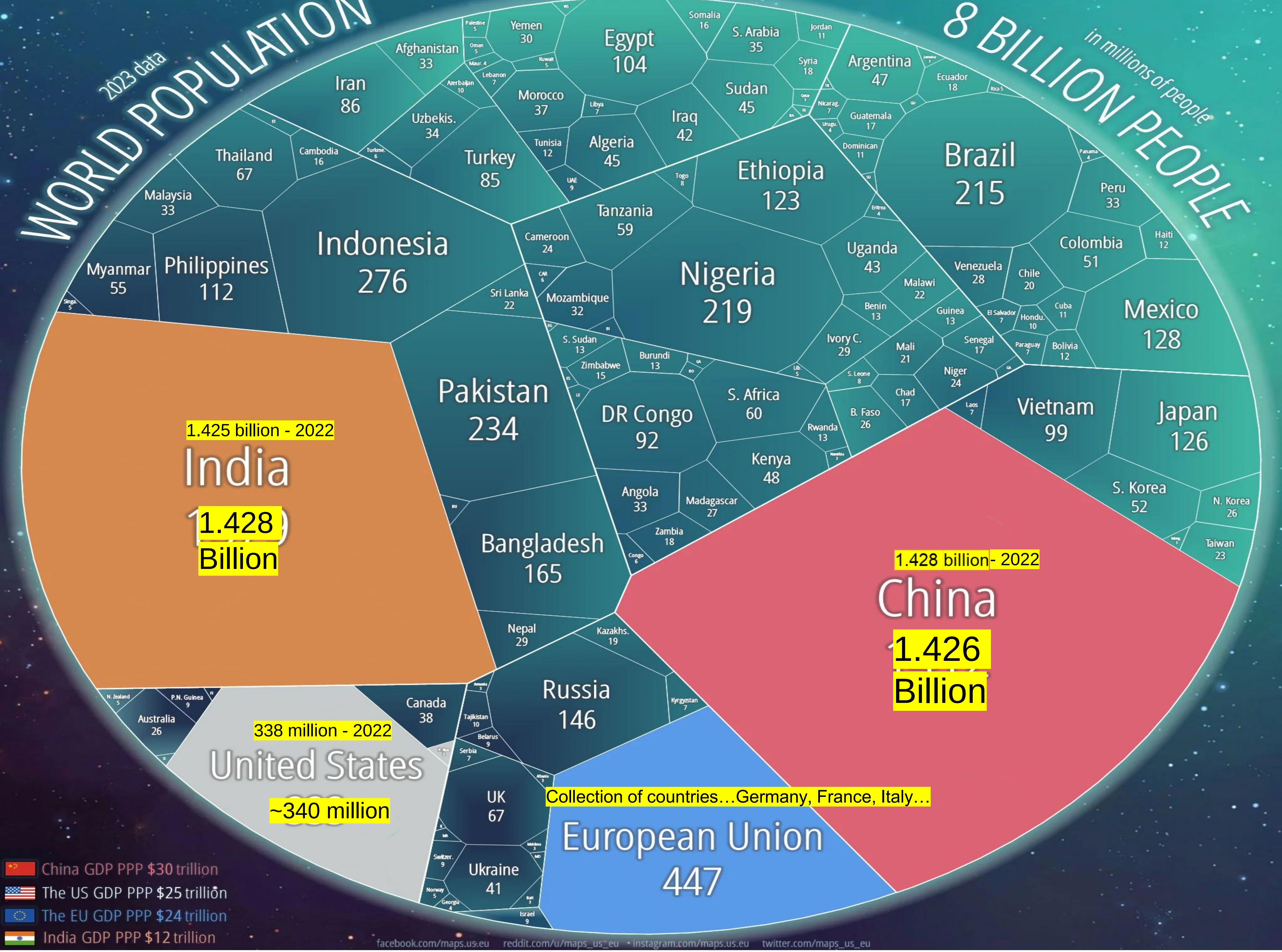
Chapter 7

The Human Population


2023 data
WORLD POPULATION
8 BILLION PEOPLE
in millions of people
1.425 billion - 2022
India
1.428
Billion
1.428 billion- 2022
China
1.426
Billion
338 million - 2022
United States
~340 million
Collection of countries…Germany, France, Italy…
European Union
447
Indonesia
276
Pakistan
234
Nigeria
219
Brazil
215
Bangladesh
165
Russia
146
Mexico
128
Japan
126
Ethiopia
123
Philippines
112
Egypt
104
Vietnam
99
DR Congo
92
Iran
86
Turkey
85
Thailand
67
UK
67
Tanzania
59
S. Africa
60
Myanmar
55
S. Korea
52
Colombia
51
Kenya
48
Argentina
47
Algeria
45
Sudan
45
Uganda
43
Iraq
42
Ukraine
41
Canada
38
Morocco
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S. Arabia
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Uzbekis.
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Afghanistan
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Malaysia
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Peru
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Angola
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Mozambique
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Yemen
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Nepal
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Ivory C.
29
Venezuela
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Madagascar
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Australia
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N. Korea
26
B. Faso
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Cameroon
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Niger
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Taiwan
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Sri Lanka
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Malawi
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Mali
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Chile
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Kazakhs.
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Zambia
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Syria
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Ecuador
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Chad
17
Guatemala
17
Senegal
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Somalia
16
Cambodia
16
Zimbabwe
15
Benin
13
Guinea
13
Rwanda
13
Burundi
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S. Sudan
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Tunisia
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Bolivia
12
Haiti
12
Jordan
11
Dominican
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Cuba
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Hondu.
10
Tajikistan
10
Azerbaijan
10
Israel
9
Belarus
9
Switzer.
9
UAE
9
P.N. Guinea
9
S. Leone
8
Togo
8
Laos
7
Libya
7
Kyrgyzstan
7
Serbia
7
Lebanon
7
El Salvador
7
Paraguay
7
Nicarag.
7
China GDP PPP $30 trillion
The US GDP PPP $25 trillion
The EU GDP PPP $24 trillion
India GDP PPP $12 trillion
facebook.com/maps.us.eu
reddit.com/u/maps_us_eu
instagram.com/maps.us.eu
twitter.com/maps_us_eu

Factors that Drive Human Population Growth

- **Demography**- the study of human populations and population trends.
  - *Changes in Population Size* – input vs. output, input is greater than output…system expands
  - *Fertility* – role of births play on population
  - *Life Expectancy* - outputs due to human life span
  - *Age Structure* – future size of the population due to age groups shifting in child bearing years
  - *Migration* –regardless of births vs. deaths, population growth, decrease, stability based on entering or leaving the country

Population Density

Population Density is number of individuals living in a given area

1. Population density = # of Individuals
   size of Area (ha, km^2)

Ex. Calculate the population density for 2,500 individuals living on 10,000 hectares of land?

Population density = # of Individuals
size of Area (ha, km^2)

Givens:
Individual = 2500ppl
Area = 10,000 ha

Pop density = 2500ppl = ***0.25 individual per hectare***
10,000ha

Reasoning:

For every 4 hectares, you have 1 individual
or
For every 1 hectare, you have ¼ individual.

Changes in Population Size

- **Crude birth rate (CBR)**= the number of births per 1,000 individuals per year. **(#births/1000ppl/year)**
- **Crude death rate (CDR)**= the number of deaths per 1,000 individuals per year. **(#deaths/1000ppl/year)**
- **We use 10 to represent the value as a percentage** *(because the rate is per 1000ppl, we have to divide by 10 to get it out of 100...%)*

1. **Global** population growth rate = $\frac{(\text{CBR} - \text{CDR})}{10}$

Ex. What was the global growth rate in 2014, when there were 20 births and 8 deaths per 1,000ppl worldwide?

$$\text{Global population growth rate} = \frac{(\text{CBR} - \text{CDR})}{10}$$

Givens:

- Birth = 20/1000ppl
- Death = 8/1000ppl
- Global Growth rate =???

$$\text{Global G.R} = \frac{(20 - 8)}{10} = \frac{12}{10} = \mathbf{1.2\%}$$

Reasonings:

In 2014, the Global G.R was 1.2%

(positive # = increase in pop., negative # = decrease in pop.)

Changes in Population Size

- **Immigration** (In)- the movement of people into a country
- **Emigration** (Exit)- the movement of people out of a country.
- **Net migration rate-** the difference between immigration and emigration in a give year per 1,000 people in the country.

Net Migration Rate (#people/year)= number of immigrants #people in the population

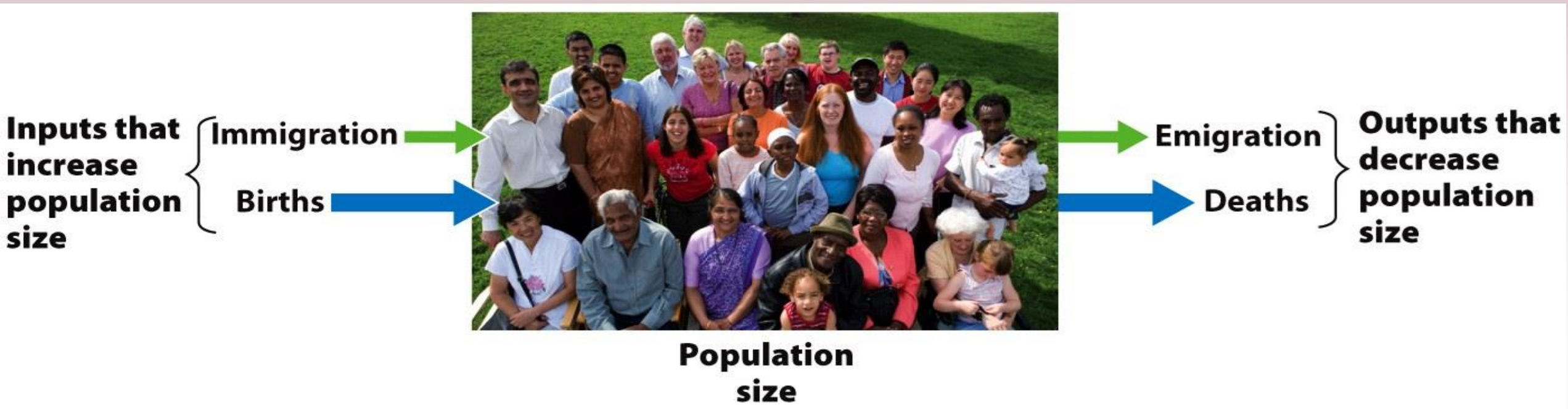


Figure 7.3
Environmental Science

Changes in Population Size

- Immigration...add to CBR
- Emigration...add to CDR

2. **National** population G. rate =

$$\frac{\text{(CBR+ immigration) - (CDR + emigration)}}{10}$$

- Ex. What is the growth rate of a population with 100,000ppl that has 2,000 births, 500 death, 200 emigrants, and 100 immigrants per year?

National population G. rate =

$$\frac{(\text{CBR} + \text{immigration}) - (\text{CDR} + \text{emigration})}{10}$$

Givens:

- Birth = 2000ppl/100 = 20 Crude births
- Death = 500ppl/100 = 5 Crude deaths
- Immigrants = 100ppl/100 = 1 Imm.
- Emigrants = 200ppl/100 = 2 Emg.
- Total population = 100,000ppl/100 *(divide by whatever # to make total pop. 1000ppl)*

- Growth rate =???

- **National** population G. rate = $\frac{(20+1)-(5+2)}{10} = \frac{21-7}{10}$

- G.R = $\frac{14}{10}$ = **1.4%** (input {births + imm.} vs. output {deaths + emi.}

Changes in Population Size

- **Doubling time-** is the number of years **(time) its takes a population to double**

- Growth rate is usually in a %, for doubling time….ignore that percentage (use # from % but not the actual % sign)

Rule of 70 **(doubling time)**

3. Doubling time (in years) = $\frac{70}{\text{growth rate}}$

Ex. What is the doubling time of a population that grows 2% per year??

$$\text{Doubling time (in years)} = \frac{70}{\text{growth rate}}$$

Givens:

Growth Rate = 2% = 2 (make it a whole number, no calculations)

Doubling Time = ???

$$\text{Doubling time (in years)} = \frac{70}{2} = 35 \text{ years}$$

Reasoning:

Whatever the starting population is...it will double in 35 years *(it will keep doubling every 35 years, until the growth rate changes)*

Try it…..

- What was the growth rate of a nation of 1,000,000 people that has 15,000 births, 4,000 deaths, 1,000 emigrants and 3,000 immigrants per year? When will this population double?

Givens:

- Birth = 15,000ppl/1000 = 15 Crude births
- Death = 4000ppl/1000 = 4 Crude deaths
- Immigrants = 3,000ppl/1000 = 3 Imm.
- Emigrants = 1,000ppl/1000 = 1 Emg.
- Total population = 1,000,000ppl/1000 = 1,000ppl

National population G. rate =

$$\frac{(\text{CBR} + \text{immigration}) - (\text{CDR} + \text{emigration})}{10}$$

1. National population G. rate =

$$\frac{(15+3) - (4+1)}{10} = \frac{13}{10} = \mathbf{1.3\%}$$

2. Doubling time (in years) = $\frac{70}{\text{growth rate}}$

Doubling time (in years) = $\frac{70}{1.3}$ = **53.8 years**

Reasonings:
In ~ 54 years, this nation will go from 1 million to 2 million…in another ~54 years, the population will go from 2 million to 4, if the D.R remains the same!!!

Fertility

- **Total Fertility Rate (TFR)-** an estimate of the average number of children that each woman in a population will bear.
- In the U.S, TFR is 1.84, each woman of childbearing age would have just under 2 children. *(World TFR = 2.42)*

- **Replacement level fertility-** the total fertility rate required to offset the average number of deaths in a population and for the current population size to remain stable. (2 children will replace the 2 parents)

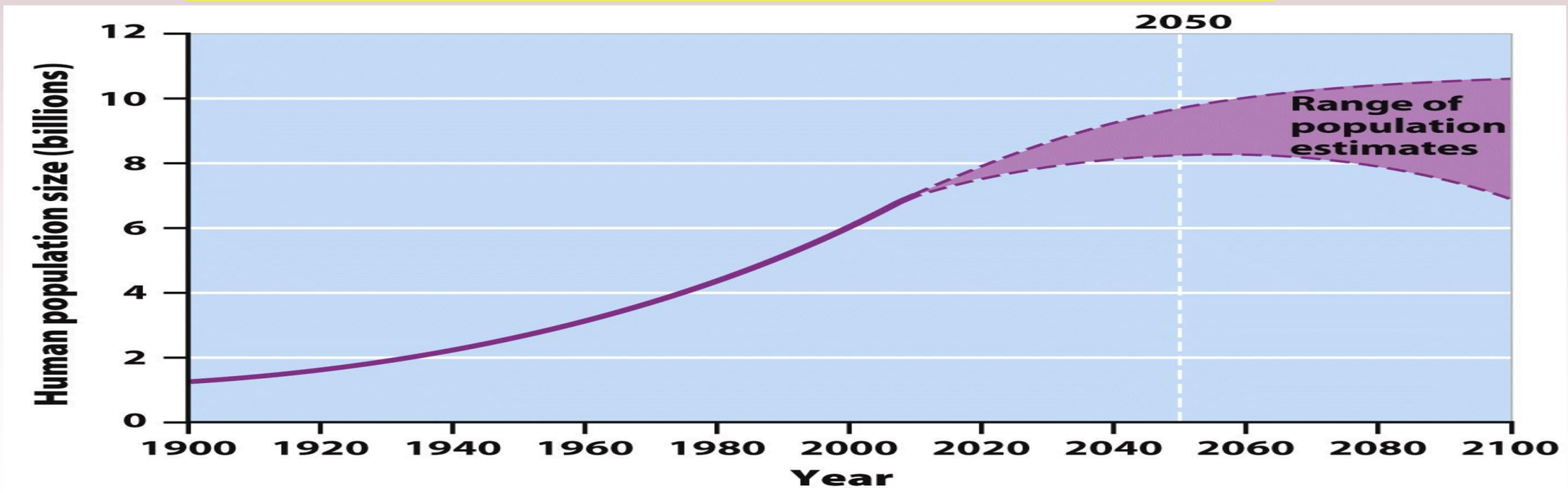


Figure 7.4
Environmental Science

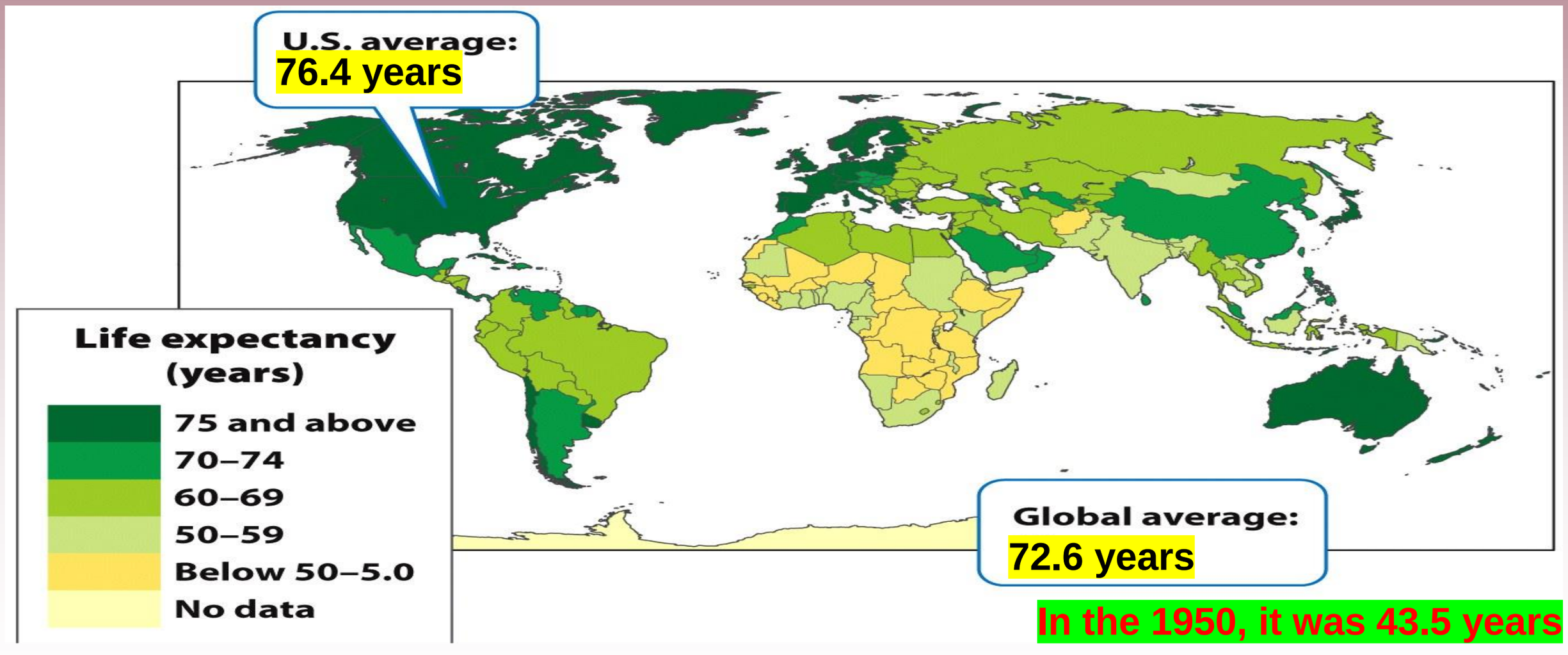
Fertility

- **Developed countries-** countries with relatively high levels of industrialization and income.
- **Developing countries-** countries with relatively low levels of industrialization and income of less that $3 per person per day.

- A country with a TFR of less than 2.1 and no net increase in immigration is most likely to experience a population decrease... Below replacement rate.
- A country with a TFR more than 2.1 and no net decrease in emigrant, is likely to experience a population growth...above replacement rate.

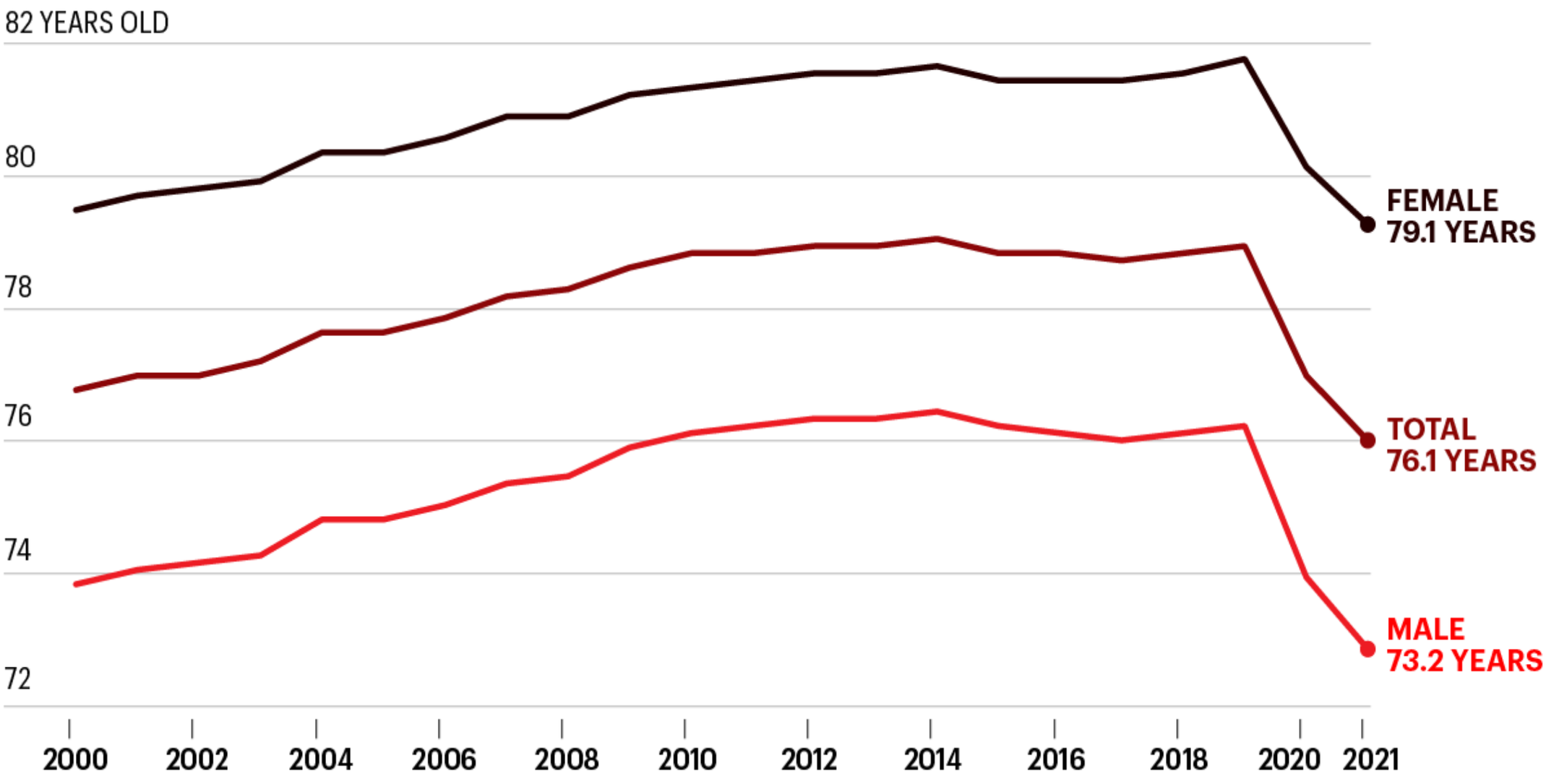
Life Expectancy

- **Life expectancy-** the average number of years that an infant born in a particular year in a particular country can be expected to live.



In the 1950, it was 43.5 years

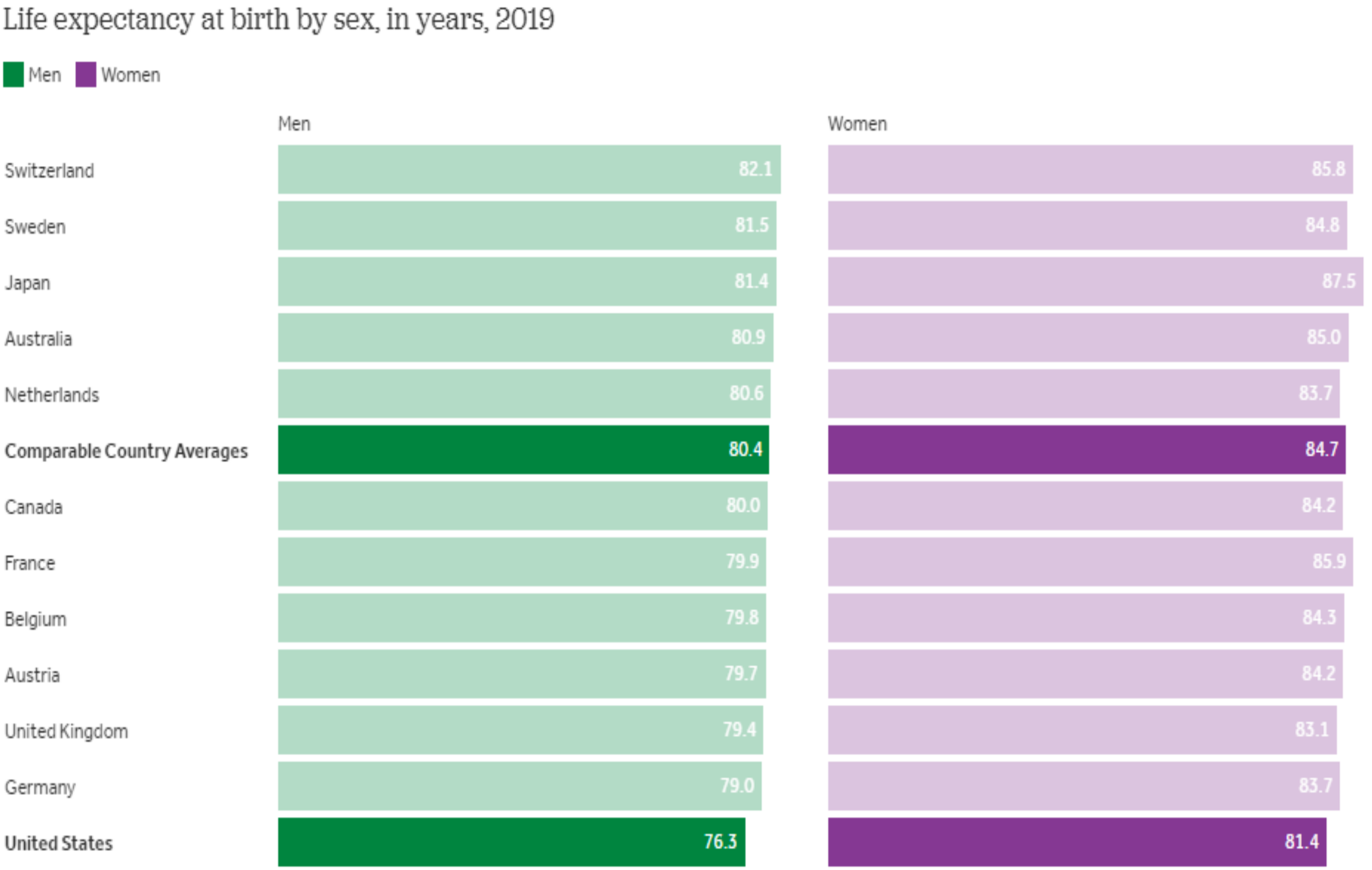
LIFE EXPECTANCY AT BIRTH IN THE U.S.



SOURCE: NATIONAL CENTER FOR HEALTH STATISTICS

FORTUNE

The U.S. has the lowest life expectancy at birth for both women and men

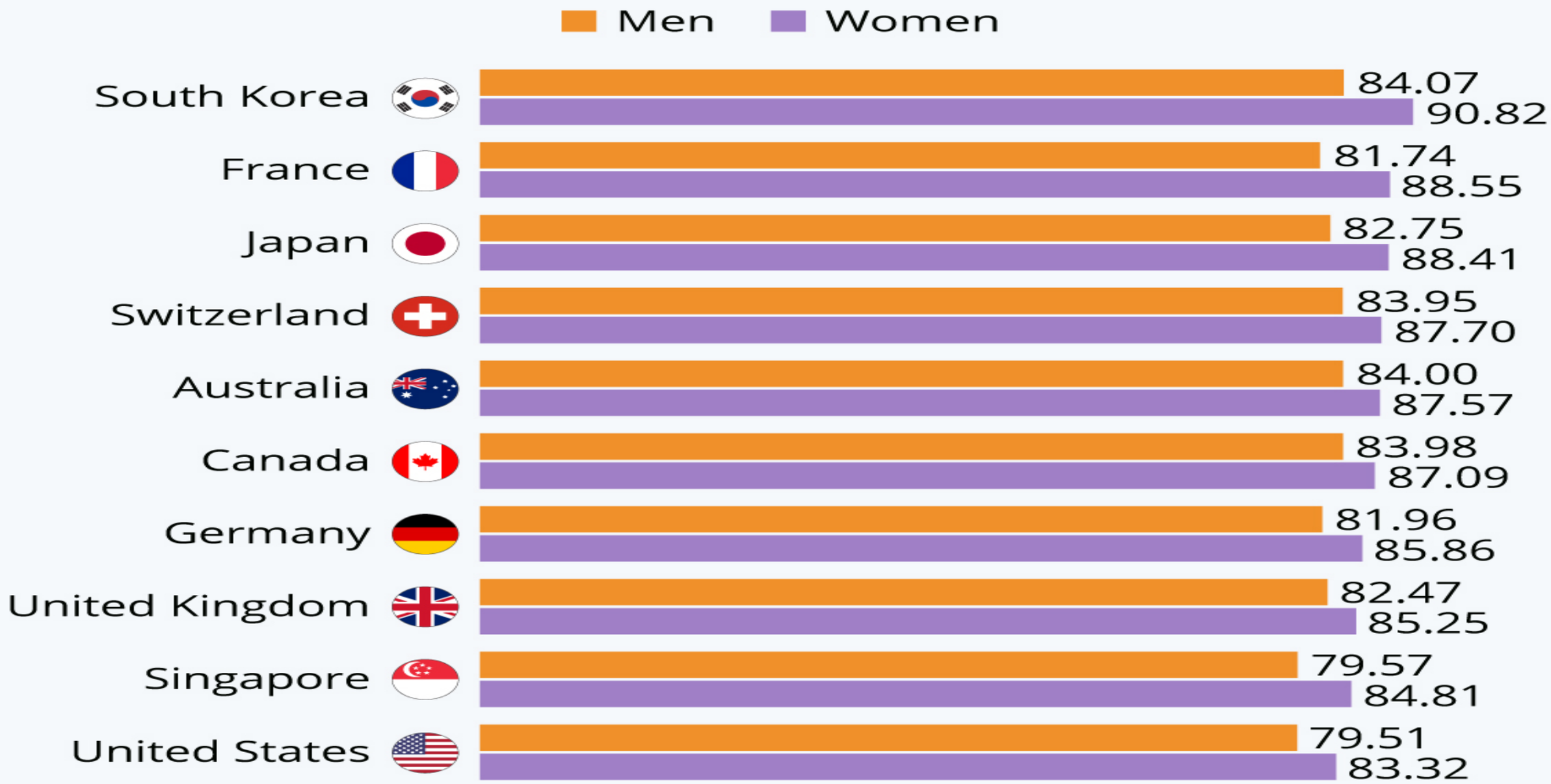


Source: KFF Analysis of OECD Data • Get the data • PNG

Peterson-KFF
Health System Tracker

U.S. Will Trail Other Rich Nations In Life Expectancy By 2030

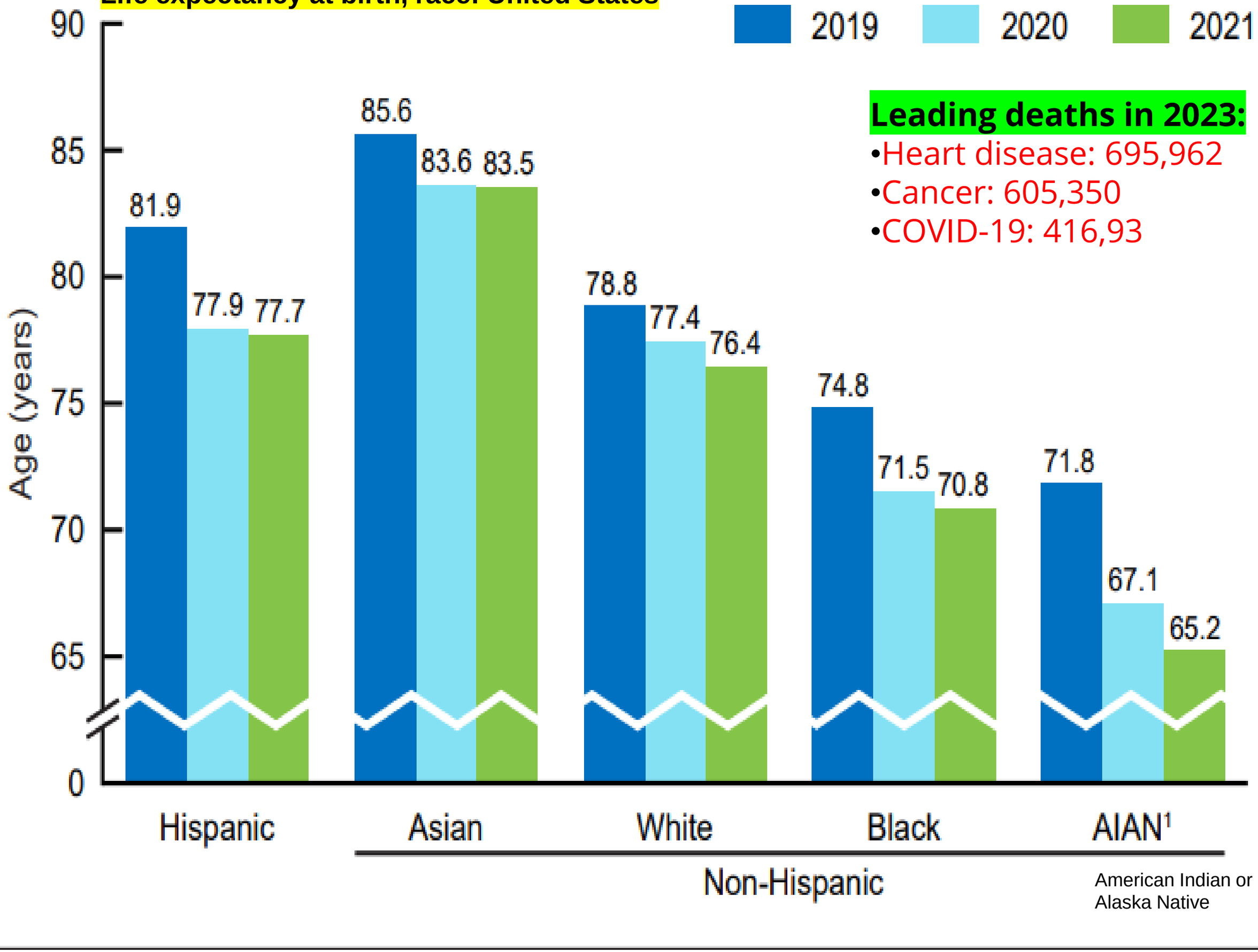
Average life expectancy at birth in selected rich nations by 2030 (in years)



Source: Imperial College London/World Health Organization

statista

Life expectancy at birth, race: United States



Leading deaths in 2023:

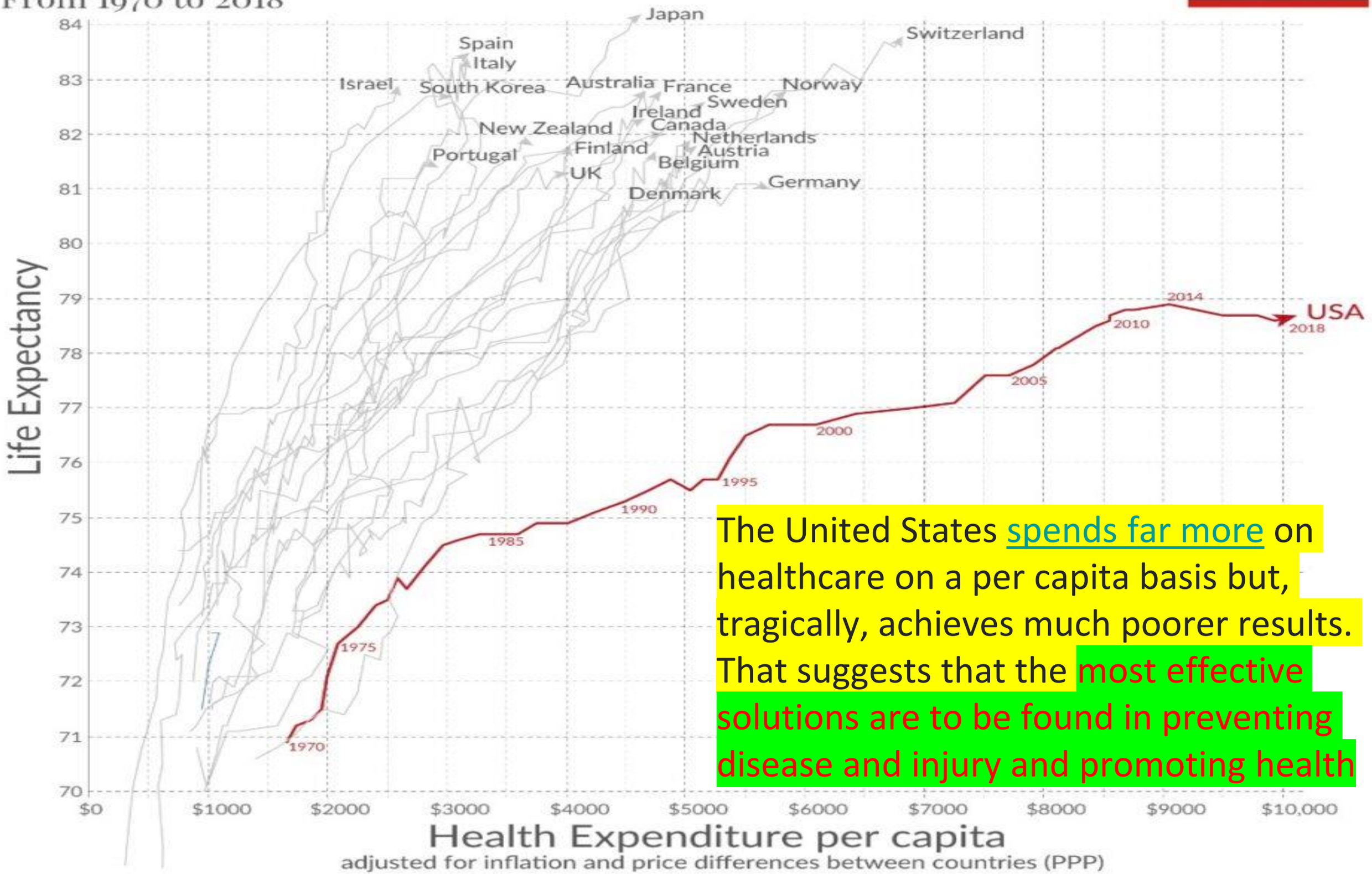
- Heart disease: 695,962
- Cancer: 605,350
- COVID-19: 416,93

[1] American Indian or Alaska Native

Life expectancy vs. health expenditure

From 1970 to 2018

Our World in Data



The United States spends far more on healthcare on a per capita basis but, tragically, achieves much poorer results. That suggests that the most effective solutions are to be found in preventing disease and injury and promoting health

Data source: OECD — Note: Health spending measures the consumption of health care goods and services, including personal health care (curative care, rehabilitative care, long-term care, ancillary services, and medical goods) and collective services (prevention and public health services as well as health administration), but excluding spending on investments.
Shown is total health expenditure (financed by public and private sources).

OurWorldinData.org – Research and data to make progress against the world's largest problems.

Life Expectancy

- **Infant mortality rate-** the number of deaths of children under 1 year of age per 1,000 live births.
- **Child mortality rate-** the number of deaths of children under age 5 per 1,000 live births.

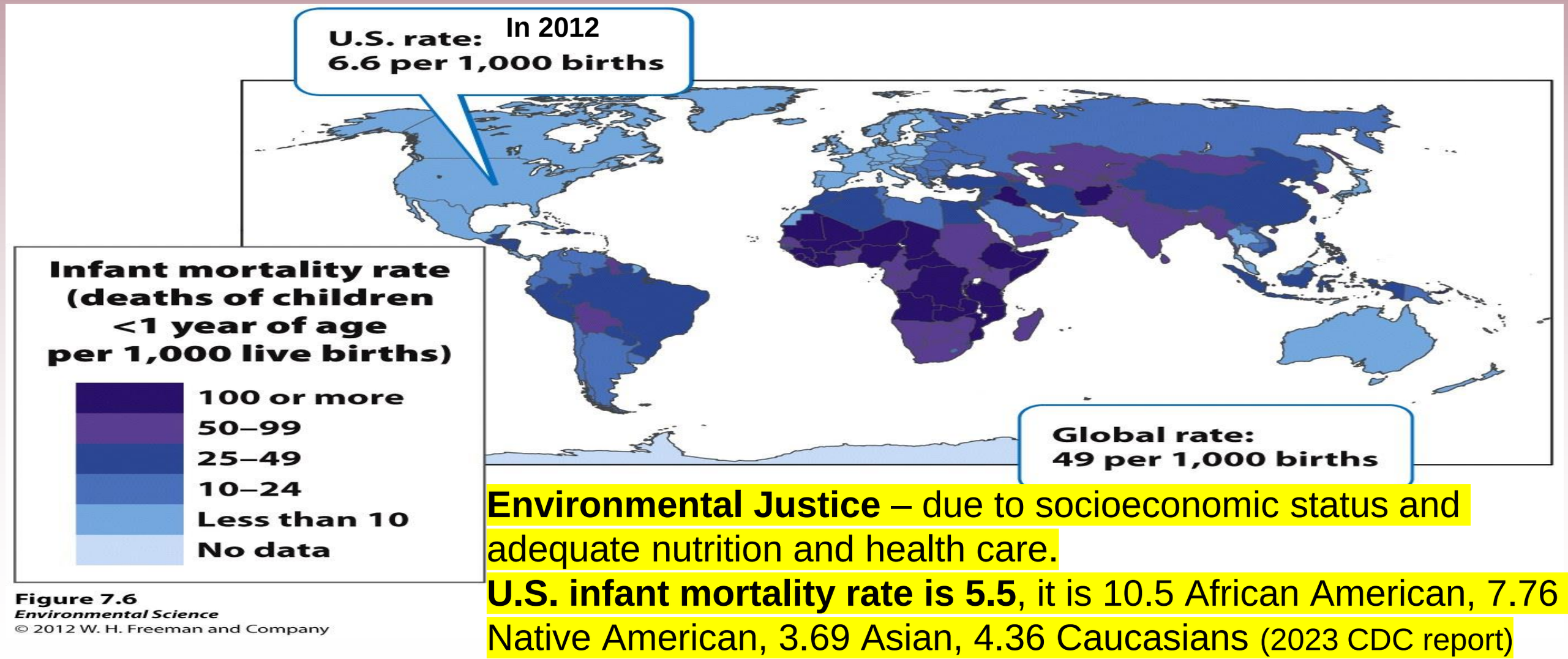


Figure 7.6
Environmental Science

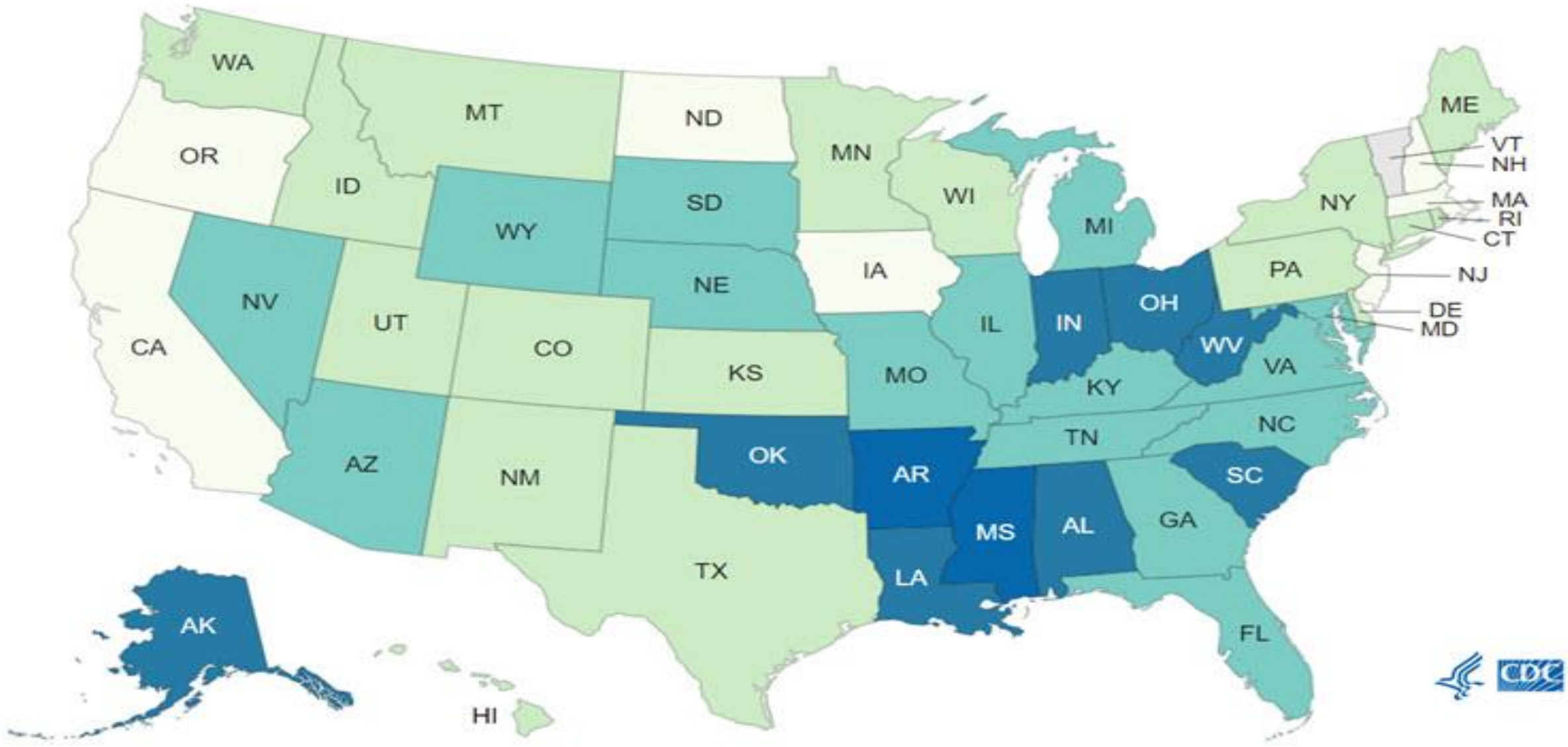
Environmental Justice – due to socioeconomic status and adequate nutrition and health care.

U.S. infant mortality rate is 5.5, it is 10.5 African American, 7.76 Native American, 3.69 Asian, 4.36 Caucasians (2023 CDC report)

Infant Mortality Rates by State

Year
2021

US average – 5.5 per 1000 births



Death Rates[1]

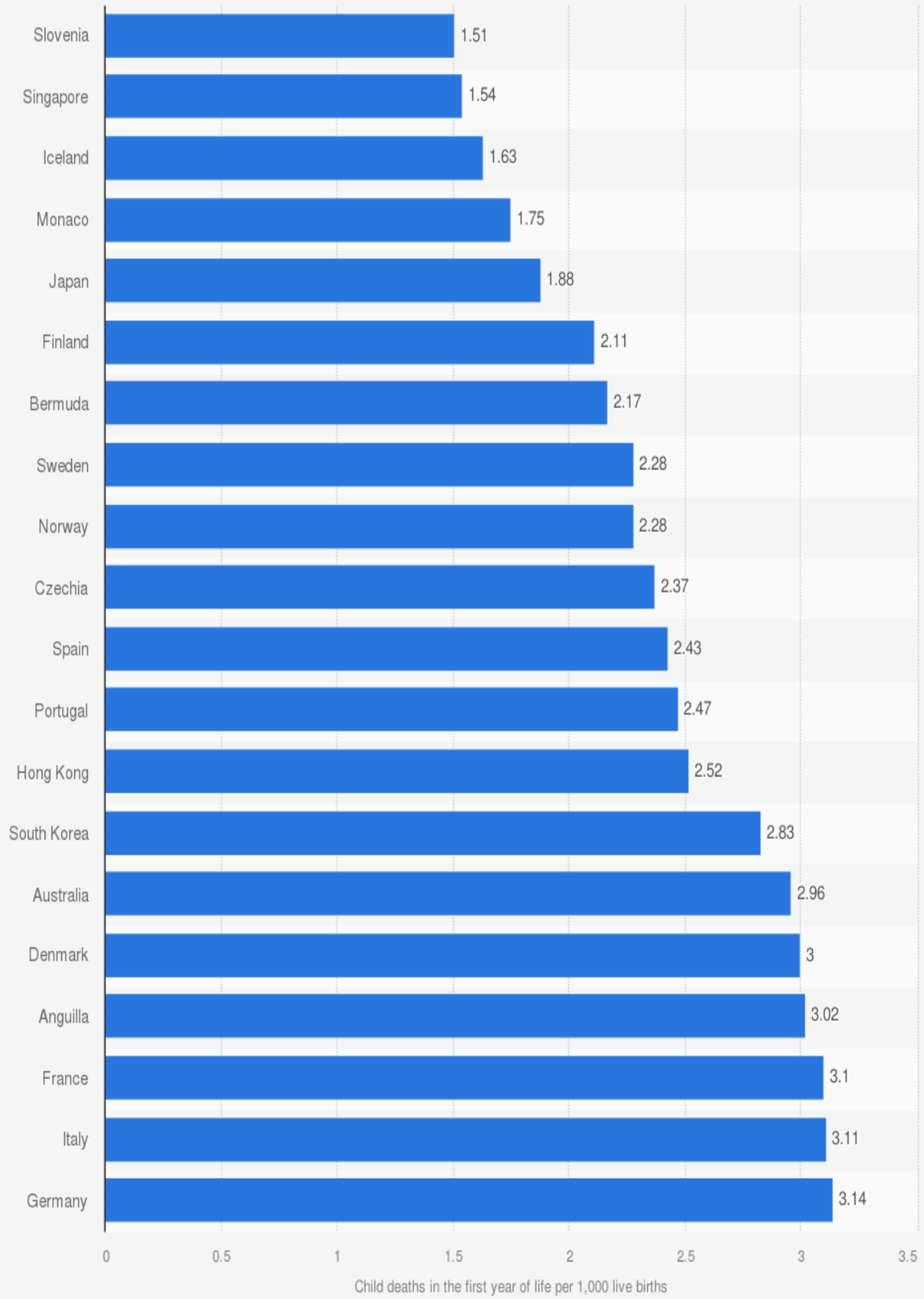
- 2.77 - < 4.09
- 4.09 - < 5.42
- 5.42 - < 6.74
- 6.74 - < 8.07
- 8.07 - 9.39

[1]The number of infant deaths per 1,000 live births.

Highest: (U.S)
Mississippi 9.39
Arkansas 8.59
Alabama 7.56

Afghanistan 103.06 (world)

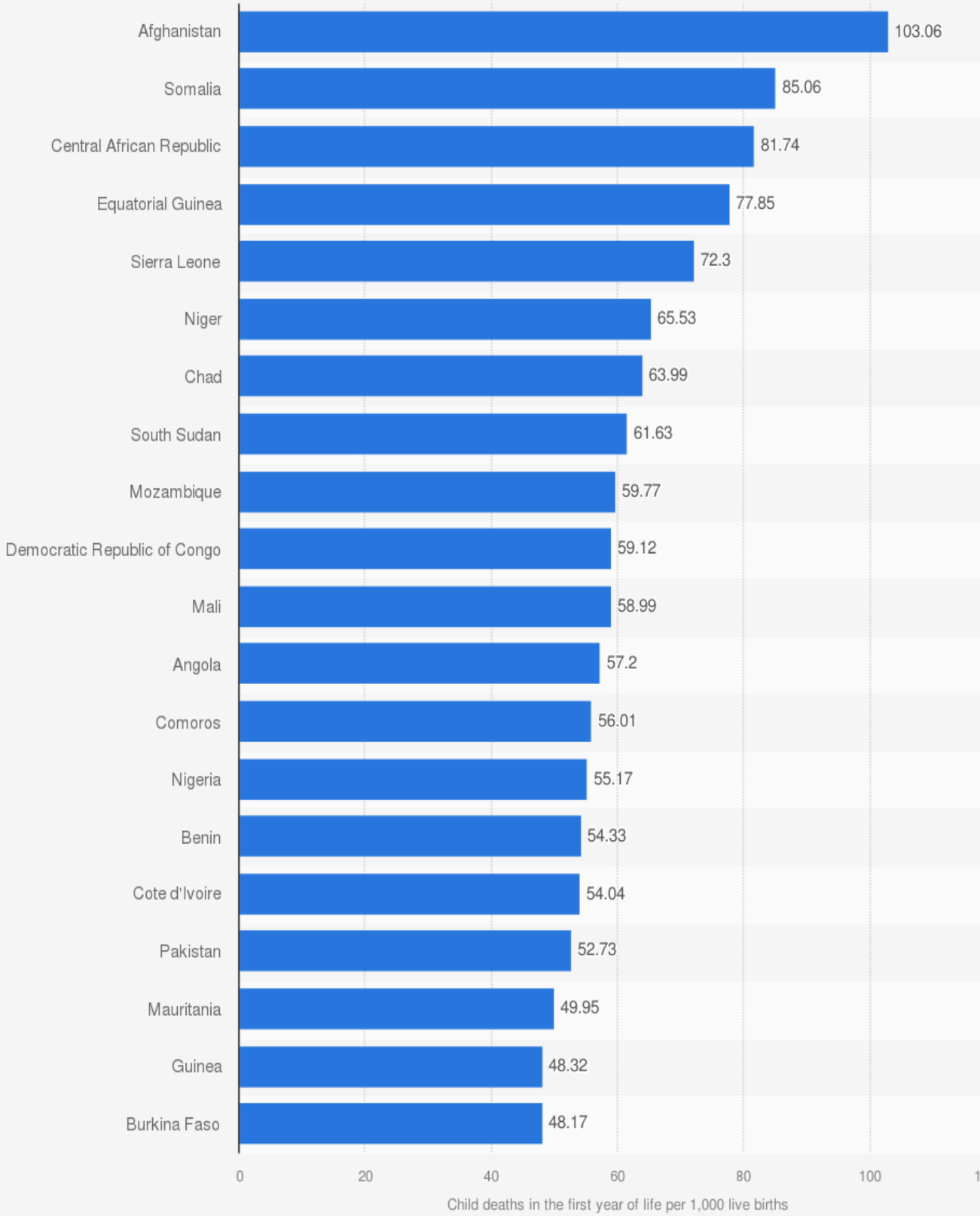
Ranking of the 20 countries* with the lowest infant mortality rate in 2023 (child deaths in the first year of life per 1,000 live births)



Source
CIA

Additional Information:
Worldwide; CIA

Ranking of the 20 countries* with the highest infant mortality rate in 2023 (child deaths in the first year of life per thousand live births)



Source
CIA

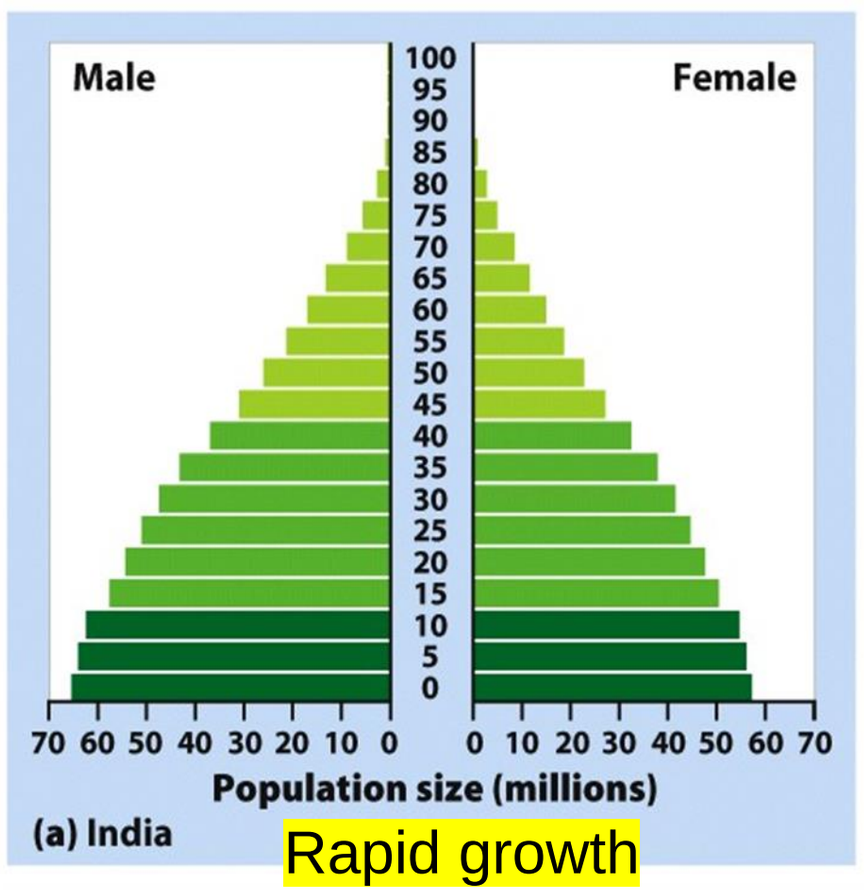
Additional Information:
Worldwide; CIA

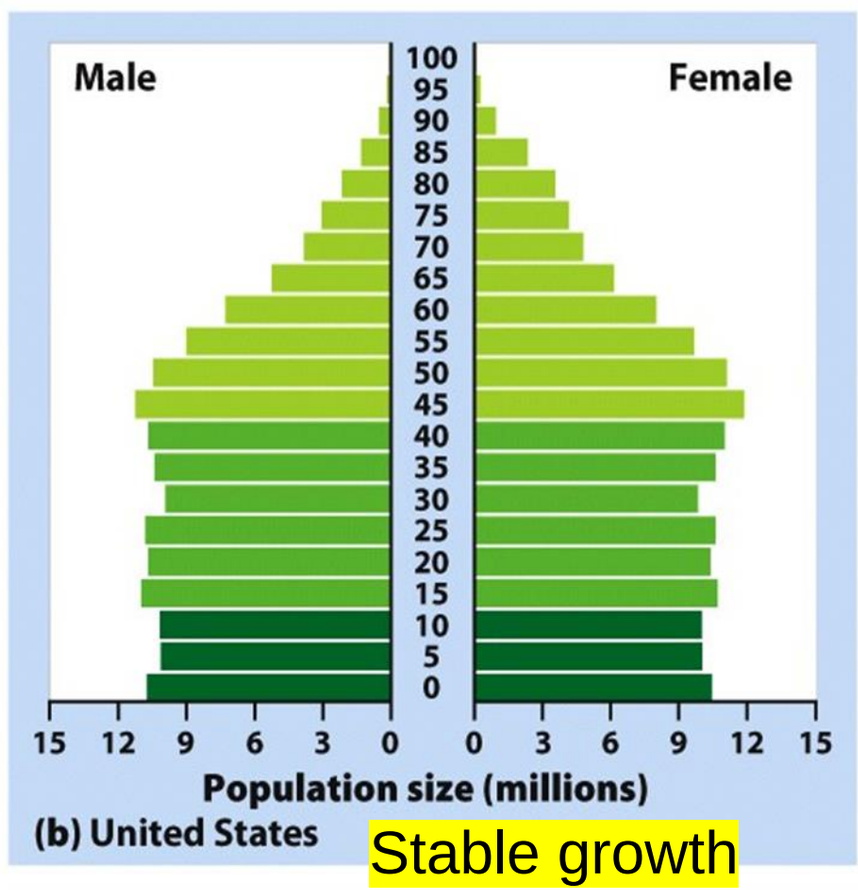
Age Structure

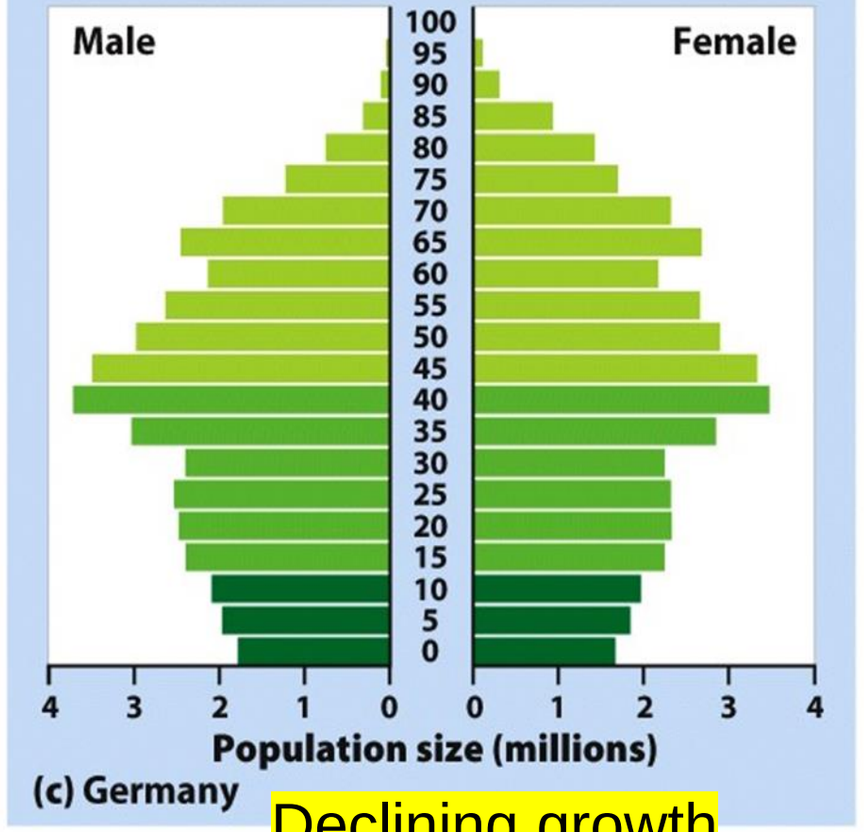
Age-Sex structure diagrams

(population pyramids)- visual representations of age structure within a country for living males and female s at a given date.

The wide base compared to the levels above indicates that the population will grow b/c most females have not hit child bearing years yet.







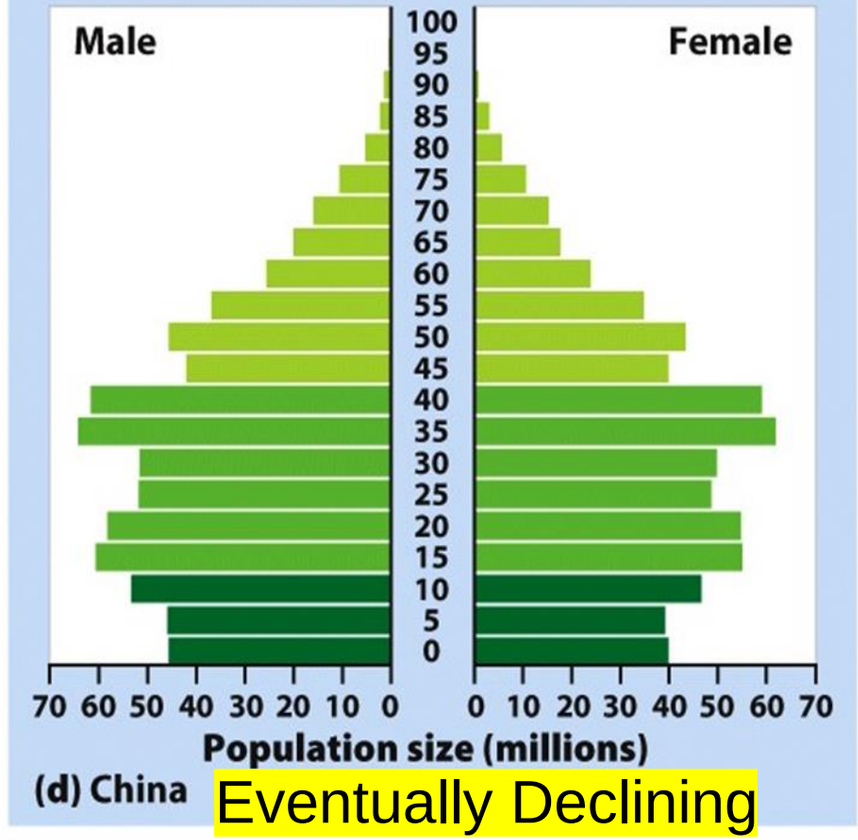


Figure 7.8
Environmental Science

Total area of all the bars, is size of whole population

The Demographic Transition

- The **theory of the demographic transition** is the theory that as a country moves from a subsistence (survival) economy to industrialization (advancements) and increased affluence (consumption), it undergoes a predictable shift in population growth.

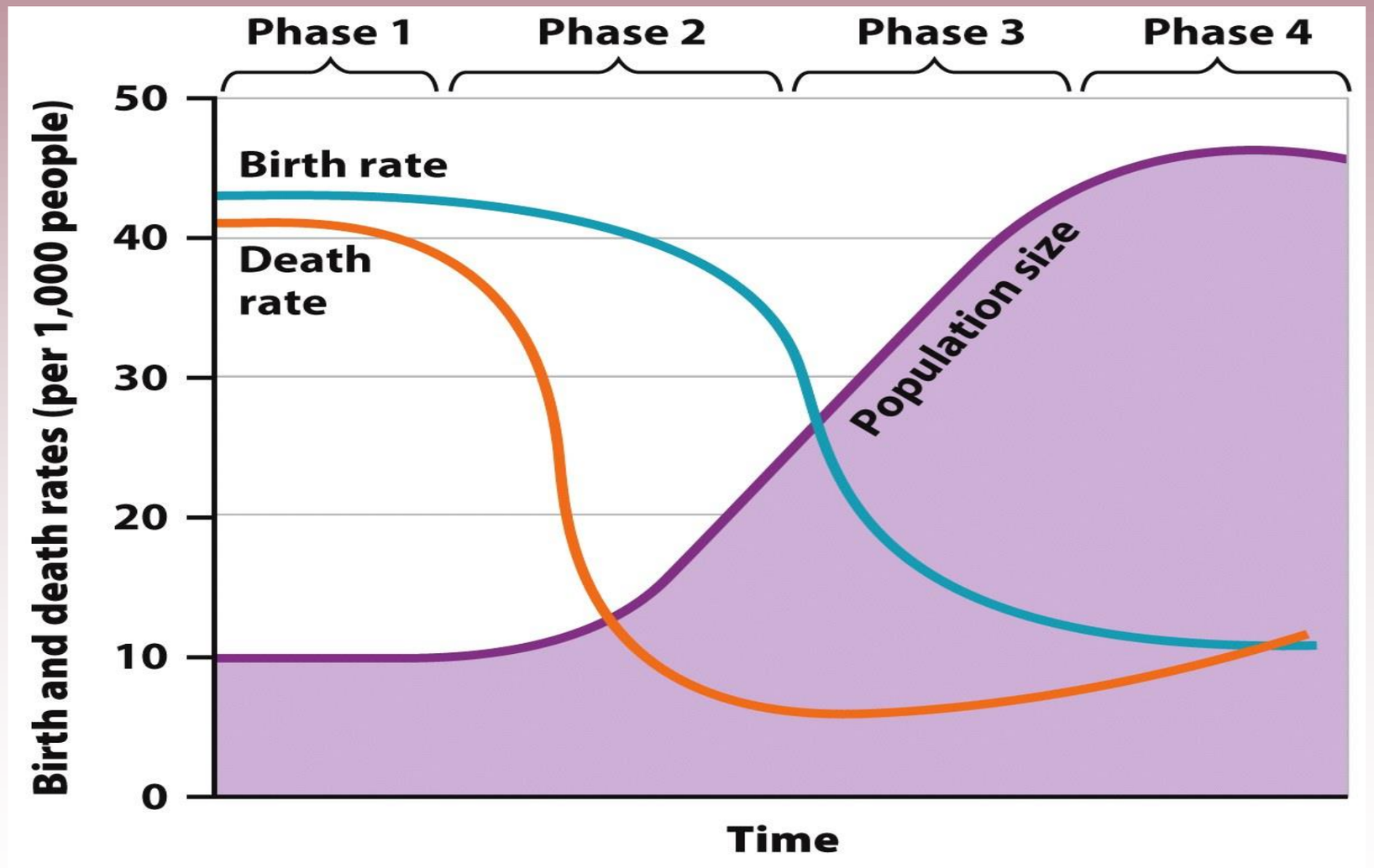


Figure 7.9
Environmental Science

Model the way the birth, death, & growth rates for a nation change with economic development (4 phases).

The Stages of the Demographic Transition

- **Phase 1**: (*Pre-industrial period*) Slow population growth because there are high birth rates and high death rates which offset each other. (birth = death rates)

- **Phase 2**: (*begins to industrialize*) Rapid population growth because birth rates remain high but death rates decline due to better sanitation, clean drinking water, increased access to food and goods, and access to health care.(death rates drop, birth rates do not change)

- **Phase 3**: *(industrialized)* Stable population growth as the economy and educational system improves and people have fewer children. (death & birth rate level out, due to birth rates declining – less people having children)

- **Phase 4:** (*industrialized*) Declining population growth because the relatively high level of affluence and economic develop encourage women to delay having children (birth rates drop below death rates)

Family Planning

- **Family planning-** the regulation of the number or spacing of offspring through the use of birth control.

Determination of number of children a family has depends on …..

1. Education of the female (mother)
2. Age of the first born (women are delaying having children)

3. Cultural & Available resources(money, contraceptives)

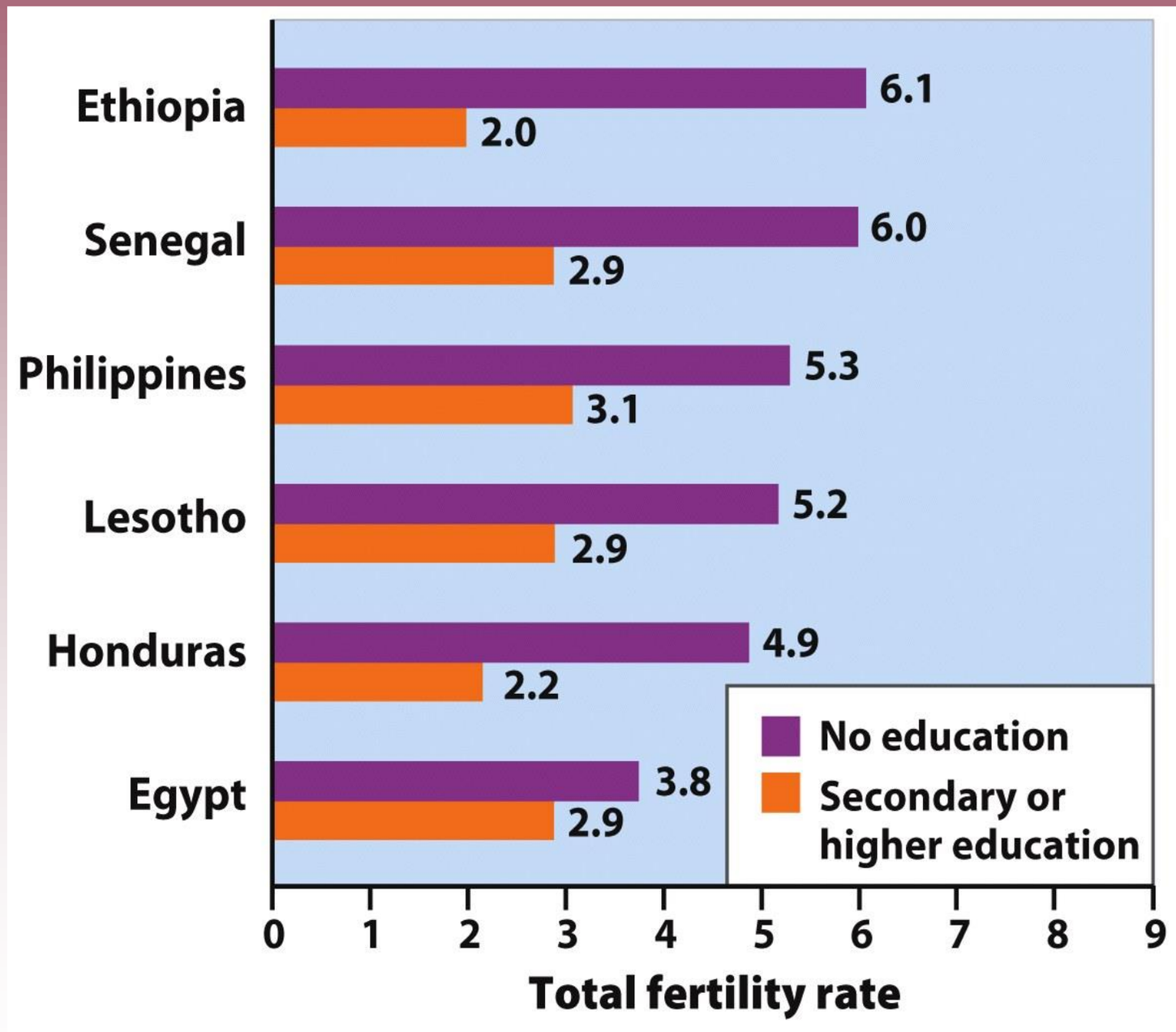
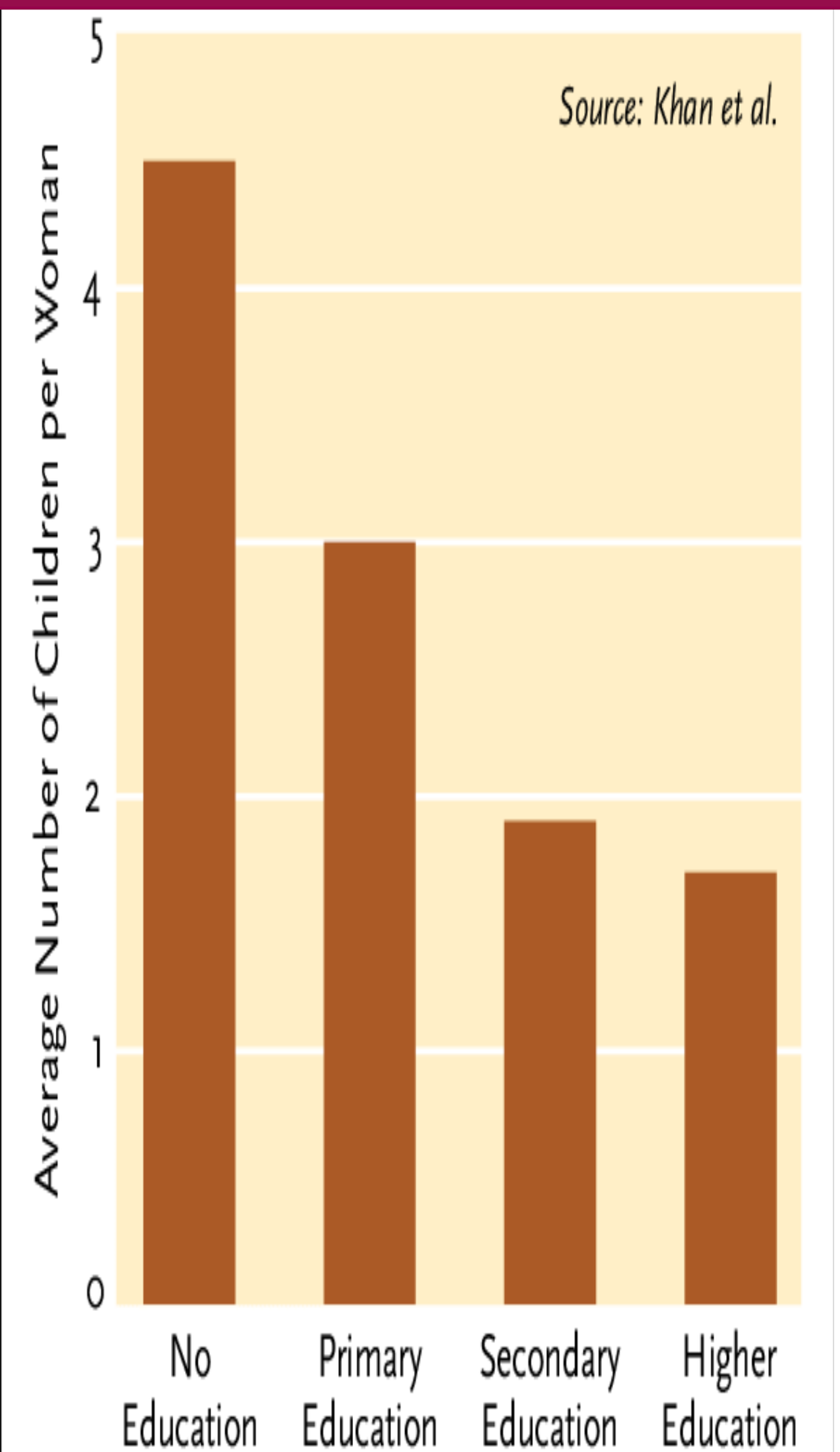
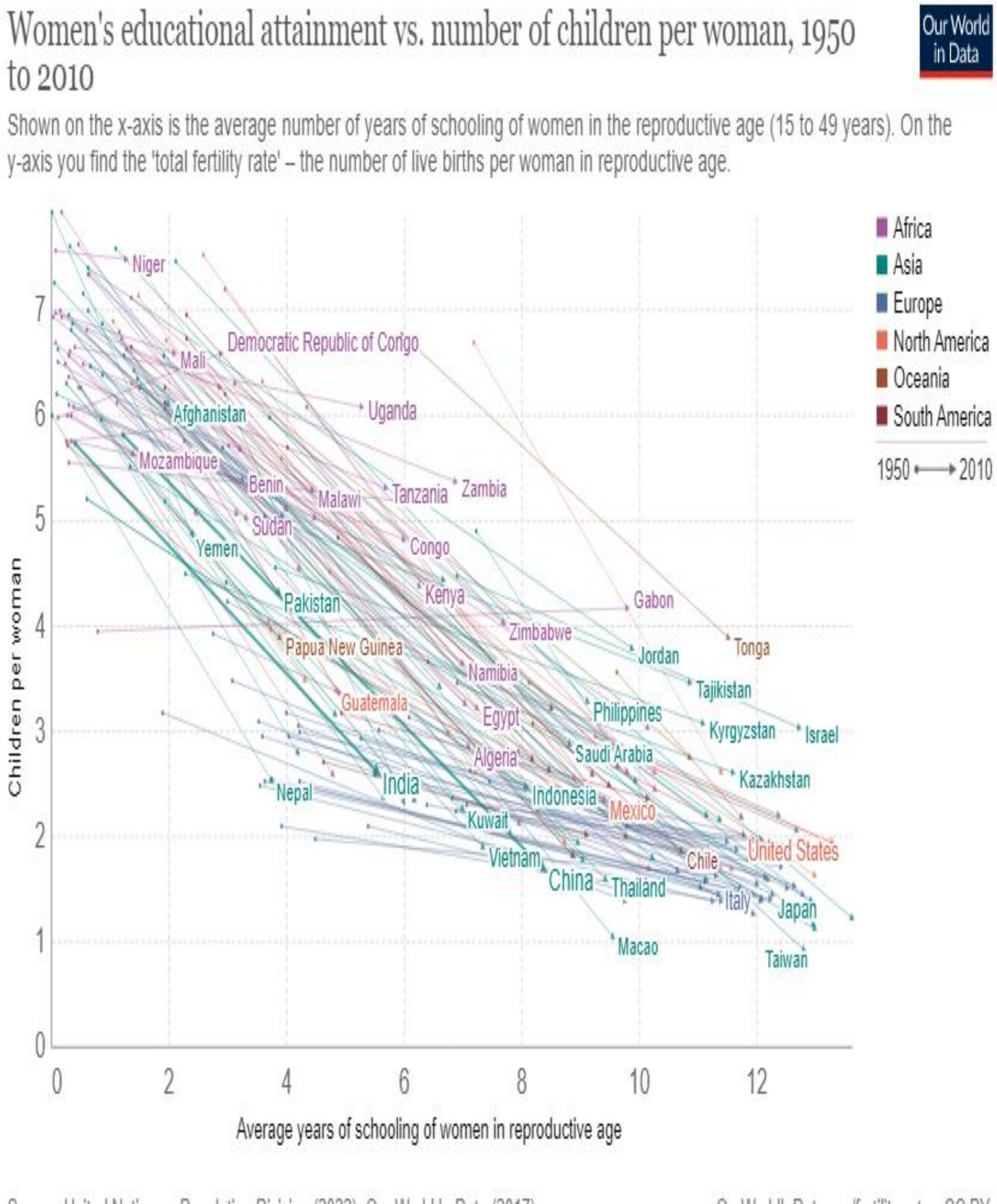


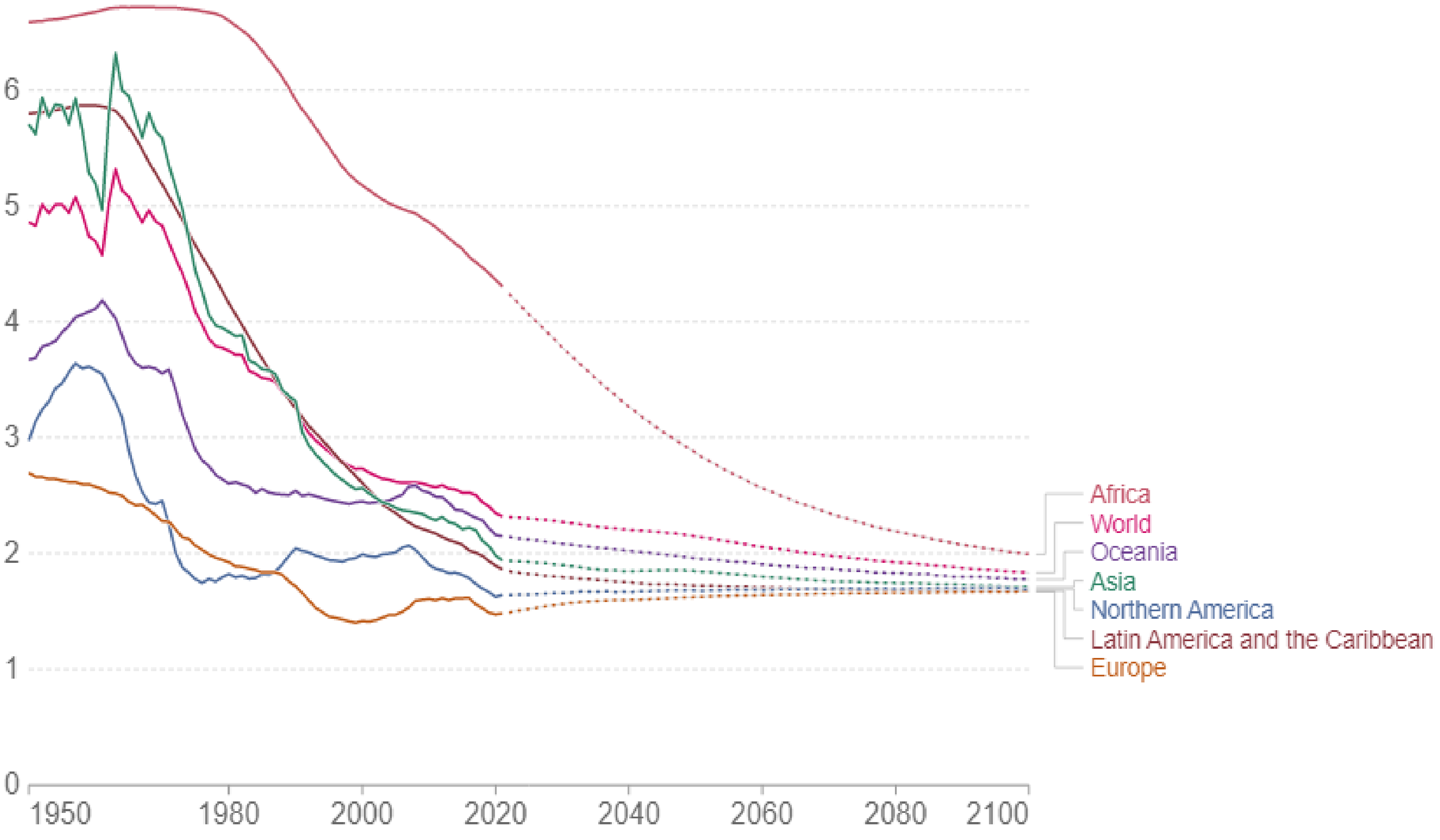
Figure 7.12
Environmental Science


Source: Khan et al.
Average Number of Children per Woman
5
4
3
2
1
0
No Education
Primary Education
Secondary Education
Higher Education


Women's educational attainment vs. number of children per woman, 1950 to 2010
Our World in Data
Shown on the x-axis is the average number of years of schooling of women in the reproductive age (15 to 49 years). On the y-axis you find the 'total fertility rate' – the number of live births per woman in reproductive age.
Children per woman
Average years of schooling of women in reproductive age
0
1
2
3
4
5
6
7
0
2
4
6
8
10
12
Africa
Asia
Europe
North America
Oceania
South America
1950 → 2010
Niger
Democratic Republic of Congo
Mali
Afghanistan
Uganda
Mozambique
Benin
Malawi
Tanzania
Zambia
Sudan
Yemen
Congo
Pakistan
Kenya
Gabon
Zimbabwe
Papua New Guinea
Jordan
Tonga
Namibia
Tajikistan
Guatemala
Egypt
Philippines
Kyrgyzstan
Israel
Algeria
Saudi Arabia
Kazakhstan
India
Nepal
Indonesia
Mexico
Kuwait
United States
Vietnam
Chile
China
Thailand
Italy
Japan
Macao
Taiwan
Source: United Nations – Population Division (2022); Our World In Data (2017)
OurWorldInData.org/fertility-rate • CC BY

Fertility rate: children per woman by world region, including the UN projections, 1950 to 2100

Our World in Data

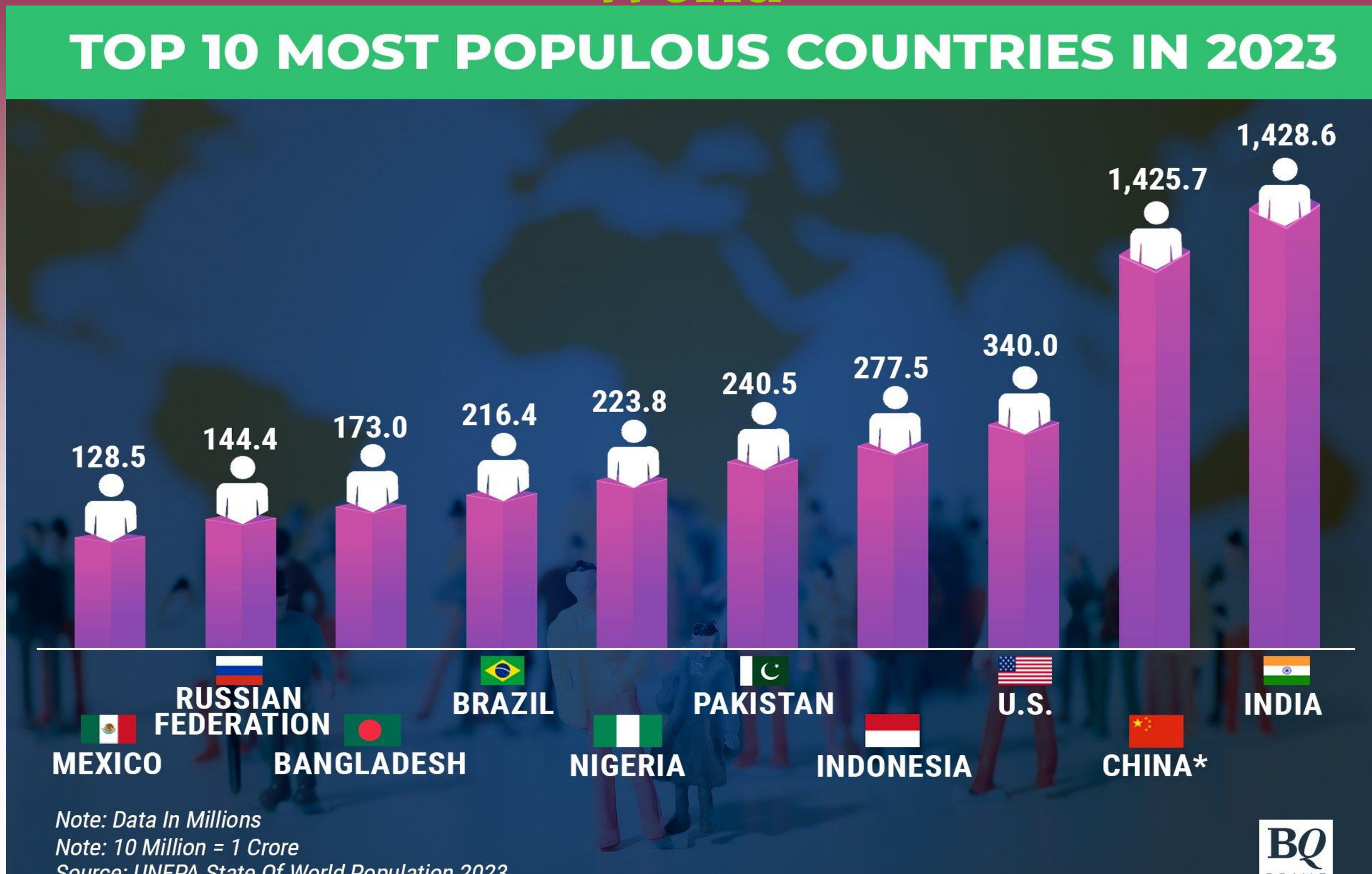


Source: United Nations - Population Division (2022)

OurWorldInData.org/future-population-growth/ • CC BY

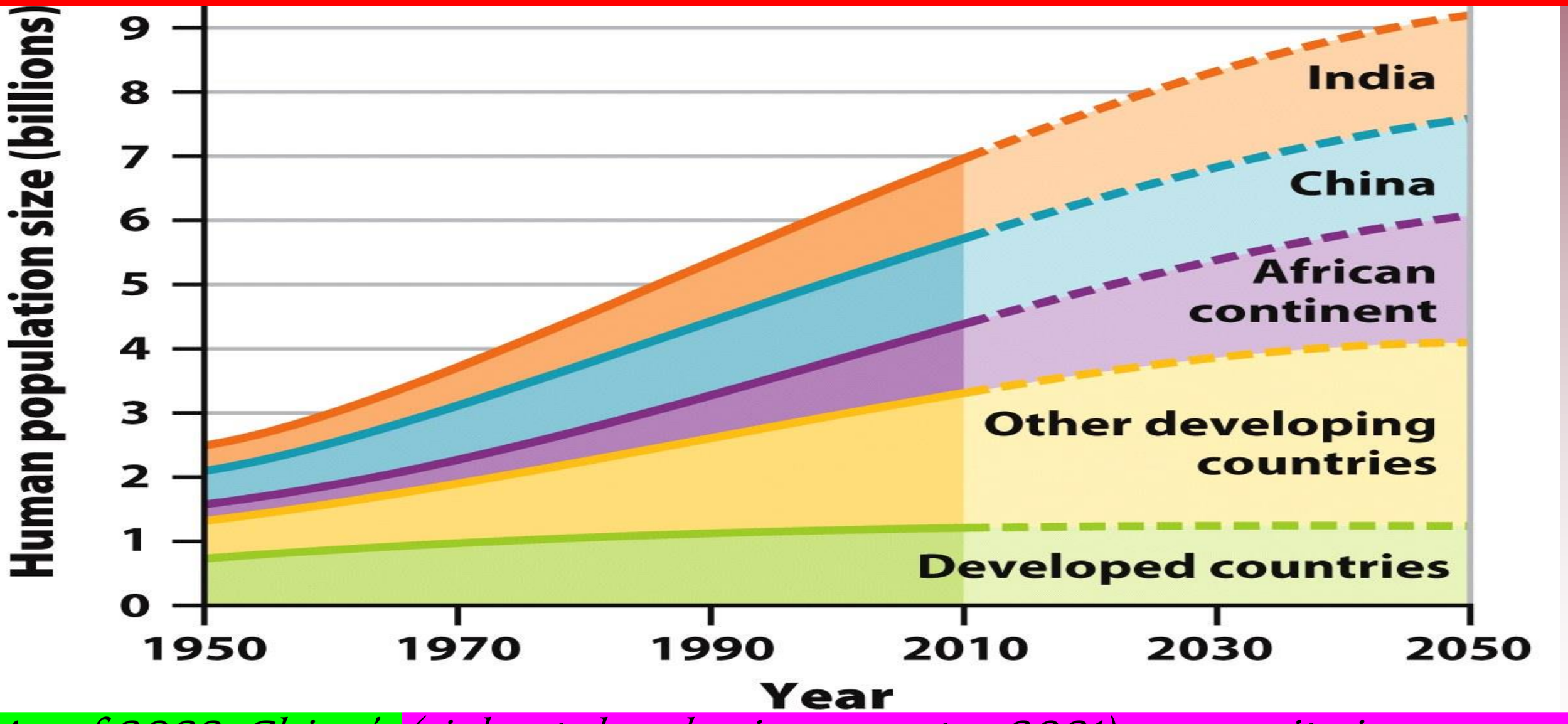
Note: The total fertility rate is the number of children that would be born to a woman if she were to live to the end of her child-bearing years and give birth to children at the current age-specific fertility rates.

The 12 Most Populous Countries in the World



The **relationship** between economic development and population growth rate for developing nations.

To be considered a **developed nation**, **country's income distribution, ecological protection, social security systems and per-capita income needs to be above the world's average (**a **country** generally has a per capita income around or above $18,000 (world's average) and has to meet certain socioeconomic criteria.



As of 2022, China's (richest developing country 2021) per capita income was $12,535 , India's was $2,357 & U.S was $75,243, Quatar was $88,046

The Impact of Affluence

- **Gross domestic product (GDP)**- the value of all products and services produced in a year in that country.

<u>GDP is made up of 4 types of economic activity:</u>

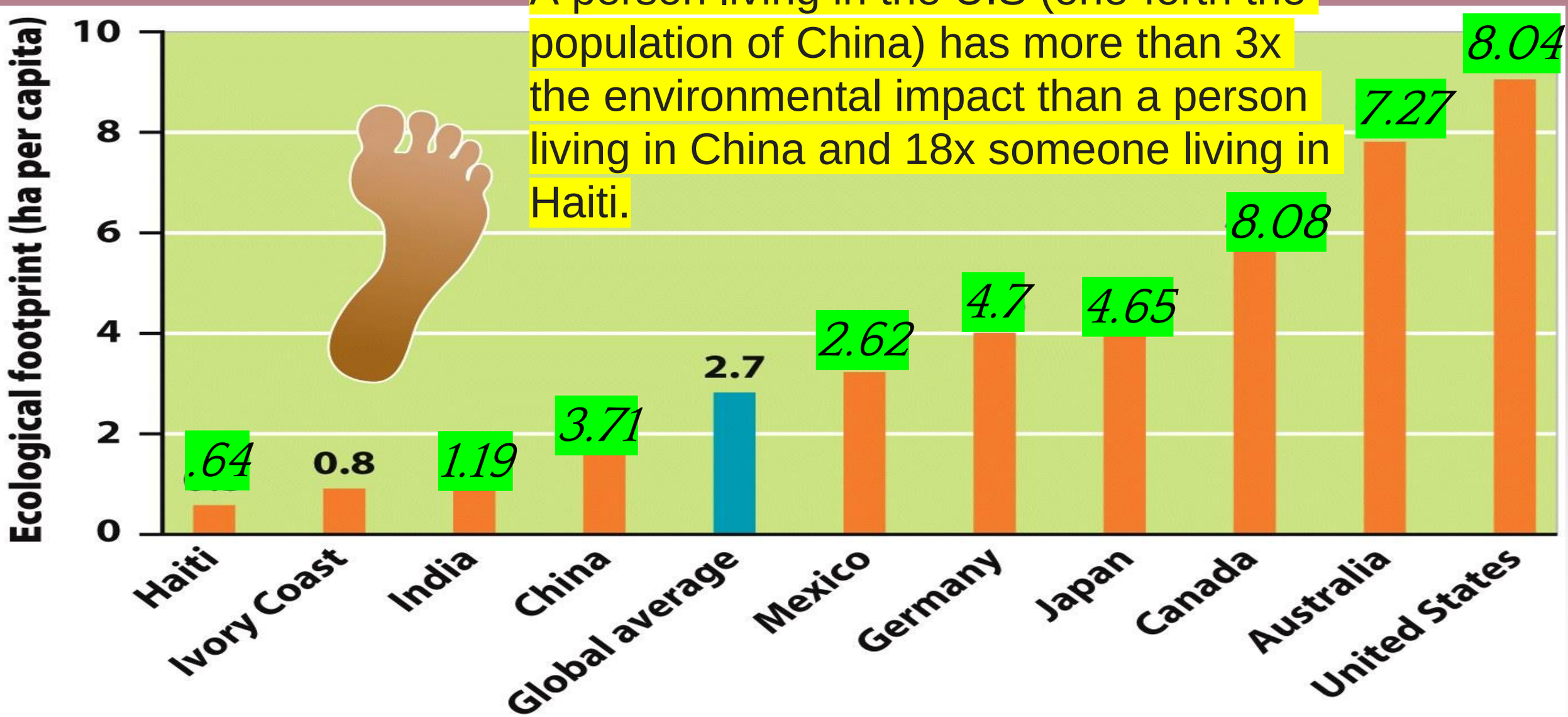
1. consumer spending
2. investments
3. government spending
4. exports minus imports.

- A countries GDP often correlates with its pollution levels. (GDP increases as a nation begins to be able to afford to burn fossil fuels).

Ecological Footprints

- **Affluence** –effect on our Earth by having a lot of wealth such as money, goods, or property (consumer).

A person living in the U.S (one-forth the population of China) has more than 3x the environmental impact than a person living in China and 18x someone living in Haiti.



However, due to China's rapid development, it is predicted that China will exceed the U.S's footprint within 10 yrs
Singapore is 5.87, highest is Quatar (Middle East) with 14.72

The IPAT Equation

- To estimate the impact of human lifestyles on Earth we can use the IPAT equation:

Impact= **P**opulation X **A**ffluence X **T**echnology

Impact – overall environmental effect of a human population

Population- straightforward effect on impact

Affluence – created by economic opportunity, consumers.

Technology – can either degrade the environment or create solutions to minimize our impact on the environment. (destructive vs. beneficial technology)

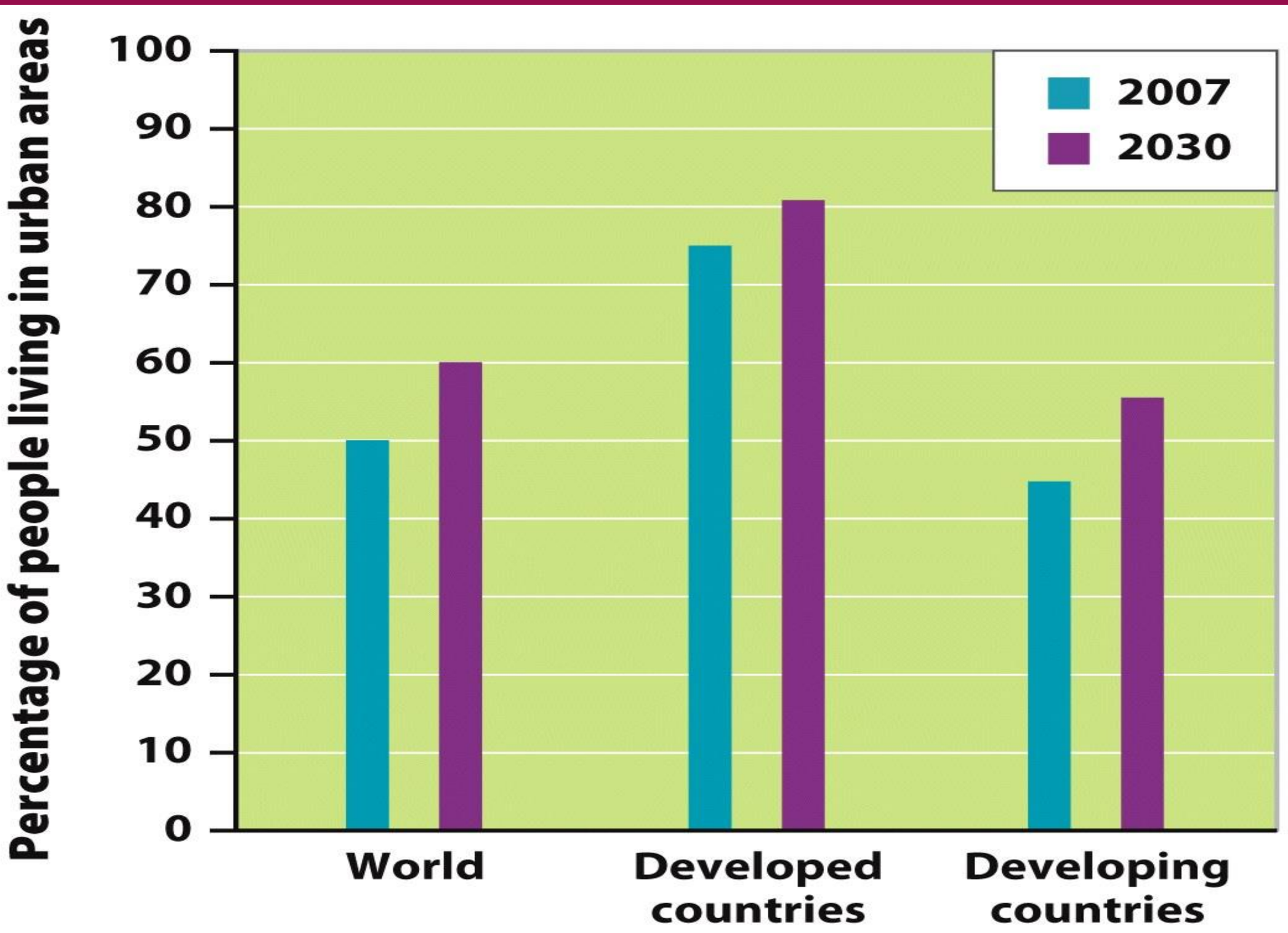


Figure 7.18
Environmental Science

More than one half of the world population will live in urban setting (**urbanization** – cities/infrastructure/suburbs) by 2030