# The Global Data Lab Vulnerability Index (GVI)

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Gl🌐bal_Data_Lab

**Institute for Management Research**
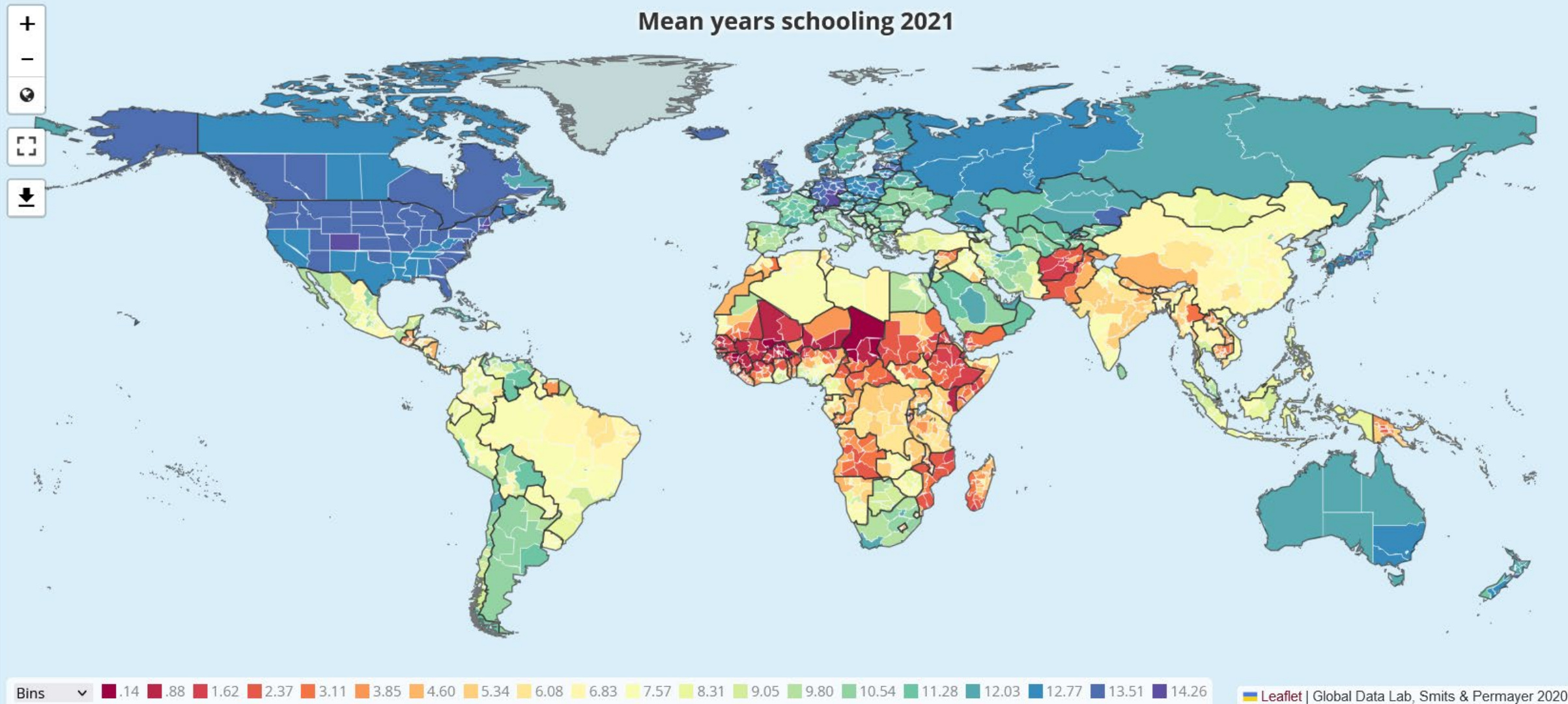Radboud University

# Global Data Lab

- Data and research center at Radboud University
- Focus on Low- and Middle-Income Countries (LMICs)
- 35+ million persons
- 130+ LMICs
- 500+ (large) household surveys
- Regularly updated

# Indicators

- Aggregating information from household surveys
- 100+ indicators
- 1300+ subnational regions
- Multiple years
- Topics include:
  - *Wealth, poverty, asset ownership, housing quality*
  - *Education, demographics, gender*
  - *Fertility, child mortality, (reproductive) health*
  - *Vaccinations, stunting, under/overweight, BMI*
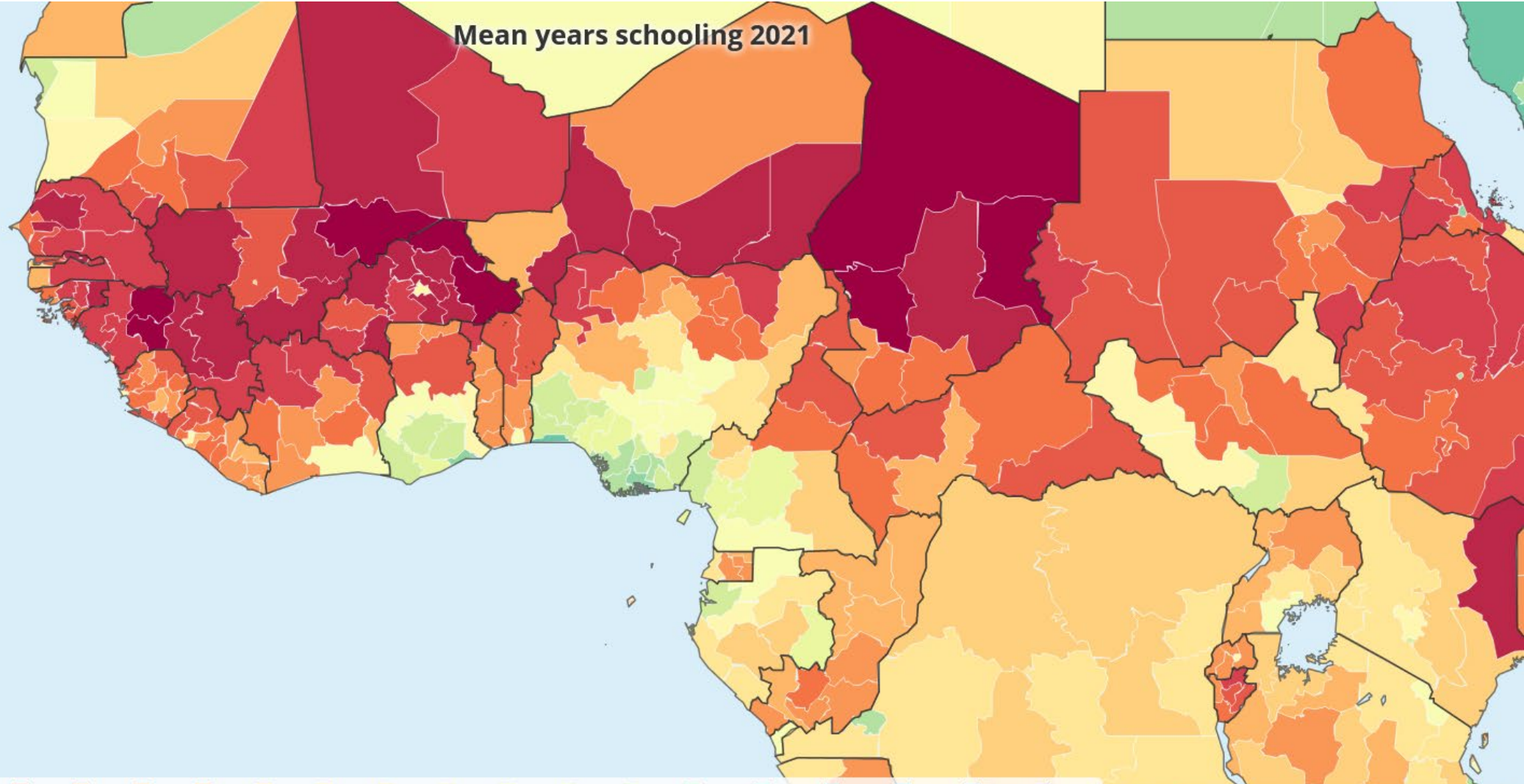  - *Access to public services*

Mean years schooling 2021

Mean years schooling 2021

Bins

.14  .88  1.62  2.37  3.11  3.85  4.60  5.34  6.08  6.83  7.57  8.31  9.05  9.80  10.54  11.28  12.03  12.77  13.51  14.26

Global Data Lab

# Climate change: Data needs

- Study of climate change requires Earth System data ánd Human System data

- Contribution GDL: broad set of comparable Human System indicators at different levels of aggregation

- GDL Vulnerability Index (GVI) developed as part of update of Climate Vulnerability Monitor of the Climate Vulnerability Forum

# GVI

- Composite index
- Focus on human and societal aspects of vulnerability
- Not included: physical aspects and human-environment interactions
- Seven major dimensions of vulnerability measured with eleven indicators

# GVI dimensions and indicators

| Dimension | Indicators | Source |
|---|---|---|
| Economy | GDP per capita PPP (constant 2017, international $) and Poverty Headcount Ratio at 3.20 US $ a day | World Bank[a] |
| Education | Mean years of schooling 25+ | UNDP[c] |
| Gender | Gender Development Index (GDI) | UNDP |
| Health | Life expectancy at birth | UNDP |
| Infrastructure | Access to clean water, electricity and (mobile) phone | World Bank |
| Governance | World Governance Indicator | World Bank |
| Demography | Urbanization and Dependency Ratio | World Bank |

[a] https://databank.worldbank.org/home.aspx
[b] https://hdr.undp.org/en/data

# Other vulnerability indices

- Other vulnerability indices:
  - ND Gain Index of Notre Dame University
  - INFORM Index of the European Commission
  - World Risk Index (WRI)
- Constructed yearly by experts
- Large number of underlying indicators (ND-GAIN: 74; INFORM: 54; WRI: 100)
- Complex, less stable, country level

# Characteristics GVI

- Not dependent on experts
- Simple additive formula
- Focus on core dimensions of socioeconomic vulnerability
- Can be applied to any area (national, subnational, group of countries)

# Data used to construct GVI

- National data 2015-2020 for eleven indicators
- Data sources: World Bank, UNDP
- 194 countries
- Missing data imputed with:
  - Data other years (intra/extrapolation)
  - Estimates on GDL-data
- For all countries data for six years used for equal weight

# Method used to construct GVI

- Principal Component Analysis, first factor
- Standardized variable explaining 67% variation in dataset
- GVI: 5-90 in 2015-2020
- High correlations with other indices

Table 2. Mean and standard deviations of the indicators, raw indicator weights, and coefficients of the GVI formula

| Indicators | Mean | Std. Deviation | Raw indicator weight | GVI Formula weight |
|---|---|---|---|---|
| GDP per capita | 18605 | 19047 | 0.10408626 | 0.00010686 |
| Poverty | 22.858 | 26.971 | -0.12524258 | -0.09081646 |
| Years schooling | 8.6810 | 3.2817 | 0.11967215 | 0.71308829 |
| Gender Development Index | 0.9446 | 0.0674 | 0.08825844 | 25.59264906 |
| Life expectancy | 71.900 | 7.6887 | 0.12382514 | 0.31492412 |
| Access to clean water | 87.446 | 15.590 | 0.12484200 | 0.1565931 |
| Access to electricity | 82.934 | 26.230 | 0.11904323 | 0.08874772 |
| Phone connections | 107.33 | 33.298 | 0.09781305 | 0.07288862 |
| World Governance Index | -0.0686 | 0.8653 | 0.10287776 | 2.32477119 |
| Dependency ratio | 60.470 | 16.401 | -0.11096747 | -0.13230595 |
| Urbanization | 57.818 | 21.900 | 0.09663833 | 0.08628689 |
| **Constant** | - | - | - | -22.63157686 |

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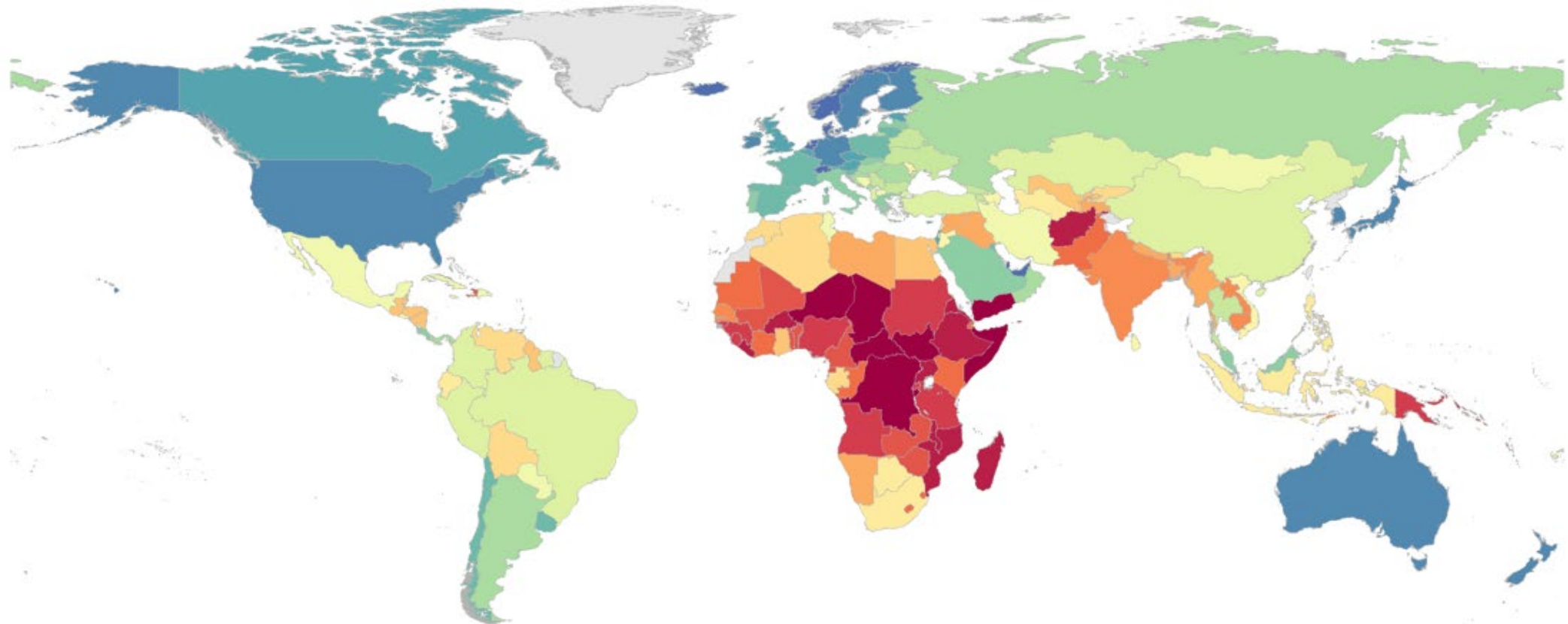| Indicators | Mean | Std. Deviation | Raw indicator weight | GVI Formula weight |
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# GDL Vulnerability Index 2020



Ventiles GVI 2020

1  2  3  4  5  6  7  8  9  10  11  12  13  14  15  16  17  18  19  20

# Correlations with other indices

- ND Gain Index of Notre Dame: 0.89
- INFORM Index of European Commission: 0.80
- World Risk Index: 0.75

- Offers good prospects for applying GVI to other aggregates
- Estimates of future GVI values along Shared Socioeconomic Pathways

# Data used to construct GVI projections

- Estimated GVI for every 10th year of 2030-2100 under SSPs
- Population, GDPpc, poverty, education, urbanization: IIASA
- Life expectancy: Wittgenstein Data Explorer
- Governance: Andrijevic et al. (2019)
- GDI, electricity, phone: own estimates
- Drinking water: excluded
- Projected indicator values entered in GVI formula

Bestand    Bewerken    Beeld    Geschiedenis    Bladwijzers    Extra    Help

W  Shared Socioeconomic Pathway ✕    🌎 climatevulnerabilitymonitor.org ✕    +

https://climatevulnerabilitymonitor.org/biophysical/ind/socio-economic-vulnerabil    |    Q  ssps

Google Translate    🐪 Book a budget campe...    Ⓦ CARAN – Car Rental A...    DSM NAS1 - Synology Disk...    ◆ Google Scholar JS    🌎 CLIMATE VULNERABIL...    🌎 Global Data Lab - Inn...    ⑤ ChatGPT

**Climate Vulnerability Monitor**
Biophysical Data Explorer
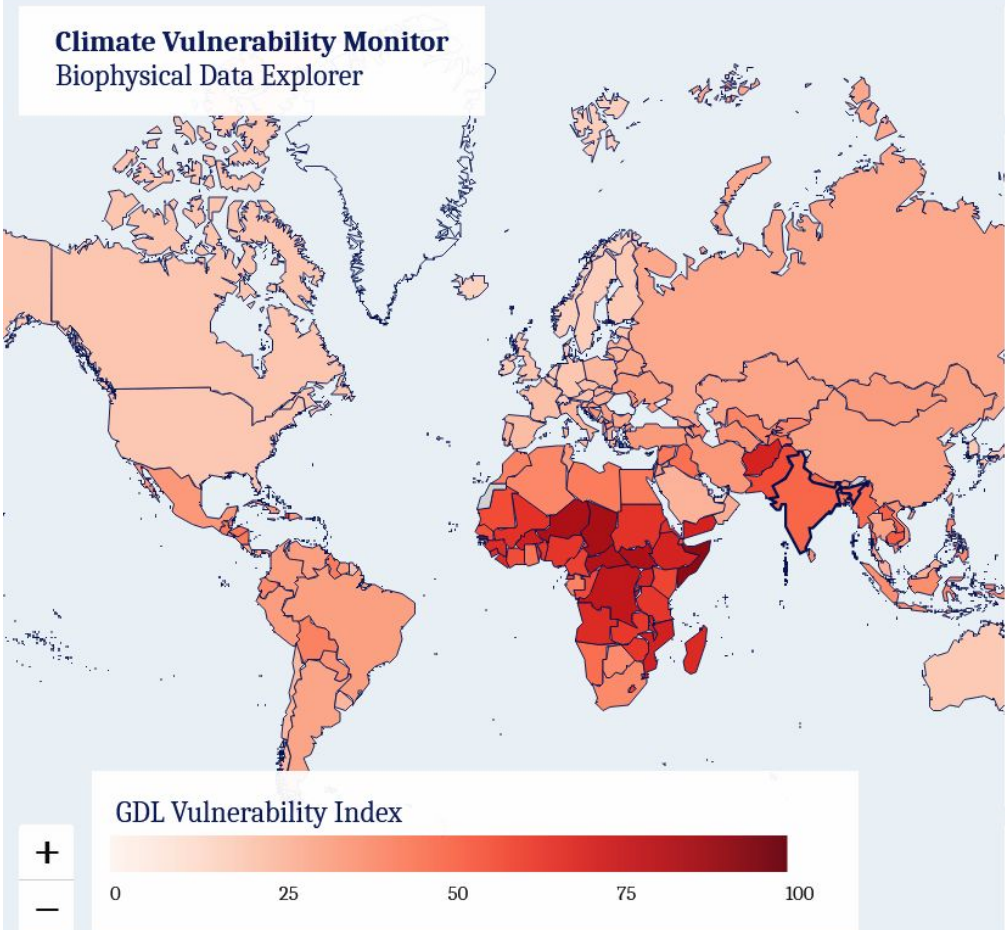
India                                                                                        ✕

◁  **Socio-economic Vulnerability**

## The GDL Vulnerability Index (GVI)

Climate impacts take place against a backdrop of exposure and vulnerability driven by socioeconomic, demographic, infrastructural and ecosystem factors. A broad set of indicators has been developed for assessing the performance of regions on these dimensions. The dimensions are interconnected, and increasingly affected by and interacting with biophysical climate impacts to contribute to climate risk.

Since it is often the combined effects of different vulnerabilities that determines a region's propensity to suffer harm from climate impacts, a composite index has been developed that aims to provide an overall picture of the socioeconomic vulnerability challenges that countries face. This GDL Vulnerability Index (GVI) is based on evidence of currently observed socio-economic vulnerability in the areas of economic growth and poverty, education, health, gender inequality, governance, demography and access to basic infrastructure[1]. It brings together these different facets of vulnerability into one composite index that provides a global picture of differential

GDL Vulnerability Index

0          25          50          75          100

○ **2020**        ◉ **2030**        ○ **2050**                    ○ **2090**
○ **Below 2°C path**    ◉ **No policy action**    ☐ **Impacts at 1.5°C**        ⓘ

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# Conclusion and next steps

- Easy to use index for specialists and non-specialists
- High correlation with other established vulnerability indices
- Simple additive formula
- Can be used for any region

- Next step: subnational GVI

www.globaldatalab.org

www.globaldatalab.org/gvi/

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