

Mapping global gender inequality in water security

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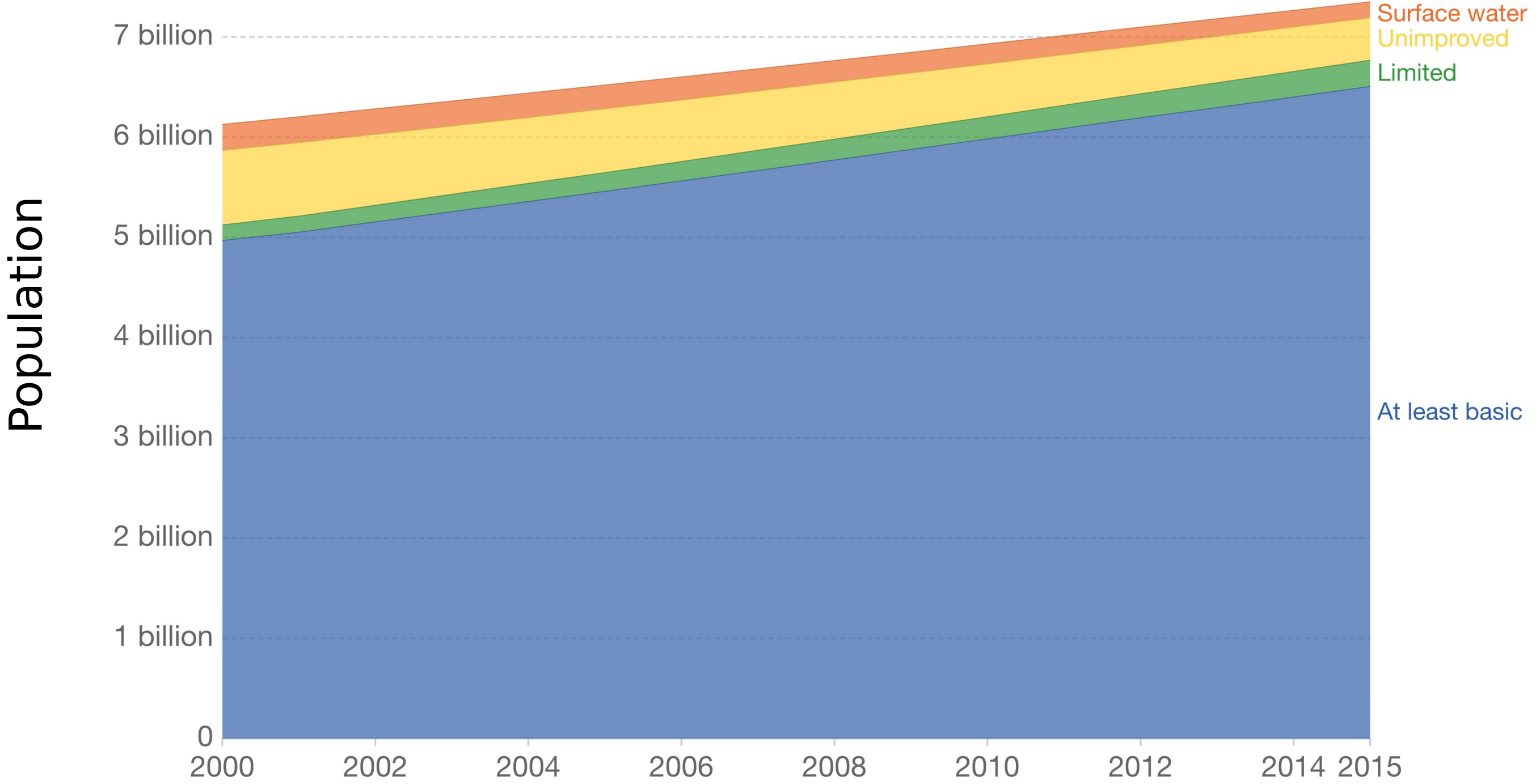
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Sustainable Development Goal 6

Equitable and **universal water access** for all by 2030 (SDG 6) is one of the most important global challenges



Source: WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (JMP)

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Despite the progress, **771 millions** still do not have access to water service (Water 2021)

Collecting water

- **Women** often take part of carrying water especially in rural Africa and Asia (Sorenson et al. 2011, UN-water 2019)
- They consume time more than 30min/day, or more during **droughts** (Bukachi et al. 2021, UN-water 2019)
- **Loss of education and labor opportunities** are pointed out (Sorenson et al. 2011, Porter et al. 2011)

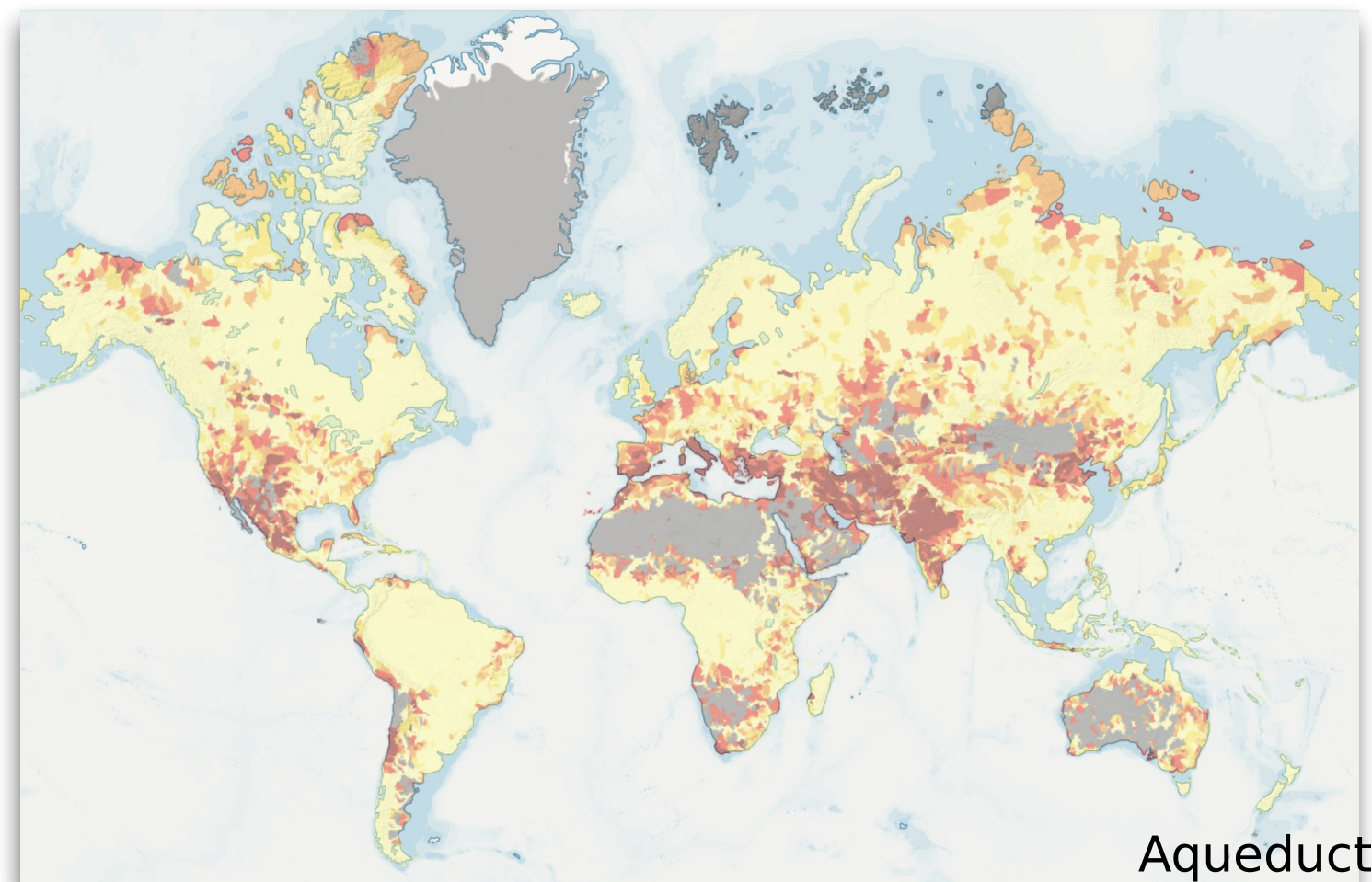
Gender inequality in water security presents a significant challenge in the world



Challenging point

Water resource assessments and gender research are conducted separately

Global water resource assessment



- Natural factors
- Global scale
- Population

Gender research

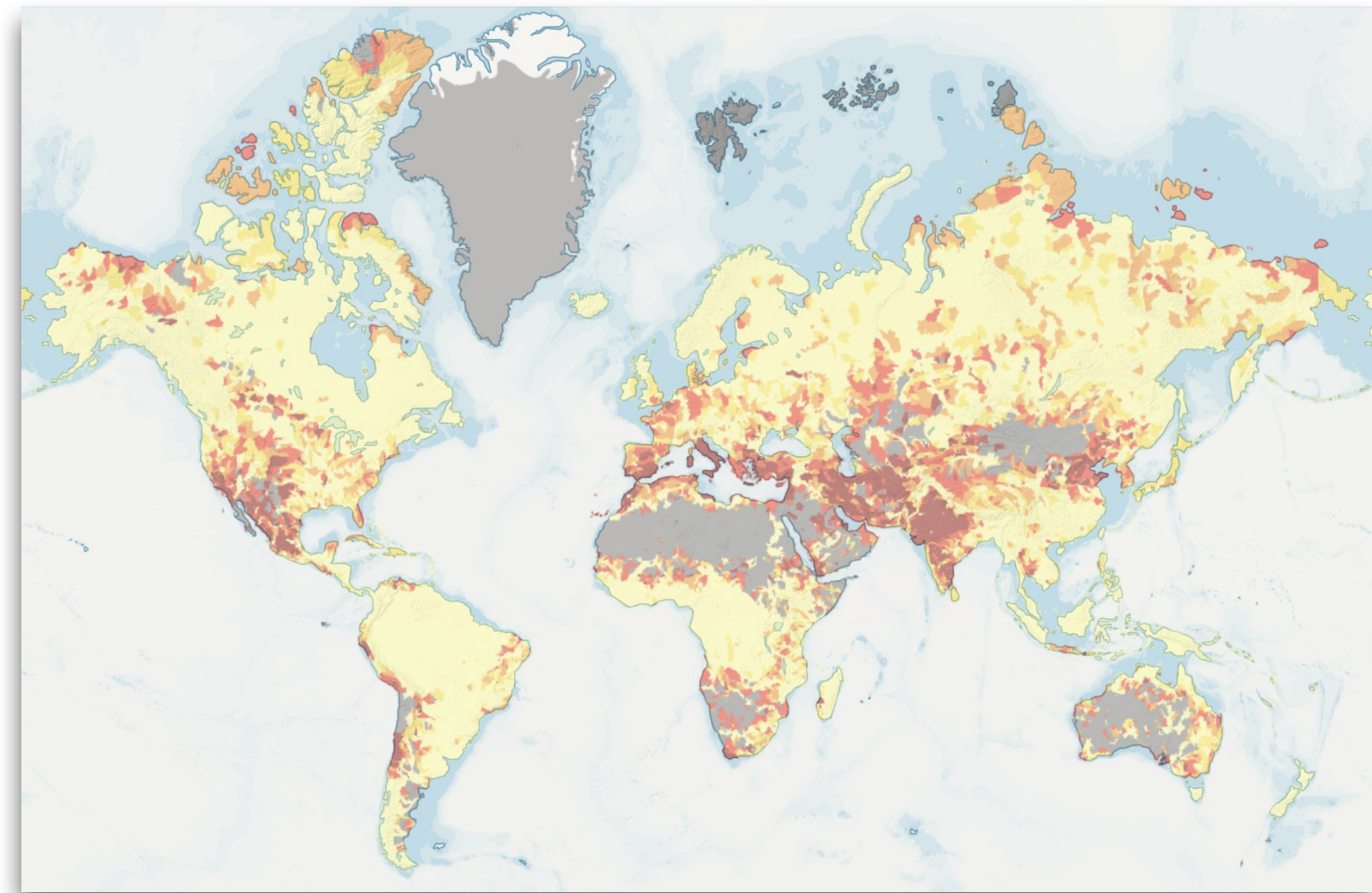


United Nation

- Social factors
- Local scale
- Population by age, gender

Large gap

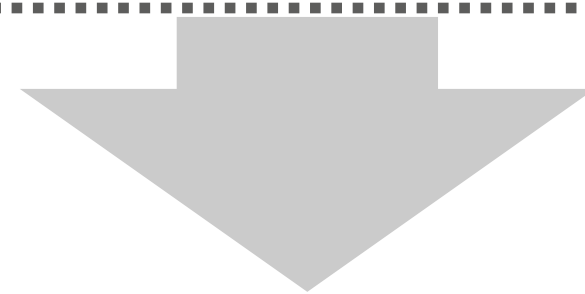
Objective



Natural Science



Social Science



Incorporating gender perspective into global water resource assessments
...Mapping gender differences in water insecurity from 2000 to 2014

Water insecurity indicators



Water stress

The ratio of total water withdrawals to available renewable surface and groundwater supplies water. 5 min (10*10km) resolution, 1963-2014. Wada et al. (2016)



Water access

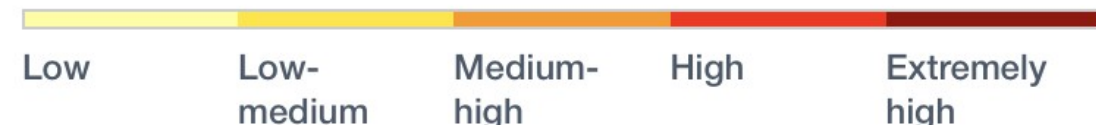
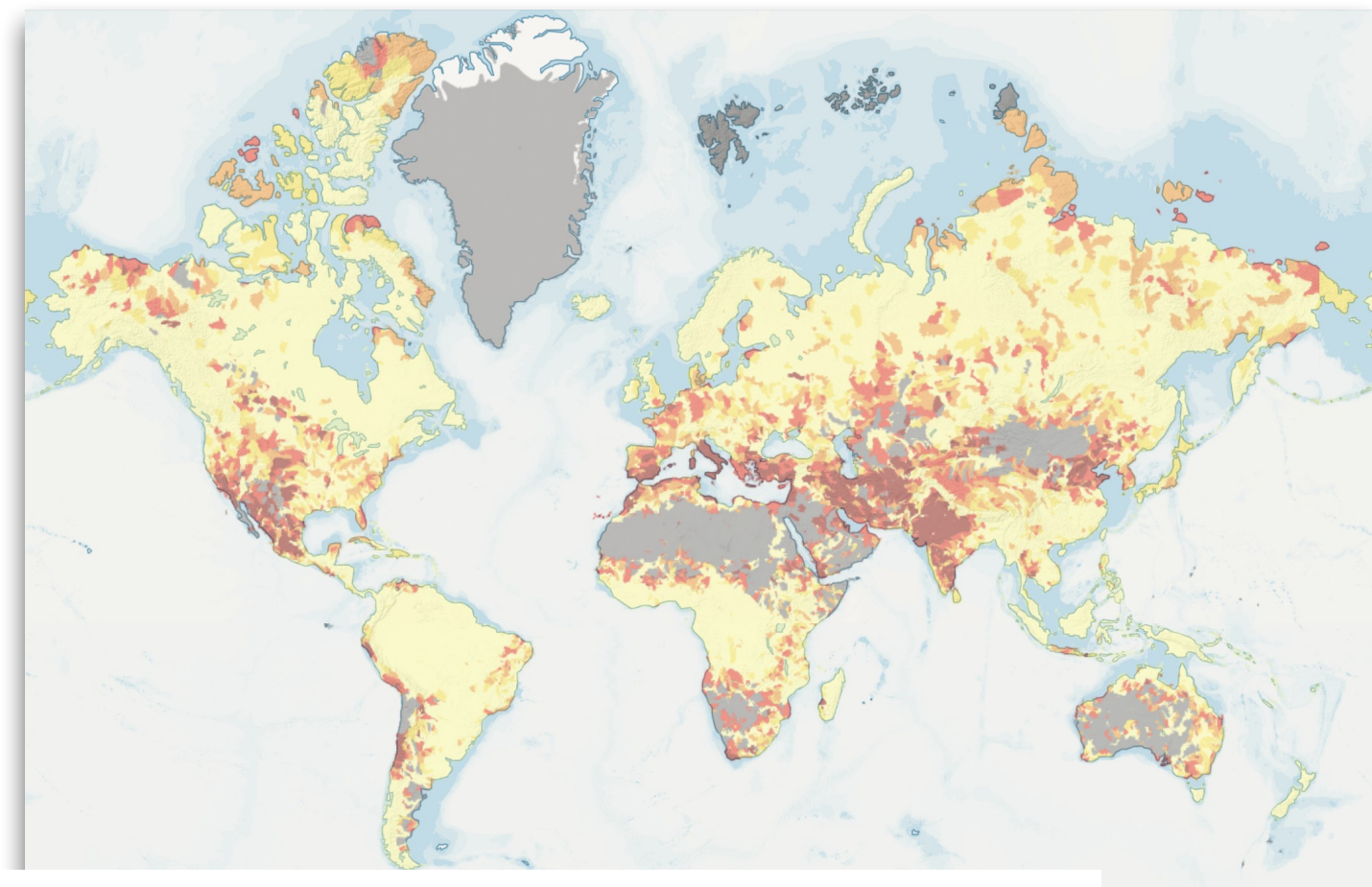
Mean percent of population who have access to piped water, 5*5km, 2000-2017. Local Burden of Disease WaSH Collaborators (2020)



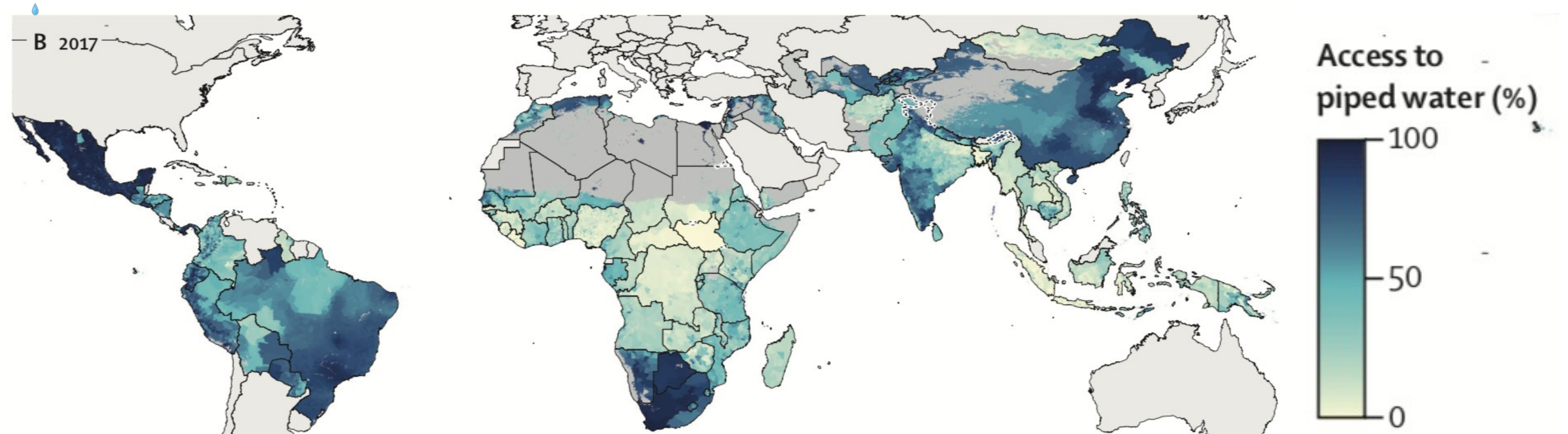
Vulnerable water environment

Characterized by both of water access (<40%) and water stress (> 40%)

Water stress



Water access



Local Burden of Disease WaSH Collaborators 2020

Aqueduct

Research flow

Step 1: Mapping and defining **water insecurity indicators**

- Areas with poor water access (< 40 %)
- Areas experiencing high water stress (40%>)
- Vulnerable areas, characterized by both poor water access (< 40%) and high water stress (40%)



Step 2: **Gender-based population estimates within each water insecurity indicator area**

- Estimating the number of Working-age (age 15-49) men and women
- Estimating the number of boys and girls (age <15), 1km gridded-data from Worldpop

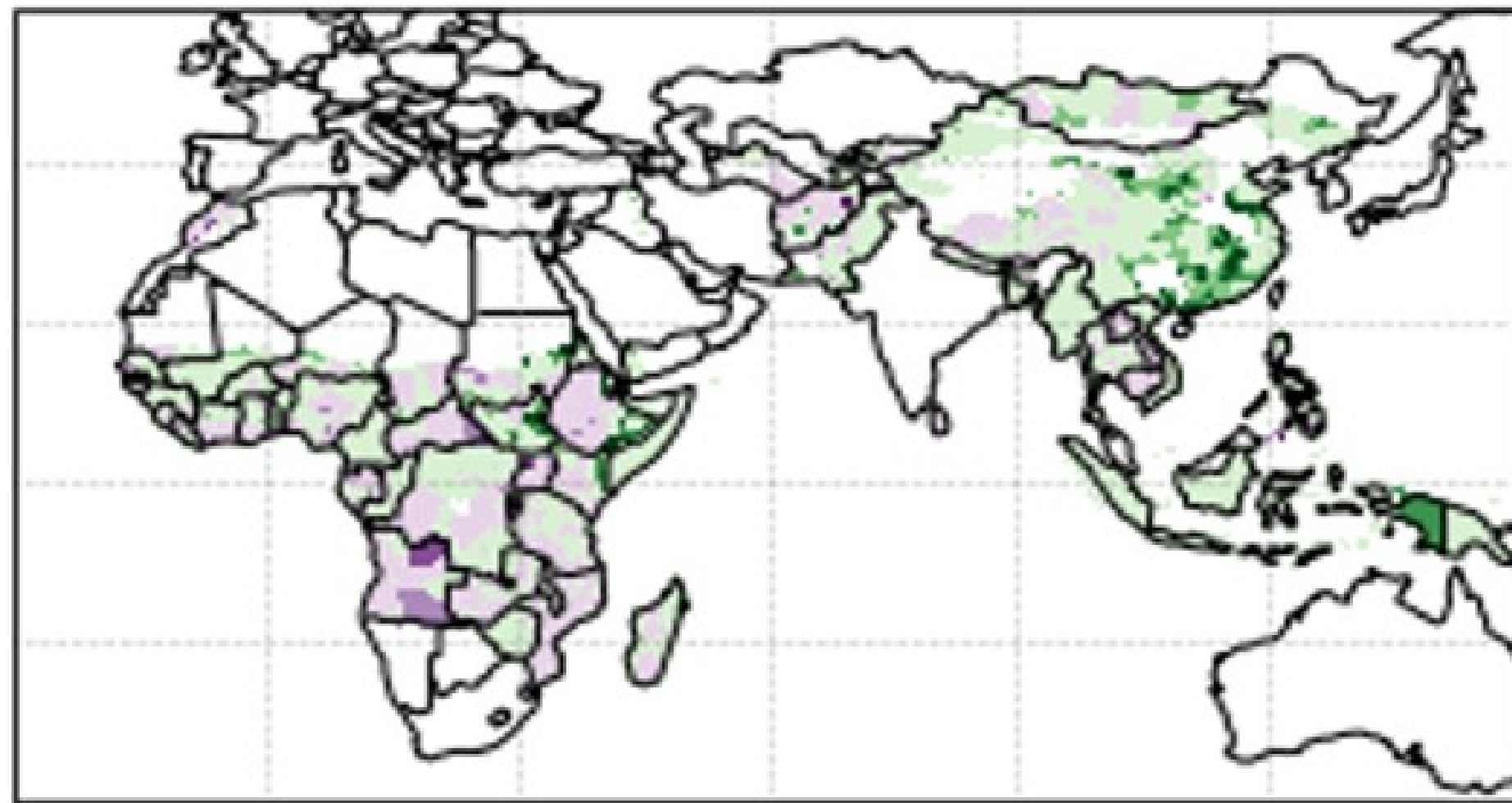


Step 3: Analyzing **gender differences across all water insecurity indicators**

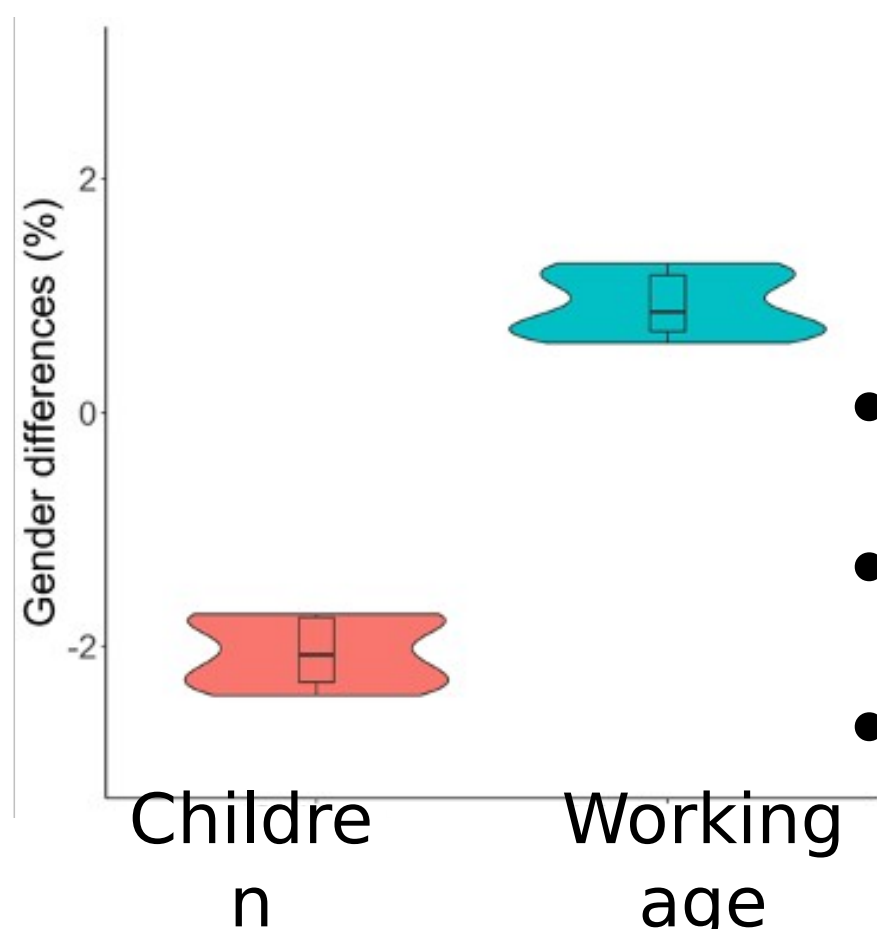
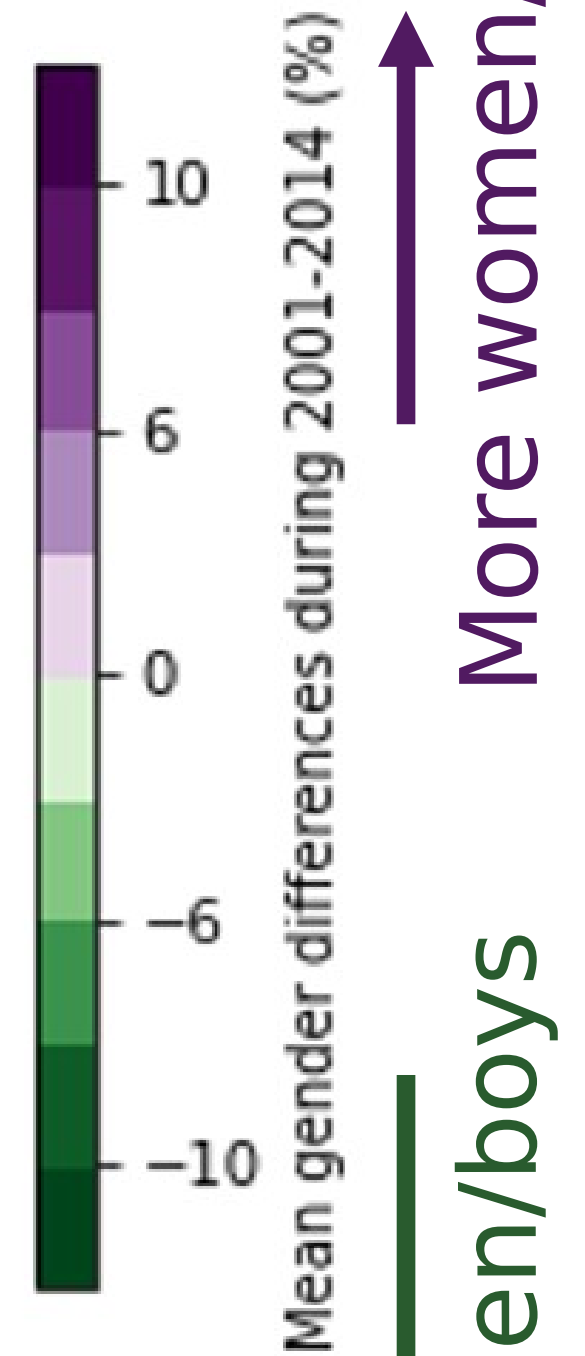
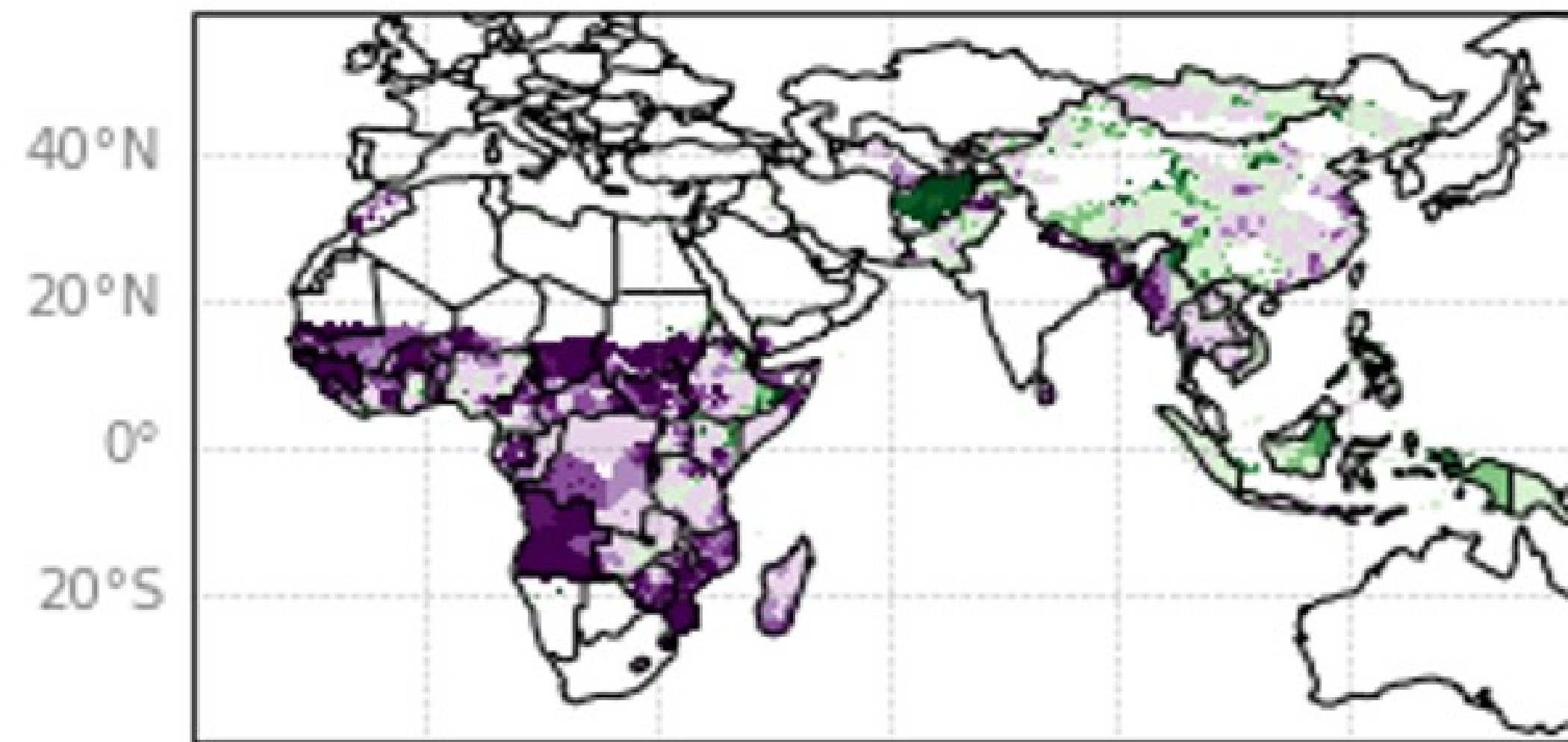
- Calculation of gender difference (%) for each water insecurity indicator
(Population of Women - Population of Men) / Total Population * 100
- Mapping gender disparities for all indicators at 5-minute grid squares (10km * 10km), 2000-2014

Gender differences with poor water access

(a) Children (age < 15)



(b) Working age population (age 15-49)

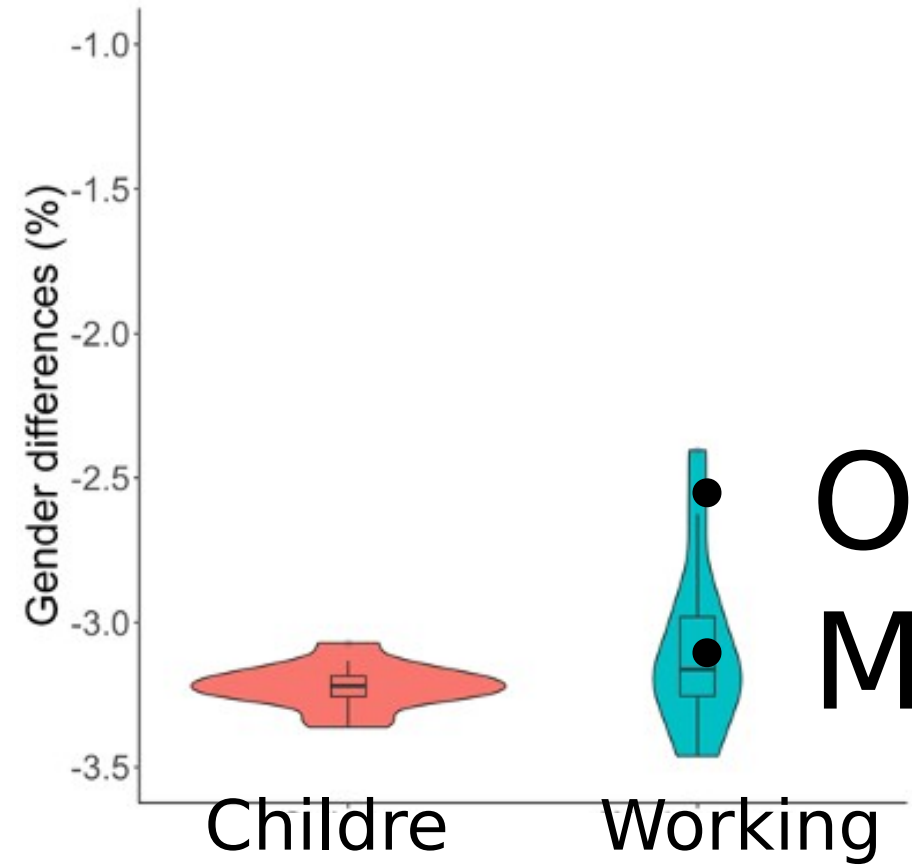
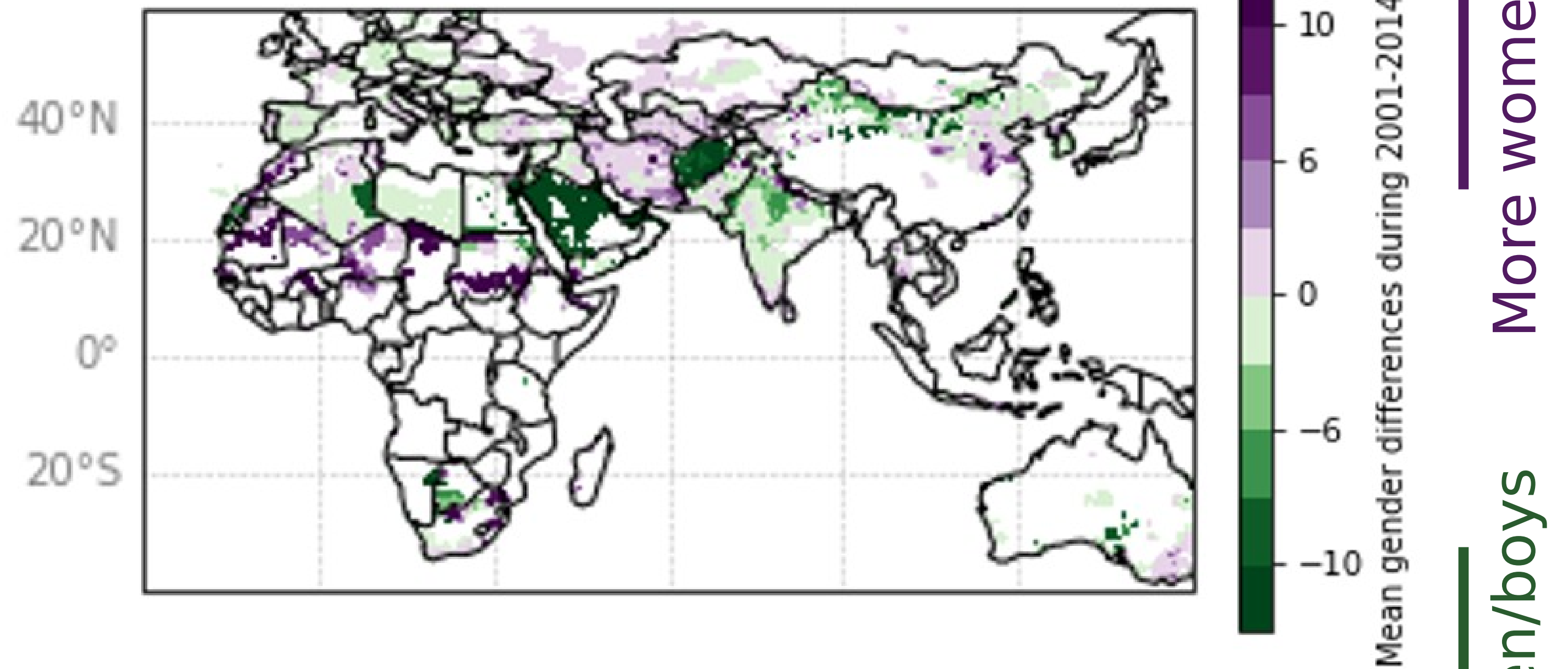
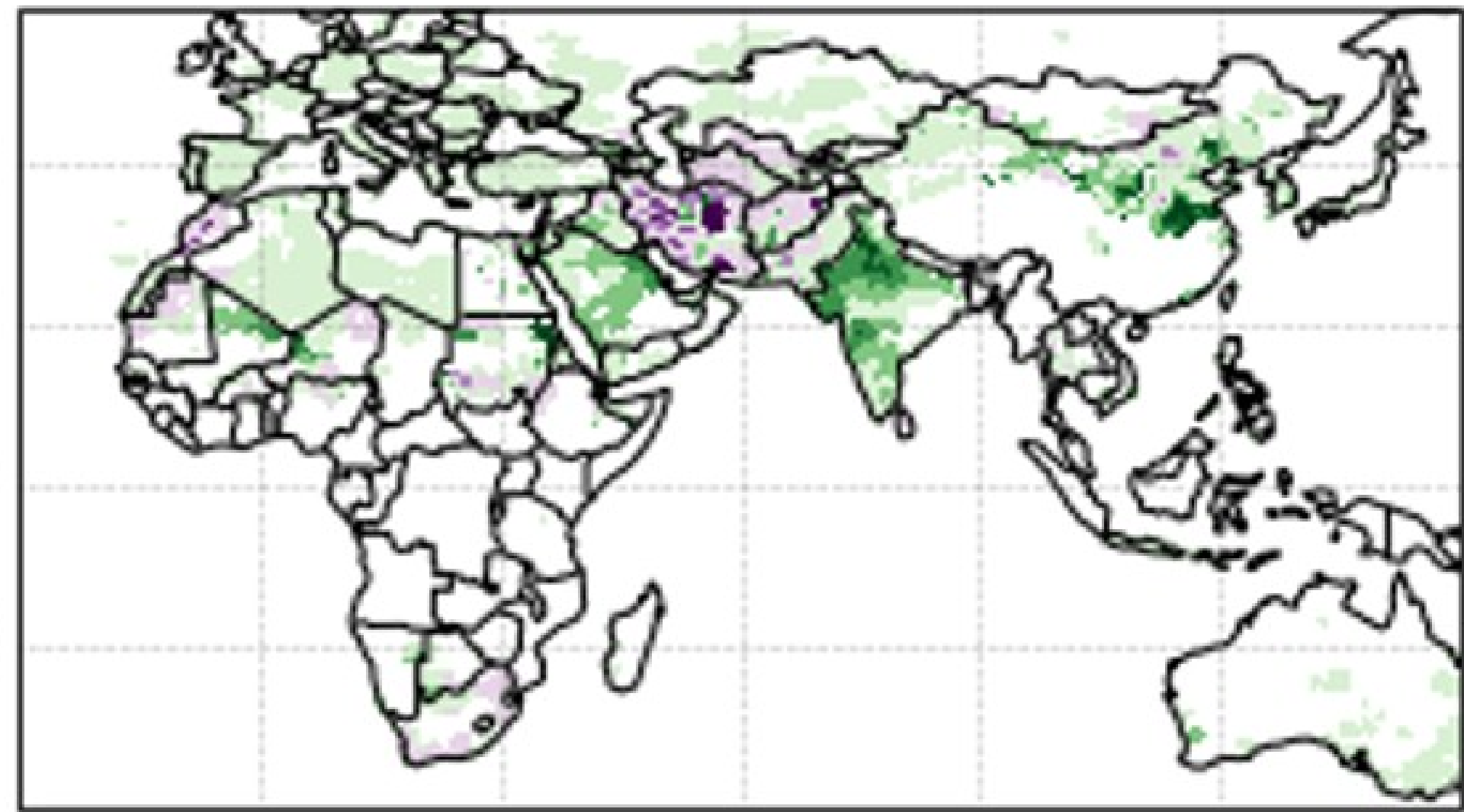


- Different trend was observed between children and adults
- More working age women with poor water access
- Note: Data in India is not available

Gender differences in high water stress

(a) Children (age < 15)

(b) Working age population (age 15-49)

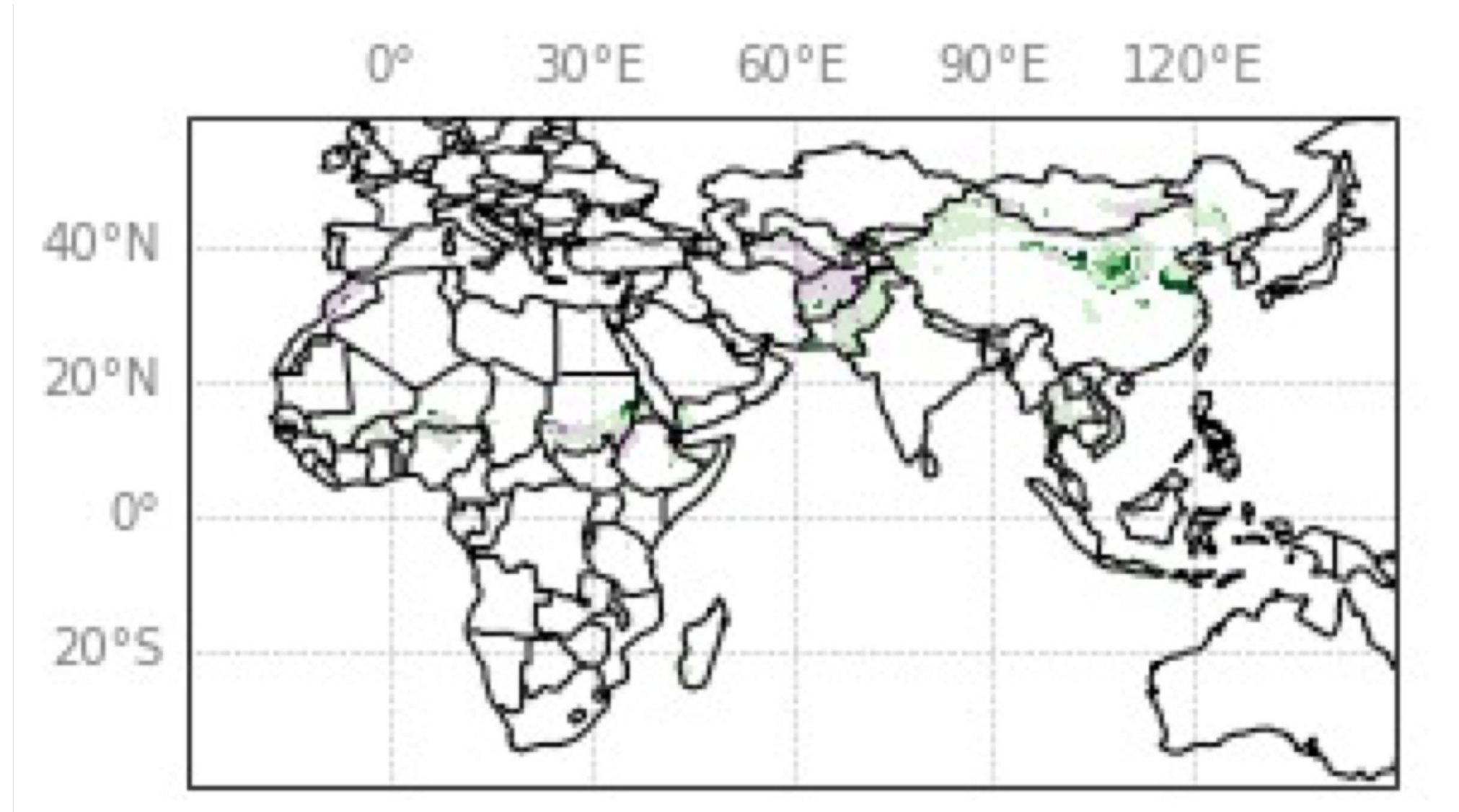


Overall same trend was observed between children and adults
More men in high water stress

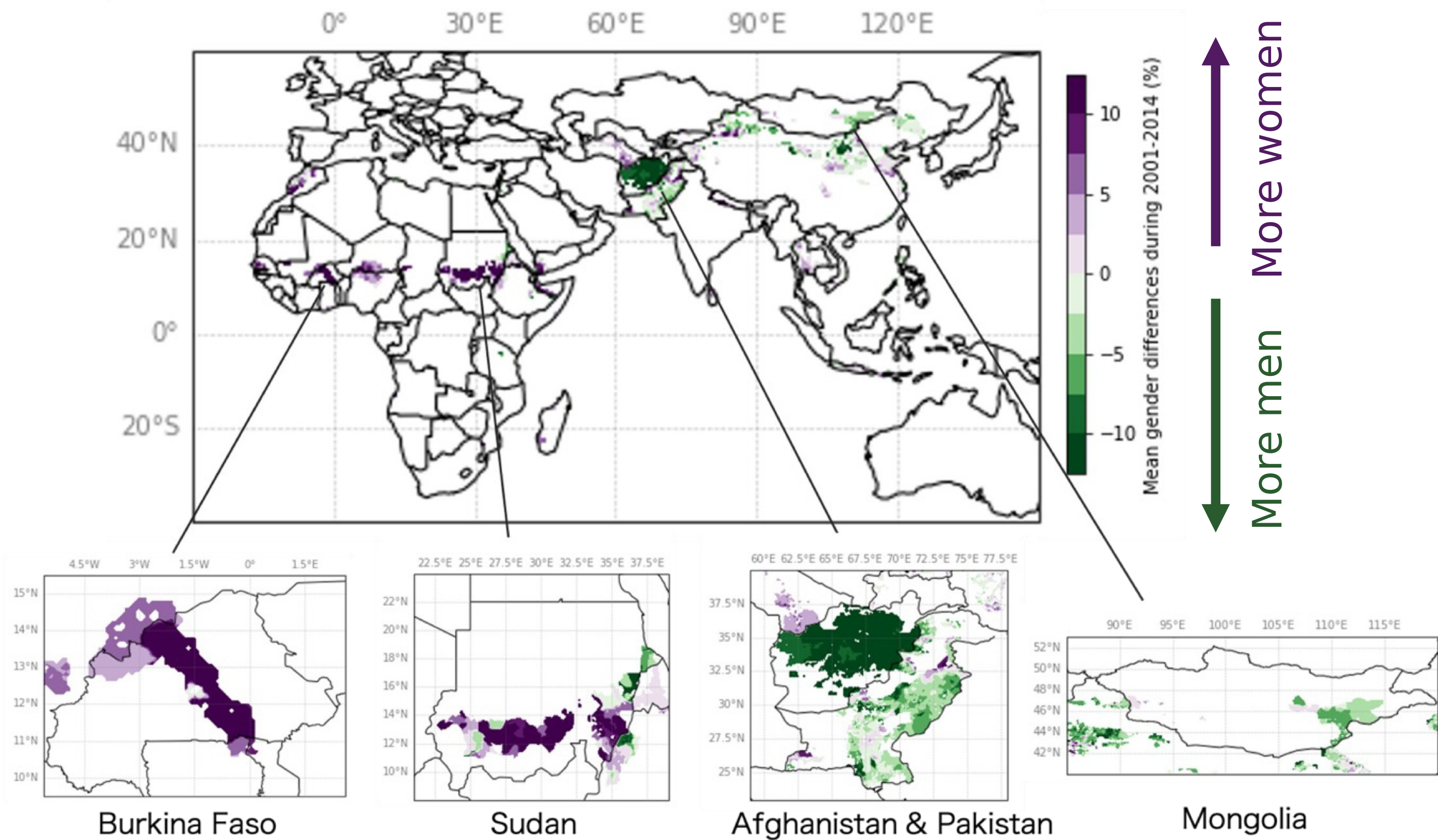
Gender differences in water vulnerable environments

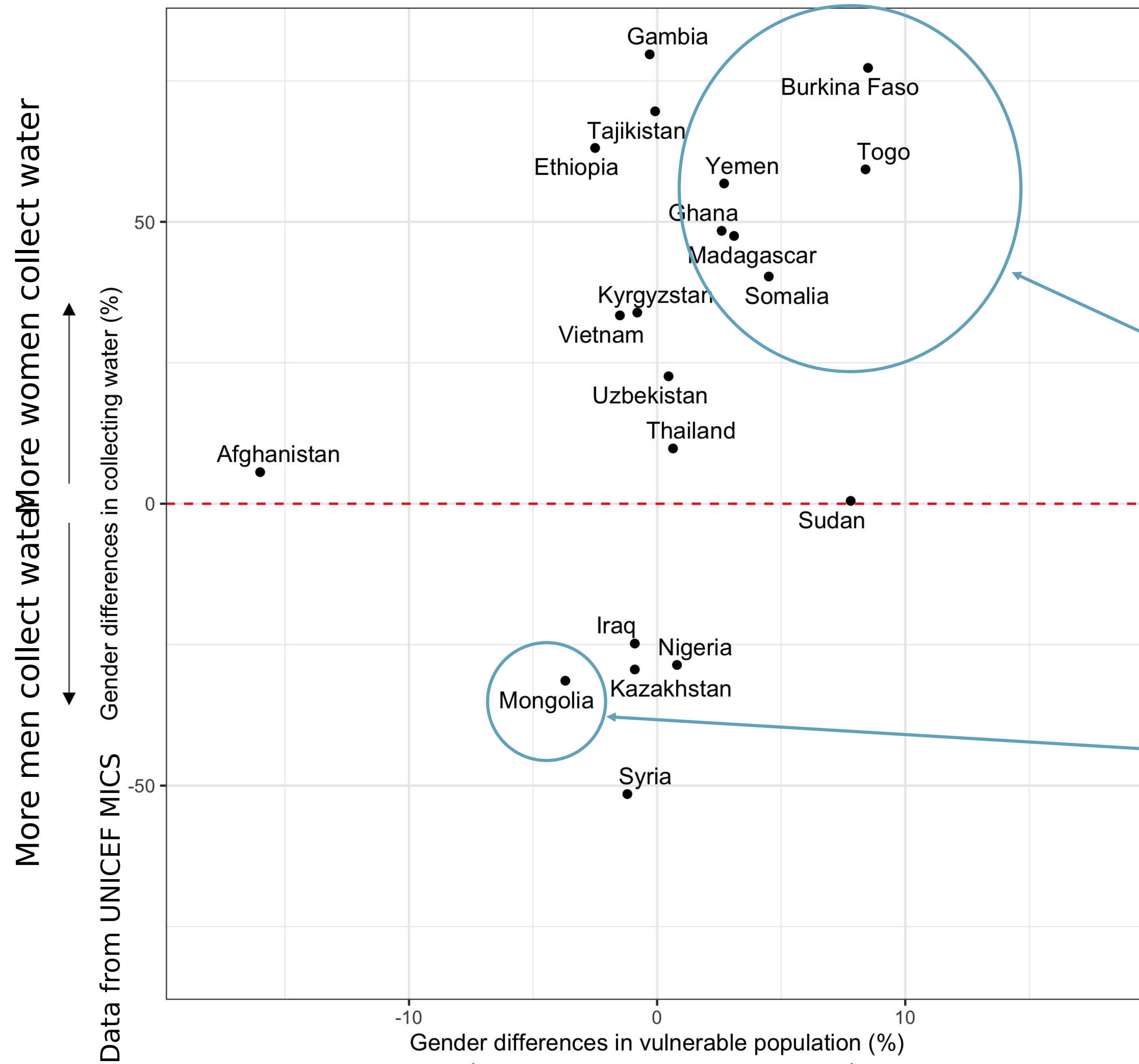


(a) Children (age < 15)



(b) Working age population (age 15-49)





- More women carry water in most of vulnerable countries

More women in vulnerable water environments and carry water

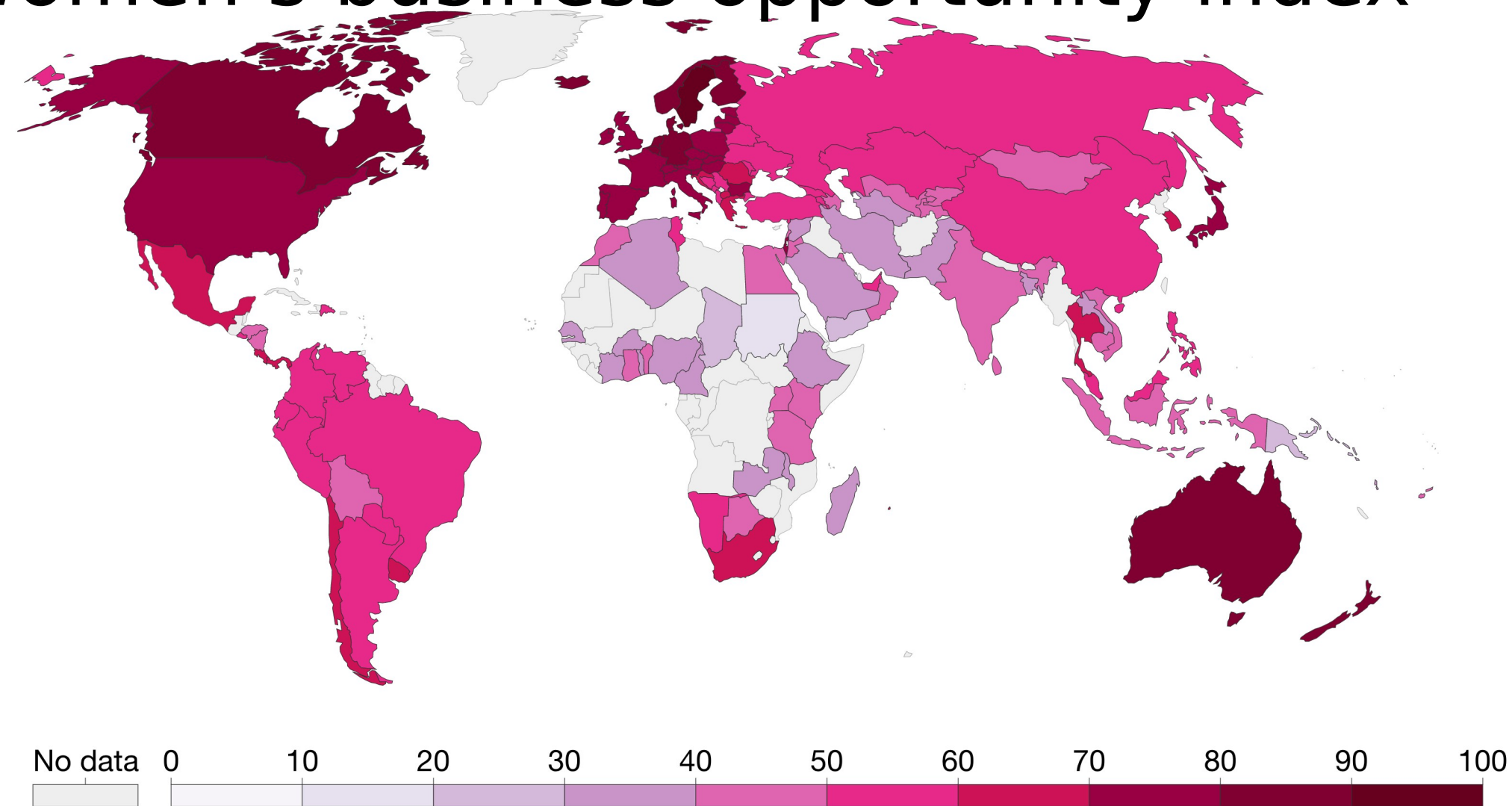
- More men in vulnerable water environments and carry water

Water insecurity and gender inequality

Gender inequality in a society would **amplify women's vulnerability to water insecurity**

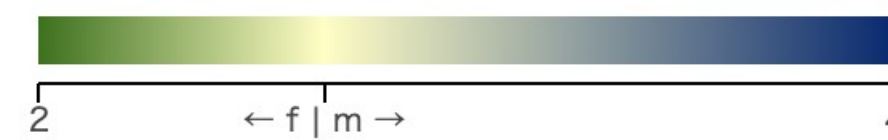
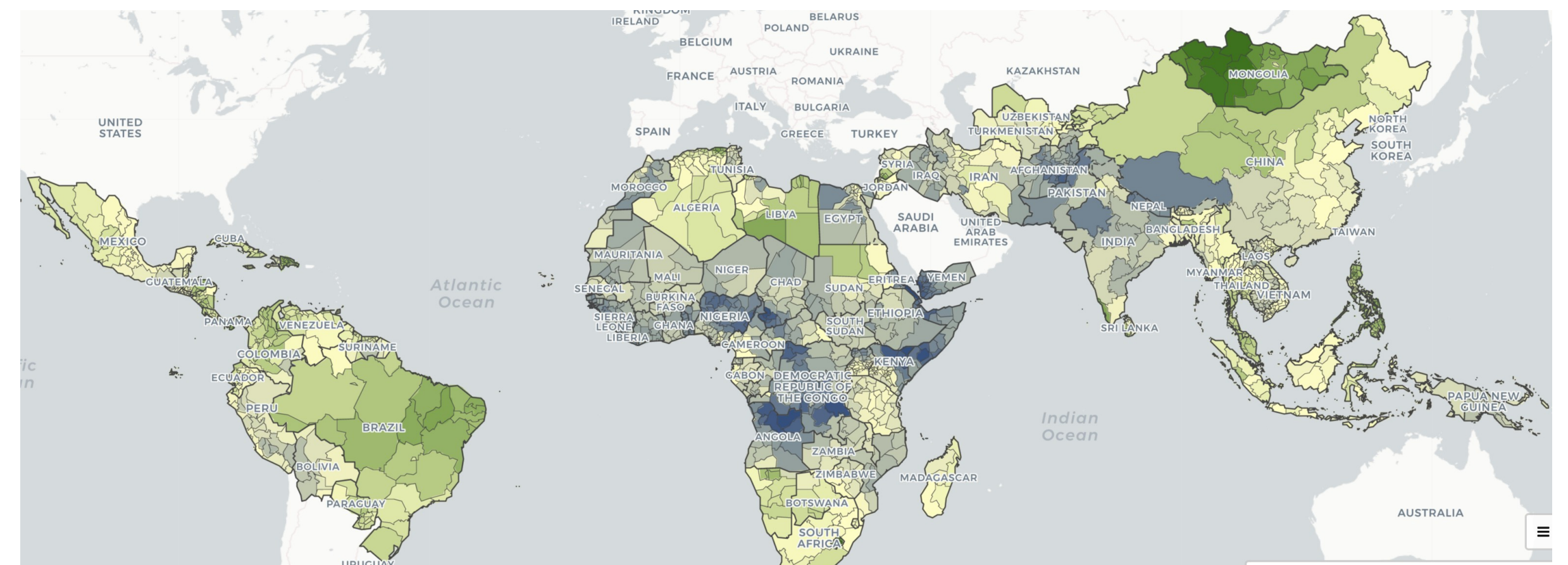
- Labour migration leads to **skewed gender distribution** in Africa (Menashe-Oren et al. 2018)
- Regions with high gender differences in water insecurity often coincide with areas of large gender inequality in education and employment opportunities

Women's business opportunity index



Our World in Data

Education difference by gender

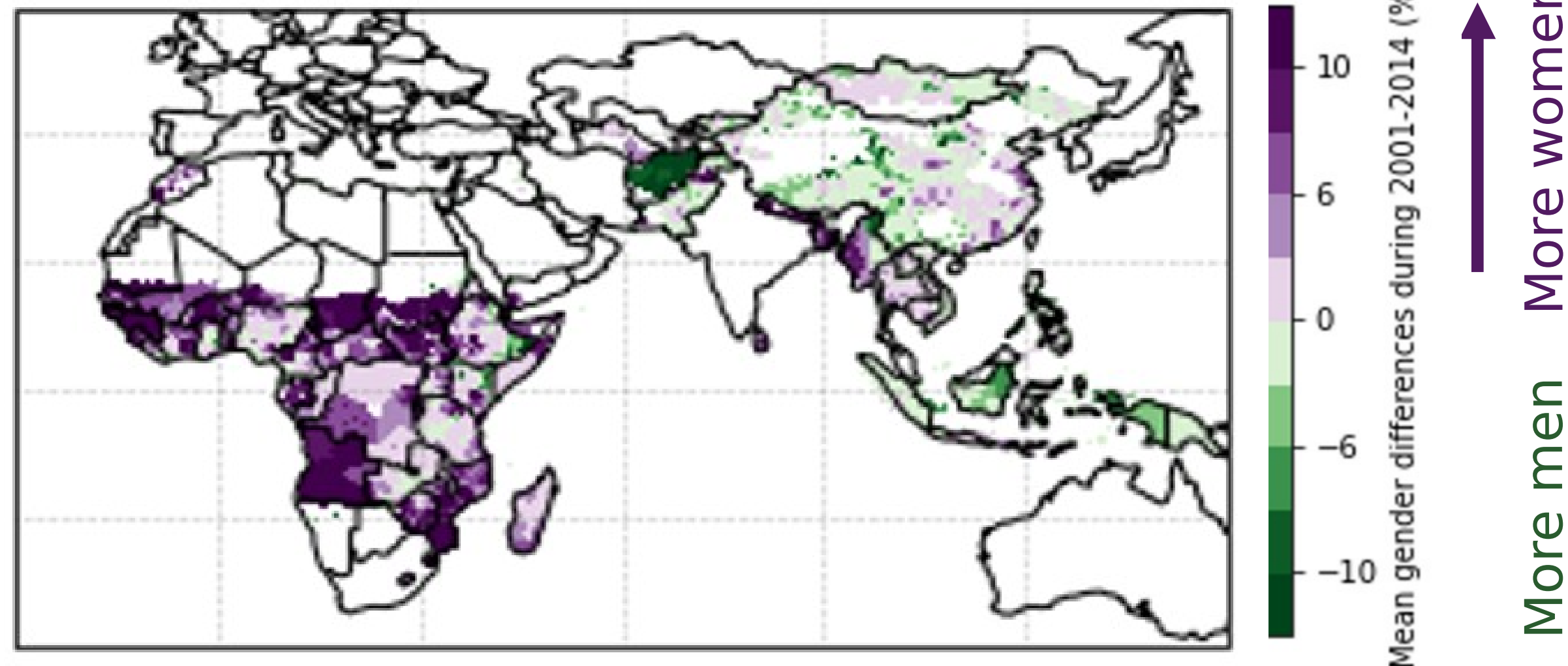


Local Burden of Disease 2020

Summary

To achieve universal and equal water access by 2030 (SDG 6), it's crucial to incorporate **gender perspectives** into **global water resource assessments**

Gender differences with poor water access

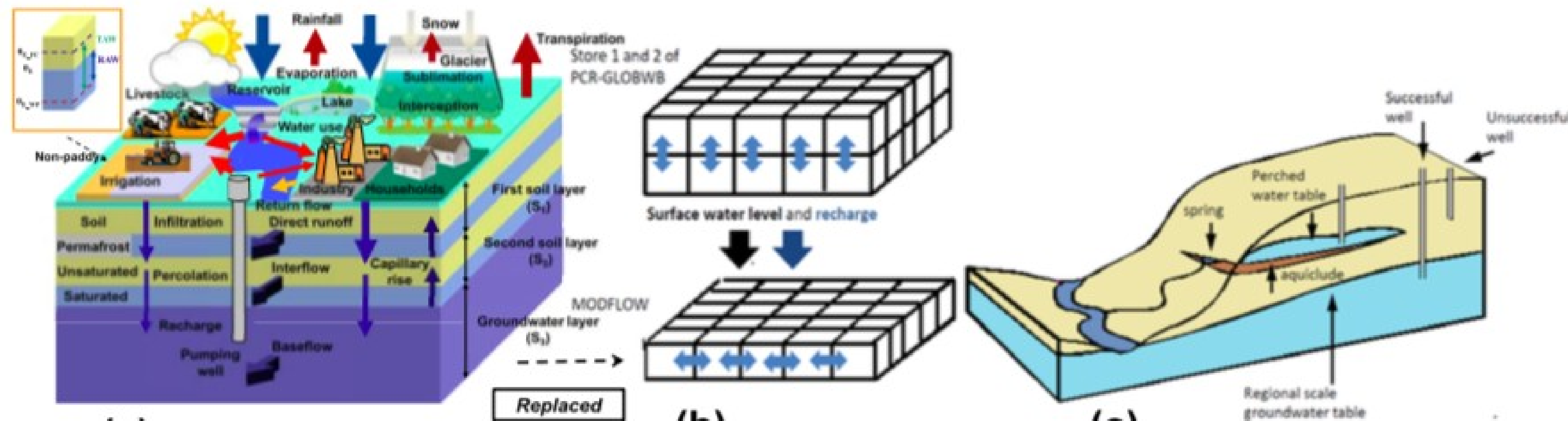


- **More women** than men were with poor water access, especially in Africa
- Women in countries such as **Burkina Faso, Yemen, Ghana and Somalia** were forced to collect water in vulnerable environments

Water stress

Water stress: water withdrawal to available water

Water withdrawal (how much people use water)



(a)
Surface water

(b)
Replaced
Available water

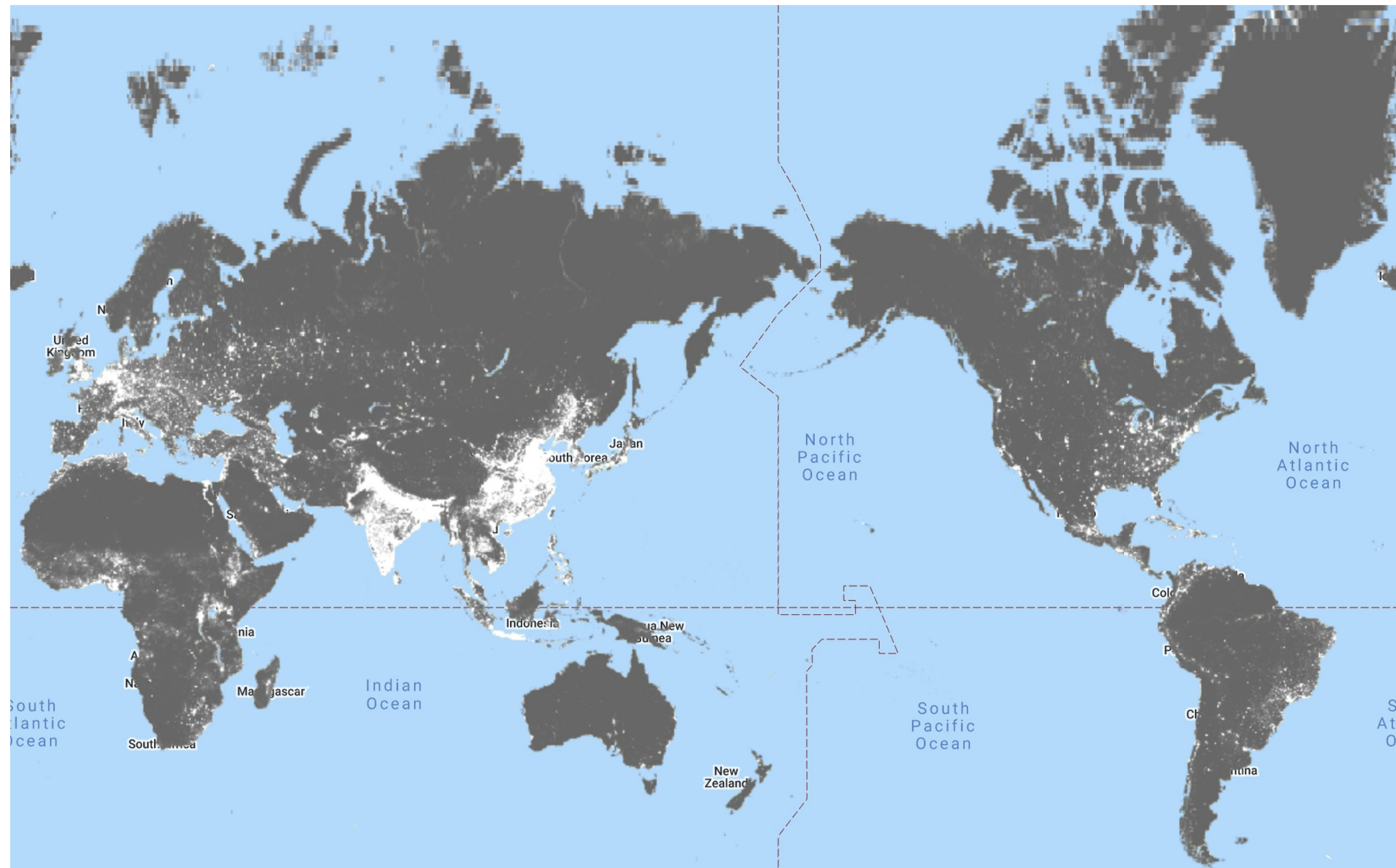
(c)
Ground water

Wada et al. (2016)

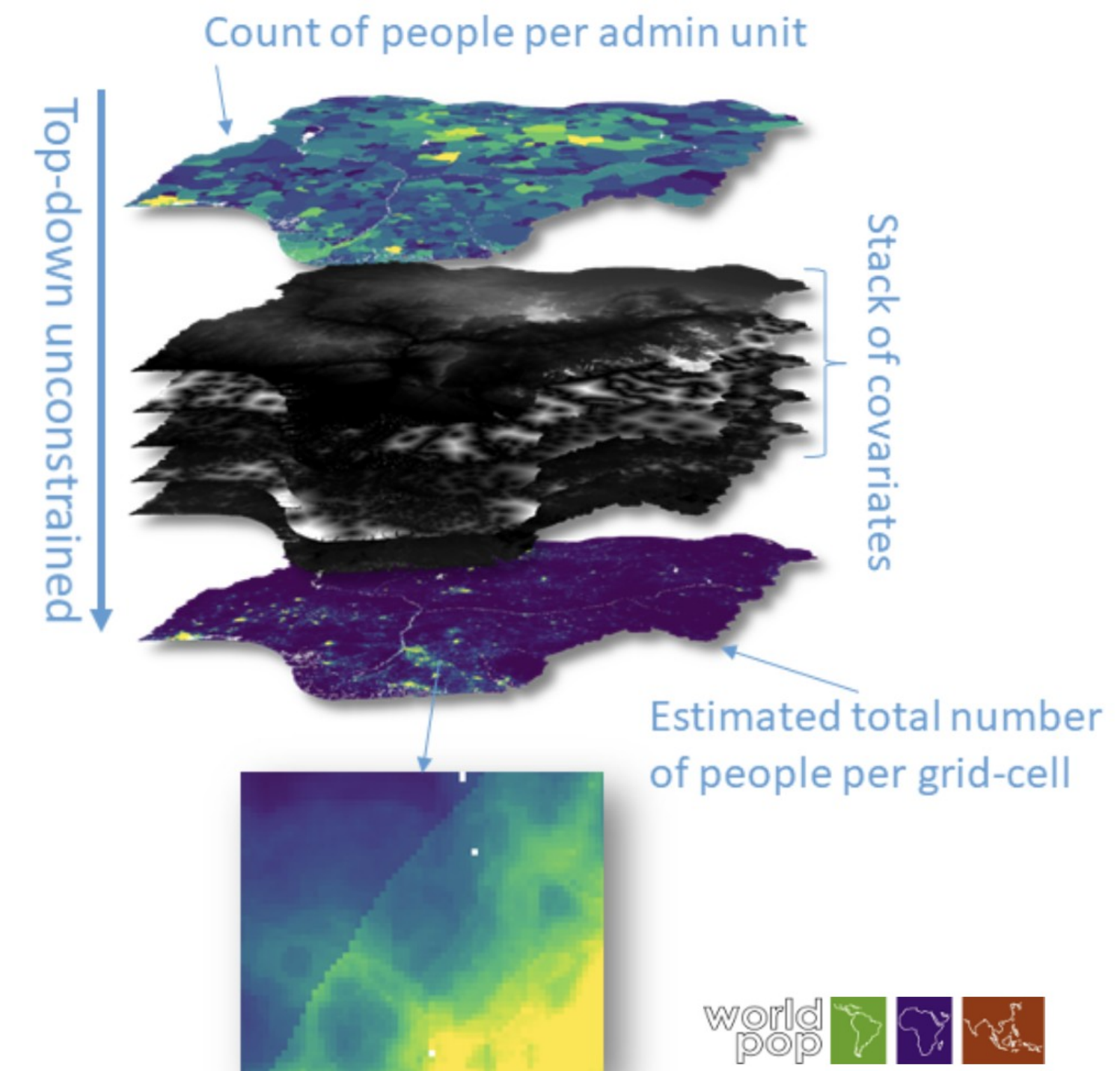
Population by age and gender

Data from Wolrdpop
Working Age (15-49) population and Children (age 5-14) by gender
30 second (1*1km) resolution, 2000-2017

Age 35-40 female population in 2001



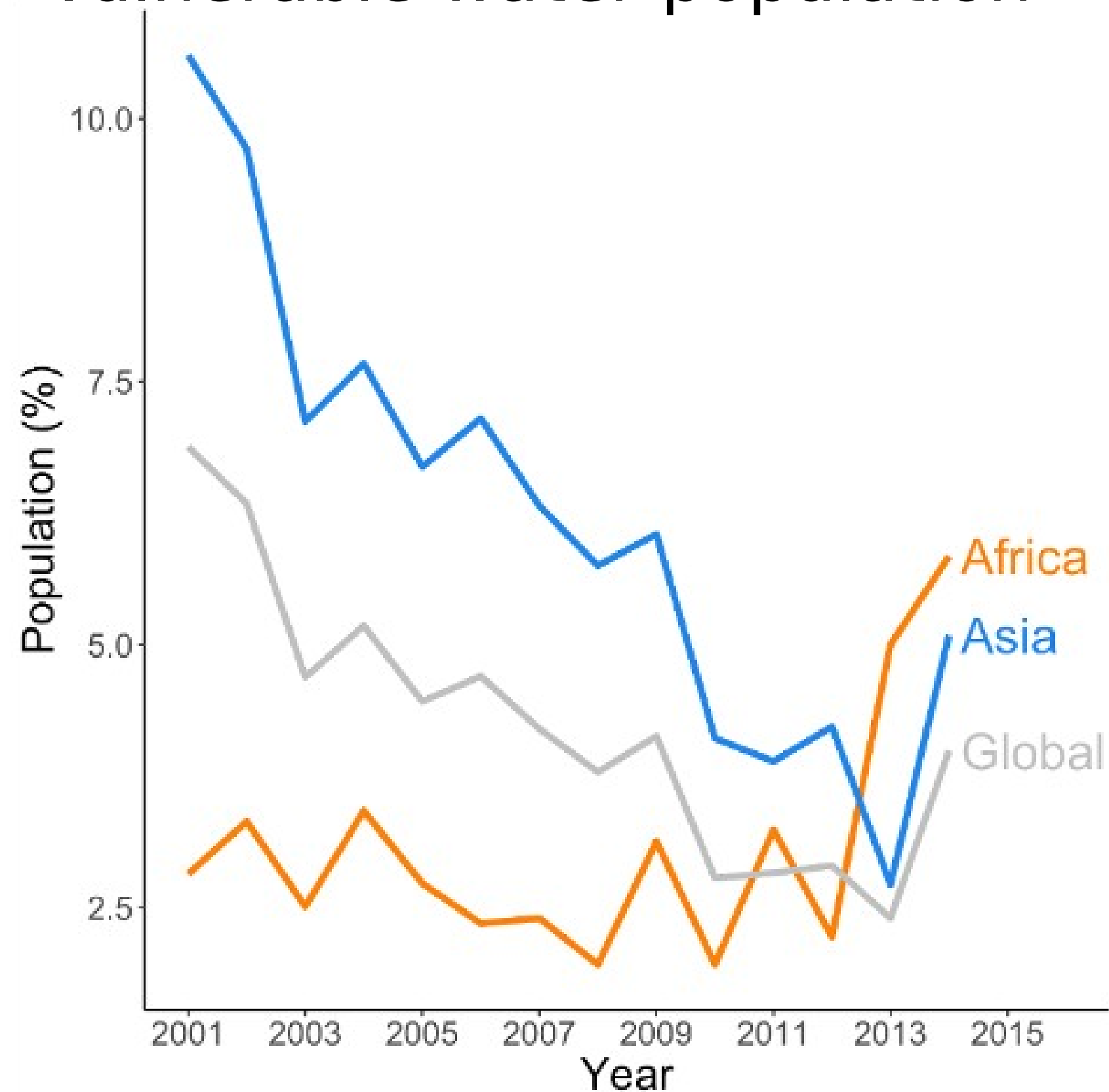
on Google earth engine



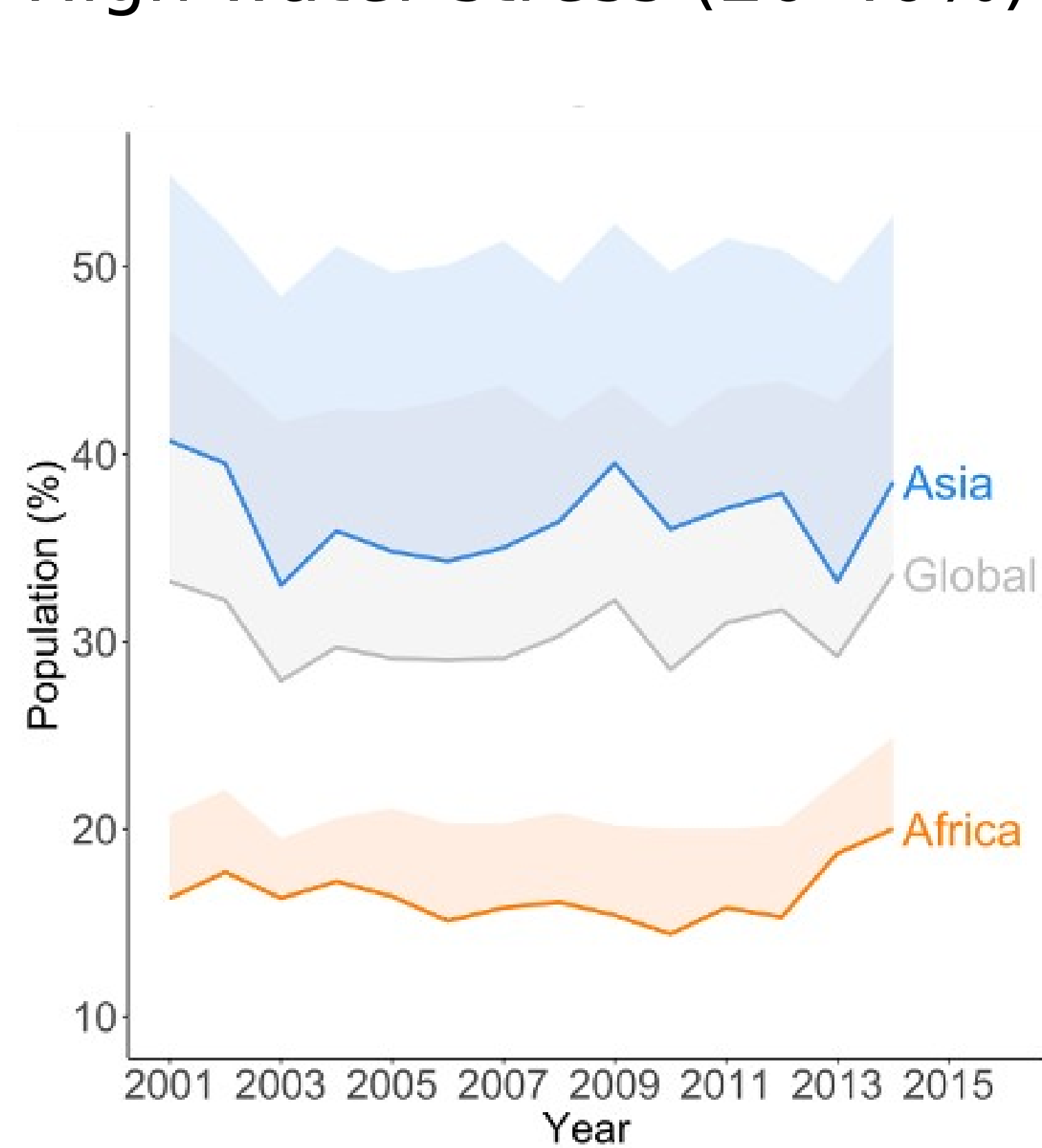
Population change in vulnerable water environment

Working-age population in vulnerable water environments doubled in Africa but decreased in Asia between 2001-2014

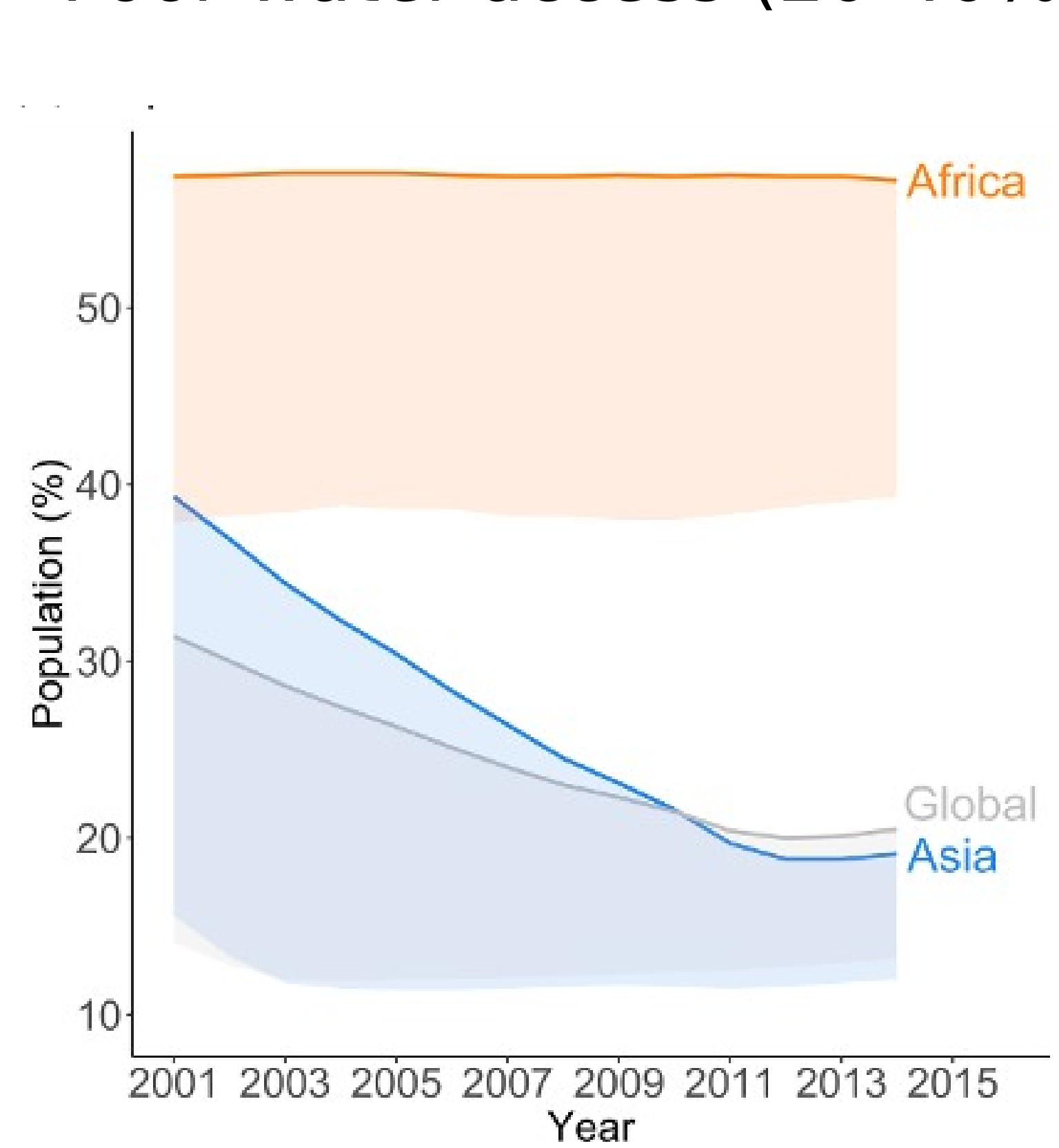
Vulnerable water population



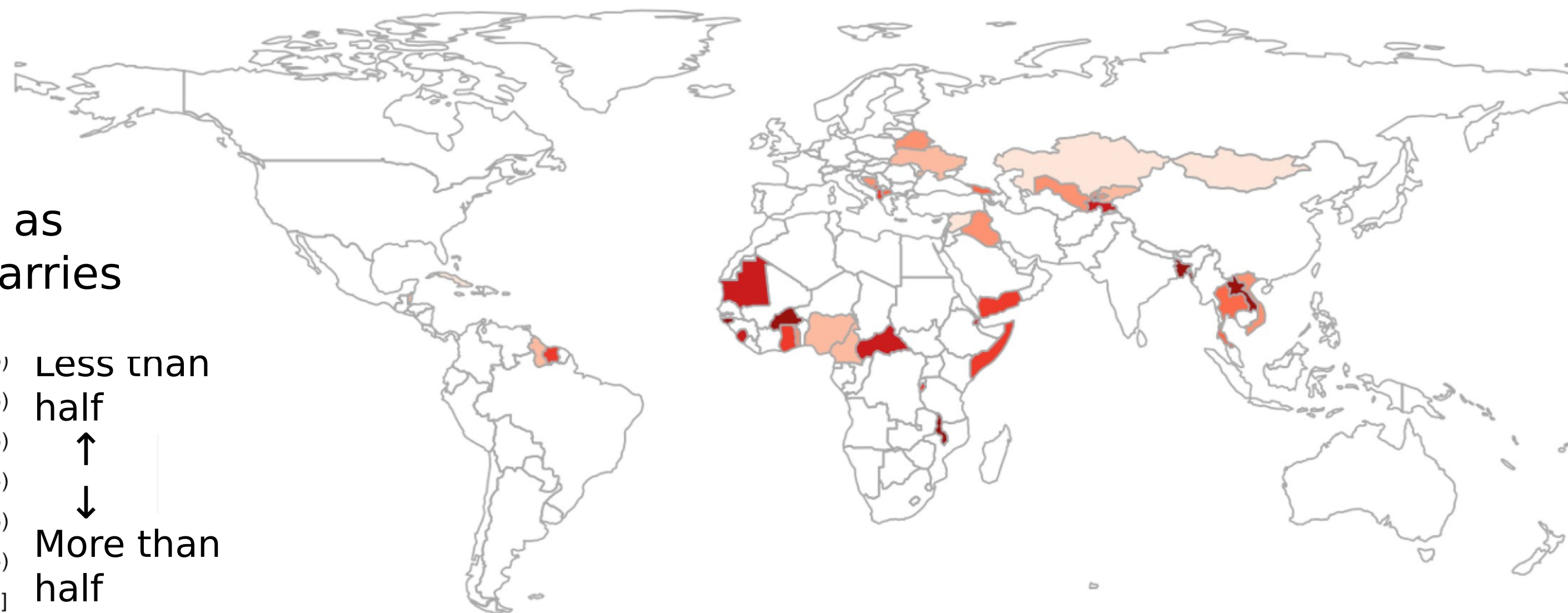
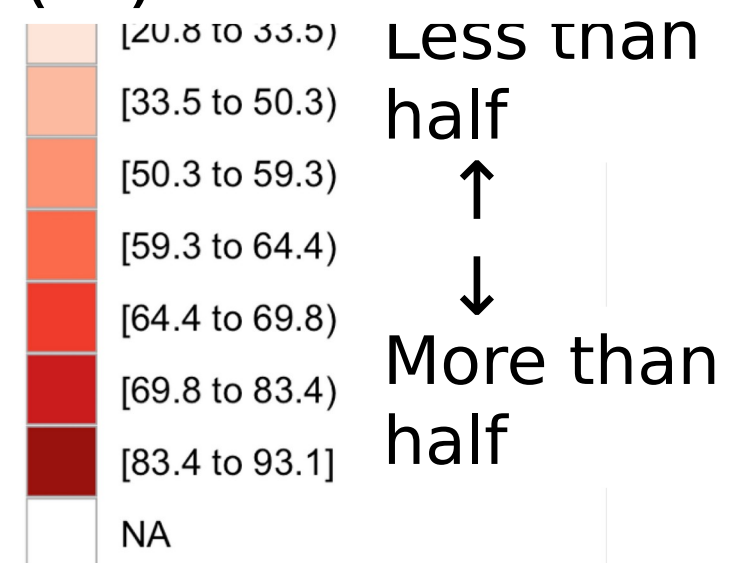
High water stress (20-40%)



Poor water access (20-40%)



Women as
water carriers
(%)



Data from Sorenson et al. 2011