

# Fine scale mapping of malaria cases at low cost and in less time in Southeastern Bangladesh using a participatory approach

*funding*

Public Engagement Bursary (PEB)

Institutional Transitional Partnership Award (iTPA)

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Asia Pacific Malaria Elimination Network (APMEN)

*Supported by*

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Transmitted Diseases Control Program

**Sazid Ibna Zaman**

GroupMappers Lead and GIS Specialist  
Mahidol Oxford Tropical medicine  
Research Unit



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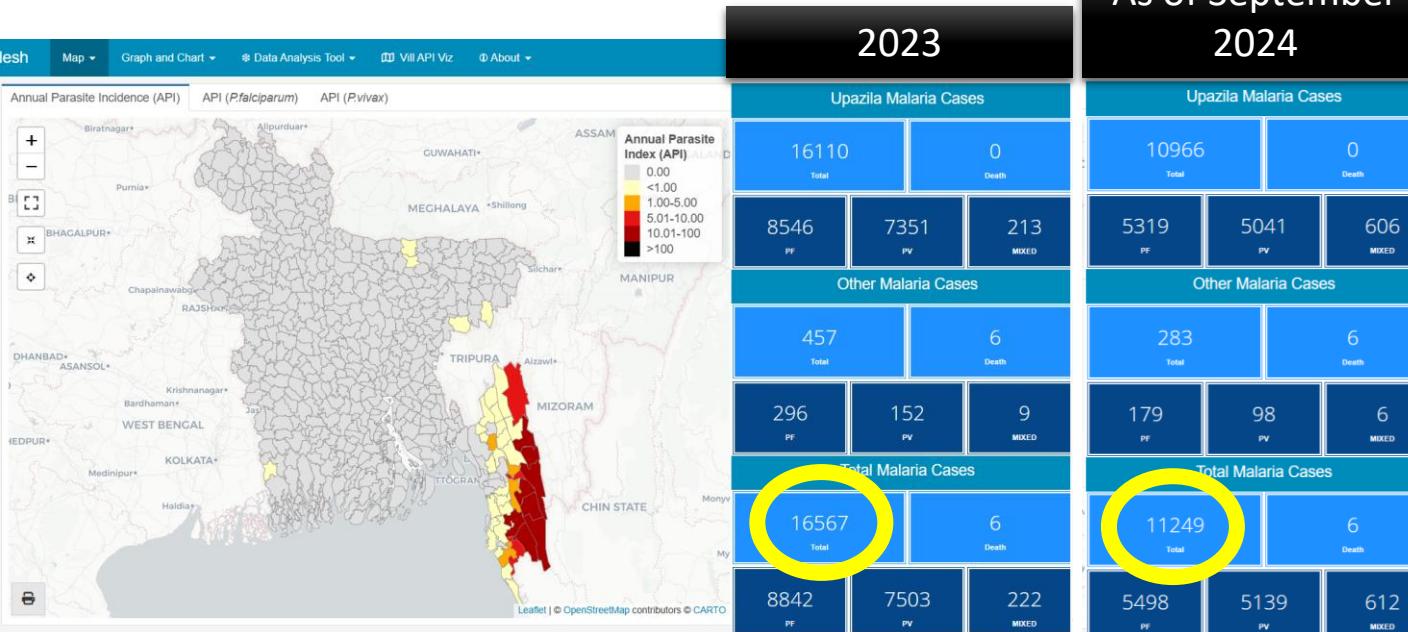
**Aim:** To geo-enable and transition malaria surveillance system from upazila down to village level in the 5 upazilas of Bandarban hill tract District.

**Impact:** Improved targeting of interventions down to village level including a more efficient use of available resources

**Implementing organization:** University of Oxford; with activities to be conducted by its Mahidol Oxford Tropical Medicine Research Unit (MORU) based in Bangkok, Thailand and National Malaria Elimination Program, CDC, DGHS, Dhaka, Bangladesh

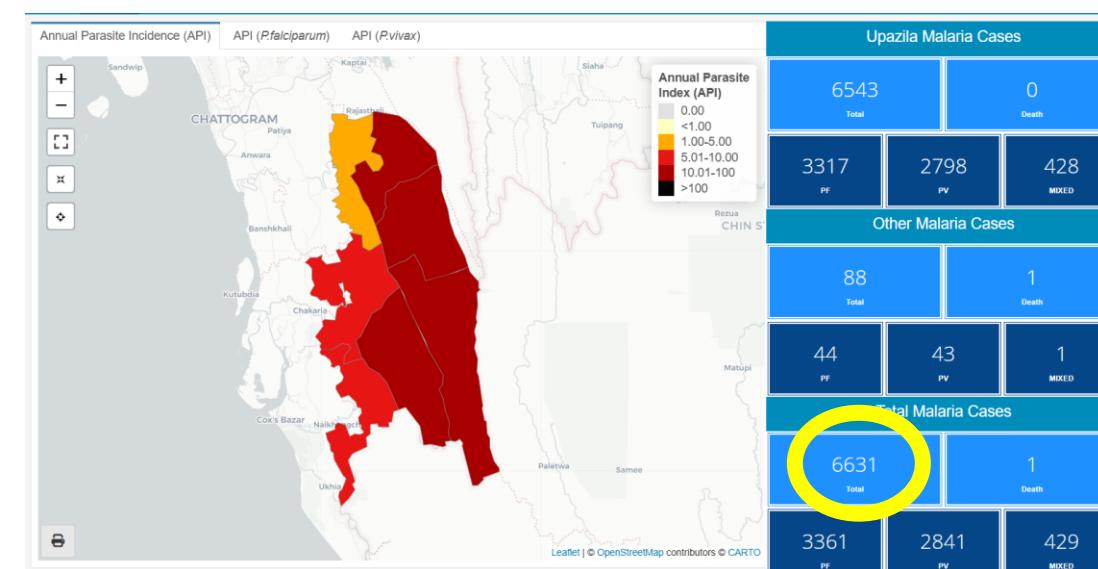
**Implementation dates:** 15 July 2023 – 31 December 2023

# What is the current status of malaria prevalence in Bangladesh



Zero transmission by  
2030 (NSP 2024-2030)

- More than 91% of malaria cases are reported from just three hill districts (Bandarban, Kagrachhari, Rangamati) of Bangladesh,
- Bandarban district alone accounting for 60% of cases.



Prioritize focused interventions and strengthen surveillance systems at the micro-level, particularly in Bandarban.

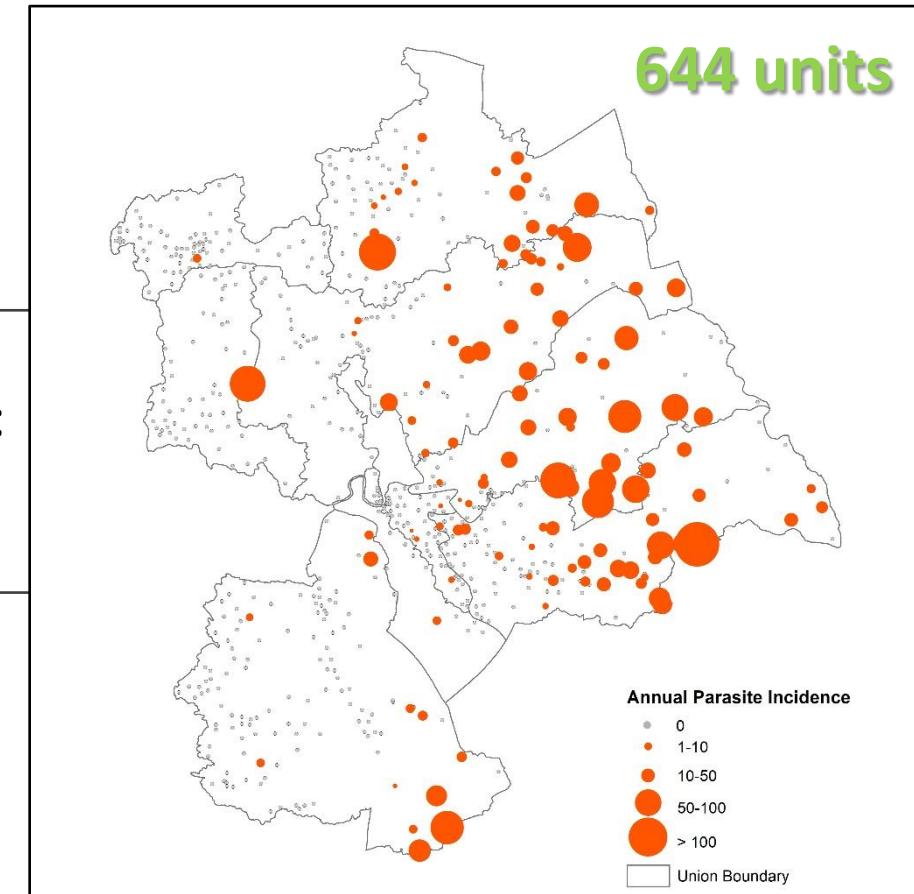
# Enhanced Malaria data: Transition from Lama upazila to villages

Before 2023



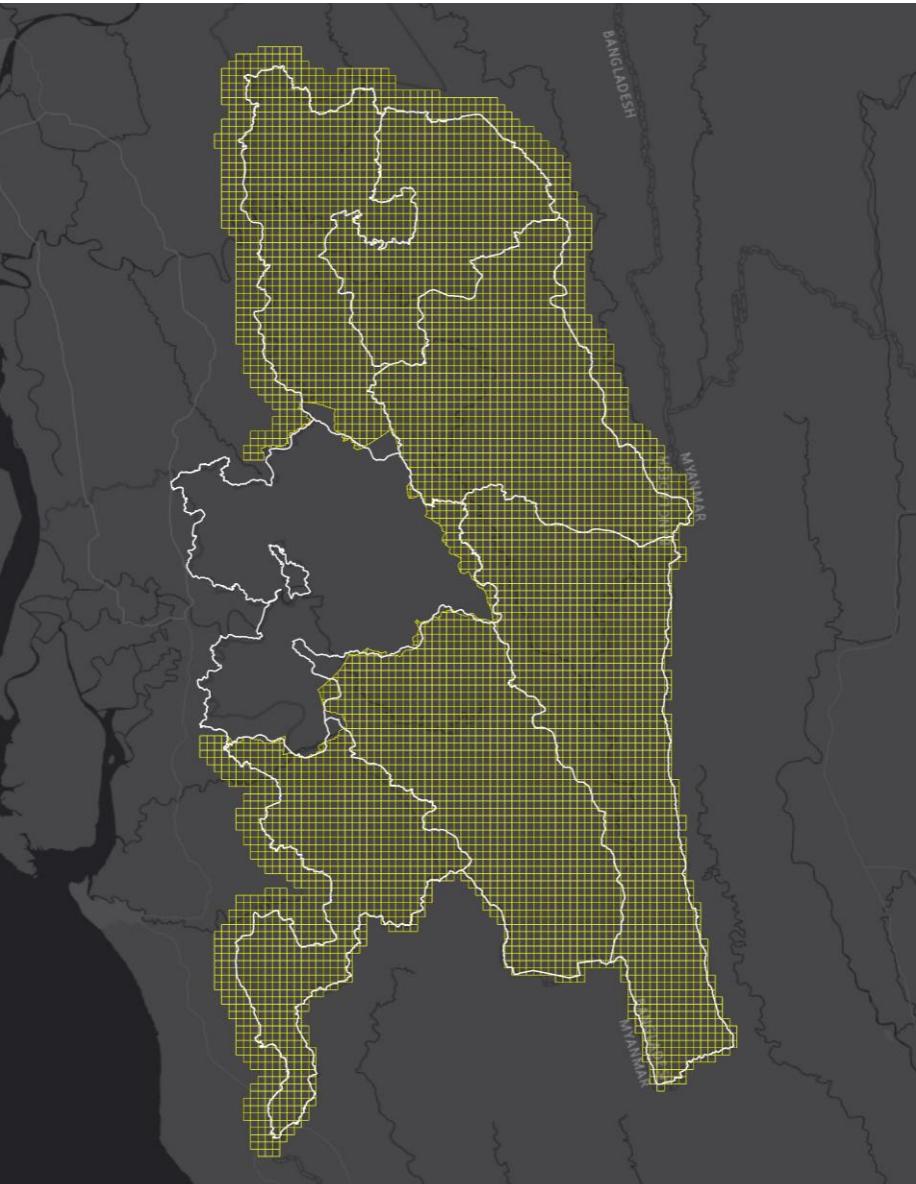
Transitioning  
from Sub-District  
to Village-Level  
Surveillance

Present (January 2023 - )



# Study area:

The study focused on the southeastern region of Bangladesh, specifically in Bandarban, an area characterized by vast hills and dense forests.



## Methods

1. **Map villages and temporary settlements:** Adjust google building footprint using satellite imagery; name/label villages to create Village Master List for malaria endemic areas; create mechanism for periodic update of village master list and village maps
2. **Update and correct administrative unit boundaries:** check and update/correct union, ward, upazila and district boundaries
3. **Calculate updated population estimates**
4. **Collection of malaria case data at village level** create system and deliver training for healthcare workers to do electronic data entry of malaria case data in real-time
5. **Geospatial analysis** to identify malaria hotspots and map fine scale malaria risk for targeting of interventions, location, referral of severe cases
6. **Integration into Malaria Information System** of village and health facility master lists and population estimates
7. **Geospatial dashboard development** to visualize case data at village level in real-time.

# Method-1: How do we collect data (Desk)?

- Collect building footprints and draw missing buildings

i) Download Open Buildings

ii) Create 1kmX1km grid with 5km buffer inside Bangladesh and 2km buffer along international boundary

iii) Overlay buildings and grid on top of Google satellite imageries

**577502** Google Building Footprint with buffer areas

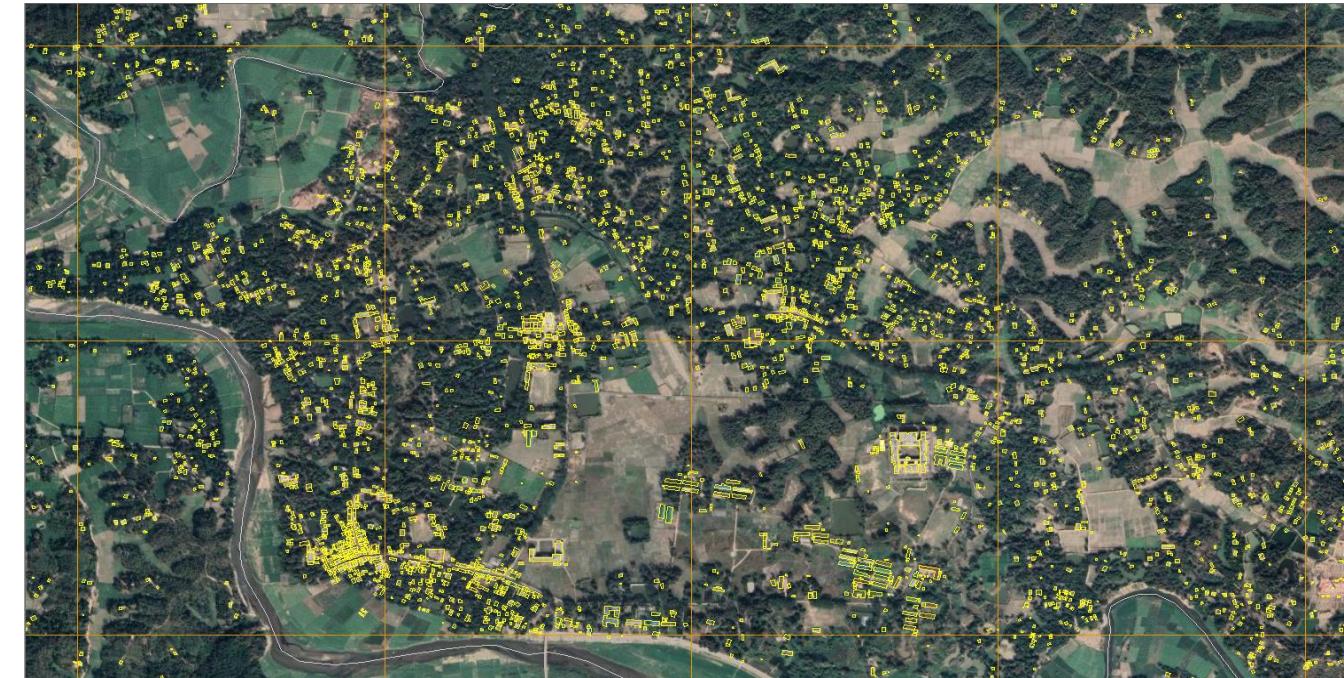
**312548** Adjusted Google Building Footprint:

**6232** Grids (in Bandarban District without Lama upazila)

**12** people

**18** working days

**6** upazila



<https://sites.research.google/open-buildings/>

# Method-1: How do we collect data (Field)?

- Operational list of villages
- Grouping buildings and naming it
- Grouping buildings and naming the next villages
- Complete one union, then other union
- Create centroid for each village
- Update and correct admin unit boundaries

**4** Upazilas

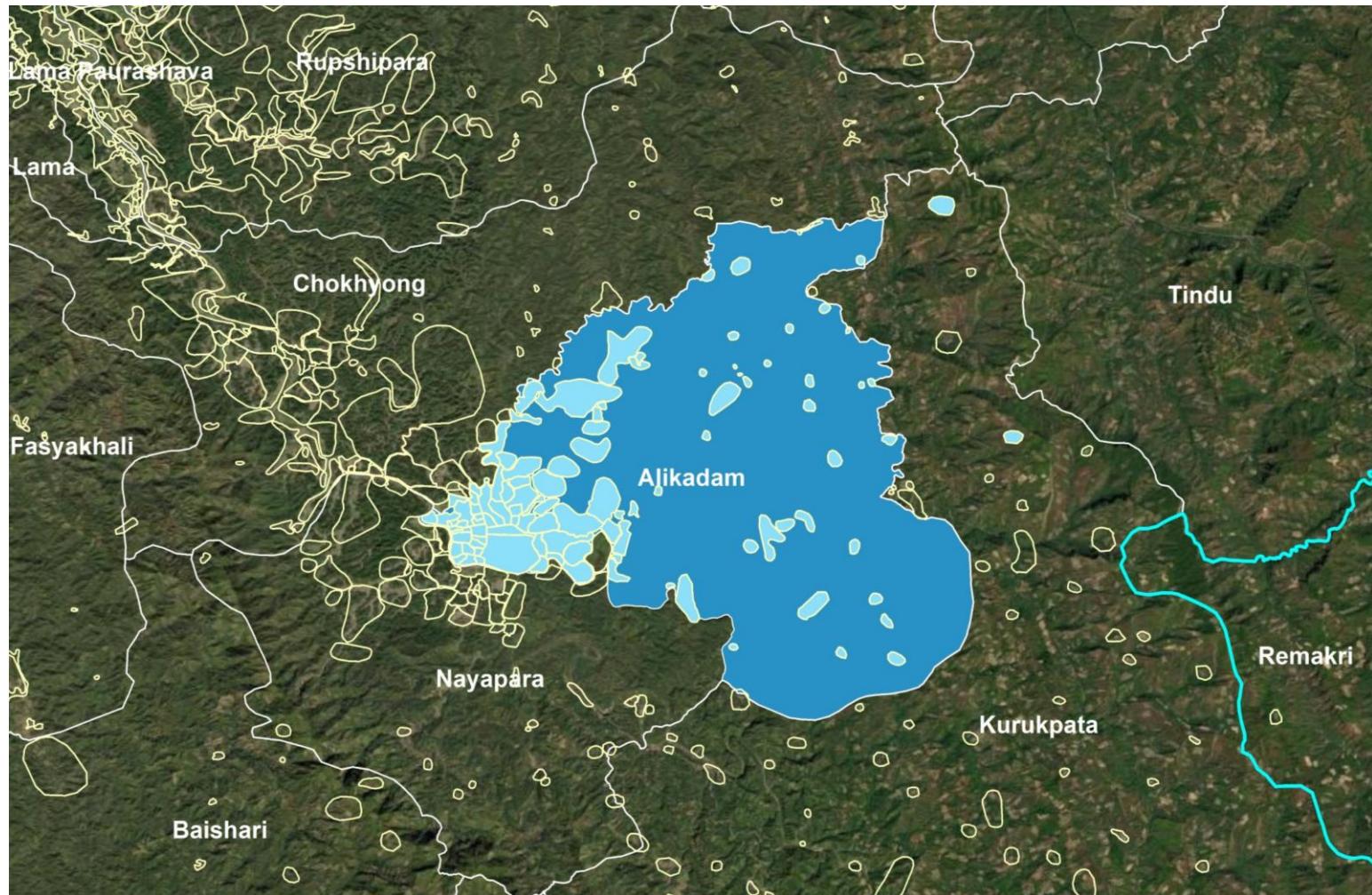
**20** Unions

**1347** Para/Mahalla

**82** Camp

**4** people

**32** working days



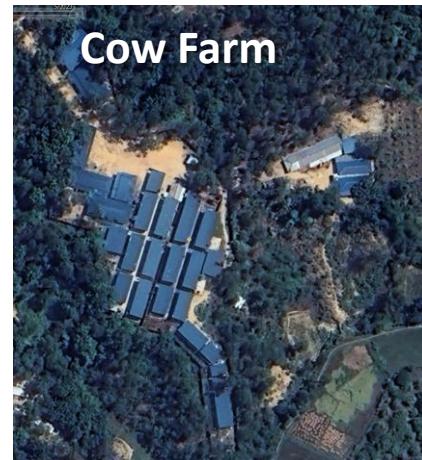
# What essential data are we collecting during village mapping?

## Geolocation

- **Admin unit:** Division, district, upazila/thana, union/municipality, ward, mauza, village, Unique village ID
- **Camps** (Armed forces Camp, BGB Camp, Police Camp, Ansar Camp, FDMN Camp, Farm, Plantation)
- **Construction project site**

## Other information at village level

- Operational list of villages
- Village ethnicity e.g. Tribal Para/Mahallah, Tribal Community Para/Mahallah, Bengali Para/Mahallah, Mixed (Bengali & Tribal) Para/Mahallah
- Ethnic groups for Farm/Plantation Sites
- Mobile network access (Existence, if not then distance in meter)
- Population count in each Village



# Results



DGHS, MOH&FW  
BANGLADESH



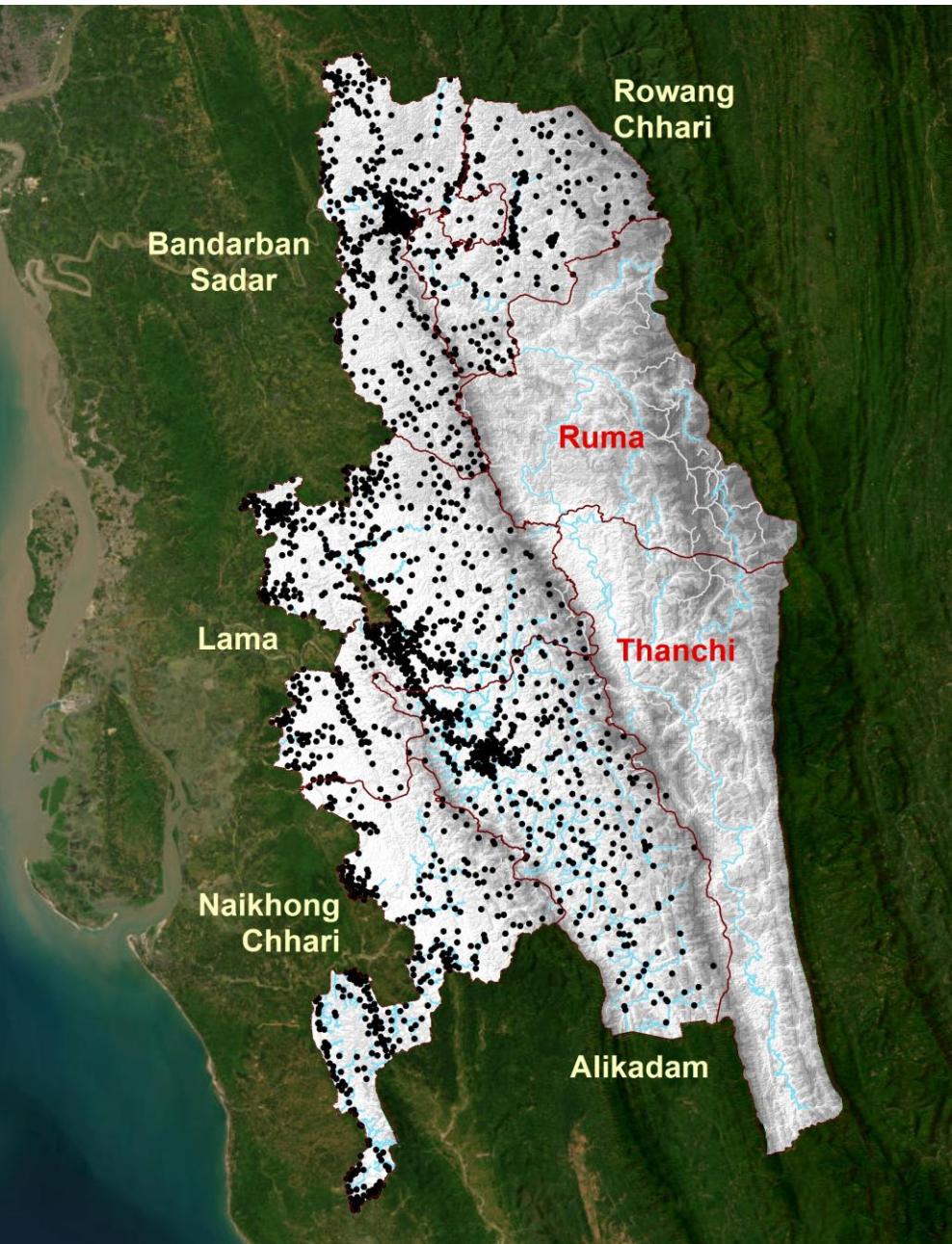
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UNIVERSITY OF  
OXFORD



## Method-1: Map villages and temporary settlements

**8500**

1 km<sup>2</sup> Grid

**312548**

Building Adjustment

**7832**

Surveyed area (sqkm)

**2009**

Para & Mahalla

**99**

Camps

**1036**

Tribal Para

**846**

Bengali Para

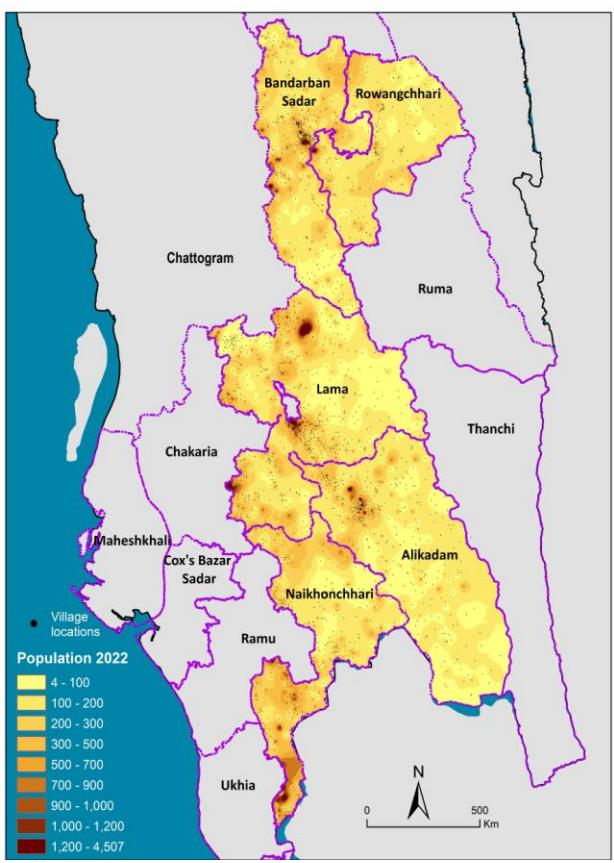
**127**

Mixed Para

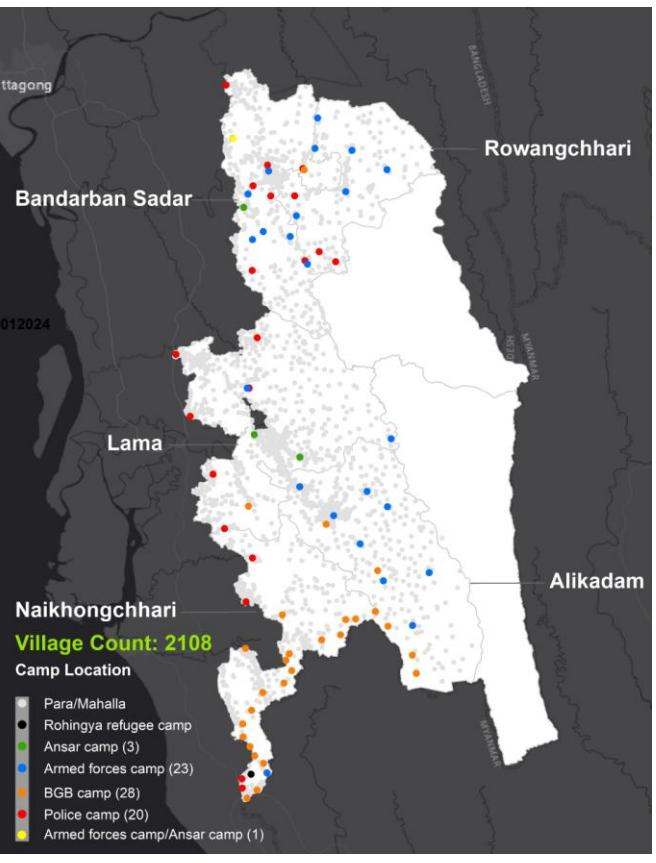
**1526**

Mobile Network  
Access

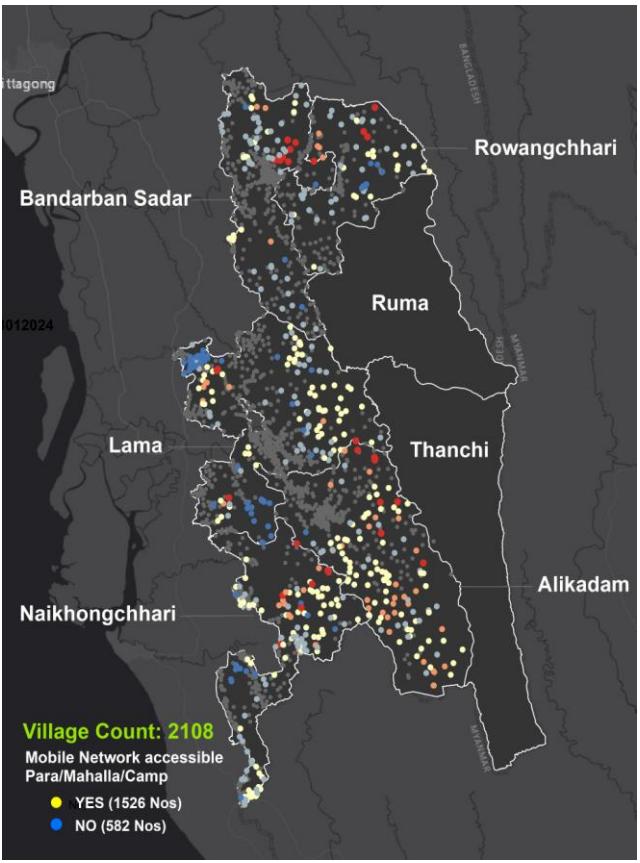
# Method-1: Map villages and temporary settlements



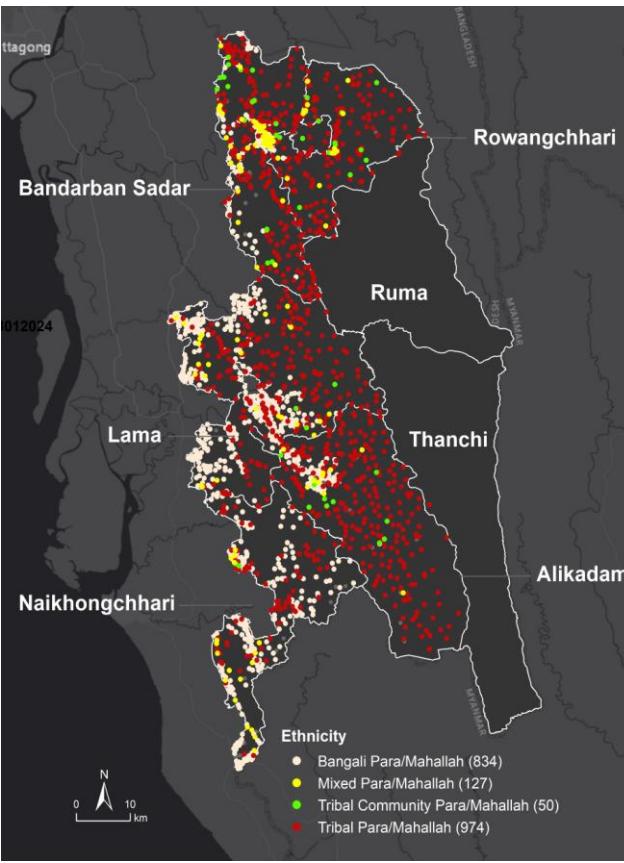
Population distribution



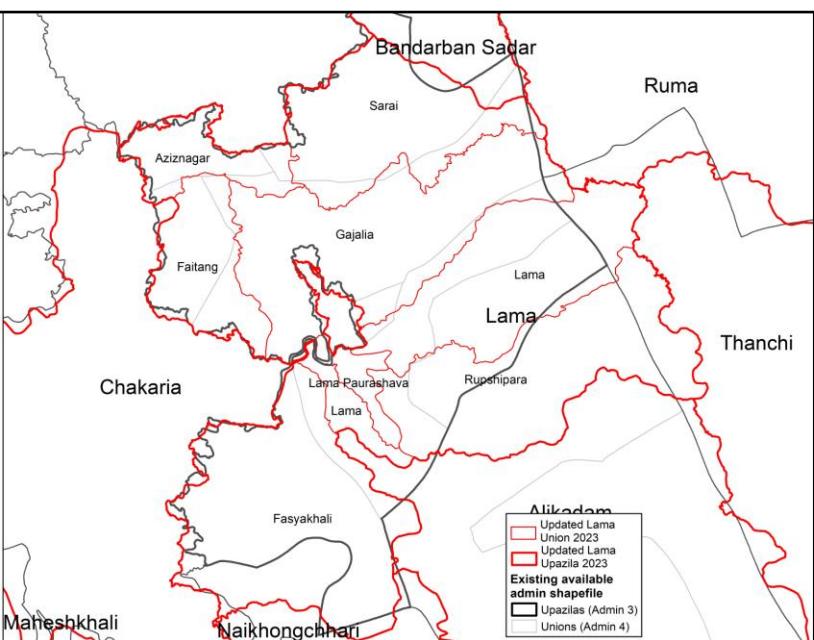
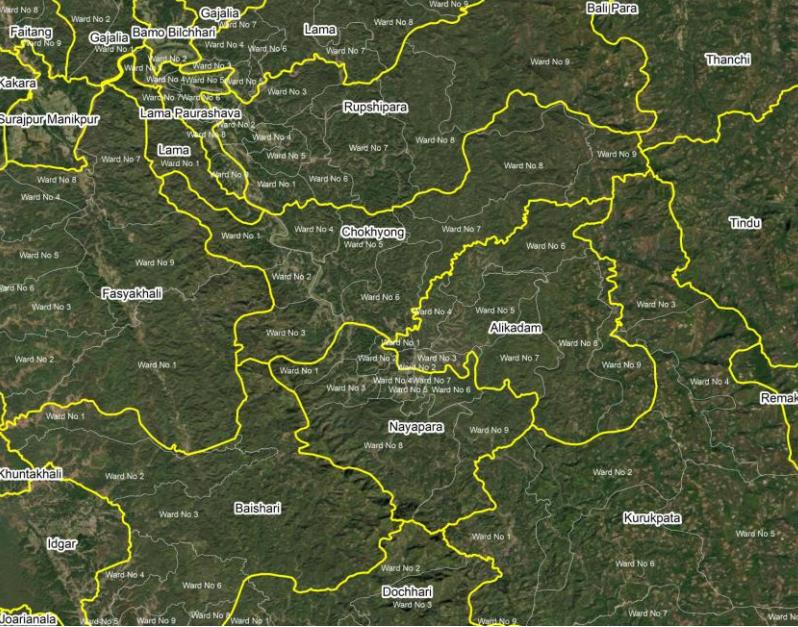
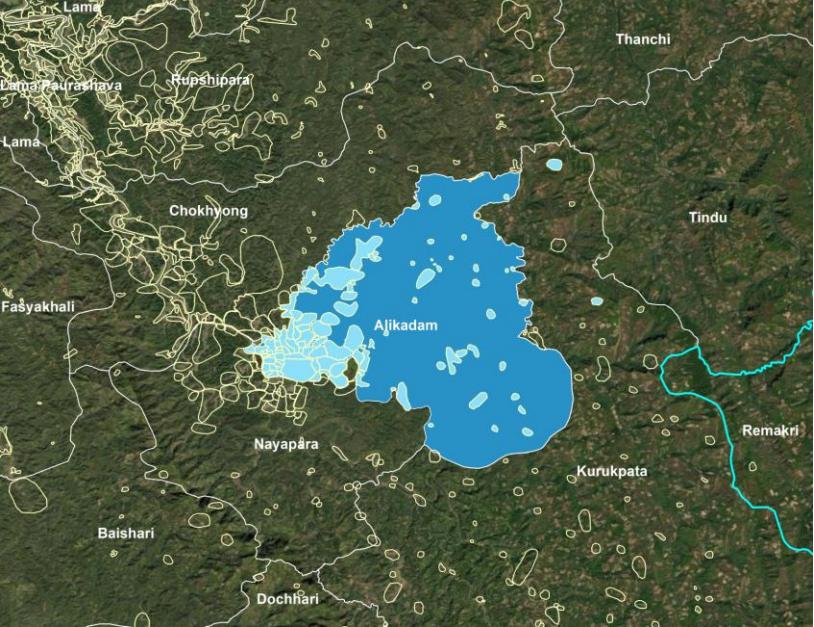
Camp distribution



Mobile network access



Ethnicity distribution

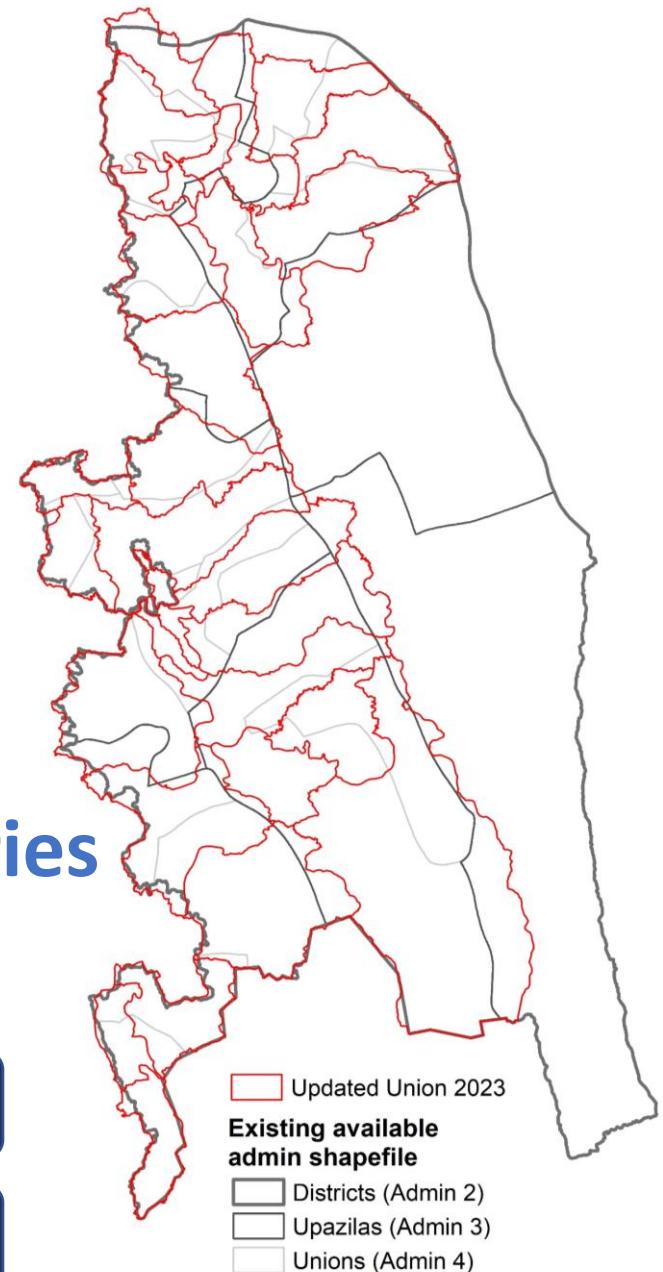


## Method-2: Updated administrative unit boundaries

Total wards: **252**

Total unions: **28**

Total upazilas: **5**



## Method-3: Population Estimate

Population Estimate from the building footprints = Count of Building footprints (26109)\*Household size (4.53)

### Population of Nikhonchhari

Estimated from the building footprints=118273.77

Consolidated from villages=107383

Bangladesh Bureau of Statistics= 75000

A. Estimated total area= Sum of the area of each Building footprint

B. Population density per square kilometre

Estimated population=A\*B



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# Method 4: Collection of malaria case data at village level

## Village level Malaria Surveillance: Empowering the Frontline in Lama, Bandarban



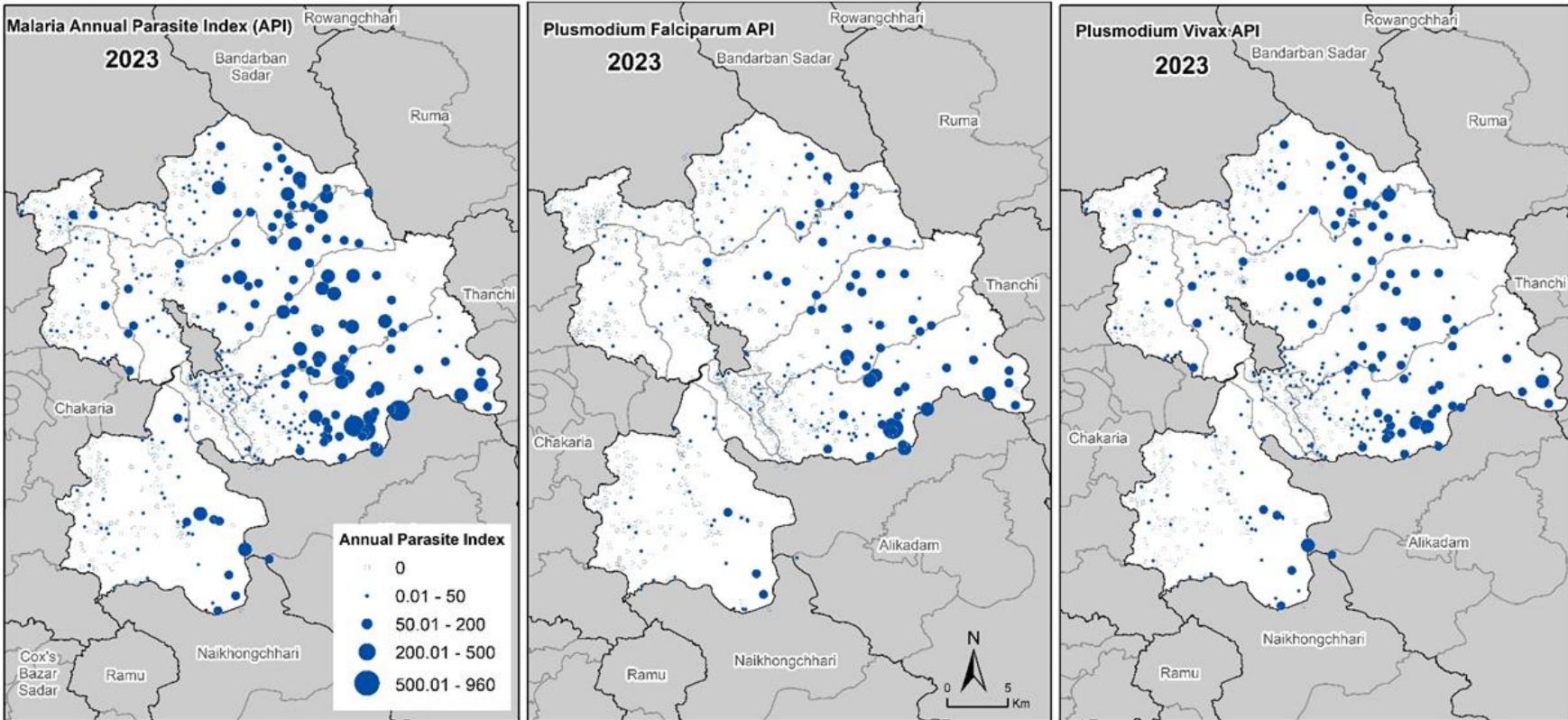
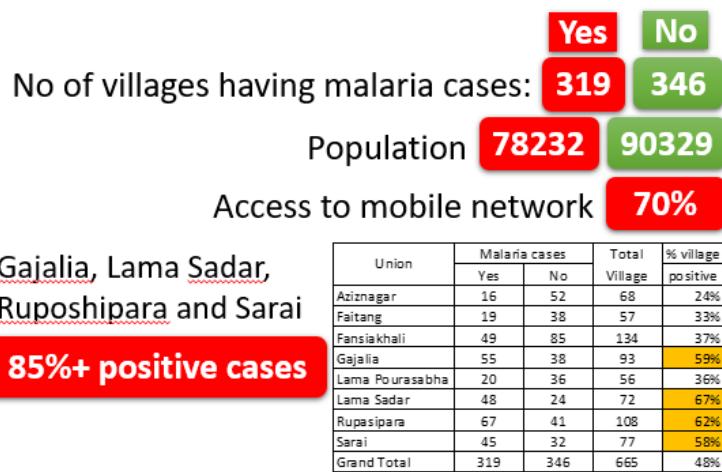
What is the key feature of piloting village-level malaria data collection?

- Local health workers collect real-time data using Kobo Toolbox and SMS.
- Empowers communities to monitor and report cases.
- Enables targeted interventions at the village level.



# Method-5: Geospatial Analysis

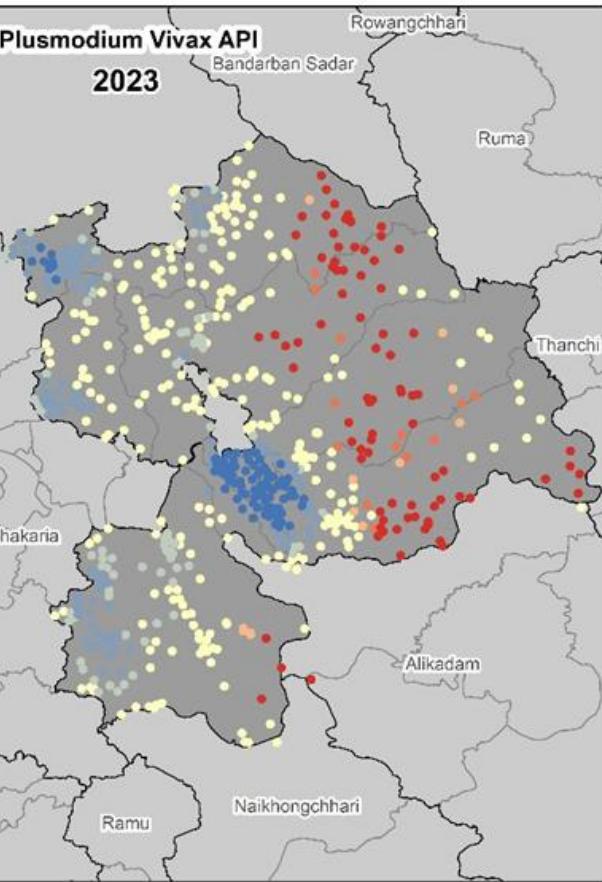
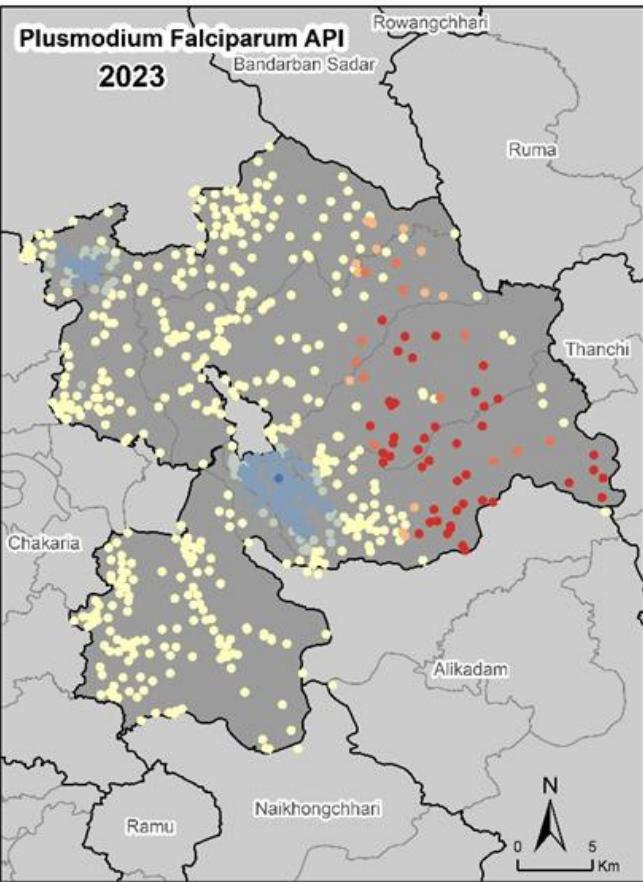
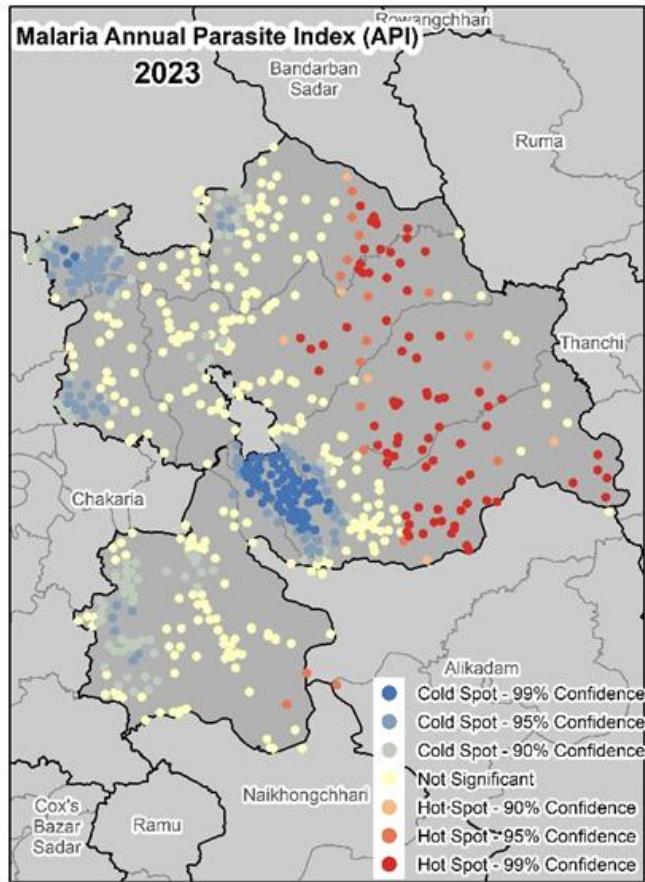
## Village level API mapping (fine scale malaria risk)



# Method-5: Geospatial Analysis

## Level of confidence at village

	Hot Spot 90-99%	Not Significant	Cold Spot 90-99%
Total API	101	280	283
PF API	71	441	153
PV API	108	255	302

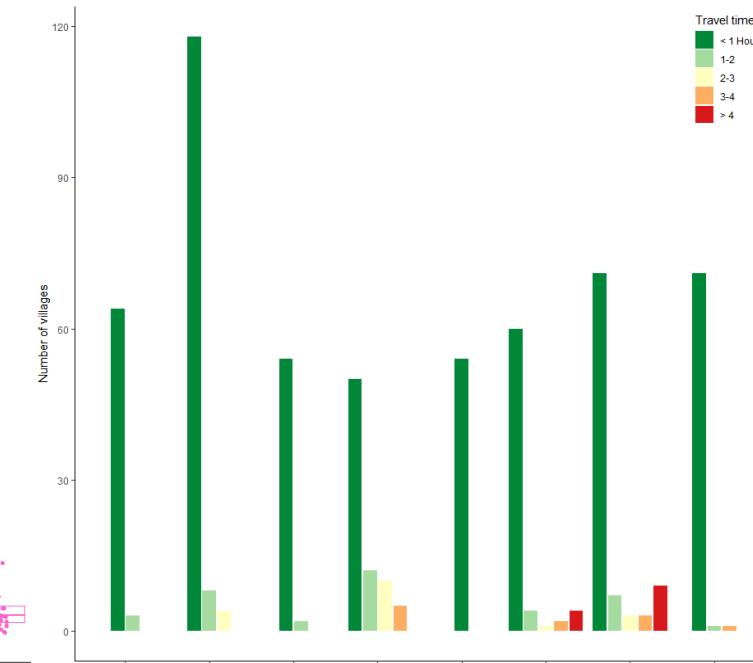
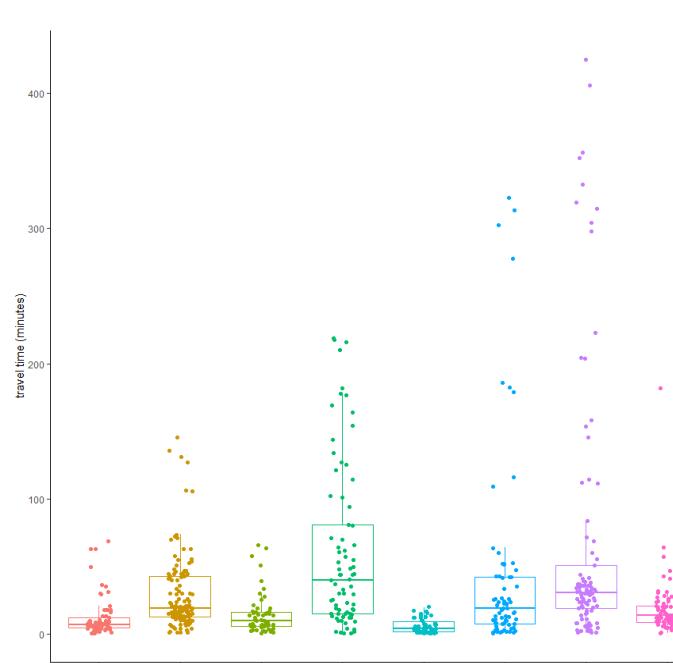
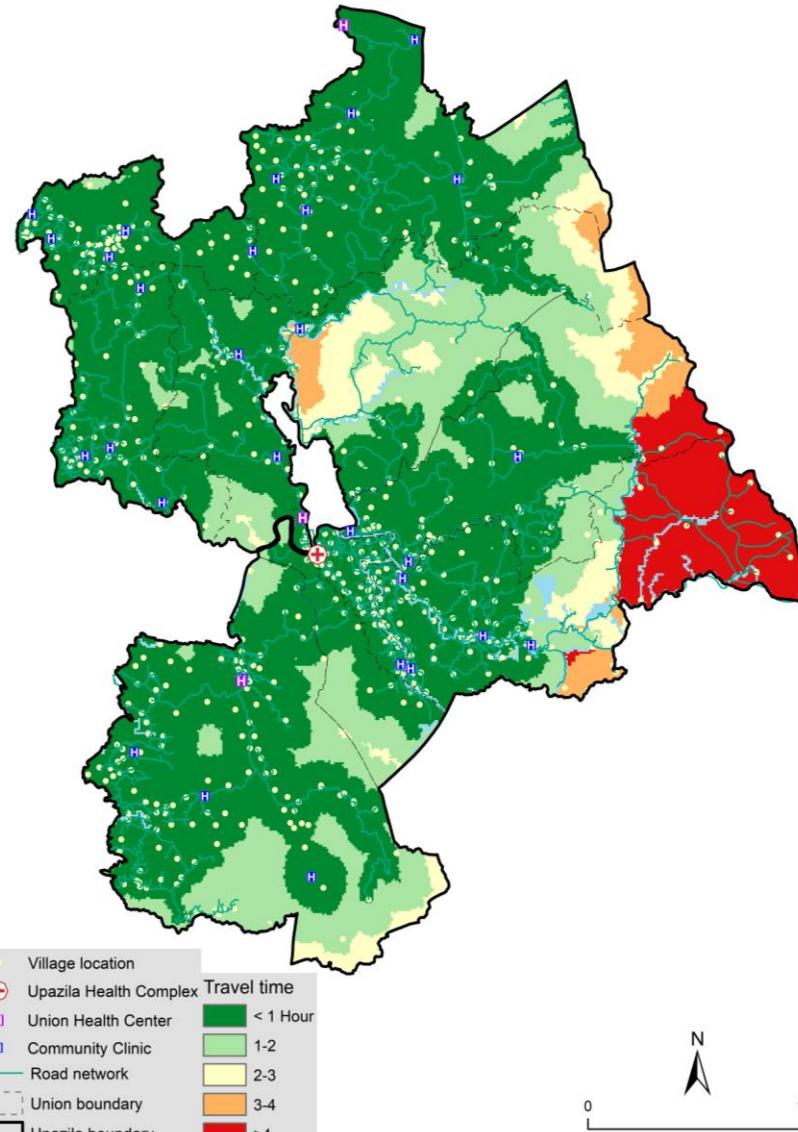


## Malaria Hotspot Map

### Hot Spot Analysis (Getis-Ord Gi\*)

# Method-5: Geospatial Analysis

## Physical Accessibility modelling to health facilities (Dry Season)



### Data

- Administrative boundaries;
- Health facilities location
- Transportation network (roads and boat routes);
- Hydrographic network (major rivers and water bodies);

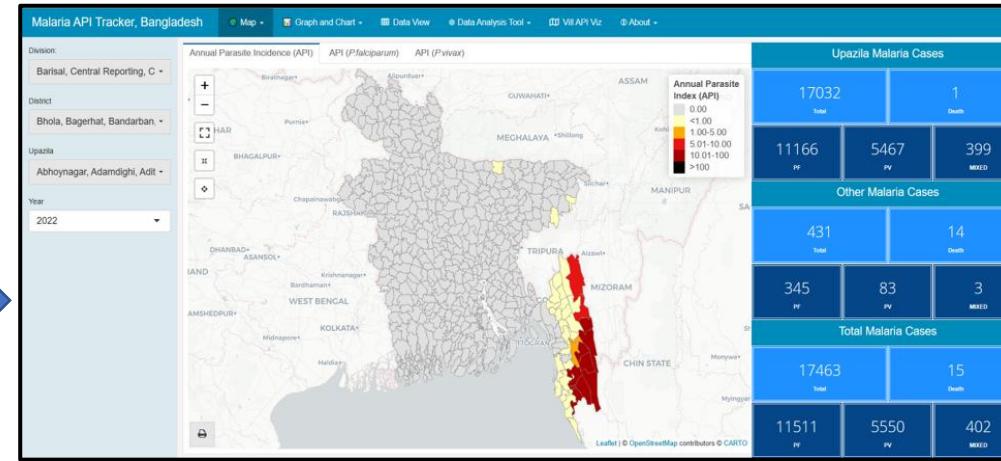
- Land cover;
- Digital Elevation Model (DEM);
- Village location and population
- Travel scenario (dry season)

# Method-6,7: Geospatial dashboard

<https://malariaapitracker.com/>

## Malaria 360 as a Surveillance Tool National Malaria Elimination Program

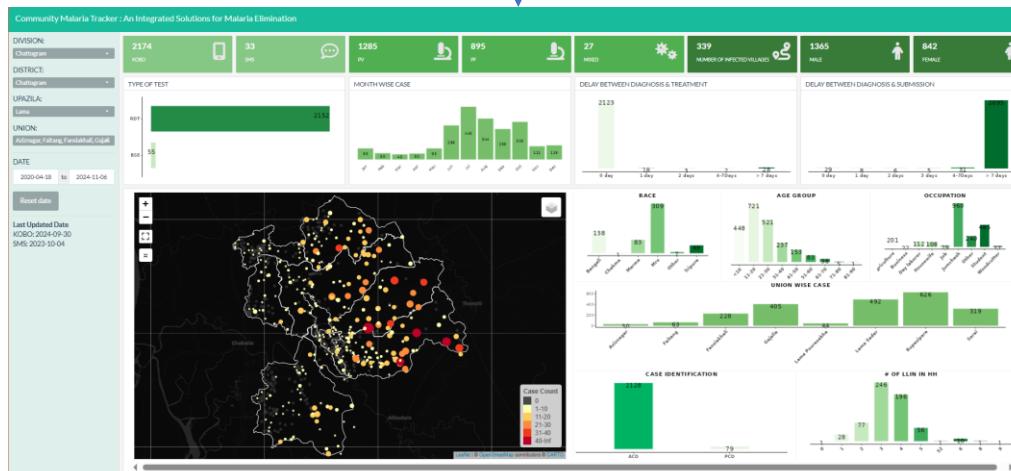
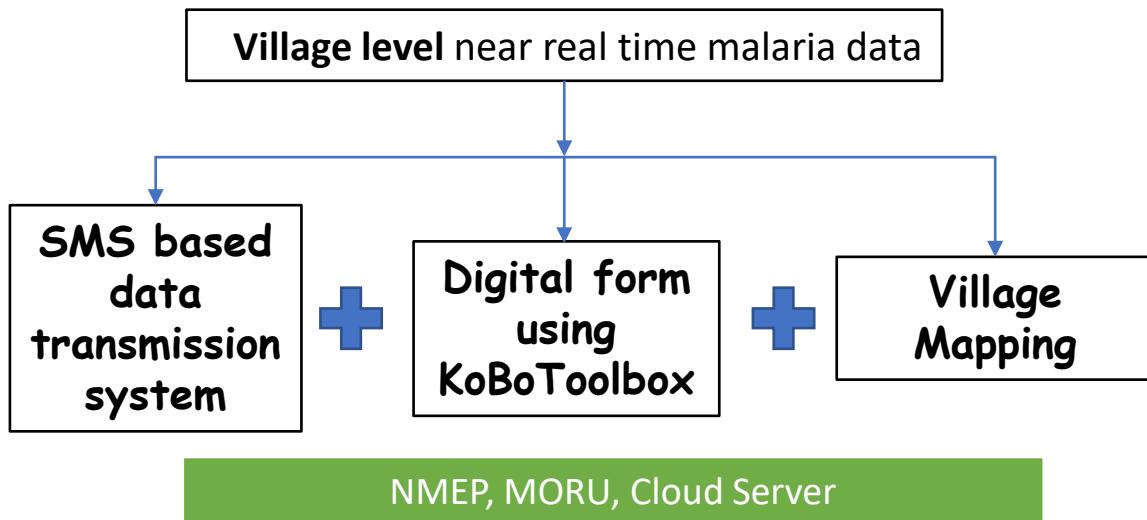
Upazila level data from Malaria Information System (**MIS**) is visualized via Application Programming Interface (**API**)  
Dcastalia Limited, Cloud Server

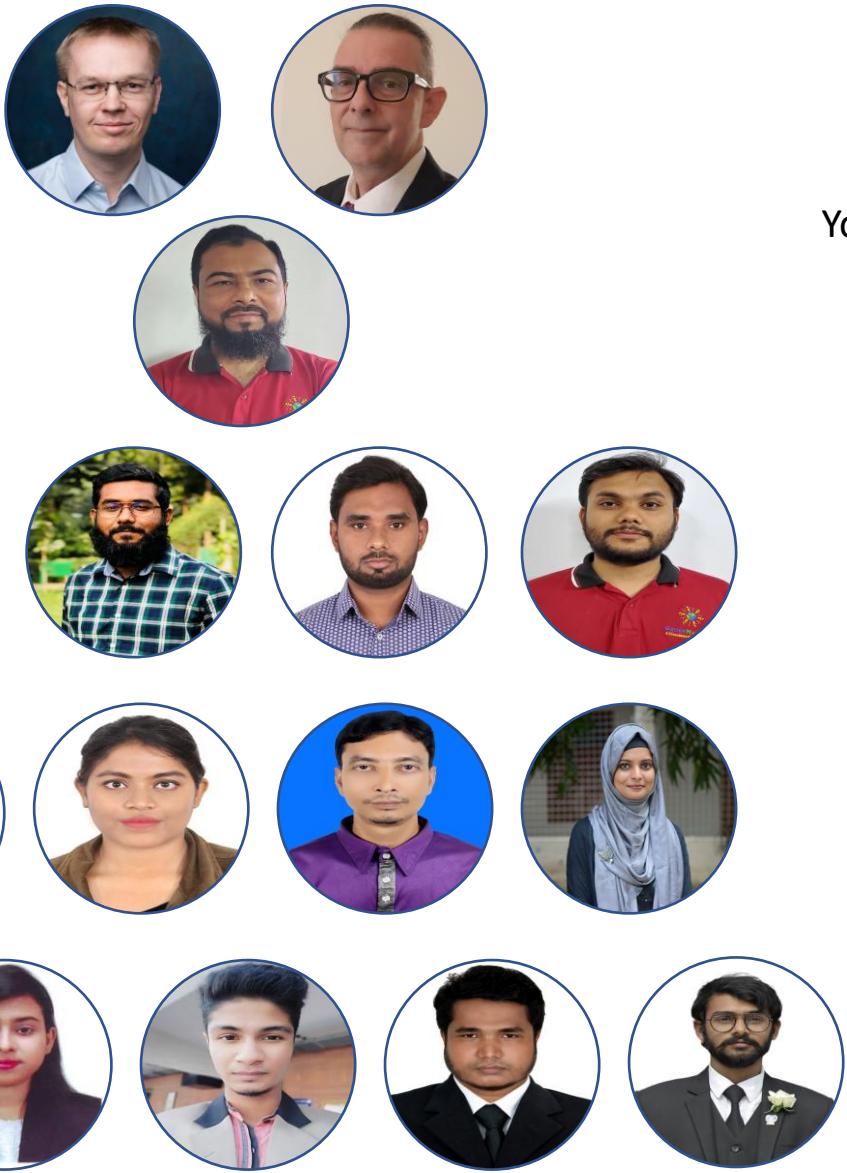


Malaria API Tracker

NMEP, MORU, Cloud Server

Community Malaria Tracker





[www.groupmappers.com](http://www.groupmappers.com)

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# Acknowledgement

- National Malaria Elimination Program, CDC, DGHS, Dhaka, Bangladesh
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- South East Asia Community Trials Network (SEACTN)
- GroupMappers volunteers
- Local government authorities, Ministry of local government, rural development and cooperation



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