**Methodological note: Social vulnerability to physical climate impacts index**

**Index Construction**

The first social vulnerability index aims to consider individuals’ vulnerability to the extreme weather events considered in the climate change exposure index (Sea level rise, drought, extreme temperature, extreme rainfall, hurricanes). The combination of the exposure index, which considers hazards (changes in climate over an area) and exposure (population living in the area), with the social vulnerability index, completes a holistic climate risk evaluation [1]. However, while, the exposure index considers the change in population and in climate extremes using climate model simulations, the vulnerability index considers present vulnerability to extreme events, since future evolution depends on investments in adaptation capacity and the development of resilience in urban and rural populations, and it is heavily clouded in uncertainty.

The present index has a global extent and thus, with the objective of having available data for the largest possible number of countries, the set of considered variables are reported at a country-wide level. While social vulnerability has structural and personal dimensions, many of which are relevant at very local scales [2], national proxies have been considered for the categories considered in the literature as determinants for vulnerability. Additional care must be exercised when comparing the social vulnerability index and the climate exposure index, since the social index is constructed at a national scale, while the climate exposure has been derived from spatially explicit population and climate data. Thus, highly vulnerable population need not be located in the same places where climate impacts are present. However, the vulnerability index gives a wide glimpse into the global inequalities determining which countries will be more affected by climate change.

The index is composed by five categories: wealth, health, age dependency, rurality, and gender. Each category is represented by one variable. For each category, a country is assigned a grade from 0 (least vulnerable) to 10 (most vulnerable) according to its corresponding rank percentile (a generalization of the classical statistical percentile that allows for repeated values). The final vulnerability index is calculated by averaging the five categories and normalizing the result to have a value of 0 for the least vulnerable country and 10 for the most vulnerable one.

For the wealth category, the selected variable is thewealth component of HDI (log GNI per capita, PPP), as calculated by UNPD [3]. The variable is relevant since higher income gives the population more agency to invest in adaptation measures, or to have assets such as cars, air conditioning, etc. that improve their mobility and reduce their exposure [4] [5]. The variable for the health category is life expectancy at birth, reported as a component of the HDI by UNPD [3] and by several national governments for their constituencies. Life expectancy is an indirect measure of the general health of individuals, which is important in the comorbidities that can increase excess deaths, and the quality of the health system, including its ability to serve individuals during emergencies [6] [7]**.** Age dependencyis measured by the percent of population under 15 or over 65 years old, using data from the World Bank’s Population Estimates and Projections [8]. Young and old individuals are more affected by extreme events and have less agency due to their increased dependency [9] [10]. Rurality is measured by the percent of rural population, reported in UNESCO’s Institute of Statistics [11]**.** Rural areas are generally less developed, with less health facilities, and the sparse population can mean they are harder to serve with emergency, early waning, and preventive services [12]. For the last category, gender, the variable is UNDP’s GDI, the Gender Development Index [3]. The GDI measures the difference access to wealth, education, and health between males and females, making women less resilient [14] [15].

Figure 1 represents the Social Vulnerability Index to Physical Climate Impacts. The 10 most vulnerable countries are Chad (Index value: 10), South Sudan (10), Niger (9.9), Central African Republic (9.7), Somalia (9.6), Afghanistan (9.5), Burundi (9.4), Mali (9.3), Guinea (9.3), and Burkina Faso (9.2). Except for Afghanistan, the most vulnerable countries are all located in Sub-Saharan Africa, a region additionally expected to bear the brunt of climate impacts.

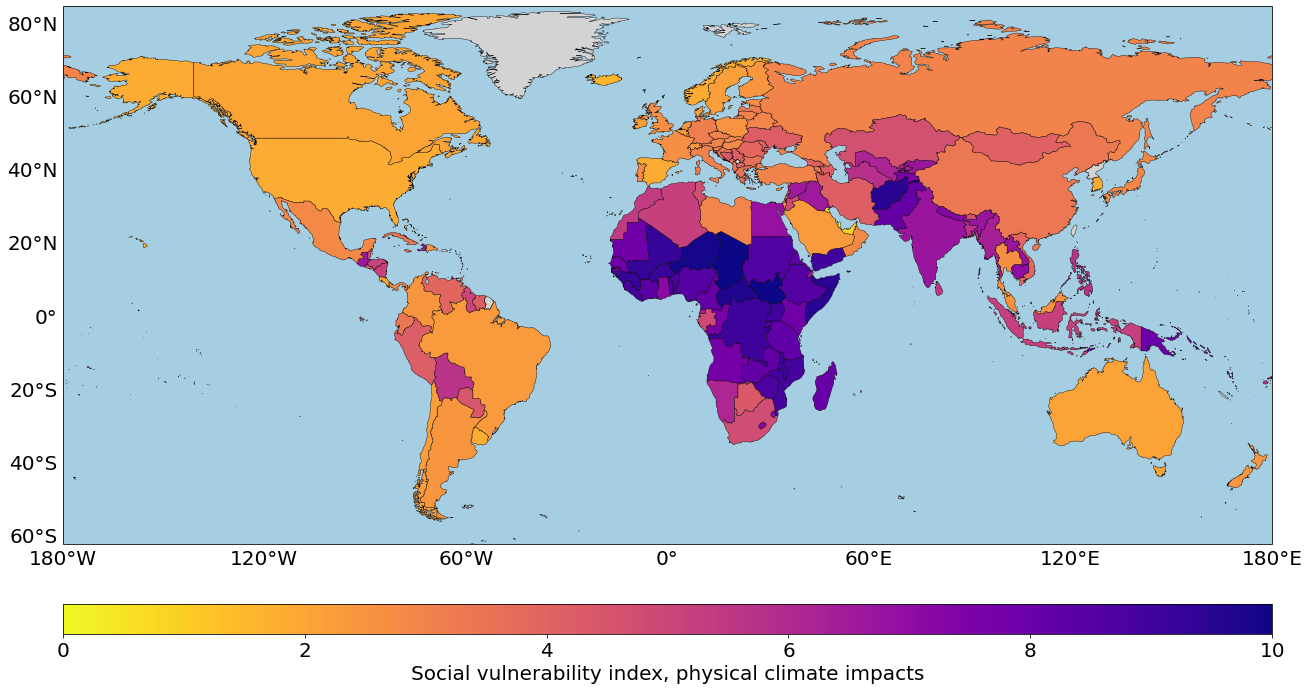


Figure 1. Social vulnerability to physical climate impacts

**Climate change risk index**

The final climate change risk index has been obtained by calculating the average of the climate change exposure index and the social vulnerability to physical climate impacts index and normalizing from 0 (least at risk) to 10 (most at risk). Figure 2 shows the risk index. Therefore, the 10 countries most at risk from climate change are Somalia (Risk index value: 10), Montserrat (9.4), Guinea (9.2), Yemen (9.14), Anguilla (9.14), Guadeloupe (8.9), Niger (8.6), Benin (8.6), Chad (8.6), and Pakistan (8.5).

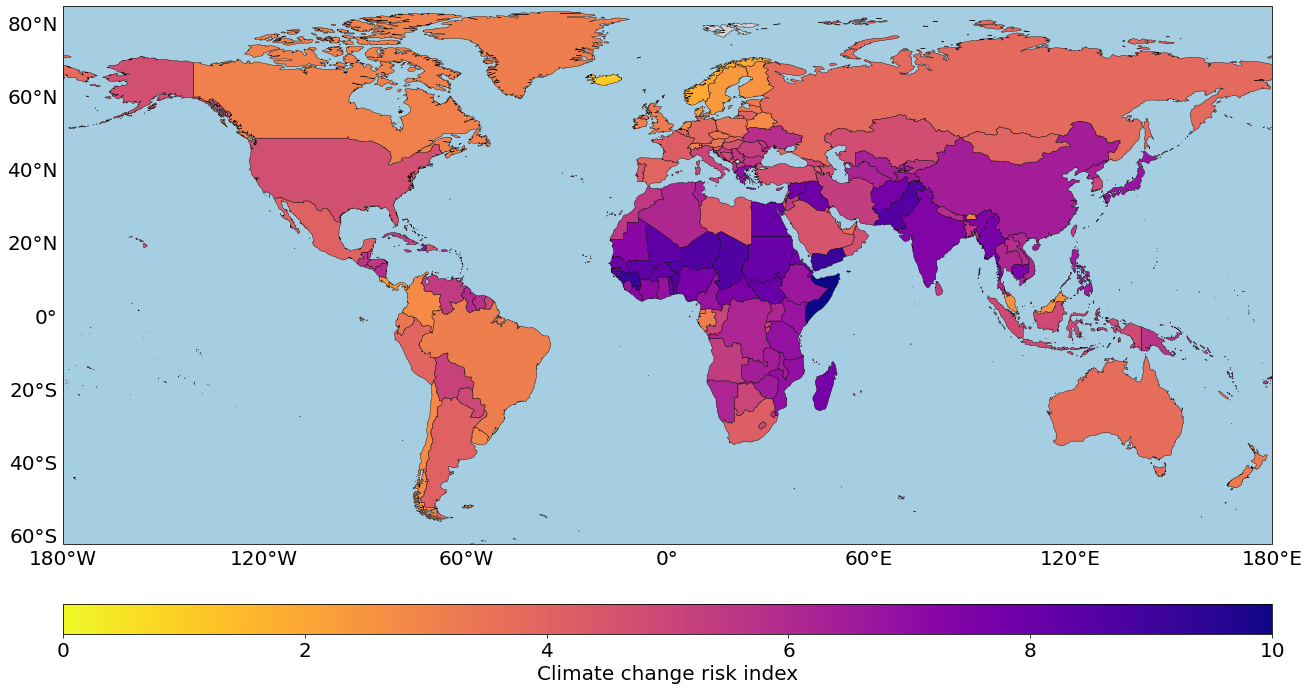
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Figure 2. Climate change risk index

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**Annex A: Physical climate vulnerability categories**

Figure A.1 represents the wealth category, measured by the wealth component of the Human Development Index (log GNI, PPP). The 10 countries with the lowest GNI per capita, measured in 2017 PPP $, are South Sudan (691), Burundi (712), Central African Republic (869), Somalia (1,072), Democratic Republic of the Congo (1,080), Yemen (1,106), Mozambique (1,219), Niger (1,283), Liberia (1,330), and Afghanistan (1,335).

Figure A.2 represents the health category, measured by life expectancy at birth. The 10 countries with the lowest life expectancy at birth are Lesotho (53.0 years), Chad (53.0), Nigeria (53.6), Central African Republic (54.5), South Sudan (55.6), Somalia (56.1), the Kingdom of Eswatini (56.4), Namibia (58.1), Côte d'Ivoire (58.9), and Guinea (59).

Figure A.3 represents the age dependency category, measured by percentage of population below 15 or above 65 years old. The 10 countries with the largest percentage of dependent population are Niger (51.2% of total population), Central African Republic (50.4%), Somalia (49.4%), Democratic Republic of the Congo (49.4%), Chad (49.4%), Mali (49.3%), Burundi (47.6%), Angola (47.2%), United Republic of Tanzania (46.2%), and Uganda (56.1%).

Figure A.4 represents the rurality category, measured by % of rural population. The 10 countries with the largest percentage of rural population are Papua New Guinea (86.3% of total population), Liechtenstein (85.4%), Burundi (85.2%), Niger (82.3%), Samoa (82.5%), Rwanda (82.1%), Malawi (81.7%), Saint Lucia (80.8%), Sri Lanka (80.8%), and South Sudan (78.8%).

Figure A.5 represents the gender category, measured by the GDI. The 10 countries with the lowest Gender Development Index are Yemen (0.456), Afghanistan (0.622), Somalia (0.769), Chad (0.776), Iraq (0.786), Syrian Arab Republic (0.805), Central African Republic (0.810), Guinea (0.818), Niger (0.826), and Mali (0.830).

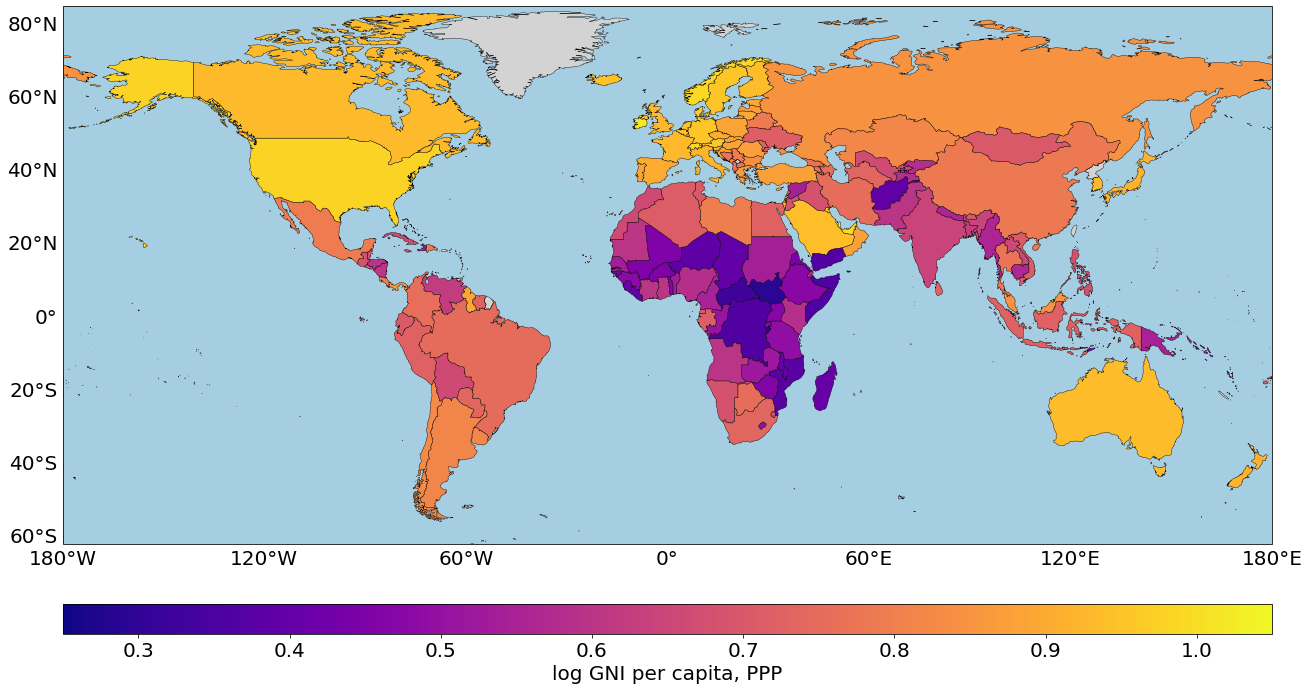


Figure A.1. Wealth component of the HDI (log GNI per capita, PPP)

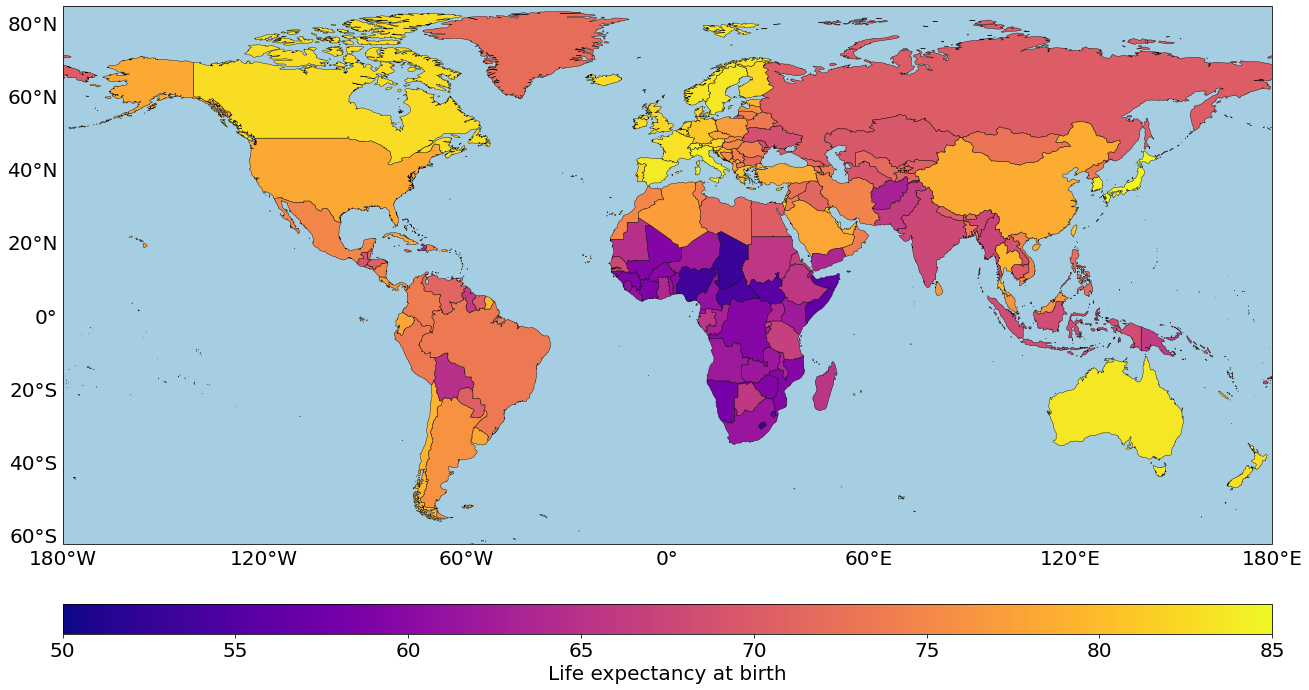


Figure A.2. Life expectancy at birth

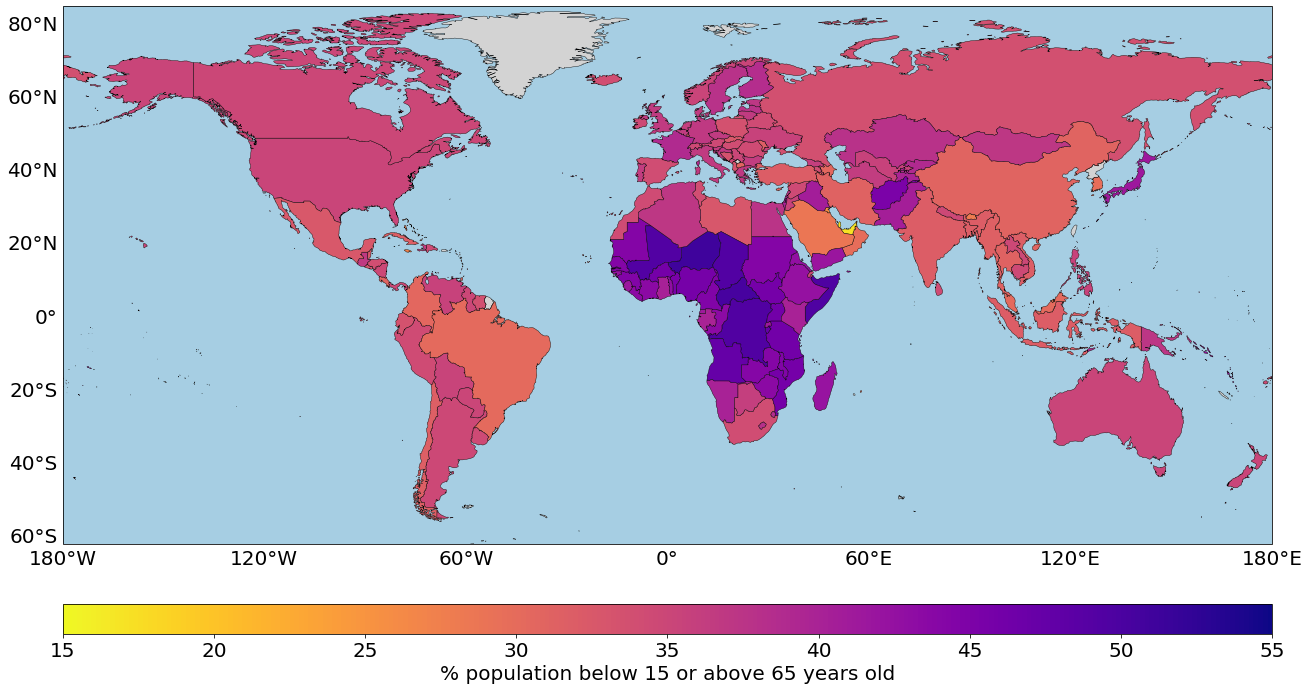


Figure A.3. Age dependency

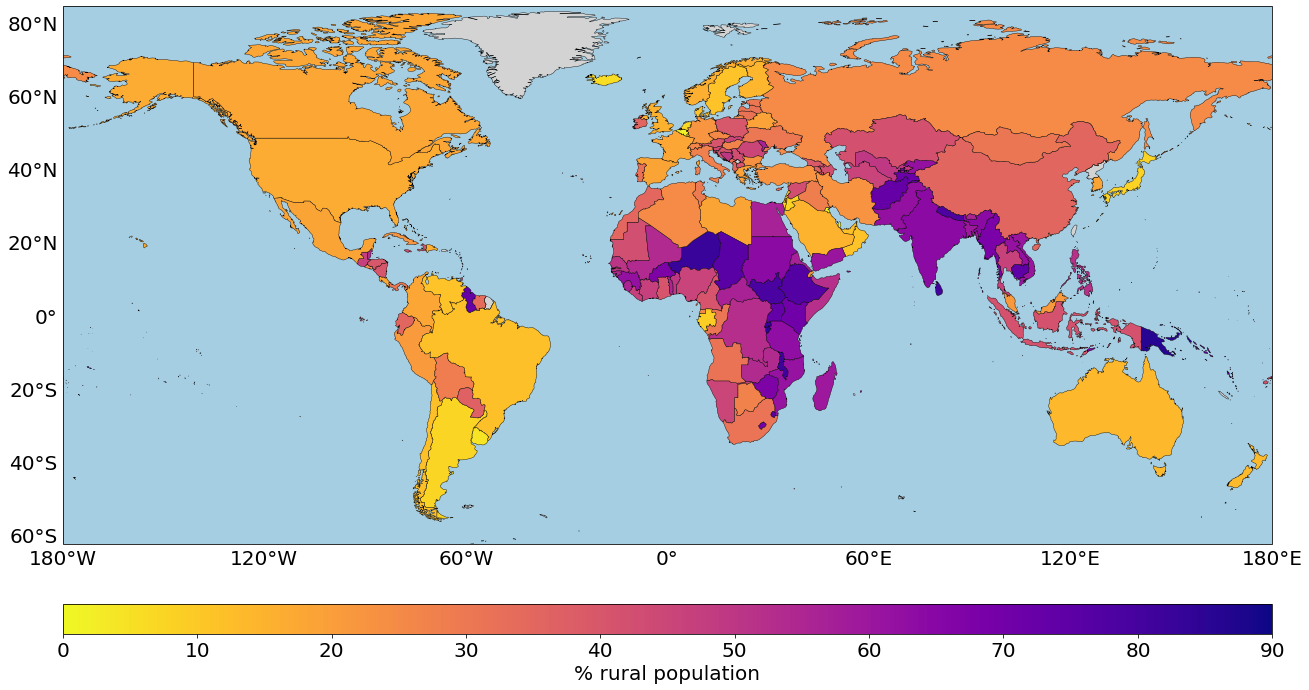
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Figure A.4. Rurality

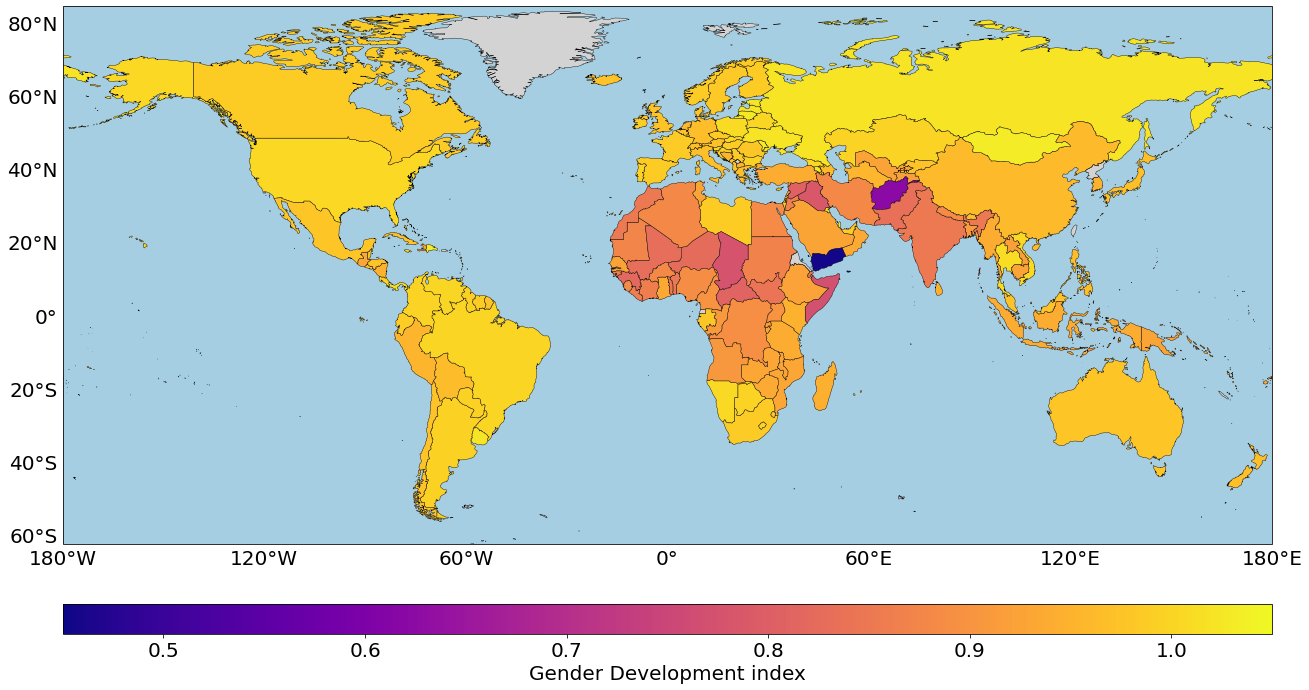
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Figure A.5. Gender Development Index

**Annex B: Index values for a given country**

As an example, the vulnerability values for Fiji are shown:

* Social vulnerability index, physical climate impacts: 5.6
* GNI per capita (2017 PPP $): 11,234
* Life expectancy at birth: 68.3
* % rural population: 41.3%
* % population below 15 or above 65 years old: 34.4%
* Gender development index: 0.940