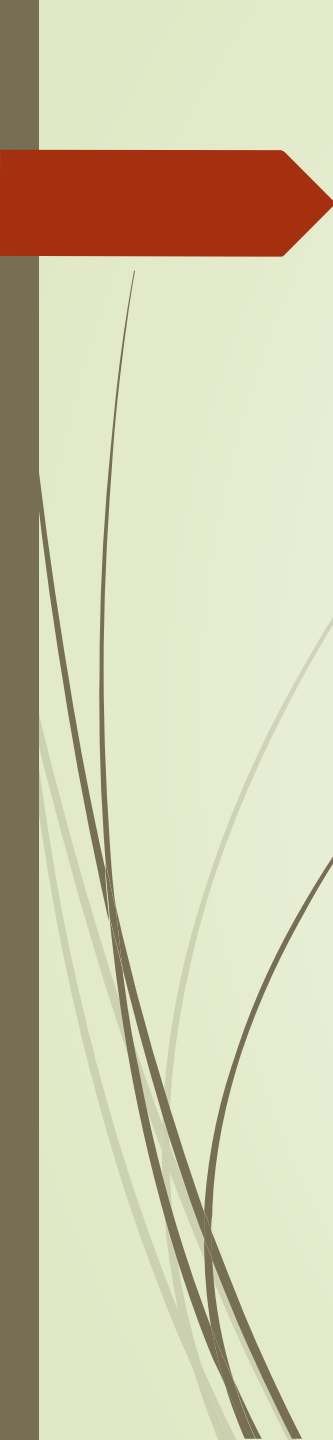





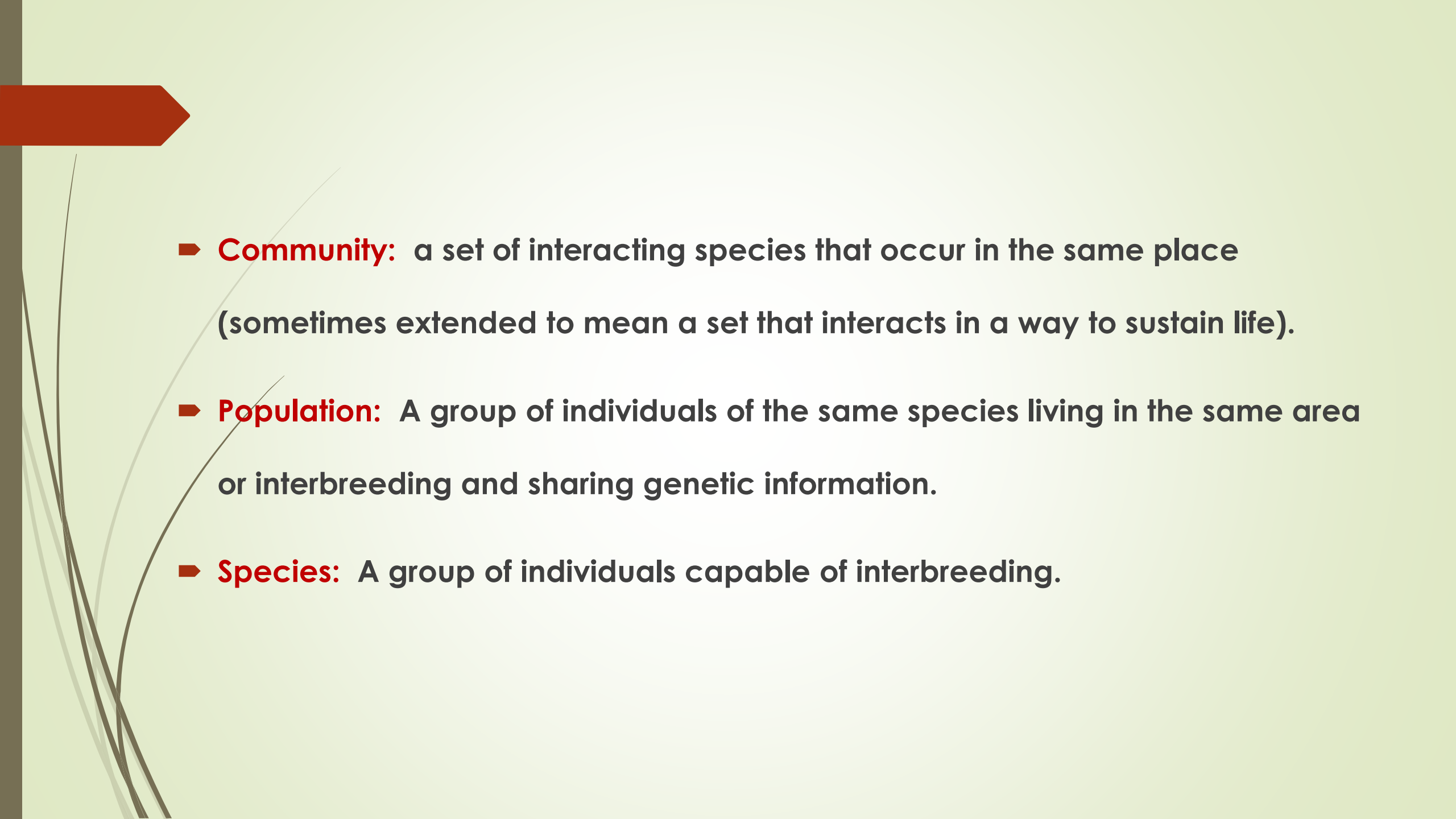
KEY THEMES IN ENVIRONMENTAL SCIENCES


After this lecture you should know the followings;

- People and nature are intimately connected;
- Why rapid human population growth is the fundamental environmental issue;
- What sustainability is, and why we must learn to sustain our environmental resources;
- How human beings affect the environment of the entire planet;
- Why urban environments need attention;
- Why solutions to environmental problems involve making value judgments, based on scientific knowledge;
- What the precautionary principle is and why it is important.

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- **Environmental Biology:** the scientific study of the origins, functions, relationships, interactions, and natural history of living populations, communities, species, and ecosystems in relation to dynamic environmental processes.
 - **Ecology:** The science of the study of the relationships between living things and their environment.
 - **Ecosystem :** An ecological community and its local, nonbiological community. An ecosystem is the minimum system that includes and sustains life. It must include at least an autotroph, a decomposer, a liquid medium, a source and sink of energy, and all the chemical elements required by the autotroph

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- **Environment:** All factors (living and nonliving) that actually affect an individual organism or population at any point in the life cycle. Environment is also sometimes used to denote a certain set of circumstances surrounding a particular occurrence (environments of deposition, for example pH and the decomposer).
 - **Environmentalism:** A social, political, and ethical movement concerned with protecting the environment and using its resources wisely.
 - **Biosphere:** part of a planet where life exists.

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- **Community:** a set of interacting species that occur in the same place (sometimes extended to mean a set that interacts in a way to sustain life).
 - **Population:** A group of individuals of the same species living in the same area or interbreeding and sharing genetic information.
 - **Species:** A group of individuals capable of interbreeding.

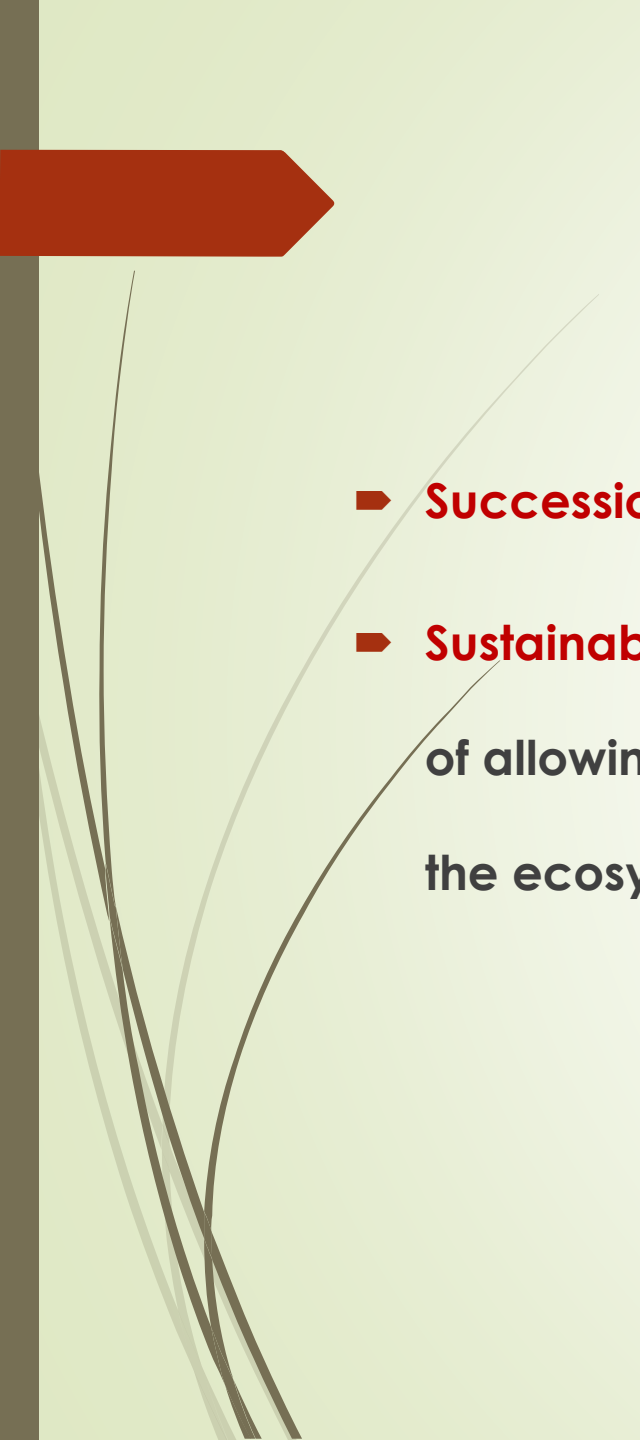



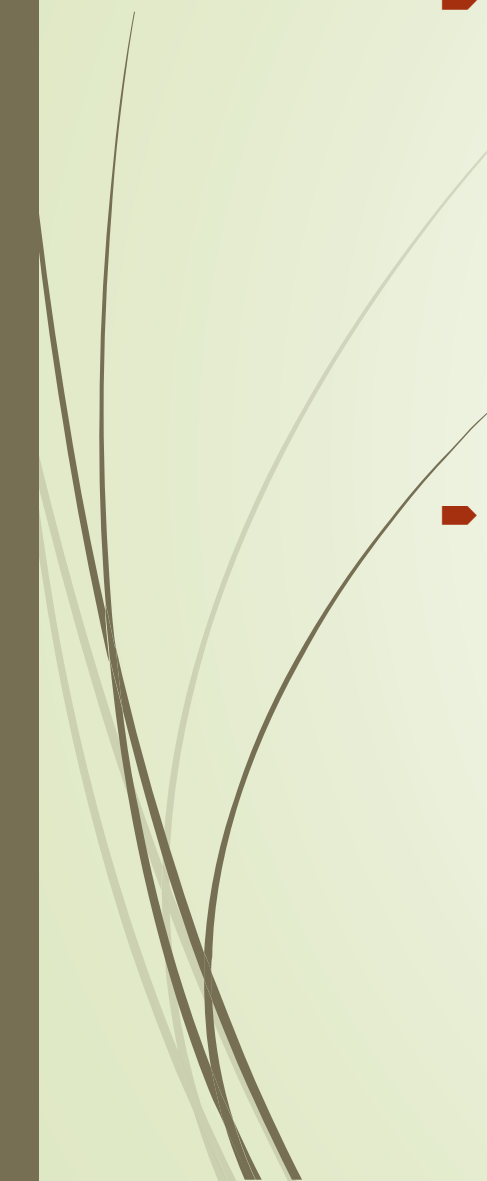
Habitat Where an individual, population, or species exists or can exist. For example, the habitat of the Joshua tree is the Mojave Desert of North America.


- **Biome:** A kind of ecosystem. The rain forest is an example of a biome; rain forests occur in many parts of the world but are not all connected to each other.
- **Niche:** (1) The “profession,” or role, of an organism or species; or (2) all the environmental conditions under which the individual or species can persist.

Biological diversity: consisting of three components:

- (1) genetic diversity—the total number of genetic characteristics;
- (2) species diversity; and
- (3) habitat or ecosystem diversity—the number of kinds of habitats or ecosystems in a given unit area. Species diversity in turn includes three concepts: species richness, evenness, and dominance.

- 
- ▶ **Succession:** The process of establishment and development of an ecosystem.
 - ▶ **Sustainability:** Management of natural resources and the environment with the goals of allowing the harvest of resources to remain at or above some specified level, and the ecosystem to retain its functions and structure.

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- **Threshold:** A point in the operation of a system at which a change occurs. With respect to toxicology, it is a level below which effects are not observable and above which effects become apparent.
 - **Conservation:** The term means adjusting our needs to minimize the use of a particular resource, such as energy.



Nonrenewable energy: Energy sources, including nuclear and geothermal, that are dependent on fuels, or a resource that may be used up much faster than it is replenished by natural processes.

➤ **Nonrenewable resource:** A resource that is cycled so slowly by natural Earth processes that once used, it is essentially not going to be made available within any useful time framework.


➤ **Competition:** The situation that exists when different individuals, populations, or species compete for the same resource(s) and the presence of one has a detrimental effect on the other. Sheep and cows eating grass in the same field are competitors.





➔ What do we need to live?

ENERGY

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- ➔ **Energy crisis produces economic crisis**
 - ➔ **from the local to global level at unprecedented environmental concerns.**

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- **At the beginning of the modern era—in A.D. 1—the number of people in the world was probably about 100 million**
 - **Present population of the United States over 300 million**
 - **Present population of Turkey is about 79 million**

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- ▶ If recent human population growth rates continue, our numbers could reach **9.4 billion** by 2050.



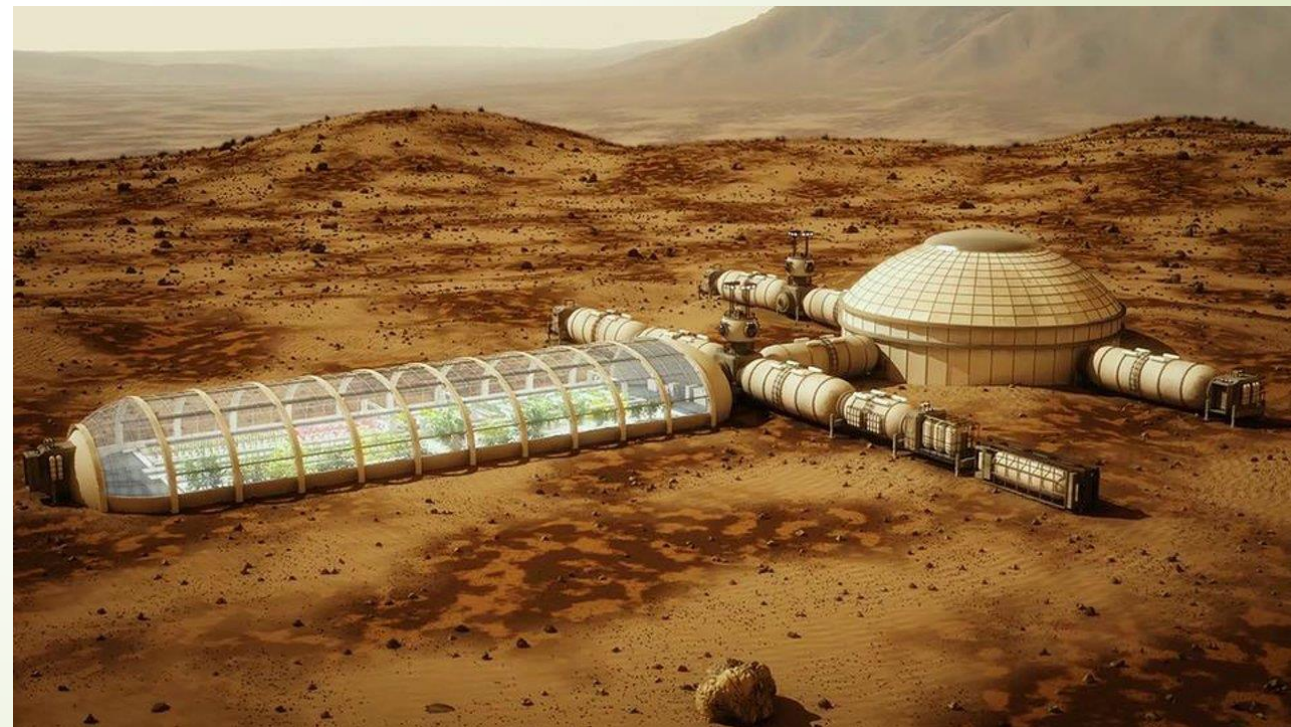
THE PROBLEM




**Earth has not grown any larger, and the abundance of its
resources has not increased**

➔ How, then, can Earth sustain all these people?

Colonies on Mars or other planets ?????





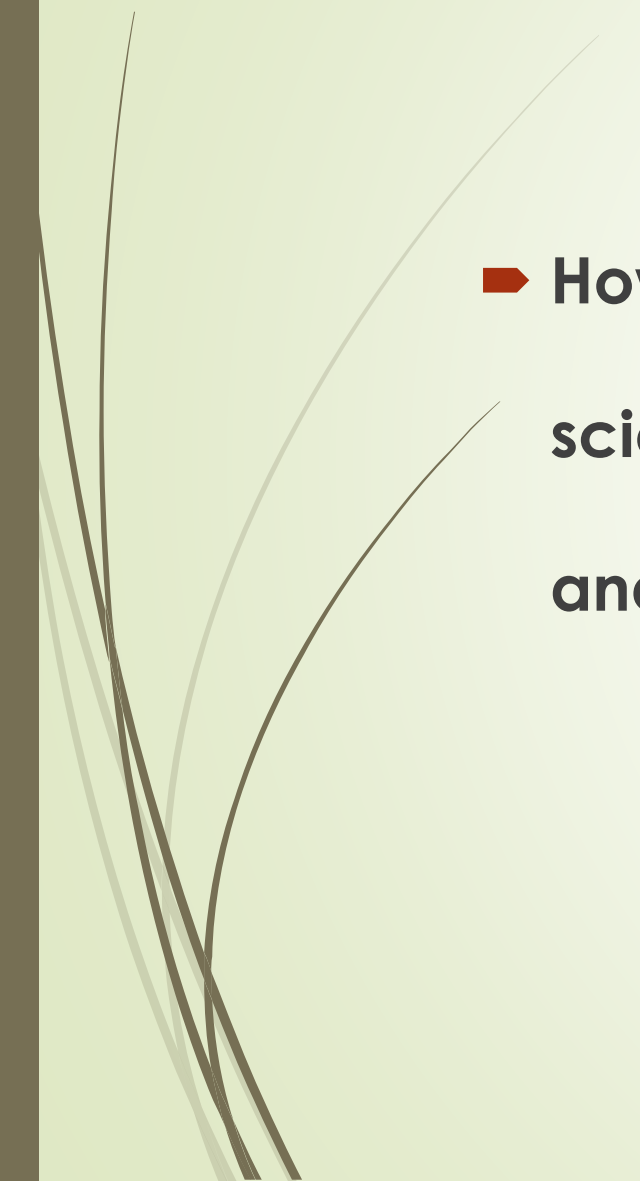
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- ➔ **And what is the maximum number of people that could live on Earth, not just for a short time but sustained over a long period?**





Estimates of how many people the planet can support range from 2.5 billion to 40 billion (a population not possible with today's technology).

Why do the estimates vary so widely?


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- Because the answer depends on what quality of life people are willing to accept. Beyond a **threshold** world population of about 4–6 billion, the quality of life declines.

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- ▶ **How many people the Earth can sustain depends on science and values and is also a question about people and nature.**

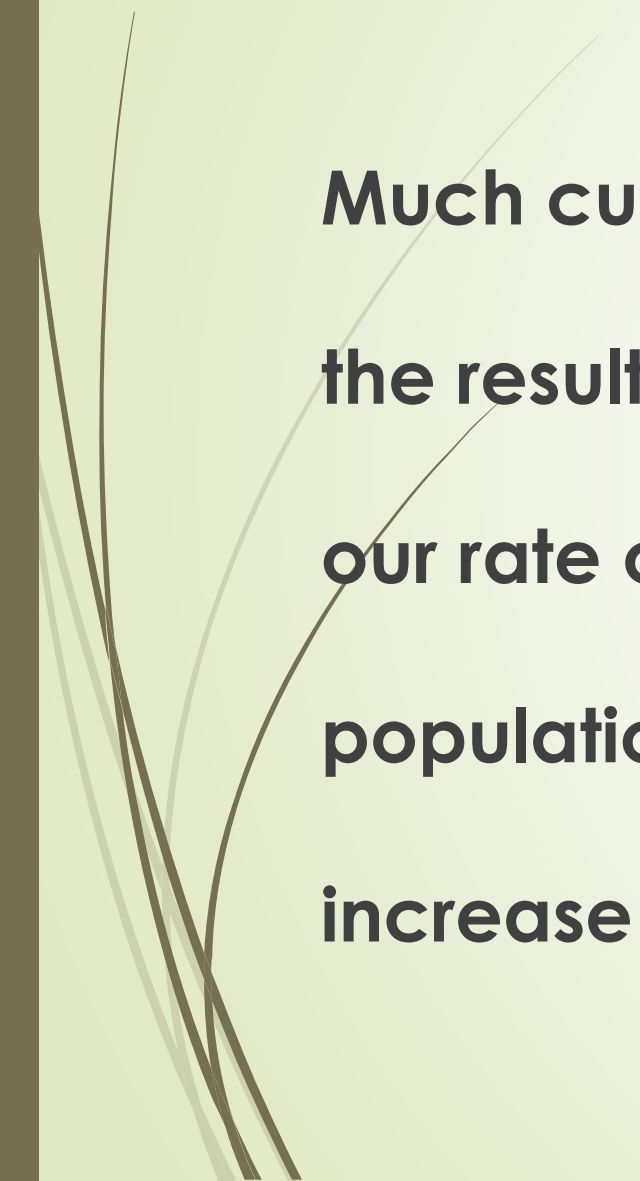
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- **The more people we pack onto the Earth, the less room and resources there are for wild animals and plants, wilderness, areas for recreation, and other aspects of nature—and the faster Earth's resources will be used.**
 - **The answer also depends on how the people are distributed on the Earth—whether they are concentrated mostly in cities or spread evenly across the land.**

Human Population Growth

- ▶ The most dramatic increase in the history of the human population occurred in the last part of the 20th century and continues today into the early 21st century. In merely the past 40 years the human population of the world more than doubled, from 2.5 billion to about 6.8 billion.



Much current environmental damage is directly or indirectly the result of the very large number of people on Earth and our rate of increase. For most of human history the total population was small and the average long-term rate of increase was low relative to today's growth rate.





► **The growth of the human population declines, fluctuates or increase.**

For example, great declines occurred during the time of the Black

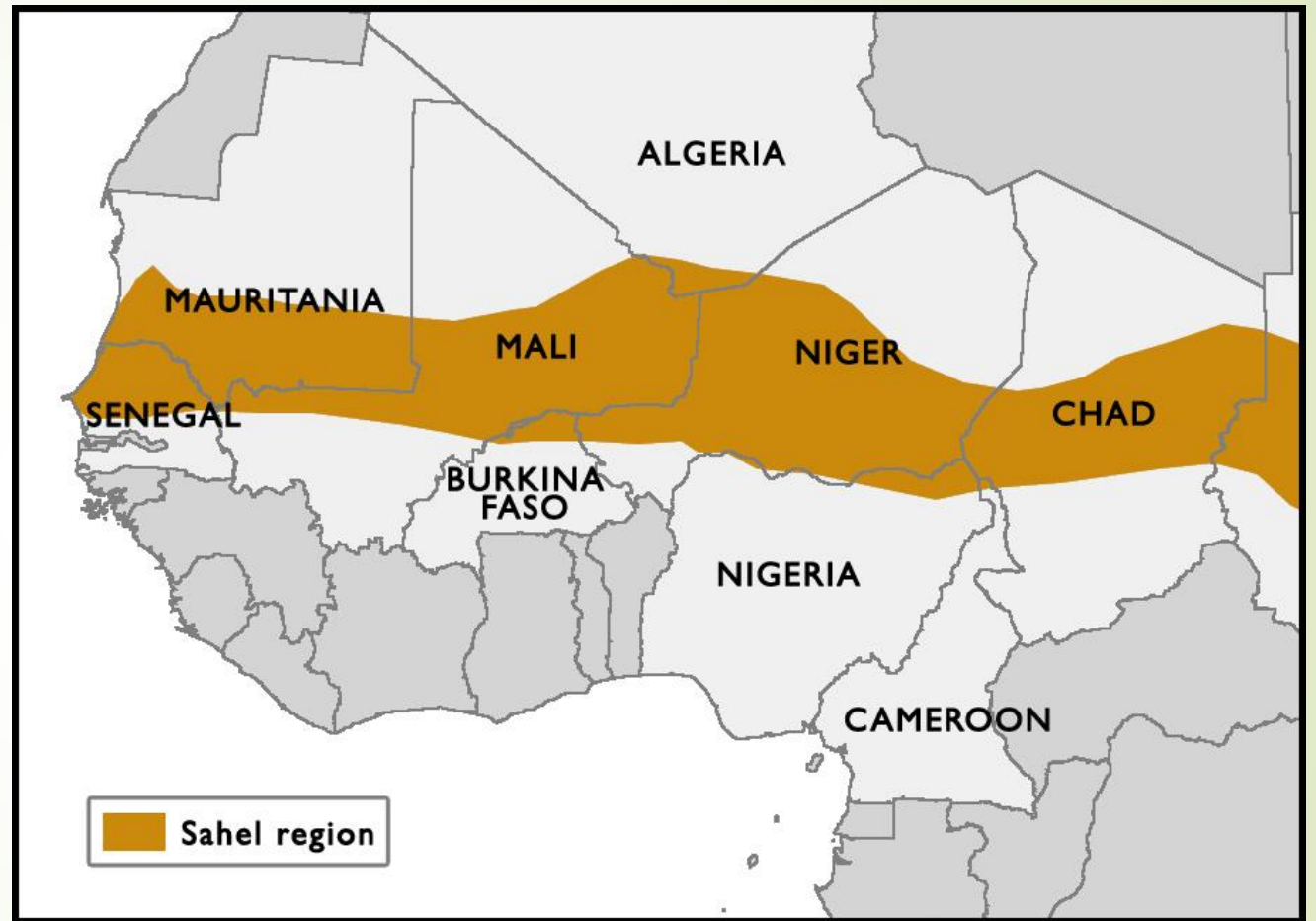
Death in the 14th century.

Famine and Food Crisis

- ▶ Famine is one of the things that happen when a human population exceeds its environmental resources.



► Famines have occurred in recent decades in Africa. In the mid 1970s, following a drought in the Sahel region, 500,000 Africans starved to death and several million more were permanently affected by malnutrition.



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- Starvation in African nations gained worldwide attention some ten years later, in the 1980s.

"We Are the World"

a song and charity single originally recorded by the supergroup United Support of Artists (USA) for Africa in 1985.



- **written by Michael Jackson and Lionel Richie**
- **produced by Quincy Jones for the album We Are the World.**




Famine in Africa has had multiple interrelated causes.


- **Drought** (the size of the population affected by drought is new).
- **Deserts** in Africa appear to be **spreading**, in part because of changing climate but also because of human activities. **EROSION** and

DEFORESTATION

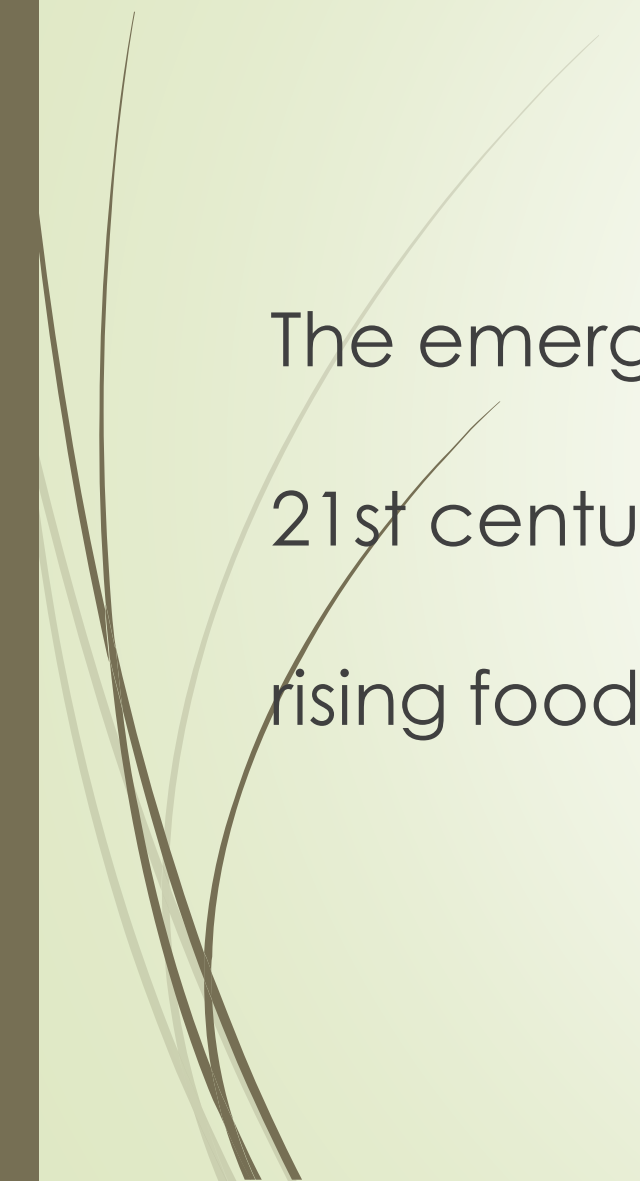



Today, **malnutrition** contributes to the **death** of about **6 million children** per **year**. Low- and middle-income countries suffer the most from malnutrition, as measured by low weight for age.

- 
- ▶ **Famines in Africa illustrate another key theme: people and nature. People affect the environment, and the environment affects people. The environment affects agriculture, and agriculture affects the environment. Human population growth in Africa has severely stretched the capacity of the land to provide sufficient food and has threatened its future productivity.**

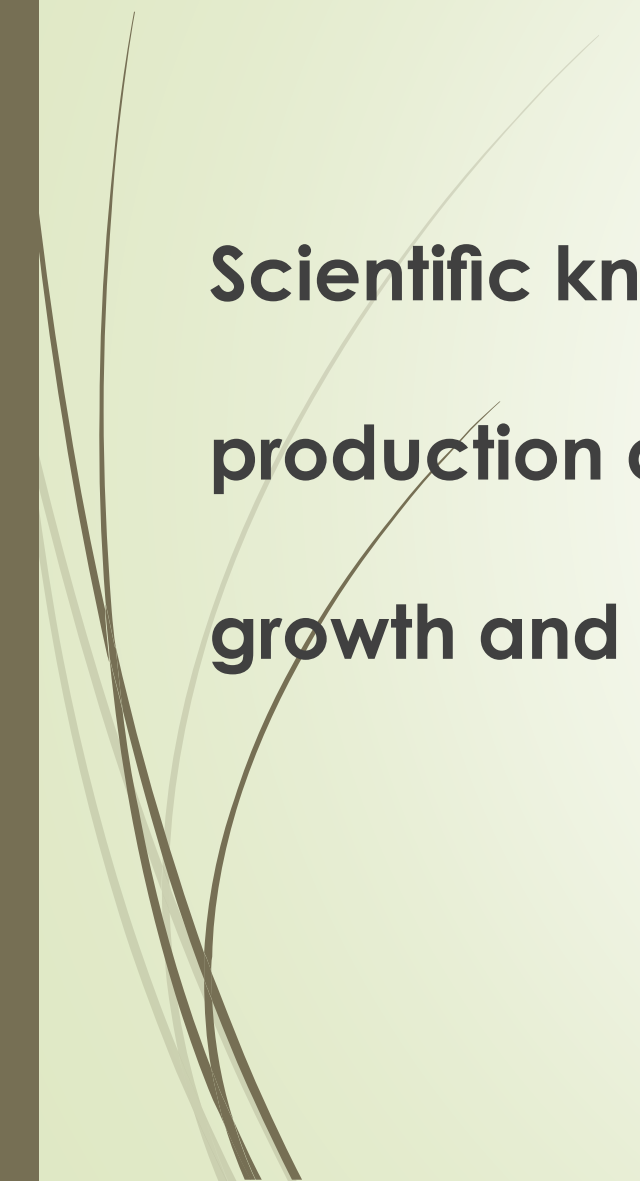


The emerging global food crisis in the first decade of the 21st century has not been caused by war or drought but by rising food costs.





Scientific knowledge has led to increased agricultural production and to a better understanding of population growth and what is required to conserve natural resources.





Which is more important,

➤ the survival of people alive today

or


➤ conservation of the environment on which future food production and human life depend?





➔ The human population continues to grow, but humans' effects on the environment are growing even faster.


People cannot escape the laws of population growth.





➔ The broad science and values question is: What will we do about the increase in our own species and its impact on our planet and on our future?

Sustainability and Carrying Capacity

- ▶ What is the maximum number of people the Earth can sustain?
- ▶ That is, what is the sustainable human carrying capacity of the Earth?

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- ➔ **We are using many renewable environmental resources BUT faster than they can be replenished MEANS we are using them unsustainably.**

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- **We are using forests and fish faster than they can regrow, and**
 - **We are eliminating habitats of endangered species and other wildlife faster than they can be replenished**
 - **We are also extracting minerals, petroleum, and groundwater without sufficient concern for their limits or the need to recycle them.**
 - **As a result, there is a shortage of some resources and a probability of more shortages in the future.**

- 
- ➔ **Clearly, we must learn how to sustain our environmental resources so that they continue to provide benefits for people and other living things on our planet.**

Sustainability: The Environmental Objective

The environmental catchphrase of the 1990s was “saving our planet.” Are all life and the environments on which life depends really in danger?


Will we leave behind a dead planet?



In the long view of planetary evolution, it is certain that planet Earth will survive us.

Our sun is likely to last another several billion years, and if all humans became extinct in the next few years, life would still flourish here on Earth.

Without HUMAN, life on Earth continue to survive


- 
- ▶ **The changes we have made—in the landscape, the atmosphere, the waters—would last for a few hundred or thousands of years but in a modest length of time would be erased by natural processes. What we are concerned with, as environmentalists, is the quality of the human environment on Earth, for us today and for our children.**


➤ **Sustainability has two formal scientific meanings with respect to environment**

- **sustainability of resources, such as a species of fish from the ocean, a kind of tree from a forest, coal from mines; and**
- **sustainability of an ecosystem.**

Strictly speaking, harvesting a resource at a certain rate is sustainable if we can continue to harvest that resource at that same rate for some specified time well into the future.

An ecosystem is sustainable if it can continue its primary functions for a specified time in the future.

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- **Removal and replenish time is important for quantitative science but ecosystems and species are always undergoing change.**

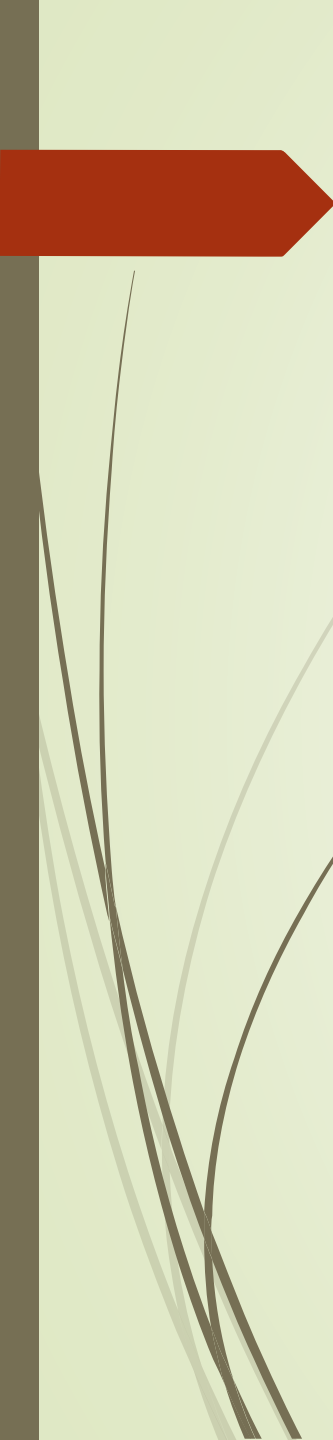
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- **Economists, political scientists, and others also use the term sustainability in reference to types of development that are economically viable, do not harm the environment, and are socially just (fair to all people).**


- 
- **One of the environmental paradigms of the 21st century will be sustainability, but how will it be attained?**
- 



What are the attributes of a sustainable economy in the information age?

- Populations of humans and other organisms living in harmony with the natural support systems, such as air, water, and land (including ecosystems).**
- An energy policy that does not pollute the atmosphere, cause climate change (such as global warming), or pose unacceptable risk (a political or social decision).**


- 
- **A plan for renewable resources—such as water, forests, grasslands, agricultural lands, and fisheries—that will not deplete the resources or damage ecosystems.**
 - **A plan for nonrenewable resources that does not damage the environment, either locally or globally, and ensures that a share of our nonrenewable resources will be left to future generations.**
 - **A social, legal, and political system that is dedicated to sustainability, with a democratic mandate to produce such an economy.**




Recognizing that population is the environmental problem, we should keep in mind that a sustainable global economy will not be constructed around a completely stable global population. Rather, such an economy will take into account that the size of the human population will fluctuate within some stable range necessary to maintain healthy relationships with other components of the environment.

To achieve a sustainable global economy, we need to do the following:

- **Develop an effective population-control strategy. This will, at least, require more education of people, since literacy and population growth are inversely related.**
- **Completely restructure our energy programs. A sustainable global economy is probably impossible if it is based on the use of fossil fuels. New energy plans will be based on an integrated energy policy, with more emphasis on renewable energy sources (such as solar and wind) and on energy conservation.**

- 
- **Moving toward Sustainability:** our present practices are not sustainable. Indeed, continuing on our present paths of overpopulation, resource consumption, and pollution will not lead to sustainability.
 - We will need to develop new concepts that will mold industrial, social, and environmental interests into an integrated, harmonious system. In other words, we need to develop a new paradigm, an alternative to our present model for running society and creating wealth. The new paradigm might be described as follows.



➤ **Evolutionary rather than revolutionary.** Developing a sustainable future will require an evolution in our values that involves our lifestyles as well as social, economic, and environmental justice.

➤ **Inclusive, not exclusive.** All peoples of Earth must be included.


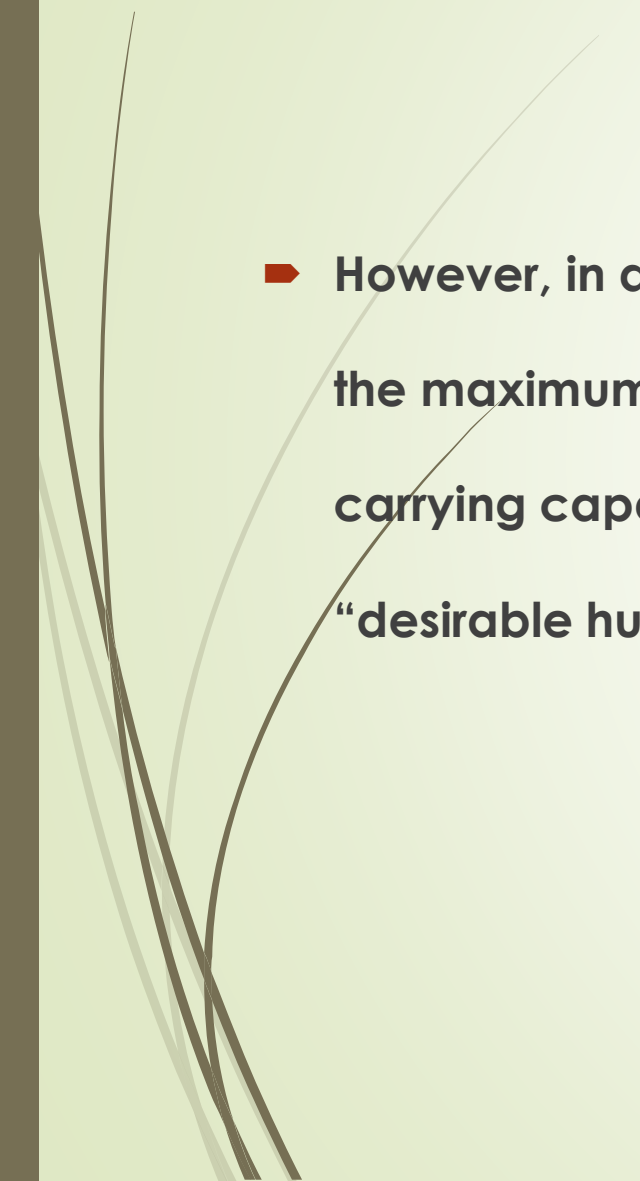
➤ **Proactive, not reactive.** We must plan for change and for events such as human population problems, resource shortages, and natural hazards, rather than waiting for them to surprise us and then reacting.


➤ **Attracting, not attacking.** People must be attracted to the new paradigm because it is right and just.

➤ **Assisting the disadvantaged, not taking advantage.** This involves issues of environmental justice. All people have the right to live and work in a safe, clean environment.

The Carrying Capacity of the Earth

- Carrying capacity is a concept related to sustainability.
- «the maximum number of individuals of a species that can be sustained by an environment without decreasing the capacity of the environment to sustain that same number in the future.»

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- ▶ **However, in doing this, we would share our land with very little else. When we ask “What is the maximum number of people that Earth can sustain?” we are asking not just about Earth’s carrying capacity but also about sustainability. As we pointed out, what we consider a “desirable human carrying capacity” depends in part on our values.**




Do we want those who follow us to live short lives in crowded conditions, without a chance to enjoy Earth's scenery and diversity of life? Or do we hope that our descendants will have a life of high quality and good health? Once we choose a goal regarding the quality of life, we can use scientific information to understand what the sustainable carrying capacity might be and how we might achieve it.



A Global Perspective

- ▶ **Our actions today are experienced worldwide. Because human actions have begun to change the environment all over the world, the next generation, more than the present generation, will have to take a global perspective on environmental issues.**





Recognition that civilization can change the environment at a global level is relatively recent.

➤ Scientists now believe that emissions of modern chemicals are changing the ozone layer high in the atmosphere.

➤ Scientists also believe that burning fossil fuels increases the concentration of greenhouse gases in the atmosphere, which may change Earth's climate.

These atmospheric changes suggest that the actions of many groups of people, at many locations, affect the environment of the entire world.

- 
- ▶ **Not only human life but also nonhuman life affects the environment of our whole planet and has changed it over the course of several billion years. These two new ideas have profoundly affected our approach to environmental issues.**
- 

- Awareness of the global interactions between life and the environment has led to the development of the **Gaia hypothesis**.
- Originated by British chemist James Lovelock and American biologist Lynn Margulis, Gaia theory or the Gaia principle, proposes that living organisms interact with their inorganic surroundings on Earth to form a synergistic and self-regulating, complex system that helps to maintain and perpetuate the conditions for life on the planet.

- Awareness of the global interactions between life and the environment has led to the development of the **Gaia hypothesis**.
- Originated by British chemist James Lovelock and American biologist Lynn Margulis, the Gaia hypothesis proposes that over the history of life on Earth, **life has profoundly changed the global environment, and that these changes have tended to improve the chances for the continuation of life. Because life affects the environment at a global level, the environment of our planet is different from that of a lifeless one.**




An Urban World

► In part because of the rapid growth of the human population and in part because of changes in technology, we are becoming an urban species, and our effects on the environment are more and more the effects of urban life.




In developed countries,

- ▶ **about 75% of the population live in urban areas and 25% in rural areas,**
- ▶ **but in developing countries only 40% of the people are city dwellers.**
- ▶ **By 2008, for the first time, more than half of the people on Earth lived in urban areas, and it is estimated that by 2025 almost two-thirds of the population—5 billion people— will live in cities. Only a few urban areas had populations over 4 million in 1950.**

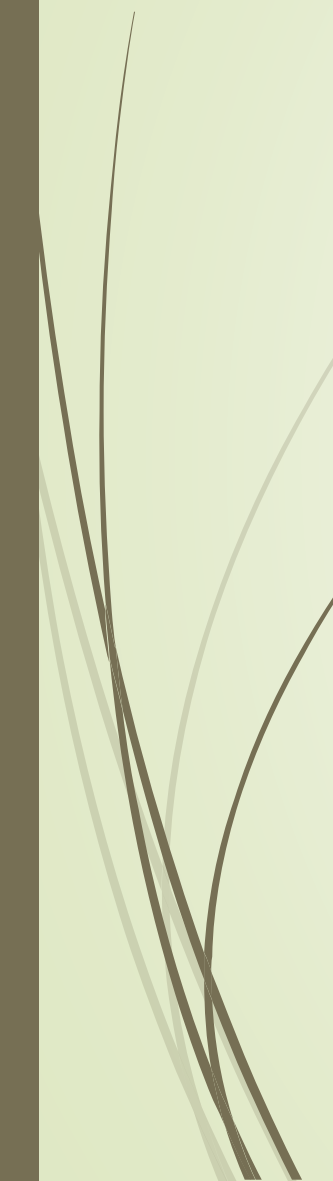
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- **In the past, environmental organizations often focused on nonurban issues—wilderness, endangered species, and natural resources, including forests, fisheries, and wildlife. Although these will remain important issues, in the future we must place more emphasis on urban environments and their effects on the rest of the planet.**


People and Nature


- Today we stand at the threshold of a major change in our approach to environmental issues. Two paths lie before us.
- One path is to assume that environmental problems are the result of human actions and that the solution is simply to stop these actions. Based on the notion, popularized some 40 years ago, that people are separate from nature, this path has led to many advances but also many failures.



The second path begins with a scientific analysis of an environmental controversy and leads from there to cooperative problem solving. It accepts the connection between people and nature and offers the potential for longlasting, successful solutions to environmental problems. **One purpose of this book is to take the student down the second pathway.**



- 
- **People and nature are intimately integrated.**
 - **We depend on nature directly or indirectly.**
- 

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- **We in turn affect nature.**
 - **One can argue that it is natural for organisms to change their environment. Elephants topple trees, changing forests to grasslands, and people cut down trees and plant crops. Who is to say which is more natural? In fact, few organisms do not change their environment.**
- 