



World Organisation
for Animal Health
Founded as OIE

USE OF MCDA (CASE STUDY): SPATIAL RISK ASSESSMENT ON SPREAD OF DOG-MEDIATED RABIES IN SARAWAK



TEAM MALAYSIA

DR. LEONORA TUAH
DR. MUHAMMAD SYAZWAN MUHD SABRI
DR. MARIANI HASHIM
DR. SITI NORSYAKIRAH HASHIM



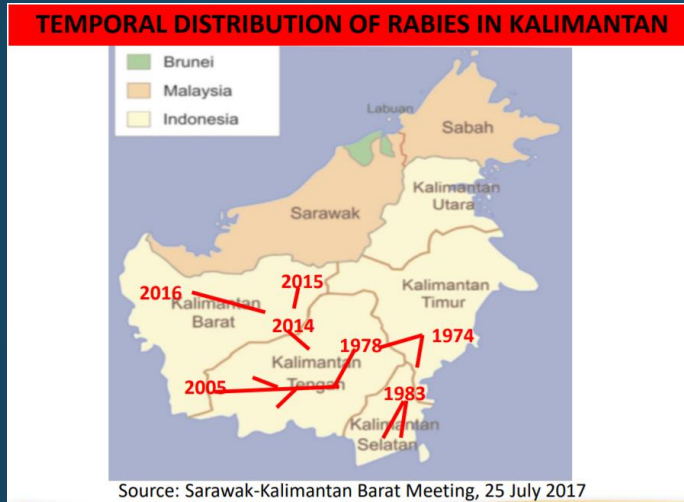
SEACFMD Joint EpiNet and LabNet Virtual meeting

8 DECEMBER 2022



BACKGROUND

- Sarawak
 - historically free prior to 2017, existing dog pop. – naïve, no vacc practiced
 - West Kalimantan – approaching cases 2016
- 1st July 2017 → **Human Rabies incidence**
 - 3 children in Serian district (incl. roaming pet dogs)
 - History: Rabid dogs from West Kalimantan – suspected during harvest festival
- Until July 2021 – all 11 divisions declared as infected areas
- **From 1st Jul 2017 - Dec 2022:** 52 human rabies cases → 45 deaths (2022: 14 cases → 11 deaths)
- Counter-measures
 - vaccination, dog population density reduction, awareness
 - Why are there still high cases?



POSITIVE ANIMAL CASES

YEAR	DOGS	CATS
2019	146	38
2020	159	24
2021	95	13
2022 (Dec: Wk 1)	34	6





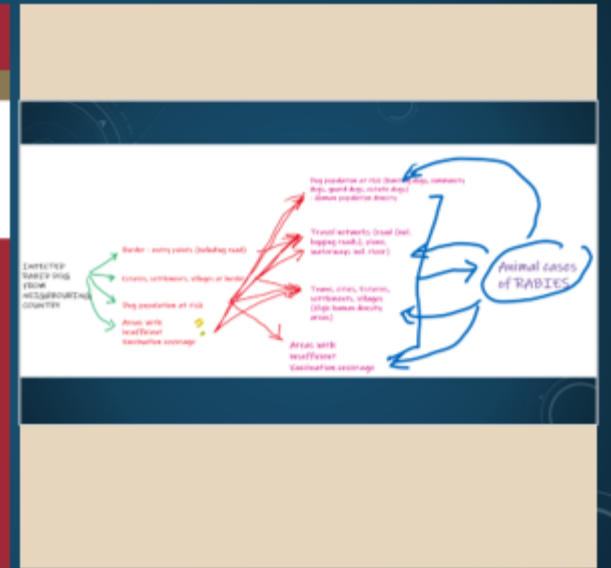
METHODOLOGY

- Risk factors – incursion, spread
 - differentiating spatial vs non-spatial data
 - availability of raw (spatial) data incl. proxies
- Causal pathway for disease occurrence
 - entry & dissemination
 - other factors contributing to incursion, spread
- Factors inputted into **MCDA excel table** (tool provided by Massey Univ.) (Via Google Form and joint discussion)
 - Weightage evaluation of spatial risk factors
 - Questionnaire → distributed across fields of expertise & field experiences with Rabies (DVS Sarawak, DVS Sabah, DVS Malaysia, DWNP, Academia, Research Institute, Retired technical experts) → circulated to 80 persons – 48 respondents

IDENTIFICATION OF RISK FACTORS AND PATHWAY MODELLING

• Identification of Risk Factors – Incursion & Spread

SPATIAL		NON SPATIAL
INCURSION Border - entry points (including road) Dog population at risk Estates, settlements, villages at border Vaccination coverage (sufficient herd immunity)		INCURSION + SPREAD Anti-rabies / owner that releases / discarded used for vaccination - correct local spot policies - availability of public as rabies - resources on control and prevention - illegal smuggling of dogs through border - illegal movement of dogs between districts / divisions
SPREAD Animal clinical cases Dog population at risk (hunting dogs, community dogs, guard dogs, estate dogs) Human population density - Towns, cities, Estates, settlements, villages - Travel networks (road incl. logging roads), plane, waterways incl. river Vaccination coverage (sufficient herd immunity)		
Factor Code	Factor Abbrev	Factor Description
A	BDR	Border entry points (legal & illegal)
B	BDRP	Border premises (e.g. estates, settlements, villages, towns)
C	DOG	Dog population at risk (incl. hunting dogs, community dogs, estate dogs)
D	VACCDOVER	Animal vaccination coverage
E	TRAVELNETWORK	Travel networks (roads incl. logging roads & highway, waterways incl. rivers, plane)
F	HUMAN	High human density areas (e.g. towns, cities, villages, estates, settlements)
G	ANIMALCASES	Animal rabies case occurrence



RESPONDENT AFFILIATION	NO.
DVS Kelantan	1
DVS Malaysia	26
DVS Sabah	1
DVS Sarawak	12
Faculty of Veterinary Medicine, Universiti Malaysia Kelantan	1
Faculty of Veterinary Medicine, Universiti Putra Malaysia	1
None_ retired from WHO	1
None_ Retired from DVS	2
Department of Wildlife and National Parks, P. Malaysia	1
Veterinary Research Institute	2
Grand Total	48

Questionnaire ID:
Participant role:

Question (circle only one answer)

1 When comparing Border premises (e.g. estates, settlements, villages, towns) with Border entry points (legal & illegal) for the incursion and spread of Rabies in Sarawak, Border premises (e.g. estates, settlements, villages, towns) is

extremely less important

very strongly less important

strongly less important

moderately less important

equally important

moderately more important

strongly more important

very strongly more important

extremely more important

2 When comparing Dog population at risk (incl. hunting dogs, community dogs, estate dogs) with Border entry points (legal & illegal) for the incursion and spread of Rabies in Sarawak, Dog population at risk (incl. hunting dogs, community dogs, estate dogs) is

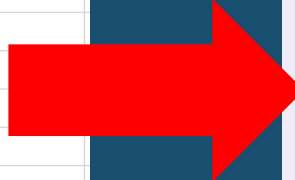
extremely less important

very strongly less important

strongly less important

moderately less important

equally important



QUESTIONNAIRE FOR SPATIAL RISK ASSESSMENT (SRA) OF DOG-MEDIATED RABIES IN SARAWAK

Dear Dato' / Prof. / Dr. / Sir / Madam / Ms.,

As part of an assignment from the Advanced GIS Epidemiology Course collaboratively conducted between the OIE and Massey University (Malaysia being an active participant), the Malaysian team has elected on spatial risk assessment of dog-mediated Rabies incursion and spread in Sarawak.

The Team has devised a Course-guided questionnaire and **greatly require your assistance to participate in answering the questions as an expert / experienced person in the field control and prevention of Rabies in Sarawak and Peninsular Malaysia.**

The goal of the questionnaire is to obtain an unbiased quantifiable weightage **via comparisons between spatial risk factors** that may contribute to the incursion and spread of dog-mediated Rabies in Sarawak.

Results from this questionnaire would enable us to proceed to the next stage of the course which is to create quantifiable mapping of risk areas through QGIS based on current available data and calculated weightage.

This questionnaire is **open until Saturday (14 Aug 2021) 6.00pm.**

⋮

When comparing **Border premises (e.g estates, settlements, villages, towns)** with **Border entry points (legal and illegal)** for the incursion and spread of Rabies in Sarawak, **Border premises (e.g estates, settlements, villages, towns)** is

Extremely less important

Very strongly less important

Strongly less important

Moderately less important

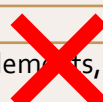
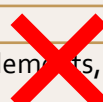



Equally important

- Risk evaluation & weightage – comparison of two alternatives & 'outranking'
- Scoring system – REMBRANDT MCDA method

RESULTS (PART 1 – MCDA (INCL. VALIDATION OF RISK FACTORS))

		Transformed score for each risk factor comparison								
		RISK FACTOR 2							Geometric row mean	Weight for spatial risk layer
RISK FACTOR 1	Border entry points (legal & illegal)	Border premises (e.g. estates, settlements, villages, towns)	Dog population at risk (incl. hunting dogs, community dogs, estate dogs)	Animal vaccination coverage	Travel networks (roads incl. logging roads & highway, waterways incl. rivers, plane)	High human density areas (e.g. towns, cities, villages, estates, settlements)	Animal rabies case occurrence			
	Border entry points (legal & illegal)	1.00	0.30	0.30	0.16	0.30	0.16	0.30	0.03	0.00
	Border premises (e.g. estates, settlements, villages, towns)	3.33	1.00	0.30	0.16	0.55	0.41	0.16	0.11	0.00
	Dog population at risk (incl. hunting dogs, community dogs, estate dogs)	3.33	3.33	1.00	0.16	0.74	0.41	0.16	0.35	0.01
	Animal vaccination coverage	6.09	6.09	6.09	1.00	0.55	1.00	0.16	3.70	0.07
	Travel networks (roads incl. logging roads & highway, waterways incl. rivers, plane)	3.33	1.83	1.35	1.83	1.00	0.41	0.30	1.30	0.03
	High human density areas (e.g. towns, cities, villages, estates, settlements)	6.09	2.47	2.47	1.00	2.47	1.00	0.55	5.47	0.11
	Animal rabies case occurrence	3.33	6.09	6.09	6.09	3.33	1.83	1.00	38.88	0.78
									1.00	

- **Identifying Factors**
 - Focus on Incursion? Spread?
 - Require brainstorming, data-based/preceding correlations
- **Focusing on SPREAD Factors:**
7 factors → 5 factors

Factor Code	Factor Abbrev	Factor Description
A	BDR	Border entry points (legal & illegal) 
B	BDRP	Border premises (e.g. estates, settlements, villages, towns) 
C	DOG	Dog population at risk (incl. hunting dogs, community dogs, estate dogs) 
D	VACCCOVER	Animal vaccination coverage
E	TRVLNETW ORK	Travel networks (roads incl. logging roads & highway, waterways incl. rivers, plane)
F	HUMAN	High human density areas (e.g. towns, cities, villages, estates, settlements) 
G	ANIMALCASES	Animal rabies case occurrence 

So the question we asked ourselves ...

- Should we focus on **both incursion and spread**, or more on **spread**? (Looking at case comparison 2018 vs 2020/2021)
 - **Rabies Cases as a RISK or a CONSEQUENCE?** (heavy bias)
- PROXIES – ANY CORRELATION BETWEEN**
- Border Entry points | Border premises?
 - Human population density | Dog population at risk density?



RESULTS (PART 1 – MCDA (INCL. VALIDATION OF RISK FACTORS))

IF 5 RISK FACTORS

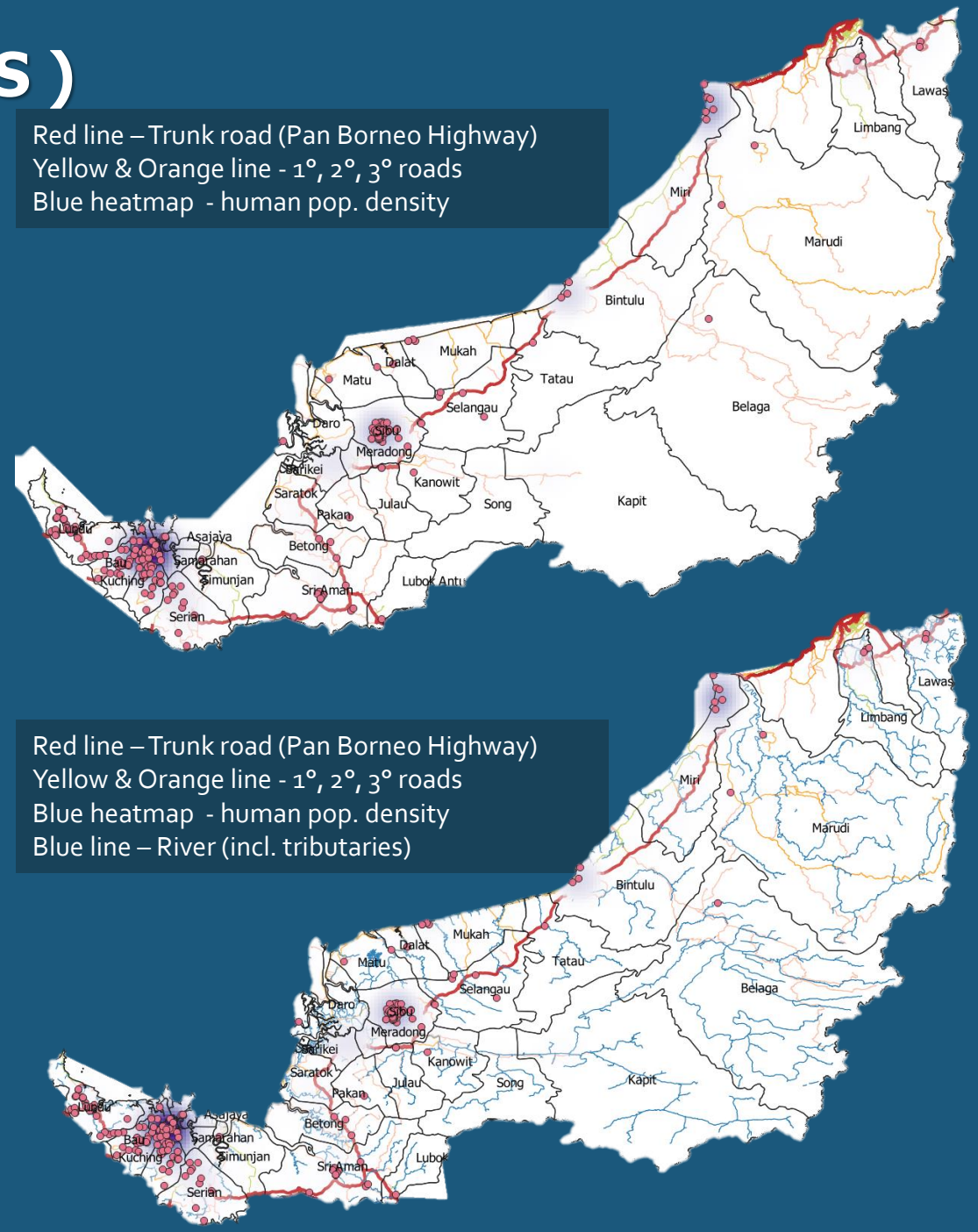
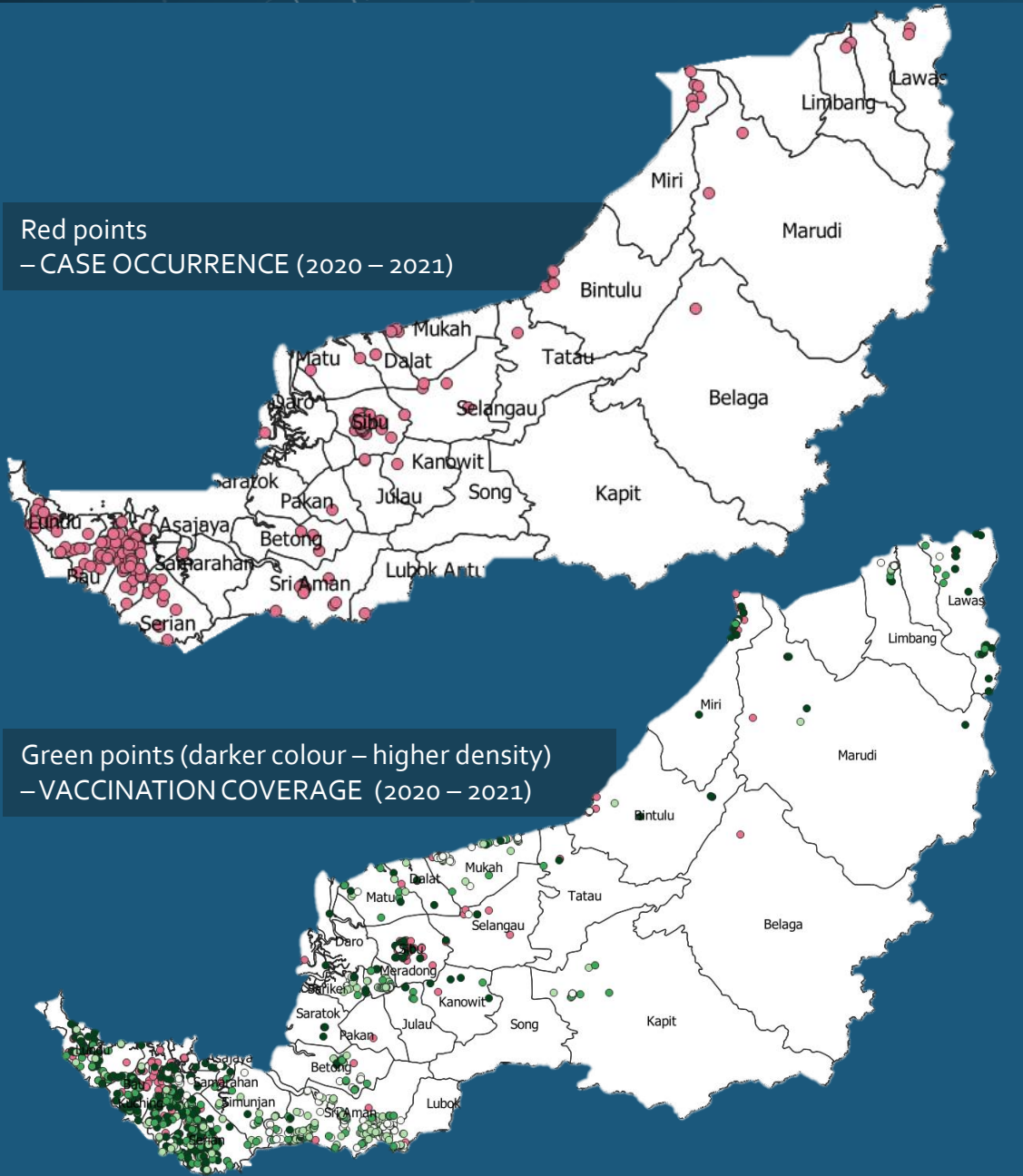
		Transformed score for each risk factor comparison						
Risk factor 1		Risk factor 2				Geometric row mean	Weight for spatial risk layer	
		Dog population at risk (incl. hunting dogs, community dogs, estate dogs)	Animal vaccination coverage	Travel networks (roads incl. logging roads & highway, waterways incl. rivers, plane)	High human density areas (e.g. towns, cities, villages, estates, settlements)			
	Dog population at risk (incl. hunting dogs, community dogs, estate dogs)	1.00	0.16	0.74	0.41	0.16	0.12	0.01
	Animal vaccination coverage	6.09	1.00	0.55	1.00	0.16	0.77	0.06
	Travel networks (roads incl. logging roads & highway, waterways incl. rivers, plane)	1.35	1.83	1.00	0.41	0.30	0.59	0.04
	High human density areas (e.g. towns, cities, villages, estates, settlements)	2.47	1.00	2.47	1.00	0.55	1.69	0.12
	Animal rabies case occurrence	6.09	6.09	3.33	1.83	1.00	10.52	0.77
								1.00

IF 3 RISK FACTORS

		Risk factor 2				
Risk factor 1		Animal vaccination coverage	Travel networks (roads incl. logging roads & highway, waterways incl. rivers, plane)	High human density areas (e.g. towns, cities, villages, estates, settlements)	Geometric row mean	Weight for spatial risk layer
			Animal vaccination coverage	1.00	0.55	1.00
	Travel networks (roads incl. logging roads & highway, waterways incl. rivers, plane)	1.83	1.00	0.41	0.88	0.28
	High human density areas (e.g. towns, cities, villages, estates, settlements)	1.00	2.47	1.00	1.48	0.47
						1.00

- From 7 factors to 5 factors – ended with 3 factors using proxy data (unavailability of suscp. population data, removed case occurrence)

RESULTS (PART 2 – SRA THROUGH GIS)



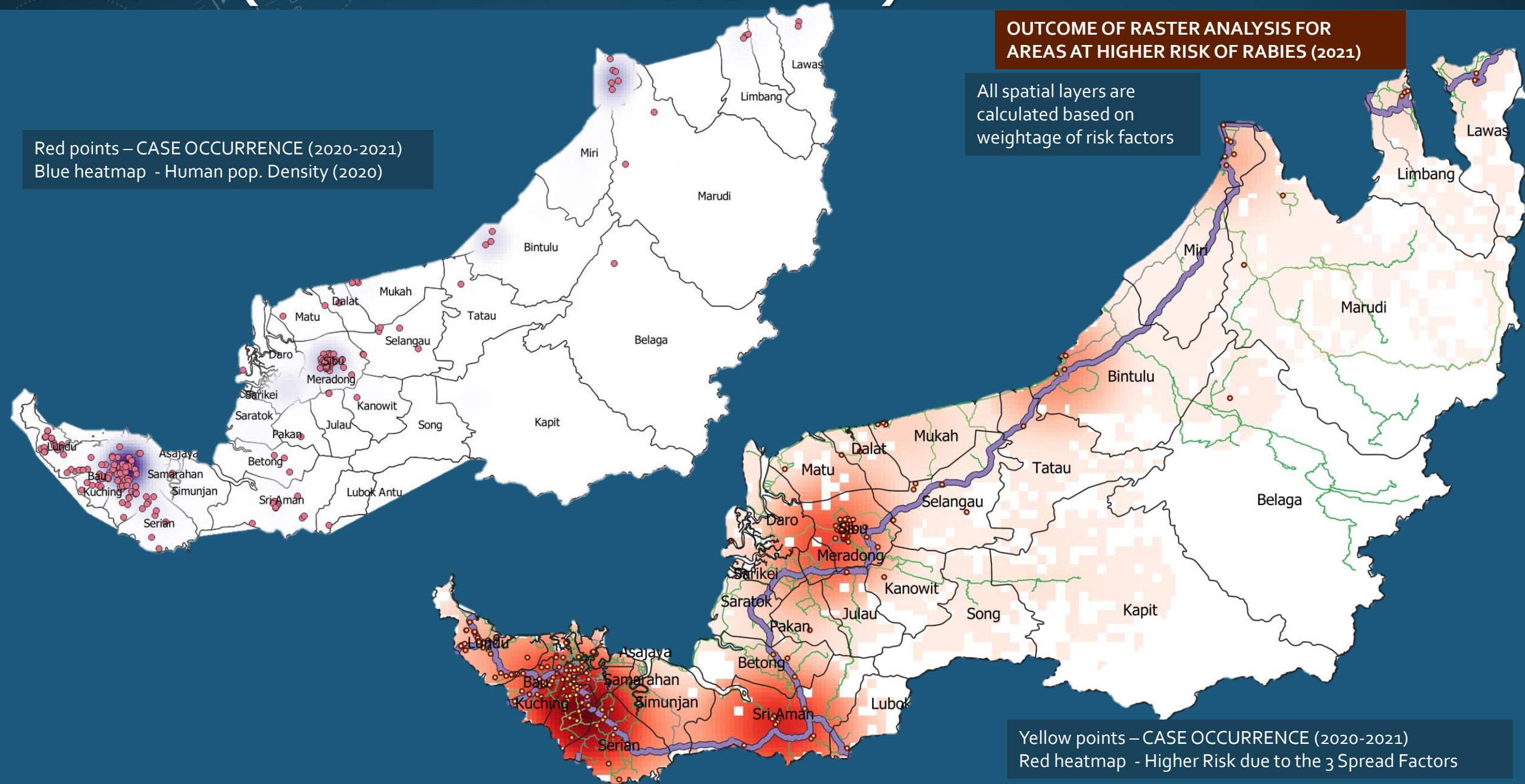
RESULTS (PART 2 – SRA THROUGH GIS)

Red points – CASE OCCURRENCE (2020-2021)
Blue heatmap - Human pop. Density (2020)

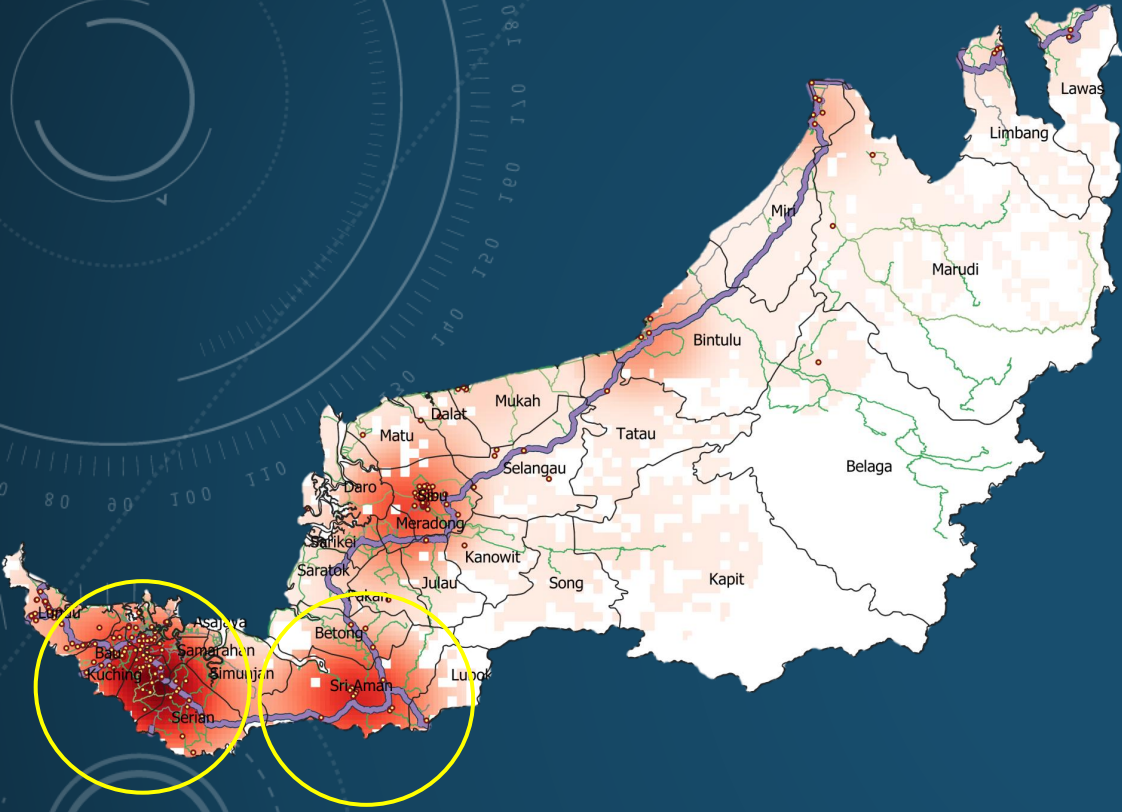
OUTCOME OF RASTER ANALYSIS FOR
AREAS AT HIGHER RISK OF RABIES (2021)

All spatial layers are
calculated based on
weightage of risk factors

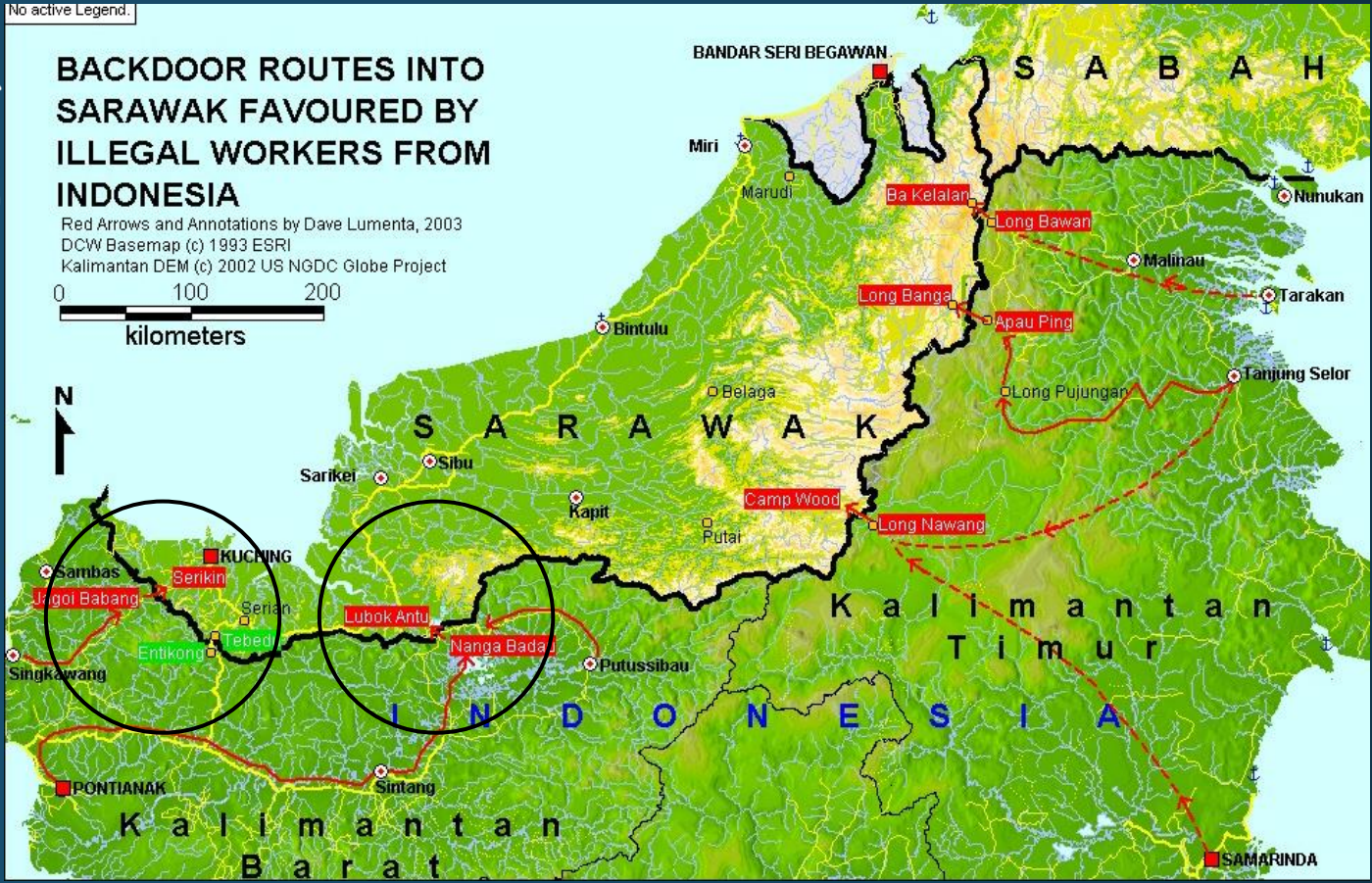
Yellow points – CASE OCCURRENCE (2020-2021)
Red heatmap - Higher Risk due to the 3 Spread Factors



RESULTS (PART 2 – SRA THROUGH GIS)



Interesting to note
– potential entry points to intensify control measures (in spite study focusing on SPREAD)



Source: Asian Border Traveller & The Borneo Post

DISCUSSION

OUTCOME OF SRA

Factors for spread and ineffectiveness of the current control measures?

- **HUMAN ELEMENTS**
- **DEFORESTATION & OPENING OF ACCESS ROADS TO PREVIOUSLY INACCESSIBLE AREAS**
- **INACCESSIBILITY OF CERTAIN AREAS**
 - Affecting vaccination coverage (possible protective factor)
 - Case reporting (tip of the iceberg)
- **DIFFERING ADMINISTRATIVE POLICIES**

CHALLENGES

SRA MCDA QUESTIONNAIRE

- Border questions (if incursion was evaluated)
 - weightage as **ZERO** (potential bias – Rabies in Sarawak since 2017 – endemic perception)
- 80 participants approached – 48 responded
- Risk factors – too vast – may require refining
- Mode – language, mode of answering

SRA GIS

- Obtaining maps layer – bureaucracy
 - require formalities and \$\$
 - e.g. Village data → Land and Survey Dept.
- Latest human population data (Sarawak data)
 - heavy for excel – require partitioning
- Data – GPS location – **require further validation & cleaning** – data collector error
- Task time pressure – inadequate for more info

WAY FORWARD

WHAT CAN BE IMPROVED

- **GPS data**
 - Communication between field officers/ground staff on the importance of GPS data
 - GPS taking training for field officers
- **Availability of relevant data**
 - Improve communication between agencies (reduce bureaucracy)
 - **Exact location of town, cities and villages**
 - River ports, official jetties
 - Availability of data (demographic - ethnicity)
 - Owned (licensed) dog population data
- **Dog population survey**
 - esp. of roaming dogs (strays, community dogs, estate dogs)
- **Other species (positive cases)**
 - i.e. cats – spillover occurrences vs canine case density

WHAT WOULD BE INTERESTING TO ADD

- **Adding in BITE CASES**
 - early indicator of re-incursion of affected areas
- **Movement of animals (frequency, aggregates)**
 - inter-district permit has been enforced
- **Adding in Dog Pop. Control Numbers**
 - any protective factor on it's own?
 - any synergy with vaccination combined as protective factor?
- **Ethnicity of owners and communities**
 - to add relevance to approach & improving communication / awareness
- **Quantifiable KAP studies on Public Perception of Rabies**
 - readily done by a local university

“

*Start by doing what's necessary;
then do what's possible;
and suddenly you are doing the impossible.*

FRANCIS OF ASSISI

”

**Don't be scared of
rabies, be aware of it
and act accordingly.**

©www.QuotesLove.xyz



QuotesLove

**TERIMA KASIH!
THANK YOU!**



TEAM MALAYSIA

DR. LEONORA TUAH
DR. MUHAMMAD SYAZWAN MUHD SABRI
DR. MARIANI HASHIM
DR. SITI NORSYAKIRAH HASHIM