

# Globaler Wandel in unsicheren Zeiten

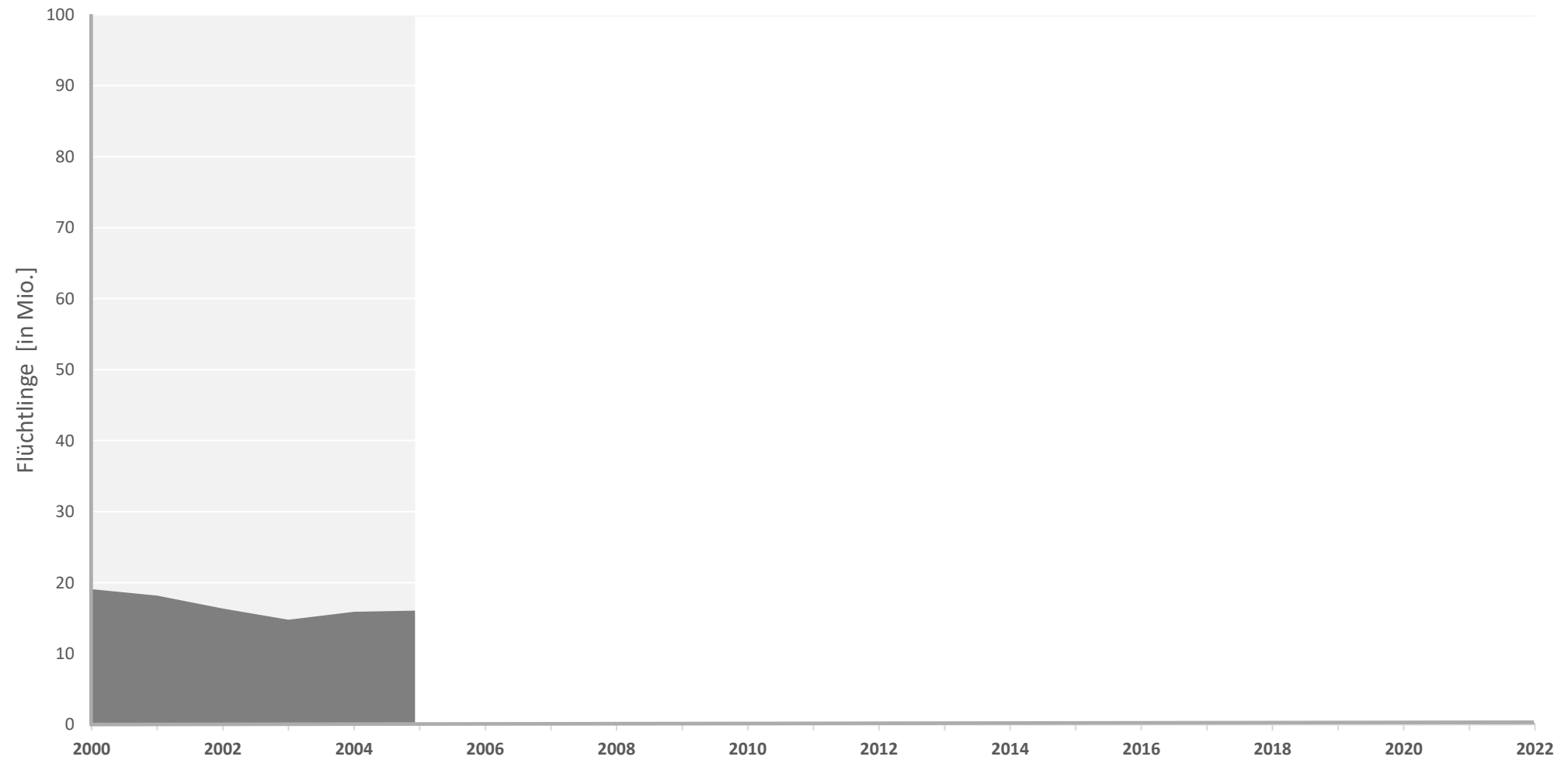
Deutsches Zentrum für Luft- und Raumfahrt (DLR) - Earth Observation Center (EOC)

Prof. Dr. Hannes Taubenböck

Deutsches Zentrum für Luft- und Raumfahrt  
Julius-Maximilians-Universität Würzburg



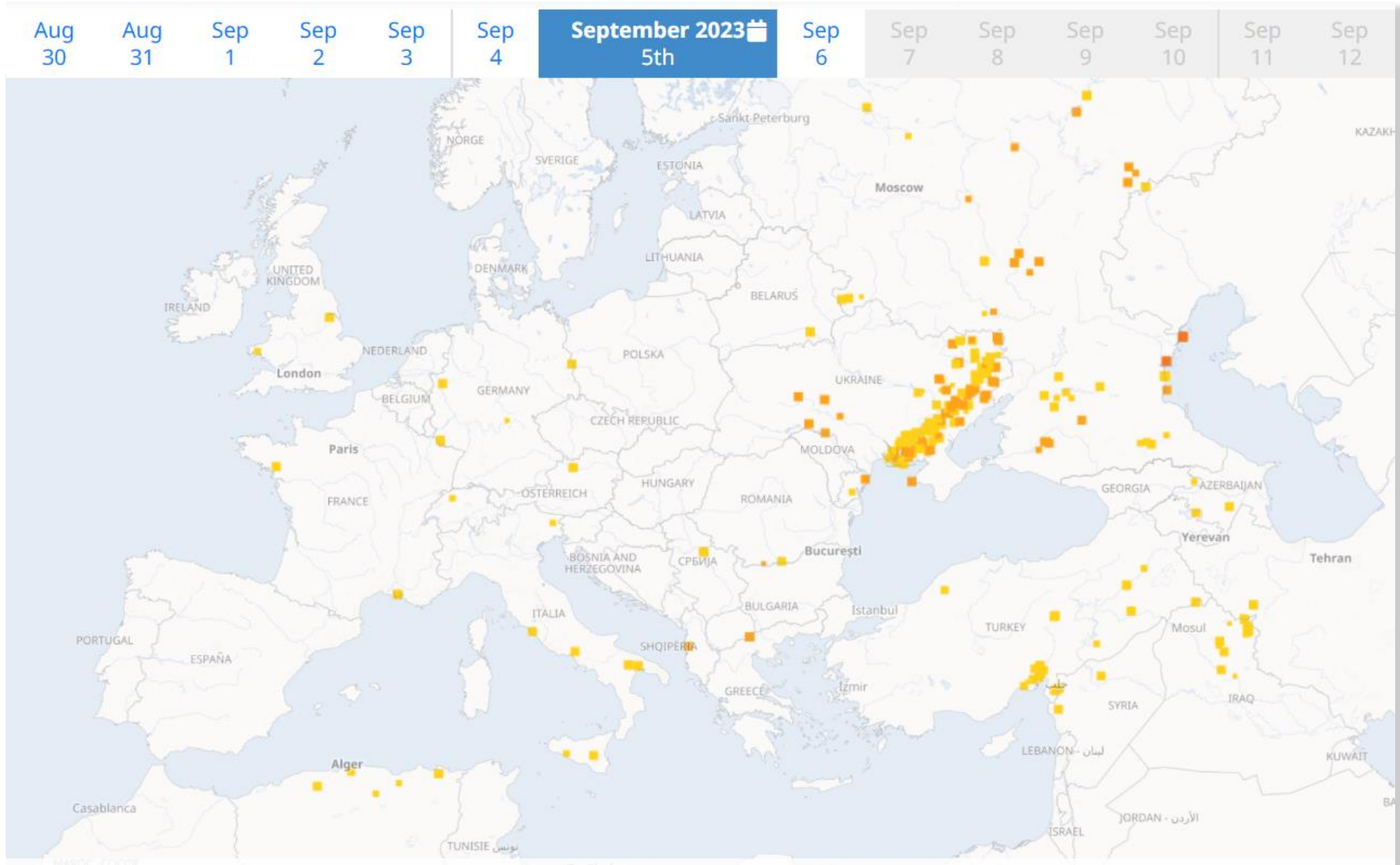
## Gewaltsam vertriebene Bevölkerung weltweit von 2000 bis 2022



# Gründe für Flucht

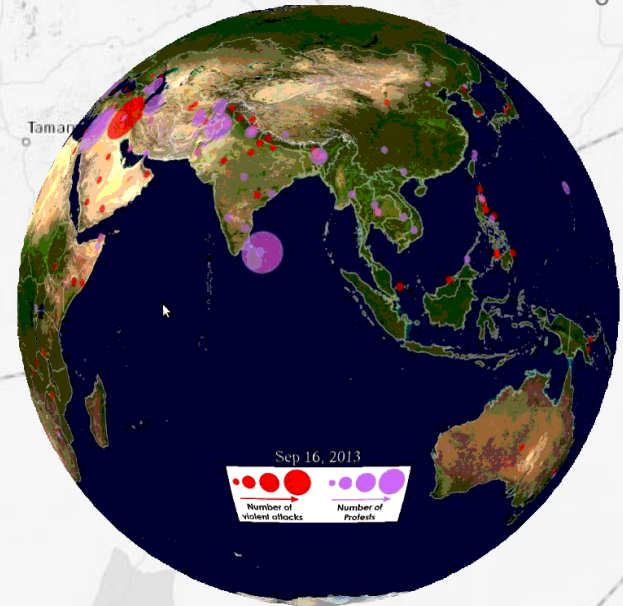


# ZKI Fire Monitoring System

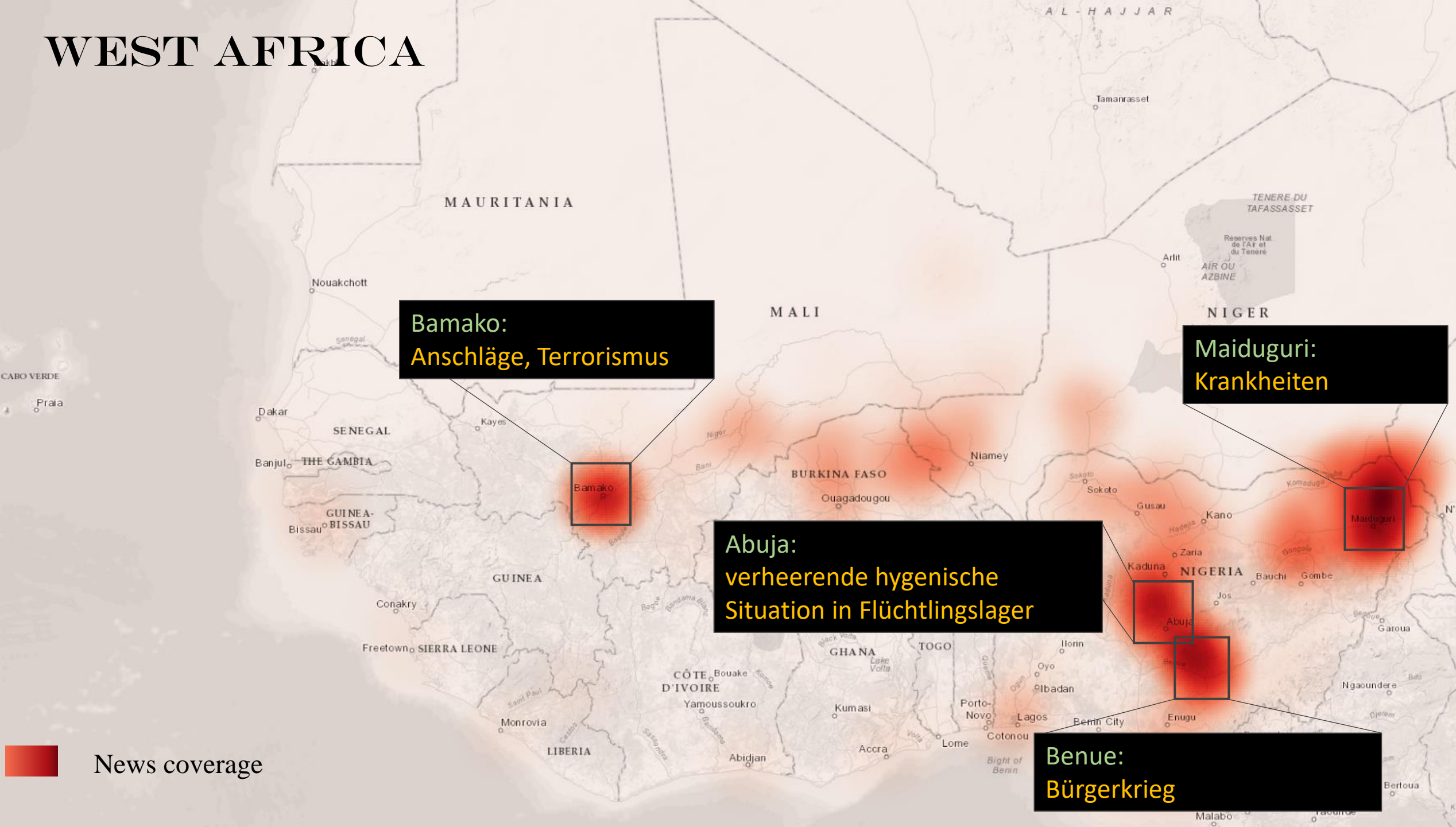


# WEST AFRICA

## Global Data on Events, Location, and Tone (GDELT)



# WEST AFRICA



**Bamako:**  
Anschläge, Terrorismus

**Maiduguri:**  
Krankheiten

**Abuja:**  
verheerende hygenische  
Situation in Flüchtlingslager

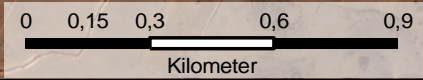
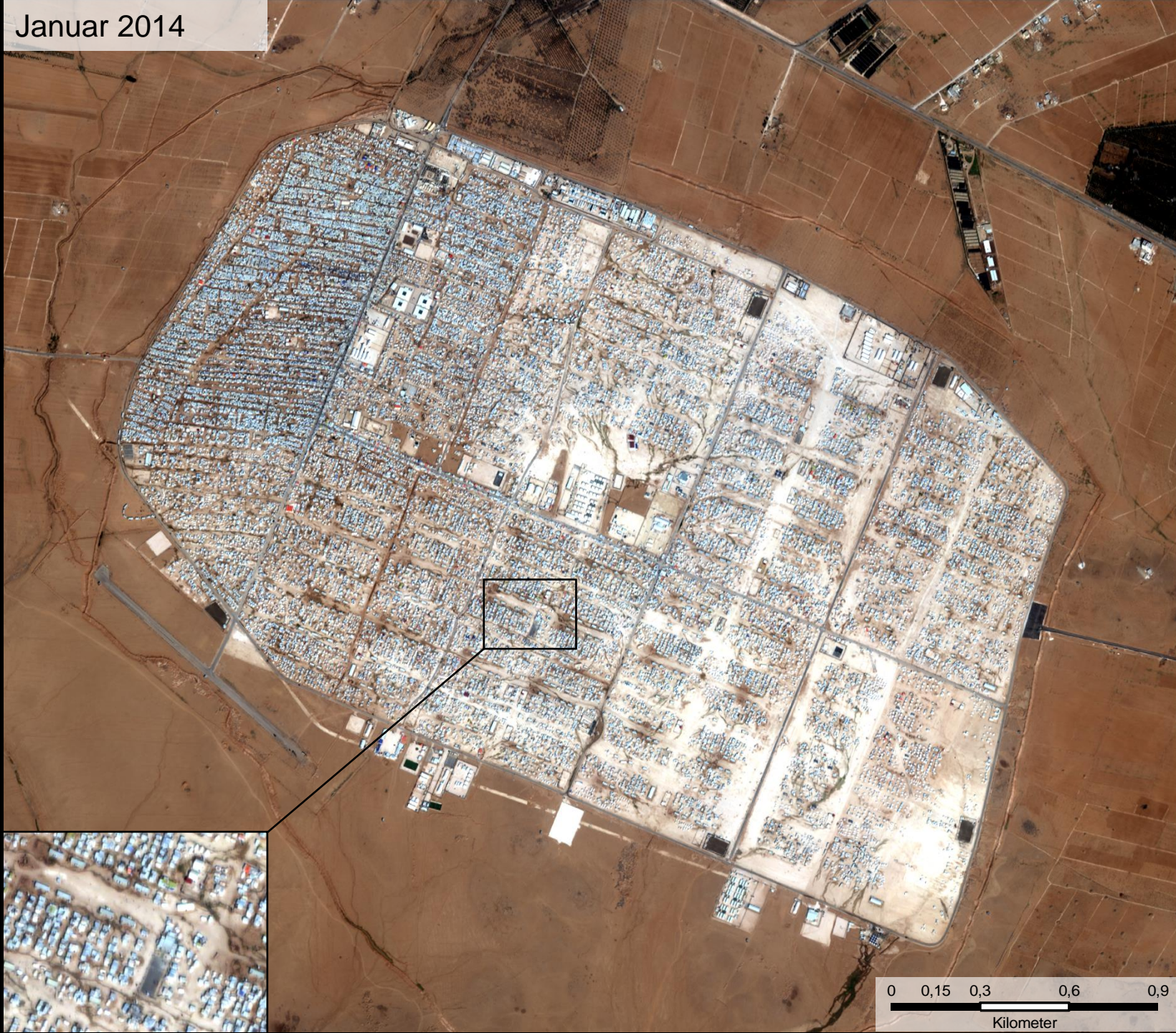
**Benue:**  
Bürgerkrieg

 News coverage

# Effekte von Flucht



Januar 2014







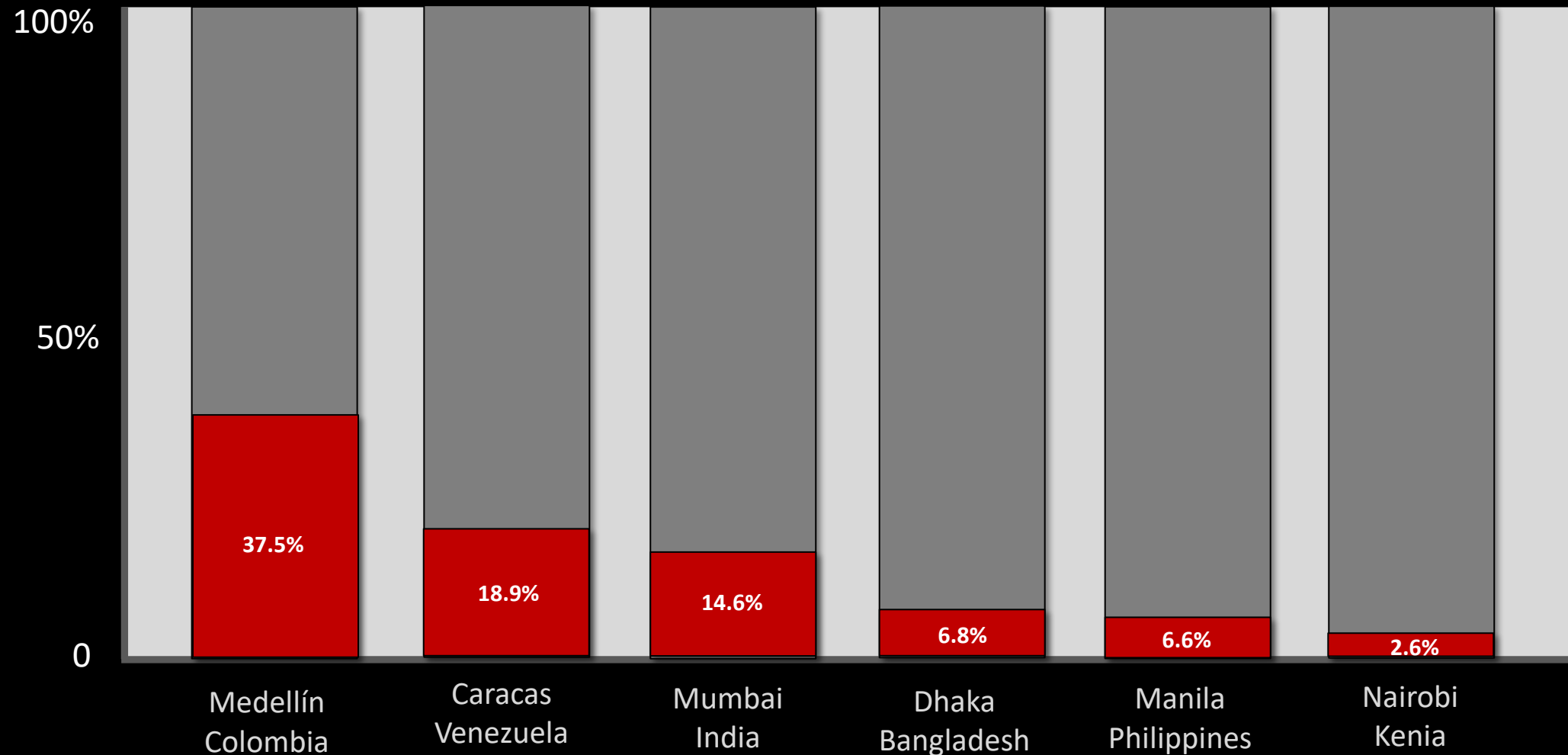
AL.

DORRIS

50

1,000 Meters

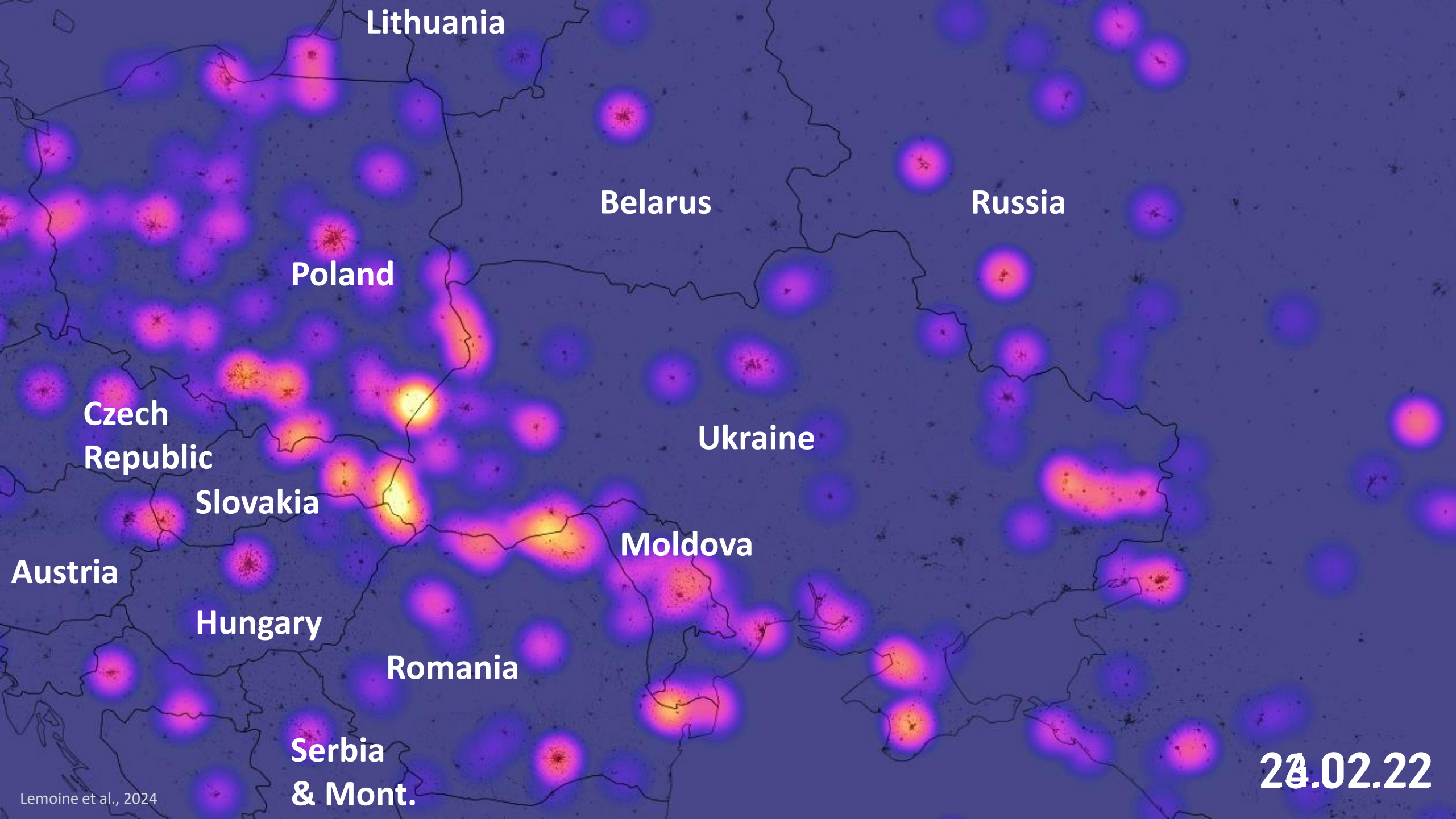
## Flächenanteil morphologischer Slums an der Siedlungsfläche



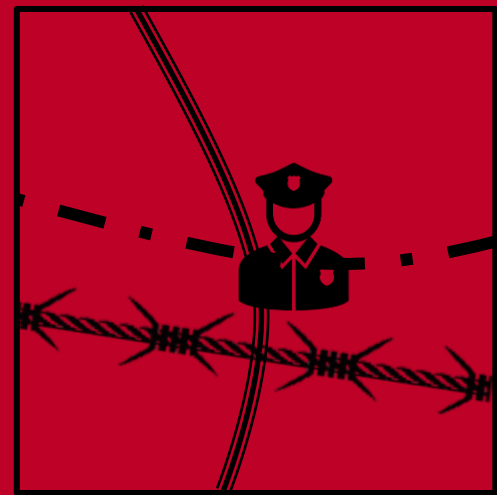
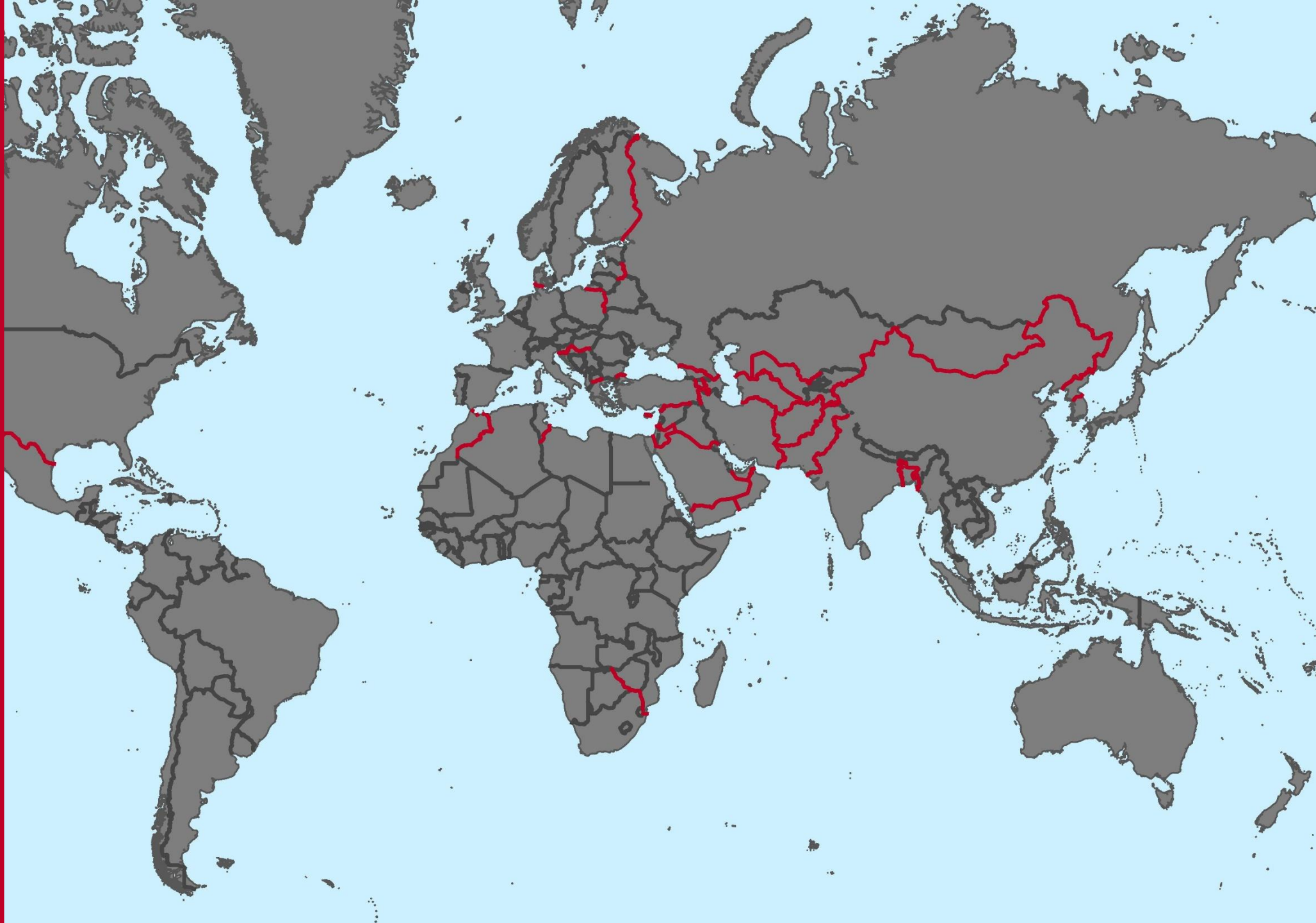
„City of the dead“ · Manila · Philippinen



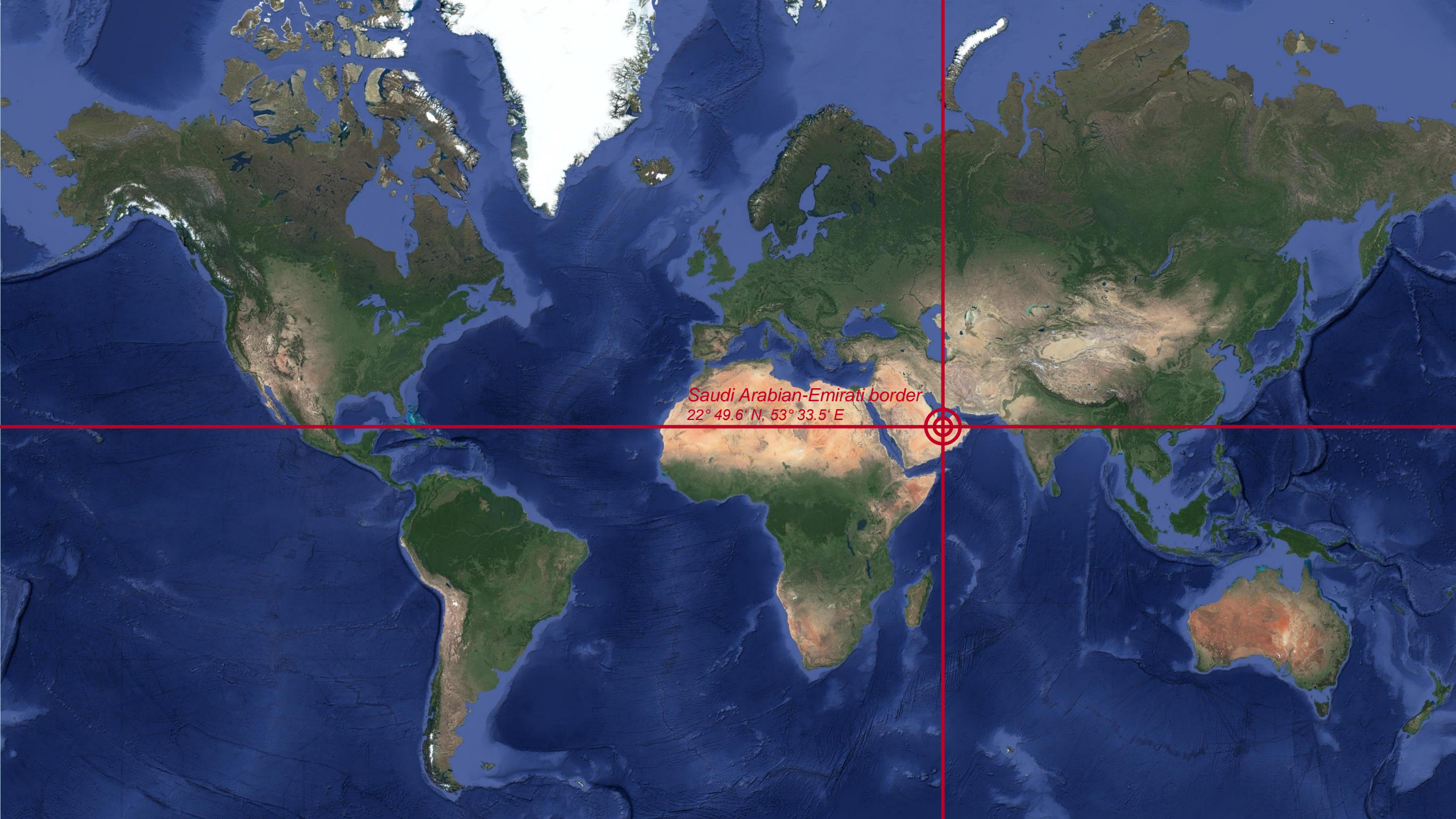
# Grenzen und Flucht



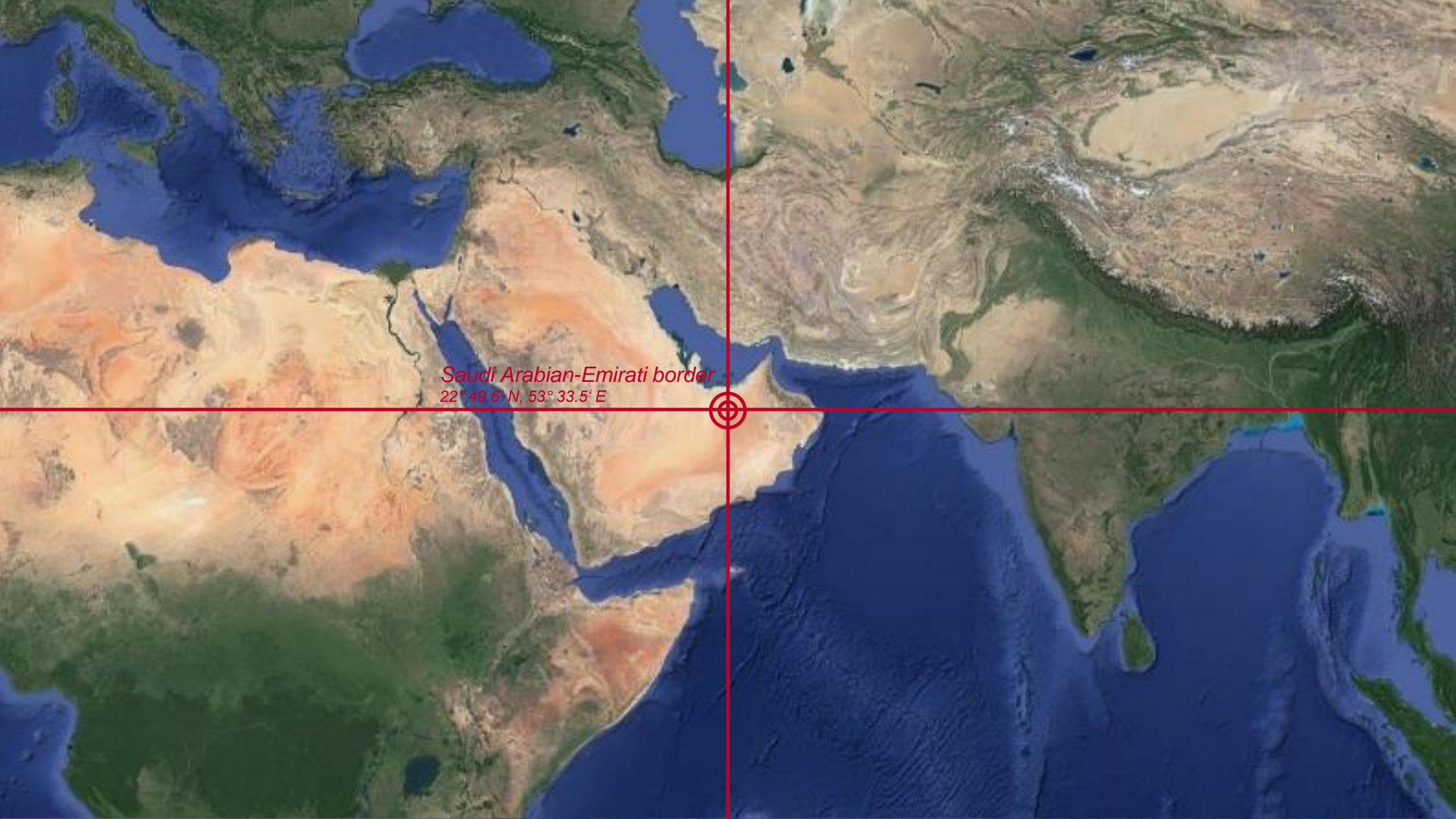
# Fortified Border







Saudi Arabian-Emirati border  
 $22^{\circ} 49.6' N, 53^{\circ} 33.5' E$

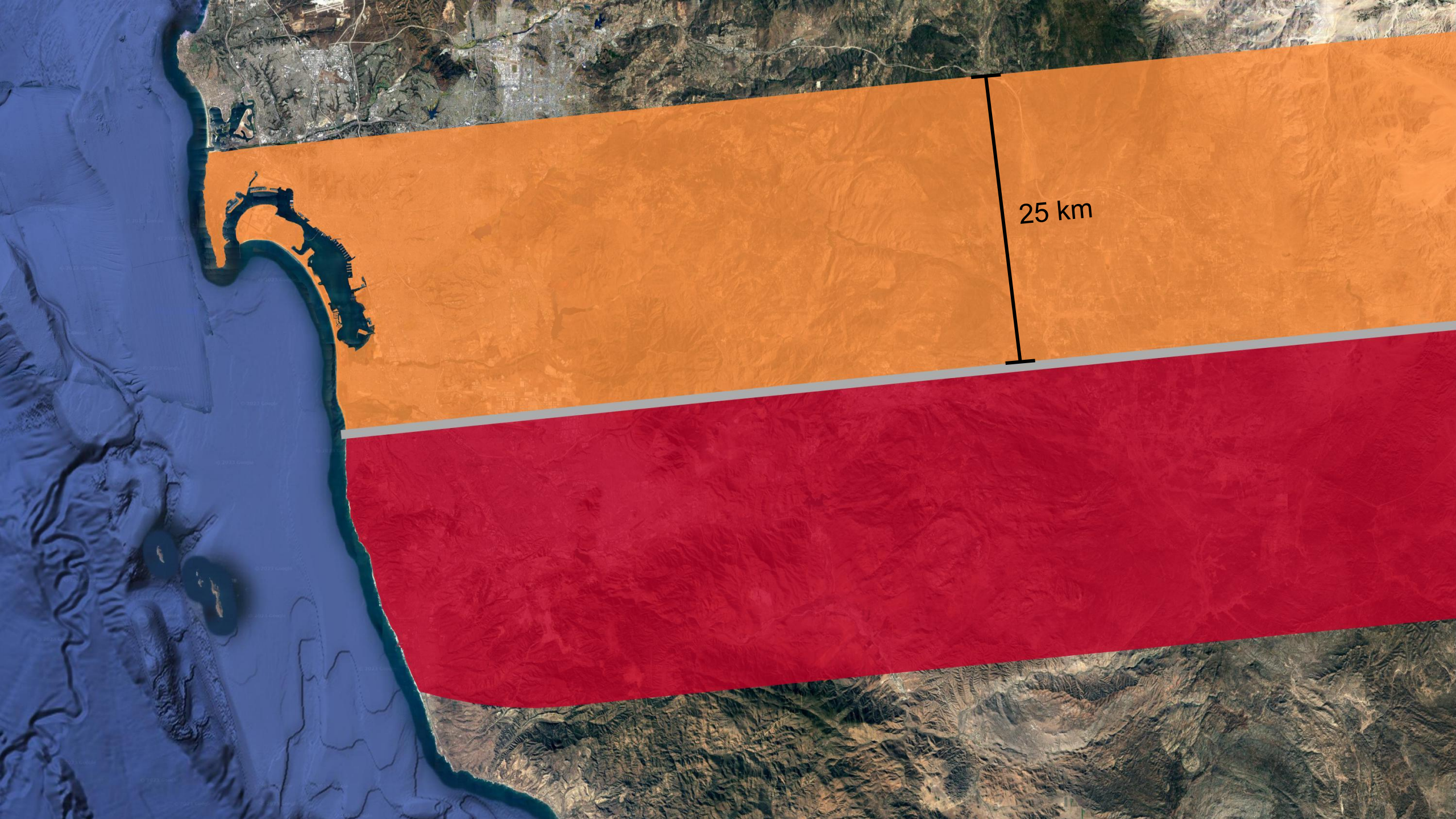


*Saudi Arabian-Emirati border*  
*22° 49.6' N, 53° 33.5' E*



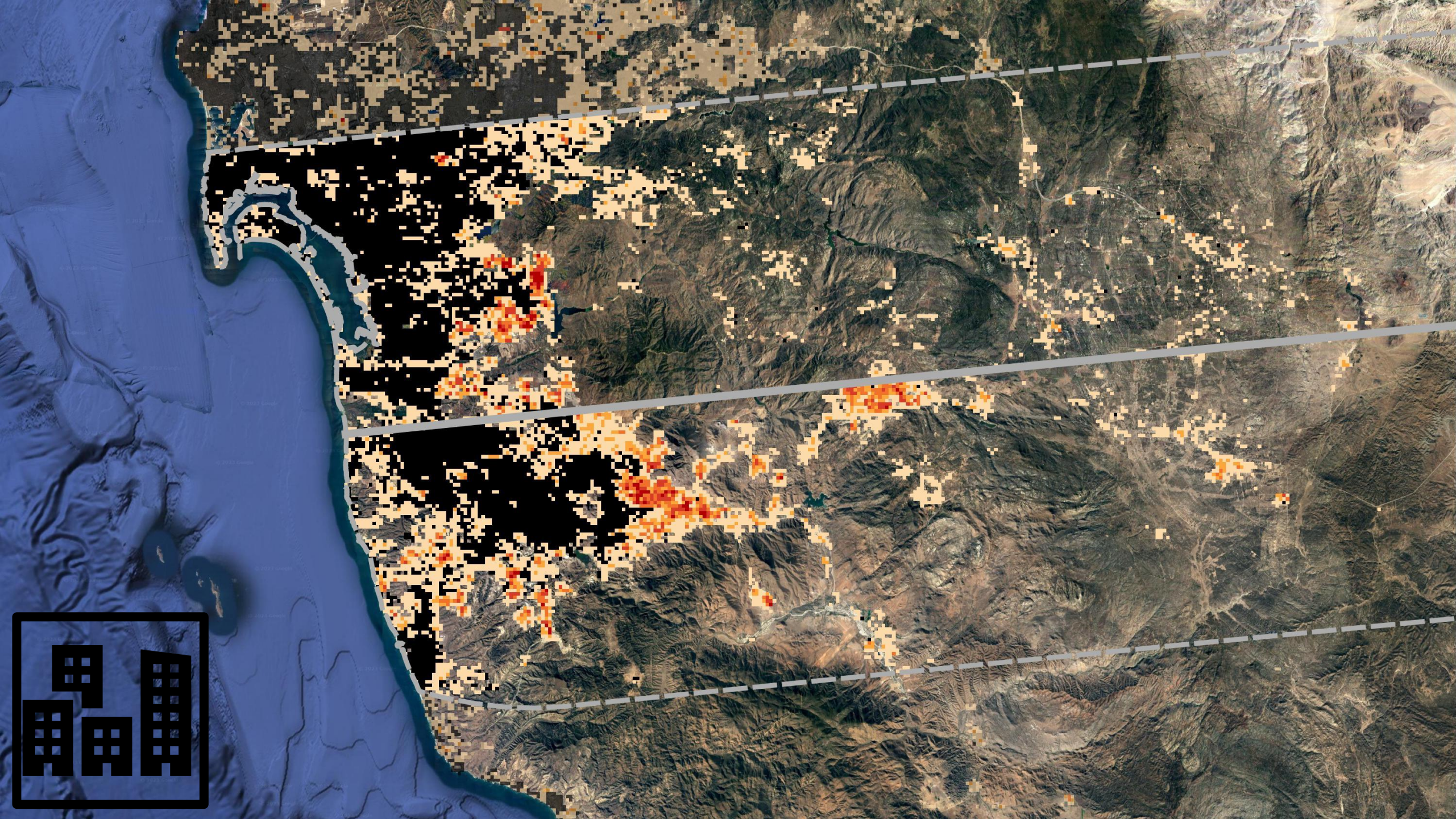






25 km





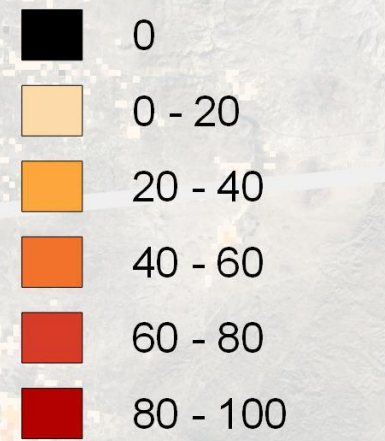


# Built-up Area

— Border Lines

□ 25km Buffers

Change [%]  
from 2000 to 2014

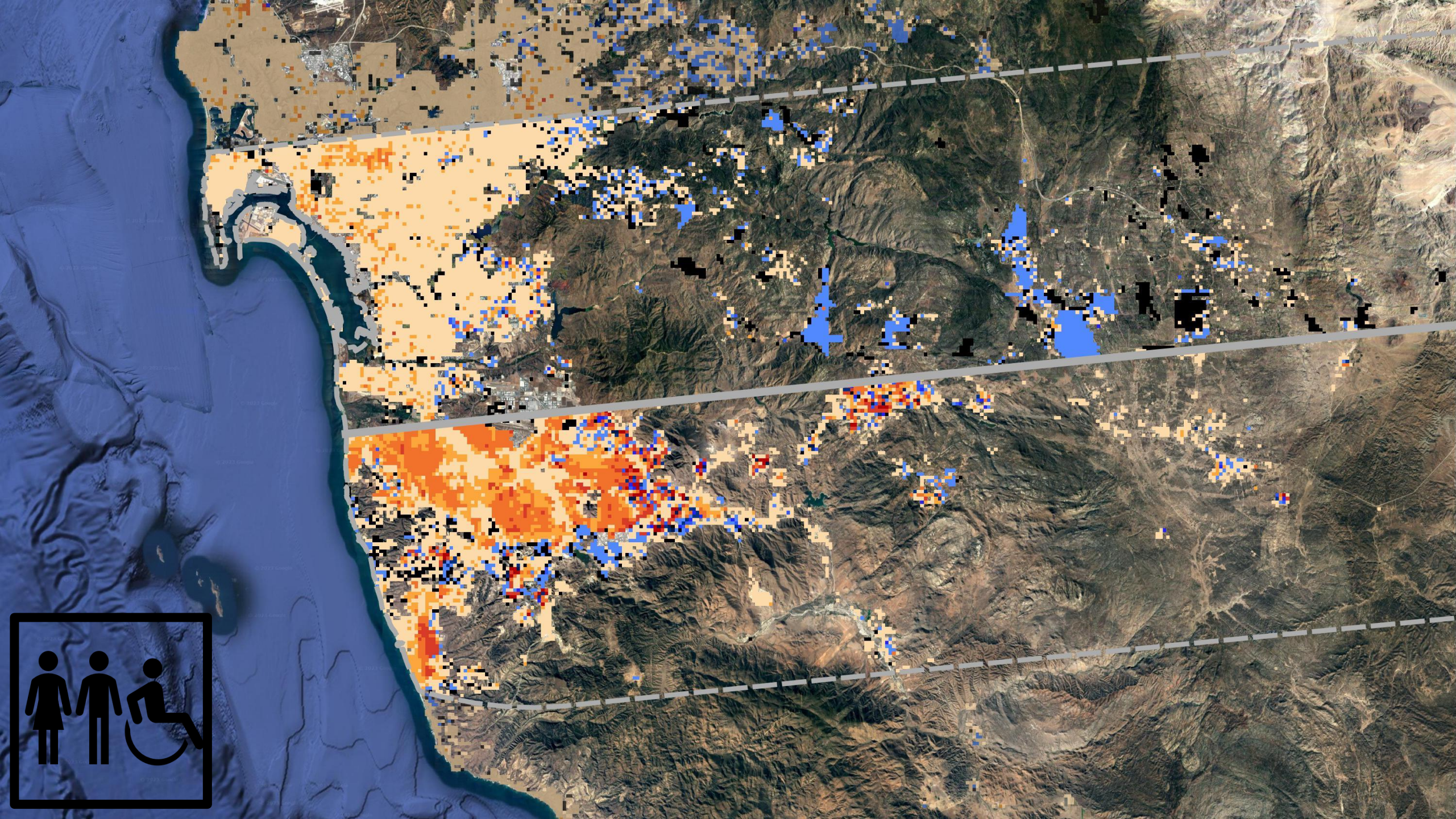


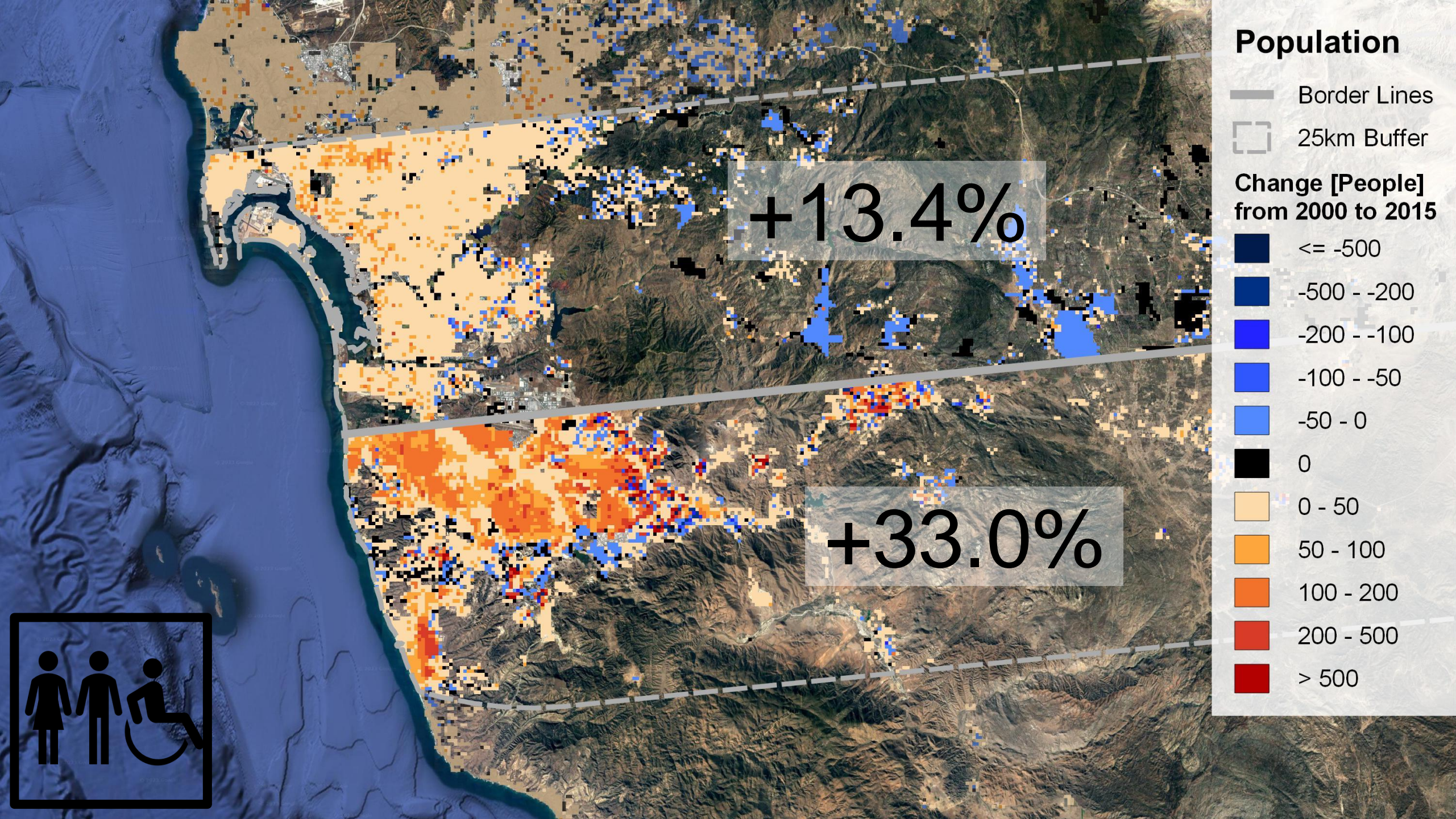
+7.5%

+21.0%









# Population

- Border Lines
- 25km Buffer

## Change [People] from 2000 to 2015

- ≤ -500
- -500 - -200
- -200 - -100
- -100 - -50
- -50 - 0
- 0
- 0 - 50
- 50 - 100
- 100 - 200
- 200 - 500
- > 500

+13.4%

+33.0%



# Settlement growth

2000 → 2015

+ 16.1%



**Border region**  
25 km vicinity to border

+ 20.3%

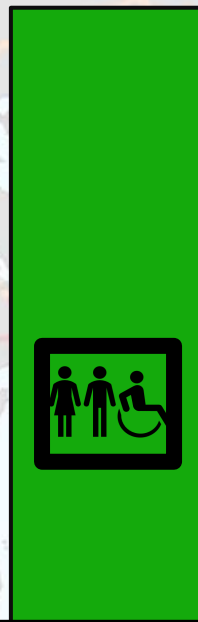


**Global**

# Population growth

2000 → 2015

+ 24.5%



**Border region**  
25 km vicinity to border

+ 20.0%



**Global**

Growth [%]



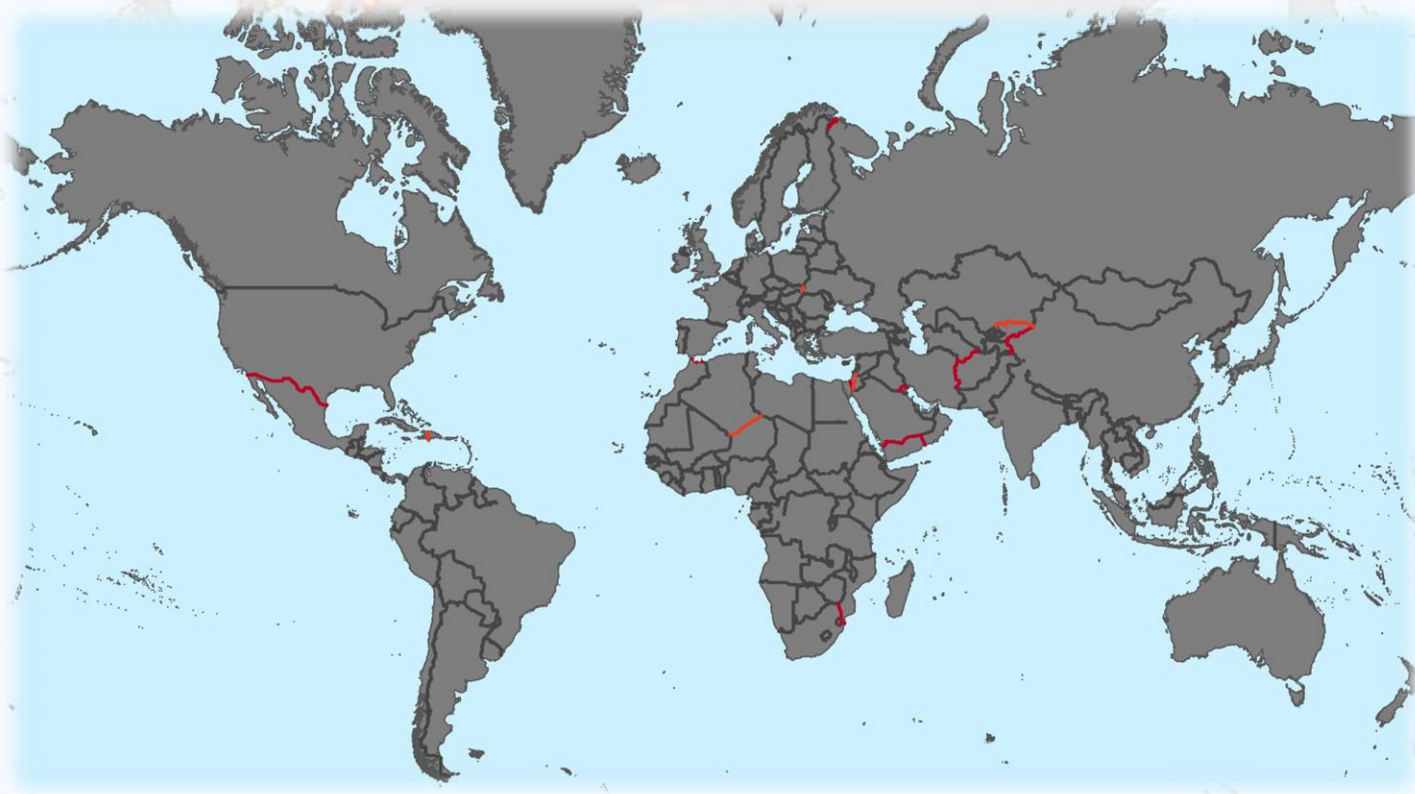
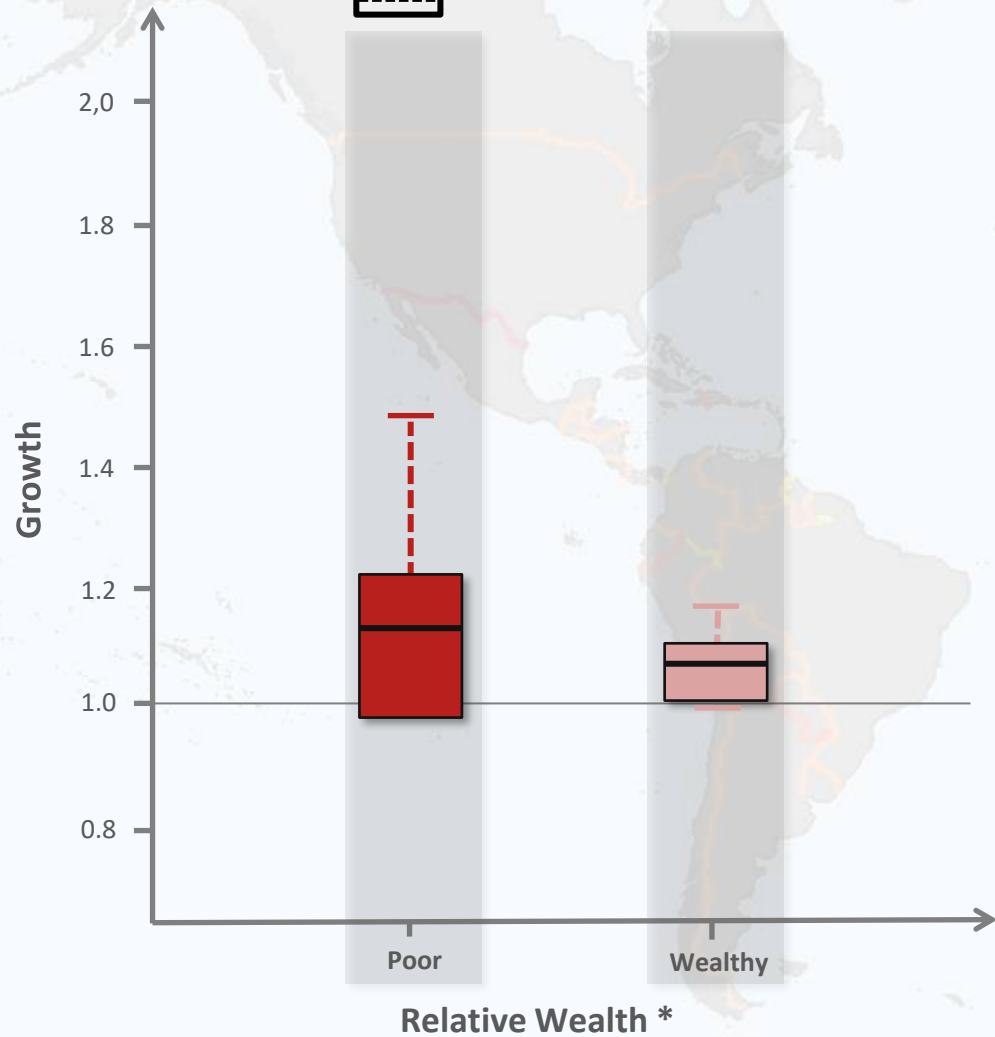


# Growth comparison

poor vs wealthy Nation-States separated by Barrier / Fortified Borders in 25 km Border Vicinity



## Settlement



\* Ratio of GDP per Capita larger than 5.59 (mean plus variance of all border areas)

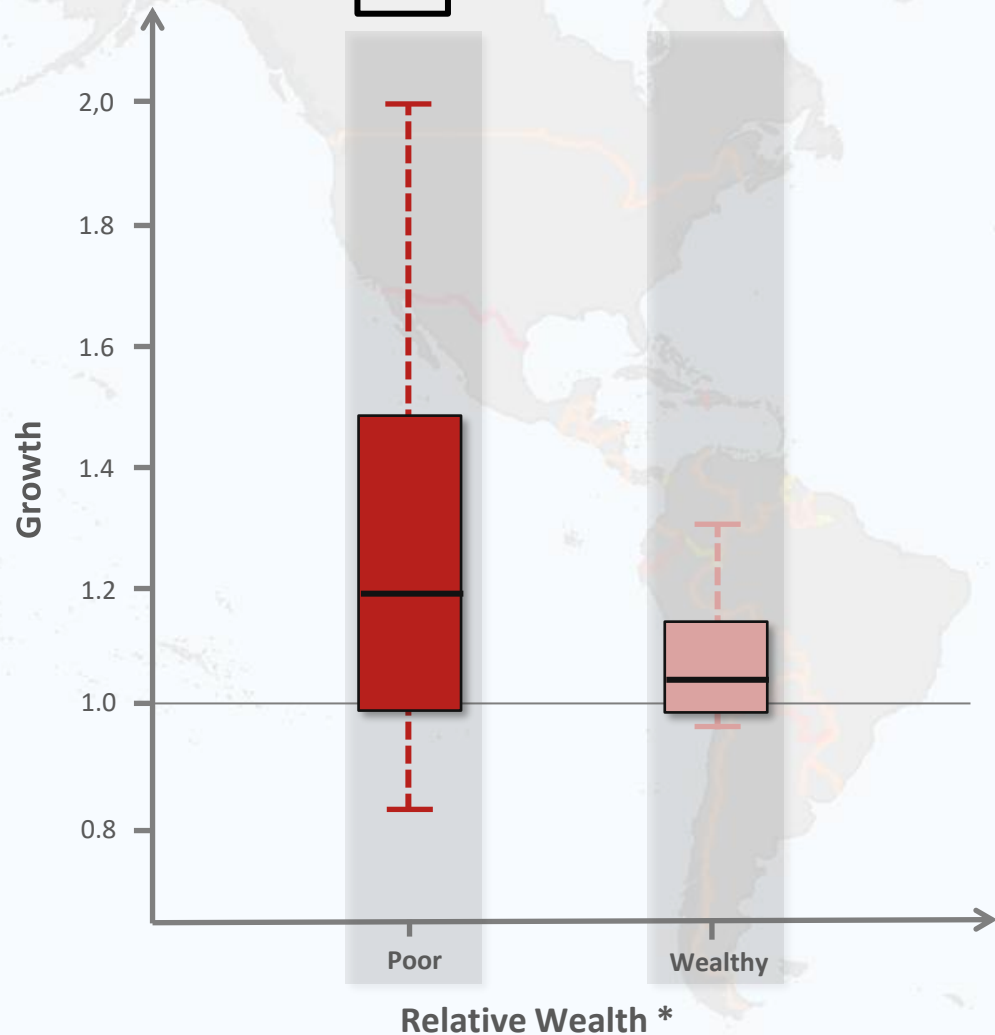


# Growth comparison

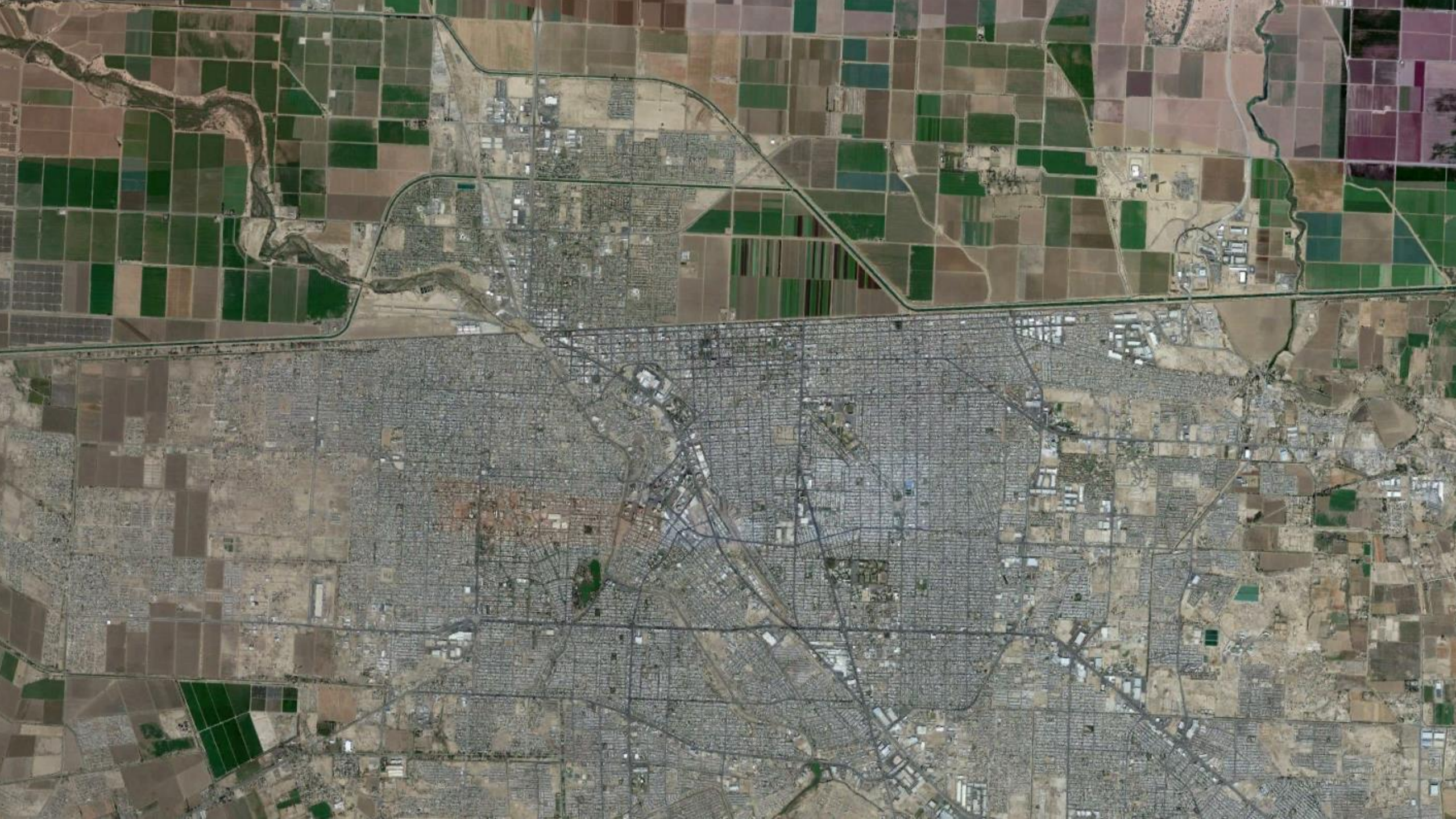
poor vs wealthy Nation-States separated by Barrier / Fortified Borders in 25 km Border Vicinity



Population



\* Ratio of GDP per Capita larger than 5.59 (mean plus variance of all border areas)





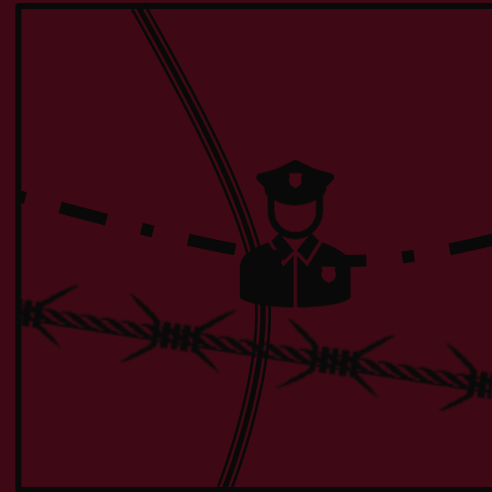
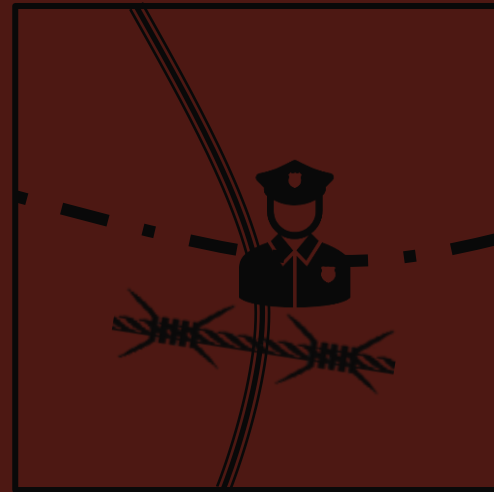
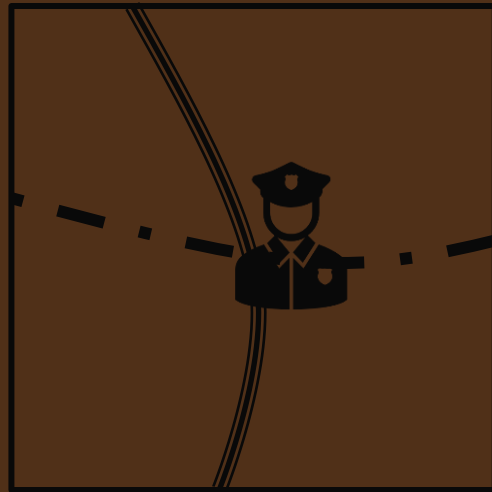
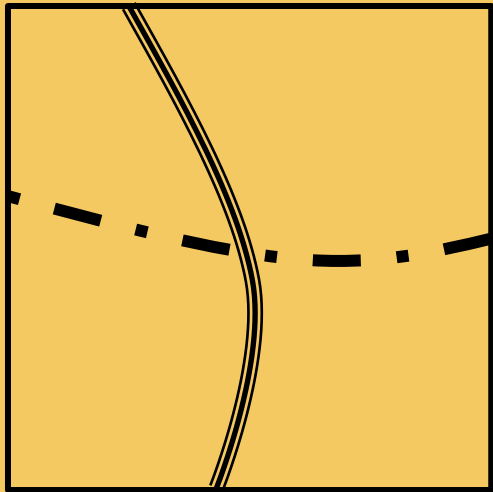
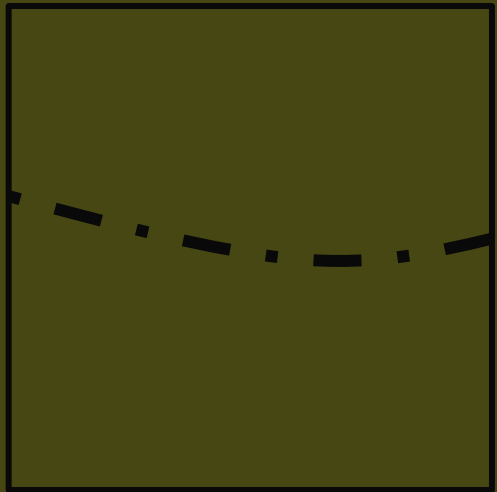
**Frontier  
Border**

**Landmark  
Border**

**Checkpoint  
Border**

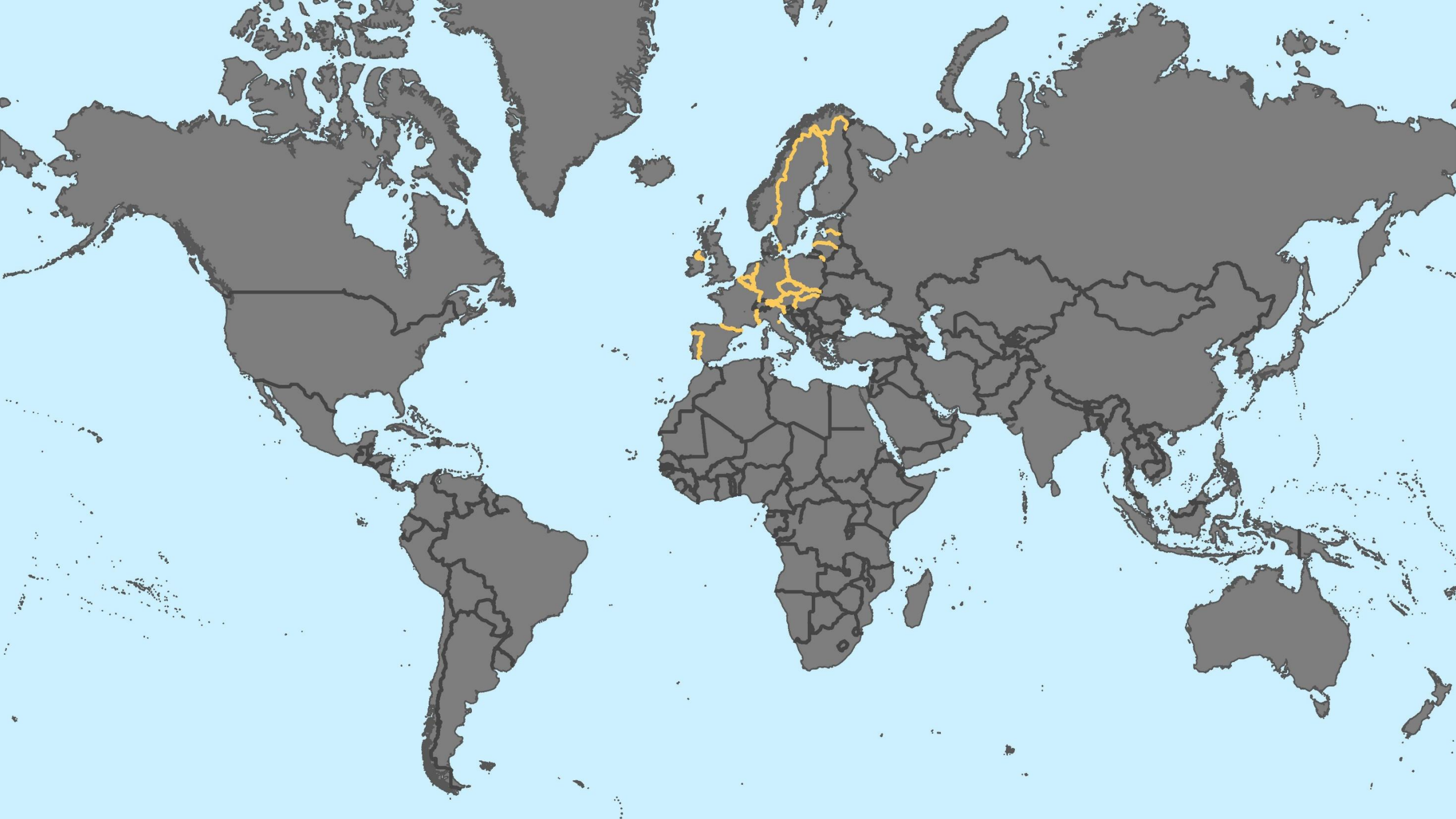
**Barrier  
Border**

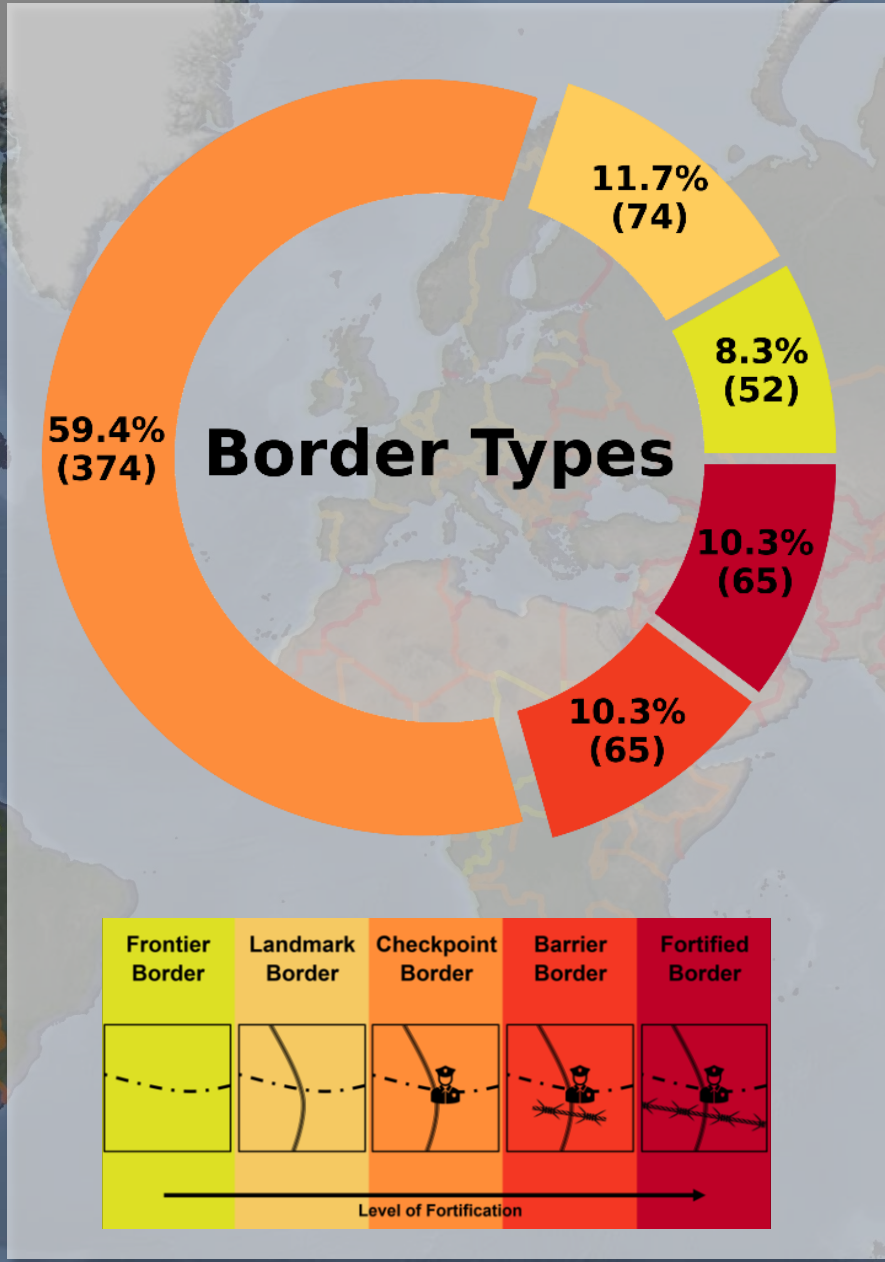
**Fortified  
Border**



**Level of Fortification**







# Flucht und Ankommen

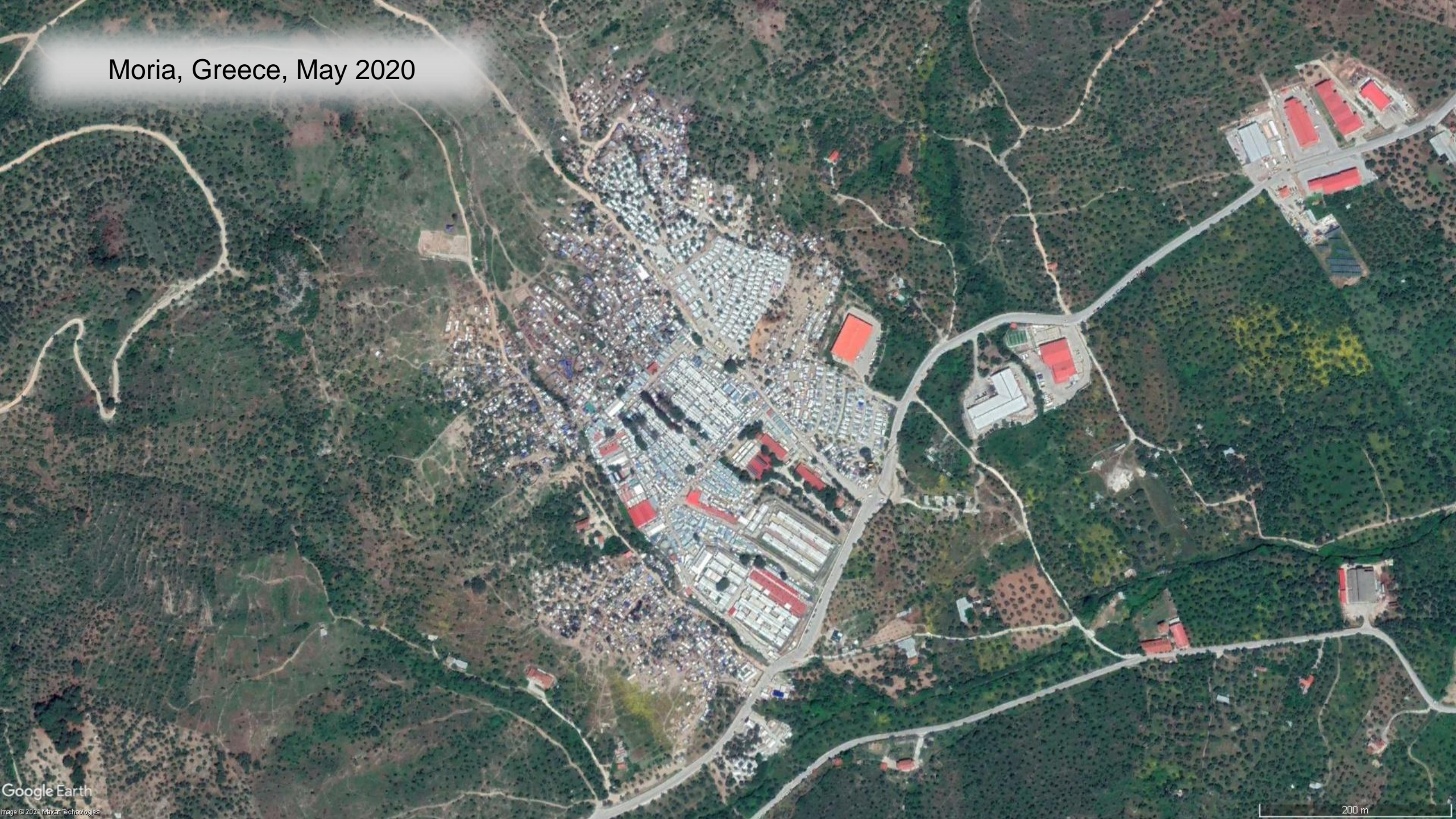
Moria, Greece, Apr. 2017



Moria, Greece, Apr. 2018



Moria, Greece, May 2020



Moria, Greece, Nov. 2020







Die Siedlung außerhalb von San Isidro beherbergt mehr als 200 Arbeiter. [Guillem Trius / Al Jazeera]

# Flucht und Sichtbarkeit



# 7.8 million

Year 2022

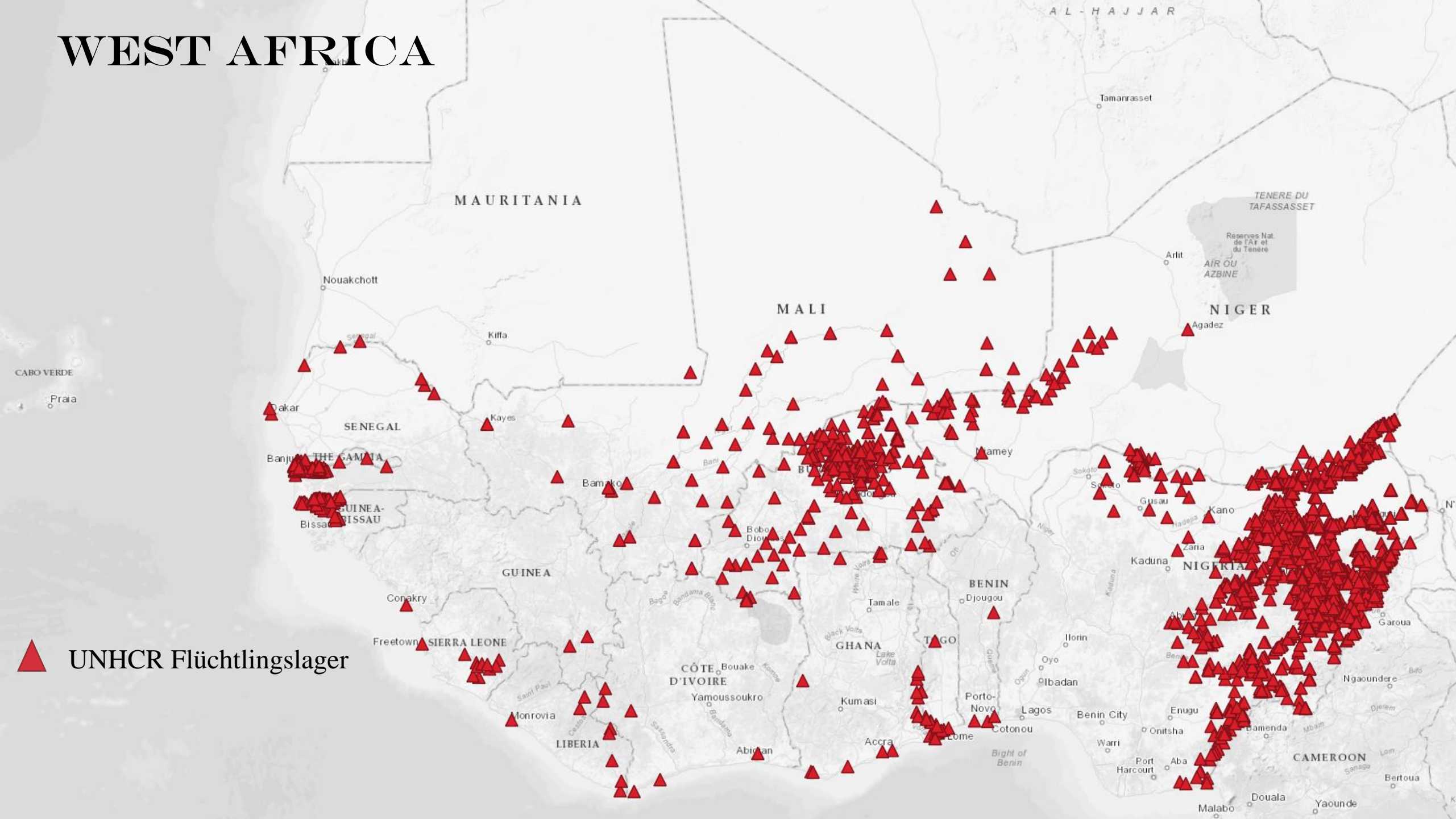


Persons of concern

# 884,000

Year 2012

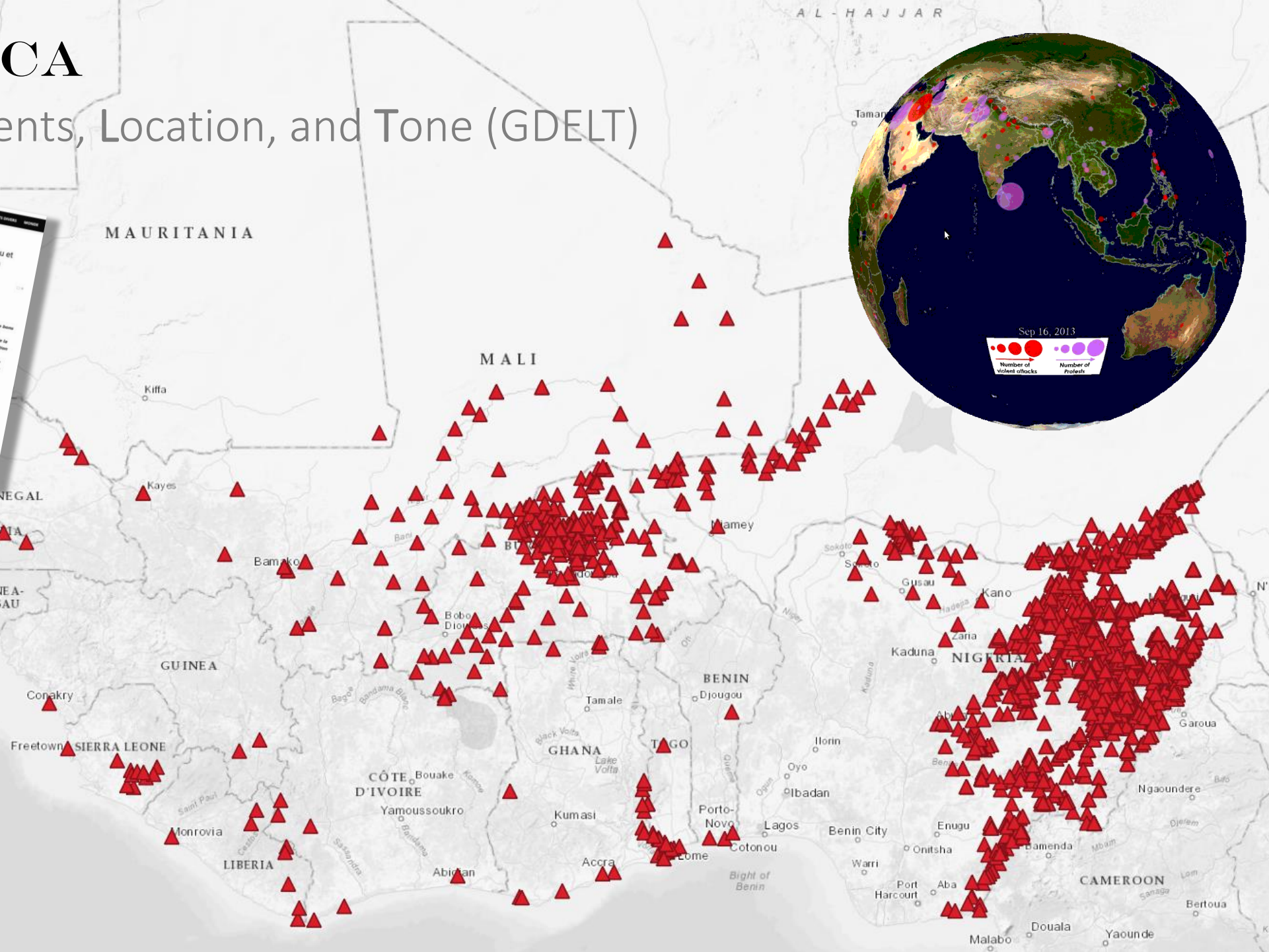
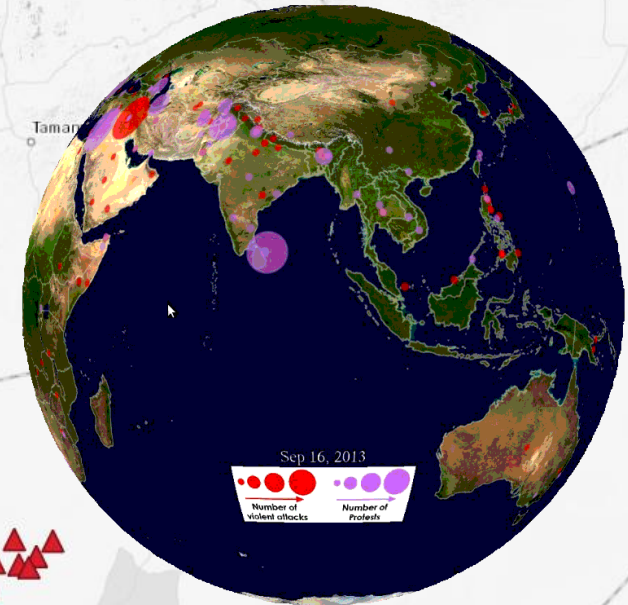
# WEST AFRICA



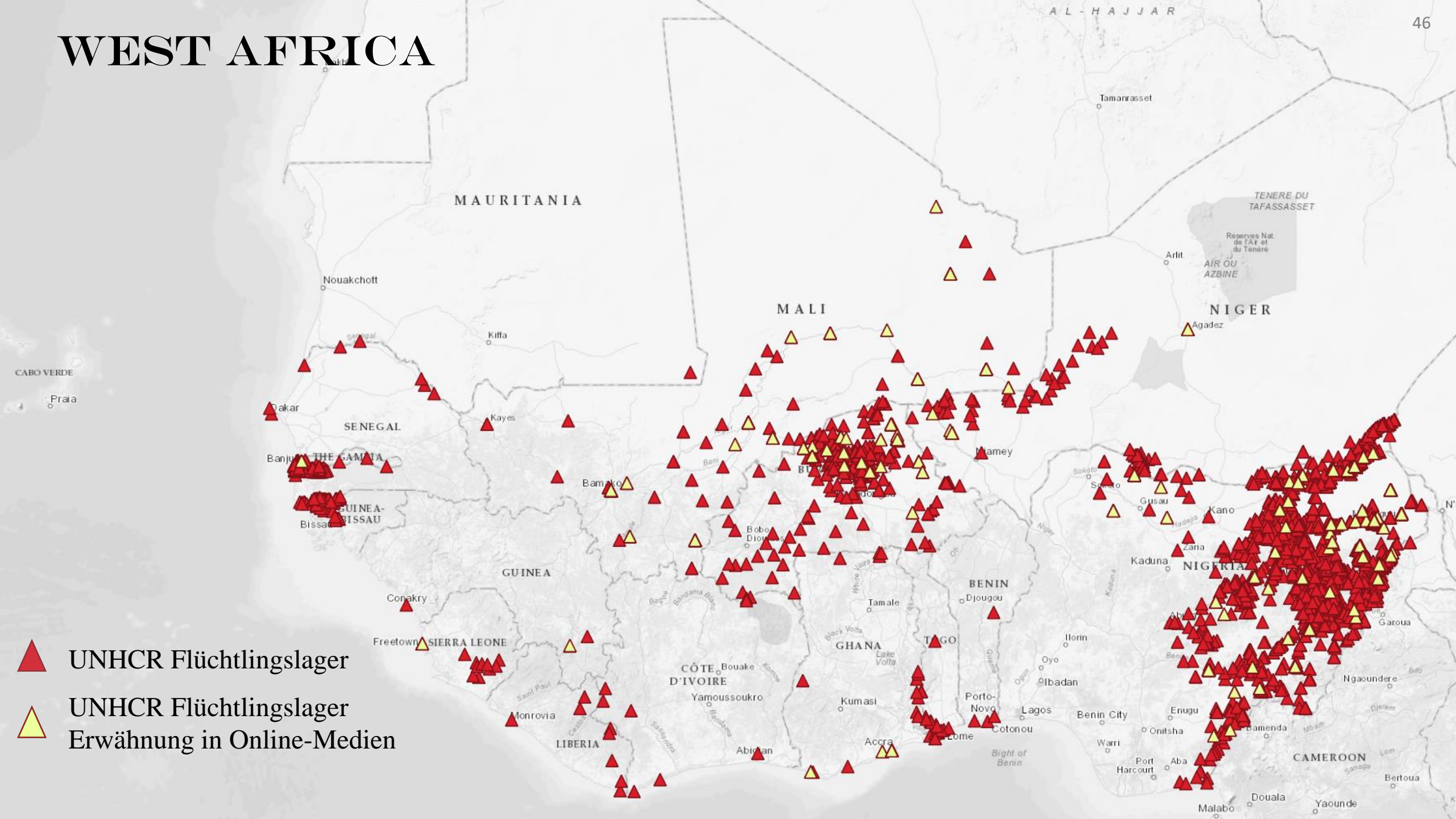
 UNHCR Flüchtlingslager

# WEST AFRICA

## Global Data on Events, Location, and Tone (GDELT)



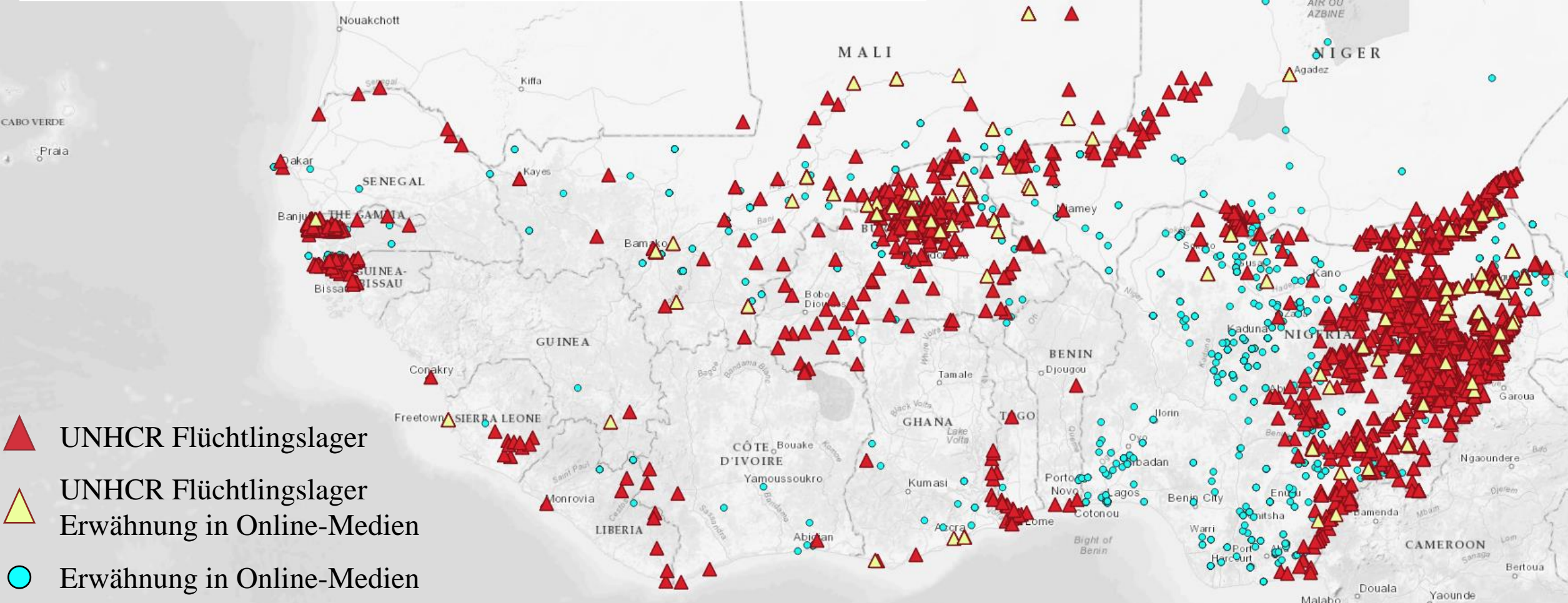
# WEST AFRICA



- ▲ UNHCR Flüchtlingslager
- ▲ UNHCR Flüchtlingslager Erwähnung in Online-Medien

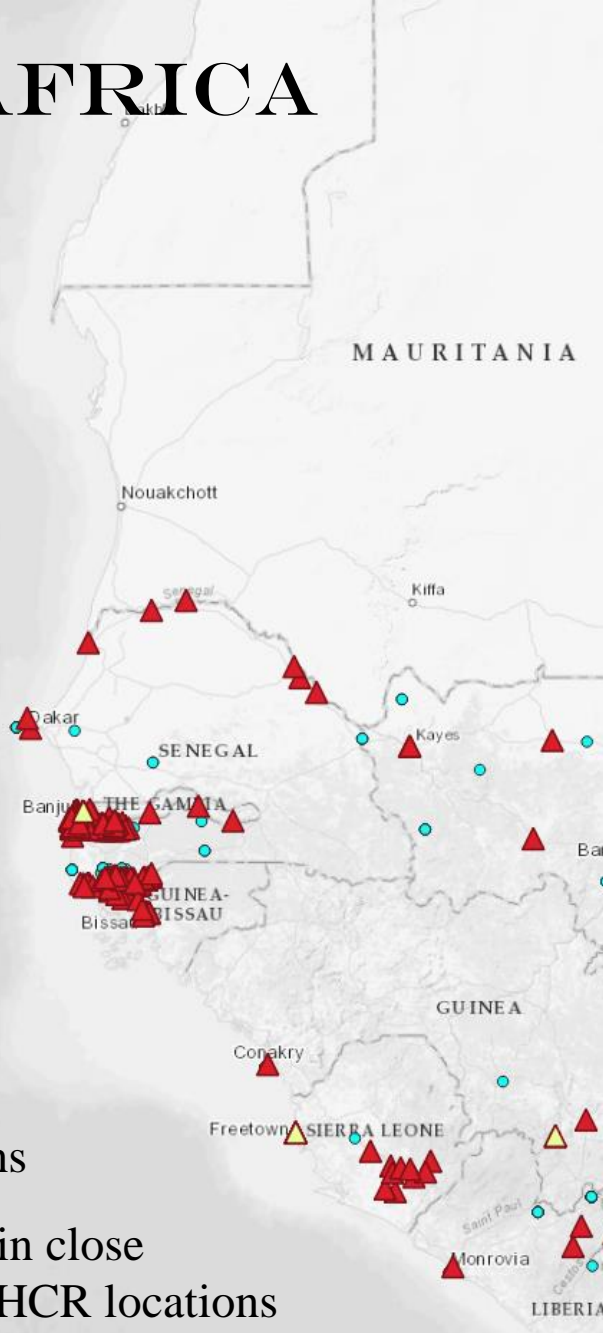
# WEST AFRICA

„... 137 refugees killed in *Tahoua, Niger* ...“



- ▲ UNHCR Flüchtlingslager
- ▲ UNHCR Flüchtlingslager Erwähnung in Online-Medien
- Erwähnung in Online-Medien

# WEST AFRICA



96.8%

aller UNHCR Flüchtlingslager werden  
in Online-Medien (weltweit)

nicht erwähnt

80.4%

aller Lokationen von Flüchtlingen, die in  
Online-Medien (weltweit) erwähnt werden

sind nicht in der UNHCR  
Datenbank

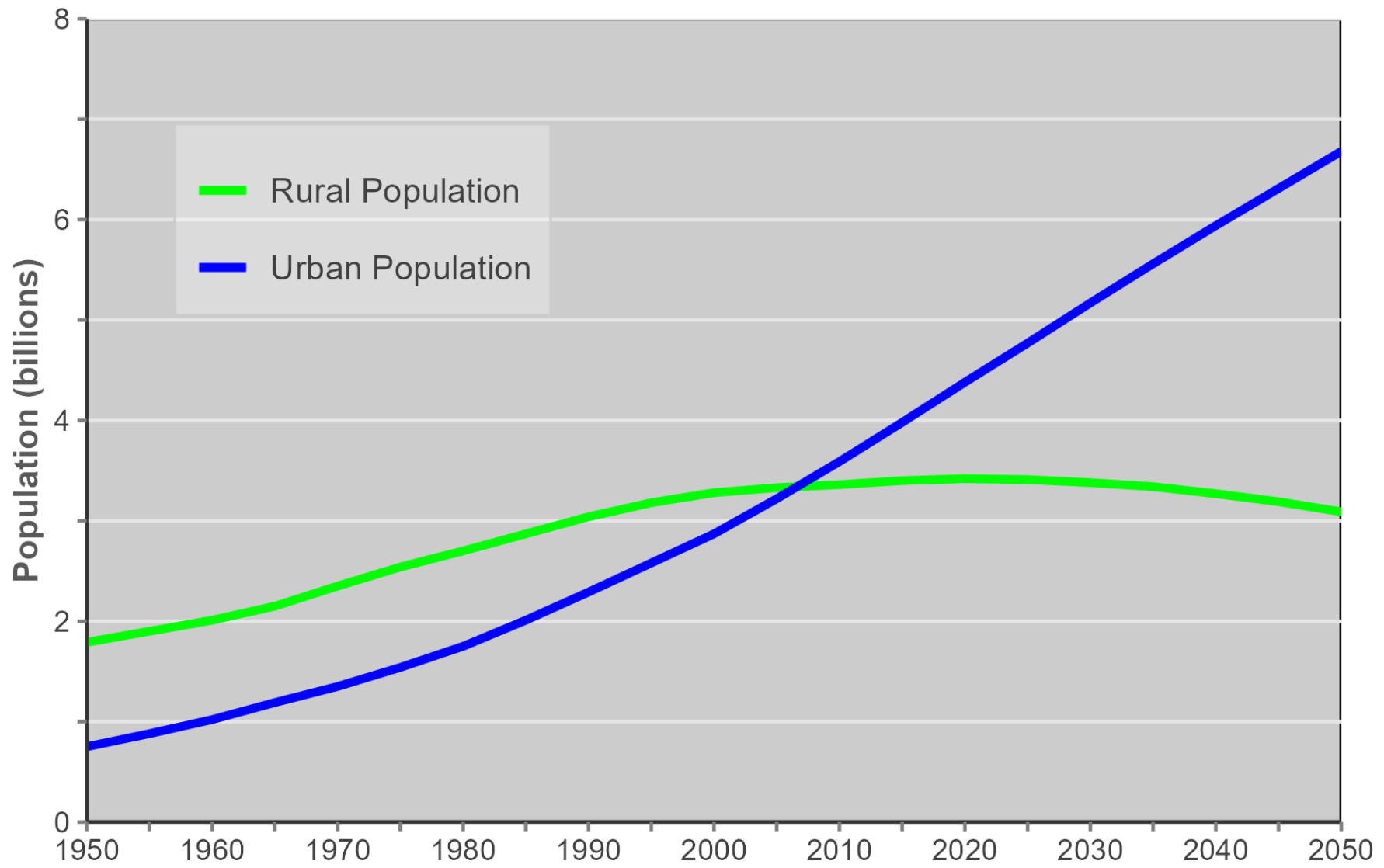


# Die größte Migrationsbewegung

jede Woche migrieren

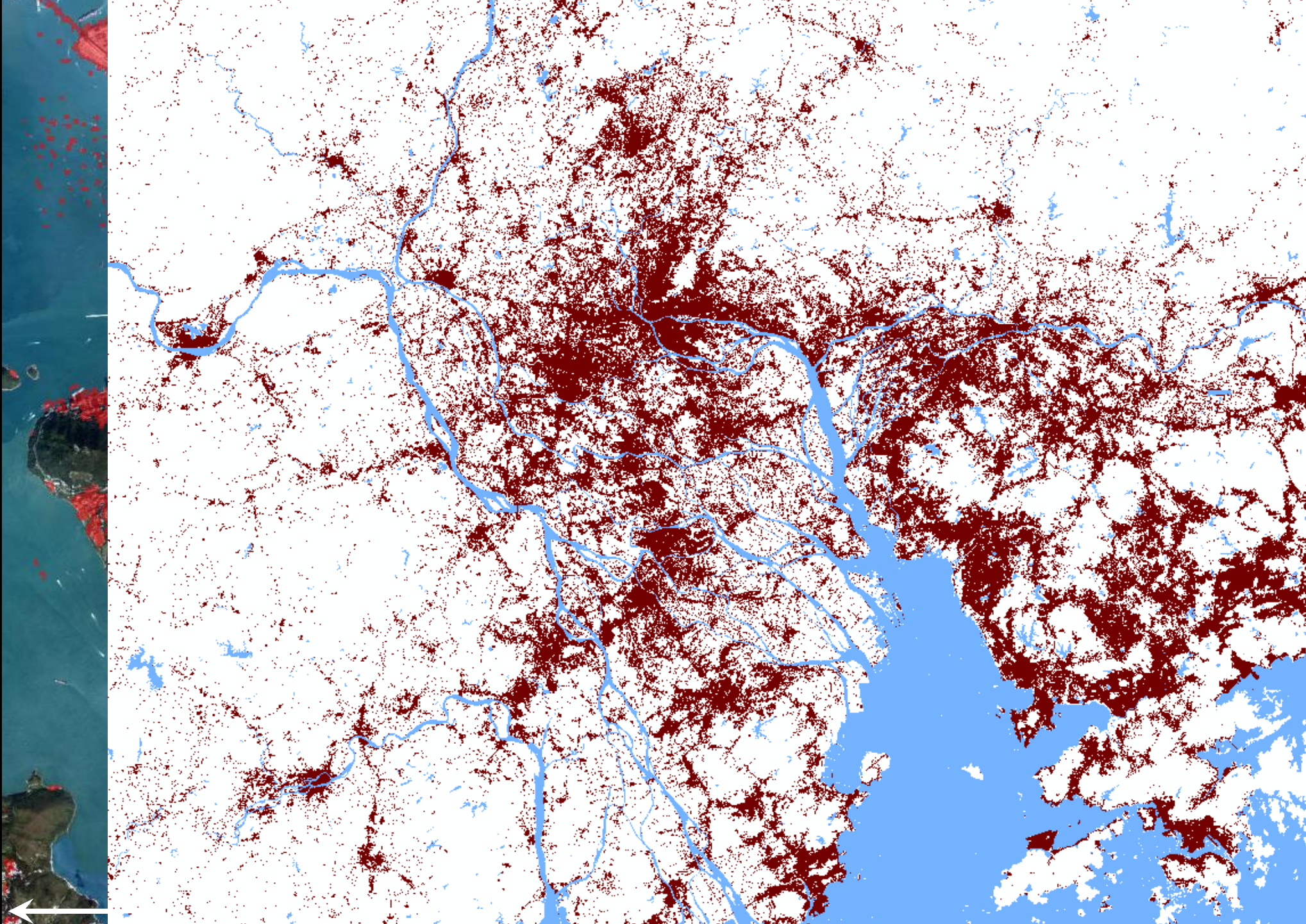
**1.4 Millionen**

Menschen in die Städte auf unserem Planeten



Source: United Nations, Department of Economic and Social Affairs, Population Division (2018).

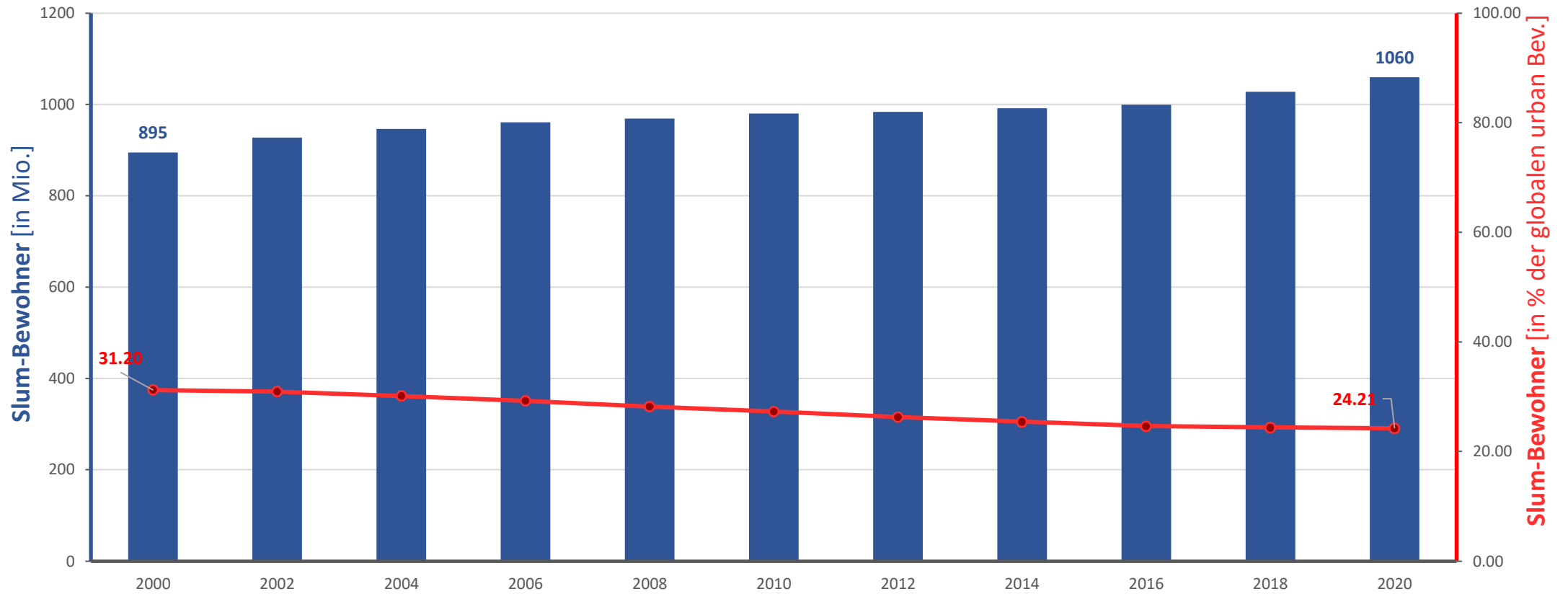
Eine neue Dimension  
urbaner Landschaften



**24%**

**der weltweiten Stadtbewohner leben in Slums**

## Weltweite Slumbewohner 2000 - 2022





# Population assessment

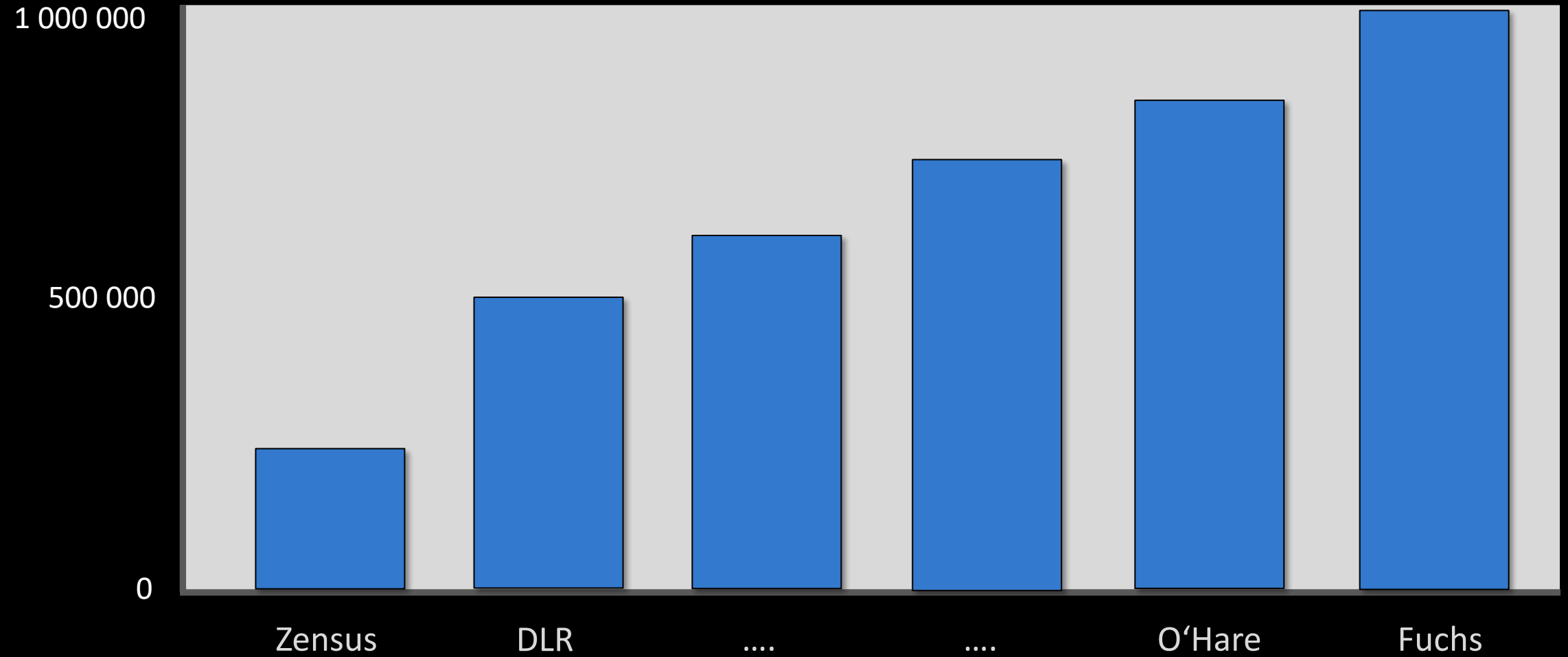
Dharavi, Mumbai





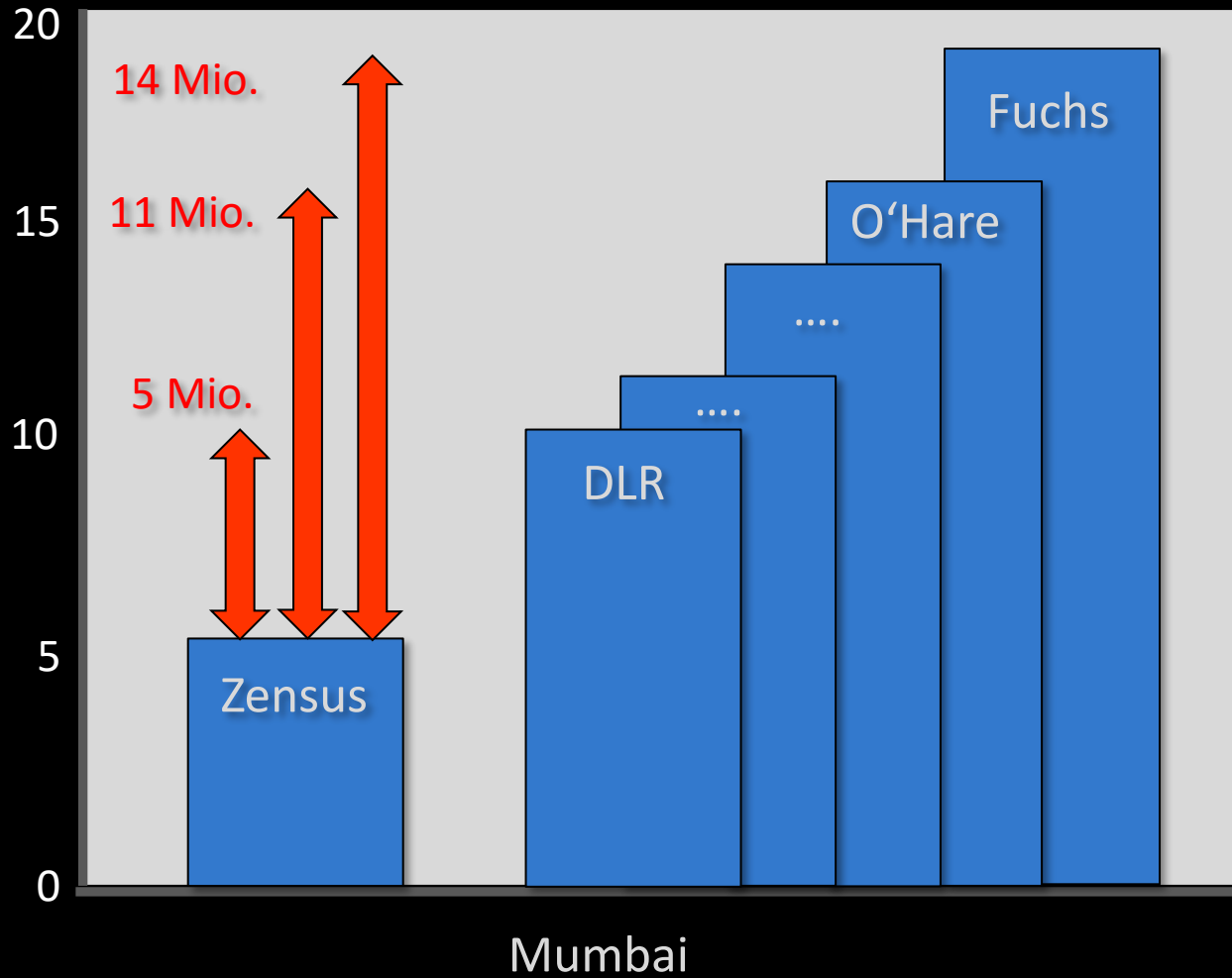
# Bevölkerungsschätzung

Mumbai, Dharavi

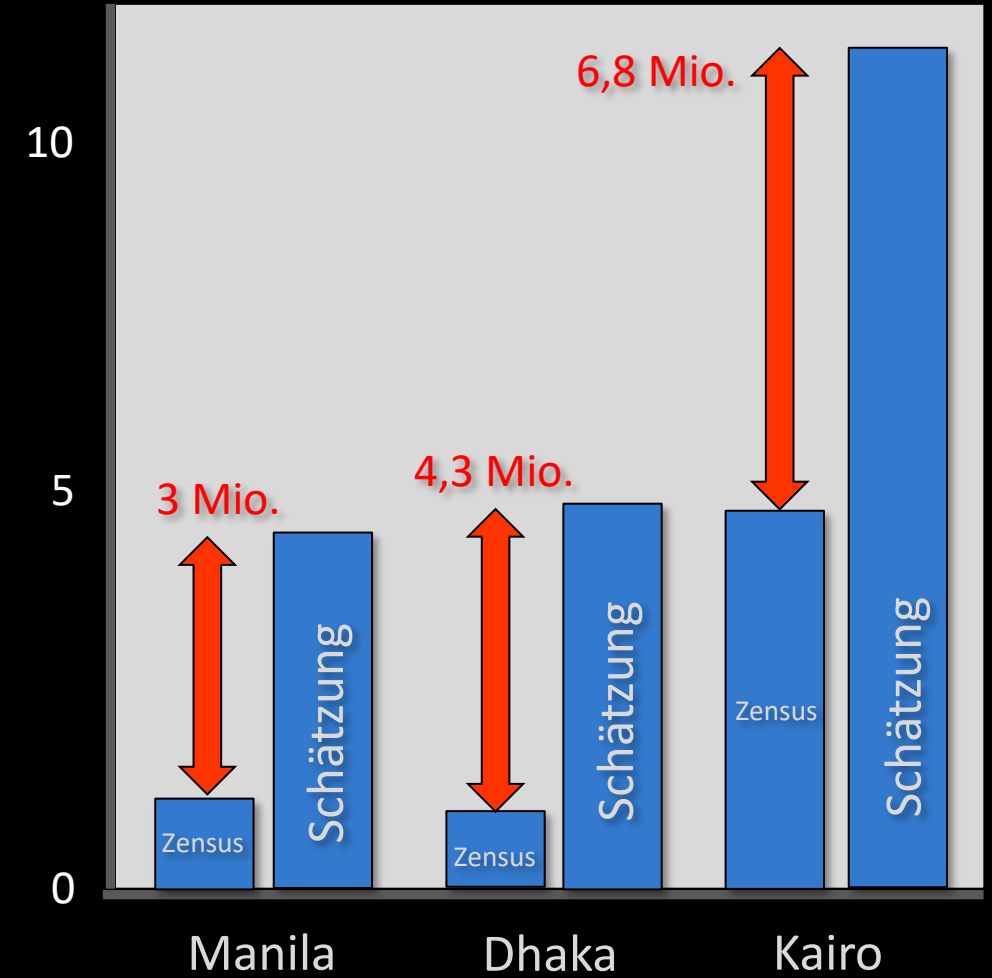


# Bevölkerungsschätzung

Slums [in Millionen]



Taubenböck & Wurm, 2015



Breuer et al., 2024

Delhi 06.02.2000





*„On the way to the moon we'd discovered the Earth“*

(Eugene Cernan, commander Apollo 17)

# Referenzen



## Fernerkundung

Weigand M, Worbis S, Sapena M & Taubenböck H (2023): *A structural catalog of the settlement morphology in refugee and IDP camps*. International Journal of Geographical Sciences. vol. 37(6), pp. 1338-1364.

Taubenböck H, Kraff N & Wurm M (2018): *The morphology of the Arrival City – A global categorization based on literature surveys and remotely sensed data*. Applied Geography, vol. 92, pp. 150-167.

Kraff NJ, Wurm M & Taubenböck H (2022): *Housing forms of poverty in Europe – A categorization based on literature research and space imagery*. Applied Geography. 149.

Aravena Pelizari P, Spröhnle K, Geiß C, Schöpfer E, Plank S & Taubenböck H (2018): *Multi-sensor feature fusion for very high spatial resolution built-up area extraction in temporary settlements*. Remote Sensing of Environment. 209, pp. 793-807.

## Fernerkundung und Zensusdaten

Breuer JHP, Friesen J, Taubenböck H, Wurm M, Pelz PF (2024): *The unseen population: Do we underestimate slum dwellers in cities of the Global South?* Habitat International. vol. 148, 103056.

Taubenböck H, Otto C, Gülzau F, Mau S (2023): *Border regions across the globe: Analyzing border typologies, development dynamics, economic and political disparities*. Applied Geography. vol 151(1):102866.

Taubenböck H & Wurm M (2015): *Ich weiß, dass ich nichts weiß – Bevölkerungsschätzung in einer Megacity*. SpringerSpektrum. S. 171-178.

## Fernerkundung und soziale Netzwerkdaten

Lemoine-Rodríguez R, Mast J, Mühlbauer M, Mandery N, Biewer C & Taubenböck H (2024): *The voices of the displaced: mobility and Twitter conversation of migrants of the 2022 Ukraine war*. Information Processing & Management. 6.

## Medien und offizielle Geodaten

Senaratne H, Mühlbauer M, Cardenas A, Kiefl R, Riedlinger T, Biewer C & Taubenböck H (2023): *The unseen – An Investigative Analysis of Thematic and Spatial Coverage of News on the Ongoing Refugee Crisis in West Africa*. MDPI ISPRS International Journal of Geo-Information. 12, 175.

# Referenzen

## Persons of concern:

2022: <https://data.unhcr.org/en/documents/download/94388>

2012: <https://www.unhcr.org/uk/51b1d635b.pdf>

<https://reliefweb.int/report/burkina-faso/west-africa-faces-its-worst-food-crisis-ten-years-over-27-million-people-already>

<https://www.unhcr.org/news/stories/2020/12/5fd7536c4/learned-refugee-camp-west-africa.html>

<https://reliefweb.int/report/democratic-republic-congo/west-and-central-africa-flooding-situation-30-august-2021>

<https://data.unhcr.org/en/documents/download/75273>

<https://reliefweb.int/report/burkina-faso/sahel-food-crisis-fueled-conflict-set-worsen-during-lean-period>

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