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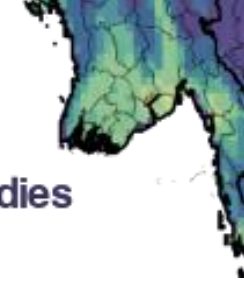

# Spatial Approach for Vector Borne and Zoonotic Diseases Research In Indonesia

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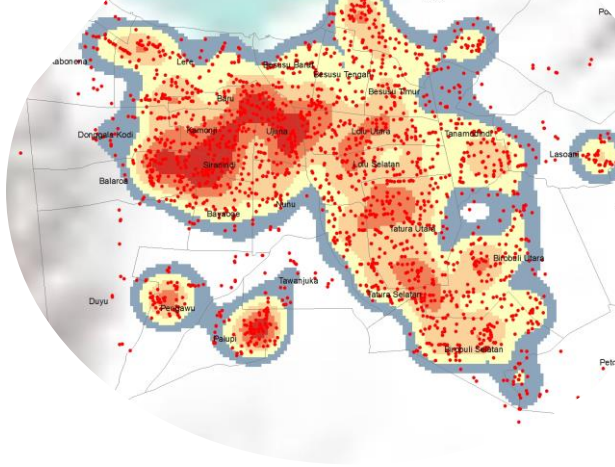
# OUTLINE

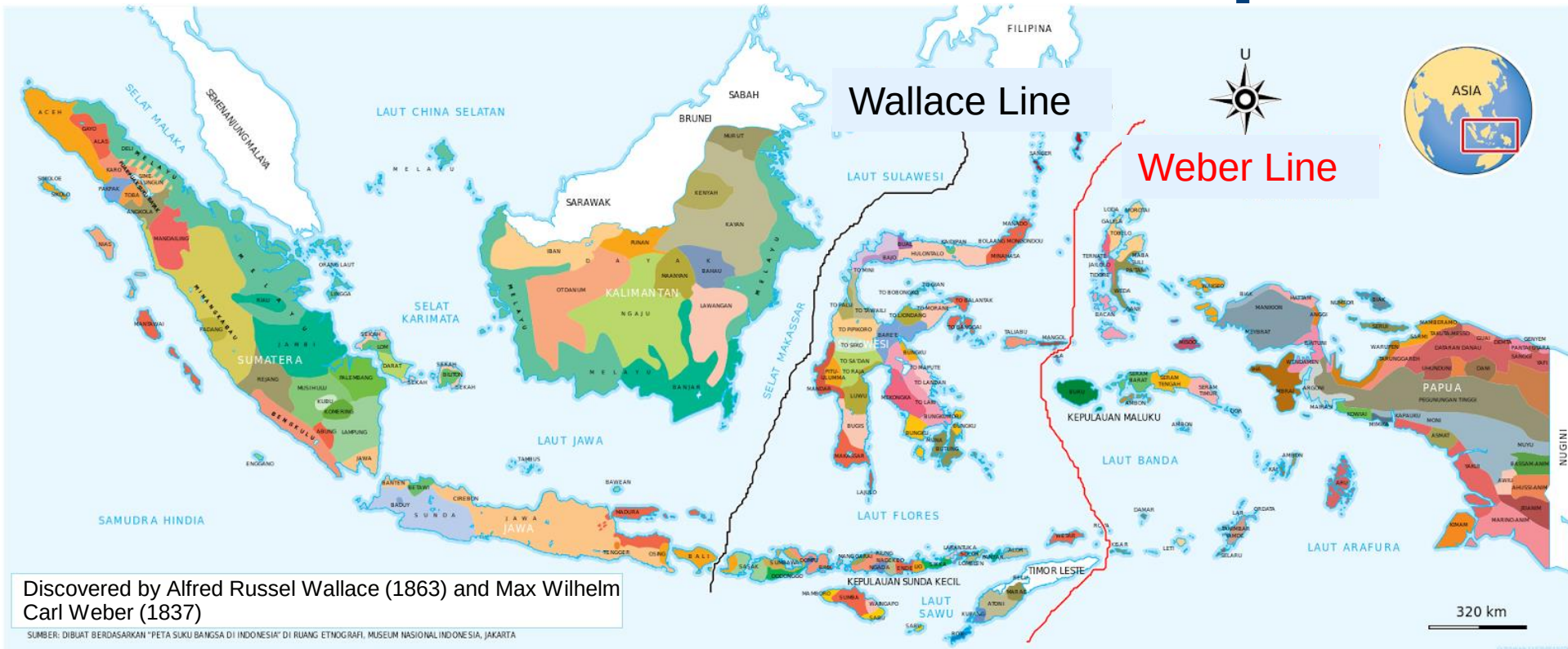


# INTRODUCTION

- **An archipelago island country lying between the Indian Ocean- Pacific Ocean, Asia continent, and the Australian continent**
- Rendezvous of three biogeographical zones
  - **Western part** which more influenced by Asian organisms **(the oriental region, across the Wallace)**
  - **The middle part** -- influenced by Asian, Australian. + has spesific organisms
  - **Eastern part of Indonesia** which is more influenced by Indo-Australian organisms **(east of the Weber line)**
- Based on the complex biogeographical condition, **Indonesia** has a variety of endemic and unique species of animal with various habitats and ecosystems
- Certain species of fauna, particularly mosquitoes, bats and rats are responsible as disease vector and reservoir that have role for the transmission of the many important diseases

# INTRODUCTION

- **The Wallace & Weber lines determine the distribution of the disease vector and reservoir in Indonesia**
- **The Wallace & Weber lines divide the geographical distribution of fauna in Indonesia into 3 regions: Western part / Indo-Malaya, The middle part, and the Eastern part/Indo-Australia.**



# INTRODUCTION

**The role of Mosquitoes, rats, and bats, as disease vector & reservoir in Indonesia (2016----- now still in the process of updating)**

- At least of 18 genera consisting of 456 spesies of mosquitoes have been identified in Indonesia.
- At least of 80 spesies of mosquitoes, have been confirmed as Malaria, Dengue, Chikungunya, Japanese encephalitis, and Lymphatic filariasis vectors.

- There are 154 spesies of rats.
- At least of 8 spesies of rats have been identified as reservoirs of several zoonosis, such as Leptospirosis, Hantavirus, Scrub typhus, Murine Typhus, etc.
- Rats have also been reported as intermediate host of plague in Indonesia

- At least of 250 spesies of bats have been identified in Indonesia
- At least of 2 spesies of them serve as reservoir of Japanese encephalitis, Nipah virus, Lyssa virus and Hendra virus

# VECTOR- BORNE DISEASES

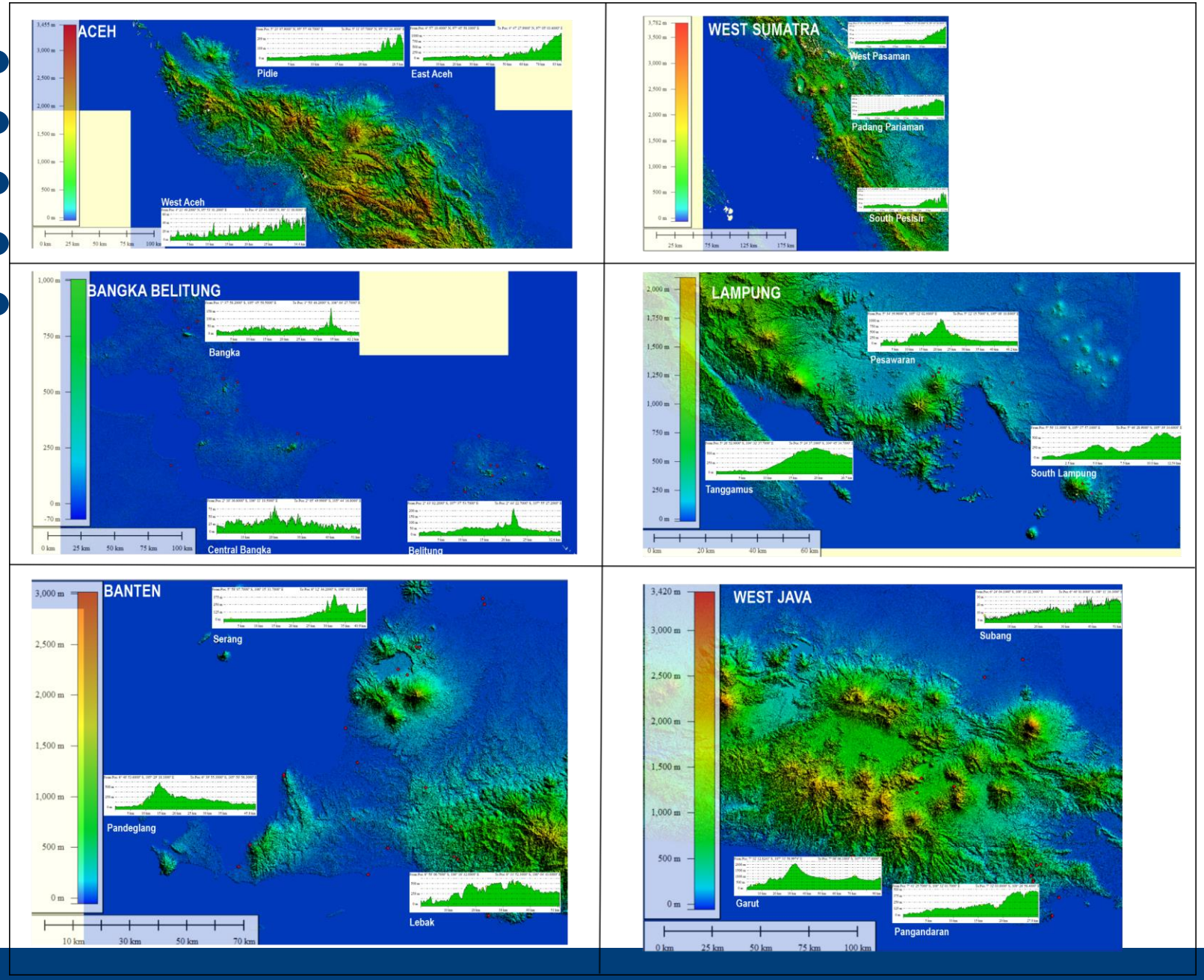
- **Mapping of *Culex quinquefasciatus* as a potential vector of *Japanese encephalitis* in some provinces in Indonesia**
  - Culex quinquefasciatus is a mosquito known as Japanese encephalitis (JE) vector in several regions in Indonesia
  - The study was conducted in 15 provinces in Indonesia (Aceh, West Sumatra, Lampung, BangkaBelitung, Banten, West Java, East Java, West Kalimantan, South Kalimantan, North Sulawesi, Southeast Sulawesi, East Nusa Tenggara, West Nusa Tenggara, Maluku, and North Maluku).
  - We recorded the coordinate of each sampling point using GPS and analyzed it using the Global Mapper program with Shuttle Radar Topography Mission (SRTM) imagery. The data were processed into a Cx.*quinquefasciatus* distribution map based on altitude.


PHILIPPINES
0
215
430
860 KM
N
ACEH :
- West Aceh
- Pidie
- East Aceh
MALAYSIA
WEST SUMATRA
- Padang Pariaman
- West Pasaman
- South Pesisir
BANGKA BELITUNG
- Bangka
- Central Bangka Belitung
WEST KALIMANTAN
- Ketapang
- North Kayong
- Sambas
NORTH SULAWESI
- Manado
- Bitung
- Minahasa
NORTH MALUKU
- South Halmahera
- Central Halmahera
- Morotai Island
SOUTH KALIMANTAN
- Tanah Laut
- Kotabaru
- Barito Kuala
SOUTHEAST SULAWESI
- Konawe
- Bombana
- Muna
MALUKU
- Western Southeast Maluku
- Southeast Maluku
- Aru Islands
LAMPUNG
- South Lampung
- Pesawaran
- Tanggamus
BANTEN
- Lebak
- Pandeglang
- Serang
I N D O N E S I A
WEST JAVA
- Subang
- Garut
- Pangandaran
EAST JAVA
- Banyuwangi
- Pasuruan
- Malang
WEST NUSA TENGGARA
- Bima
- North Lombok
- West Lombok
EAST NUSA TENGGARA
- Belu
- Ende
- Central Sumba
AUSTRALIA
Research Locations

- We collected mosquitoes using several methods human landing catches (HLCs). The mosquito collection with human bait was carried out indoor and outdoor, with three houses each. The houses were located near suspected mosquito breeding sites. Mosquito collections were carried out from 6 pm to 6 am. The duration was 50 minutes each hour for 12 hours.

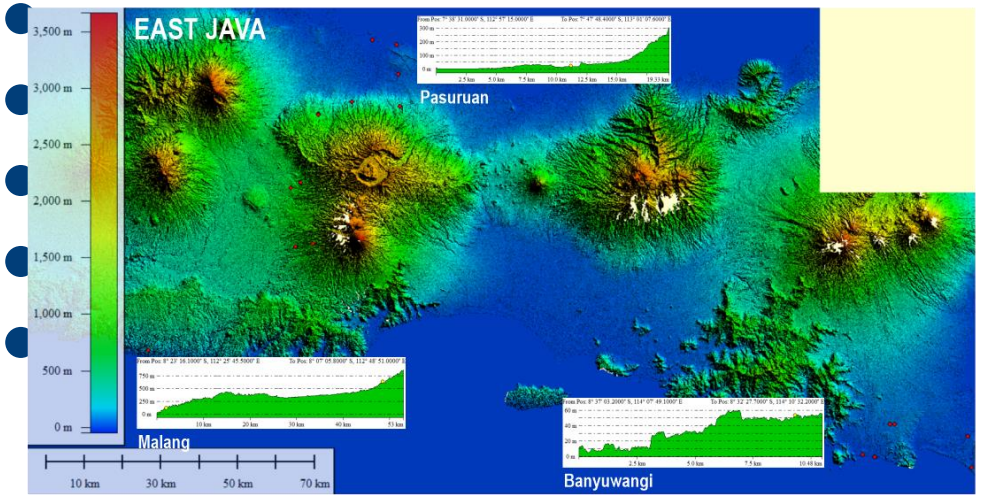
| No | Province | Total of individuals | | Density (individual/person/hour) | |
|---|---|---|---|---|---|
| | | IHB | OHB | IHB | OHB |
| a | b | c | d | e | f |
| 1 | Aceh | 364 | 731 | 2.43 | 1.43 |
| 2 | West Sumatera | 537 | 579 | 3.58 | 1.14 |
| 3 | Lampung | 1019 | 855 | 6.79 | 1.68 |
| a | b | c | d | e | f |
| 4 | Bangka Belitung | 183 | 359 | 1.22 | 0.7 |
| 5 | Banten | 1981 | 2553 | 13.21 | 5.01 |
| 6 | West Java | 1656 | 946 | 11.04 | 1.85 |
| 7 | East Java | 1163 | 1205 | 7.75 | 2.36 |
| 8 | West Kalimantan | 200 | 511 | 1.33 | 1 |
| 9 | South Kalimantan | 488 | 576 | 3.25 | 1.13 |
| 10 | North Sulawesi | 77 | 188 | 0.51 | 0.37 |
| 11 | Southeast Sulawesi | 516 | 712 | 3.44 | 1.4 |
| 12 | West Nusa Tenggara | 138 | 127 | 0.92 | 0.25 |
| 13 | East Nusa Tenggara | 264 | 168 | 1.76 | 0.33 |
| 14 | Maluku | 1016 | 886 | 6.77 | 1.74 |
| 15 | North Maluku | 1302 | 1634 | 8.68 | 3.2 |
| Density Average | | | | 4.85 | 1.57 |

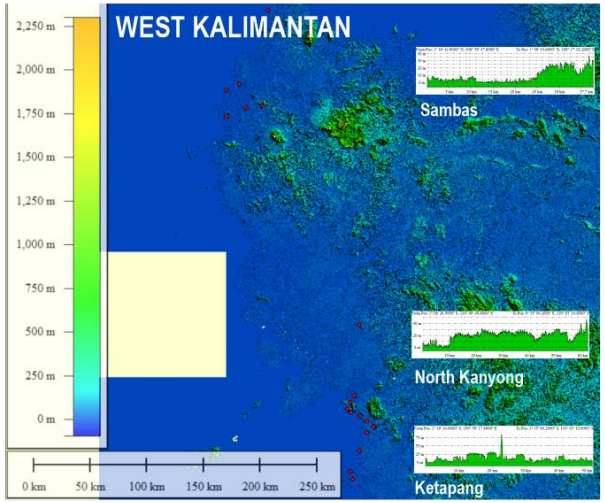
IHB: indoor human bait OHB: outdoor human bait

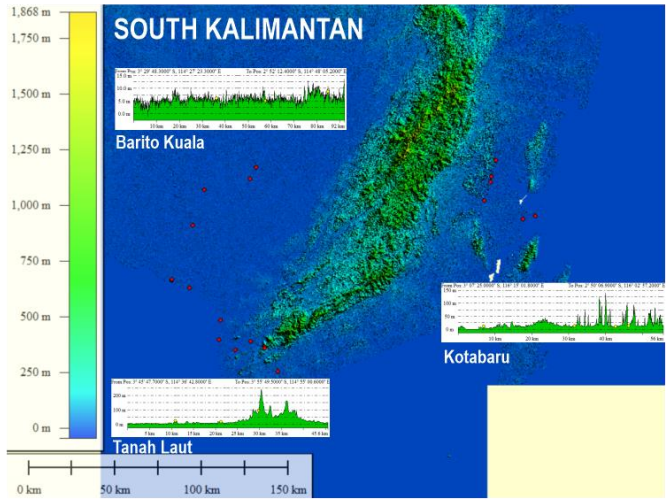


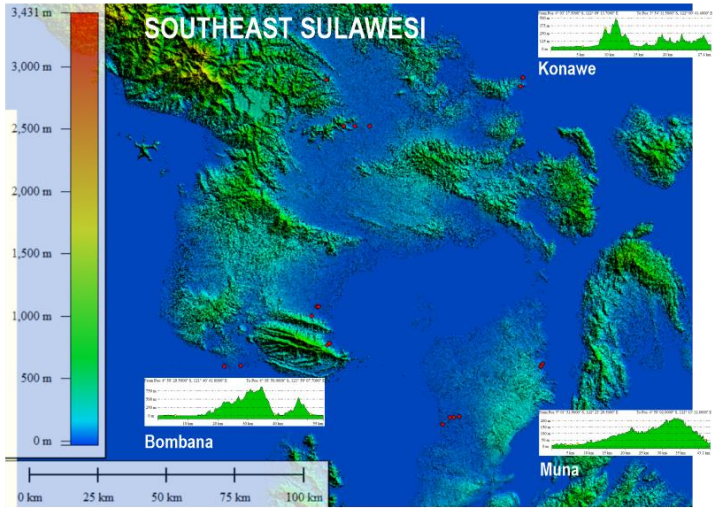

The elevation of *Cx. quinquefasciatus*. It can be found
from 0-1,500 m altitude.

- Aceh 0-1,000 m.
- West Sumatra 0-500m.
- Bangka Belitung 0-100m
- Lampung 0-500 m.
- Banten 0-500 m.
- West Java 0-1.500m.



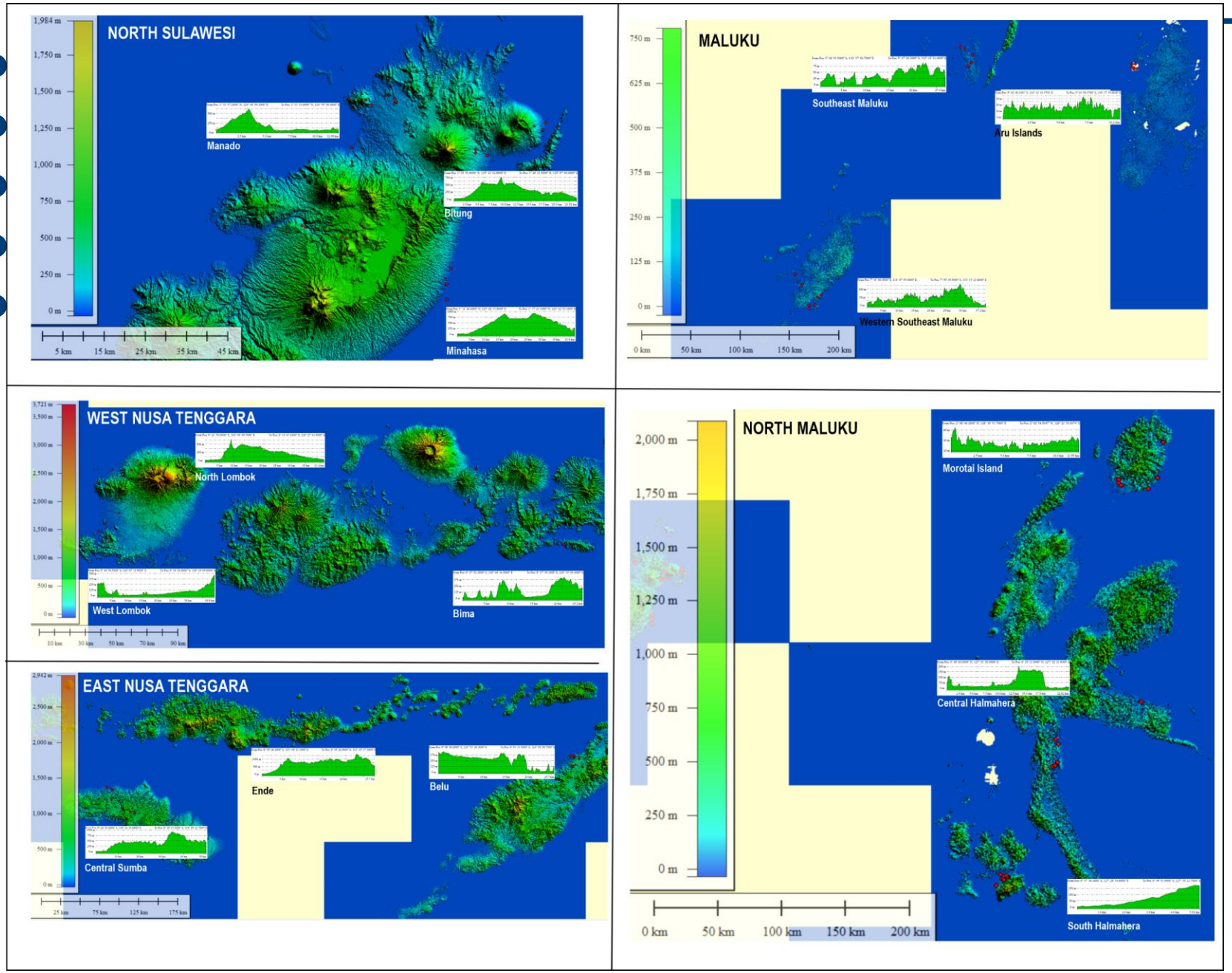




The elevation of *Cx. quinquefasciatus.* It can be found
from 0-1,500 m altitude.

- East Java 0-800m.
- West Kalimantan 0-100m.
- South Kalimantan 0-250m..
- Southeast Sulawesi 0-750m.




The elevation of *Cx. quinquefasciatus*. It can be found from 0-1,500 m altitude.

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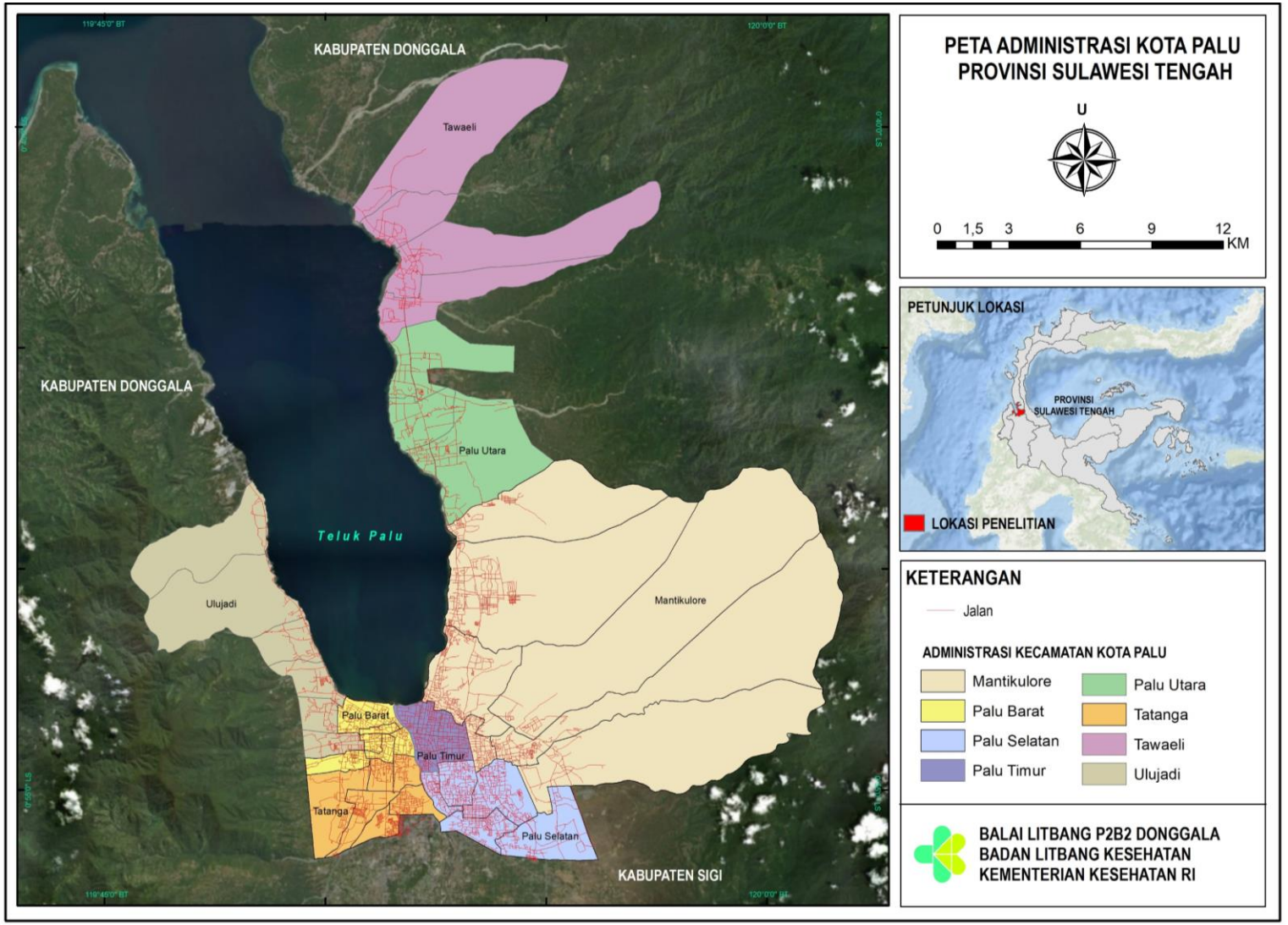
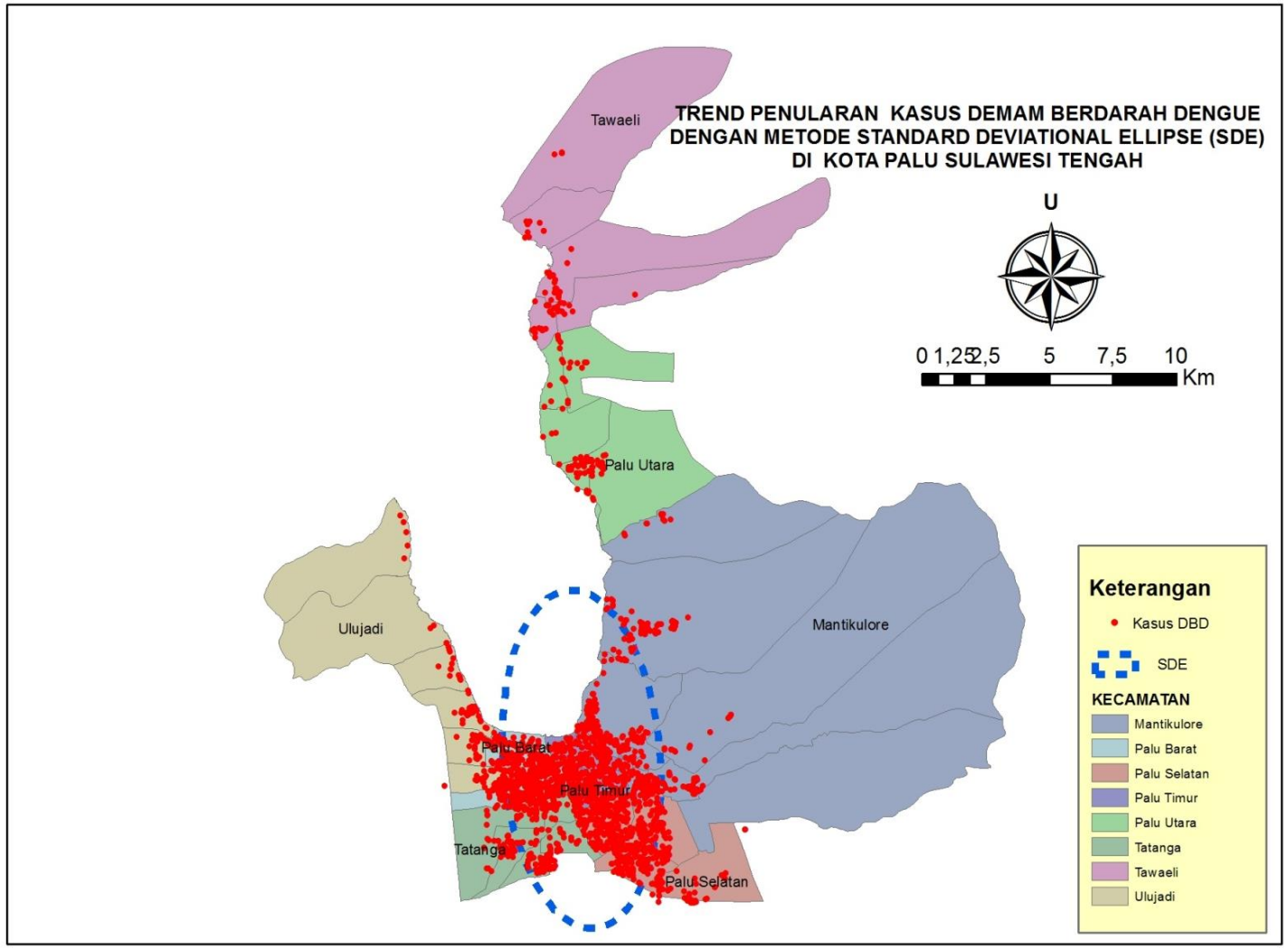
- North Sulawesi 0-800m..
- (West NusaTenggara 0-600m.
- East Nusa Tenggara 0-700m.
- Maluku 0-100m.
- North Maluku 0-200m.

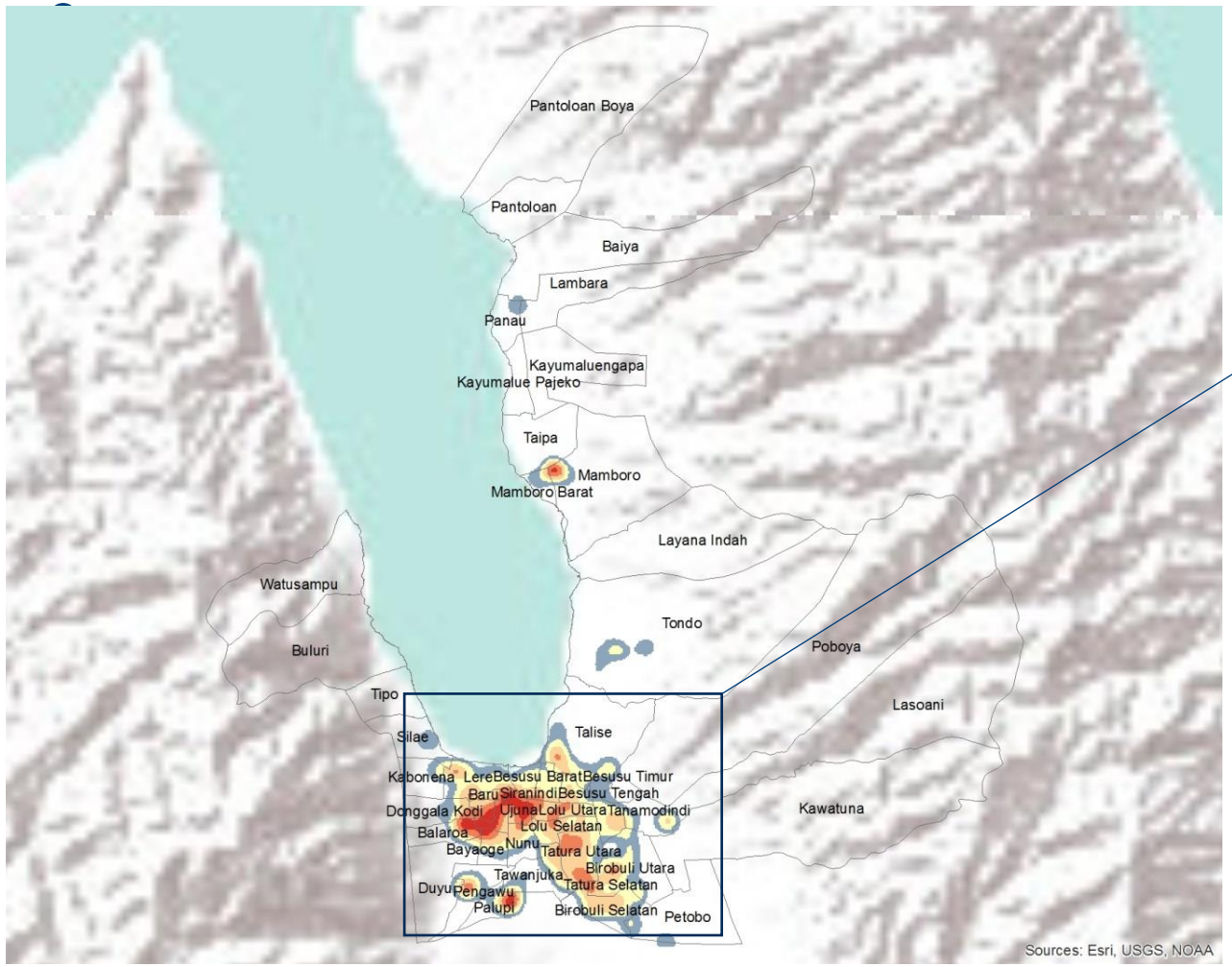
- **Point Pattern Analysis of Dengue Cases in Palu City, Central Sulawesi Indonesia**
  - Study Area in Palu City, Central Sulawesi:
  - 8 Sub-district
  - 45 villages
  - Dengue case data was obtained from the Palu City Health Office, namely routine reports of dengue patients in the Palu City area in 2011-2016
  - Conducted a survey on the patient's address and mapped the coordinates of dengue cases

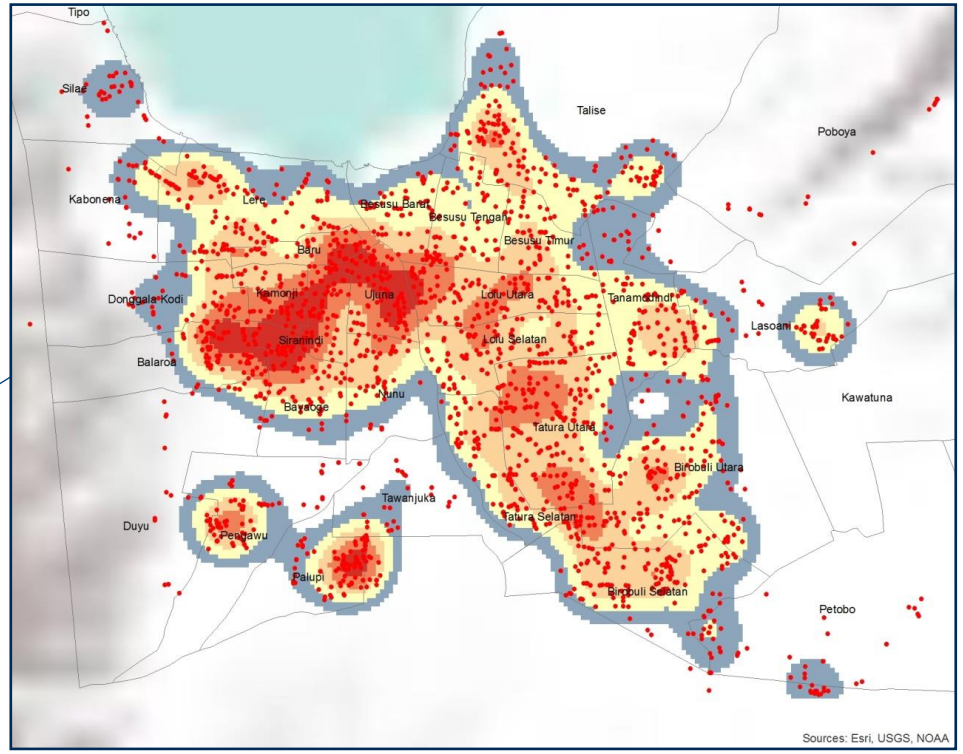





The results showed that the transmission of dengue tended to the north and south from the center of Palu City

The Standard Deviational Ellipse model can help determine the source of an occurrence based on a particular geographic pattern and provide a better knowledge of the geographical phenomenon behind it.

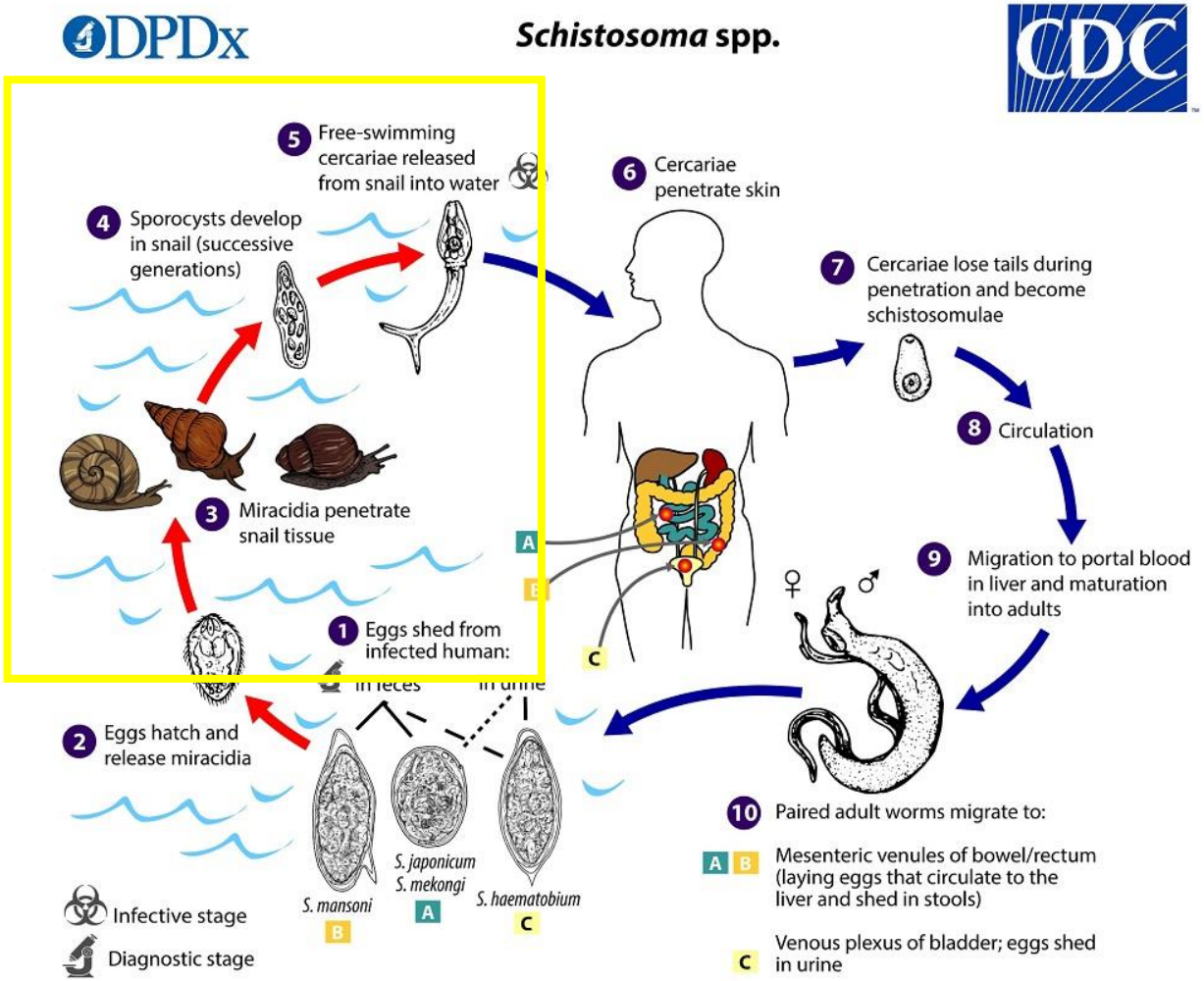



The results of the Kernel Density Estimation analysis showed that the highest risk area is the red color with the darkest gradation

# SCHISTOSOMIASIS

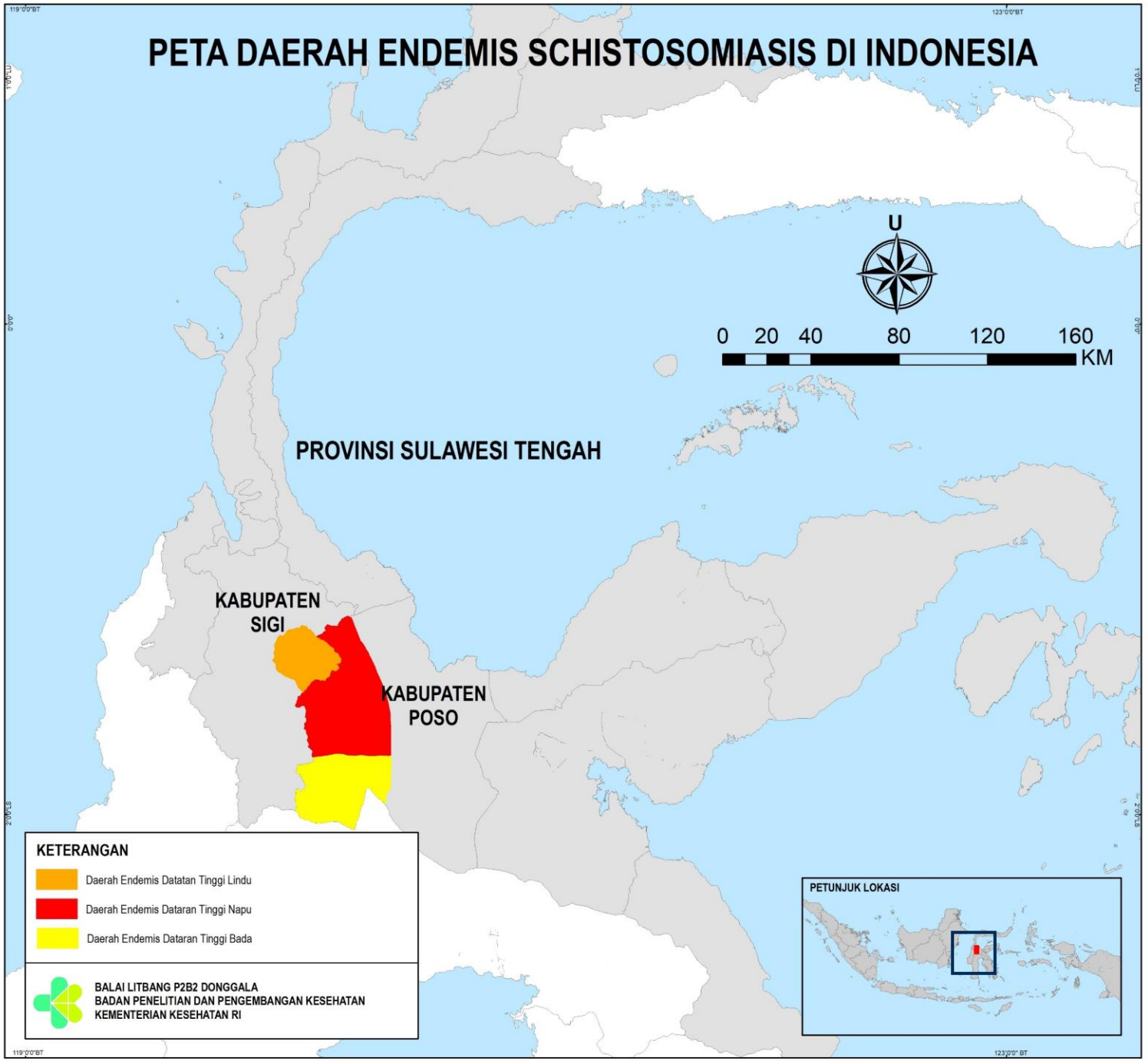
- Schistosomiasis is an acute and chronic parasitic disease caused by blood flukes (trematode worms) of the genus Schistosoma.
- Estimates show that at least 236.6 million people required preventive treatment in 2019.
- Preventive treatment, which should be repeated over a number of years, will reduce and prevent morbidity.
- Schistosomiasis transmission has been reported from 78 countries.
- Schistosomiasis is a neglected disease (NTD's) which is still a problem in Indonesia

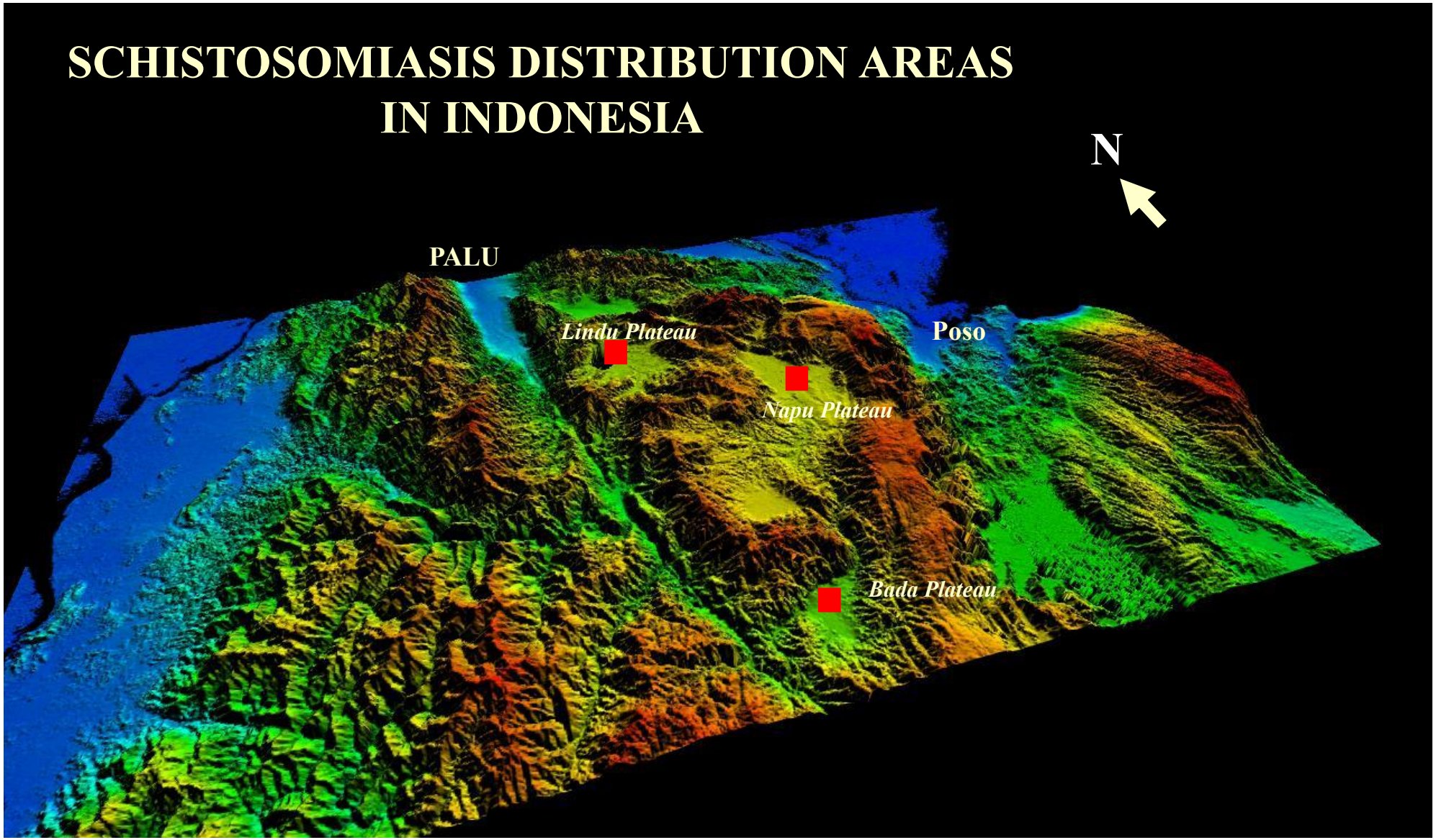


# SCHISTOSOMIASIS IN INDONESIA

- Schistosomiasis is only found in Central Sulawesi Province (28 villages endemic)
- Sigi District: Lindu Plateau (5 villages)
- Poso District: Napu and Bada Plateau (23 villages)

Snail *Oncomelania hupensis lindoensis*

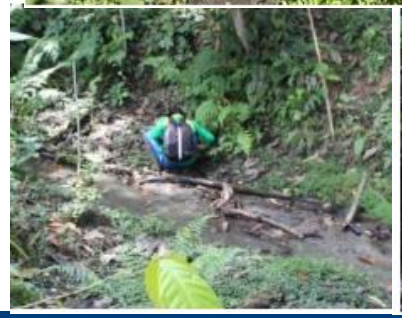


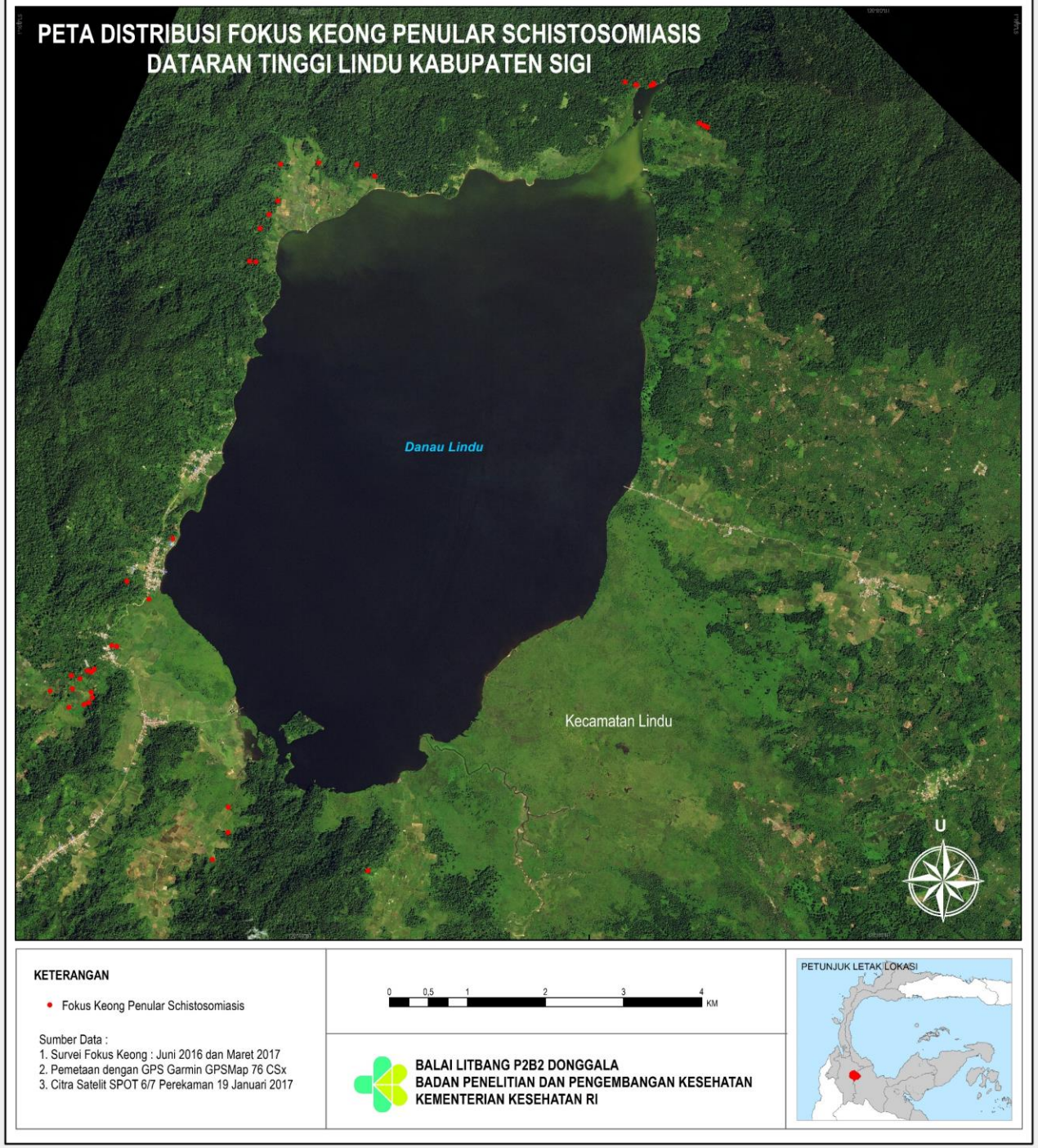

SCHISTOSOMIASIS DISTRIBUTION AREAS
IN INDONESIA
N
PALU
Lindu Plateau
Poso
Napu Plateau
Bada Plateau

# Mapping of Snails Habitat in Lindu Plateau (2016-2017)

Habitat types:
- The drains are not cemented
- Seepage / springs
- Swamp

On the Lindu Plateau found 32 habitat/foci with a wide area 552,759 $m^2$





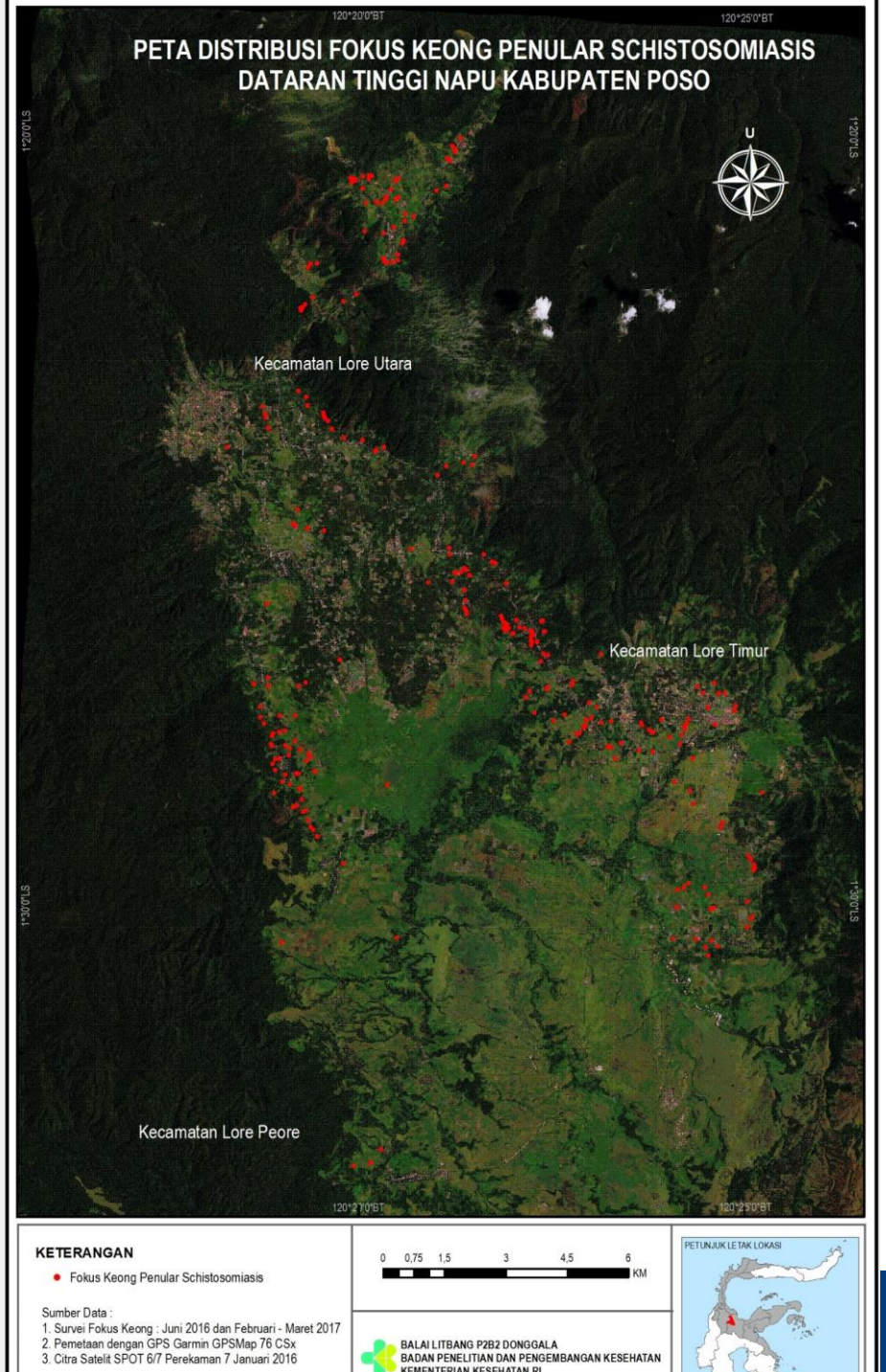
# Mapping of Snails Habitat in Napu Plateau (2016-2017)

Habitat types:
- The drains are not cemented
- Seepage / springs
- Uncultivated rice fields
- Swamp
- Ponds

On the Napu Plateau found 243 habitat/ foci with a wide area 1.082.185 $m^2$



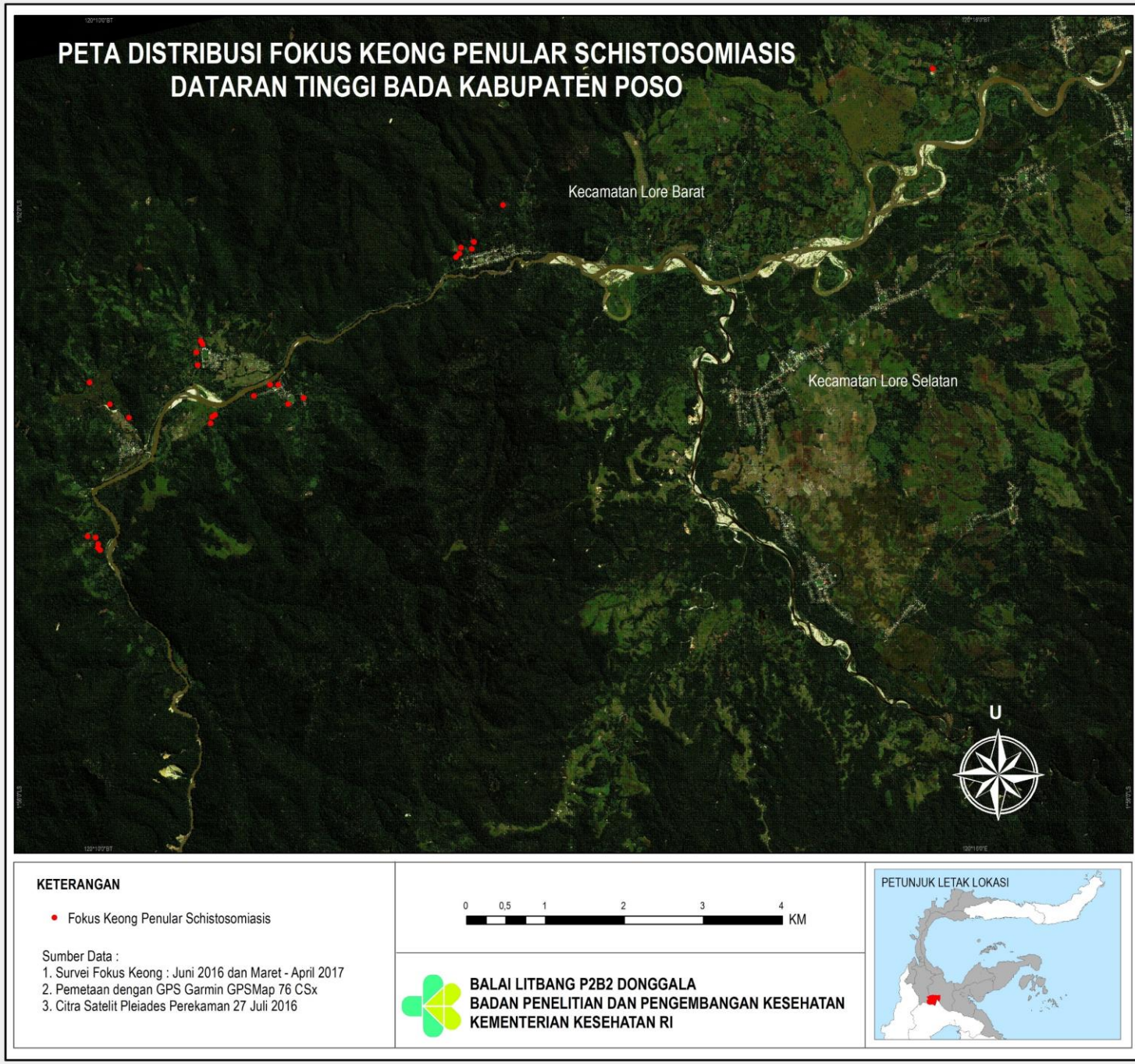


# Mapping of Snails Habitat in Bada Plateau (2016-2017)

Habitat types:
- The drains are not cemented
- Seepage / springs
- Ponds

On the Bada Plateau found 26 habitat/ foci with a wide area 14.461 $m^2$

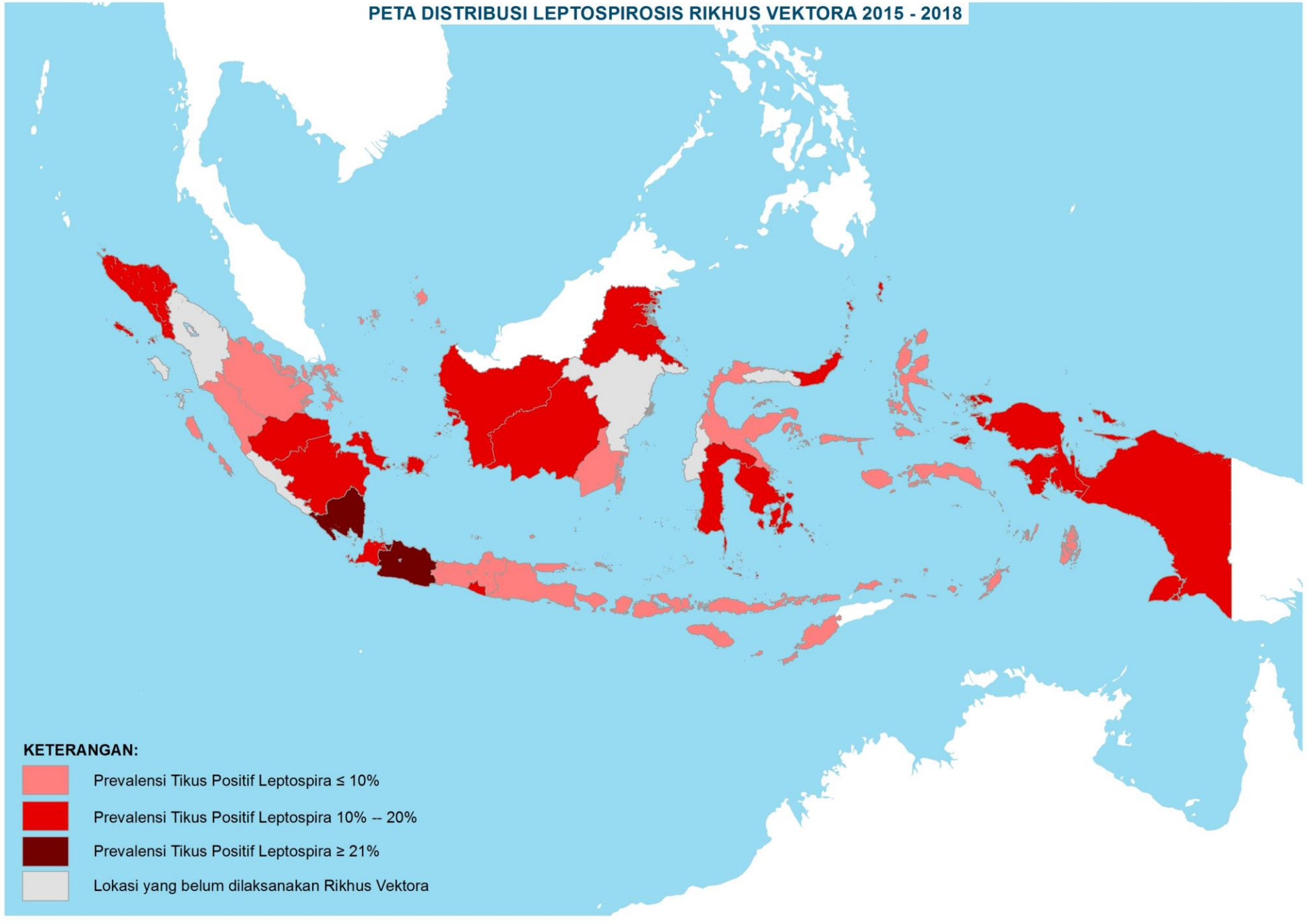


Utilization of the mapping or coordinates of the location of the snail habitat has been used to develop a roadmap guide for schistosomiasis eradication in Indonesia (2018 – 2025)

# LEPTOSPIROSIS

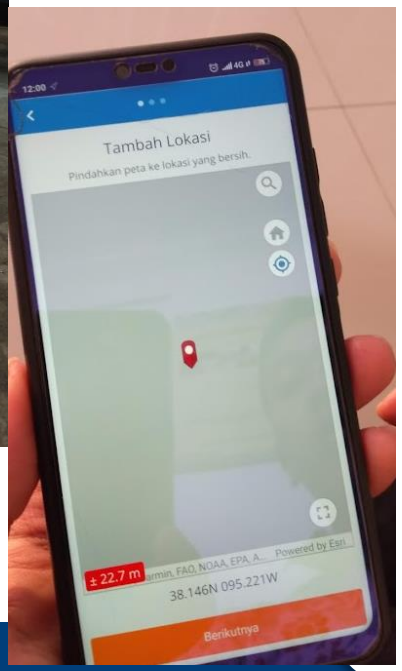
## Mapping of Leptospirosis in Banyumas District, Central Java, Indonesia (2019)

- In Indonesia, leptospirosis in humans has been reported in eight provinces: East Java, Central Java, Yogyakarta, Banten, DKI Jakarta, North Kalimantan, West Java, and East Kalimantan.
- Indonesia is one of the countries with a high risk of leptospirosis, an environment that is prone to flooding and waterlogging.
- Poor sewerage and sanitation conditions in several residential areas are driving the increase in leptospirosis cases like in many other countries.
- Results of Research on Vectors and Reservoirs Disesases (Rikhus Vektora) conducted by B2P2VRP Salatiga, MoH in 2015-2018 in 29 provinces, all provinces had positive leptospira rats

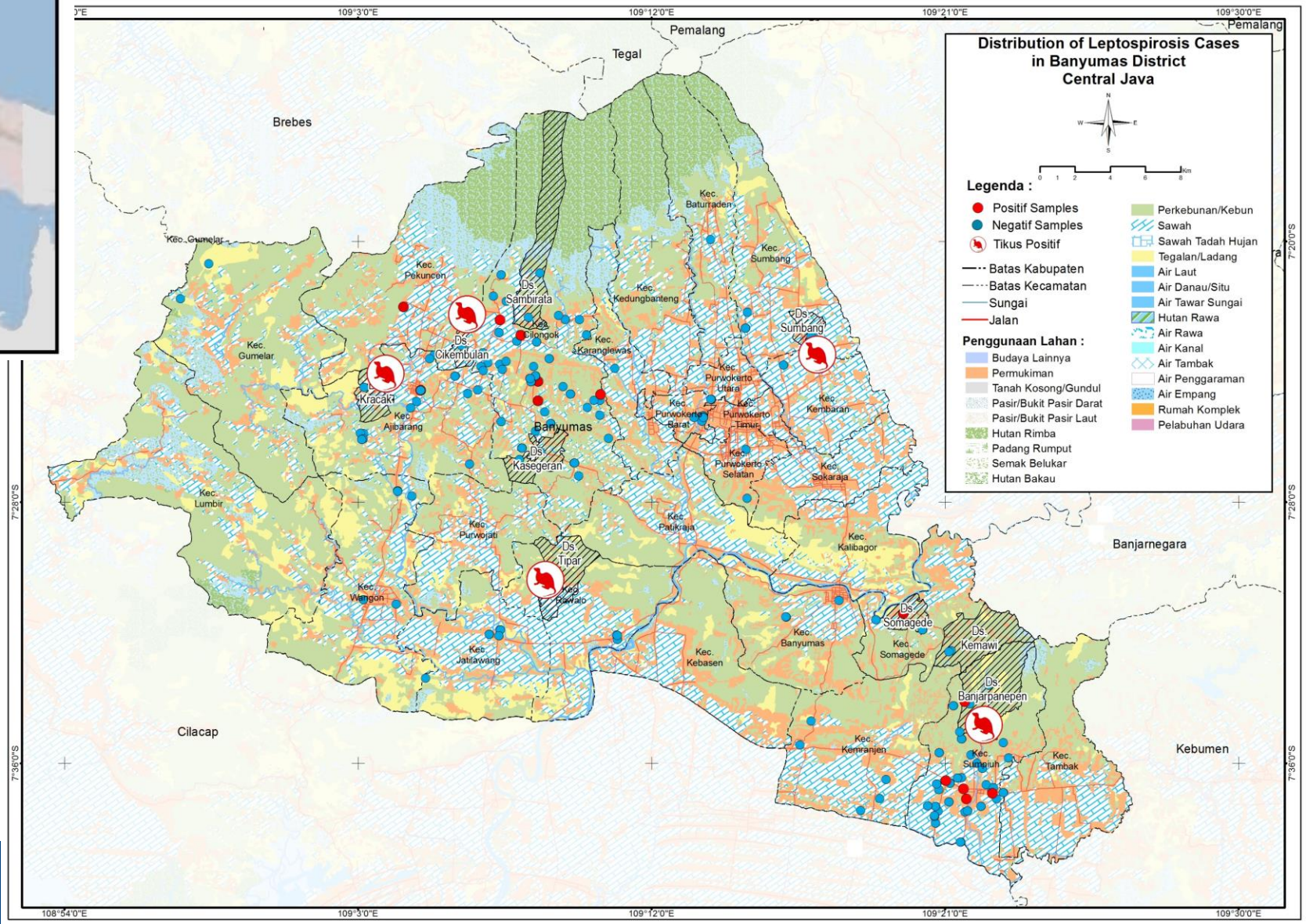

PETA DISTRIBUSI LEPTOSPIROSIS RIKHUS VEKTORA 2015 - 2018
KETERANGAN:
Prevalensi Tikus Positif Leptospira ≤ 10%
Prevalensi Tikus Positif Leptospira 10% -- 20%
Prevalensi Tikus Positif Leptospira ≥ 21%
Lokasi yang belum dilaksanakan Rikhus Vektora

# Mapping of Leptospirosis in Banyumas District, Central Java, Indonesia (2019)

- In 2018, the distribution of leptospirosis cases in Central Java was found in 15 districts, the number of leptospirosis cases was 427 cases (IR, 1.24/100,000) and 89 deaths (CFR, 20.84%).
- Banyumas is one of the districts in Central Java which has experienced an increase in leptospirosis cases




# Distribution map of Leptospirosis Cases in Banyumas District Central Java, Indonesia



# CONCLUSIONS

- Integration of remote sensing data with various types of satellite imagery and combination of analysis with GIS is one of the methods for monitoring the distribution of diseases.
- The spatial approach in mapping a disease can be used as a basis for further research
- Utilization of mapping results can be used by programs in eliminating or eradicating diseases.

# ACKNOWLEDGEMENT

**Ministry of Health Republic of Indonesia**

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INDONESIA

*Thank You*

*Arkoun*

*Terima Kasih*