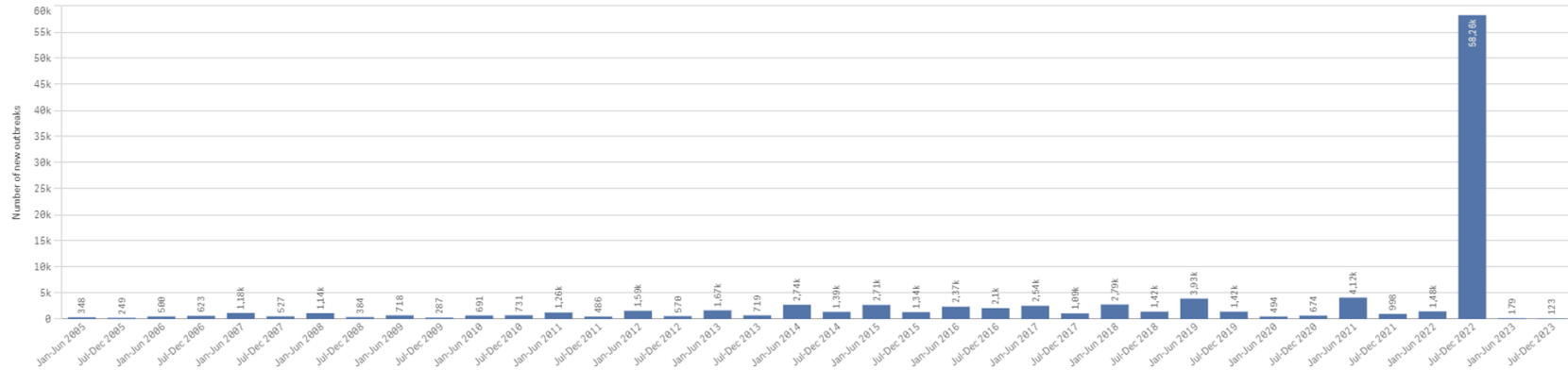
Visualization results

Number of LSD outbreak reports for every 6 month

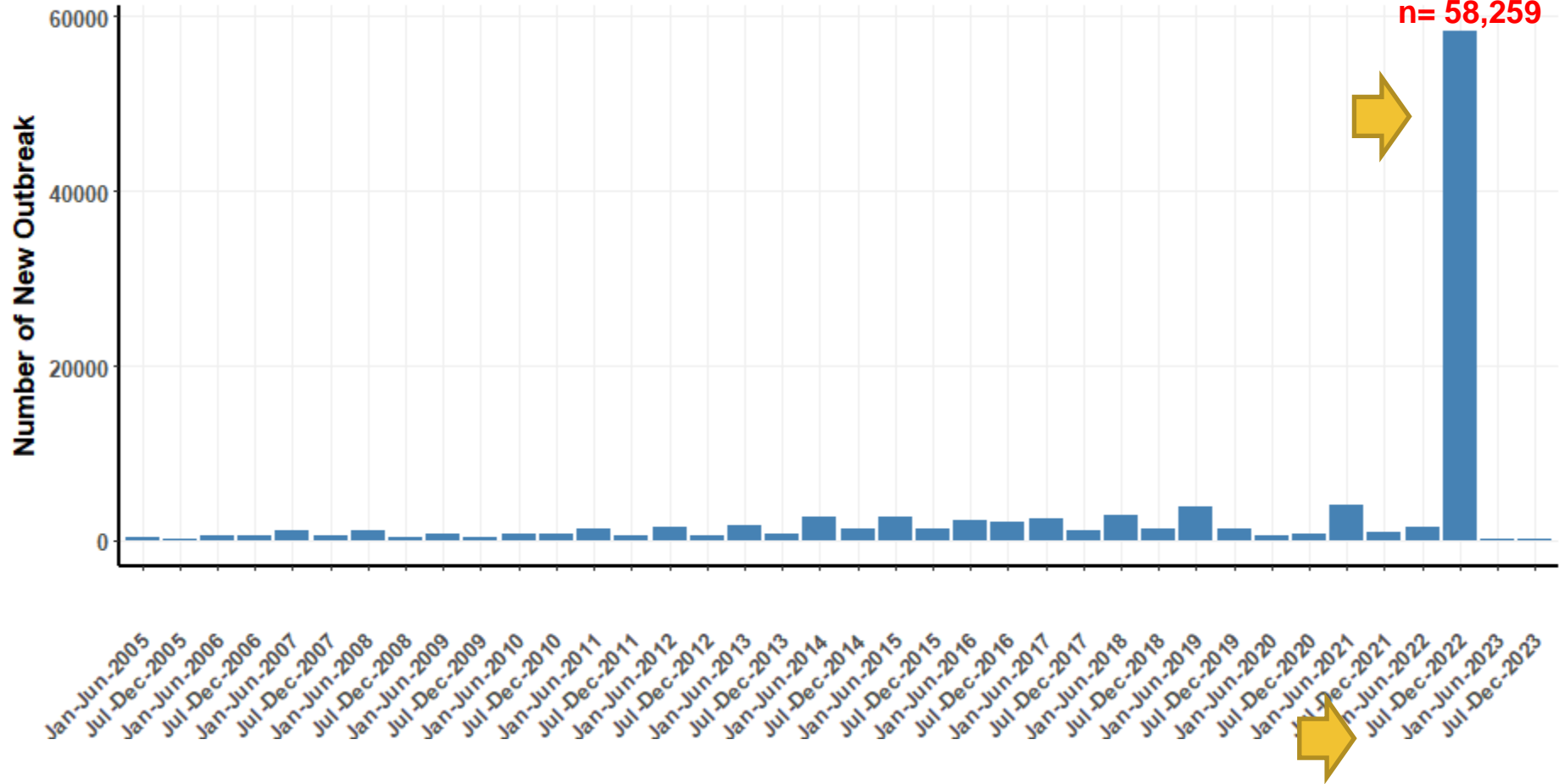
Data in excel format is also available to be download

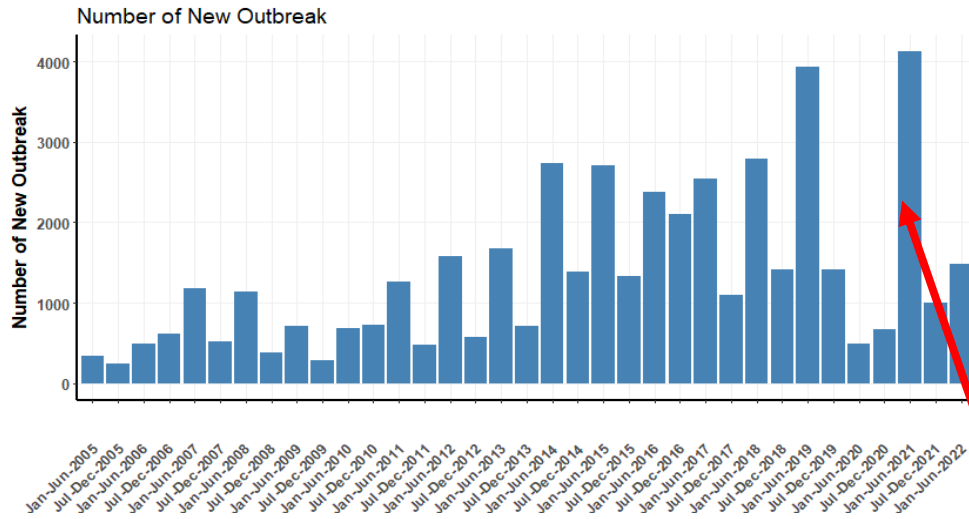
Please be aware that displaying a large quantity of data may increase the loading time

Number of new outbreaks



Number of New Outbreak





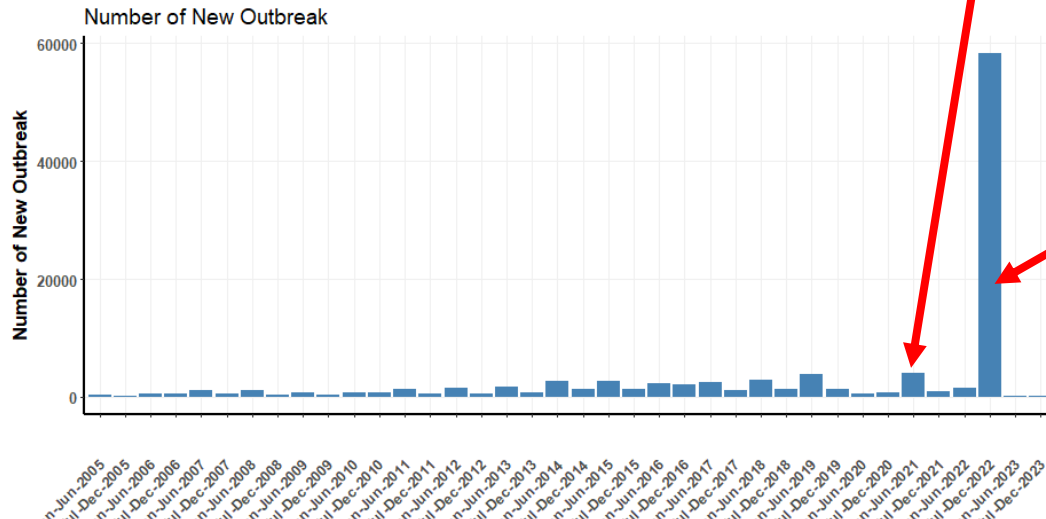
Compare data with and without the period of Jul-Dec, 2022



Graph appearance was changed



A surge in the outbreak reports



n= 4,121
Africa = 1,320
Asia = 2,801
Europe = 0

Jul-Dec 2022
n= 58,259
Africa = 358
Asia = 57,893 (mainly from India)
Europe = 3

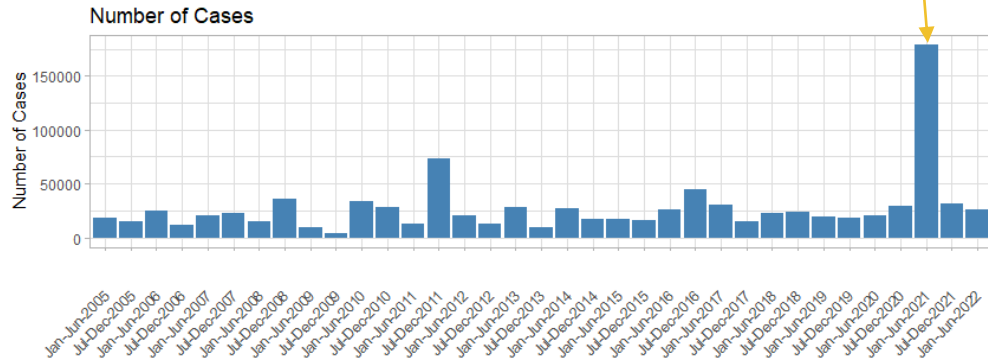
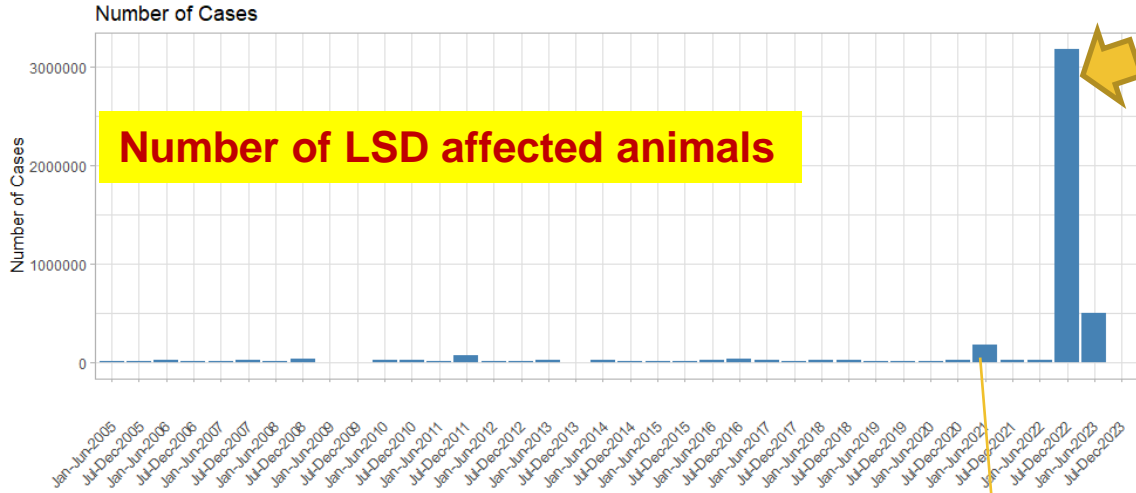
Jul-Dec 2022

3 million (n= 3,184,419)

Africa = 6238

Asia = 3177931

Europe = 250



n= 178,630

Africa = 22,353

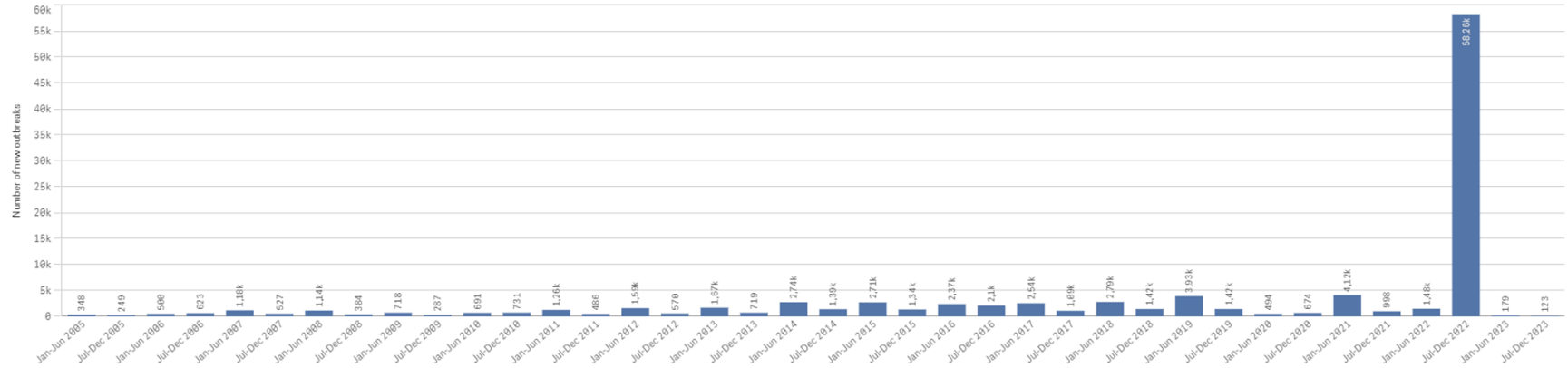
Asia = 156,227

Europe = 0

Please be aware that displaying a large quantity of data may increase the loading time

N= 57,893

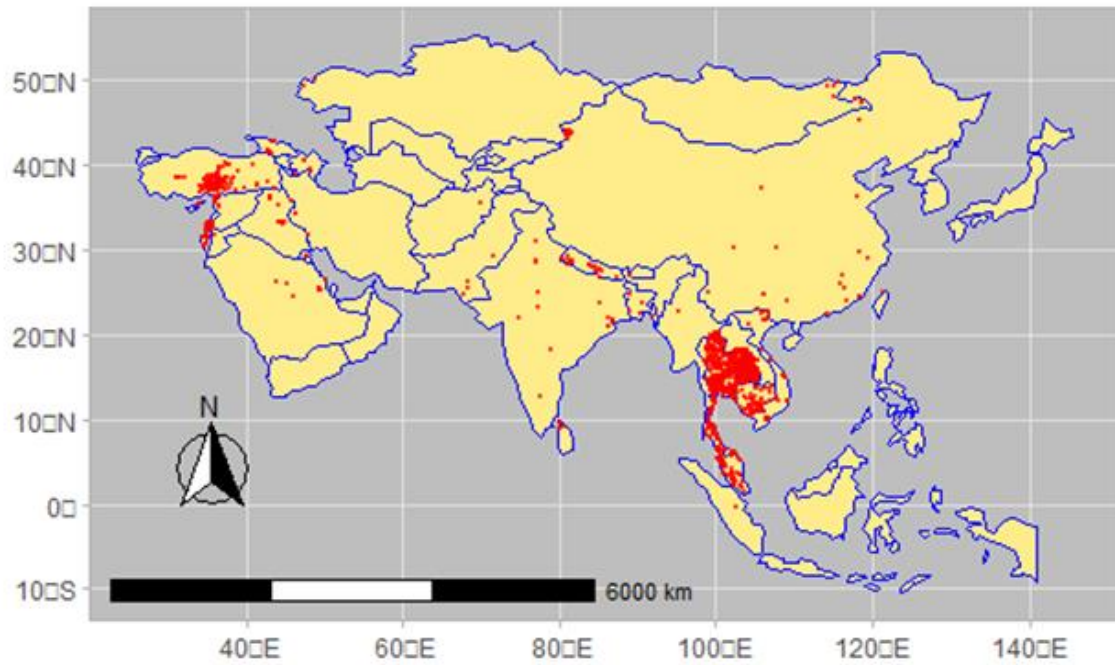
Number of new outbreaks



- **The high number of LSD outbreak may be due to the different in defining an outbreak unit**
- **Province / district / subdistrict / village / farm**
- **Compare the number of outbreak from one country of others is very challenge**

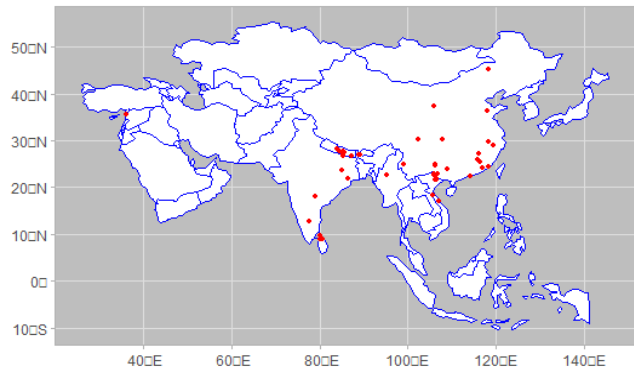
02

Spatial Distribution of LSD in Asia

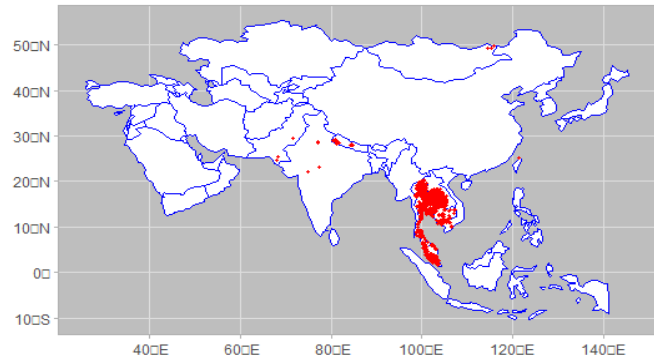


Locations (XY-coordinate: latitude and longitude) of lumpy skin disease outbreaks in Asia from January, **2006 to May, 2023**

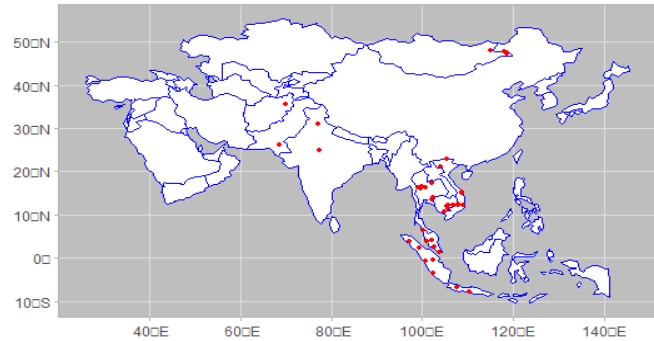
2020



2021



2022



Recent situation in Asia

- LSD outbreaks were reported from various countries
- Thailand had the highest number of LSD outbreak in 2021
- Very high number of outbreak were reported from India during Jul-Dec 2022

Spatial Epidemiology

- Spatio-temporal LSD outbreak clusters in Asia (2012-2022)
- In Thailand, LSD outbreak clusters are identified in the areas with the first LSD outbreak (Roi-Et; north-eastern), dairy farming area in the north-eastern and north.
- Directional distribution of LSD outbreaks is also identified

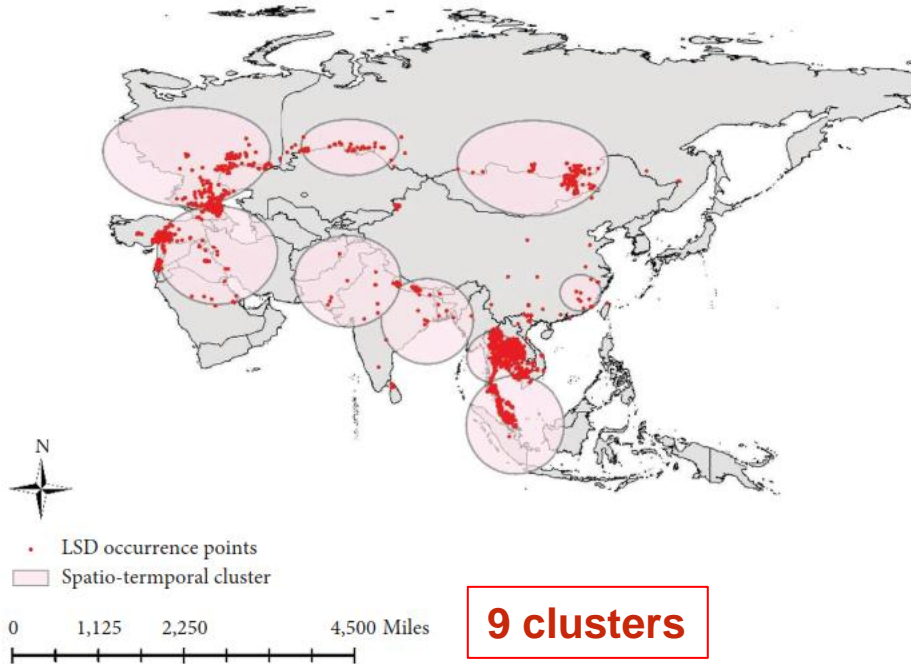
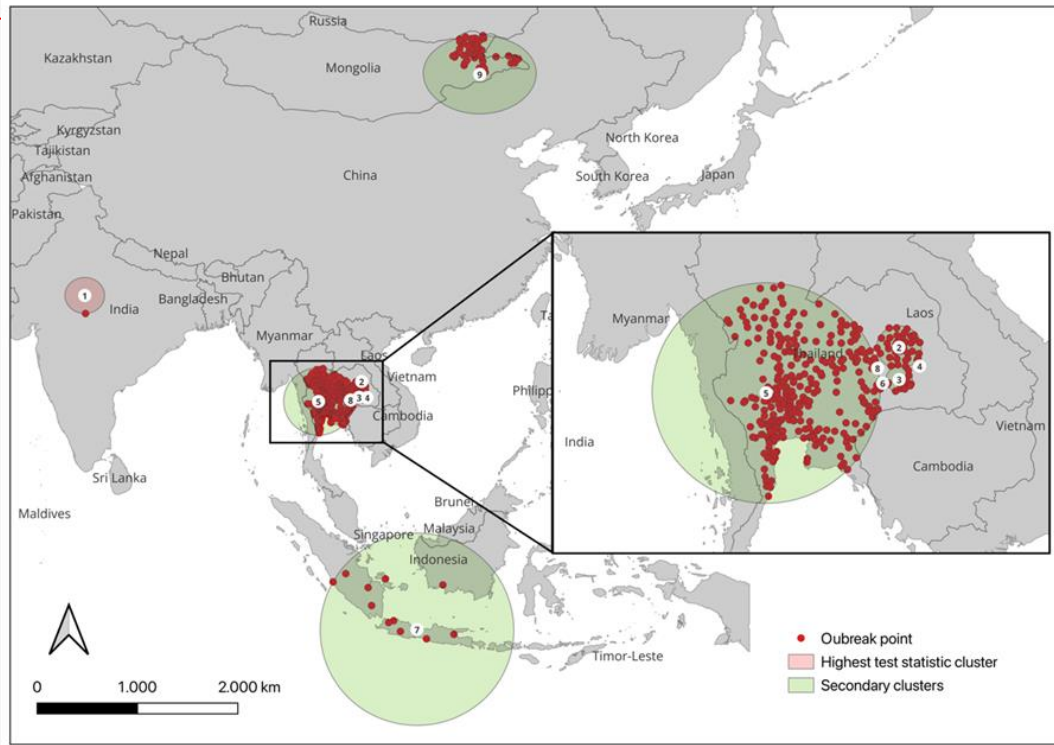


FIGURE 1: The LSD epidemic outbreak point and spatiotemporal clusters areas in the Asian continent (January 2012 to September 2022).

Within the maximum extension of the spatial window, the maximum radius was set to 1000 km, and 50% of the study period was set as the maximum time window.

No	Type of analysis	Model	Area	Time aggregation	Maximum temporal cluster size
1	Space-time	Poisson	Asia	Year	50% of the study period
2	Space-time	Poisson	Asia	Year	1 year
3	Space-time	Poisson	Asia	Month	50% of the study period
4	Space-time	Poisson	Asia	Month	1 month
5	Space-time	STP	Asia	Year	50% of the study period
6	Space-time	STP	Asia	Year	1 year
7	Space-time	STP	Asia	Month	50% of the study period
8	Space-time	STP	Asia	Month	1 month
9	Space time	Poisson	SEA	Year	50% of the study period
10	Space time	Poisson	SEA	Year	1 year
11	Space-time	Poisson	SEA	Month	50% of the study period
12	Space-time	Poisson	SEA	Month	1 month
13	Space-time	STP	SEA	Year	50% of the study period
14	Space-time	STP	SEA	Year	1 year
15	Space-time	STP	SEA	Month	50% of the study period
16	Space-time	STP	SEA	Month	1 month

Model	Description	Area	Number of clusters	Model	Description	Number of clusters	Table number
1	Space time - Poisson model	ASIA	8	9	Space time - Poisson model	1	3.9
2	Space time - Poisson model	ASIA	8	10	Space time - Poisson model	1	3.10
3	Space time - Poisson model	ASIA	2	11	Space time - Poisson model	2	3.11
4	Space time - Poisson model	ASIA	4	12	Space time - Poisson model	2	3.12
5	Space time - STP model	ASIA	6	13	Space time – STP model	6	3.13
6	Space time - STP model	ASIA	7	14	Space time – STP model	6	3.14
7	Space time - STP model	ASIA	9	15	Space time – STP model	7	3.15
8	Space time - STP model	ASIA	9	16	Space time – STP model	8	3.16



The space-time permutation model

Monthly time aggregation is applied, and the maximum temporal cluster size is set to 1 month. The model identifies one primary cluster and eight secondary clusters.

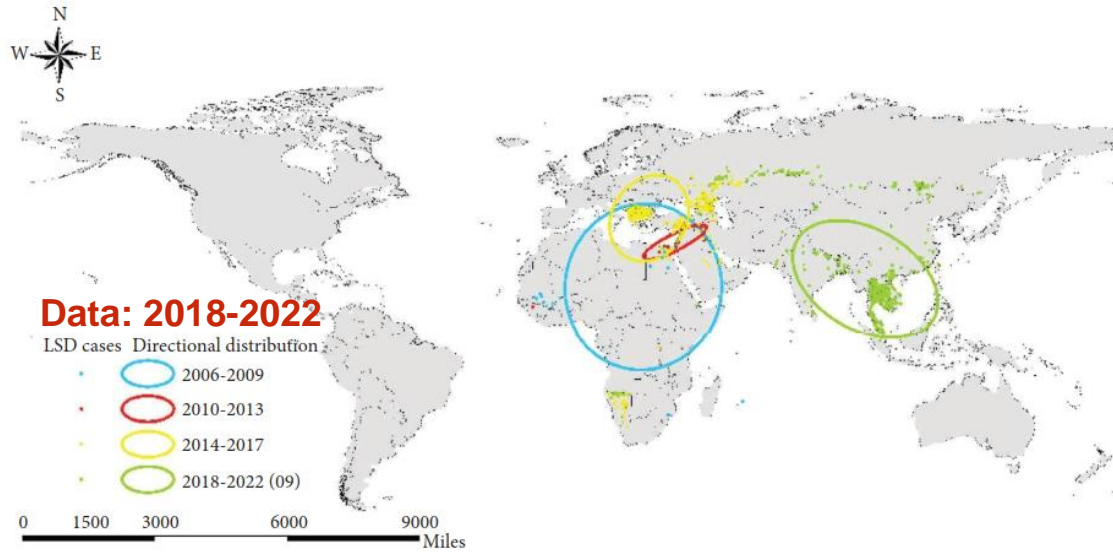
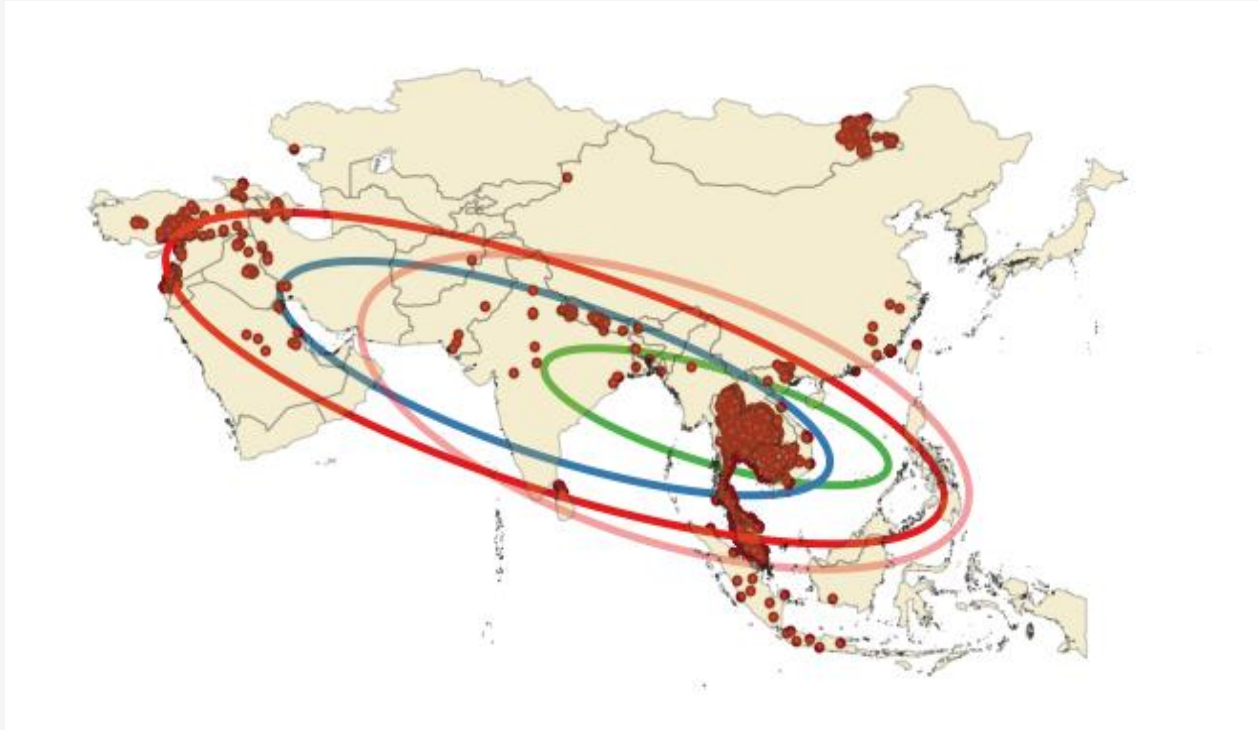
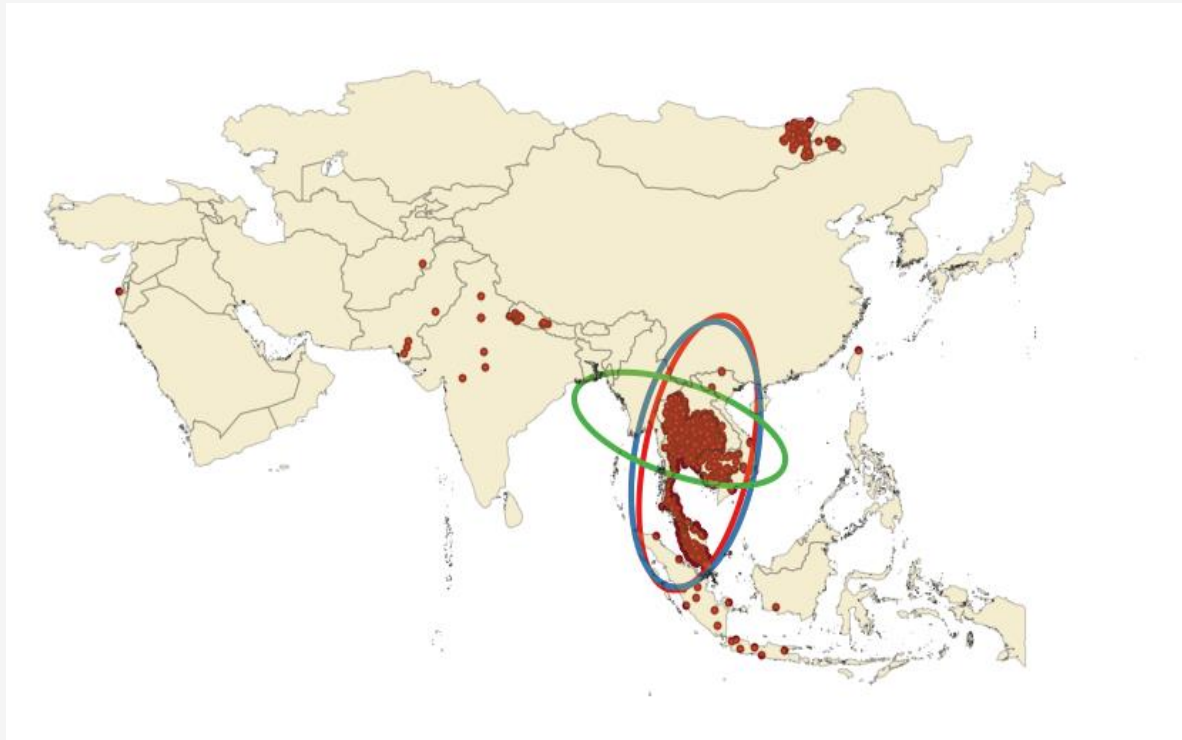


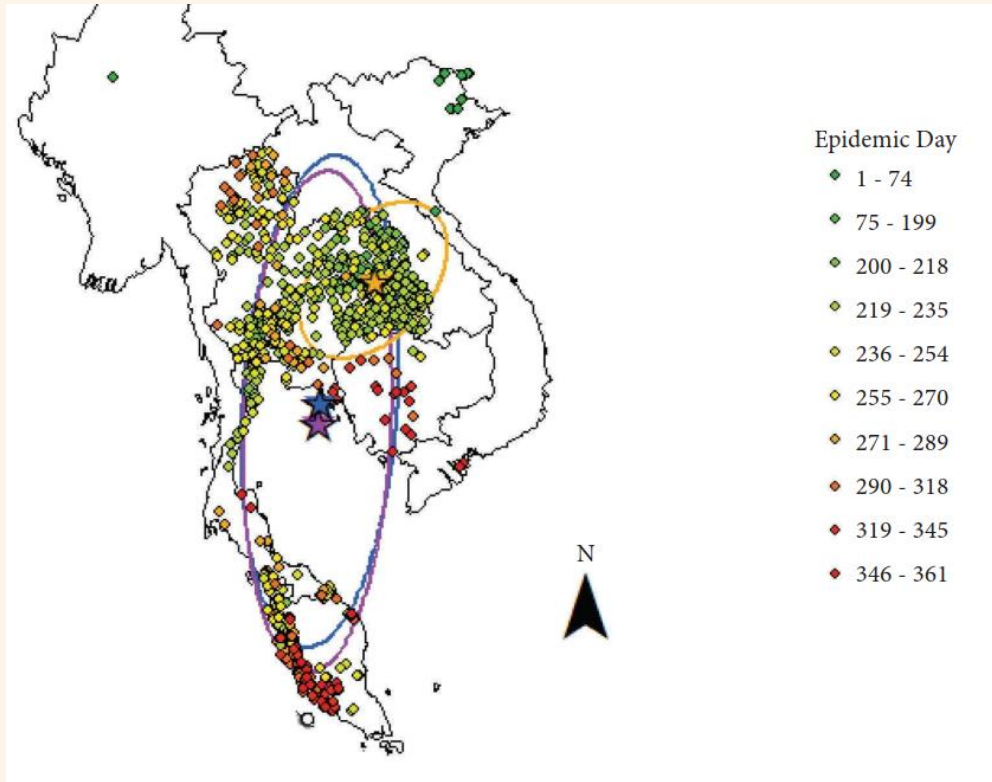
FIGURE 1: Directional distribution analysis of LSD cases in the world from 2006 to September 2022. The points and ellipses represent the LSD cases and standard deviation ellipses for the different phases. The blue color depicts 2006–2009, the red color depicts 2010–2013, the yellow color depicts 2014–2017, and the green color depicts 2018–September 2022.



Standard deviation ellipses were obtained from the **Yuill method**, with (green line) and without weighting (blue line) and **CrimeStat** with (pink line) and without weighting (red line) based on lumpy skin disease outbreak data from **2006 to 2023 (May)**.



Standard deviation ellipses were obtained from the Yuill method, with (green line) and without weighting (blue line) and CrimeStat, with (pink line) and without weighting (red line) based on lumpy skin disease outbreak data from **2021 to 2023 (May)**.



Wilhelm and Ward, 2023

Spatial Epidemiology : key message

- Type of models and parameter settings affect on the results (e.g., cluster size, number of cases, time period)
- Type of data : global and local data
- The directional trend provides a better understanding of the LSD spreading. For example, in Thailand, the disease spread is observed to move from northeast to south

Qi An et al, 2023; Arjkumpa et al, 2021;
Punyapornwithaya et al, 2022, Modethed et al., 2023

03

Impact of LSD

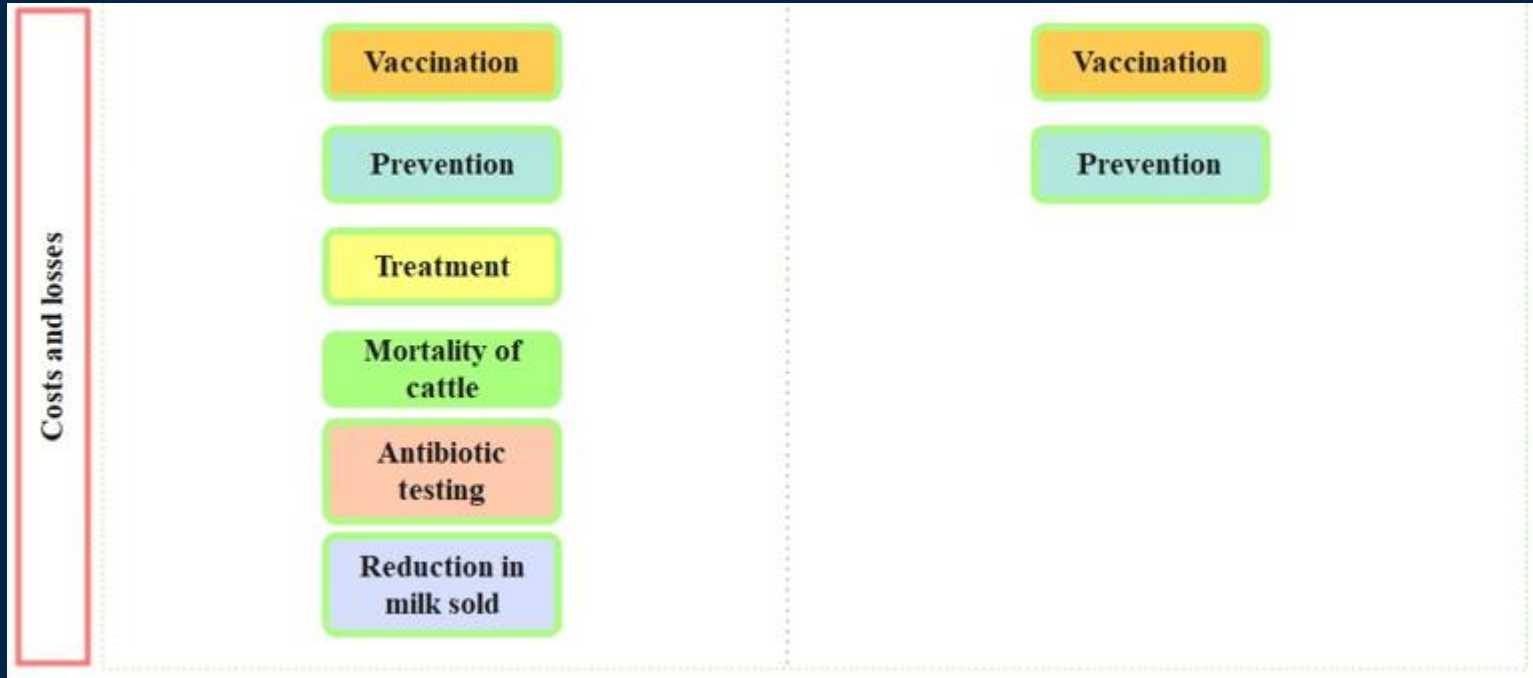
Impacts of LSD

- **Estimate : 1.45 US billion (South, East and SEA)**
- **Ethiopia: 1,176 USD/farm, Kenya: 755 USD/farm**
- **Thailand: Loss in milk sold (119-412 USD/)**

Studies in Thailand

Farm with LSD outbreak

Farm without LSD outbreak

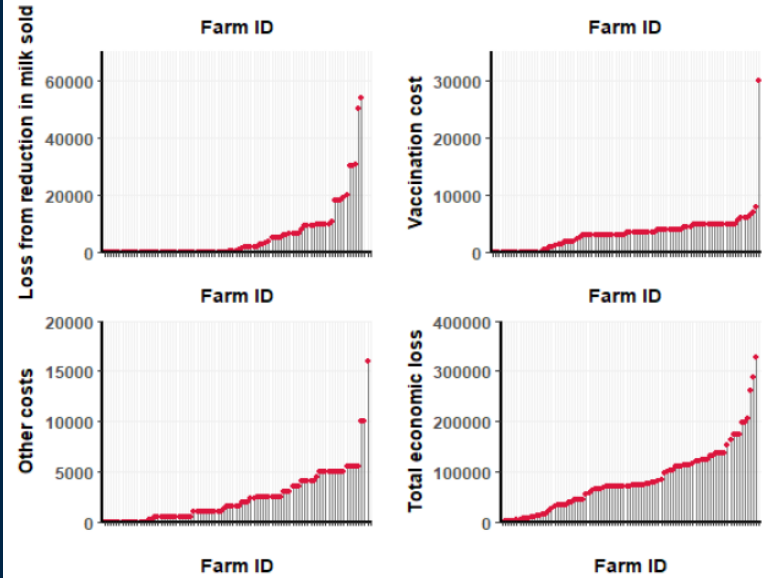
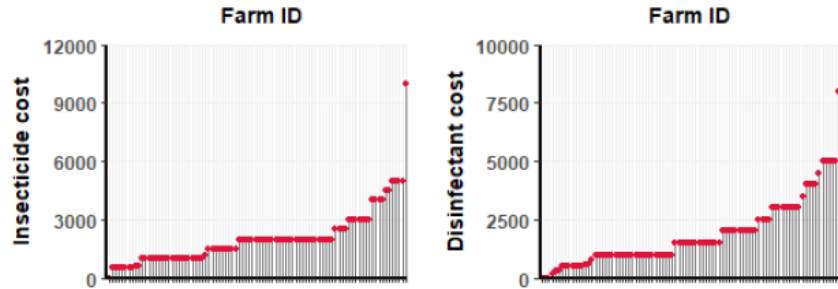
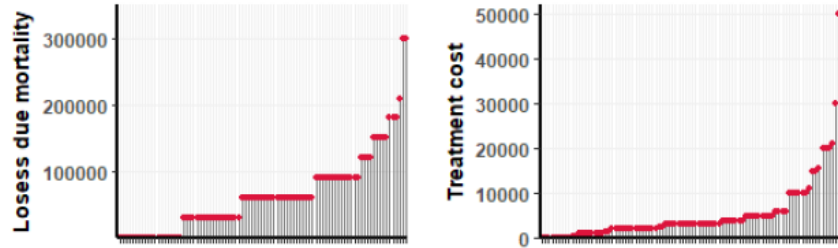


Impacts of LSD: Field study WOAH-CMU project

Economic loss due to lumpy skin disease outbreaks.

Items	Mean±Standard deviation (Thai Bath)	USD *
Loss due to mortality of cattle	64,000±61,366.46	1,801± 1,727
Treatment cost	5,227 ±7,273.22	147± 204
Insecticide cost	2,026 ±1,430.01	57± 40
Disinfectant cost	1,858±1,435.26	52± 40
Loss due to reduction in milk sold	8,084±1,722.71	227± 48
Vaccination cost	3,327±34,66.17	93± 97
Other costs	2,903 ±5,651.59	81± 150
Total economic loss	87,429 ± 74,903.06	2,461 ±2,108

*Approximate 35.5 Thai Bath equal 1 USD



- Primary loss: mortality of LSD-affected cattle.
- Vaccination cost was notably higher than insecticides and disinfectants, but lower than treatment cost



Economic loss due to LSD outbreaks in Lopburi province (Promsathit et al., 2022) .

Items	Thai Baht	USD
Mortality of cattle	5,000	14.7
Insect control	1,515	42.6
Disinfectant	NA	-
Vaccination	2,520	70.9
Treatment cost	3,835	107.9
Reduction in milk sold	5,385	151.5
Other expenses	NA	
Total economic losses	14,221	400.23

NA = data is not available

04

Transmission of LSD and Risk factors

Transmission of LSD

- Long distance : animal movements
- Short distance: insect vector
- Transmission via insect vectors is confirmed
- Kernel transmission indicates short-distance transmission in several outbreak areas
- Insect controls for naïve herd ?

Sprygin et al., 2019;
Sohier et al., 2019;
Punyapornwithaya et al., 2023

Risk factors

- **Animal movements**
- **Lack or ineffective insect control (Thailand and Indonesia)**
- **Climate**
- **Others**

05

Control measure of
LSD

Vaccination

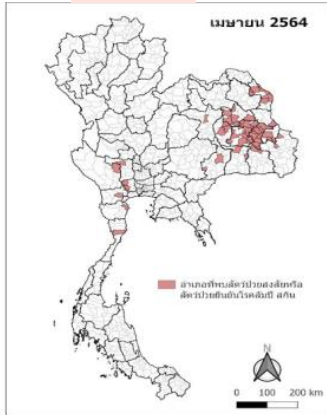
Country	Vaccine	Trade Brand
Vietnam	Homologues Heterologous	LumpyShield-N® / LumpyShield-G® JovivacStrong®
Thailand	Homologues	LUMPYVAX®, MEVAC®
Malaysia	Homologues	Bovivax LSD-N®, LUMPYVAX®, MEVAC®
Cambodia	Homologues	LUMPYVAX®,
Indonesia	Homologues	LUMPYVAX®, MEVAC®
India	Homologues	Lumpi-ProVacInd®

Example: control measures implemented in the country with a nationwide LSD outbreak

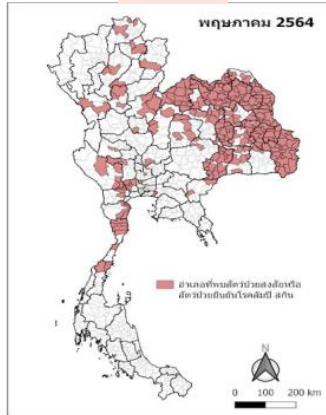
March



April

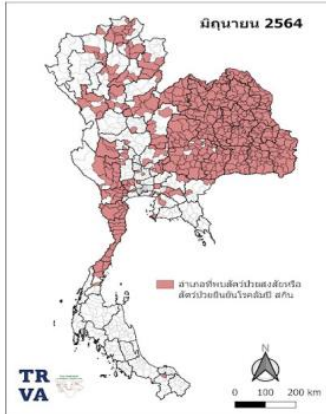


May

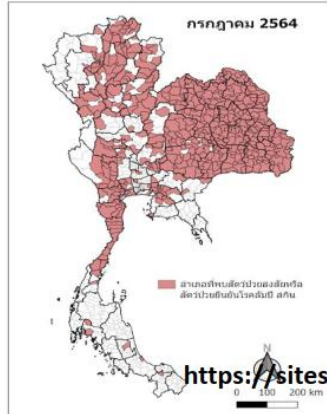


Thailand has a massive LSD outbreaks in 2021

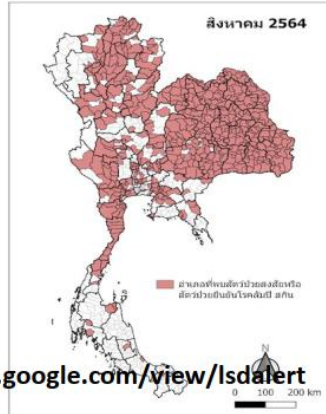
มิถุนายน 2564



กรกฎาคม 2564



สิงหาคม 2564



<https://sites.google.com/view/lstdalert>

DLD-Website:
frequently update
the outbreak situation

June

July

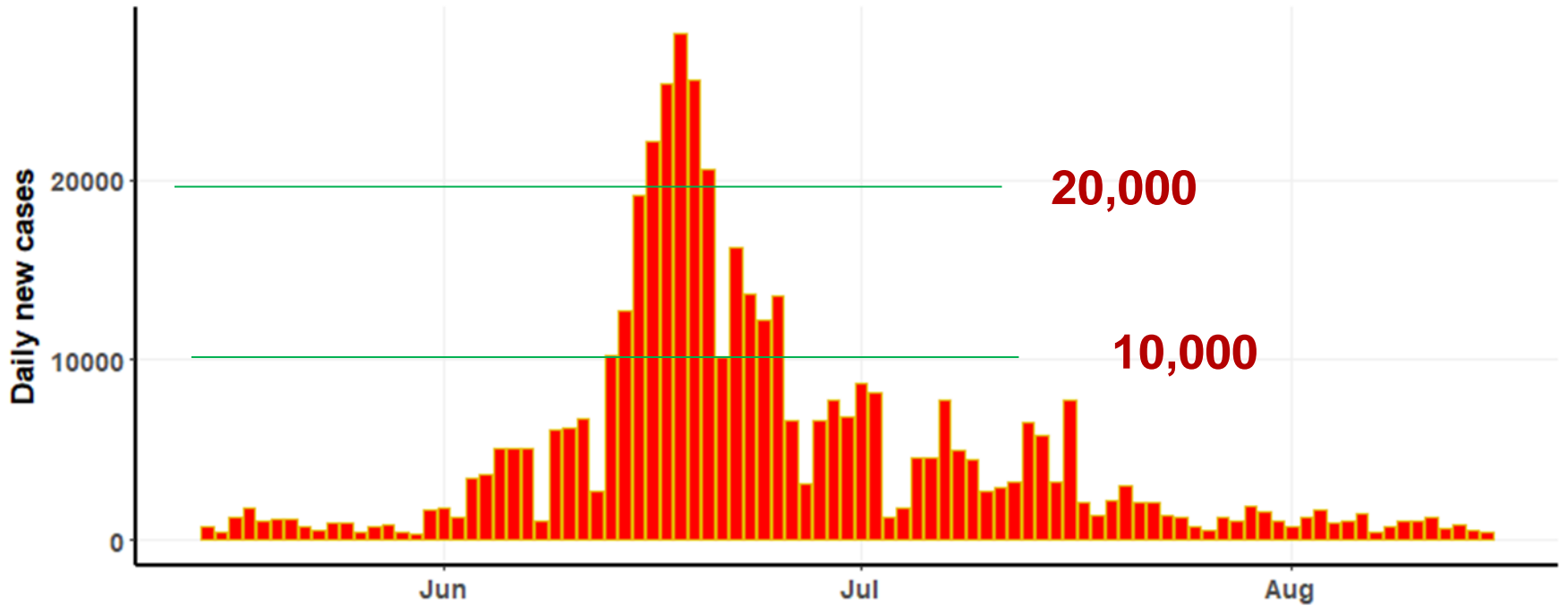
August

Article

Rapid Spread and Genetic Characterisation of a Recently Emerged Recombinant Lumpy Skin Disease Virus in Thailand

Nutthakarn Suwankitwat ^{1,2}, Tapanut Songkasupa ², Prakrit Boonpornprasert ², Phurida Sripipattanakul ², Sirin Theerawatanasirikul ¹, Taweewat Deemagarn ², Minta Suwannaboorn ³, Orapun Arjkumpa ³, Noppawan Buamithup ², Akkarapol Hongsawat ², Sirima Jindajang ⁴, Nawakarn Nipaeng ⁵, Dilok Aunpomma ³, Lamul Molee ², Kanokwan Puangjinda ², Walaiporn Lohlamoh ², Bandit Nuansrichay ², Rawint Narawongsanont ¹, Pipat Arunvipas ^{6,*} and Porntipa Lekcharoensuk ^{1,*}

- **March to July 2021 : 426 out of 859 samples were confirmed positive by p32 real-time PCR**
- **Nearly identical to strains found in Vietnam and China**



LSD outbreaks in Thailand (2021)

Control measures at national scale

Following the WOAAH meeting presentation (WOAH, 2021a, b), the control measures implemented immediately after the first outbreak in 2021 included:

- Controlling vectors.
- Utilizing disinfectants.
- Establishing a containment zone with a 50 km radius around outbreak farms.
- Conducting active surveillance in areas adjacent to the containment zone to monitor new cases.
- Employing active LSD cases finding approaches for active surveillance within the containment zone.
- Implementing quarantine measures for all confirmed and suspected herds.
- Enforcing a ban on animal movement both into and out of the contaminant zones.



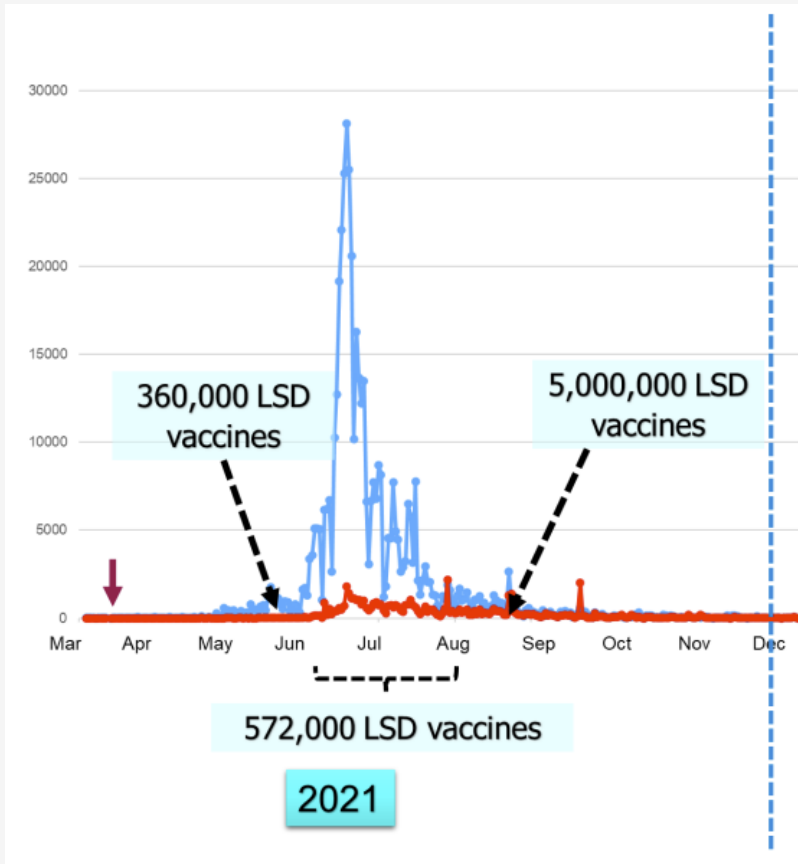
WOAH, Suwankitwat et al.,



https://rr-asia.woah.org/wp-content/uploads/2022/12/thailand_lsd_update_presentation-1.pdf

The follow-up WOAAH meeting, which focused on LSD prevention and control (WOAH, 2022), provided the following updates on LSD vaccination:

- Live attenuated vaccines, including LUMPYVAX and MEVAC, with a total of 5,923,000 doses imported, and an additional 6,300,000 doses are expected in 2023.
- Data revealed that 5,923,000 doses were administered.
- Spot-on insecticide was applied in 38,348 farms, while spray insecticide was used in 227,121 farms. Additionally, insecticide was distributed to 134,863 farms.
- Disinfectant was utilized in 174,353 farms.
- Public relations and education initiatives were conducted involving 434,994 farmers.



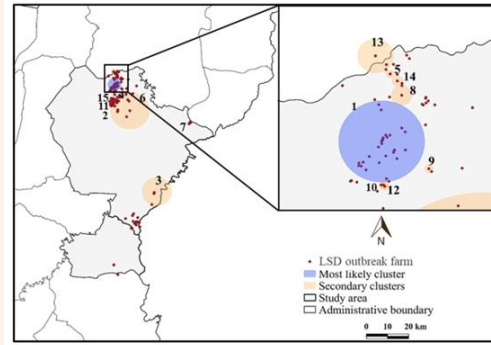
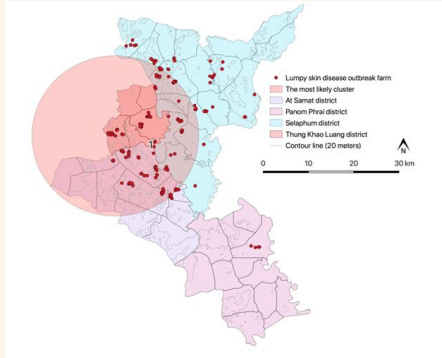
Results from a Bayesian interrupted model indicate the effects of mass vaccination on the reduction of new LSD cases (under review manuscript)

https://rr-asia.woah.org/wp-content/uploads/2022/12/thailand_lsd_update_presentation-1.pdf

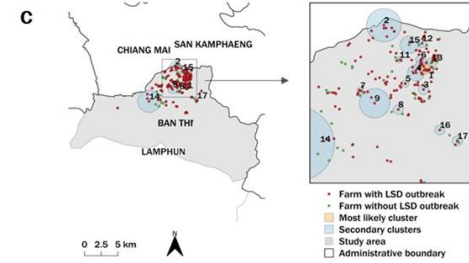
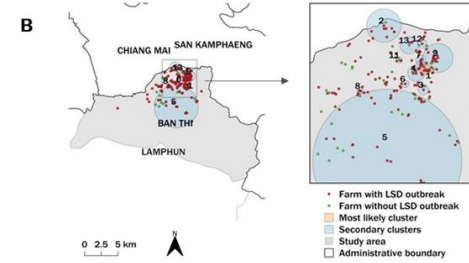
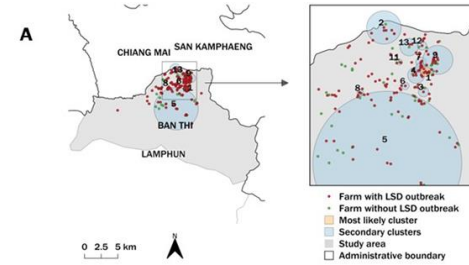


Knowledge gap

- **Policy: 50 km radii for animal movement control**
- **No suggestion for insect vector control radius**



- Results from 4 publications
- Most of clusters had radius < 1 km
- Suggestion for **effective insect vector control** in the 1 km radii of outbreak farm for area with high density of farms and abundant of insects

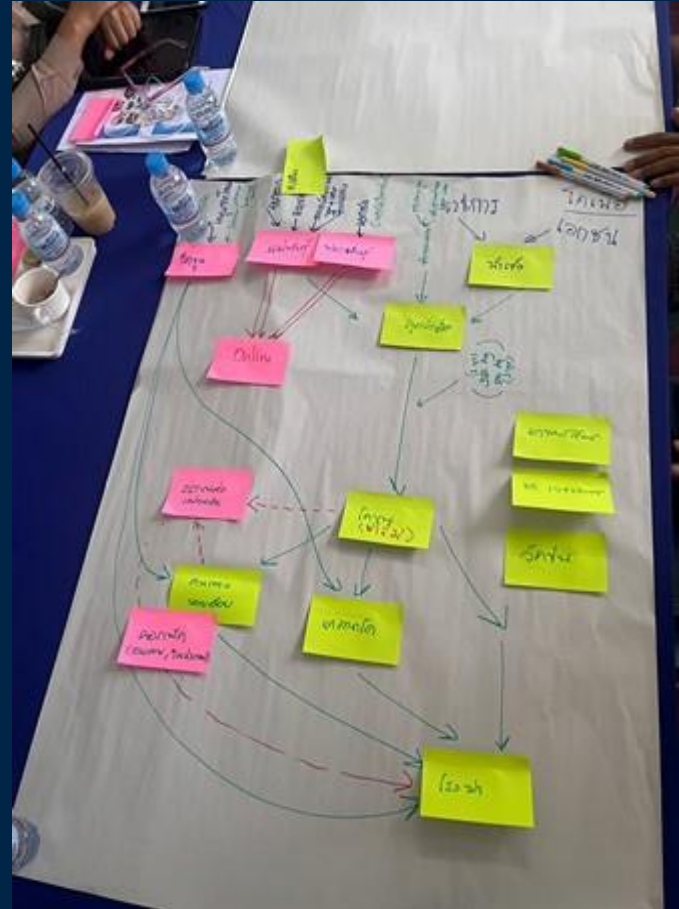


Effective insect vector control

- Using insecticide over a large area may not be effective and could be costly
- Applying insecticide by spraying it on the body surface of animals may be challenging
- The elimination of breeding habitats for insects may not provide complete protection.
- The production of smoke through burning grass has a solely repellent impact on insects.

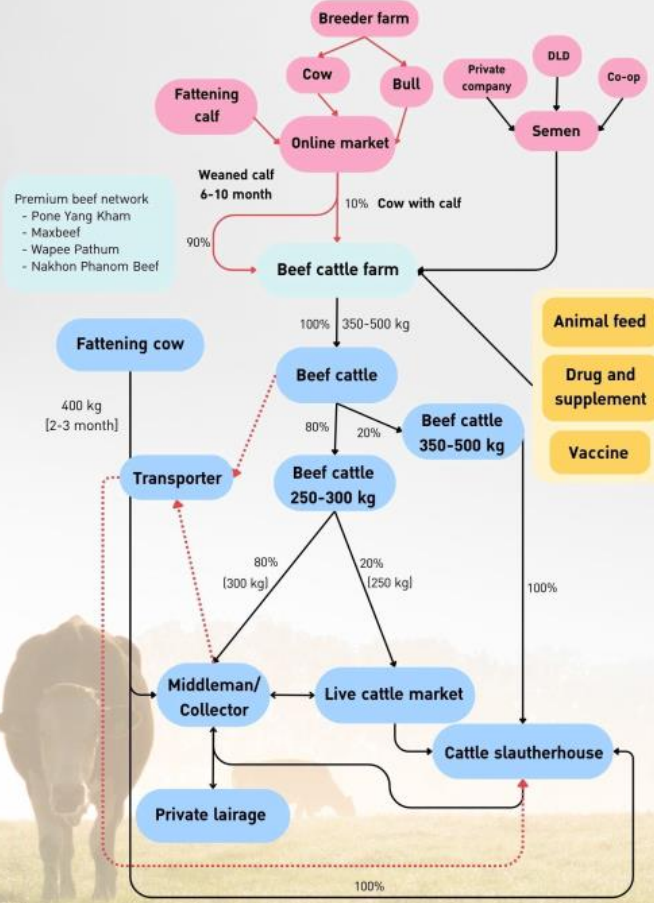
Value chain analysis

WOAH-CMU project

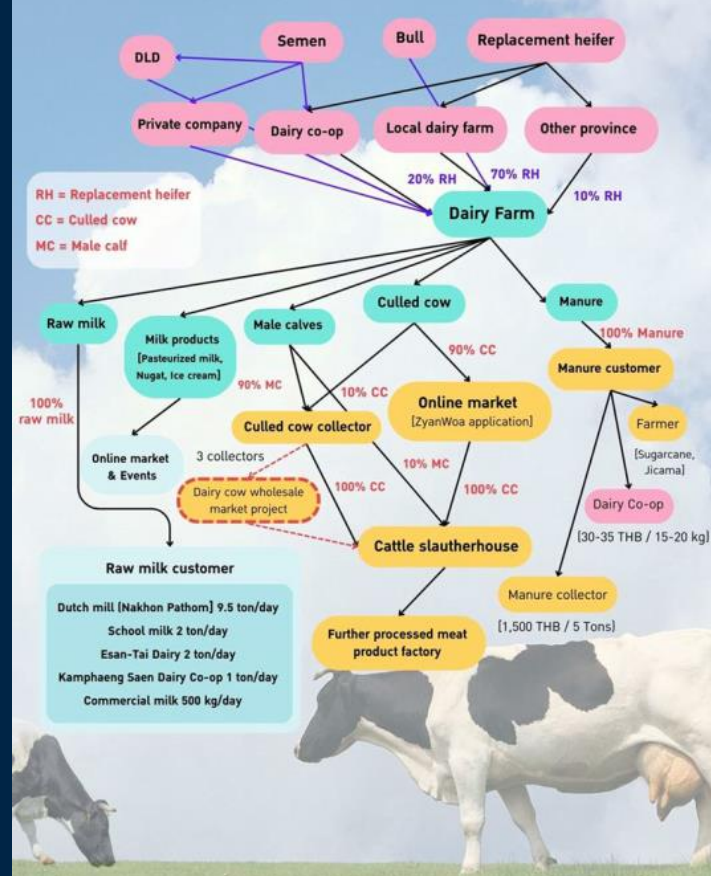


Khokkho dairy cooperative

Beef cattle value chain



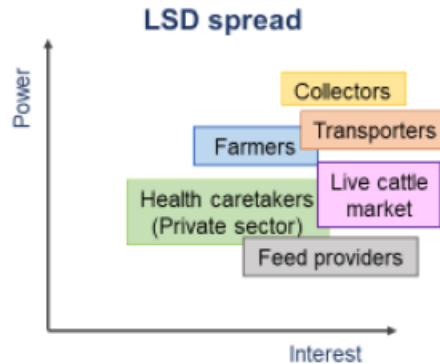
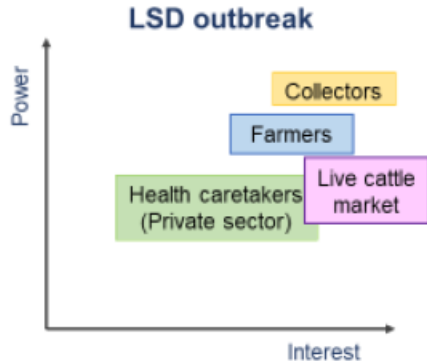
Dairy cattle value chain



Understanding the connection of stakeholders in the value chain

Preliminary knowledge is valuable for disease prevention and control

How did the stakeholders engage with each other during the outbreak?



Animal traders play important role for LSD outbreak and spread

Farmers play important role for LSD prevention and control

Cooperation among stakeholders (e.g. dairy cooperative, livestock officers and University faculty) is the key.

Conclusion: key message

- LSD is currently widespread in Asia.
- Establishing guidelines or recommendations for the prevention and control of LSD is crucial.
- Cooperation among countries is necessary
- Enhancing the reporting system for LSD outbreaks.
- Conducting regional and local studies.

Acknowledgement

- Study working group from WOAHA
- WOAHA
- Australia DAFF : Enhanced capacity of countries in South-East Asia to detect, control and prevent the spread of priority transboundary animal disease

Thank you for your attention