COURSE MODULE

NORTHERN BUKIDNON STATE COLLEGE
(*Formerly Northern Bukidnon Community College*) R.A.11284
Manolo Fortich, 8703 Bukidnon • 0975-3032951• nbscadmin@nbsc.ph
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GE 12: People and The Earth's Ecosystem

2nd Semester of A.Y. 2024-2025

Rationale

Earth's human population grew faster in the 20th century than ever before.This rapid growth has led to environmental problems around the globe. Thus, we must try to understand and predict changes in human populations.

Specific Learning Outcomes

A. *Identify the major causes of the human population.*
B. *Cite factors that can affect the birth rate of a population.*
C. *Enumerate different ways in which we can slow the growth of the population.*

Activating Content

◉ Synchronous Session
○ Asynchronous Session

Content Discussion
Birth, Death, and Changes

Setting Application

Assessment/ Reflection/Action
The students will actively participate in class discussions. Students will answer Module 2: Self-Check Questions.

Establishing Feedback

The teacher will send students a link where they can write their feedback on the week's experience.

Resources and Additional Resources

- *Arms, K. 2006. Holt Environmental Science. Holt, Rinehart, and Winston, Inc. Chapter 8: Understanding the Populations, pages 196 – 209); Chapter 9: TheHuman Population, pages 218 – 231); (Chapter 19: Waste, pages 480 – 499); (Chapter 11: Water, pages 284 – 293); (Chapter 12: Air, pages 302 – 313); (Chapter 13: Atmosphere and Climate Change, pages 326 – 345)*
- *Urry, L., M. Cain, S. Wasserman, P. Minorsky, & J. Reece. 2017. Campbell Biology, 11th Edition. Pearson Higher Education. (Chapter 53: Population Ecology, pages 1188 – 1209)*

Discussion

Factors that Cause Populations to Change

Population Ecologists classify factors causing changes in populations as density-dependent or density-in-dependent factors. Density refers to the number of animals per unit area (usually measured in animals/hectare or animals/square kilometer).

Density-dependent factors

As the density of a population increases, the number of resources available to each individual decreases, and the health of individuals decreases. As health decreases, mortality (death rate) increases, and reproduction decreases. Thus, we may talk about density-dependent mortality or density-dependent reproduction. Density-dependent forms of mortality include parasites, disease, starvation, and predation.

Density-independent factors

These are factors that act on a population independent of its size. Typical density-independent causes of mortality are weather, accidents, and environmental catastrophes like volcanoes, floods, landslides, fire, etc.

The rate at which animals reproduce is a basic component of population dynamics. The rate of natural increase is the difference between birth and death rates. It measures the degree to which a population is growing. Since birth and death rates are measured as the number of births (or deaths) occurring per 1000 population, the difference is divided by 10 to convert this rate into a percentage.

Rate of Natural Increase = Birth Rate -Death Rate

Wildlife biologists usually express birth rates as fecundity, the number of young produced per female over a given period. Usually, one year is the time period considered, but for smaller animals, especially those that may breed several times a year, a shorter time period may be selected. Thus, if 1,000 female grizzly bears produced 200 young in a year, the birth rate, or fecundity, would be 200/1,000 = 0.2.

Several factors affect a population's birth rate:

- The amount and quality of food determine if an individual has enough energy to reproduce. Animals in poor nutritional condition have fewer young and/or breed less often.
- Age at first reproduction is also essential in determining birth rate. Large, long-lived animals typically do not become sexually mature until they are several years of age. A vole or meadow mouse might become sexually mature and breed for the first time in 18 days. An Asian elephant, on the other hand, will typically be 9-12 years old when it first breeds.
- The birth interval is also important in determining birth rates. A vole might produce a little young every 30 days during the breeding season, but a grizzly bear may only reproduce every 3 or 4 years.

- The average number of young produced is important in a population's birth rate. Some animals, such as fish or amphibians, produce hundreds or thousands of eggs (not all of them hatch, of course), while much wildlife only has one young at a time.
- Potential population growth rates are related to fecundity rates. A doubling in the fecundity rate will more than double the population growth rate.

Human Population Growth

Should we worry about human population growth or not? Why?

Man is relatively new in this world; although there are already animals of millions of years, modern man evolved only four hundred thousand years ago. During most of this period, people lived by hunting and gathering food. Our planet could feed about ten million people living in this way. Estimations say that ten thousand years ago, five and ten million people lived on earth. Our planet was at or near the maximum population it could support at that time. The average growth rate until then was almost zero, then 0.005 percent yearly.

Table 1. World Population Number of years to add each billion (1991 estimate)

Billion Reached	Year	Years to Add	Average growth% since previous
1	1800	All human history	0.005
2	1930	130	0.5
3	1960	30	1.4
4	1975	15	1.9
5	1987	12	1.9
6	1998	11	1.7
7	2009	11	1.4
8	2020	11	1.2
9	2033	13	0.9
Billion Reached	**Year**	**Years to Add**	**Average growth% since previous**
10	2046	13	0.8
11	2066	20	0.5
12	about 2100	34	0.3

Anthropologists believe the human species dates back at least 3 million years. For most of our history, these distant ancestors lived precarious lives as hunters and gatherers. This way of life kept their total numbers small, probably less than 10 million. However, as agriculture was introduced, communities evolved to support more people. The world population expanded to about 300 million by A.D. 1. It continued to grow moderately, but after the Industrial Revolution in the 18th century, living standards rose, and widespread famines and epidemics diminished in some regions. Population growth accelerated. The population climbed to about 760 million in 1750, reaching 1 billion around 1800.

Major Causes of Human Population Change

a) **Agricultural Revolution**
Ten thousand years ago, the agricultural revolution significantly increased the human population. This was a transition from hunting and gathering food for subsistence to settlement, easy access to food, reduced mortality, and increased life expectancy.

b) **Industrial revolution**
Around 1750, another revolution started in England, making even faster growth possible: the Industrial Revolution. Since the beginning of the Industrial Revolution, the average growth rate has been 0.84%, about seventeen times the previous rate.

c) **Progressing growth**
With the development and spreading of modern medicine and sanitation, the growth rate is still progressing.

How Many People Can the Earth Support?

Human population growth continues, but it is unevenly distributed. For most of history, the human population grew slowly. But for the past 200 years, the human population has experienced rapid exponential growth, reflected in the characteristic J-curve.

Three major factors account for this population increase. First, humans developed the ability to expand into diverse new habitats and different climate zones. Second, the emergence of early and modern agriculture allowed more people to be fed for each unit of land area farmed. Third, developing sanitation systems, antibiotics, and vaccines helped control infectious disease agents. As a result, death rates dropped sharply below birth rates, and population size grew rapidly.

About 10,000 years ago, when agriculture began, there were about 5 million humans on the planet; now, there are 6.7 billion of us. From the time we arrived until about 1927, it took the first 2 billion people to the planet, less than 50 years to add the next 2 billion (by 1974), and just 25 years to add the next 2 billion (by 1999). 2012, the Earth had already supported 7 billion people, and perhaps 9.3 billion by 2050. Such growth raises the question of whether the earth is overpopulated.

The population growth rate has slowed, but the world's population grows exponentially at 1.22% yearly. This means that 82 million people were added to the world's population during 2008—an average of nearly 225,000 more people each day, or 2.4 more people every time your heart beats.

Geographically, this growth is unevenly distributed. About 1.2 million people were added to the world's developed countries, growing at 0.1% annually. About 80.8 million were added to developing countries, growing 15 times faster at 1.5% annually. In other words, most of the world's population growth occurs in already heavily populated parts, most of which are the least equipped to deal with the pressures of such rapid growth. In our demographically divided world, roughly 1 billion people live in countries with a stable population size, while another billion live in countries with populations projected to at least double between 2008 and 2050.

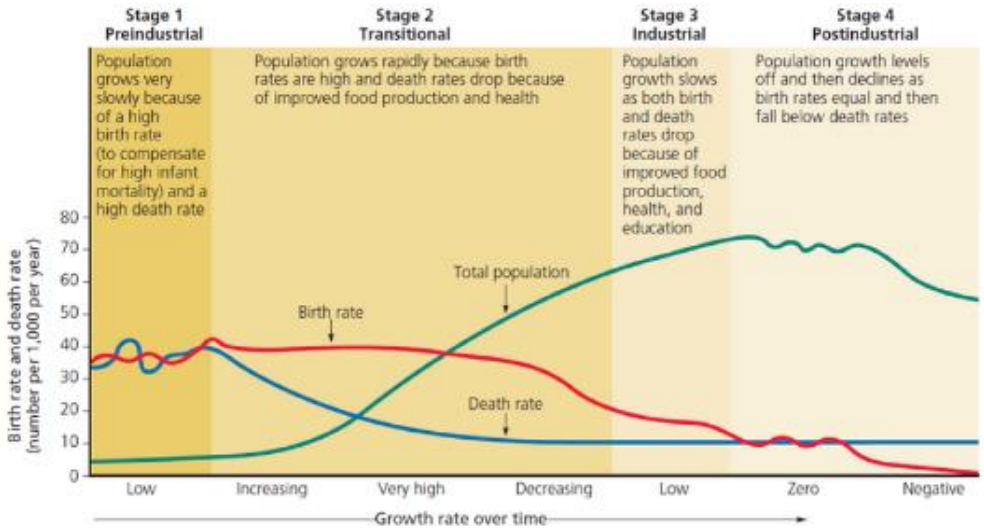

Figure 1.2 Four stages of the demographic transition, which a country's population can experience when it becomes industrialized. There is uncertainty about whether this model will apply to some of today's developing countries.

Family Planning

Family planning provides educational and clinical services that help couples choose how many children to have and when to have them. Such programs vary from culture to culture, but most provide information on birth spacing, birth control, and health care for pregnant women and infants.

Family planning has been a major factor in reducing the number of births throughout most of the world, mostly because of increased knowledge and availability of contraceptives. According to the U.N. Population Division, 58% of married women ages 15–45 in developed countries and 54% in developing countries used modern contraception in 2008. Family planning has also reduced the number of legal and illegal abortions performed each year and decreased the number of deaths of mothers and fetuses during pregnancy.

Studies by the U.N. Population Division and other population agencies indicate that family planning is responsible for at least 55% of the drop-in total fertility rates (TFRs) in developing countries, from 6.0 in 1960 to 3.0 in 2008. Between 1971 and 2008, for example, Thailand used family planning to cut its annual population growth rate from 3.2% to 0.5% and its TFR from 6.4 to 1.6 children per family. Another family planning success involves Iran, which between 1989 and 2000, cut its population growth rate from 2.5% to 1.4%.

Empowering Women

Studies show that women tend to have fewer children if they are educated, hold a paying job outside the home, and live in societies where their human rights are not suppressed. Although women make up roughly half of the world's population, in most societies they do not have the same rights and educational and economic opportunities as men do.

Women do almost all the world's domestic work and childcare for little or no pay and provide more unpaid health care than the world's organized health services combined. They also do 60–80% of the work associated with growing food, gathering and hauling wood and animal dung for use as fuel, and carrying water in rural areas of Africa, Latin America, and Asia. As one Brazilian woman said, "For poor women, the only holiday is when you are asleep."

Globally, women account for two-thirds of all hours worked but receive only 10% of the world's income, and they own less than 2% of the world's land. Also, about 70% of the world's poor and 64% of all 800 million illiterate adults are women.

Because sons are more valued than daughters in many societies, girls are often kept at home to work instead of being sent to school. Some 900 million girls—three times the entire U.S. population—do not attend elementary school. Teaching women to read has a major impact on fertility rates and population growth. Poor women who cannot read often have five to seven children, compared to two or fewer in societies where almost all women can read.

According to Thorya Obaid, executive director of the U.N. Population Fund, "Many women in the developing world are trapped in poverty by illiteracy, poor health, and unwanted high fertility. All of these contribute to environmental degradation and tighten the grip of poverty."

An increasing number of women in developing countries are taking charge of their lives and reproductive behavior. As the population expands, such bottom-up change by individual women will play an important role in stabilizing the population and reducing environmental degradation.

POPULATION GROWTH

SELF-CHECK 2

Write **TRUE** if the statement is correct, and write **FALSE** if the statement is incorrect.
Note: You will answer this activity on google form.

1. The development of modern technology in the health sector and the discovery of new vaccines made the death rate grew fast.
2. Agricultural revolution made a great change to decrease the human population.
3. Density refers to the number of animals per unit area.
4. Empowering woman can help to slow down the growing rate of population.
5. Death caused by car accident is an example of density-independent factor.
6. Animals that are in poor nutritional condition have fewer young and/or breed less often.
7. Population growth rate tend to slowdown when the country is more developed.
8. Family planning is illegal in the Philippines because Christianity is the predominant faith in the country.
9. A 35 years old male was infected by covid-19 virus, he was advised to do a self-quarantine since it is not severe. After 3 days, the 35 years old male died due to the infection. This scenario is an example of density-independent factor of mortality.
10. Fecundity means the ability to produce offspring.