

GEOGRAPHY STANDARD 14: How human actions modify the physical environment

Image credit: iStockphoto.com

Farmers modify the physical environment by building terraces on steep slopes, like these in Nepal, to increase the land area for farming different types of crops.

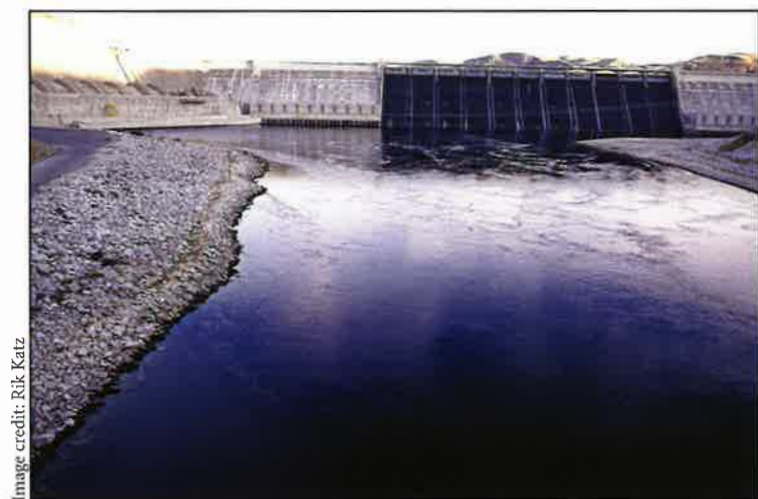


Image credit: Rik Katz

The Grand Coulee Dam on the Columbia River in Washington is an example of human modification of the physical environment. Dams can be used for generating energy and flood control.

The geographically informed person must understand the human imprint on the physical environment. Many of the important issues facing modern society are the result of human modifications of the physical environment. Some of these modifications are intended and positive; others unintended and negative. These changes have political, economic, and social implications at all scales, from the global to local.

Therefore, Standard 14 contains these themes: Modification of the Physical Environment, The Use of Technology, and Consequences for People and Environments.

To survive, people depend on the physical environment. They adapt and modify it to suit their changing needs to meet life's necessities. In the process, they bring knowledge and technology to bear on physical systems. Alterations to the environment have brought economic prosperity to some areas at some times and created environmental crises in others. Resulting modifications that vary in scope, scale, and duration often place enormous demands on the capacity of physical systems to absorb and accommodate such changes. Contrast the benign long-term consequences of terracing hillsides to grow rice for food with the dramatic depletion of Arctic sea ice as a result of global warming since the Industrial Revolution. Because of these significant spatial and temporal variations in impact, students must understand both the potential benefits and costs of changes to an environment.

Understanding global interdependence begins with awareness of the continuous modification of Earth to meet human wants and needs. When successful, the relationship between people and their environment is adaptive in the short- and long-term; when modifications are excessive or inappropriate, the relationship is fractured. Increasingly, students will be required to make decisions about connections between human needs and the physical environment.

Students must understand the consequences their actions have on the physical environment and make informed, sustainable choices as they modify the current physical environment. Understanding these themes enables students to see how human actions modify the physical environment and set those changes in a local to global context that ensures sustainability.

GEOGRAPHY STANDARD 14: How human actions modify the physical environment

4th GRADE

the student knows and understands:

Modification of the Physical Environment

1. People modify the physical environment

Therefore, the student is able to:

A. Identify and describe ways in which humans modify the physical environment, as exemplified by being able to

► Identify and describe examples of human modifications to the physical environment surrounding the school or neighborhood (e.g., paving over vegetated areas, constructing buildings, building bridges, installing culverts or drainage ditches, removing or adding trees or shrubs).

► Describe human-generated changes in the physical environment during different time periods using aerial photographs or satellite images of the same location (e.g., farmland to subdivisions, open fields to baseball diamonds, traditional downtown areas to new shopping centers).

► Describe examples of changes that would occur if people decided to build a new road, water park, or shopping center in the local community (e.g., changes in ecosystem, land cover, landforms, drainage patterns or runoff).

The Use of Technology

2. People use technology to get what they need from the physical environment

Therefore, the student is able to:

A. Describe and explain ways in which people use technology to get what they need from the physical environment, as exemplified by being able to

► Describe and explain examples of the technology used in different industries in the United States (e.g., high-tech farming and irrigation, excavating machinery in strip mining, drilling in oil production).

► Explain how the use of technology in students' daily lives (e.g., rototiller in the garden, applying plant fertilizer, pumps that provide bore or well water, hybrid or disease resistant seeds) can help people get things they need from the physical environment.

► Describe and explain how inventions helped people settle the Great Plains (e.g., barbed wire, steel plow, railroad, steamboat, threshing machines).

8th GRADE

the student knows and understands:

Modification of the Physical Environment

1. Human modifications of the physical environment in one place often lead to changes in other places

Therefore, the student is able to:

A. Describe and explain how human-induced changes in one place can affect the physical environment in other places, as exemplified by being able to

► Describe and explain how the construction of dams and levees on rivers in one region affects places downstream (e.g., water availability for human consumption and agriculture, flood control, electricity generation, aquatic and riparian ecosystems).

► Describe how human changes to land cover can have negative impacts on other areas (e.g., deforestation and downstream flooding, siltation, soil erosion).

► Explain how industrial activities (e.g., factories, electric power generating plants) affects other locations (e.g., acid rain downwind, thermal inversions, smog).

The Use of Technology

2. The use of technology has changed the scale at which people can modify the physical environment

Therefore, the student is able to:

A. Describe and explain the ways in which technology has expanded the scale of human modification of the physical environment, as exemplified by being able to

► Describe and explain how strip-mining technology has altered the physical environment of the United States (e.g., mountaintop removal in West Virginia, culm heaps in the anthracite region of northeastern Pennsylvania, deep craters in the Powder River Basin strip mine).

► Describe how changes in technology have altered the methods and amount of travel and therefore the effects on the physical environment (e.g., car emissions, road building, airplane jet exhaust and noise).

► Describe and explain how green construction techniques may increase sustainability and reduce the scale of human-induced effects on the physical environment (e.g., reduced energy use, the use of new sustainable building materials).

12th GRADE

the student knows and understands:

Modification of the Physical Environment

1. Human modifications of the physical environment can have significant global impacts

Therefore, the student is able to:

A. Explain the global impacts of human changes in the physical environment, as exemplified by being able to

► Explain the spatial consequences, deliberate and inadvertent, of human activities that have global implications (e.g., dispersal of plant and animal species, fungi, and disease worldwide; global petroleum production, transport, and consumption; global climate change).

► Explain how changes in human behavior can result in the introduction of aerosols into the atmosphere that have effects on a global scale (e.g., dust from Chinese agriculture and industry affecting Hawaii's weather, dust from the Saharan Africa affecting weather in Florida).

► Explain the implications of modifying the physical environment in Brazil to grow soybeans for global export (e.g., siltation, desertification, deforestation, global climate change).

The Use of Technology

2. The use of technology can have both intended and unintended impacts on the physical environment that may be positive or negative

Therefore, the student is able to:

A. Evaluate the intended and unintended impacts of using technology to modify the physical environment, as exemplified by being able to

► Evaluate how the technologies used in petroleum production and transportation have expanded the scale of the industry from local or regional to global over the last century (e.g., offshore oil drilling, oil sands, supertankers, pipelines).

► Evaluate various types of contemporary agricultural techniques (e.g., no-till farming, herbicides, pesticides, center-pivot application of chemicals, crop rotation, irrigation, increased acreage in production), and compare the positive and negative implications of using these techniques.

► Evaluate the environmental impact of road building into remote locations (e.g., rain forests in Brazil, old growth forests in Oregon, agricultural land in China, Alaskan pipeline in the Arctic).

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4th GRADE

the student knows and understands:

Consequences for People and Environments

3. The consequences of human modifications of the physical environment

Therefore, the student is able to:

- A. Identify and describe examples of how human activities impact the physical environment, as exemplified by being able to
- ▶ Identify and describe the changes in local habitats that resulted from human activities.
 - ▶ Identify and describe the impacts that students' dietary choices may have on the physical environment.
 - ▶ Describe examples of human modifications to the physical environment as a result of improving transportation routes (e.g., bridges, drainage ditches, widening streets or roads, divided highways).

8th GRADE

the student knows and understands:

Consequences for People and Environments

3. The physical environment can both accommodate and be endangered by human activities

Therefore, the student is able to:

- A. Analyze the positive and negative consequences of humans changing the physical environment, as exemplified by being able to
- ▶ Analyze the positive and negative effects of human actions on the lithosphere (e.g., land degradation and erosion, soil salinization and acidification).
 - ▶ Analyze the proportion of built area to vegetation land cover around a community and identify possible consequences in changes to that proportion (e.g., habitat changes, heat island effect, water and wetland patterns).
 - ▶ Analyze the ways humans can have positive effects on the physical environment (e.g., open green space protection, wetland restoration, sustainable forestry).

12th GRADE

the student knows and understands:

Consequences for People and Environments

3. People can either mitigate and/or adapt to the consequences of human modifications of the physical environment

Therefore, the student is able to:

- A. Describe and evaluate scenarios for mitigating and/or adapting to environmental changes caused by human modifications, as exemplified by being able to
- ▶ Compare the costs and benefits of alternative solutions for a human-caused environmental problem, such as acid rain (e.g., coal with lower sulfur content, scrubbers on smokestacks, nuclear waste disposal, use of alternative energies) or urban heat islands (e.g., green roof construction, increased public transportation, energy efficient buildings).
 - ▶ Explain and evaluate the policy implications of managing upstream development in relation to downstream impacts (e.g., flooding, dam construction or removal, zoning).
 - ▶ Evaluate the feasibility, costs, and benefits of green construction techniques (e.g., Leadership in Energy and Environmental Design [LEED] certification) and describe how these efforts may increase sustainability and mitigate human impact on the physical environment.
 - ▶ Construct a plan for a public-awareness campaign about a hazardous issue including suggestions for mitigation and adaptation (e.g., radon gas, potential flooding, lead paint, water quality, industrial pollutants).

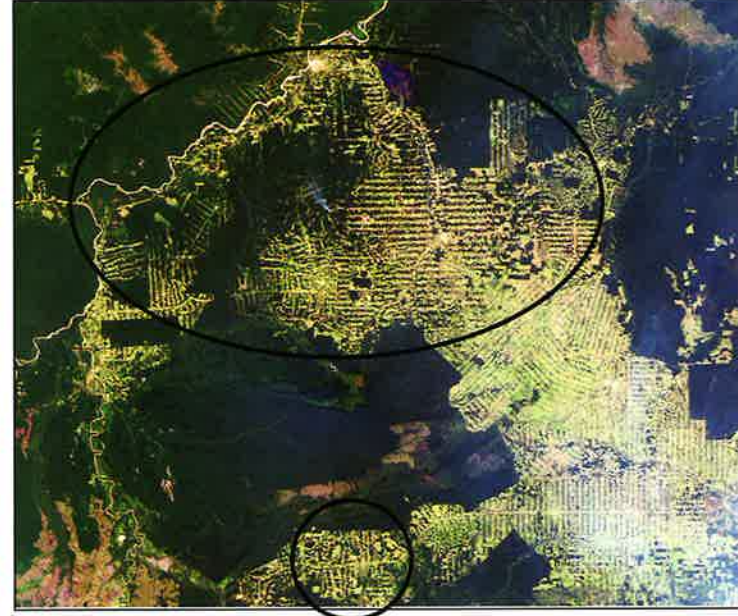
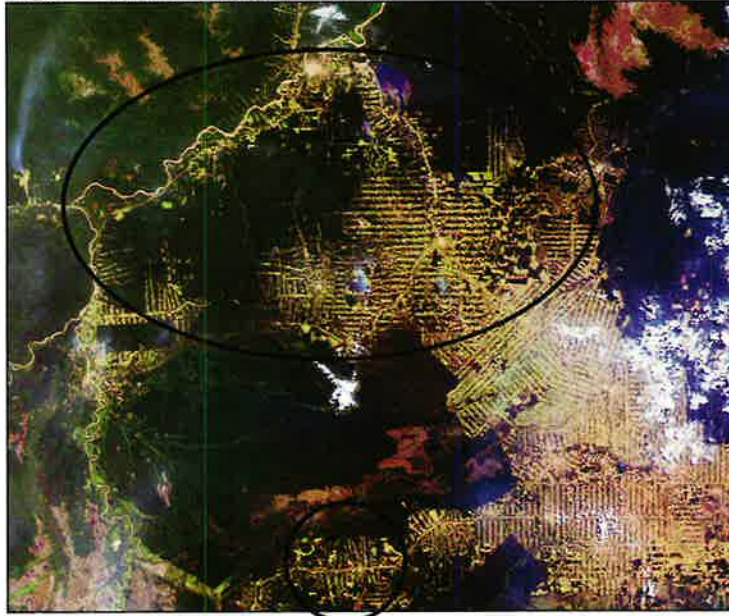


Image credit: D.J. Zeigler

As a result of evaporation and poor irrigation practices, salt accumulates on the surface of a field in northern Syria, reducing its productivity.

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Images credit: Department of Geography, University of North Alabama/Lisa Keys-Mathews



Satellite images from 2000 (top left), 2005 (top right), and 2010 (lower left) show the increased deforestation in the Brazilian rainforest. Note the changes in vegetation along the river in the upper left and lower center regions of each image.

Data source: NASA Earth Observatory.