Global population and the state of the world

World Population
Projected world population until 2100

- **1990**: 5.3 billion
- **2017**: 7.6 billion
- **2030**: 8.6 billion
- **2050**: 9.8 billion
- **2100**: 11.2 billion

Source: United Nations Department of Economic and Social Affairs, Population Division, World Population Prospects: The 2017 Revision
Produced by: United Nations Department of Public Information
Global population and the state of the world

I. Global population and growth: past, present, future
II. Economic growth
III. Sustainable Development
IV. Physical environment
V. Group work
Population density history

Klein Goldewijk et al., 2010, Long-term dynamic modeling of global population and built-up area in a spatially explicit way: HYDE 3.1
I. Global population and growth: past, present, future

Table 2. Total population and population density estimates, selected timesteps

| Total population (in millions) | 10 000 BC | 5000 BC | 0  | 500 | 1000 | 1500 | 1600 | 1700 | 1800 | 1900 | 1950 | 2000 |
| North America | 0 | 0 | 1 | 1 | 2 | 1 | 1 | 7 | 82 | 172 | 316 |

Table 3. Computed regional population growth rates (in %/yr per time period)

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</thead>
<tbody>
<tr>
<td>North America</td>
<td>0.03%</td>
<td>0.03%</td>
<td>2.21%</td>
<td>1.40%</td>
<td>2.58%</td>
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<td>0.07%</td>
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<td>0.41%</td>
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<td>0.57%</td>
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<td>0.77%</td>
<td>0.93%</td>
<td>0.69%</td>
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<td>0.53%</td>
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<td>0.14%</td>
<td>0.42%</td>
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<td>Oceania</td>
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<td>World</td>
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I. Global population and growth: past, present, future

United States Census Bureau
Current population state (estimates)
1. Global population and growth: past, present, future

First some terms …

… Population ecology …

… Population dynamics …

… Population inertia …
I. Global population and growth: past, present, future

Population Ecology

Study of populations in relation to environment, including environmental influences on density and distribution, age structure, and population size.
I. Global population and growth: past, present, future

Please name examples for the different survivorships.
I. Global population and growth: past, present, future

General patterns of population dynamics:

• Exponential growth
• “Boom and bust” cycles
• S-shaped growth
• Single species population oscillations
Population demography

World population
By five-year age group, m

Male Female

Source: UN

*Projection
II. Economic growth

The world by income, FY2017
Classified according to World Bank estimates of 2015 GNI per capita (current US dollar, Atlas method)
- Low income ($1,025 or less)
- Lower middle income ($1,026–$4,035)
- Upper middle income ($4,036–$12,475)
- High income ($12,476 or more)
- No data

II. Economic growth

- the world economy is **vast, growing rapidly** (by 3–4 percent per year in scale), and **highly unequal** in the distribution of income within countries and between countries
- World economy creates **environmental crisis**
- Economic growth signifies **increase in GDP per capita**
- Gross domestic product (GDP) at purchasing power parity (PPP) at constant/international prices
- Is **NOT** a measure of well-being
II. Economic growth – example

• The rule of 70 with increase of GWP per person gives a time estimate until economy size has doubled

• From 1820 to 2010 (estimate by Maddison 2006):
  - GWP rose from $695 billion to $41 trillion (59x)
  - World population rose from 1.1 billion to 6.9 billion (6.25x)
  - Thus, GWP per person rose from $651 to $5,942
  - Use of rule of 70: annual growth equals 1.1% over 190 years
II. Economic growth

World GDP over the last two millennia
Total output of the world economy; adjusted for inflation and expressed in 2011 international dollars.

OurWorldInData.org/economic-growth • CC BY-SA
II. Economic growth – serious downsides

**Disrupted** the lives of hundreds of millions of people – How?

**Inequality** of income is **exacerbated** – Why?

Physical environment has been **devastated** – What can we change?
III. Sustainable Development

Sustainable Development is development that meets the needs of the present **without compromising** the ability of future generations to meet their own needs.

(Brundtland 1987, 41)
III. Sustainable Development

Sustainable Development tries to make sense of the interactions of three complex systems: the world economy, the global society, and the Earth’s physical environment. (Sachs, 2015)
III. Sustainable Development

Sustainable Development is a normative outlook

Develop Sustainable Development goals (SDGs)

SDGs call for social inclusive and environmentally sustainable economic growth (Sachs, 2015)
III. Sustainable Development

Complex System containing:

- Global economy
- Social interactions
- Earth systems
- Governance
III. Sustainable Development

Fourth objective: Governance

Governments ↔ Multinational companies
III. Sustainable Development

Technology

- Main **driver** of long-term global economic growth
- Often have **negative** side-effects
- Under human **guidance** (to some extent)
III. Sustainable Development

Normative perspective of a Good Society?
IV. Physical environment

Humanity has become a **serious threat** to its own future well-being.

Human-induced climate change greatly **amplified the impact** of climate related disasters, e.g. Storms, Droughts, …
Physical environment

Hydrometeorological disasters **rise** in number and severity

*Unintended* (at first) climate engineering

New scientific age: **Antropocene**
Physical environment

Latest CO$_2$ reading
September 10, 2018
405.70 ppm

CO$_2$ Concentration (ppm)

Thousands of Years Ago

Carbon dioxide concentration at Mauna Loa Observatory

Full Record ending September 10, 2018

Image source: The Keeling Curve from https://scripps.ucsd.edu/programs/keelingcurve/
“...tree cover has increased by 2.24 million km² (+7.1% relative to the 1982 level). This overall net gain is the result of a net loss in the tropics being outweighed by a net gain in the extra-tropics.” (Song et al., 2018. Nature.)
IV. Group Work

Choose any city, county, country, or continent and think about its population (dynamics, ecology, ...) and affecting features. Can you prioritize some of the sustainable development goals? How can they affect the population? What are serious environmental threats? How can we improve sustainability efforts on that scale? Is technology the solution for climate and societal change adaptation?

Write your key points on a whiteboard.
Choose any city, county, country, or continent and think about its population (dynamics, ecology, …) and affecting features. Can you **prioritize** some of the **sustainable development goals**? How can they affect the population? What are serious environmental threats? How can we improve sustainability efforts on that scale? Is technology the solution for climate and societal change adaptation?

Write your key points on a whiteboard.
IV. Group Work

UN Sustainable Development Goals

1. No Poverty
2. Zero Hunger
3. Good Health and Well-being
4. Quality Education
5. Gender Equality
6. Clean Water and Sanitation
7. Affordable and Clean Energy
8. Decent Work and Economic Growth
9. Industry, Innovation, and Infrastructure
10. Reduced Inequalities
11. Sustainable Cities and Communities
12. Responsible Consumption and Production
13. Climate Action
14. Life Below Water
15. Life on Land
16. Peace, Justice, and Strong Institutions
17. Partnerships for the Goals

School of Sustainability
Arizona State University
Thank you!
Literature


• The Keeling Curve from [https://scripps.ucsd.edu/programs/keelingcurve](https://scripps.ucsd.edu/programs/keelingcurve)

• United Nations