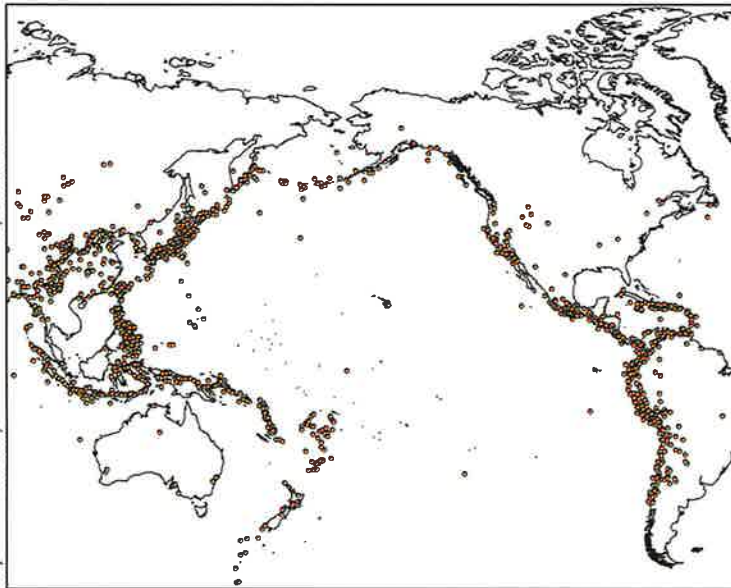


GEOGRAPHY STANDARD 15: How physical systems affect human systems



Image credit: D.J. Zeigler

Coastal barrier formations, such as Alabama's Dauphin Island, are desirable locations for housing developments, but building so close to the sea brings devastating risks and vulnerabilities such as storms like Hurricane Katrina in 2005.



Map credit: University of North Alabama/Lisa Keys-Mathews

The geographically informed person must understand how humans are able to live in various physical settings and the role the physical features of those settings play in shaping human activity. Regardless of spatial scale, Earth's surface is diverse in terms of climates, vegetation, fauna, soils, underlying geology, and topography. That diversity offers a range of environmental contexts where people can live and work. Physical systems and environmental characteristics do not, by themselves, determine the patterns of human activity; however, they do influence and constrain the choices people make.

Therefore, Standard 15 contains these themes: Environmental Opportunities and Constraints, Environmental Hazards, and Adaptation to the Environment.

To live in any physical environment, no matter how accommodating or how challenging, people must develop ways to take advantage of its opportunities and minimize its risks. If the incentives are great enough, people can adapt to the harshest of environments, often regardless of cost or risk.

A concept central to understanding environments is the idea of carrying capacity: the maximum number of animals and/or people a given area can support at a given time under specified levels of consumption without incurring significant environmental deterioration. Environments vary in their carrying capacities. Failure to recognize that reality can lead to environmental disaster. Increasingly, people are recognizing their responsibility to manage the environment in ways that are sustainable for future generations.

Humans employ evolving technologies when possible to reduce the negative effects of physical systems on human activities. However, there are trade-offs that result in unintended consequences. Dam building to control river flooding is a case in point. In some parts of the world, dams have diminished soil replenishment and increased water salinity and riverbank erosion. Environmental hazards such as hurricanes, tornadoes, earthquakes, wildfires, and flash floods also take their toll despite early warning systems, improved building design, and public education programs.

Students must understand the characteristics of physical environments in relation to human activities. Whether it is an issue of mitigating an environmental hazard or recognizing the carrying capacity of a given area, students must be able to envision the physical processes and patterns of a place as a potential home for people. Understanding these themes enables students to recognize that there are limits to growth and to weigh the challenges of environmental opportunities and constraints when they measure the effects of physical systems on human activities.

The Pacific Rim is easily identified by mapping the distribution of earthquakes. Due to tectonic movements, their frequency increases along the edges of the Pacific plate.
Data source: USGS/Esri Data & Maps Media Kit.

GEOGRAPHY STANDARD 15: How physical systems affect human systems

4th GRADE

the student knows and understands:

Environmental Opportunities and Constraints

1. The physical environment provides opportunities for and imposes constraints on human activities

Therefore, the student is able to:

- A. Describe examples in which the physical environment provides opportunities for human activities, as exemplified by being able to
- ▶ Identify and describe the characteristics of the community's physical environment that first attracted people and enabled them to thrive and prosper (e.g., climate, water, soil, landforms).
 - ▶ Identify and describe examples of places that offer vacation activities for people because of the physical environment (e.g., snow skiing, ocean beaches, boating, river rafting).
 - ▶ Describe how people take advantage of the physical environment of their local community (e.g., water supply, farming, gardens, recreational activities).
- B. Describe examples in which the physical environment imposes constraints on human activities, as exemplified by being able to
- ▶ Describe how human activities are limited by landforms such as flood plains, deltas, mountains, and slopes in choices of land use (e.g., agriculture, human settlement, transportation networks).
 - ▶ Describe examples in which human activities are limited by different types of climates (e.g., cold or polar, rainy or dry, equatorial).
 - ▶ Describe how transportation routes are shaped by the physical environment (e.g., horseshoe curves, tunnels, bridges).

8th GRADE

the student knows and understands:

Environmental Opportunities and Constraints

1. The characteristics of a physical environment provide opportunities for and impose constraints on human activities

Therefore, the student is able to:

- A. Explain how the characteristics of different physical environments offer opportunities for human activities, as exemplified by being able to
- ▶ Describe and explain the environmental characteristics that people consider when deciding on locations for human activities (e.g., locating a waterwheel at a river's fall line for power, locating a ski resort in a high snowfall area with easy access for recreational skiers, farming on fertile flood plains for high crop yields).
 - ▶ Explain how physical features in the local community provide opportunities for future development (e.g., tourist river-walk development, beachfront resorts, solar and wind farms).
 - ▶ Explain how agricultural practices developed rapidly and successfully in favorable physical environments (e.g., along flood plains and in river valleys, in flat lands with adequate rainfall).
- B. Explain how the characteristics of different physical environments place constraints on human activities, as exemplified by being able to
- ▶ Explain how environmental characteristics (e.g., rainfall, length of growing season, temperatures, soil) restrict the range of crops that can be grown successfully in an area.
 - ▶ Explain how building technologies are designed to respond to the constraints of the environment (e.g., building on permafrost in polar climates, designing buildings to withstand earthquakes).
 - ▶ Explain how the development of a city can be influenced by the physical environmental characteristics of the area (e.g., requirement of bedrock to support skyscrapers, filling in water areas to add buildable space, reduction of hills to level areas, mountain valleys with limited usable land area).

This ski run at Copper Mountain, Colorado offers the perfect environment for downhill skiing. It overlooks the highway below that can be a challenge to keep open in winter but is essential to connect skiers to the ski slopes.

12th GRADE

the student knows and understands:

Environmental Opportunities and Constraints

1. Depending on the choice of human activities, the characteristics of the physical environment can be viewed as both opportunities and constraints

Therefore, the student is able to:

- A. Explain how people may view the physical environment as both an opportunity or a constraint depending on their choice of activities, as exemplified by being able to
- ▶ Explain how mountainous terrain may constrain some farming techniques due to a lack of flat areas and yet offer opportunities in growing crops that are only suited to high-elevation growing conditions.
 - ▶ Explain how the ski industry and state roads departments may view the same mountainous region and its weather patterns as presenting both opportunities and constraints.
 - ▶ Explain how the physical environment of the arid West of the United States presents both opportunities and constraints for human activities (e.g., the construction, use, and maintenance of golf courses, cultivation of cotton and citrus fruits, numerous outdoor swimming pools, water intensive lawns and landscaping).

Image credit: Susan Gallagher Hefron



4th GRADE*the student knows and understands:*

Environmental Hazards

2. Environmental hazards affect human activities*Therefore, the student is able to:*

A. Identify and describe the locations of environmental hazards, as exemplified by being able to

- ▶ Identify on a US map the locations of occurrences of tornadoes, earthquakes, and hurricanes and overlay a map of population density and identify locations where people and hazards are both located.
- ▶ Identify on a map of the Pacific basin the occurrences of earthquakes and volcanoes and describe the pattern that results (e.g., the Pacific Ring of Fire).
- ▶ Identify the types of environmental hazards that occur in the student's state or region, graph the occurrences during a five-year period, and map the locations of the occurrences.

B. Describe and analyze the effects of environmental hazards on human activities, as exemplified by being able to

- ▶ Describe how people change their behaviors in response to environmental hazards (e.g., knowing evacuation routes, building a storm shelter, conducting earthquake or tornado drills).
- ▶ Describe how people might build their houses differently on a coast or beach as compared to another location (e.g., elevated footings for storm surge, shutters over windows, metal reinforced roof trusses for wind).
- ▶ Construct a disaster preparedness manual for your community or school that includes a list of actions people should take in an emergency situation due to a local environmental hazard event.

8th GRADE*the student knows and understands:*

Environmental Hazards

2. The types, causes, and characteristics of environmental hazards occur at a variety of scales from local to global*Therefore, the student is able to:*

A. Describe and explain the types and characteristics of hazards, as exemplified by being able to

- ▶ Identify and explain the types of threats posed to human settlement by different types of environmental hazards (e.g., wind destruction, fires, flooding, collapse of structures).
- ▶ Construct a table of climate-related and tectonic-related hazards and explain the characteristics of each type of hazard.
- ▶ Identify the locations of environmental hazards in the student's state or region, describe the characteristics of each, and explain how people adapt to living in these areas.

B. Explain the causes and locations of various types of environmental hazards, as exemplified by being able to

- ▶ Describe the physical environmental conditions that create or result in different environmental hazards (e.g., plate tectonics causing earthquakes, sea surface temperatures contributing to hurricane development in the Atlantic, strong frontal systems in thunderstorms spawning tornadoes).
- ▶ Identify the tectonic plate boundaries on a map and analyze the most likely locations of future earthquakes and volcanoes based on an explanation for the causes of these environmental hazards.
- ▶ Explain where and why tornadoes are most likely to occur in the United States.

12th GRADE*the student knows and understands:*

Environmental Hazards

2. Humans perceive and react to environmental hazards in different ways*Therefore, the student is able to:*

A. Explain and compare how people in different environments think about and respond to environmental hazards, as exemplified by being able to

- ▶ Construct a list of environmental hazards and compare and contrast how people in developed and developing world regions prepare for and cope with the aftermath of these disasters.
- ▶ Construct and compare maps of recent wildfires and population distribution in Southern California and explain the reasons for and consequences of people building structures in the most vulnerable areas in this region (e.g., fire protection, insurance, financing, land values, quality of life, fuel suppression of vegetation).
- ▶ Explain how people from different parts of the country might have differing views on federal government insurance programs for areas susceptible to environmental hazards (e.g., hail insurance programs in Kansas, national flood insurance in Louisiana).

B. Explain how environmental hazards affect human systems and why people may have different ways of reacting to them, as exemplified by being able to

- ▶ Explain how volcanoes have sometimes been incorporated into local cultural traditions and lore by people who live with the unpredictability of eruptions rather than to relocate farther away from the hazard.
- ▶ Describe and explain the short- and long-term effects of hurricanes in the Gulf of Mexico and Atlantic coast on beaches, buildings, and human activities (e.g., insurance rates, zoning, building codes, beach replenishment, displaced populations).
- ▶ Compare the human responses to the potential predicted effects of climate change on different regions of Earth (e.g., people living in coastal versus landlocked areas, high- versus low-latitude areas, Northern versus Southern Hemisphere areas).

GEOGRAPHY STANDARD 15: How physical systems affect human systems

4th GRADE

the student knows and understands:

Adaptation to the Environment

3. People adapt to the conditions of the physical environment

Therefore, the student is able to:

- A. Describe how people adapt to conditions of the physical environment, as exemplified by being able to
 - ▶ Identify and describe how people adapt to the physical environment through choices of clothing, housing styles, food choices, recreational activities, and land use.
 - ▶ Describe how people adapt differently to different physical environments (e.g., clothing in Florida versus Alaska, houses in Hawaii versus Minnesota).
 - ▶ Describe different types of transportation needed in different environments (e.g., boats versus cars, air boats in swamps, sleds and snowmobiles).

8th GRADE

the student knows and understands:

Adaptation to the Environment

3. People use tools and technologies in adapting to the physical environment

Therefore, the student is able to:

- A. Explain how people use tools and technologies in adapting to the physical environment, as exemplified by being able to
 - ▶ Compare the tools and technologies used in agriculture in different environmental regions (e.g., terraced farming, center-pivot irrigation, slash-and-burn plots).
 - ▶ Explain how humans use technologies (e.g., pipelines, air conditioning, water recycling) to adapt to different physical environments.
 - ▶ Explain how people developed new building technologies to adapt to the physical environment (e.g., skywalks in Minneapolis, tunnels in downtown Montreal).

12th GRADE

the student knows and understands:

Adaptation to the Environment

3. Societies use a variety of strategies to adapt to changes in the physical environment

Therefore, the student is able to:

- A. Explain how societies adapt to reduced capacity in the physical environment, as exemplified by being able to
 - ▶ Explain how societies historically adapted to reduced capacity in the physical environment (e.g., migration, limiting population growth, building aqueducts and cisterns) and predict locations where adaptation strategies might be required in the future.
 - ▶ Explain how societies use technology in dealing with resource shortages amidst growing human populations (e.g., recycling used water, recycling paper products, converting to drip irrigation systems, development of new alternative energy sources).
 - ▶ Describe and explain how societies may change their use of building materials in response to changes in the physical environment.
- B. Analyze the concept of “limits to growth” to explain adaptation strategies in response to the restrictions imposed on human systems by physical systems, as exemplified by being able to
 - ▶ Analyze how people have adapted to physical environments that vary in carrying capacity (e.g., slash-and-burn agriculture practices, nomadic herding or hunting, importation of needed products).
 - ▶ Analyze the lifestyles of humans in extreme or island environments and explain strategies inhabitants use to survive and not overwhelm the limits of their environments (e.g., water collection and rationing in arid climates, Inuit seasonal seal hunting and fishing practices, Antarctic researchers using sustainable living practices).
 - ▶ Identify world locations that have vulnerable environmental conditions (e.g., extreme temperatures, limited access to water, steep topography) and high population density and explain adaptation strategies used in these locations that address the limits to growth.



The people of Amsterdam have a long history of using dikes and canals to control flooding and reclaim land from the sea. Canals and bicycles are practical forms of transportation in a city with limited land area and flat terrain.

Image credit: Susan Gallagher Heffron