

Name \_\_\_\_\_ Period \_\_\_\_\_ Date \_\_\_\_\_

**ENVIRONMENTAL SCIENCE**

**CHAPTER 1: Science and the Environment**

**Directions: Fill in the information using pages 7 and 13 in the Environmental Science Textbook or the online Notes available at our website.**

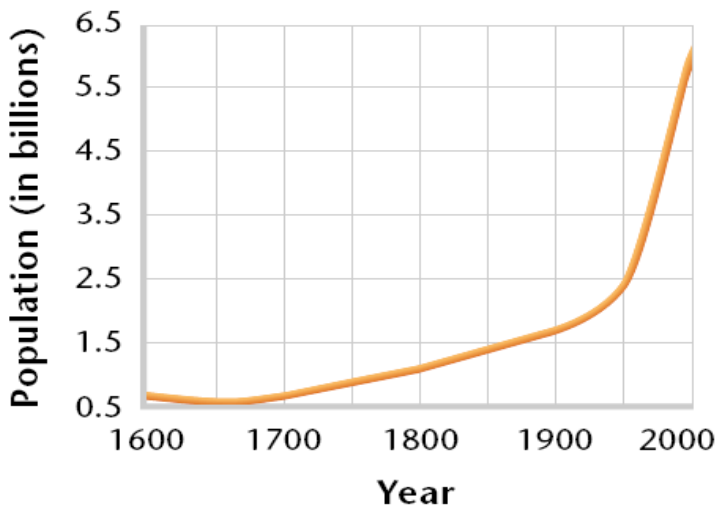
- 1.) Turned in completed chart on time. \_\_\_\_\_yes \_\_\_\_\_no  
(AFTER BEING CHECKED, PUT IN NOTEBOOK)
- 2.) All notes were complete and accurate with no abbreviations. \_\_\_\_\_yes \_\_\_\_\_no
- 3.) All fields of study descriptions were complete and accurate with no abbreviations. \_\_\_\_\_yes  
\_\_\_\_\_no
- 4.) All information was written neatly with no spelling, punctuation, or writing errors. \_\_\_\_\_yes \_\_\_\_\_no

GEORGIA SCIENCE STANDARD:

**SEV5. Students will recognize that human beings are part of the global ecosystem and will evaluate the effects of human activities and technology on ecosystems.**

Major Fields of Study That Contribute to Environmental Science	
Biology is the study of living organisms.	Zoology is the study of animals. Botany is the study of plants. Microbiology is the study of microorganisms. Ecology is the study of how organisms interact with their environment and each other.
Earth science is the study of the Earth's nonliving systems and the planet as a whole.	Geology is the study of the Earth's surface, interior processes, and history. Paleontology is the study of fossils and ancient life. Climatology is the study of the Earth's atmosphere and climate. Hydrology is the study of Earth's water resources.
Physics is the study of matter and energy.	Engineering is the science by which matter and energy are made useful to humans in structures, machines, and products.
Chemistry is the study of chemicals and their interactions.	Biochemistry is the study of the chemistry of living things. Geochemistry, a branch of geology, is the study of the chemistry of materials such as rocks, soil, and water.
Social sciences are the study of human populations.	Geography is the study of the relationship between human populations and Earth's features. Anthropology is the study of the interactions of the biological, cultural, geographical, and historical aspects of humankind. Sociology is the study of human population dynamics and statistics.

**World Population: 1600–2000**



The \_\_\_\_\_  
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### HUNTER-GATHERERS (Estimated at 10,000 years ago)

<b>Definition of Hunter-Gatherer Society</b>	<hr/> <hr/> <b>The groups were small, and they migrated from place to place as different types of food became available at different times of the year.</b>
<b>Environmental Impact on Land</b>	<b>Hunter-Gatherers affected their environment by setting</b> <hr/> <hr/> <hr/>

### AGRICULTURE REVOLUTION (Estimated at 8,000 BC)

<b>Definition of Agricultural Society</b>	<b>Agricultural Societies</b> were formally Hunter-Gatherers who realized they could <hr/> <hr/>
<b>Environmental Impact on Land</b>	<b>When Agricultural Societies began to grow crops and live in one place it caused</b> <hr/> <hr/>

### INDUSTRIAL REVOLUTION (Started 1700's/Peaked 1840-1914)

<b>Definition of Industrial Revolution</b>	<b>People who lived during the 18th to 19th centuries during the <u>Industrial Revolution</u> saw major changes occur in agriculture, manufacturing, mining, and transport.</b> <hr/> <hr/> <hr/> <hr/>
<b>Environmental Impact on Land</b>	<b>Machinery reduced the amount of land and human labor needed for farming but</b> <hr/> <hr/>

**MAIN ENVIRONMENTAL PROBLEMS WITH HUNTER-GATHERERS AND AGRICULTURAL SOCIETIES:**

- \_\_\_\_\_ (fossil fuels, clean drinking water, wood, animals, etc.)
- \_\_\_\_\_
- \_\_\_\_\_ (many plants and animals have become and are becoming extinct)

**MAIN PROBLEMS CAUSED BY THE INDUSTRIAL REVOLUTION:**

- \_\_\_\_\_ (chemicals) were added to foods
- \_\_\_\_\_ were developed, widely used, and then discovered to be toxic to plants, people, and animals.
- \_\_\_\_\_ materials began to accumulate in landfills.
- Water, land, \_\_\_\_\_.
- The human population began to grow at alarming rates \_\_\_\_\_

**TRAGEDY OF THE COMMONS**

The tragedy of the commons is an \_\_\_\_\_ in which every individual tries to reap the greatest benefit from a given resource. As the \_\_\_\_\_ for the resource overwhelms the supply, every individual who consumes an additional unit directly harms others who can no longer enjoy the benefits. Generally, the resource of interest is easily available to all individuals; the tragedy of the commons occurs when individuals neglect the \_\_\_\_\_ of society in the pursuit of \_\_\_\_\_ gain.

The concept and name originate in an essay written in 1833 by the Victorian economist William Forster Lloyd, who used a \_\_\_\_\_ example of the effects of unregulated grazing on common land (then called "the commons") in the British Isles. The

concept became widely known over a century later due to an article written by the evolutionary biologist and ecologist \_\_\_\_\_  
\_\_\_\_\_. His paper addressed the growing concern of overpopulation, and Hardin used an example of grazing land when describing the adverse effects of overpopulation. In this context, commons is taken to mean any \_\_\_\_\_ and unregulated resource such as atmosphere, oceans, rivers, fish stocks, or even an office refrigerator.

The tragedy of the commons is a very real \_\_\_\_\_ issue where individuals tend to exploit shared resources so the demand greatly outweighs supply, and the resource becomes unavailable for the whole. Common grazing lands yield adequate food for herd animals as long as the number of grazing animals is limited from natural population control such as disease. If, however, the natural \_\_\_\_\_ are circumvented or do not come to pass, the population of herd animals increases and the grazing land is unable to support the larger population. Hardin's point was if humans faced the same issue as in the example with herd animals, each person would act in his own self interest and consume as much of the scarce resource as possible, making the resource even harder to find.

## **TEN REAL-LIFE EXAMPLES OF *THE TRAGEDY OF THE COMMONS***

### **1. Grand Banks Fisheries**

The Grand Banks are \_\_\_\_\_ off the coast of Newfoundland. For centuries, explorers and fishermen described this region as home to an endless supply of cod fish. In the 1960s and 1970s, advances in fishing technology allowed huge catches of cod. Following a few dramatically large seasons, the fish populations dropped, forcing Canadian fishermen to sail farther to maintain large catch sizes each season. By the 1990s, cod populations were so low that the Grand Banks fishing industry collapsed. It was too late for regulation and management; the cod stocks had been irreparably damaged. Since then, the cod populations have remained low, and some scientists doubt the Grand Banks ecosystem will ever recover.

## **2. Bluefin Tuna**

Currently the bluefin tuna populations in the Atlantic Ocean and Mediterranean face a similar fate as that of the Grand Banks cod. In the 1960s, fishermen realized the tuna populations \_\_\_\_\_, and an International Convention for the Conservation of Atlantic Tuna (ICCAT) formed in an effort to manage fish harvesting more sustainably. Unfortunately, not every nation is a member of the ICCAT or follows the convention's guidelines. Instead, many nations continue to seek profit from large bluefin tuna catches every year without regard for conservation. Bluefin tuna have already been fished to extinction in the Black Sea and Caspian Sea, and perhaps the Atlantic bluefin tuna will follow.

## **3. Passenger Pigeons**

When Europeans arrived in \_\_\_\_\_, passenger pigeons migrated across the sky in huge numbers. As settlers spread farther into the continent, they began to clear the forests that passenger pigeons inhabited (destroying the birds' habitat) and eventually began to hunt the pigeons for food. In the mid-1800s, they caught massive numbers of pigeons in nets and sold the birds in cities as a food resource. By 1870, nearly all the passenger pigeons had been killed; hunting limits were enacted in the 1890s, but by that time, the passenger pigeon population couldn't recover. The last known passenger pigeon (held in captivity at a zoo) died in 1914, completing the extinction of a species because of unsustainable hunting practices.

## **4. Ocean Garbage Gyres**

The ocean is an excellent example of a shared resource that can easily be abused and degraded because it's *shared* by many different nations. No single authority has the power to pass laws that protect the entire ocean. Instead, each nation manages and protects the ocean resources along its coastlines, leaving the shared common space beyond any particular jurisdiction vulnerable to pollution. Throughout the world's oceans, garbage has begun to accumulate in the center of circular currents, or *gyres*. These giant patches of ocean garbage occur because many different countries allow solid waste to enter the oceans from land or ships. Destruction of ocean ecosystems because of garbage, especially

plastic pollutants, is likely to affect every person on the planet as these pollutants cycle through the food chain.

### **5. Earth's Atmosphere**

Earth's atmosphere is another resource that everyone on the planet uses and abuses. Air pollution and \_\_\_\_\_ from various industries and transportation increasingly damage this valuable, shared resource. As an example of a tragedy of the commons, the atmosphere offers some hope for a solution: More than once, international agreements have recognized the importance of taking care of the atmosphere. One example is the Kyoto Protocol, which attempted to bring nations together in reducing greenhouse gas emissions and slowing global climate warming. Multiple nations recognized that everyone had an interest in preserving this common resource for the future and agreed to look beyond short-term gain and immediate self-interest to a sustainable future.

### **6. Gulf of Mexico Dead Zone**

Thousands of farms are located along the \_\_\_\_\_ and its tributaries through the central U.S. As water washes into the river after a heavy rain, it brings with it nutrients from fertilizers added to farmland. These materials flow downriver and eventually enter the Gulf of Mexico, where they create conditions for a *dead zone* — a region of the ecosystem that can't support any living creatures. The Gulf of Mexico has a dead zone because everyone along the Mississippi River shares the waterway without considering how each small contribution of nutrient and chemical pollution adds up to have dramatic results.

### **7. Traffic Congestion**

Public roads are an excellent example of \_\_\_\_\_ shared by many people. Each of these people has his or her own interest in mind — typically, how to get to work as quickly and easily as possible. But when everyone decides that public roads are the best way to meet traveling needs, the roads jam up and slow down overall traffic movement, filling the air with pollutants from idling cars. Turning public roads into private roads or toll roads creates a different scenario. With a toll to pay (especially if the toll is higher during peak-use hours such as

rush hour), drivers may consider a less-direct route or choose to drive to work at a different time.

### **8. Groundwater in Los Angeles**

Landowners around Los Angeles each have rights to use the water pumped up from wells on their land. This water is part of a regional groundwater aquifer, so each landowner is ultimately pulling water from the same pool. As the city grew in the 1930s and 1940s, the amount of water drawn from the underground aquifer increased each year to meet the needs of the growing population. Eventually, residents drew so much water from the \_\_\_\_\_ that the supply reached levels that left the aquifer vulnerable to saltwater intrusion from the nearby Pacific Ocean. Facing potential water shortages and possible destruction of the renewable water resource they depended on, the water users created a voluntary organization to discuss how to manage and conserve the groundwater for the future.

### **9. Unregulated Logging**

The tropical rainforests are a common resource that \_\_\_\_\_ benefits from. In some parts of the world, vast expanses of dense rainforests aren't governed or owned in a way that allows effective management for resource extraction. Timber producers are driven to remove as much timber as possible as cheaply as possible. The result is that logging irreparably damages acres of rainforest each year. Although some laws protect these forests from destructive logging practices, illegal logging continues — particularly along boundaries between countries, where the laws may be different on each side of the border.

### **10. Population Growth**

Some scientists consider the \_\_\_\_\_ of the human population to be an example of a tragedy of the commons. In this case, the common resource is the planet Earth and all its shared resources. The world's population has reached a whopping 7 billion individuals. Examining population growth as a tragedy of the commons illustrates that the depletion of common resources isn't always the result of greed. Just by existing, each person uses water, air, land, and food

resources; splitting those resources among 7 billion people (and counting) tends to stretch them pretty thin.

### **KEY GOAL IN ENVIRONMENTAL SCIENCE**

A key goal in environmental science is achieving \_\_\_\_\_.  
***Sustainability*** is when both human and nature's needs are met in such a way that they can survive forever in a healthy environment. Our current problem is that we are using natural resources faster than they can be replaced in nature and we are polluting the biosphere that we live in.