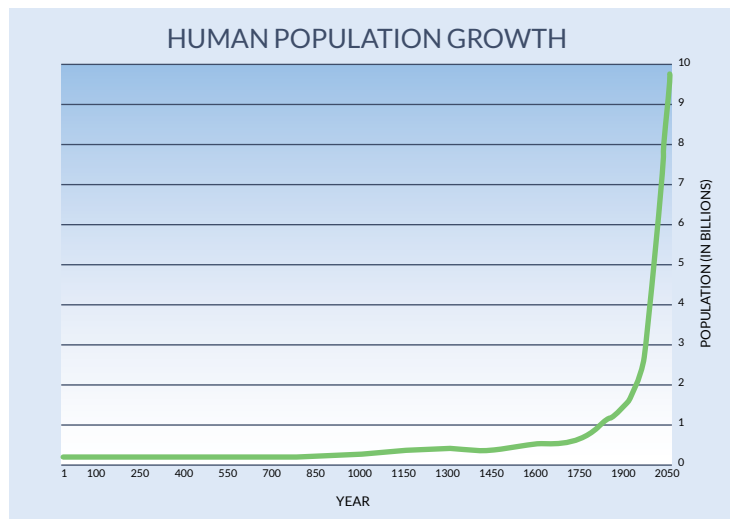


# The Basics of Population Education

The following facts and principles form the backbone of Population Education materials. Each PopEd lesson is designed to communicate one or more of the following concepts, all of which are integral to a working understanding of the relationships between people, resources and the environment.

## World Population History: The Numbers

A graph of human population before the agricultural revolution would likely look like a wave, reflecting growth in times of plenty and decline in times of want, similar to graphs of other species' populations. The graph of recent human population growth is referred to as a "J curve" because it follows that letter's shape, starting low and straight before sharply curving upwards.



Year	Population	Years Elapsed
10,000 BCE	5-10 Million	3,000,000
1 CE	170 Million	10,000
1804	1 Billion	~1,800
1927	2 Billion	123
1960	3 Billion	33
1974	4 Billion	14
1987	5 Billion	13
1999	6 Billion	12
2011	7 Billion	12
2023*	8 Billion	12
2037*	9 Billion	14

\*Projected by the UN

## What Enabled Population Growth?

**Agriculture:** About 12,000 years ago, several cultures shifted from hunting and gathering to farming. Humans became the first and only species ever to control its own food supply, and steady population growth was the result. In the absence of other limiting factors, any population will expand to the limit of its food supply. This happens so reliably that it is considered a law of ecology.

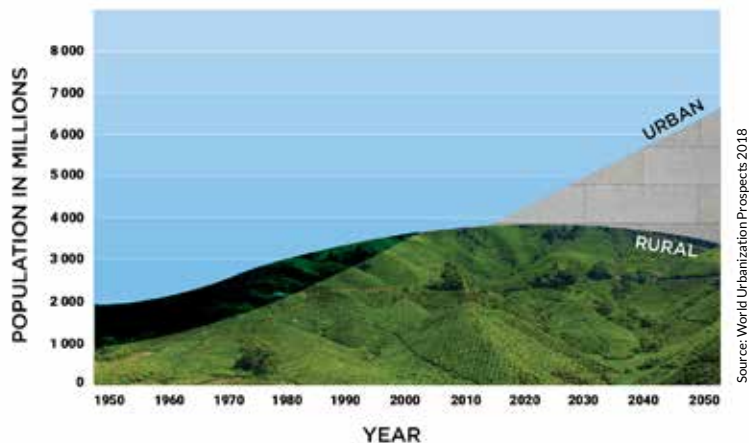
**Technology:** The development of agriculture led to changes in settlement, division of labor, mathematics, literacy, and science. By 1800, the Industrial Revolution was underway, and breakthroughs in medicine, nutrition and sanitation brought down child mortality rates and led to longer life spans. The mechanization of agriculture and improvements in food preservation led to even greater increases in food production and availability. Human numbers began doubling at an unprecedented pace.

## World Population Today

As of 2019, world population was approximately 7.7 billion people and growing. While world population growth continues to slow from its peak growth rate in the 1960s, approximately 80 million people are added to the planet annually at the current growth rate of 1.1 percent. Most of the world's population growth today is occurring in less developed countries, where birth rates are high. At the current rate, we add the equivalent of another Rio de Janeiro every month, and a Germany each year. China and India are the two most populous countries, each with more than 1 billion people. At 329 million people, the United States is the third most populous nation.

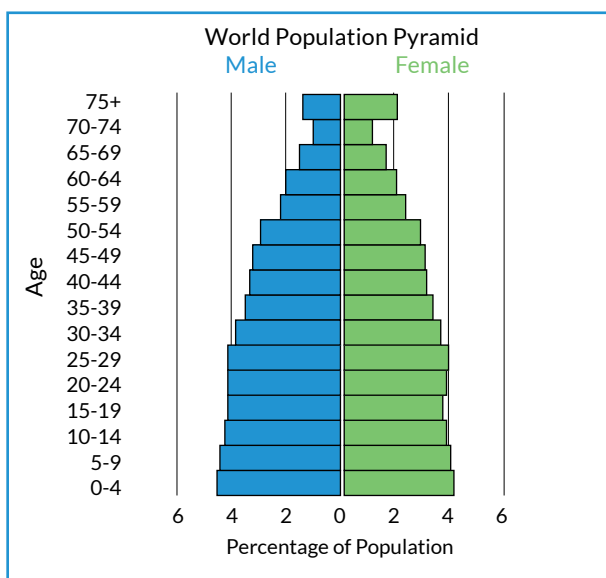
In 2011, for the first time in history, over 50 percent of the world's population lived in urban areas, and that number is expected to reach 68 percent by 2050. An increasing number of people will live in so-called "megacities" – urban areas with populations of greater than 10 million people. The most dramatic urbanization will occur in Asia and Africa: India, China, and Nigeria will collectively account for nearly 1 billion more urban residents over the next 30 years.<sup>1</sup> Though cities can offer economic opportunities and more efficient infrastructure, a larger urban population can exacerbate problems like housing shortages, pollution, and increased resource consumption.

## GROWTH OF URBAN POPULATION



## World Population in the Future

Demographers expect world population to continue to grow through this century, reaching over 10.9 billion by 2100. In making projections, demographers consider likely fertility trends (number of children born per woman), as well as variables that could affect life expectancy such as trends in health, pandemics, war, and food security. The United Nations releases new projections every other year.



A population eventually stabilizes once the fertility rate reaches a two-child average. Even once this replacement fertility is reached, the population will continue to grow until the proportion of young people is equal to that of older people. This can take 60-70 years. In the world today, there are three times as many people under the age of 15 as over age 65. With such a large segment of the population yet to start bearing children, the population is expected to grow through this century, even as fertility rates are dropping.

Experts agree that the status of women around the globe is a key to population stabilization. In places where girls have equal access to an education and women have economic opportunity, families have fewer children.

## Understanding Carrying Capacity

The Earth is a finite system. It has a carrying capacity for how many people can be adequately supported without degrading the environment and habitats of other living things and future generations. Sometimes people look at vast open spaces in places like the U.S. and think there is plenty of space to accommodate many additional people. However, carrying capacity isn't about physical space – it's about the types of land and resources available to sustain life. For instance, arable land must be available to grow the food for people living in cities and suburbs, and trees and other plants must be left to produce the oxygen we all need.

**How many people can the Earth support?** That depends on people's lifestyles, which impacts the rates at which people consume resources. In more affluent countries where people eat an animal-rich diet, use more energy in private homes, and produce more goods, people consume resources at a greater pace. So, if everyone lived as residents of wealthier countries, fewer people could be supported by Earth's resources than live on the planet today. Wealthier countries consume, on average, ten times as many resources as developing countries, and nearly double the resource use of the world average; Europe and North America are the world's top consumers per capita.<sup>2</sup> In the least developed countries, people use fewer resources, but are at risk for malnutrition and fewer opportunities to lead healthy lives and contribute to their nation's economy.

Global demand for natural resources doubled in the past 50 years. Humans' ecological footprint is a measure of how fast we consume resources and generate waste compared to how fast nature can absorb waste and generate new resources. Scientists calculated that since the 1970s, demand for resources has exceeded what the Earth can regenerate



Source: Global Footprint Network; World Wildlife Fund

in a year.<sup>3</sup> It now takes 1.7 years to regenerate what we use in one year. A sustainable outlook considers not how many people *could* live on Earth, but how to balance people and resources in a way that raises the standard of living for all people around the globe without degrading the environment.

## Environmental Impacts

There are many ways in which our large and growing human population impacts the global environment. Using resources faster than they can be replenished is just part of the issue. Over the past 50 years, humans altered ecosystems more rapidly and extensively than in any other comparable period in history, primarily to meet the rapidly growing demands for food, fresh water, timber, fiber, and fuel.

**Climate Change:** The global temperature is on the rise due to the ever-increasing amount of greenhouse gases emitted through fossil fuel use, deforestation, and livestock grazing. This warming causes sea level rise from Arctic ice melt, more extreme weather, and loss of habitat including coral reefs. An increase in the annual global temperature of only 2 degrees Celsius above pre-industrial levels would have catastrophic, irreversible effects on the world's ecosystems, with consequences extending across all parts of human life.<sup>4</sup> Population growth only exacerbates climate change, as more people demand more food and energy. With renewable energy supplying only a small fraction of total energy use, fossil fuel use is expected to expand for the foreseeable future.

**Water Scarcity:** More than half of the world's people already face chronic water shortages.<sup>5</sup> As the population grows, more water is needed for agriculture and industry, as well as for domestic uses. The average person in a developed country consumes more than 7 times the amount of water as a person in the developing world.<sup>6</sup> Pollution further reduces the worldwide supply of clean, accessible water. In 2015, 663 million people were without safe drinking water and 2.3 billion lacked improved sanitation.<sup>7</sup>

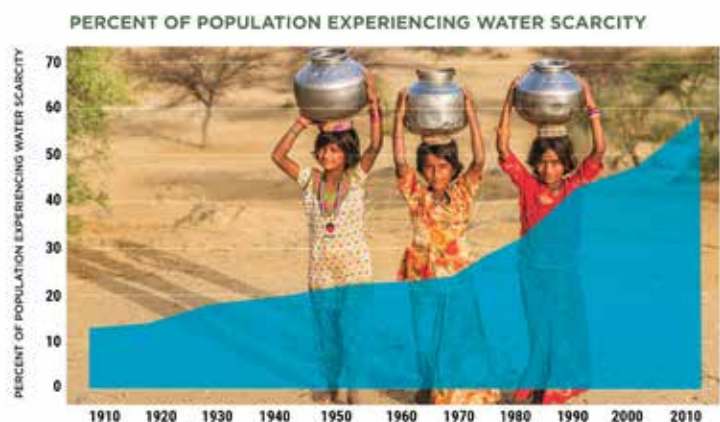
**Biodiversity Loss:** Nearly all of the world's ecosystems are shrinking to make way for more humans and their homes, farms, factories, and shopping centers. According to the Food and Agriculture Organization, global forest area decreased by an area the size of Florida between 2010 and 2015.<sup>8</sup> Coral reefs are threatened by rising carbon dioxide levels in the oceans, which leads to bleaching that destroys coral ecosystems; scientists anticipate that by 2085, all coral reefs will face dissolution from ocean acidification.<sup>9</sup> The World Wildlife Fund's Living Planet Index shows a 60 percent decline in the Earth's biodiversity since 1970, and an 89 percent decline in the tropics.<sup>10</sup> Humans depend on a rich biodiversity for survival – food, medicines, climate regulation, and more.

**Unequal Consequences:** Human impacts on the environment affect everyone, but the harshest consequences will not be distributed equally. Climate change exacerbates global income inequality, making poor countries poorer and rich countries richer.<sup>11</sup> Impoverished nations, especially those closer to the equator, are more damaged by environmental degradation and have fewer resources to combat problems like desertification and rising sea levels.<sup>12</sup> At the same time, people in the richest countries contribute significantly more to global greenhouse gas emissions. The poorest 3.5 billion people only account for 10 percent of emissions, yet live overwhelmingly in countries that will face the starkest consequences of environmental degradation.<sup>13</sup>

## What Will the Future Hold for People and the Planet?

Population stability and efficient resource use are key aspects of long-term sustainability. The good news is that the very conditions that will help the population stabilize – like universal education and gender equality, or access to reproductive healthcare and family planning services – are those that help people live longer and healthier lives, raise healthier children, and enjoy greater prosperity.

And though achieving ecological sustainability may seem like a daunting task, people all around the world are already taking steps to mitigate the consequences of escalating consumption. Policies like the Paris Agreement to tackle climate change or cities' bans on plastic bags work in conjunction with choices that individuals make every day to bring humanity closer to a sustainable and equitable future.



Source: Kummu, M. et al. The world's road to water scarcity: shortage and stress in the 20th century and pathways towards sustainability. *Sci. Rep.* 6, 38495; doi: 10.1038/srep38495 (2016).

## Recommended Resources

### Reference Sources

CIA World Factbook – An online database with population information for every country and world region. [www.cia.gov/library/publications/the-world-factbook](http://www.cia.gov/library/publications/the-world-factbook)

Population Reference Bureau – Find the most up-to-date population data for all countries. [www.prb.org/DataFinder](http://www.prb.org/DataFinder)

United Nations Population Information Network – A guide to population information that can be found on the UN website. [www.un.org/popin](http://www.un.org/popin)

U.S. Census Bureau – U.S. and international population data and resources for teachers. [www.census.gov](http://www.census.gov)

### Background Information and Multimedia Resources

Population Education – Your one-stop site for population-related lesson plans and background materials. [www.populationeducation.org](http://www.populationeducation.org)

Los Angeles Times, *Beyond 7 Billion* – Well-researched series of stories, videos, maps, photos and narrated graphics on world population history and current challenges. [www.latimes.com/world/population](http://www.latimes.com/world/population)

TED Talks, *Global Population Growth, Box by Box* – A video by data expert Hans Rosling visualizing population growth through history and into the future. [www.ted.com/talks/hans\\_rosling\\_on\\_global\\_population\\_growth](http://www.ted.com/talks/hans_rosling_on_global_population_growth)

Science Magazine, *Special Population Issue* – Articles, graphics and an educational video about population figures, trends and projections. [www.sciencemag.org/site/special/population](http://www.sciencemag.org/site/special/population)

World Population History – Stream the *World Population* “dot” video or explore the interactive version of the map with annotated dots, data overlays, and a thematic timeline. <https://worldpopulationhistory.org>

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<sup>1</sup> UN Department of Economic and Social Affairs (2018). “68% of the world population projected to live in urban areas by 2050, says UN.” <https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html>

<sup>2</sup> EcoWatch (2016). “Human Consumption of Earth’s Natural Resources has Tripled in 40 Years.” <https://www.ecowatch.com/humans-consumption-of-earths-natural-resources-tripled-in-40-years-1943126747.html>

<sup>3</sup> Global Footprint Network, [www.footprintnetwork.org](http://www.footprintnetwork.org).

<sup>4</sup> NASA (2016). “Why a half-degree temperature rise is a big deal.” <https://climate.nasa.gov/news/2458/why-a-half-degree-temperature-rise-is-a-big-deal/>

<sup>5</sup> Matti Kummu, The world’s road to water scarcity: shortage and stress in the 20th century and pathways toward sustainability. *Sci. Rep.* 6, 38495 (2016).

<sup>6</sup> Improve International (2014). “How much water is enough? Determining realistic water use in developing countries.” <http://www.improveinternational.org/2014/04/27/how-much-water-is-enough-determining-realistic-water-use-in-developing-countries/>

<sup>7</sup> CDC (2017). “Assessing Access to Water and Sanitation.” <https://www.cdc.gov/healthywater/global/assessing.html>

<sup>8</sup> Food and Agriculture Organization of the United Nations, *Global Forest Resource Assessment 2015*.

<sup>9</sup> Smithsonian Institute (2019). “Corals and Coral Reefs.” <https://ocean.si.edu/ocean-life/invertebrates/corals-and-coral-reefs>

<sup>10</sup> World Wildlife Fund, *Living Planet Report 2018*

<sup>11</sup> New York Times (2019). “Global Wealth Gap Would Be Smaller Today Without Climate Change, Study Finds.” <https://www.nytimes.com/2019/04/22/climate/climate-change-global-wealth-gap.html>

<sup>12</sup> Washington Post (2018). “The people who’ll be most hurt by climate swings did the least to cause them, study says.” <https://www.washingtonpost.com/news/energy-environment/wp/2018/05/02/scientists-just-showed-why-climate-change-is-enormously-unfair/>

<sup>13</sup> United Nations University (2015). “The World’s Richest People Also Emit the Most Carbon.” <https://ourworld.unu.edu/en/the-worlds-richest-people-also-emit-the-most-carbon>



Population Education is a non-profit that provides K-12 teachers with innovative, hands-on lesson plans and professional development to teach about human population growth and its effects on the environment and human well-being.