



# Understanding the role of land cover / land use nexus in malaria transmission under changing socio-economic climate in Myanmar

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2018.01.26 01:04











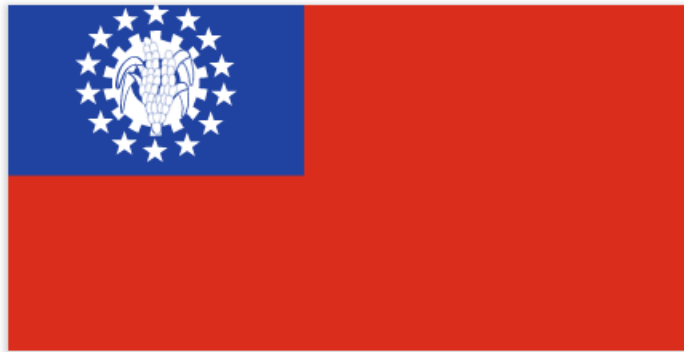




# Malaria Atlas Country Profile: Myanmar



THE MALARIA ATLAS PROJECT



## MYANMAR

Myanmar has [the highest rate of malaria-related mortality in south-east Asia](#). The primary parasite is *Plasmodium falciparum* and there is also *P. vivax* present. Vectors include *Anopheles dirus*, *A. minimus* and *A. epiroticus*.

### FEEDBACK

Data enquiries, corrections, or other comments? Contact us.

SEND FEEDBACK

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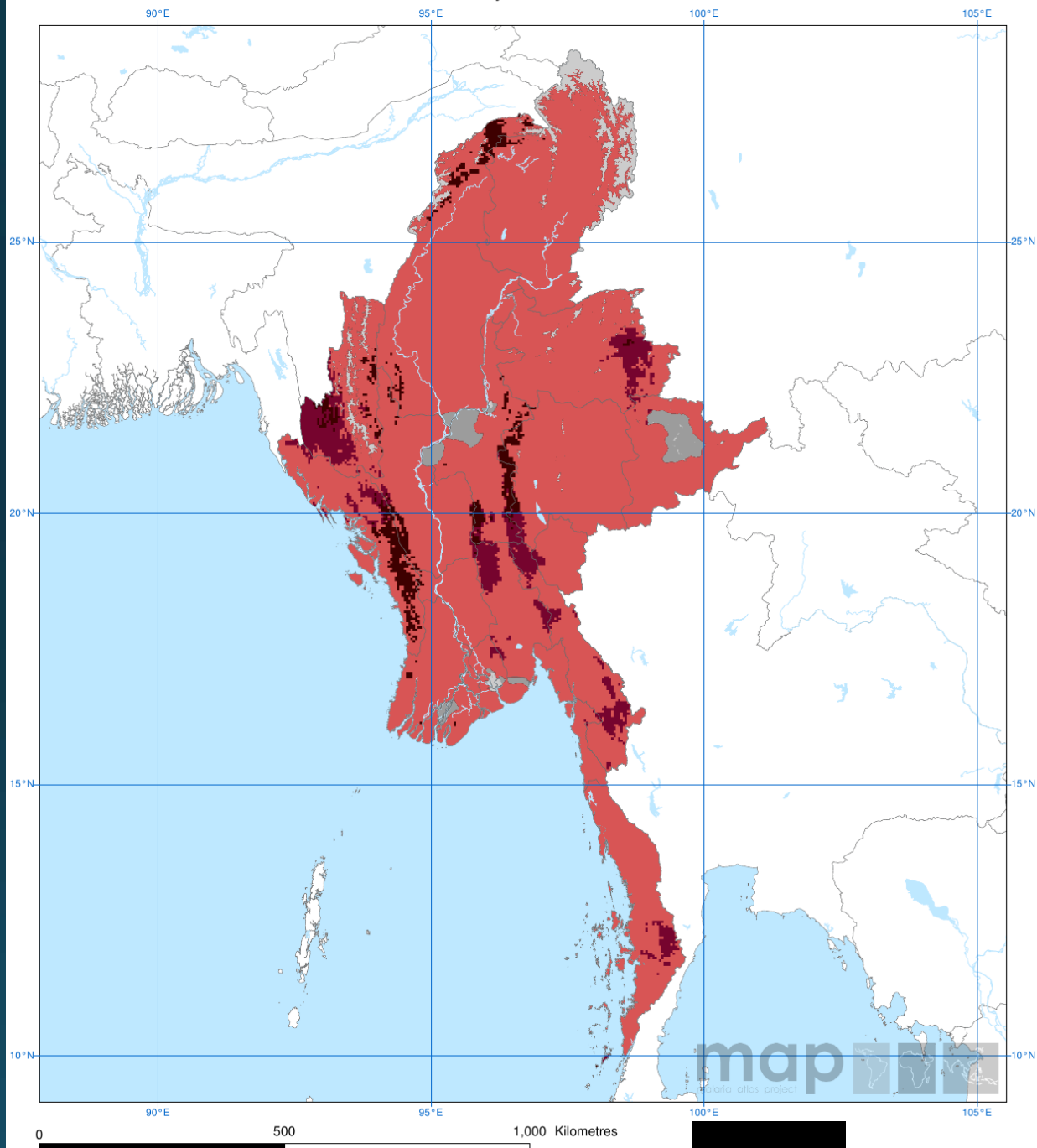
ENDEMICITY		
Parasite	Endemic	Year Eliminated
<i>Plasmodium falciparum</i>	Yes	Not applicable
<i>Plasmodium vivax</i>	Yes	Not applicable

### DATA SOURCES

- T.T. Oo, V. Storch, N. Becker (2003) *Anopheles dirus and its role in malaria transmission in Myanmar*.
- W. Tun-Lin, A.A. Sebastian, Myo-Paing (1989)



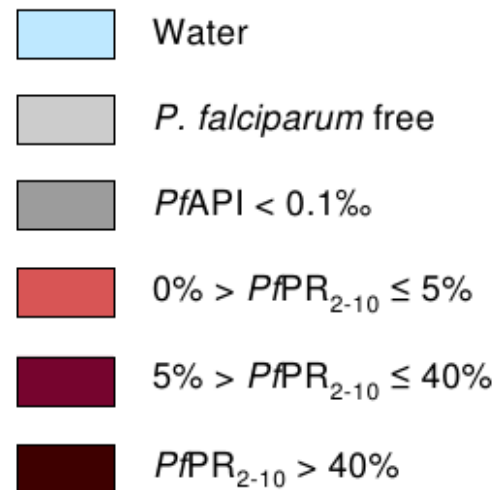
The spatial distribution of *Plasmodium falciparum* malaria in 2010 stratified by endemicity class  
Myanmar



Gething et al. 2011 – Available  
via Malaria Atlas Project

Fig 3 shows predictions  
categorized as:

- low risk - light red;
- intermediate risk - medium red;
- high risk - dark red.



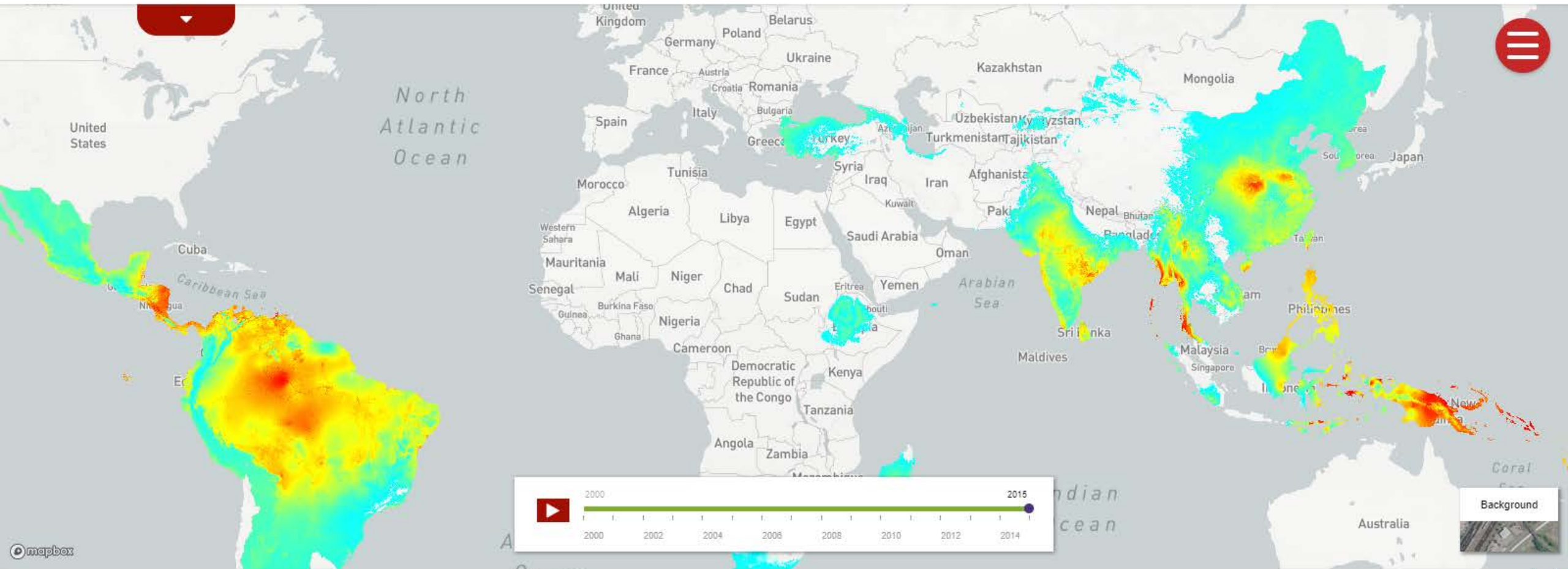


# *P. vivax* endemicity globally



THE MALARIA ATLAS PROJECT

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2000 km

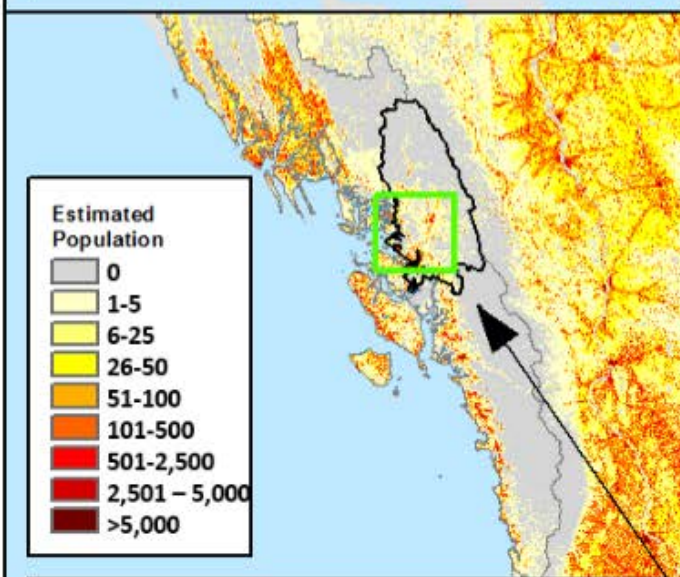
COORDINATES (LON/LAT): 96.3281, -24.0465



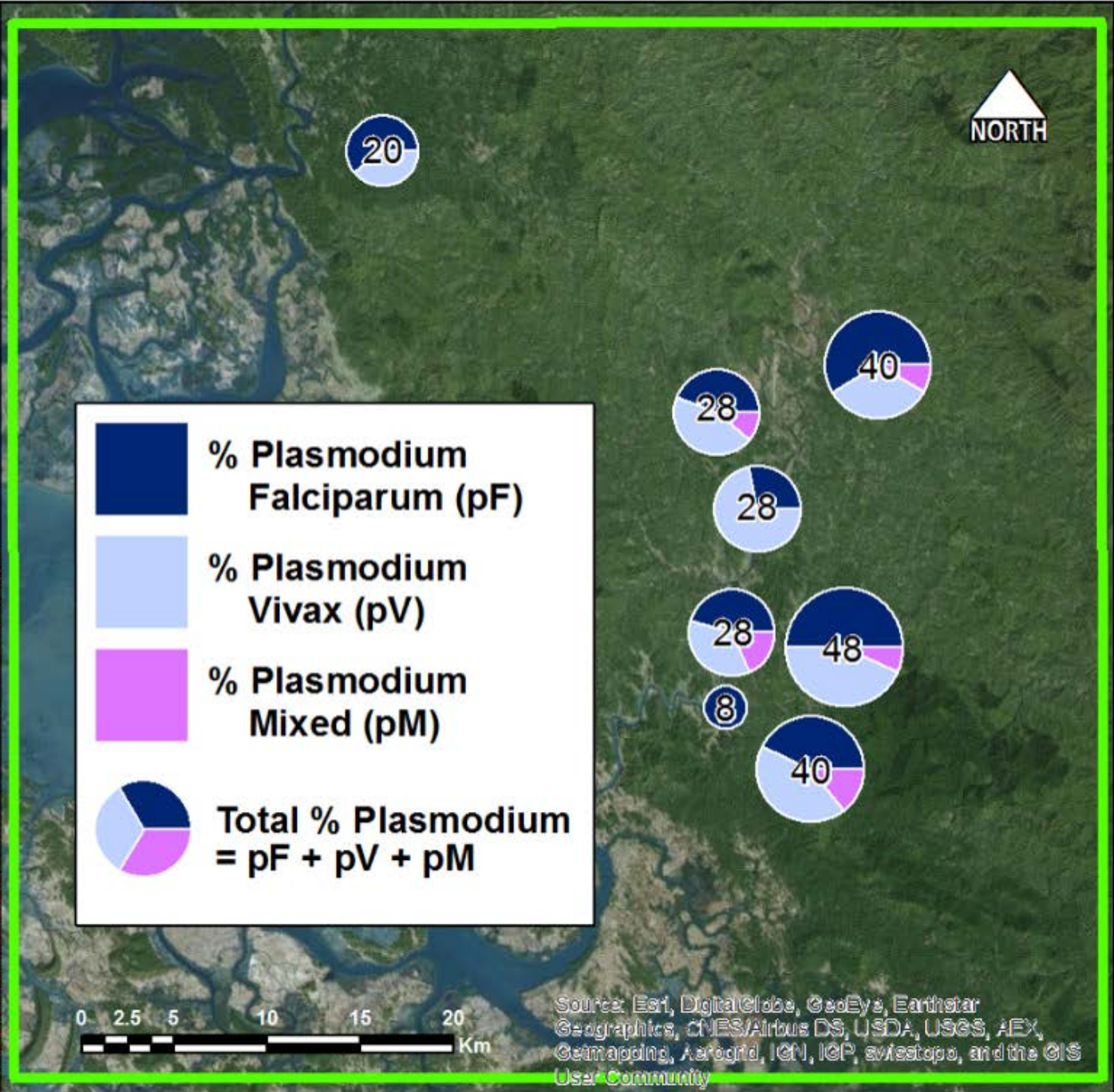




**Rakhine State in Myanmar**



**Ann Township in Rakhine**



**% Plasmodium Falciparum (pF)**

**% Plasmodium Vivax (pV)**

**% Plasmodium Mixed (pM)**

**Total % Plasmodium = pF + pV + pM**

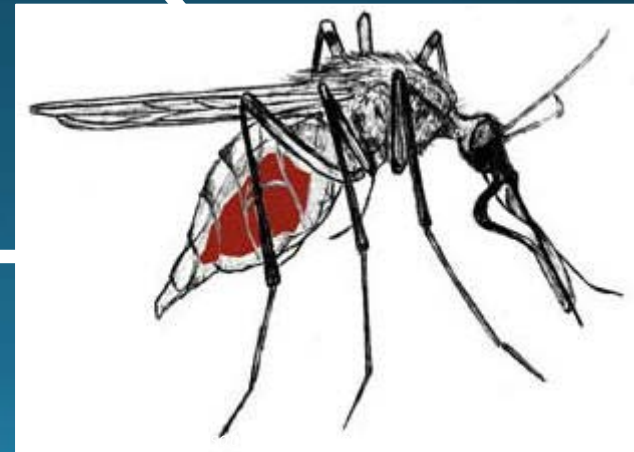
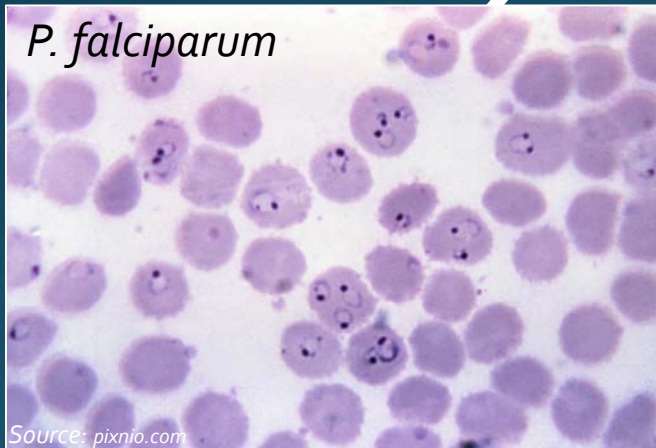
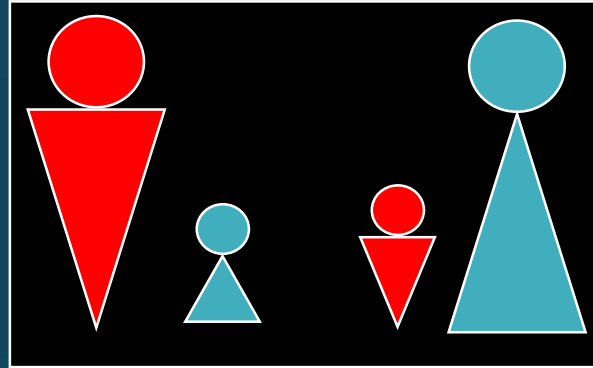


# Overarching research question

- What environmental and land use factors are contributing to the observed differences in malaria presence and prevalence between the villages in Ann Township of Rakhine State in Myanmar?



# The malaria triangle





## Objective 1: Land cover/use mapping

Downscaled meteorological parameters (8-day)

Dynamic mapping of surface conditions (8-day)

Land cover/use baseline assessment (single time)

## Objective 2: Mobility

Identifying mobility networks

Human mobility pattern mapping from surveys and auxiliary data

## Objective 3: Analytics

Analyze malaria prevalence as a function of environmental conditions

Analyze malaria prevalence as a function of human mobility

## Objective 4: Expert verification

*Focus group interviews:*  
Verify study findings in focus group interviews with health practitioners and researchers in the Rakhine state.



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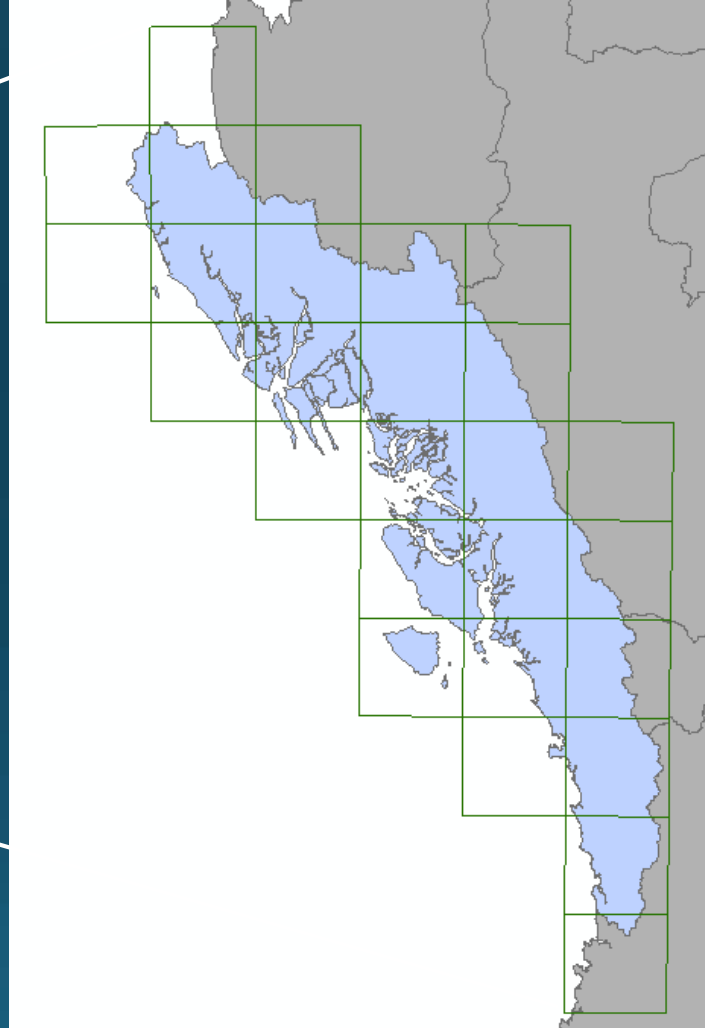
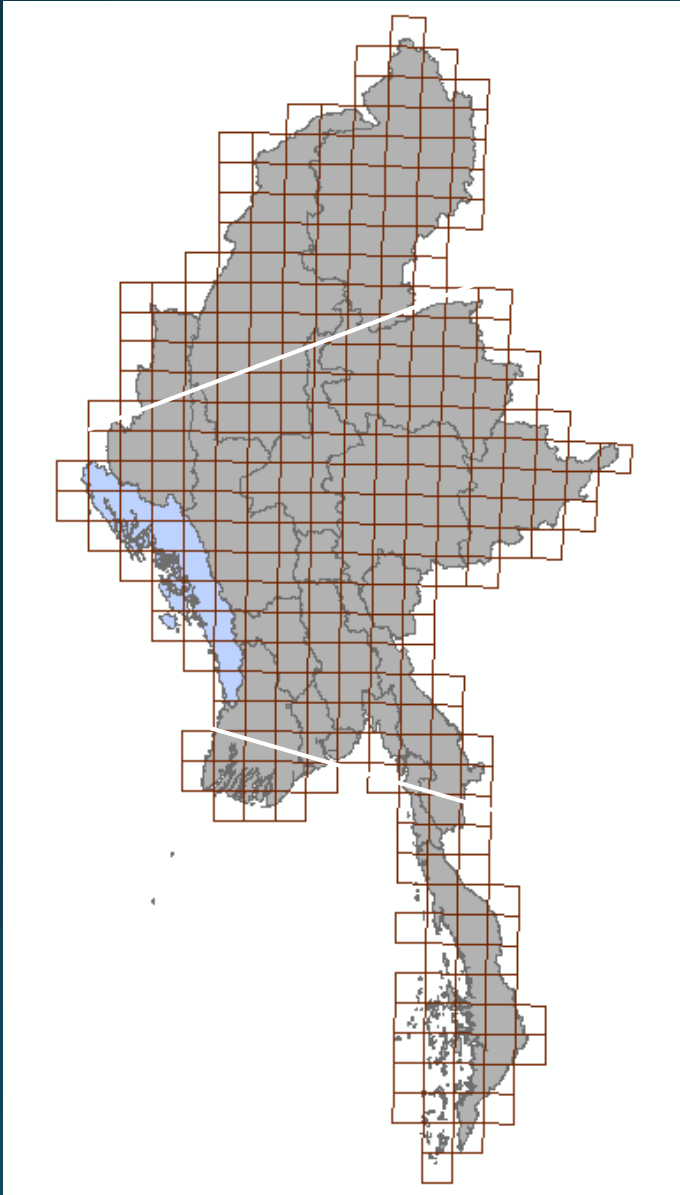
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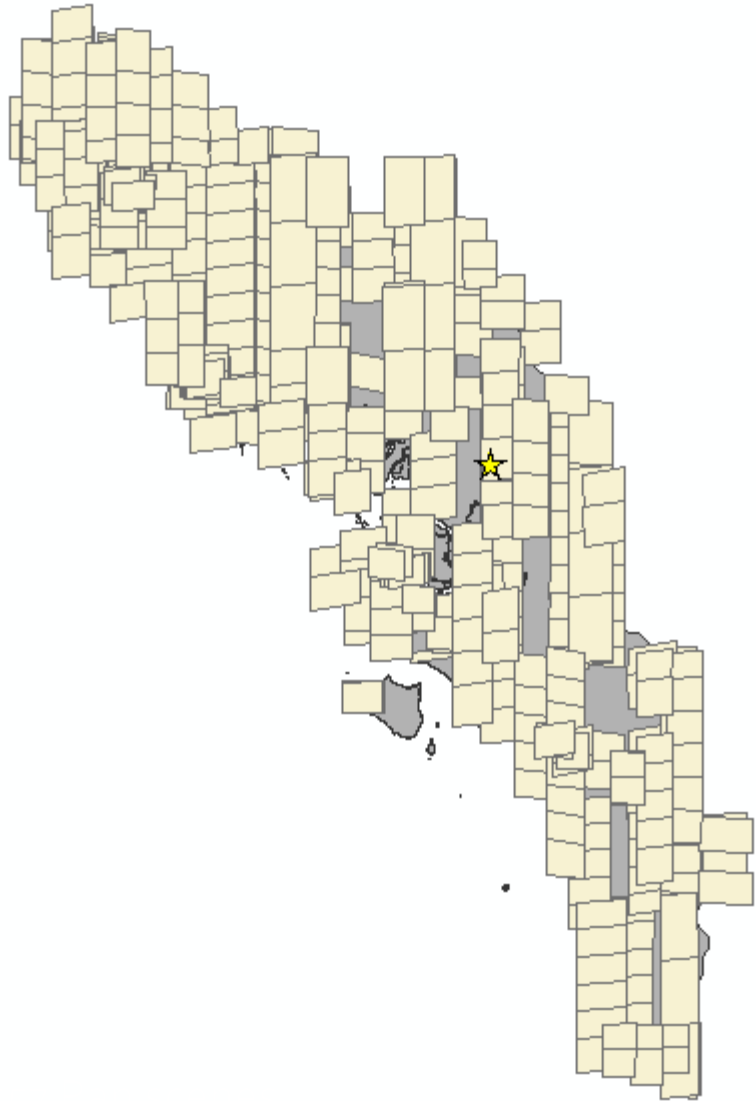
# Processing and analysis grid



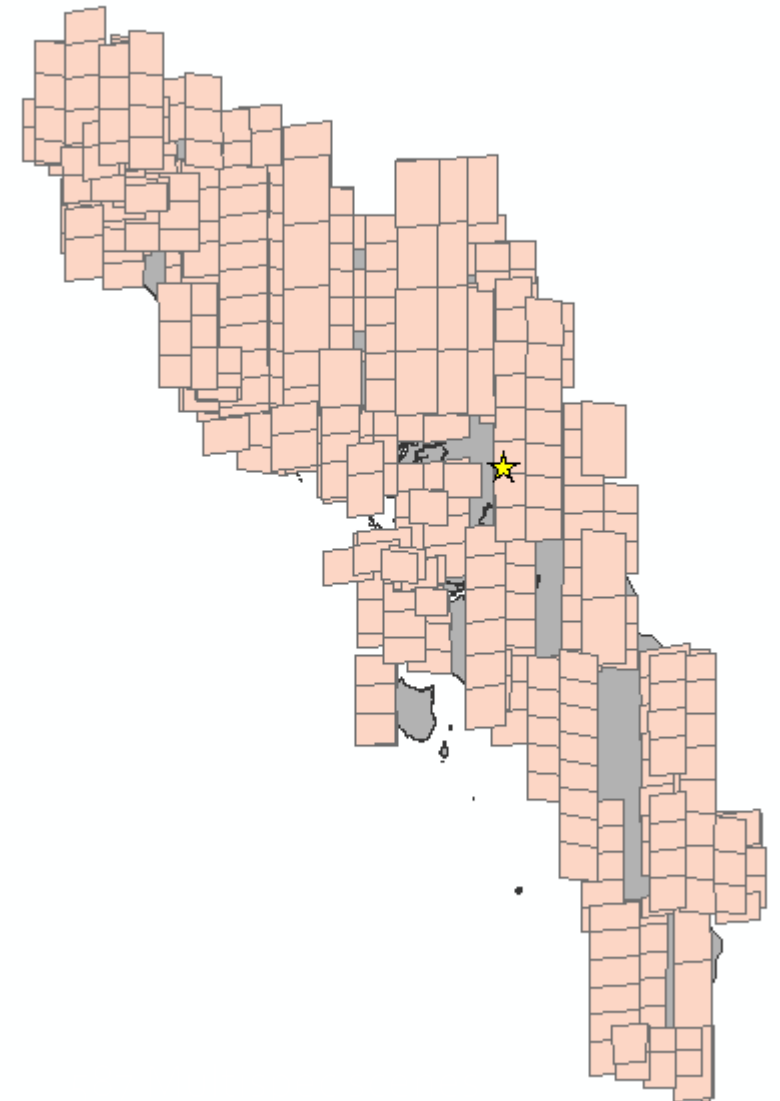
- Common grid:  $\frac{1}{2}^\circ$  longitude x  $\frac{1}{2}^\circ$  latitude projected into UTM zone 46
- Optimizes raster images at fine resolution (1 – 2 m) and moderate resolution (30 m)



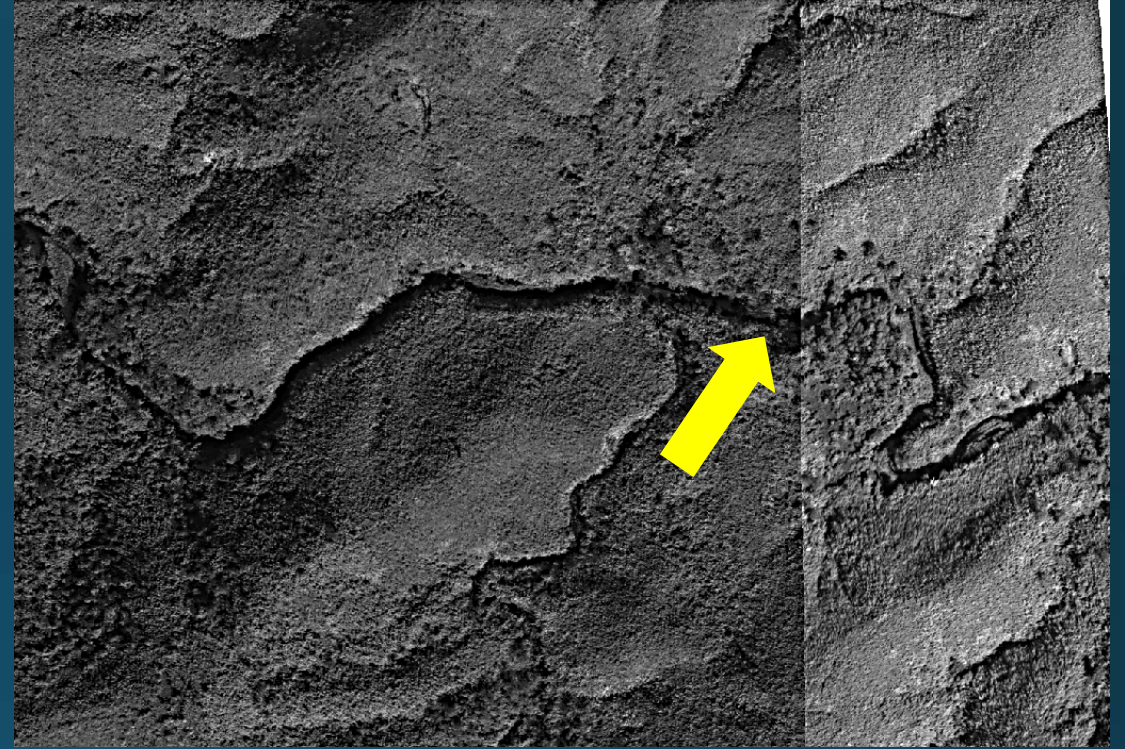
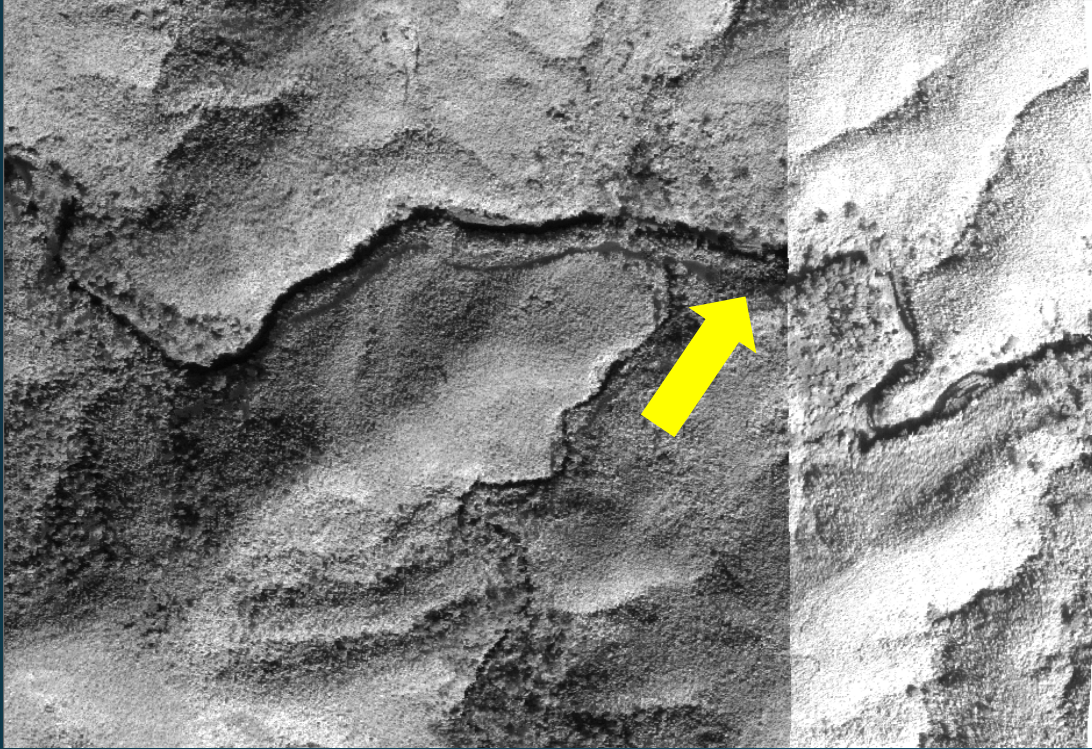
# VHR Panchromatic (left) and Multispectral (right) data for Rakhine



- Very High Resolution (VHR): WorldView @ 1 – 2 m pixel
- > 1,100 scenes over 2010 – 2017
- Able to ortho-rectify and convert to TOA reflectance all images in ~12 hours on 10 virtual machines

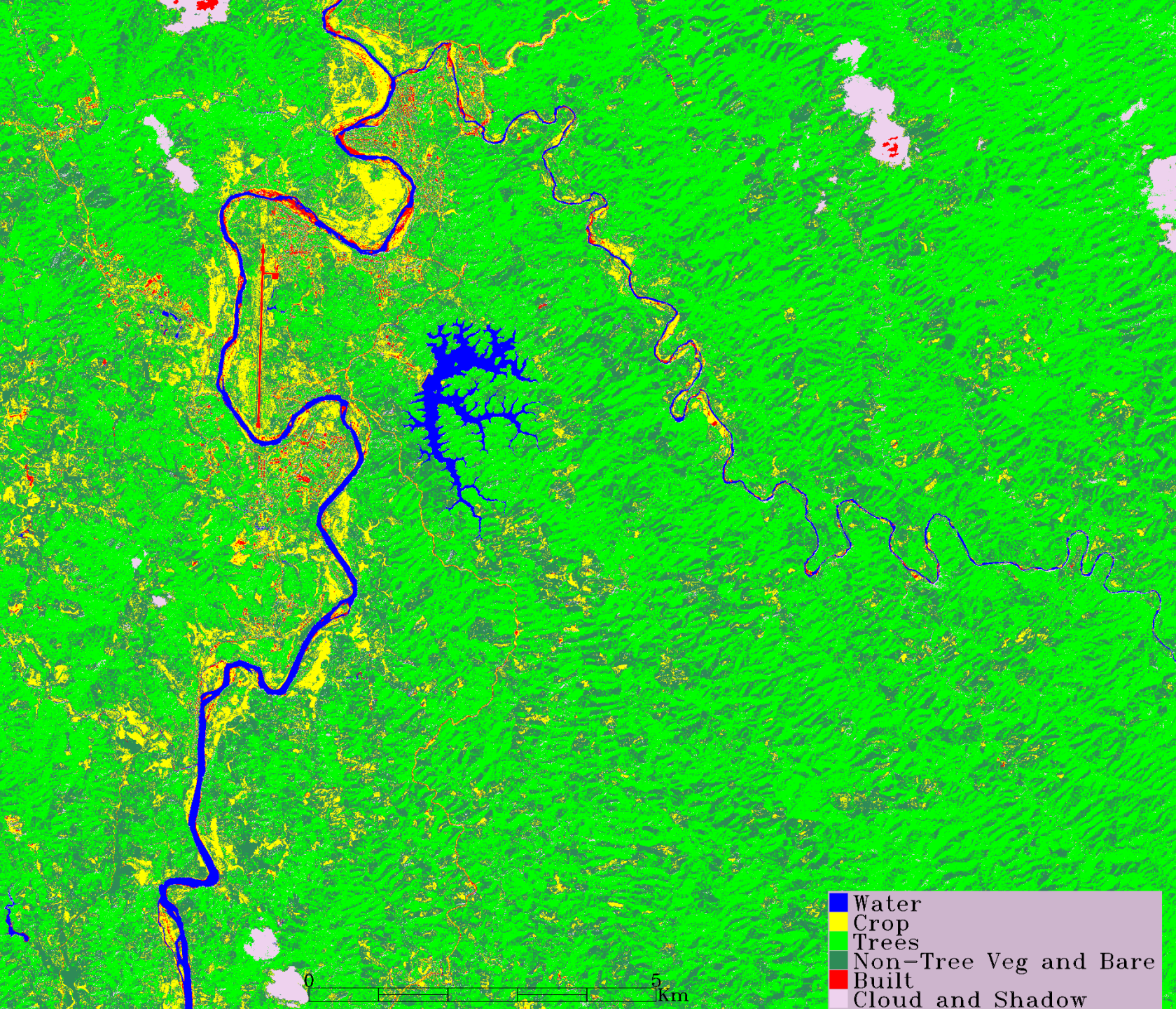


# Sample mosaic in Rakhine before (left) and after (right) adjustment



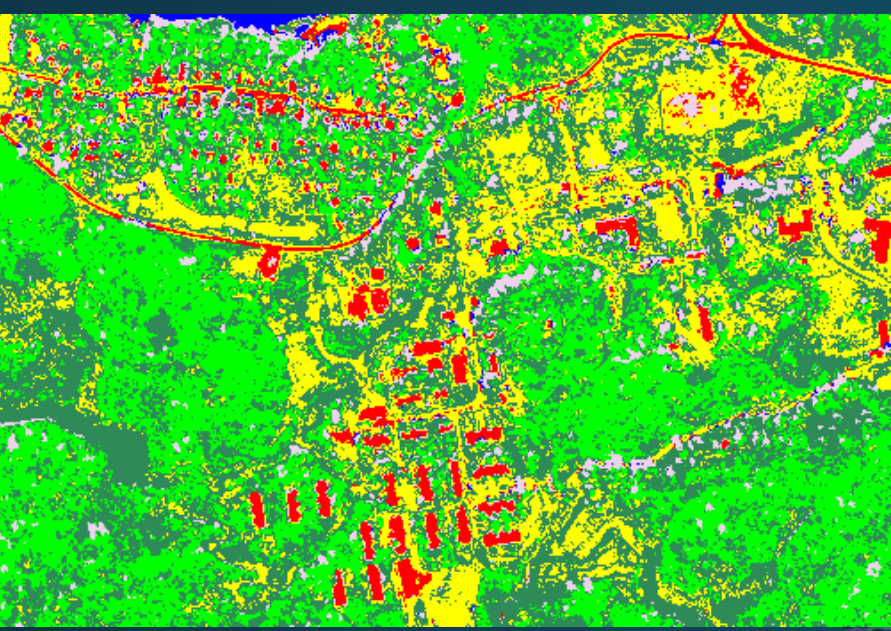
- A geolocation problem (a mismatch in the geoid)
- TOA reflectance (right) normalization of sensor /solar geometry effects





	Prod Acc%	User Acc%
Water	71.79	100
Crop	79.17	79.17
Trees	100	88.14
Non-tree&bare	63.95	98.21
Built	9.09	3.85
Cloud&shadow	100	58.62
Overall Acc = 79.7		
Kappa Coefficient = 0.73		

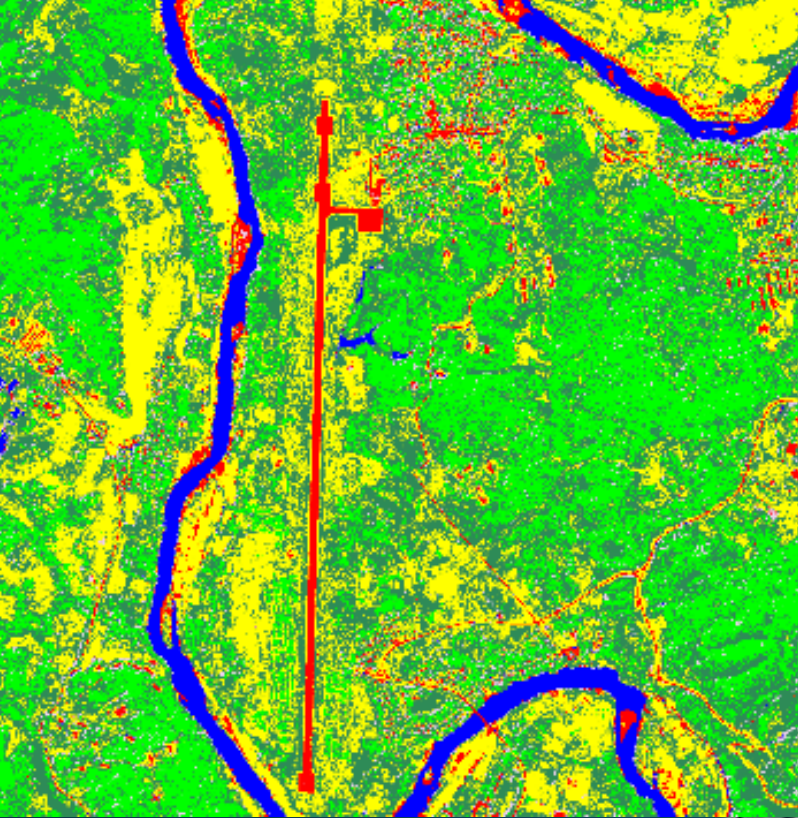




- Water
- Crop
- Trees
- Non-Tree Veg and Bare
- Built
- Cloud and Shadow





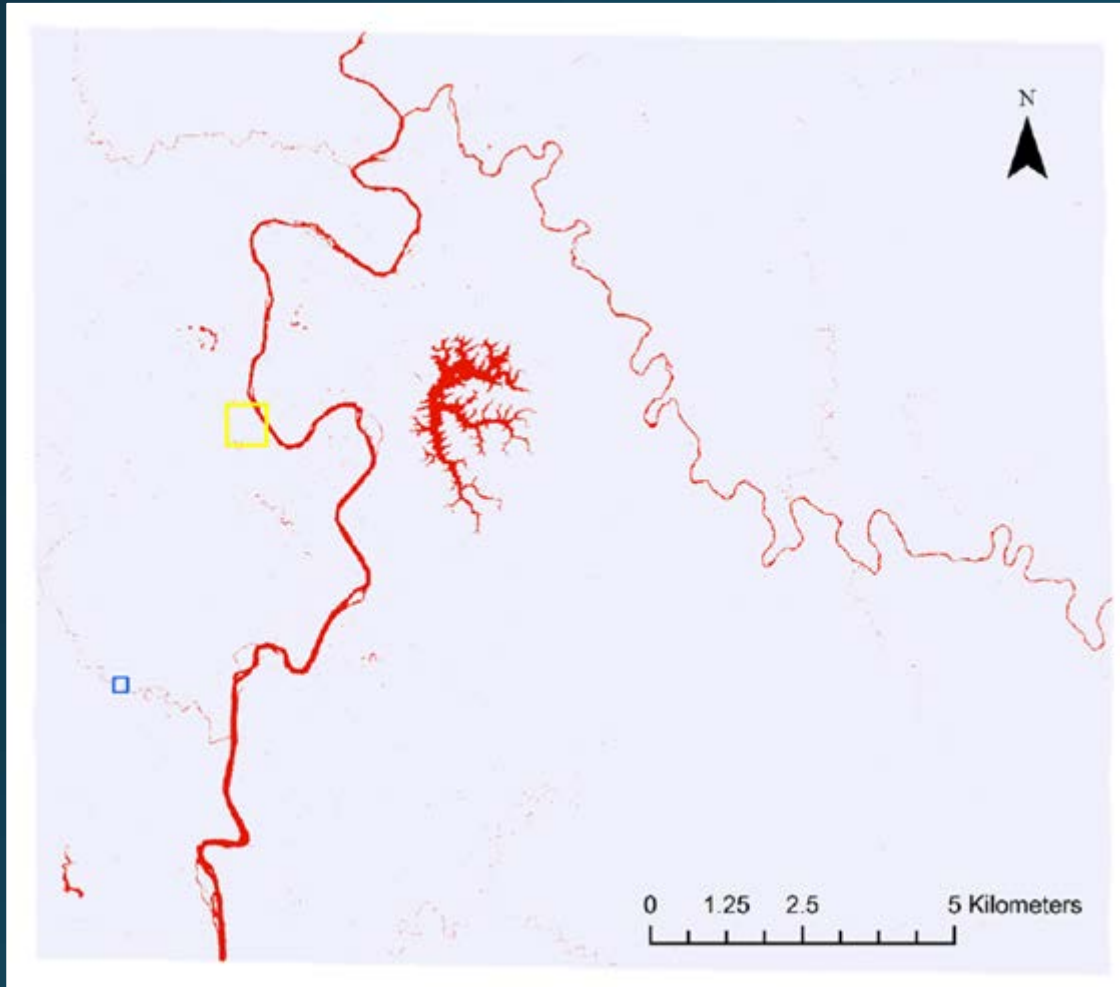


- Water
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## Random Forests for classifying water in Rakhine near Ann:



Classification results of model with number of trees = 200, and max features =  $\log_2(n \text{ features})$



Pixels incorrectly classified as water are scattered throughout the image in yellow, west of the identified river

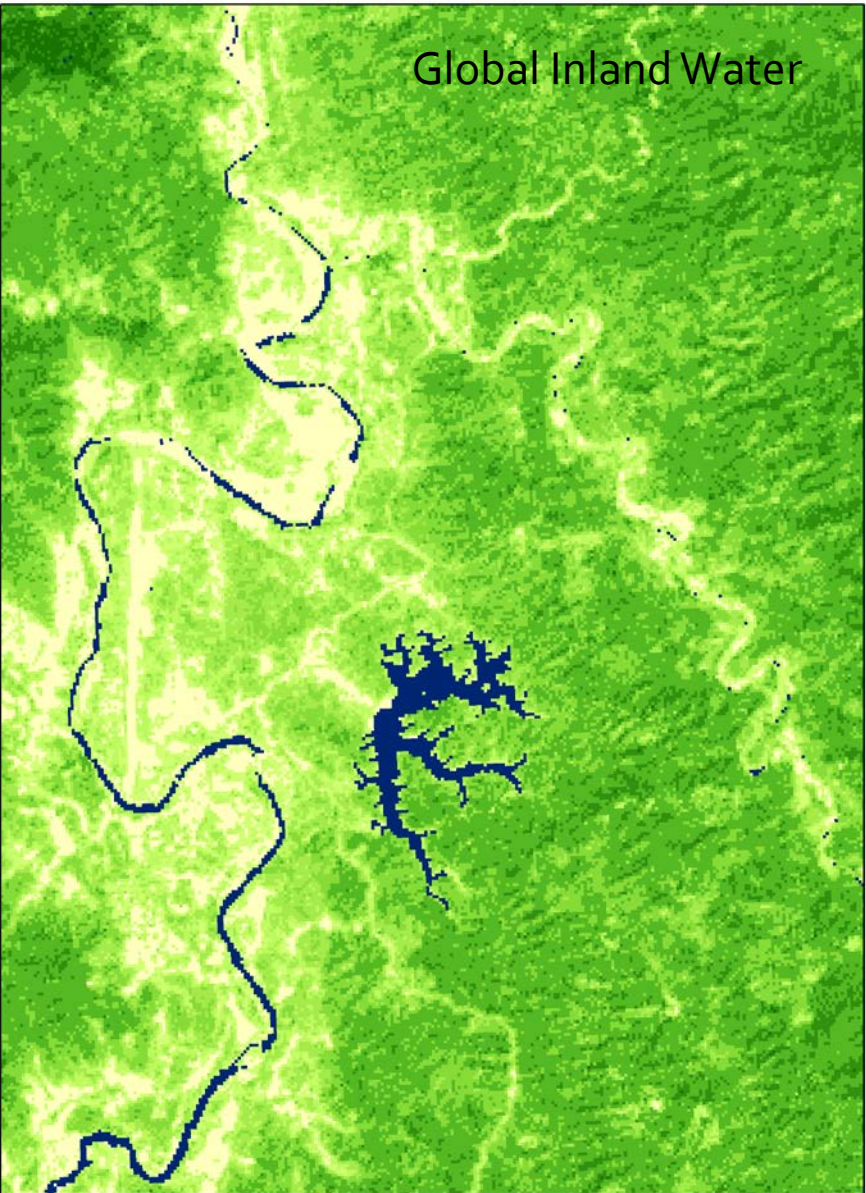


Heavy growth and shadows from riparian vegetation hinder the model's ability to identify some portions of small streams

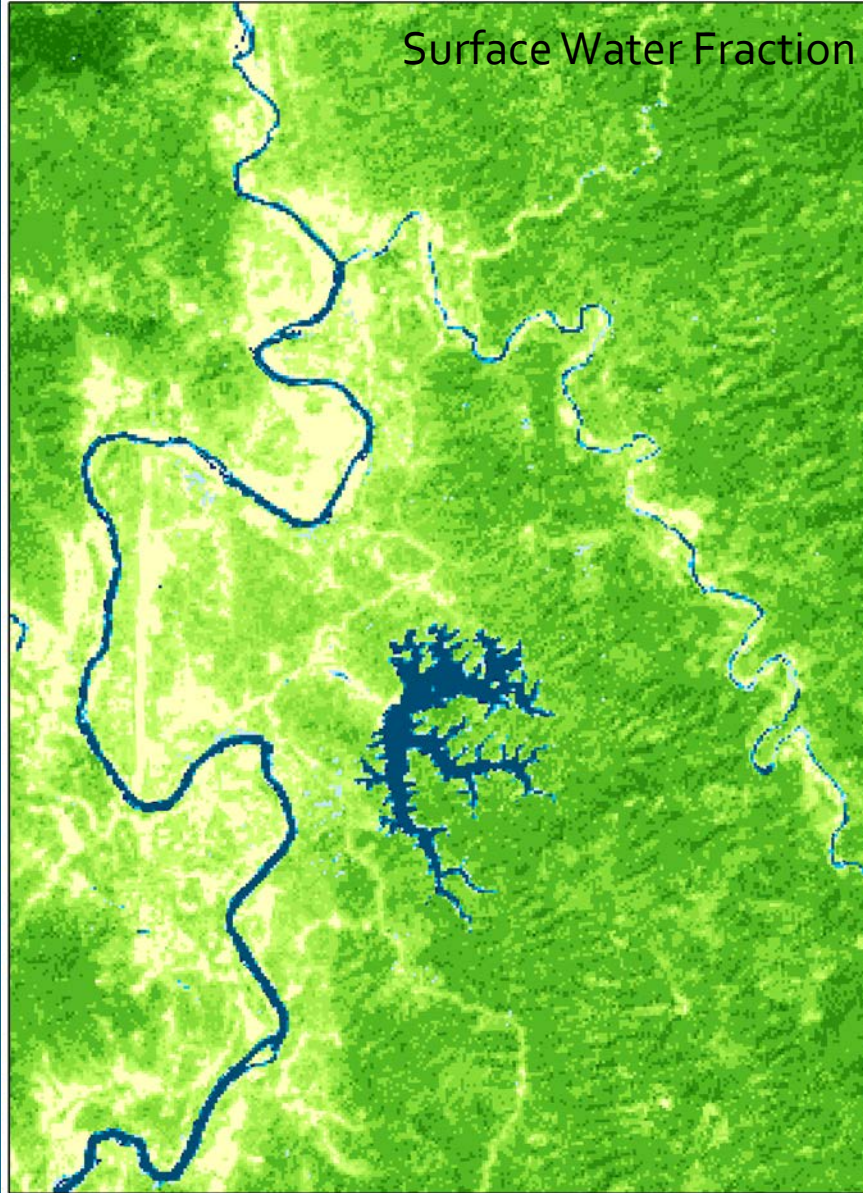


# Multi-year 30m Surface Water Fraction

Global Inland Water



Surface Water Fraction



- All individual Landsat scenes for years 2013-2017





2018.02.02 23:54





2018.02.03 00:07





2018.02.03 00:23





2018.02.03 20:59



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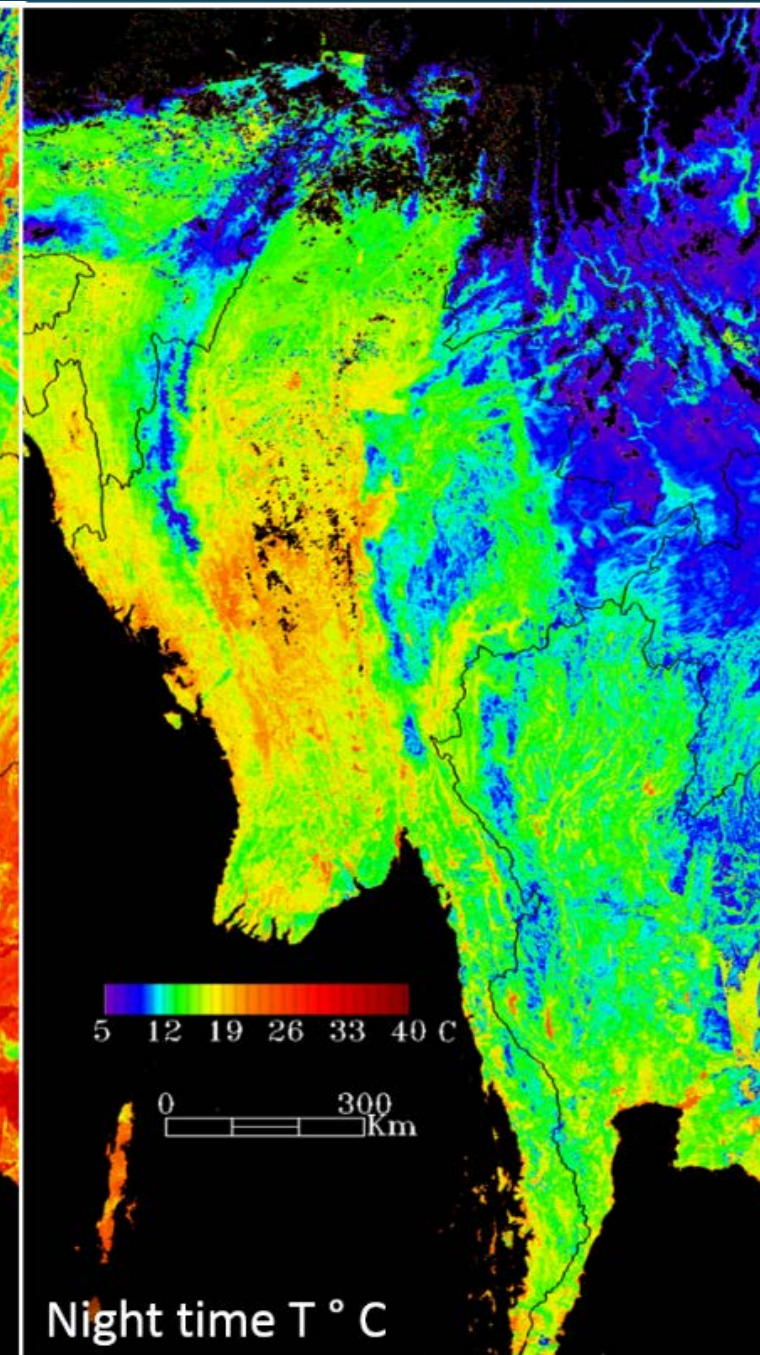
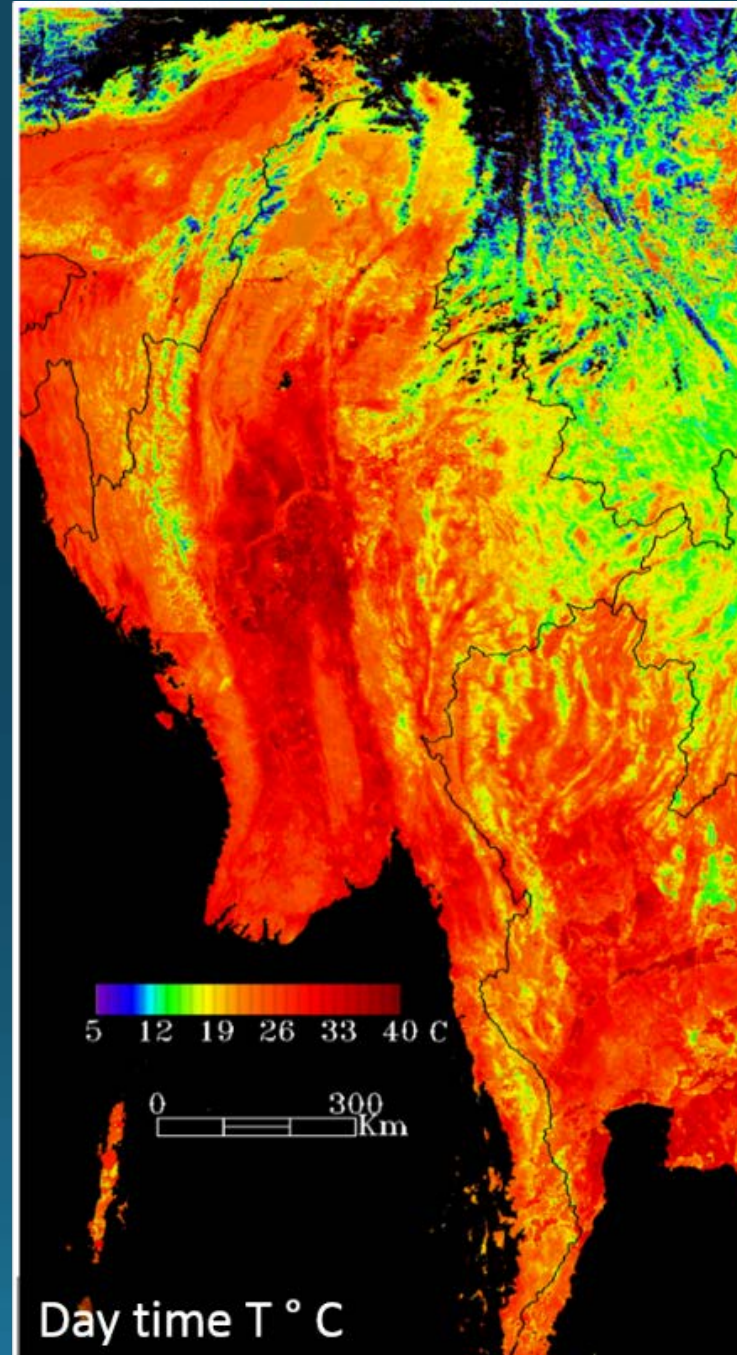
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## Downscaling meteorological parameters

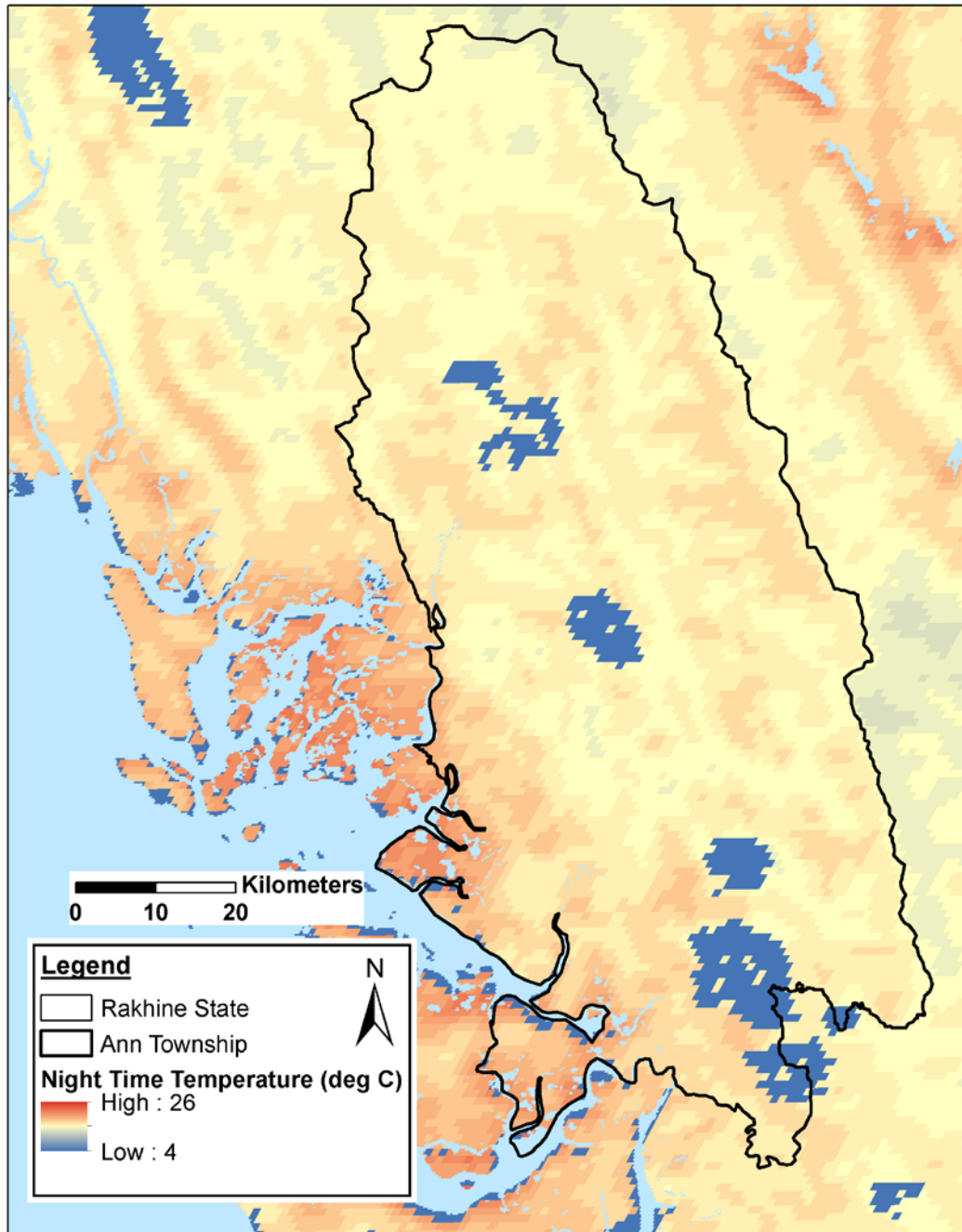
- MODIS 8-day land surface temperature (MOD/MYD11A2)
- MODIS daily precipitable water (MOD/MYD05L2)





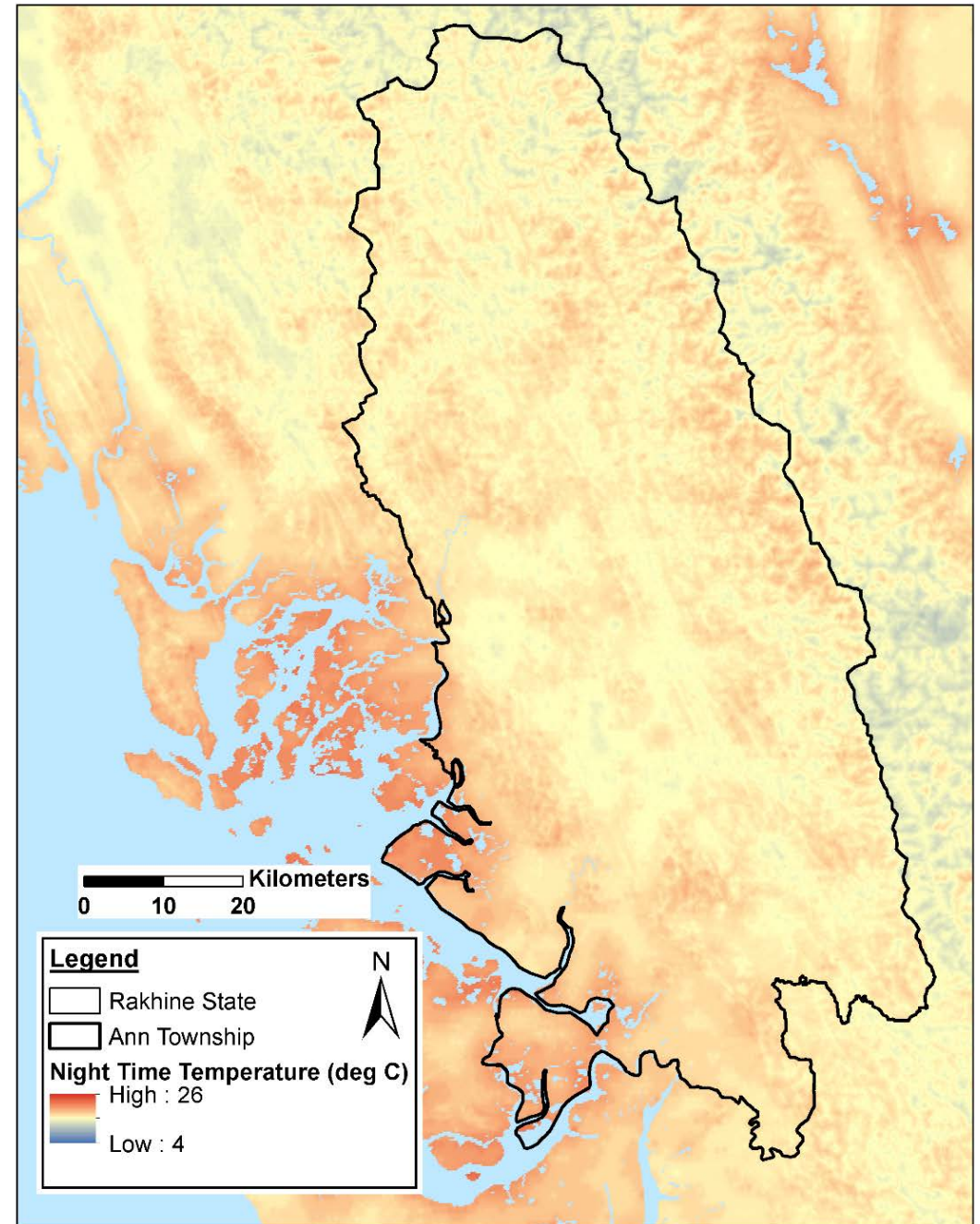
**MODIS TERRA Land Surface Temperature (Night Time)**

**1km resolution: 1st January 2014**



**MODIS TERRA Land Surface Temperature (Night Time)**

**30m resolution: 1st January 2014**





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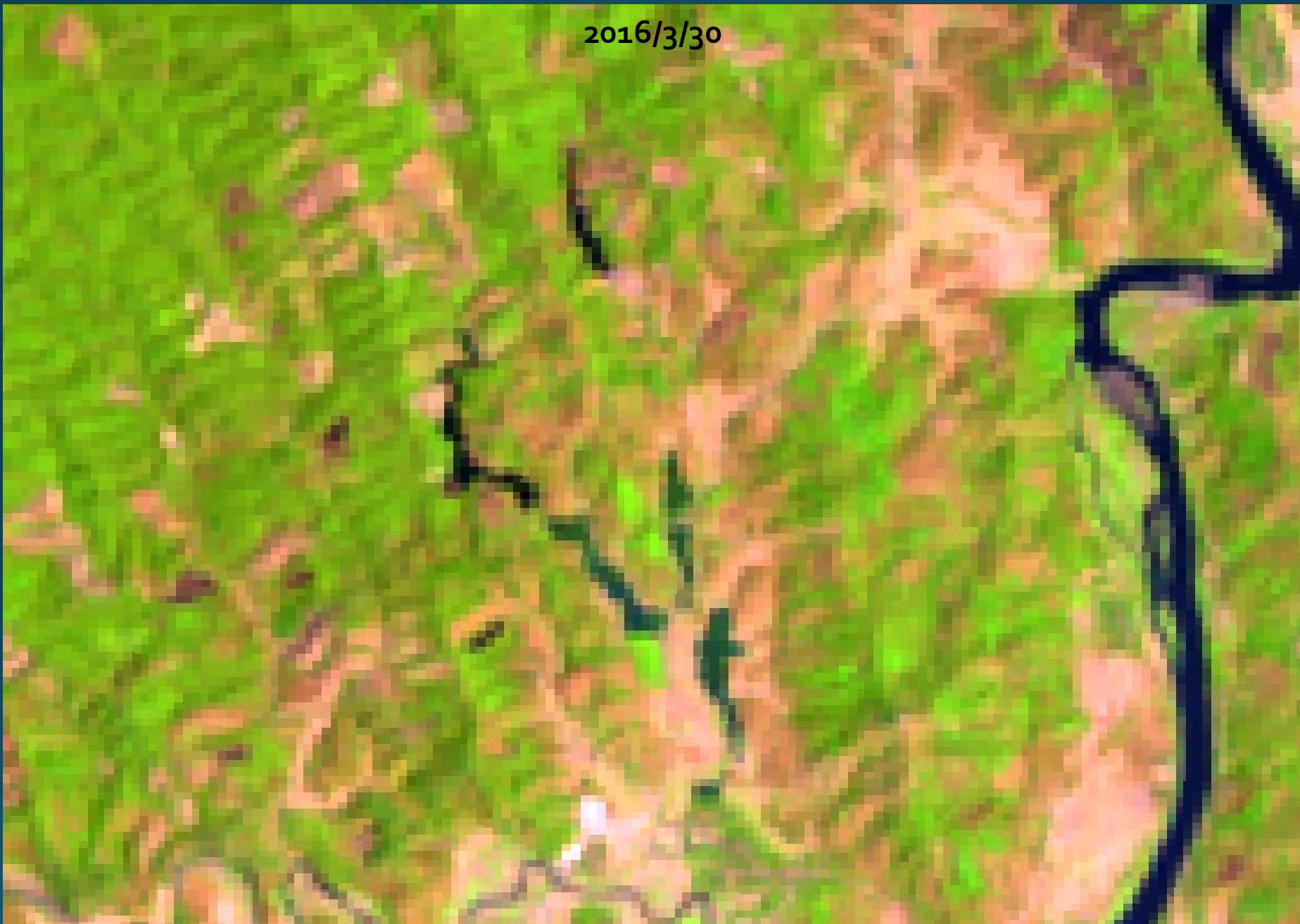
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2016/3/30





2014/11/20





LCLU class	Change components
surface water	loss/gain (flooding*)
cropped areas	flooding*
built-up and impervious surfaces	flooding*
forest & forest patch	flooding*, tree loss, vegetation condition (NDVI/EVI)
forest clearance	flooding*, tree gain, vegetation condition (NDVI/EVI)
short vegetation	vegetation condition (NDVI/EVI)
bare and sparsely vegetated	flooding*



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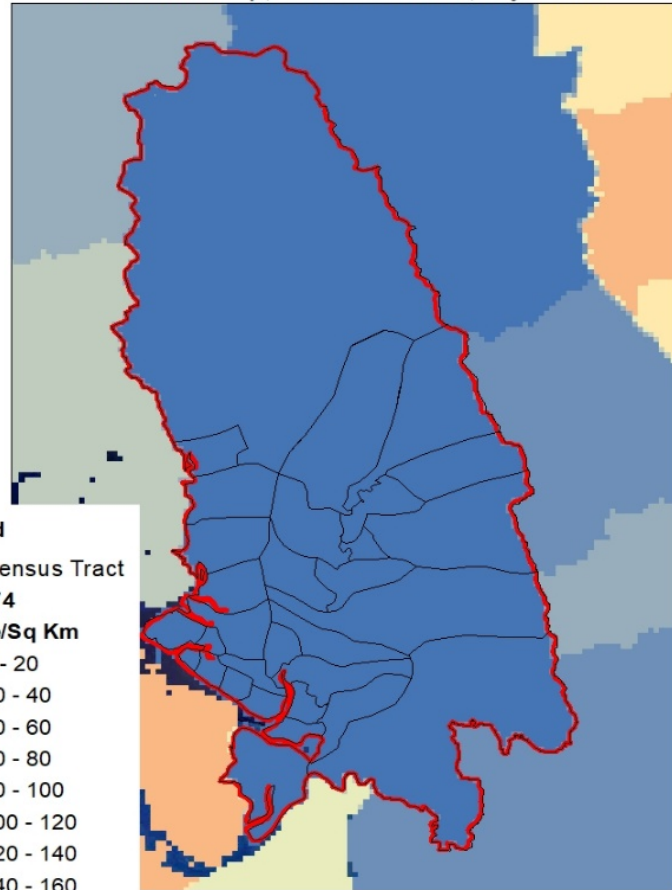


# GPW

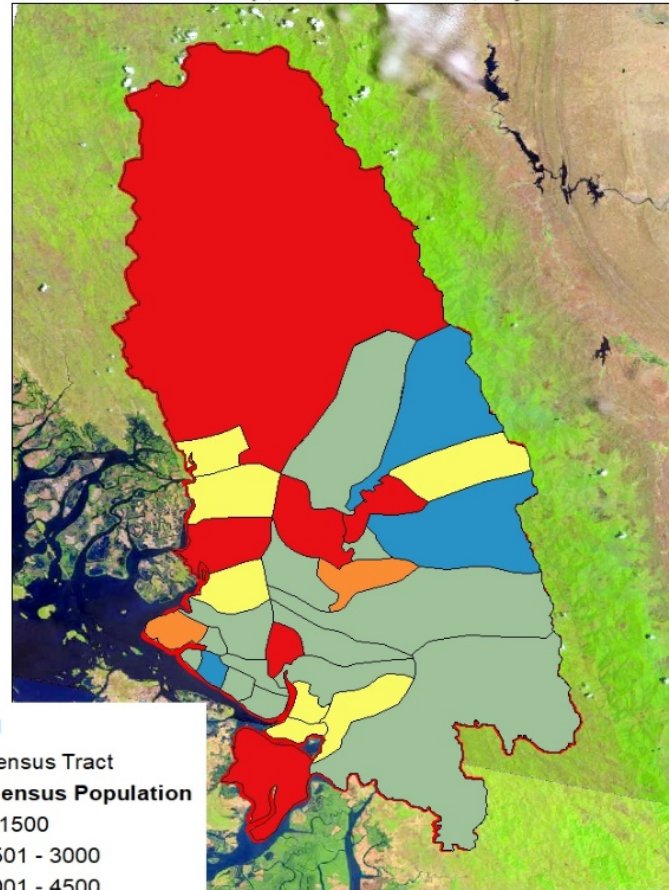
# Census

# Villages

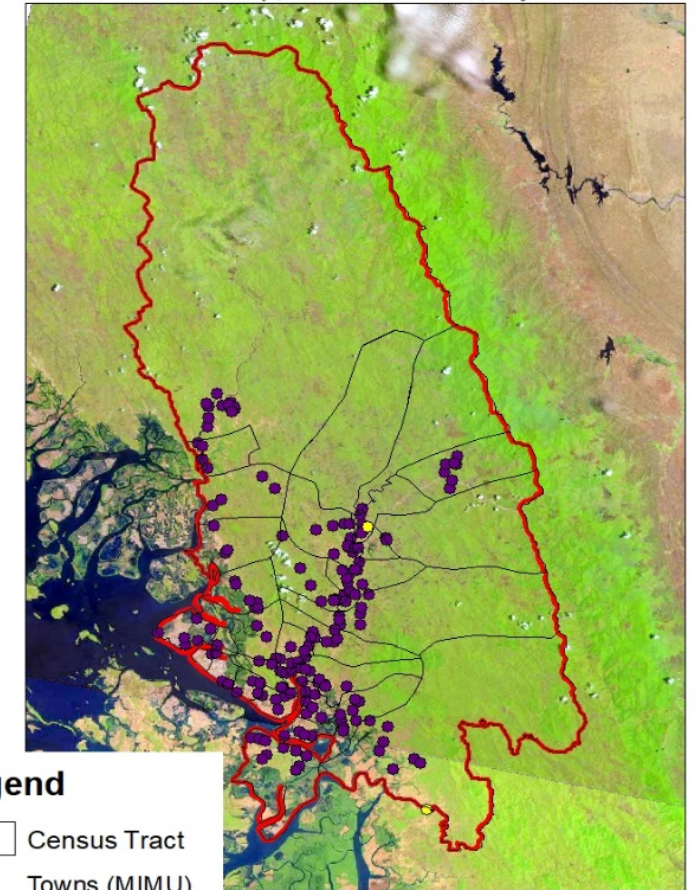
Ann Township, Rakhine State, Myanmar



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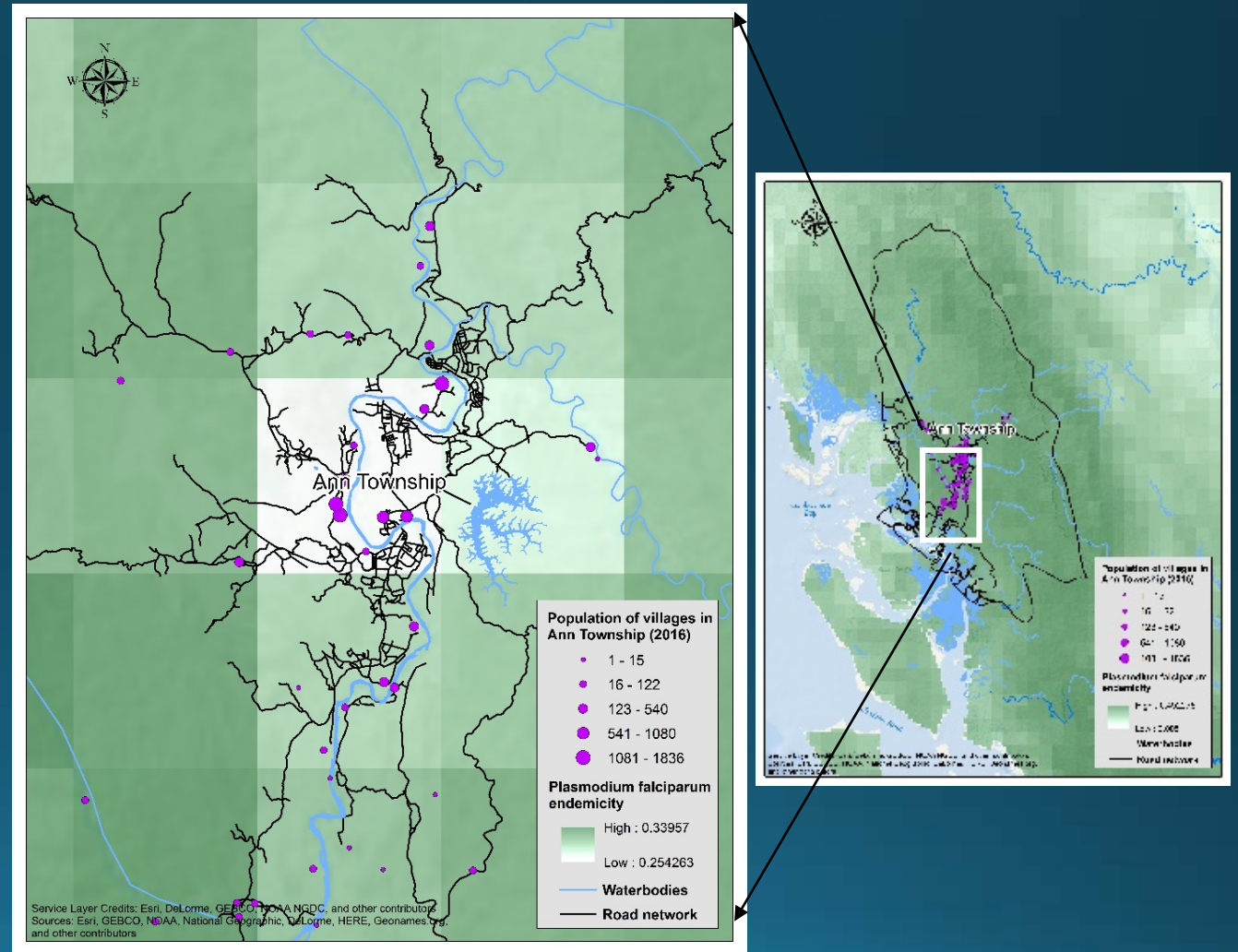
Ann Township, Rakhine State, Myanmar





# Road network analysis for Ann Township

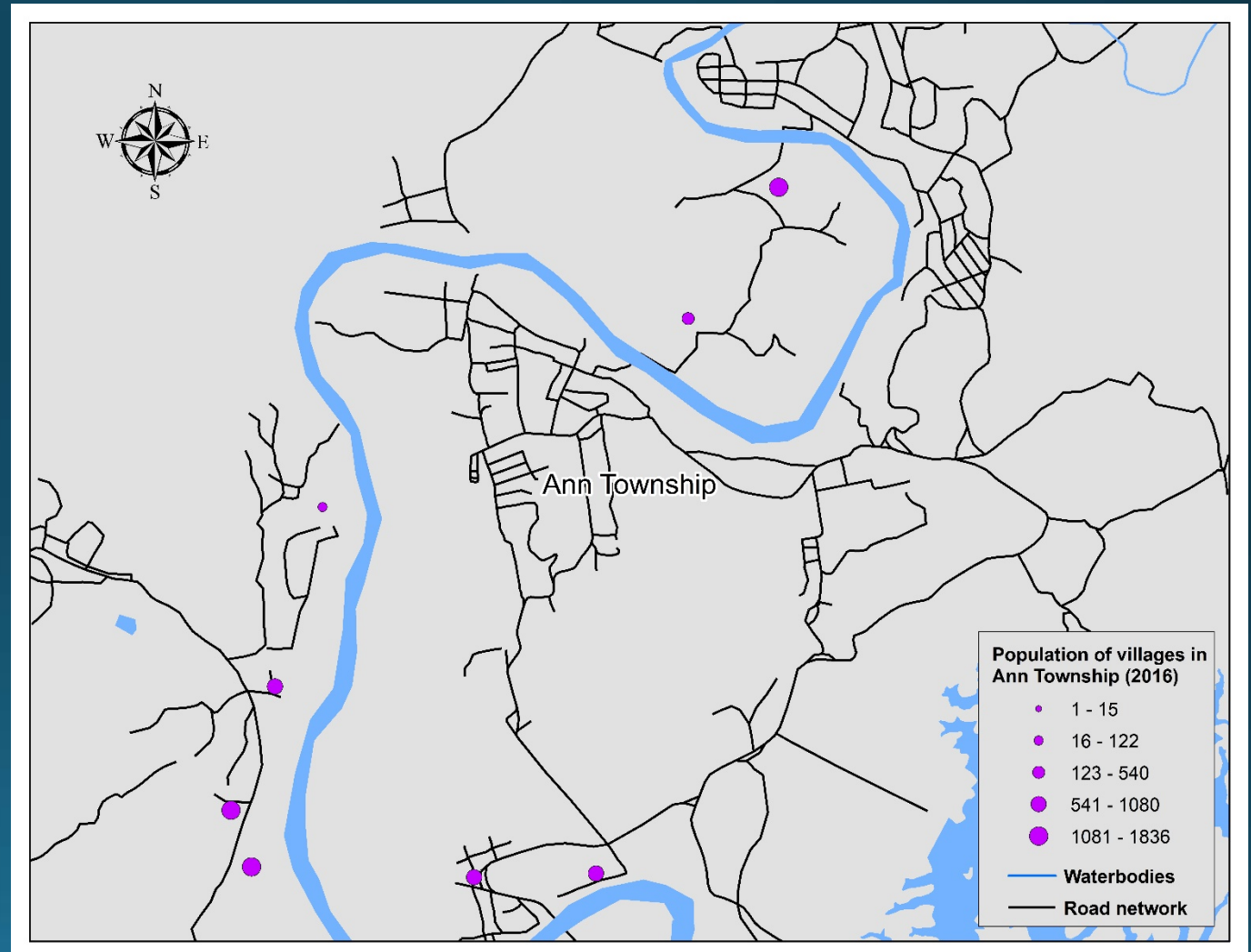
- Digitized road network for Ann Township
  - 1057 road segments have been digitized
- A road typology is being built capturing travel speed and road materials to capture:
  - road network usage during dry and rainy seasons
  - time of day for travel
  - different travel modalities





# Geospatial mobility analysis

- Spatial accessibility analyses for key POI
- Support for a **simulation model** of local and regional travel characteristics



Residential areas in Ann Township



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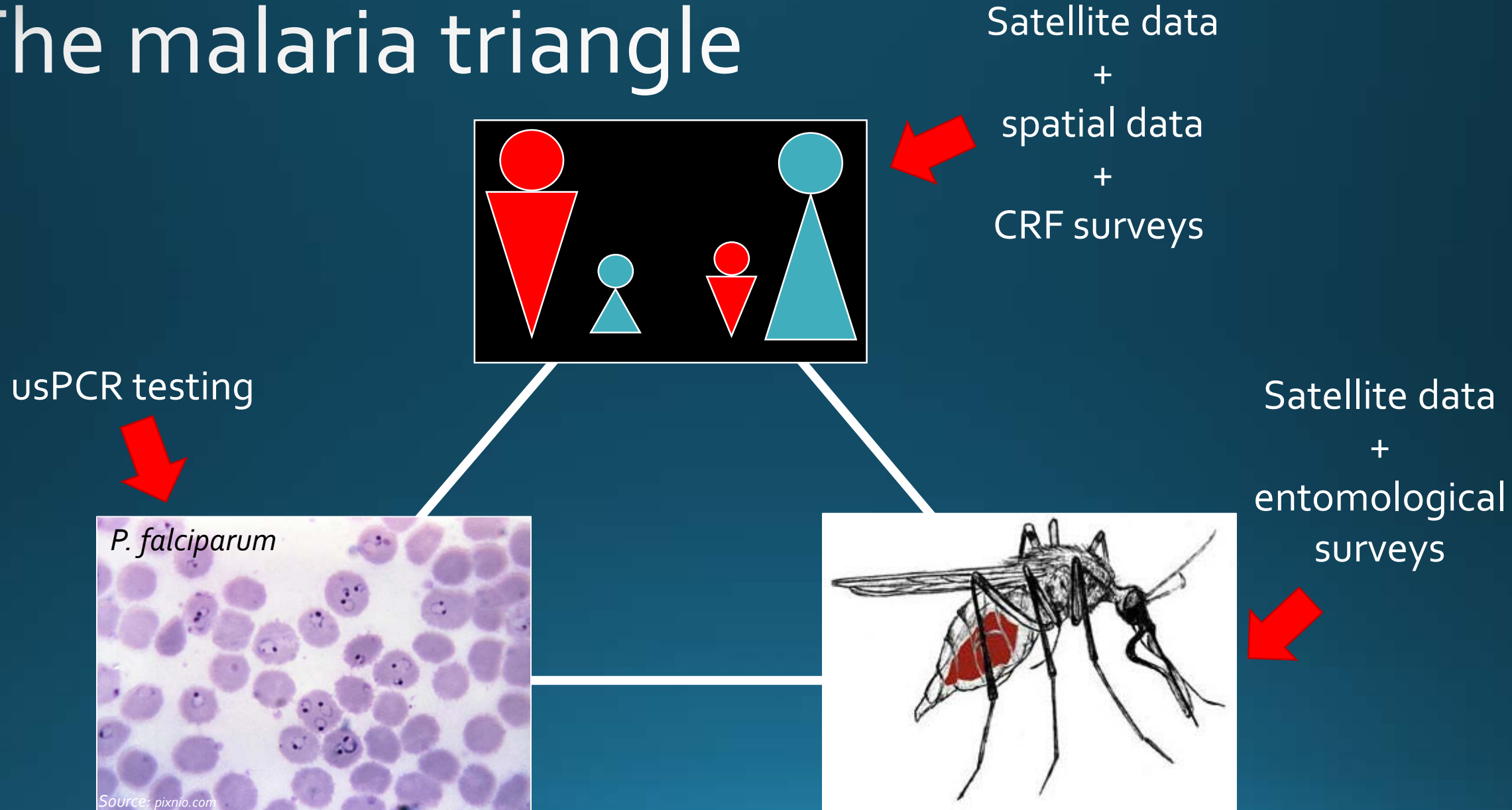
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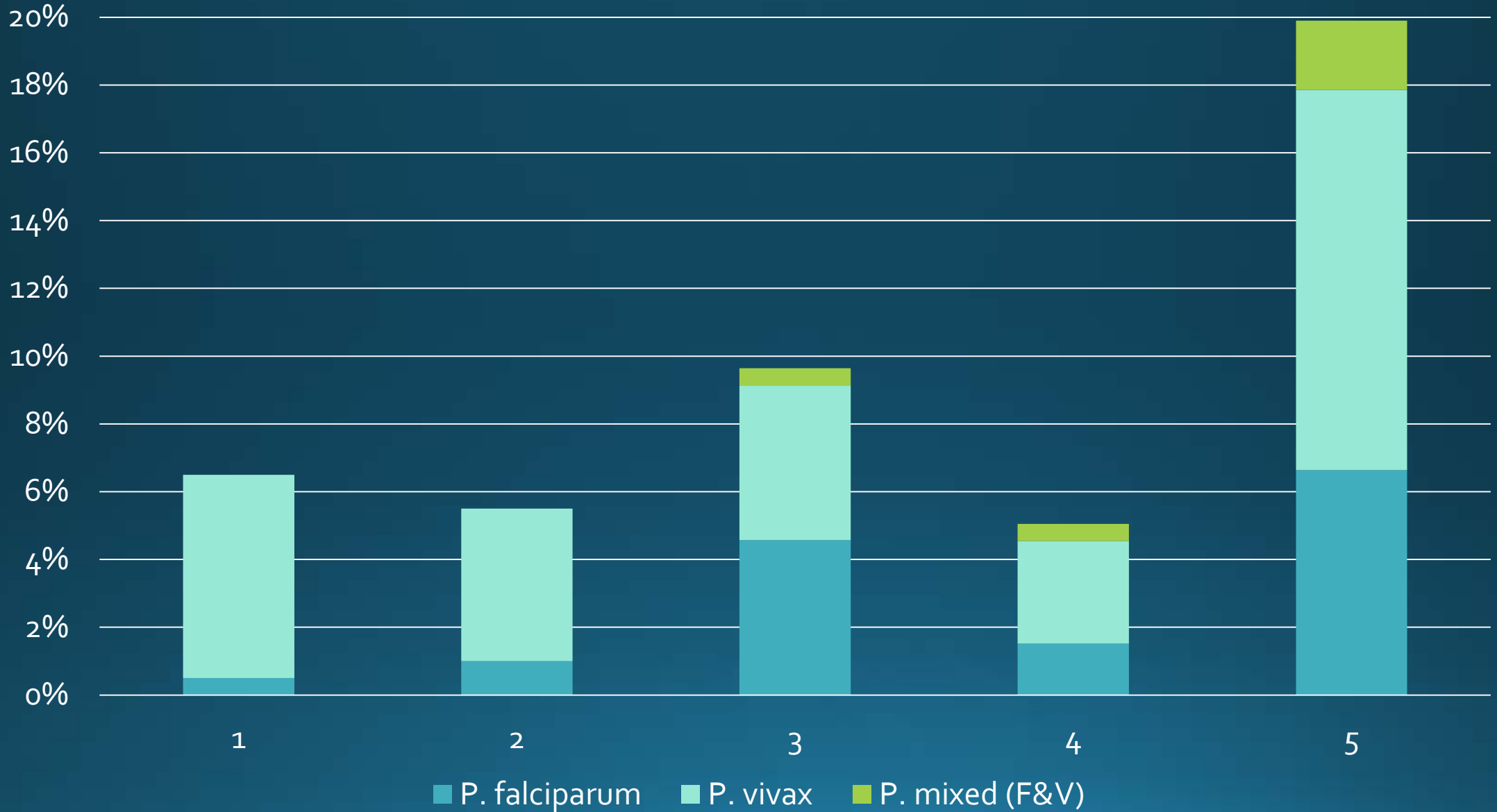




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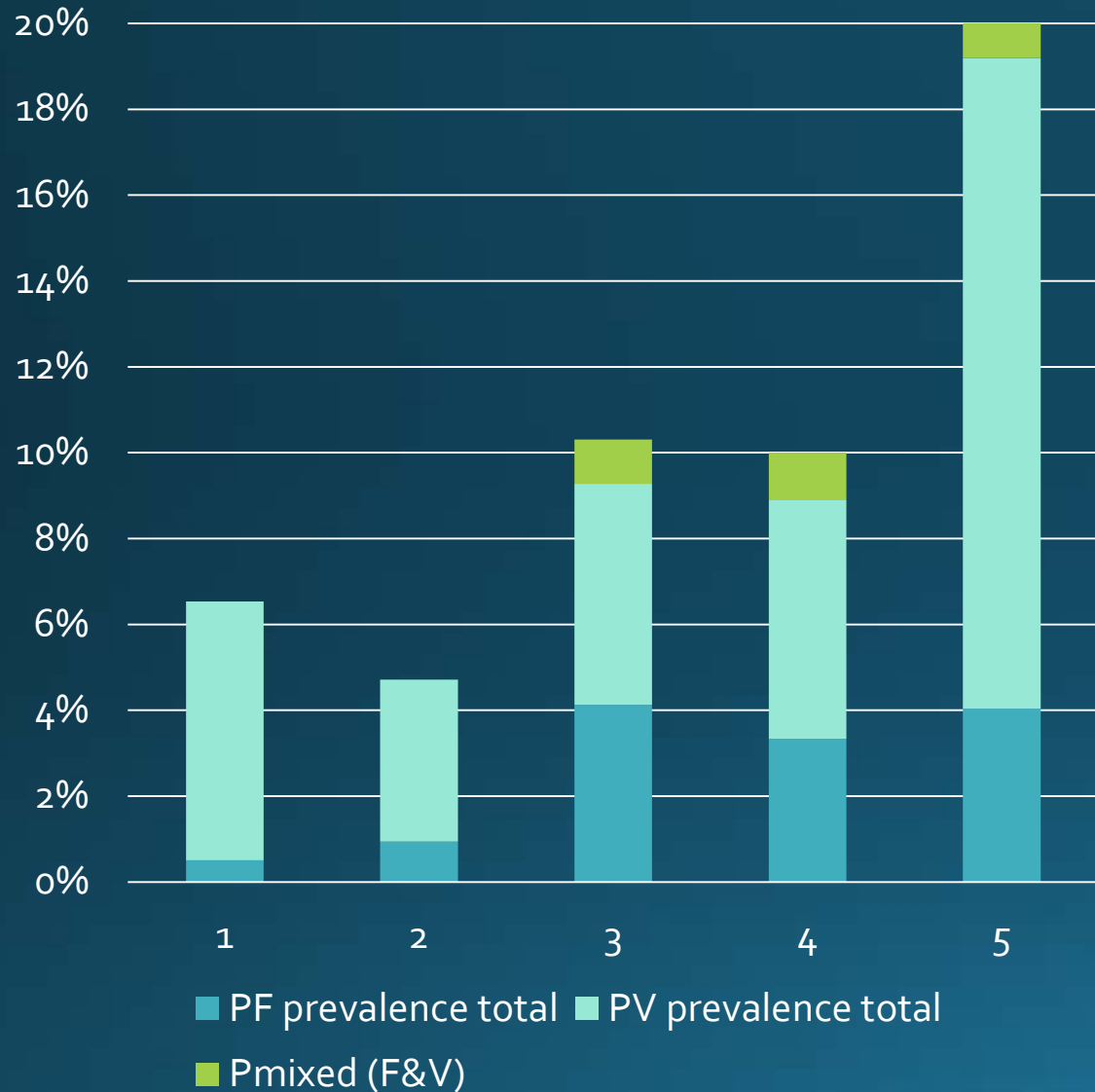


# Malaria prevalence (all population)

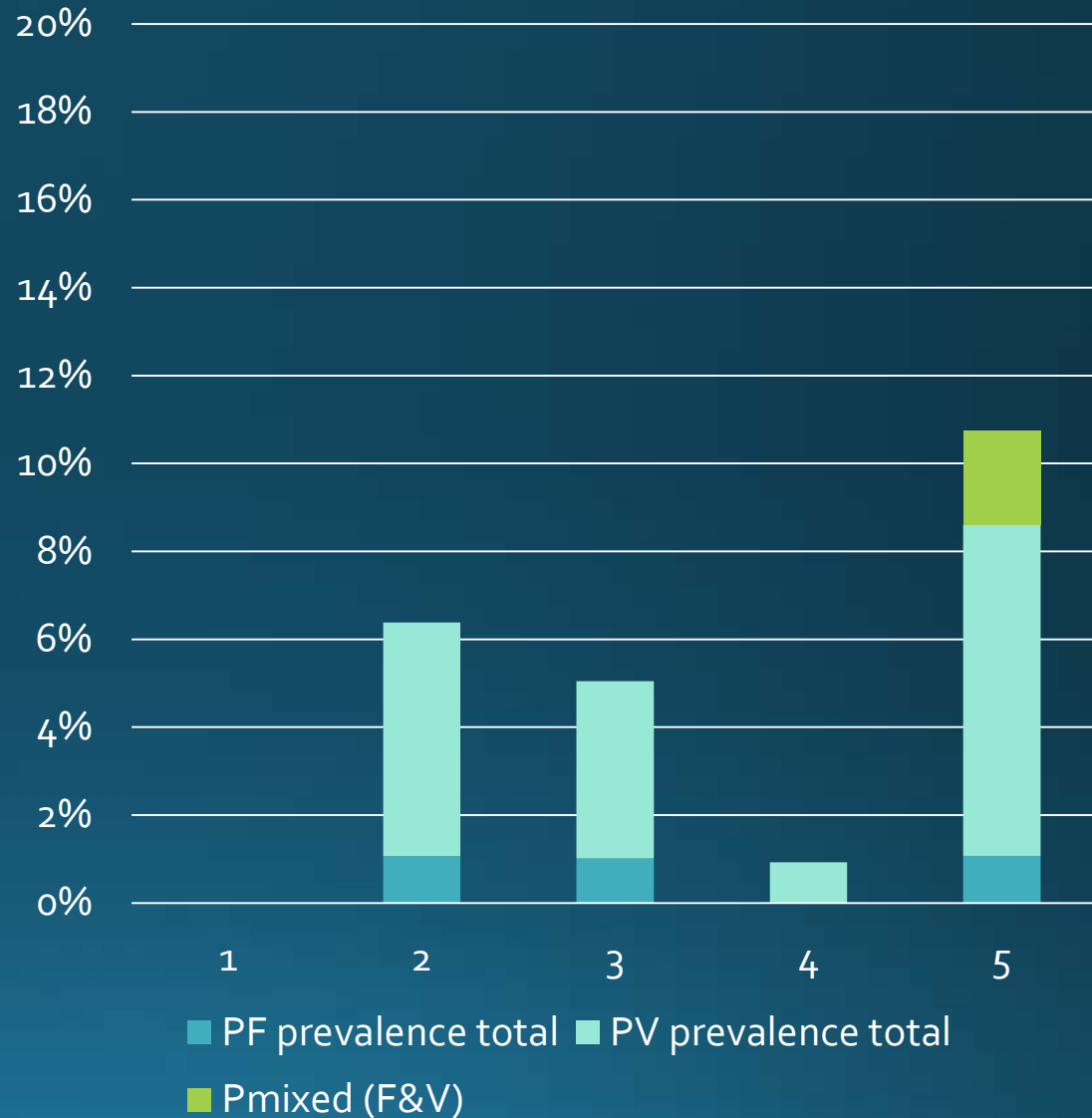




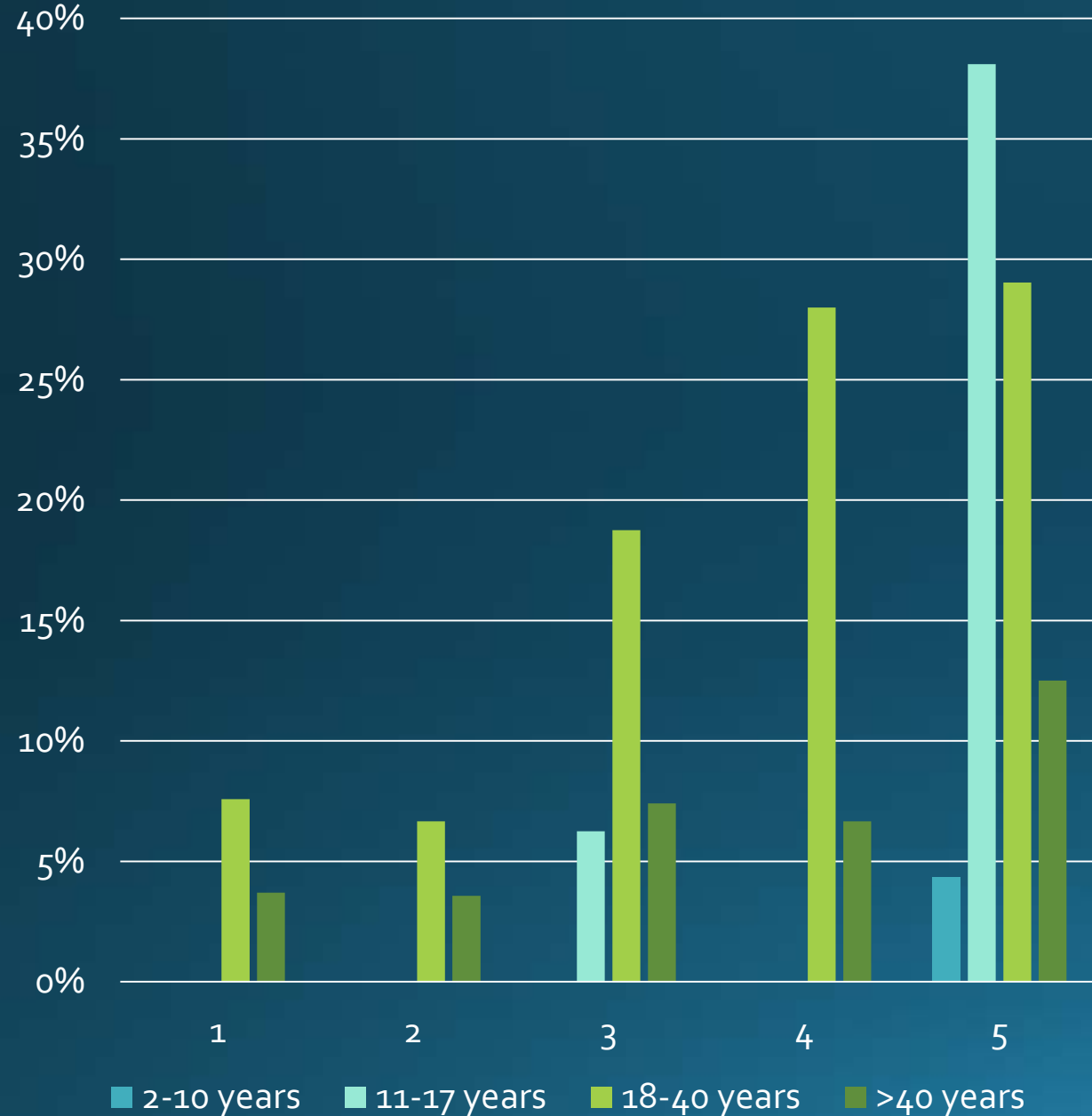
### Malaria prevalence (men)



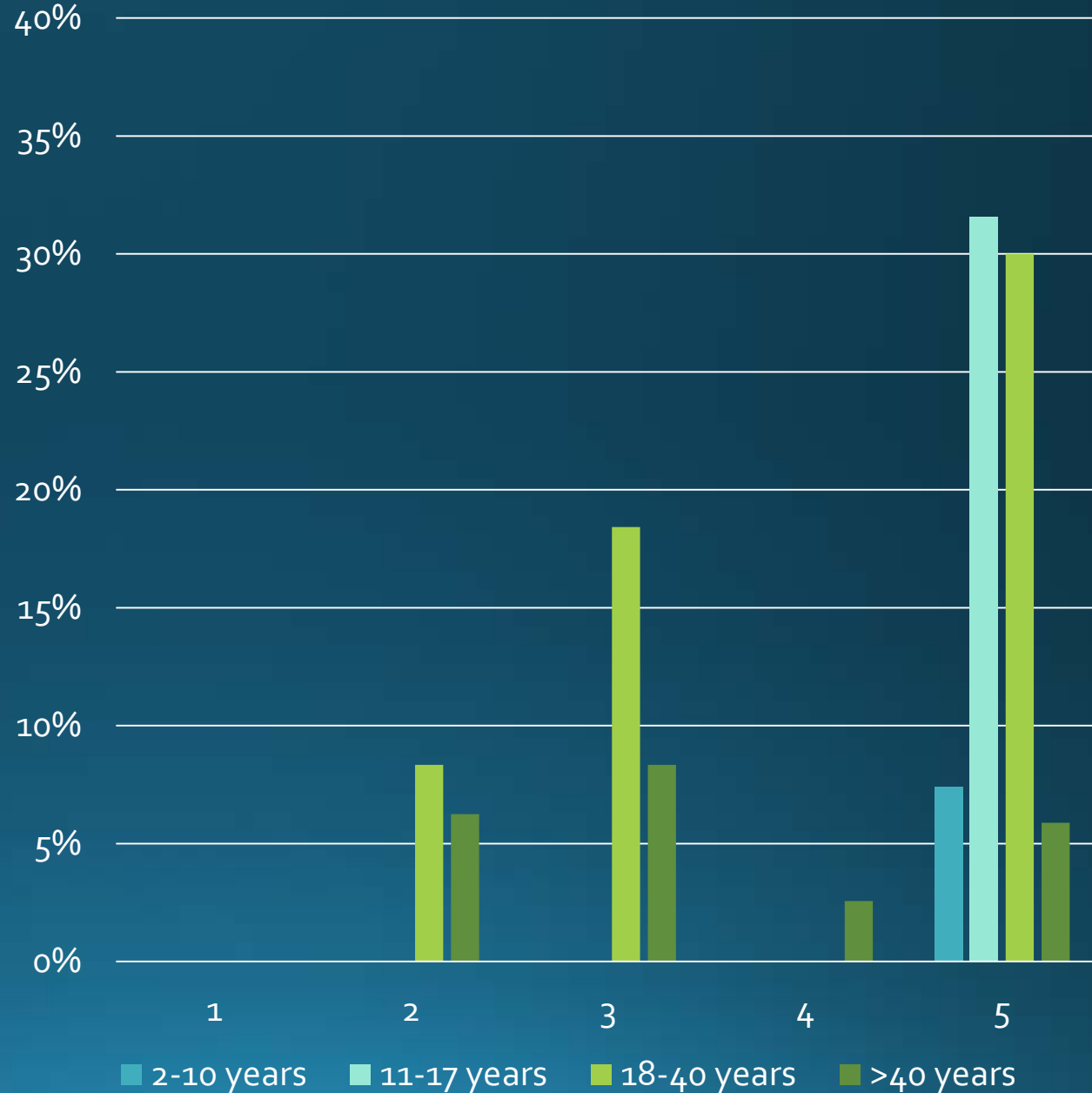
### Malaria prevalence (women)



All malaria prevalence by age group (men)



All malaria prevalence by age group (women)





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2018.01.27 21:42



# Questions?

