Name: _____ Date: _____ Period: _____

FRQ 1.5: Sustainability & Ecology

KEY ISSUE 4

Why Are Some Actions Not Sustainable?

LEARNING OUTCOME 1.4.1

Describe the three pillars of sustainability.

Geography is distinctive because it encompasses both social science (human geography) and natural science (physical geography). This book focuses on human geography but doesn't forget that humans are interrelated with Earth's atmosphere, land, water, and vegetation, as well as with its other living creatures.

Geography, Sustainability, and Resources

A **resource** is a substance in the environment that is useful to people, economically and technologically feasible to access, and socially acceptable to use. **Sustainability** is the use of Earth's resources in ways that ensure their availability in the future.

From the perspective of human geography, nature offers a large menu of resources available for people to use. A substance is merely part of nature until a society has a use for it. Food, water, minerals, soil, plants, and animals are examples of resources.

Earth's resources are divided between those that are renewable and those that are not:

- A **renewable resource** is produced in nature more rapidly than it is consumed by humans.
- A **nonrenewable resource** is produced in nature more slowly than it is consumed by humans.

Geographers observe that the sustainability of resources is being damaged by human actions:

- Humans deplete nonrenewable resources, such as petroleum, natural gas, and coal.
- Humans destroy otherwise renewable resources through pollution of air, water, and soil.

Geographers also document efforts to improve the sustainability of resources. Recycling paper and plastic, developing new industrial processes, and protecting farmland from urban sprawl are examples of practices that contribute to a more sustainable future.

THREE PILLARS OF SUSTAINABILITY

According to the United Nations, sustainability rests on three pillars: environment, society, and economy (Figure 1-45). The 1987 U.N. report *Our Common Future* is a landmark work in recognizing sustainability as a combination of natural and human elements. It is frequently called the Brundtland Report, named for the chair of the World Commission on Environment and Development, Gro Harlem Brundtland, former prime minister of Norway.

Sustainability requires curtailing the use of nonrenewable resources and limiting the use of renewable resources to the level at which the environment can continue to supply them indefinitely. To be sustainable, the amount of timber cut down in a forest, for example, or the number of fish removed from a body of water must remain at a level that does not reduce future supplies.

The Brundtland Report argues that sustainability can be achieved only by bringing together environmental protection, economic growth, and social equity. The report is optimistic about the possibility of promoting environmental protection at the same time as economic growth and social equity.

THE ENVIRONMENT PILLAR. The sustainable use and management of Earth's natural resources to meet human needs such as food, medicine, and recreation is **conservation.** Renewable resources such as trees and wildlife are conserved if they are consumed at a less rapid rate than they can be replaced. Nonrenewable resources such as petroleum and coal are conserved if we use less today in order to maintain more for future generations (Figure 1-46a).

Conservation differs from **preservation,** which is the maintenance of resources in their present condition, with as little human impact as possible. Preservation takes the view that the value of nature does not derive from human needs and interests but from the fact that every plant and animal living on Earth has a right to exist and should be preserved, regardless of the cost. Preservation does not regard nature as a resource for human use. In contrast, conservation is compatible with development but only if natural resources are utilized in a careful rather than wasteful manner.

THE SOCIETY PILLAR. Humans need shelter, food, and clothing to survive, so they make use of resources to meet these needs. Homes can be built of grass, wood, mud, stone, or brick. Food can be consumed by harvesting grains, fruit, and vegetables or by eating the flesh of fish, cattle, and pigs. Clothing can be made from harvesting cotton, removing skins from animals, or turning petroleum into polyester.

Consumer choices can support sustainability when people embrace it as a value. For example, a consumer might prefer clothing made of natural or recycled materials to clothing made directly from petroleum products. They can also choose products that benefit people living in a particular place (Figure 1-46b). Society's values are the basis for choosing which resources to use.

Name: _____ Date: _____ Period: _____

THE ECONOMY PILLAR. Natural resources acquire a monetary value through exchange in a marketplace (Figure 1-46c). In a market economy, supply and demand are the principal factors that determine affordability. The greater the supply, the lower the price; the greater the demand, the higher the price. Consumers will pay more for a commodity if they strongly desire it than if they have only a moderate desire. However, geographers observe that some goods do not reflect their actual environmental costs. For example, motorists sitting in a traffic jam do not have to pay a fee for the relatively high level of pollution their vehicles are emitting into the atmosphere.

The price of a resource depends on a society's technological ability to obtain it and to adapt it to that society's purposes. Earth has many substances that we do not use today because we lack the means to extract them or the knowledge of how to use them. Things that might become resources in the near future are potential resources.

Sustainability and Earth's Physical Systems

LEARNING OUTCOME 1.4.2

Describe Earth's three abiotic physical systems

Geographers classify natural resources as part of four interrelated systems. These four physical systems are classified as either biotic or abiotic. A **biotic** system is composed of living organisms. An **abiotic** system is composed of nonliving or inorganic matter. Three of Earth's four systems are abiotic:

- The **atmosphere**: A thin layer of gases surrounding Earth.
- The **hydrosphere**: All of the water on and near Earth's surface.
- The **lithosphere**: Earth's crust and a portion of upper mantle directly below the crust.

One of the four systems is biotic:

- The **biosphere**: All living organisms on Earth, including plants and animals, as well as microorganisms.

The names of the four spheres are derived from the Greek words for "air" (*atmo*), "water" (*hydro*), "stone" (*litho*), and "life" (*bio*).

ATMOSPHERE. A thin layer of gases surrounds Earth at an altitude up to 480 kilometers (300 miles). Pure dry air in the lower atmosphere contains approximately 78 percent nitrogen, 21 percent oxygen, 0.9 percent argon, 0.036 percent carbon dioxide, and 0.064 percent other gases (measured by volume). As atmospheric gases are held to Earth by gravity, pressure is created. Variations in air pressure from one location to another are responsible for producing such weather features as wind blowing, storms brewing, and rain falling.

The long-term average weather condition at a particular location is **climate.** Geographers frequently classify climates according to a system developed by German climatologist Vladimir Köppen. The modified Köppen system divides the world into five main climate regions that are identified by the letters A through E, as well as by names:

- A: Humid low-latitude climates.
- B: Dry climates.
- C: Warm mid-latitude climates.
- D: Cold mid-latitude climates.
- E: Polar climates.

The modified Köppen system divides the five main climate regions into several subtypes (Figure 1-47). For all but the B climate, the basis for the subdivision is the amount of precipitation and the season in which it falls. For the B climate, subdivision is made on the basis of temperature and precipitation. In addition, "H" denotes highland areas in which climates are cold due to elevation, or local climate variations that are too great to show on the map.

Humans have a limited tolerance for extreme temperature and precipitation levels and thus avoid living in places that are too hot, too cold, too wet, or too dry. Compare the map of global climate to the distribution of population in Figure 2-4. Relatively few people live in the Dry (B) and Polar (E) climate regions, or in the Highlands.

HYDROSPHERE. Water exists in liquid form in oceans, lakes, and rivers, as well as groundwater in soil and rock. It can also exist as water vapor in the atmosphere and as ice in glaciers. Over 97 percent of the world's water is in the oceans. The oceans supply the atmosphere with water vapor, which returns to Earth's surface as precipitation, the most important source of fresh water. Consumption of water is essential for the survival of plants and animals, and a large quantity and variety of plants and animals live in it. Because water gains and loses heat relatively slowly, it also moderates seasonal temperature extremes over much of Earth's surface.

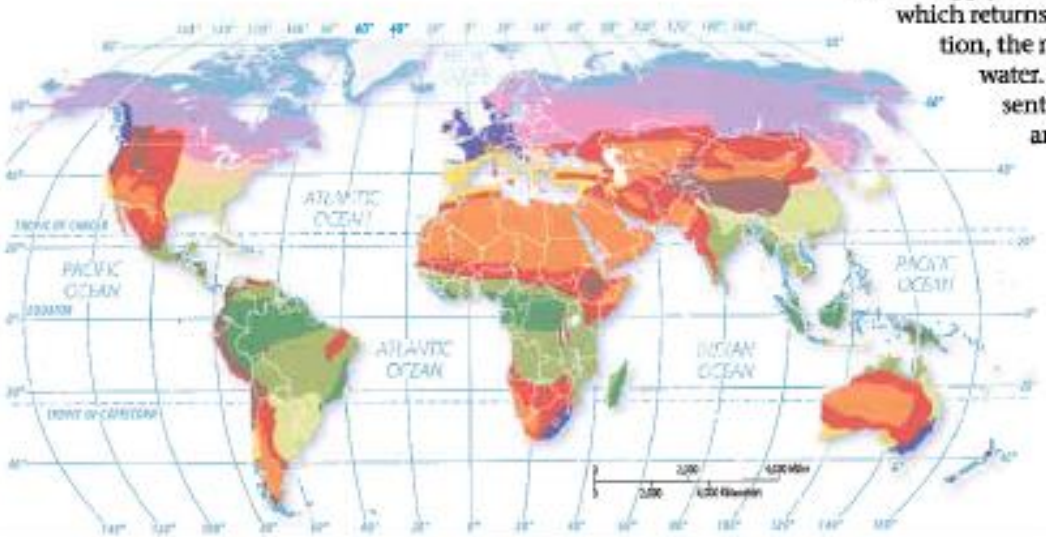

FIGURE 1-47 CLIMATE REGIONS Geographers frequently classify global climates according to a system developed by Vladimir Köppen

Name: _____ Date: _____ Period: _____

The climate of a particular location influences human activities, especially production of the food needed to survive. People in parts of the A climate region, especially southwestern India, Bangladesh, and the Myanmar (Burma) coast, anxiously await the annual monsoon rain, which is essential for successful agriculture and provides nearly 90 percent of India's water supply (Figure 1-48). For most of the year, the region receives dry, somewhat cool air from the northeast. In June, the wind direction suddenly shifts, bringing moist, warm, southwesterly air, known as the monsoon, from the Indian Ocean. The monsoon rain lasts until September. In years when the monsoon rain is delayed or fails to arrive—in recent decades, at least one-fourth of the time—agricultural output falls, and famine threatens in the countries of South Asia, where nearly 20 percent of the world's people live. The monsoon rain is so important in India that the words for "year," "rain," and "rainy season" are identical in many local languages.

LITHOSPHERE. Earth is composed of concentric spheres. The core is a dense, metallic sphere about 3,500 kilometers (2,200 miles) in radius. Surrounding the core is a mantle about 2,900 kilometers (1,800 miles) thick. The crust is a thin, brittle outer shell 8 to 40 kilometers (5 to 25 miles) thick. The lithosphere encompasses the crust, a portion of the mantle extending down to about 70 kilometers (45 miles). Powerful forces deep within Earth bend and break the crust to form mountain chains and shape the crust to form continents and ocean basins.

Earth's surface features, or landforms, vary from relatively flat to mountainous. Geographers find that the study of Earth's landforms—a science known as geomorphology—helps explain the distribution of people and the choice of economic activities at different locations. People prefer living on flatter land, which generally is better suited for agriculture. Great concentrations of people and activities in hilly areas may require extensive effort to modify the landscape.

Topographic maps, published for the United States by the U.S. Geological Survey (USGS), show details of physical features, such as bodies of water, forests, mountains, valleys, and wetlands. They also show cultural features, such as buildings, roads, parks, farms, and dams. "Topos" are used by engineers, hikers, hunters, people seeking home sites, and anyone who really wants to see the lay of the land (Figure 1-49). The brown lines on the map are contour lines that show the elevation of any location. Lines are further apart in flatter areas and closer together in hilly areas.

Geography, Sustainability, and Ecology

LEARNING OUTCOME 1.4.3

Explain how the biosphere interacts with abiotic systems.

Modern technology has altered the historic relationship between people and the environment. People are now the most important agents of change on Earth, and they can modify the environment to a greater extent than in the past. Geographers are concerned that people sometimes use modern technology to modify the environment insensitively. Human actions can deplete scarce environmental resources, destroy irreplaceable resources, and use resources inefficiently.

ECOLOGY AND THE BIOSPHERE

The fourth natural resource system, the biosphere, encompasses all of Earth's living organisms. Because living organisms cannot exist except through interaction with the surrounding physical environment, the biosphere also includes portions of the three abiotic systems near Earth's surface. Living organisms in the biosphere interact with each of the three abiotic systems. For example, a piece of soil may comprise mineral material from the lithosphere, moisture from the hydrosphere, pockets of air from the atmosphere, and plant and insect matter from the biosphere.

Most of the living organisms interact within the top 3 meters (10 feet) of the lithosphere, the top 200 meters (650 feet) of the hydrosphere, and the lowest 30 meters (100 feet) of the atmosphere:

- The lithosphere is where most plants and animals live and where they obtain food and shelter.
- The hydrosphere provides water to drink and physical support for aquatic life.
- The atmosphere provides the air for animals to breathe and protects them from the Sun's rays.

A group of living organisms and the abiotic spheres with which they interact is an **ecosystem** (Figure 1-50). The scientific study of ecosystems is **ecology.** Ecologists study interrelationships between living organisms and the three abiotic environments, as well as interrelationships among the various living organisms in the biosphere.

Human geographers are especially interested in ecosystems involving the interaction of humans with the rest of the biosphere and the three abiotic spheres:

- If the atmosphere contains pollutants, or its oxygen level is reduced, humans have trouble breathing.
- Without water in the hydrosphere, humans waste away and die.
- A stable lithosphere provides humans with materials for buildings and fuel for energy.
- The rest of the biosphere provides humans with food.

Human actions are sustainable if they preserve and conserve elements of the four spheres and unsustainable if the cause destruction. For example, human actions contribute to the destruction of soil, the material that forms on Earth's surface at the thin interface between the air and the rocks. Two sustainability issues arise from the destruction of soil:

Name: _____ Date: _____ Period: _____

- **Erosion.** Erosion occurs when soil washes away in the rain or blows away in the wind. Farmers contribute to erosion by making inappropriate choices. To reduce erosion, farmers can avoid steep slopes, plow less, and plant crops whose roots help bind the soil.
- **Depletion of nutrients.** Soil contains the nutrients necessary for successful growth of plants, including those that are useful to humans. Nutrients are depleted when plants withdraw more nutrients than natural processes can replace. Each type of plant withdraws certain nutrients from the soil and restores others. To minimize depletion, farmers can plant different crops from one year to the next so that the land remains productive over the long term.

CULTURAL ECOLOGY: INTEGRATING CULTURE AND ECOLOGY

Human geographers are especially interested in the fact that different cultural groups modify the four spheres in distinctive ways. The geographic study of human–environment relationships is known as **cultural ecology.** The roots of cultural ecology reach back more than 200 years, to an era when early scientists traveled the globe, observing how people lived in different environments.

ENVIRONMENTAL DETERMINISM. Pioneering nineteenth-century German geographers Alexander von Humboldt (1769–1859) and Carl Ritter (1779–1859) believed that the physical environment caused social development, an approach called **environmental determinism.** According to Humboldt and Ritter, human geographers should apply laws from the natural sciences to understanding relationships between the physical environment and human actions. They argued that the scientific study of social and natural processes is fundamentally the same. Natural scientists have made more progress in formulating general laws than have social scientists, so an important goal of human geographers is to discover general laws. Humboldt and Ritter urged human geographers to adopt the methods of scientific inquiry used by natural scientists.

Other influential geographers adopted environmental determinism in the late nineteenth and early twentieth centuries. Friedrich Ratzel (1844–1904) and his American student Ellen Churchill Semple (1863–1932) claimed that geography was the study of the influences of the natural environment on people.

Another early American geographer, Ellsworth Huntington (1876–1947), argued that climate was a major determinant of civilization. For instance, according to Huntington, the temperate climate of maritime northwestern Europe produced greater human efficiency, as measured by better health conditions, lower death rates, and higher standards of living.

POSSIBILISM. To explain relationships between human activities and the physical environment, modern geographers reject environmental determinism in favor of possibilism. According to **possibilism,** the physical environment may limit some human actions, but people have the ability to adjust to their environment. People can choose a course of action from many alternatives in the physical environment.

For example, the climate of any location influences human activities, especially food production. From one generation to the next, people learn that different crops thrive in different climates—rice requires plentiful water, whereas wheat survives on limited moisture and actually grows poorly in very wet environments. On the other hand, wheat is more likely than rice to be grown successfully in colder climates. Thus, under possibilism, people can choose the crops they grow and yet be compatible with their environment.

Some human impacts on the environment are based on deep-seated cultural values. Why do we plant our front yard with grass, water it to make it grow, mow it to keep it from growing tall, and impose fines on those who fail to mow often enough? Why not let dandelions or wildflowers grow instead (Figure 1-51)? Why does one group of people consume the fruit from deciduous trees and chop down the conifers for building materials, whereas another group chops down the deciduous trees for furniture while preserving the conifers as religious symbols? Are some of these actions more sustainable than others?

A people's level of wealth can also influence its attitude toward modifying the environment. A farmer who possesses a tractor may regard a hilly piece of land as an obstacle to avoid, but a poor farmer with a hoe may regard hilly land as the only opportunity to produce food for survival through hand cultivation.

POSSIBILISM AND SUSTAINABILITY. Human geographers use the cultural ecology, or human–environment, approach to understand whether particular patterns and processes are sustainable. For example, world population growth is a problem if the number of people exceeds the capacity of the physical environment to produce food. However, people can adjust to the capacity of the physical environment by controlling their numbers, adopting new technology, consuming different foods, migrating to new locations, and taking other actions.

The physical environment is not always the most significant factor in human decisions. People can fashion a landscape by superimposing new forms on the physical environment. For example, the critical factor in selecting a site for a cotton textile factory is not proximity to a place where cotton is grown. A more important factor in selecting a suitable location is access to a supply of low-cost labor. Economic systems, political structures, living arrangements, religious practices, and human activities can produce distinctive landscapes that do not stem primarily from distinctive physical features. The geographer's job is to sort out the associations among various social characteristics, each of which is uniquely distributed across Earth's surface.

Name: _____ Date: _____ Period: _____

==========

AP© HUMAN GEOGRAPHY -- SECTION II -- Time—25 minutes --- Percent of total score—100

Directions: You have 25 minutes to answer the free response portion. It is suggested that you take 5 minutes of this time to plan and outline each answer. While a formal essay is not required, it is not enough to answer a question by merely listing facts. Illustrate your answers with substantive geographic examples where appropriate. Be sure to number each of your answers, including individual parts, in this booklet as the questions are numbered below

1. Geography is distinctive because it encompasses both social science (human geography) and a natural science (physical geography).

   HINT: None of these should be answered in a few sentences

   A. Explain the concept of *sustainability* and how it relates to humans.
   B. Describe the three abiotic physical systems of Earth.
   C. **Explain** the difference between *environmental determinism* and *possibilism.*