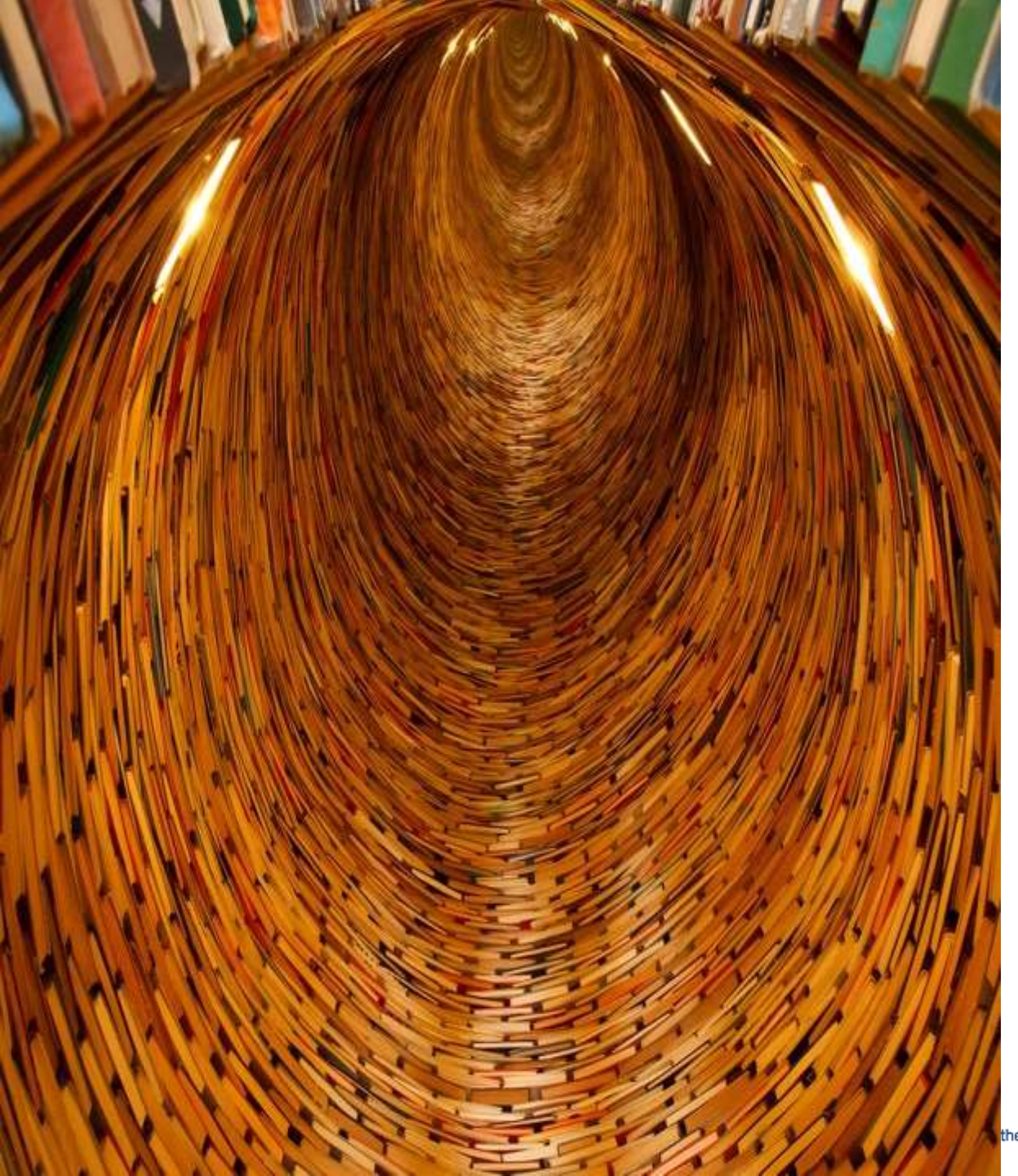

Learning unit SUSTAINABLE DEVELOPMENT AND CLIMATE CHANGE

Co-funded by the European Union

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General objective

To learn the basics of the sustainable development goals, the role of people, the planetary boundaries, the value of renewable energy, sustainable consumption and climate change endeavours.

Competencies to be acquired

1. Introduction to sustainable development

- **Knowledge:**
  - to understand the sustainable development approach
  - to distinguish between sustainable growth patterns and business-as-usual growth patterns
  - to identify the consequences of business-as-usual patterns on the environment and society

- **Skills:**
  - to define the Sustainable Development Goals
  - to identify global poverty regions

- **Responsibility and Autonomy:**
  - to articulate and summarize the sustainable development approach

Competencies to be acquired

2. Economic Development – How We Measure It, How It Varies Around the World

- **Knowledge:**
  - to understand standard ways of measuring income and economic growth and progress globally

- **Skills:**
  - to distinguish between patterns of urban versus rural economic growth

- **Responsibility and Autonomy:**
  - to critical analyse the GDP as a metric of economic success in a sustainable development framework
  - to identify the driving factors behind urban migration

Competencies to be acquired

3. Sustainable Food Supply and the End of Hunger

- **Knowledge:**
  - to understand the complex concept of malnutrition in a global context
  - to understand the relationship between climate change and food systems

- **Skills:**
  - to illustrate and use key indicators of malnutrition, including stunting, wasting, and obesity

- **Responsibility and Autonomy:**
  - to interpret the link between agriculture as driver of climate change and climate change as a threat to food systems

Competencies to be acquired

4. Sustainable Cities

- **Knowledge:**
  - to identify the factors driving urbanization and its consequences

- **Skills:**
  - to relate the consequences of the factors driving urbanization

- **Responsibility and Autonomy:**
  - to justify the relation between the key sectors central to making cities more sustainable

Competencies to be acquired

5. Curbing Climate Change

- **Knowledge:**
  - to identify the human factors driving climate change

- **Skills:**
  - to illustrate and relate the mechanisms behind anthropogenic climate change

- **Responsibility and Autonomy:**
  - to identify the key greenhouse gases and their sources and lifespans

Competencies to be acquired

6. Saving Biodiversity

- **Knowledge:**
  - to define “biodiversity” and “ecosystem services
- **Skills:**
  - to illustrate and relate how the terrestrial ecosystems works
- **Responsibility and Autonomy:**
- to identify the human factors driving the sixth extinction

Chapter 1. Introduction to Sustainable Development

1.1 What Sustainable development is

Sustainable development is really two ideas:

- One, is a way to understand this complicated world.

How do the economic, the social, the environmental, the political, the cultural factors fit together?

- And the second aspect of sustainable development is the idea of sensible goals for this crowded, interconnected planet.

1.2 Economic Growth and Progress

One very crucial aspect of sustainable development is economic well-being and prosperity.

There have been great gains in material well-being. In average income per person, in other indicators of material life, such as health and life expectancy, over the course of recent decades.

1.3 Continuing Poverty

Poverty is usually viewed as lack of adequate income, but let's think about it as a lack of income, a lack of access to basic health services.

A lack of access to basic amenities that most of the world takes for granted.

Safe water, sanitation, electricity, access for children to, a decent education.

People living in extreme poverty are people who cannot meet these basic needs.

CHART OF THE WEEK

Where Do the Richest People Live?

Ranking the world's most affluent countries by average and median wealth

Countries often compete over who's the richest, and rely on economic indicators such as average wealth to make their case.

But some argue that this simple metric doesn't factor in the gap between the richest and poorest in a nation—also known as income inequality.

Average wealth:
Calculated by dividing a country's overall wealth (gross assets) by its total adult population.

Median wealth:
Calculated by dividing wealth distribution into two equal groups—those with more above, and those with less below, the middle wealth value.

Using data from the Credit Suisse Global Wealth Report 2018, we break down the top 10 countries by average wealth per adult, and who's really the richest when median wealth is accounted for.

Top 10 (Average)

1	SWITZERLAND	$530,244
2	AUSTRALIA	$411,060
3	UNITED STATES	$403,974
	BELGIUM	$315,045
	NORWAY	$291,103
	NEW ZEALAND	$280,798
	CANADA	$266,265
	DENMARK	$260,712
	SINGAPORE	$265,118
	FRANCE	$260,580

Top 10 (Median)

AUSTRALIA	$191,453
SWITZERLAND	$161,339
BELGIUM	$163,429
NETHERLANDS	$114,935
FRANCE	$106,827
CANADA	$106,342
JAPAN	$103,880
NEW ZEALAND	$98,613
UNITED KINGDOM	$87,168
SINGAPORE	$91,696

Data estimates are for mid-2018 values
Source: Credit Suisse Global Wealth Report 2018, Global Wealth Databook 2018

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1.4 Environmental Threats

We need to understand what those planetary boundaries are:

- climate change,
- ocean acidification,
- ozone depletion,
- the nitrogen cycle,
- the phosphorous cycle,
- global fresh water use,
- changes in land use,
- loss of biodiversity,
- driving other species to extinction,

that is, aerosol loading, the particles we're putting into the atmosphere through industrial processes, and chemical pollution, poisoning air and waterways.

These are planetary boundaries that we trespass at profound risk for ourselves and for our children.

1.5 Business as Usual vs. Sustainable Development

One part of sustainable development is to understand the inter-linkages of the economy, of society, of the environment, and of our politics and government processes, and the other part of sustainable development to do something about it.

We need to move from the business as usual trajectory to the sustainable development trajectory.

1.6 Agenda 2030

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Chapter 2: Economic Development – How We Measure It, How It Varies Around the World

2.1 Incomes Around the World

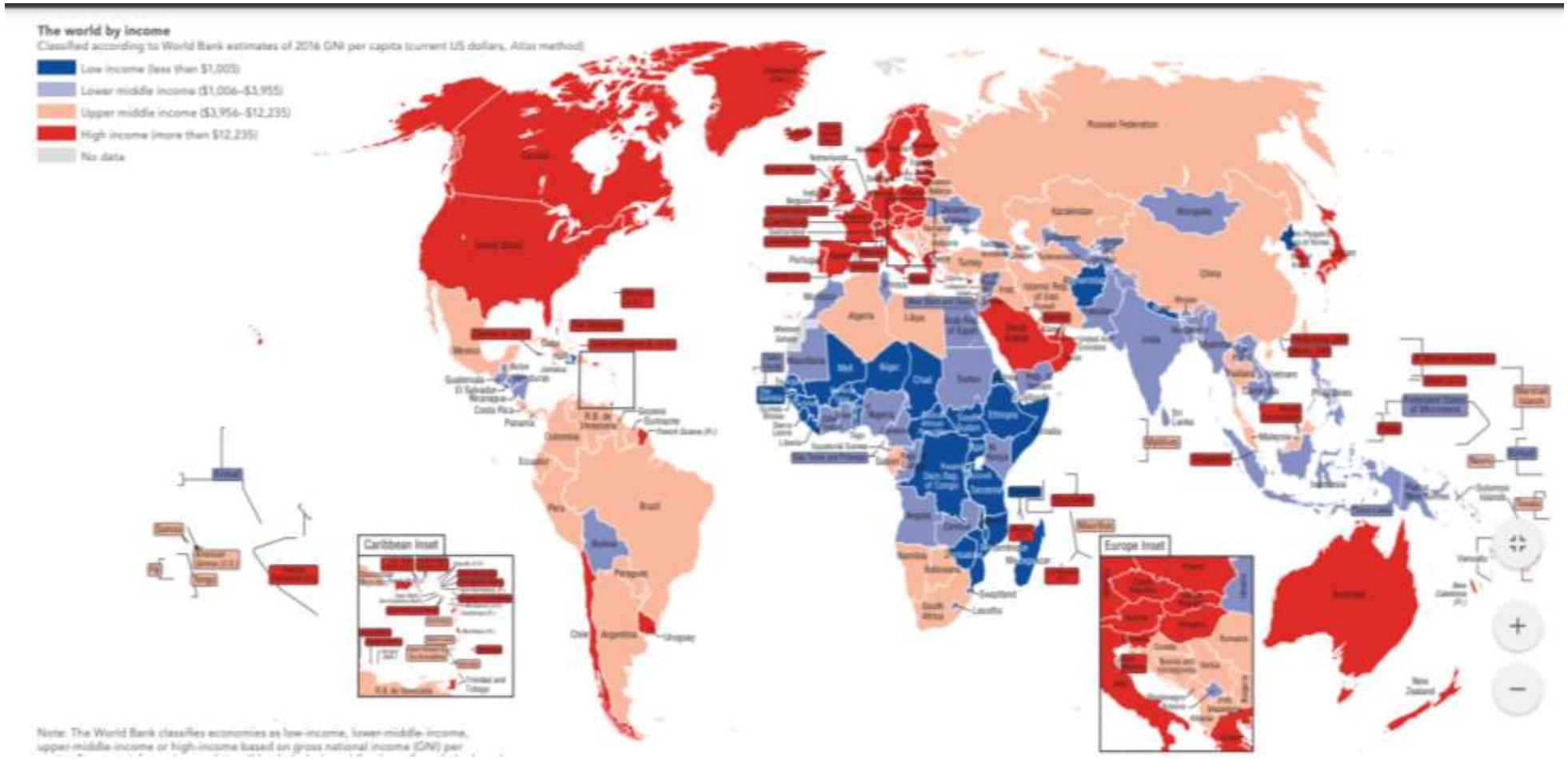
Sustainable development we've seen has three major aspects:

- economic development,
- broad-based inclusion and
- environmental sustainability,

all supported by good governance.

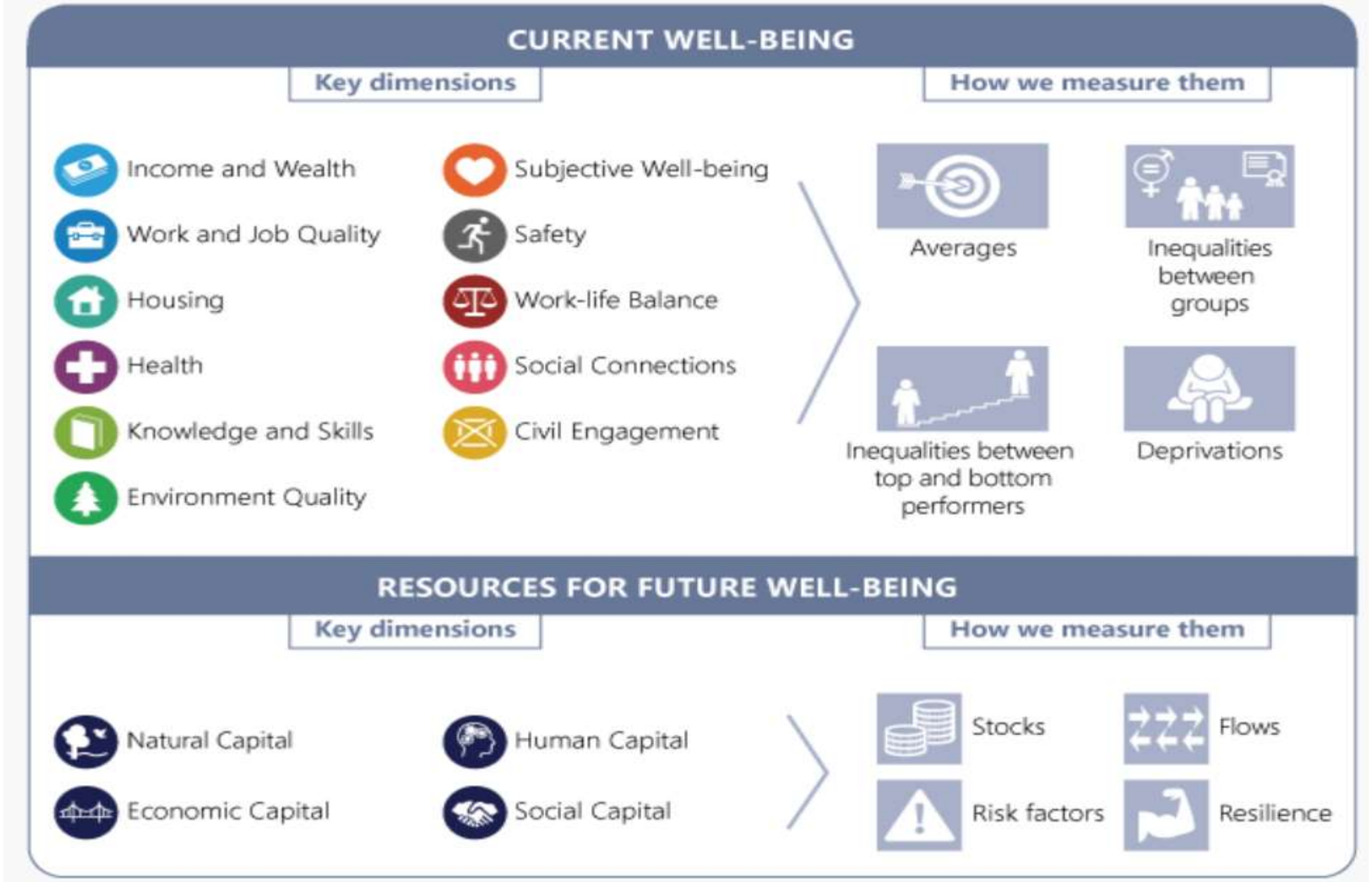
The World Bank gives three categories of countries:

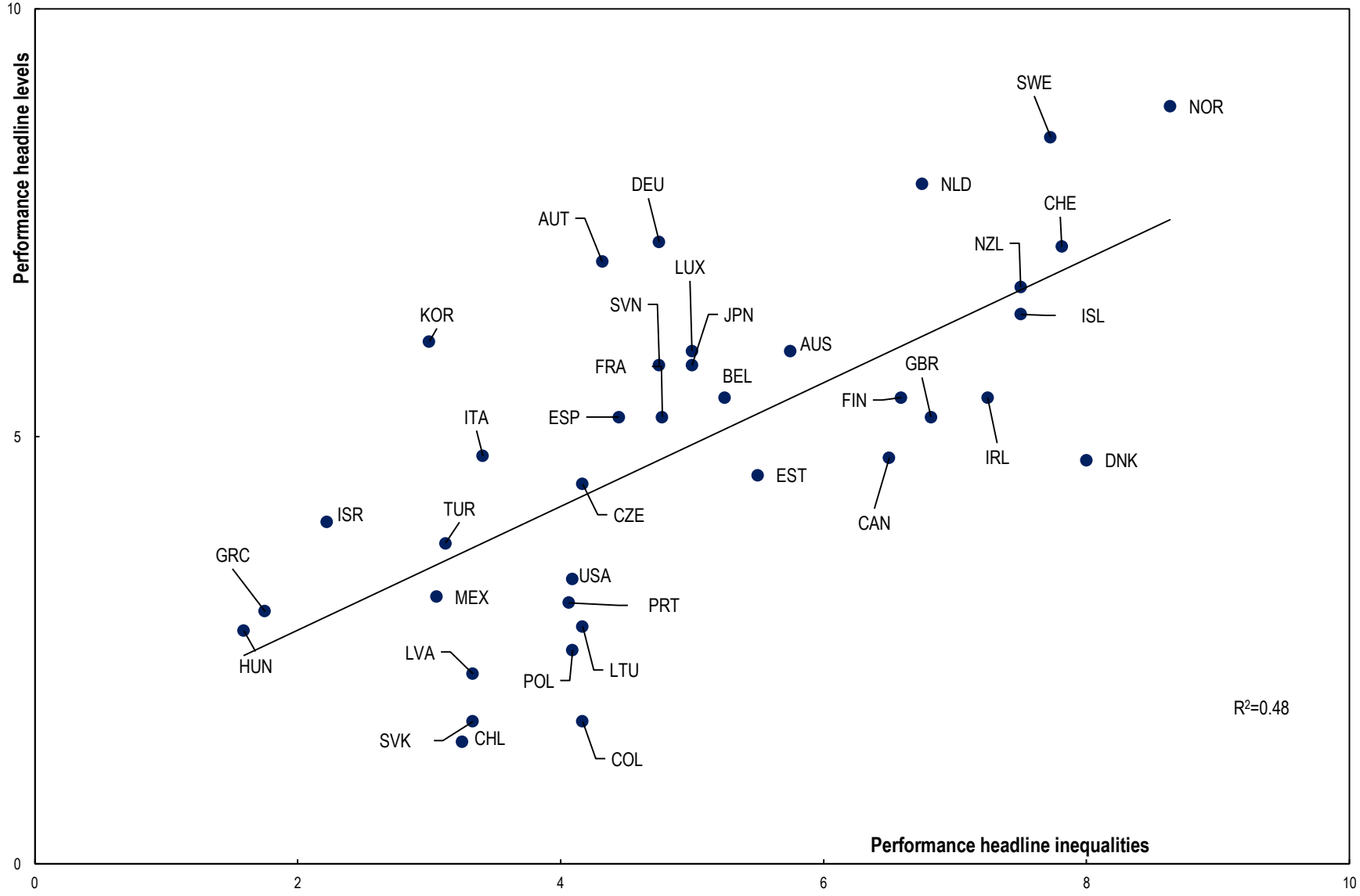
- ✓ high income countries,
- ✓ middle income countries and
- ✓ low income countries,



2.2 Measuring Well-being

The Organisation for Economic Co-operation and Development (https://www.oecd.org/) differentiates between measures of material conditions of life, which are essentially measures of income and wealth, jobs and earnings, and housing, and other quality of life indicators which include leisure time, health, education, social connectedness, whether society has the social capital to come to the aid of each other, civic engagement, voter turnout, environmental quality, personal safety, and subjective well-being.


CURRENT WELL-BEING
Key dimensions
How we measure them
Income and Wealth
Work and Job Quality
Housing
Health
Knowledge and Skills
Environment Quality
Subjective Well-being
Safety
Work-life Balance
Social Connections
Civil Engagement
Averages
Inequalities between groups
Inequalities between top and bottom performers
Deprivations
RESOURCES FOR FUTURE WELL-BEING
Key dimensions
How we measure them
Natural Capital
Economic Capital
Human Capital
Social Capital
Stocks
Flows
Risk factors
Resilience



In 2018, the countries expressing the highest subjective well-being were Finland, Norway, Denmark, and Iceland--four Nordic countries--and Sweden, the fifth of the Nordic countries

Chapter 3: Sustainable Food Supply and the End of Hunger

3.1. End of Hunger

Around 2.8 billion people on a planet of 7.2 billion people are malnourished, about 40% of the population.

We have a food crisis. It varies in different parts of the world, sometimes it's hidden, sometimes it's the wrong kinds of foods, sometimes it's simply not enough food.

3.2 How Environmental Change Threatens the Food System

Under the pressures of intensive agriculture, often when farms have encroached on forest lands or in topography not really suitable for farms, the result is also rapid land degradation. Soil loss. Depletion of soil nutrients.

Chapter 4: Sustainable Cities

4.1 The Patterns of Urbanization Around the World

In 1950, 38% of the world's urban population was in Europe. Now, the era in which European and U.S. cities were the dominant cities of the world is coming to an end.

World Population by Region

back to top ↑

#	Region	Population (2020)	Yearly Change	Net Change	Density (P/Km²)	Land Area (Km²)	Migrants (net)	Fert. Rate	Med. Age	Urban Pop %	World Share
1	Asia	**4,641,054,775**	0.86 %	39,683,577	150	31,033,131	-1,729,112	2.2	32	0 %	59.5 %
2	Africa	**1,340,598,147**	2.49 %	32,533,952	45	29,648,481	-463,024	4.4	20	0 %	17.2 %
3	Europe	**747,636,026**	0.06 %	453,275	34	22,134,900	1,361,011	1.6	43	0 %	9.6 %
4	Latin America and the Caribbean	**653,962,331**	0.9 %	5,841,374	32	20,139,378	-521,499	2	31	0 %	8.4 %
5	Northern America	**368,869,647**	0.62 %	2,268,683	20	18,651,660	1,196,400	1.8	39	0 %	4.7 %
6	Oceania	**42,677,813**	1.31 %	549,778	5	8,486,460	156,226	2.4	33	0 %	0.5 %

TOP 20 LARGEST COUNTRIES BY POPULATION (LIVE)

1	China	1,441,273,319
2	India	1,384,805,010
3	U.S.A.	331,685,463
4	Indonesia	274,548,117
5	Pakistan	222,431,455
6	Brazil	213,091,919
7	Nigeria	207,987,699
8	Bangladesh	165,270,042
9	Russia	145,956,301
10	Mexico	129,412,529
11	Japan	126,342,016
12	Ethiopia	115,993,628
13	Philippines	110,099,767
14	Egypt	103,026,440
15	Vietnam	97,648,089
16	D.R. Congo	90,554,745
17	Turkey	84,660,613
18	Germany	83,877,820
19	Iran	84,374,993
20	Thailand	69,861,291

Rank	City	Population in Year 2018
#1	Tokyo	38,194,000
#2	Delhi	27,890,000
#3	Shanghai	25,779,000
#4	Beijing	22,674,000
#5	Mumbai	22,120,000
#6	Sao Paulo	21,698,000
#7	Mexico City	21,520,000
#8	Cairo	19,850,000
#9	Dhaka	19,633,000
#10	New York City	18,713,000

4.2 What Makes a City Sustainable?

- Is a green city

Green in the literal sense that there are parks and places of people and open areas combined. But also green in the sense that its economic impact on the environment, the ecological footprint of the city, is also limited.

- Is a resilient city

In the era of planetary boundaries, in a period where, whether we like it or not, we are going to be experiencing more jolts of human-induced climate change know that the cities are going to be buffeted.

- The energy system
- Transport
- The infrastructure, its water, its sanitation, its waste management

4.3 Planning for Sustainable Development

- A good example in sustainable development city planning is the plan of the city of New York, PlaNYC

10 goals:

1. Housing and neighborhoods
2. Parks and Public Spaces
3. Brownfields
3. Waterways- Waste fills dumping sites
4. Water Supply
5. Transportation
6. Energy
7. Air Quality
8. Solid Waste
9. Climate Change

Chapter 5: Curbing Climate Change

5.1 The Basic Science of Climate Change

Climate change is the biggest of all the environmental threats that we face, and the magnitude of this threat is only gradually dawning on humanity.

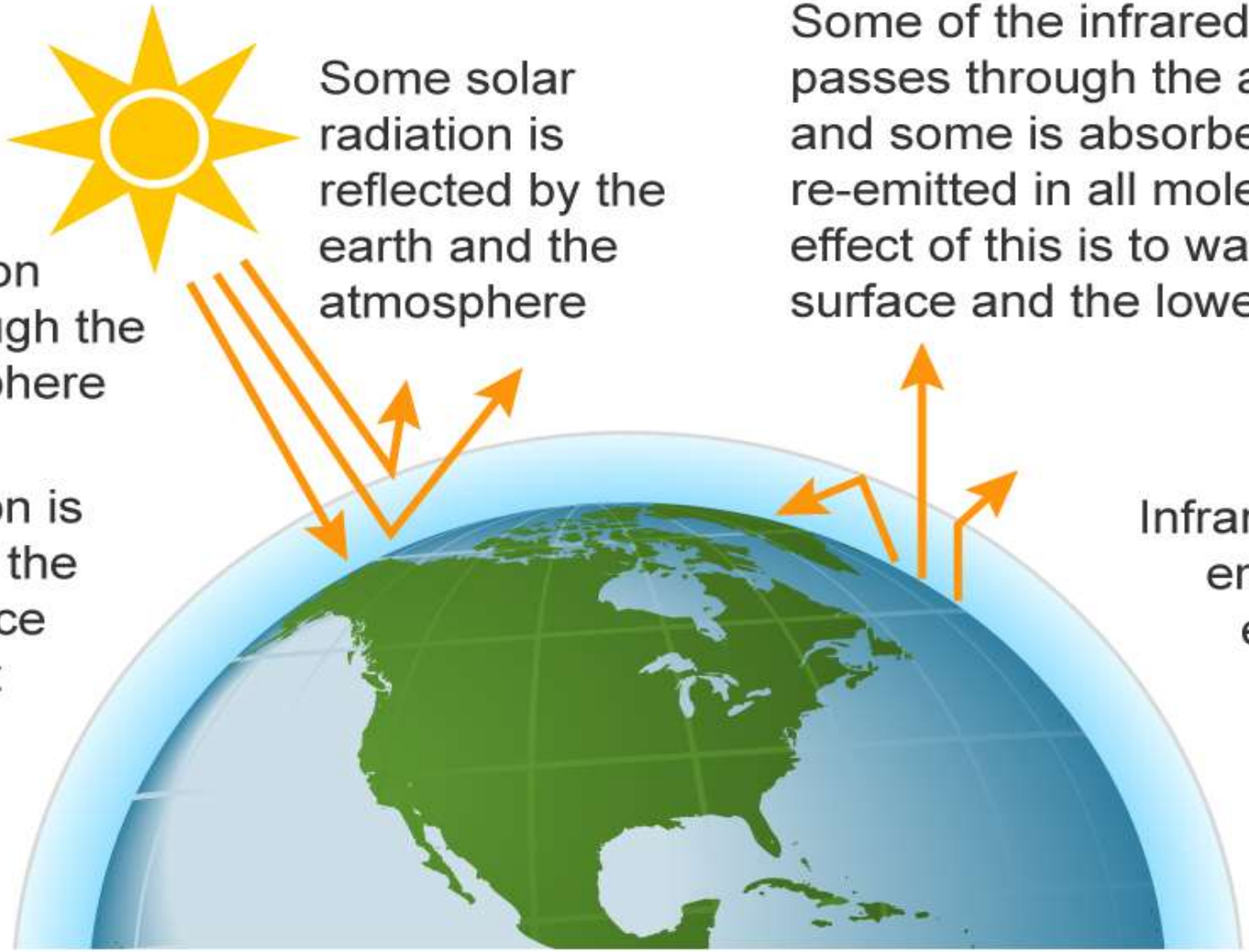
The greenhouse effect

Some solar radiation is reflected by the earth and the atmosphere

Some of the infrared radiation passes through the atmosphere, and some is absorbed and re-emitted in all molecules. The effect of this is to warm the earth's surface and the lower atmosphere.

Solar radiation passes through the clear atmosphere

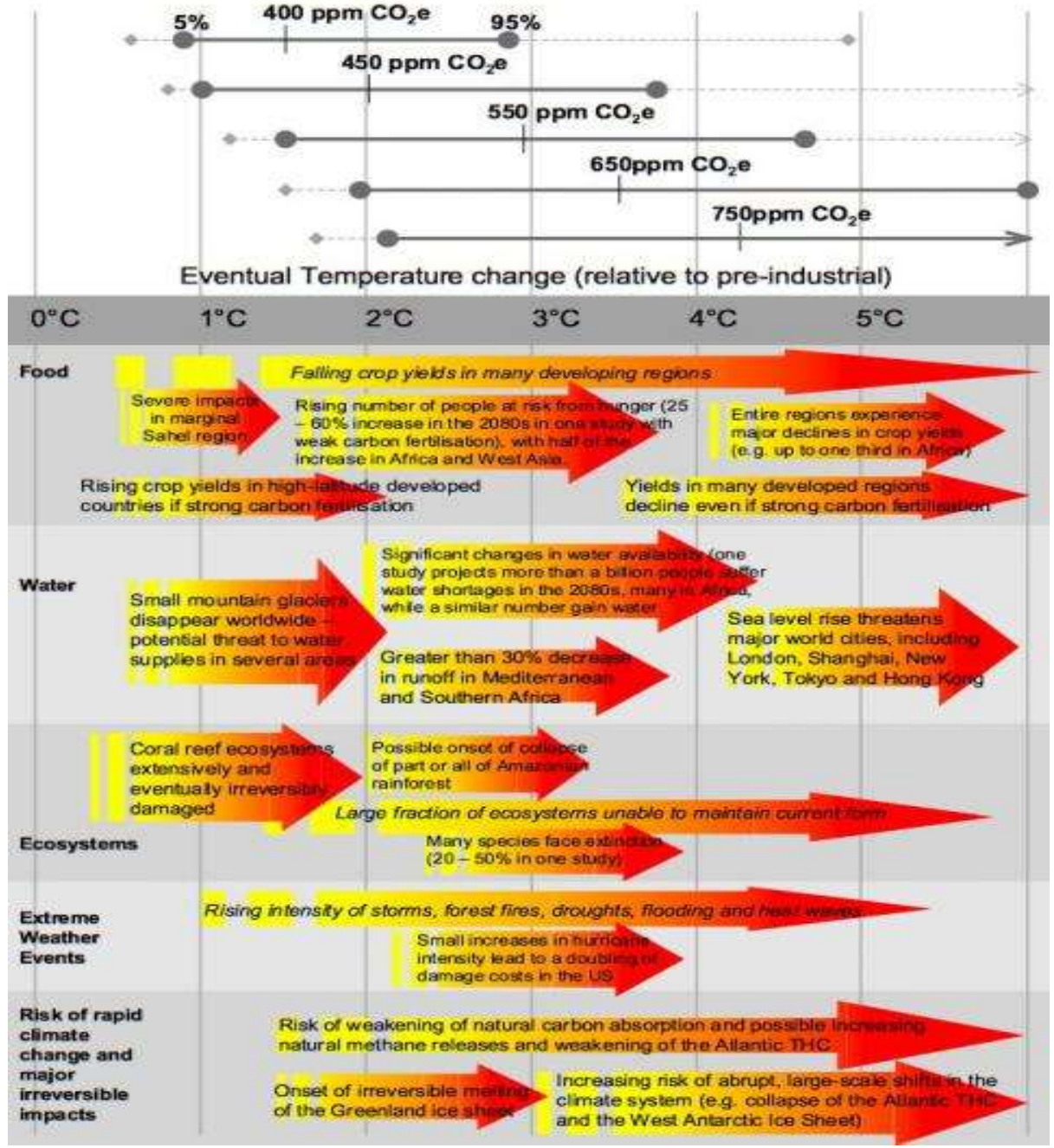
Most radiation is absorbed by the earth's surface and warms it



Infrared radiation is emitted from the earth's surface

5.2 Consequences

We are on a path of putting so much carbon dioxide, methane, nitrous oxide into the atmosphere that the temperature increase on average on the planet could be several degrees centigrade by the end of this century.


5%
400 ppm CO_2e
95%
450 ppm CO_2e
550 ppm CO_2e
650ppm CO_2e
750ppm CO_2e
Eventual Temperature change (relative to pre-industrial)
0°C
1°C
2°C
3°C
4°C
5°C
Food
Falling crop yields in many developing regions
Severe impacts in marginal Sahel region
Rising number of people at risk from hunger (25 – 60% increase in the 2080s in one study with weak carbon fertilisation), with half of the increase in Africa and West Asia
Entire regions experience major declines in crop yields (e.g. up to one third in Africa)
Rising crop yields in high-latitude developed countries if strong carbon fertilisation
Yields in many developed regions decline even if strong carbon fertilisation
Water
Small mountain glaciers disappear worldwide – potential threat to water supplies in several areas
Significant changes in water availability (one study projects more than a billion people suffer water shortages in the 2080s, many in Africa, while a similar number gain water)
Greater than 30% decrease in runoff in Mediterranean and Southern Africa
Sea level rise threatens major world cities, including London, Shanghai, New York, Tokyo and Hong Kong
Ecosystems
Coral reef ecosystems extensively and eventually irreversibly damaged
Possible onset of collapse of part or all of Amazonian rainforest
Large fraction of ecosystems unable to maintain current form
Many species face extinction (20 – 50% in one study)
Extreme Weather Events
Rising intensity of storms, forest fires, droughts, flooding and heat waves
Small increases in hurricane intensity lead to a doubling of damage costs in the US
Risk of rapid climate change and major irreversible impacts
Risk of weakening of natural carbon absorption and possible increasing natural methane releases and weakening of the Atlantic THC
Onset of irreversible melting of the Greenland ice sheet
Increasing risk of abrupt, large-scale shifts in the climate system (e.g. collapse of the Atlantic THC and the West Antarctic Ice Sheet)

5.3 Adaptation

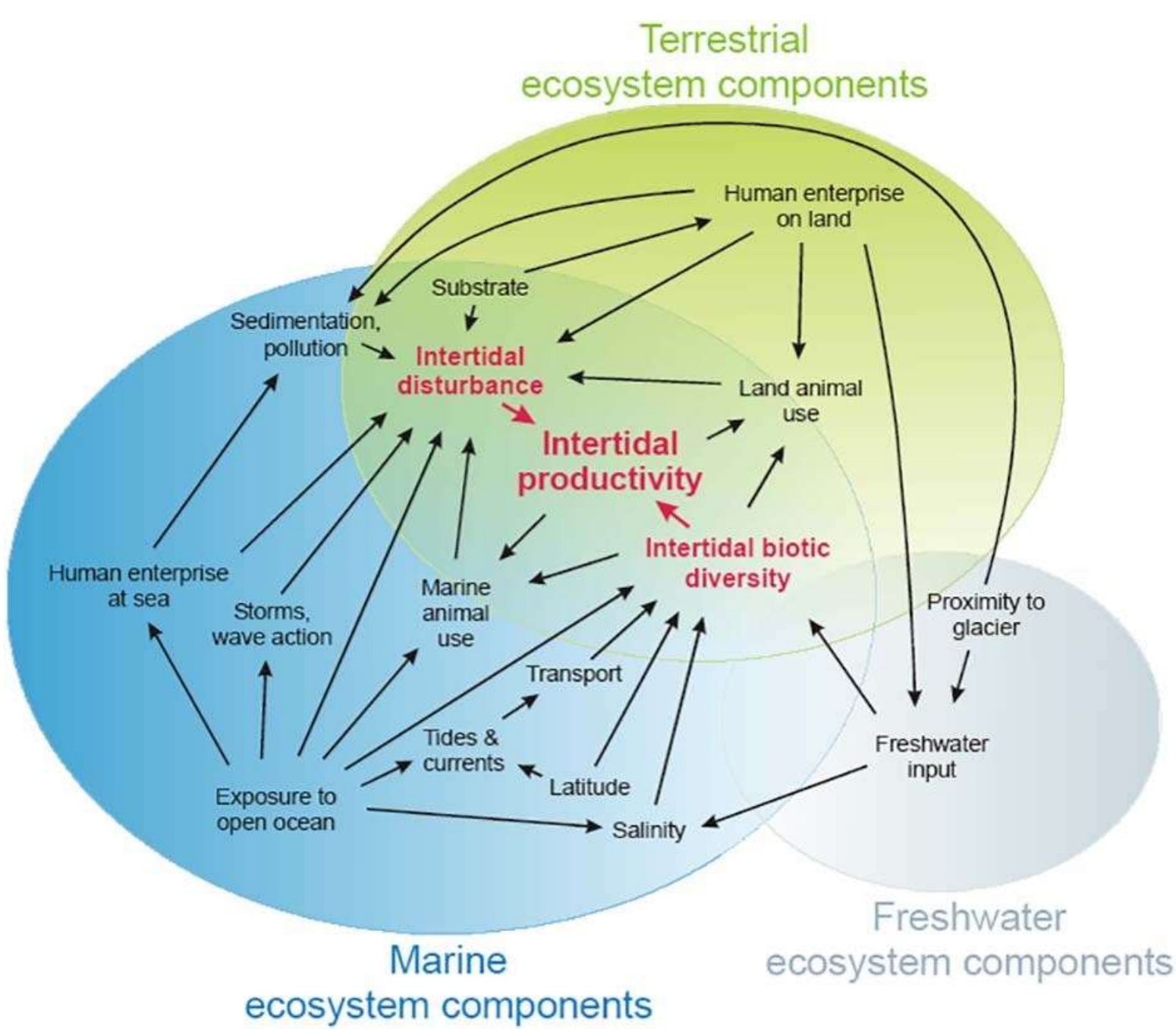
It is possible to reduce human emissions of greenhouse gases substantially. The technologies are within reach.

- We need energy efficiency.
- We need low carbon electricity.
- And we need electrification of parts of the economy, like automobiles, like home heating, and some industrial processes, to use that clean energy from clean electricity rather than the dirty energy coming from burning fossil fuels.

Chapter 6: Saving Biodiversity

6.1 What is Biodiversity?

Biodiversity is the variability among living organisms from all sources, including terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems.


Terrestrial
ecosystem components
Human enterprise
on land
Substrate
Sedimentation,
pollution
Intertidal
disturbance
Land animal
use
Intertidal
productivity
Intertidal biotic
diversity
Human enterprise
at sea
Storms,
wave action
Marine
animal
use
Proximity to
glacier
Transport
Tides &
currents
Freshwater
input
Latitude
Exposure to
open ocean
Salinity
Marine
ecosystem components
Freshwater
ecosystem components

6.2 Biodiversity Under Threat

Some of the main threats to biodiversity are:

1. Human Activities and Loss of Habitat,
2. Deforestation,
3. Desertification,
4. Marine Environment,
5. Increasing Wildlife Trade and
6. Climate Change.

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