Fundamentals of Physical Geography 2e

Physical Geography: Earth Environments and Systems

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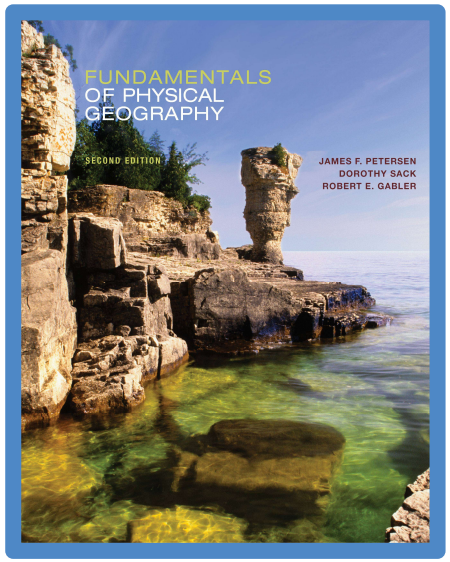
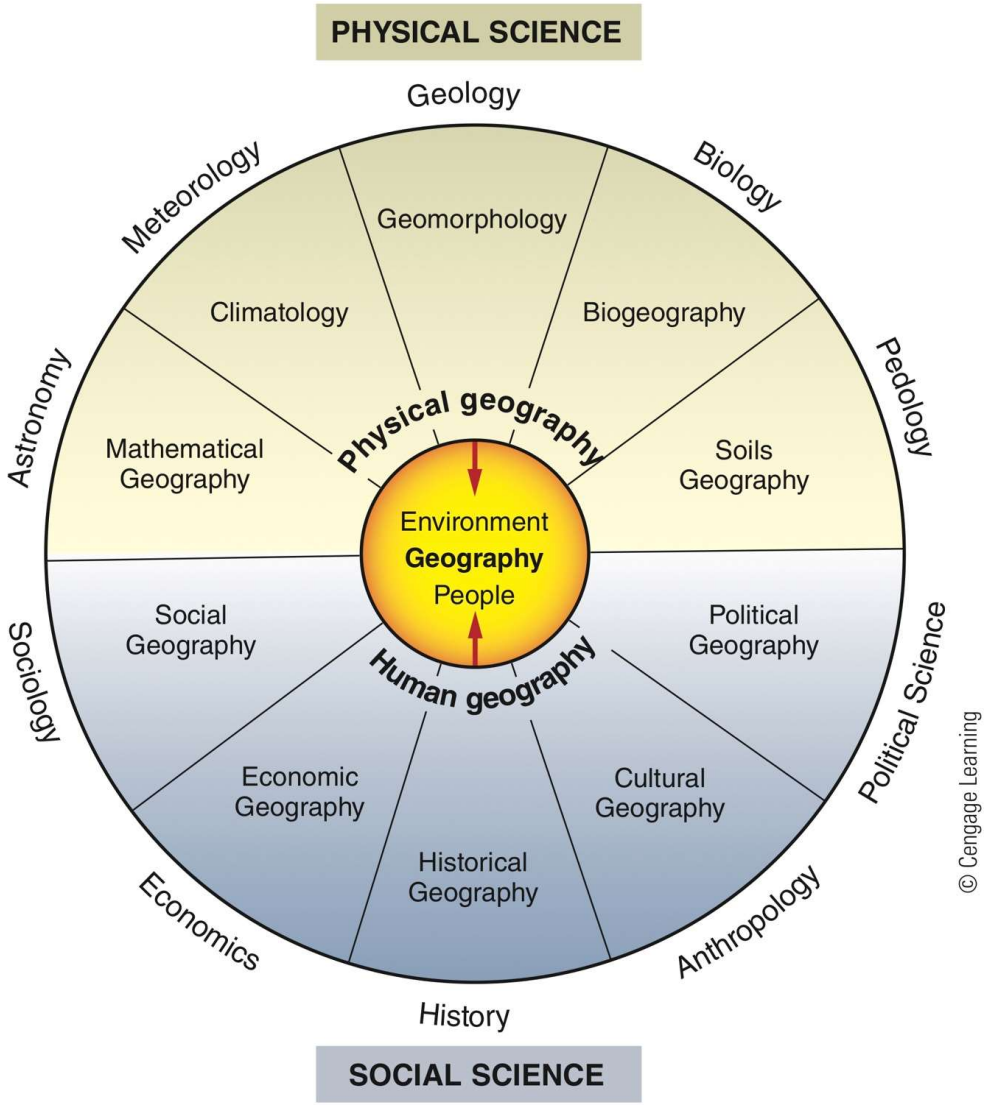


- Peterson
  - Sack
    - Gabler

The Study of Geography

- The examination, description, and explanation of Earth
  - Focuses on surface variations
  - A spatial science
  - Involves processes that influence the Earth's landscape
  - Divides areas into meaningful regions (*regional geography*)



What advantage might a geographer have when working with other physical scientists seeking a solution to a problem?

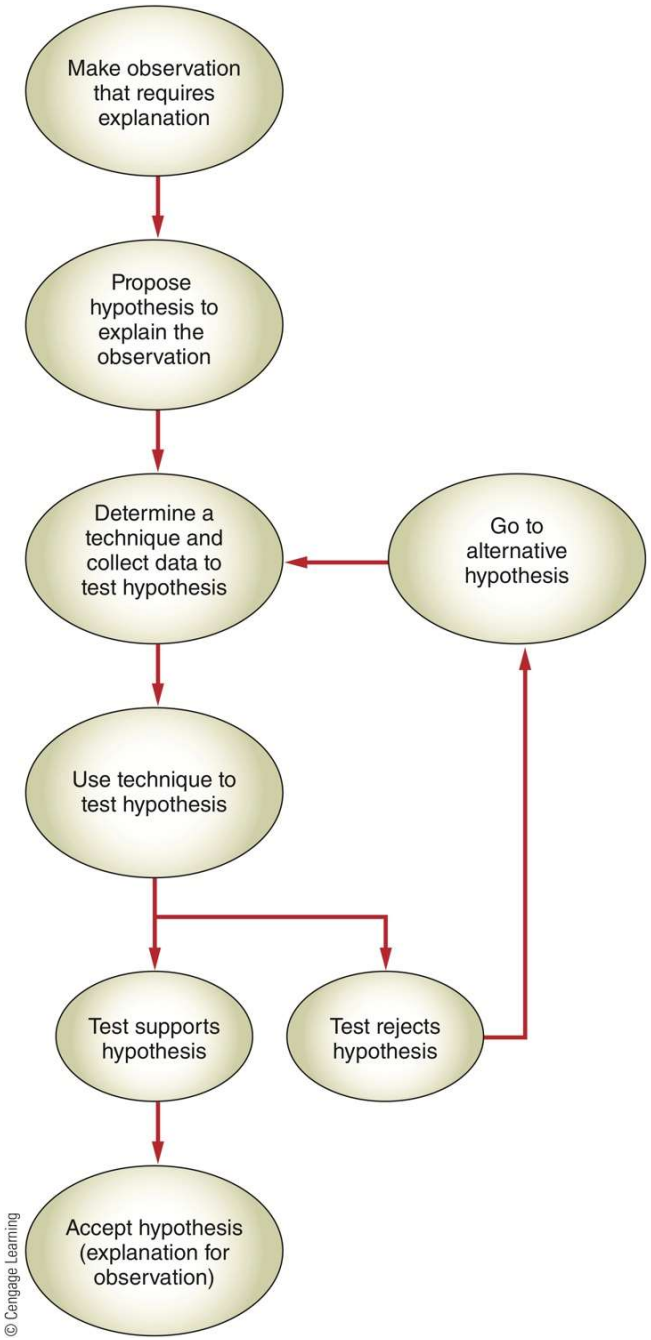
The Study of Geography (cont'd.)

- Physical geography
  - Meteorologists
  - Climatologists
  - Geomorphologists
  - Biogeographers
  - Soil scientists
  - Hydrologists
  - Oceanographers
  - Glaciologists

What physical geography characteristics can you observe in this scene?

The Study of Geography (cont'd.)

- Technology, tools, and methods
  - Holistic approach
  - Scientific method
    1. Make an observation
    2. Restate as a hypothesis
    3. Determine technique to test hypothesis and collect data
    4. Test the validity of hypothesis



The Study of Geography (cont'd.)

- Technology, tools, and methods
  - Computing systems
  - Internet resources
  - Images from aircraft and satellites
  - Environmental data
  - Data measured in the field

The Study of Geography (cont'd.)

- Technology, tools, and methods
  - Field and laboratory experiments
  - High-resolution and 3-D graphics
  - Videos and animations
  - Global Positioning Systems (GPS)
  - Cartography
  - Geographic information systems (GIS)

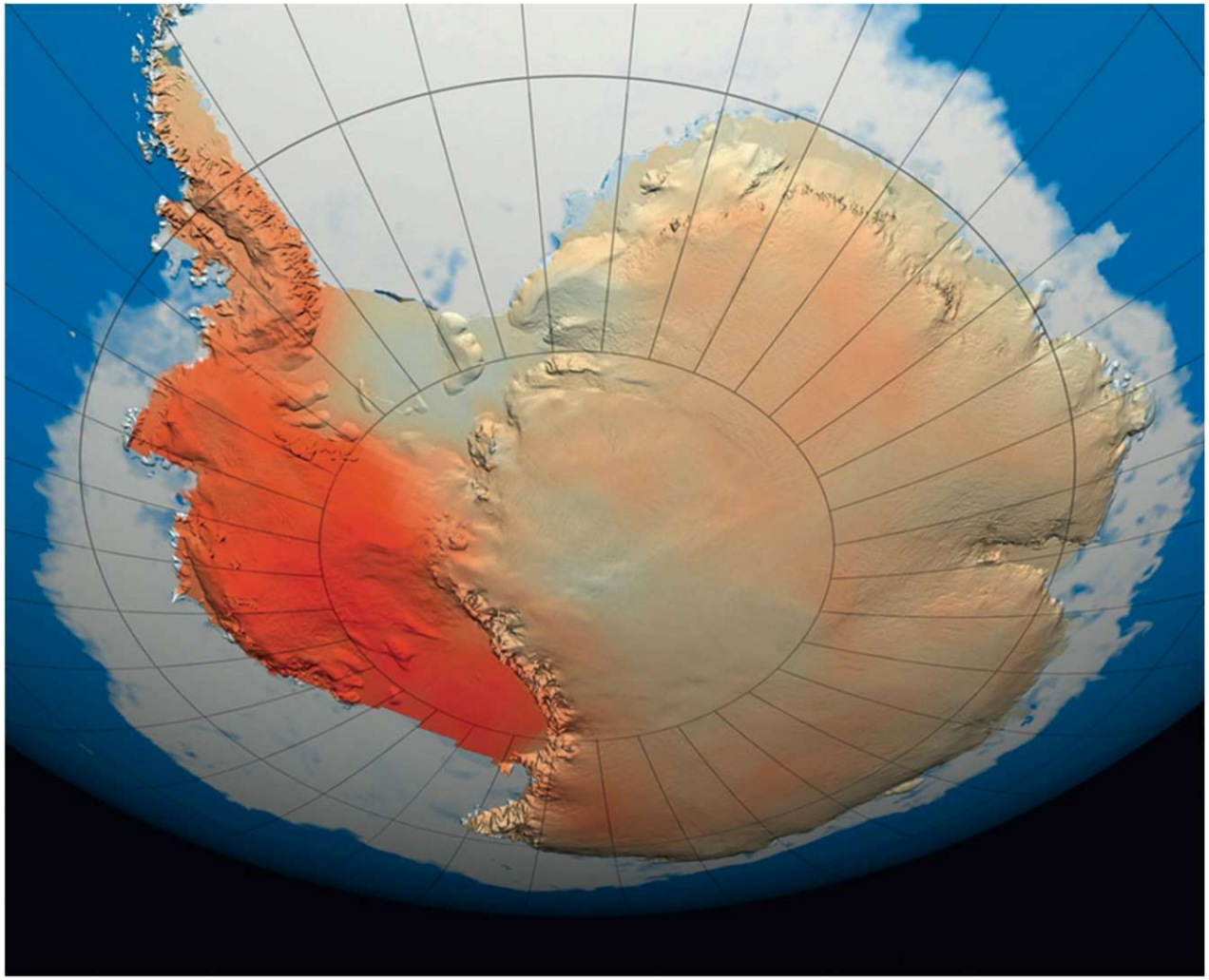


Image by R.B. Husar, Washington University; land layer from the SeaWiFS Project; fire maps from the European Space Agency; sea surface temperature from the Naval Oceanografic Office's Visualization Laboratory; and cloud layer from SSEC, University of Wisconsin

What global warming impacts have caused concern in recent years?

The Study of Geography (cont'd.)

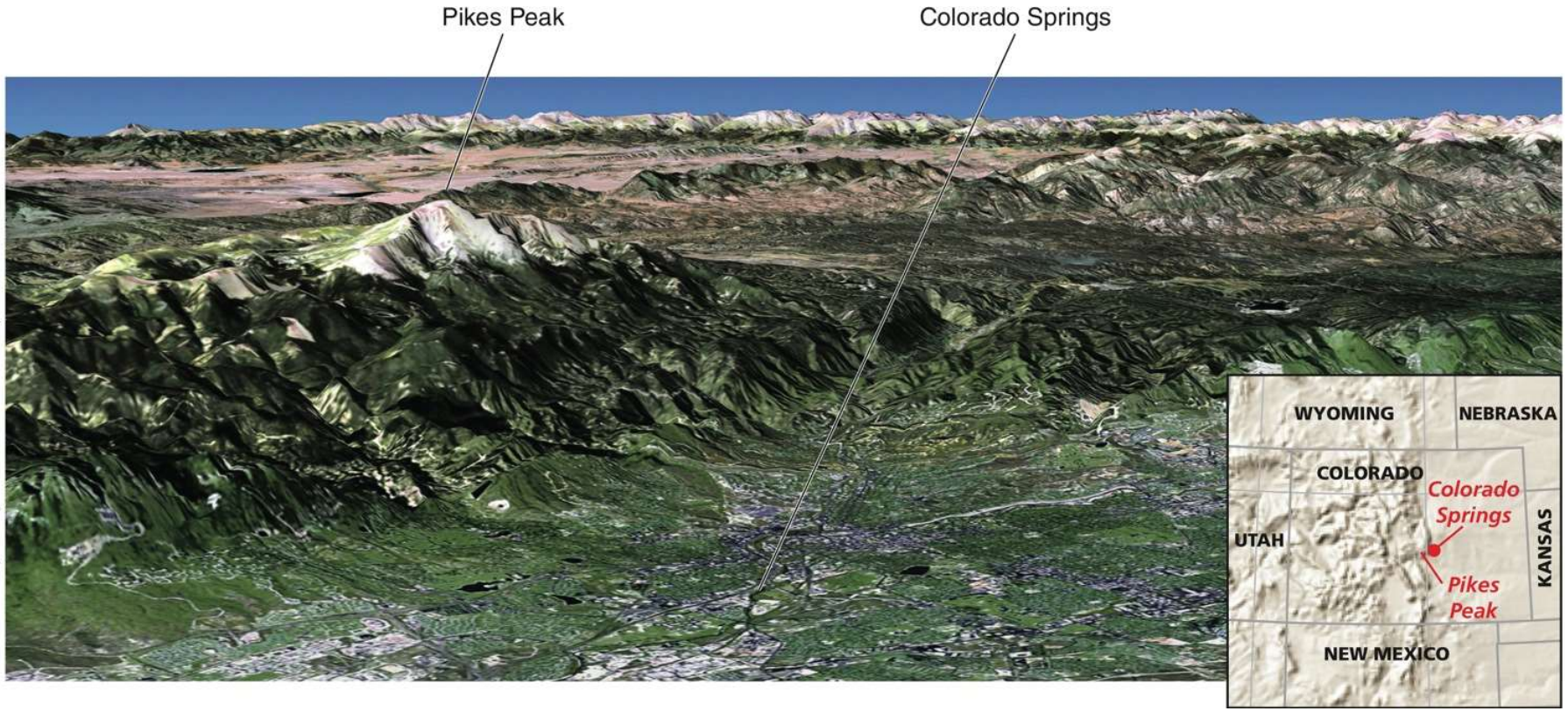
- Physical geographers:
  - Make observations
  - Gather data
  - Utilize technology
  - Test hypotheses
  - Explain processes and distributions

© Ashley Cooper/Corbis

In what ways are computer-generated maps and landscape images helpful in studying physical geography?

Major Perspectives in Physical Geography

- The spatial perspective
  - Location: absolute vs. relative
  - Characteristics of places
  - Spatial distribution and pattern
  - Spatial interaction
  - Continuous change through time



NASA/Goddard Space Flight Center/Earth Observatory

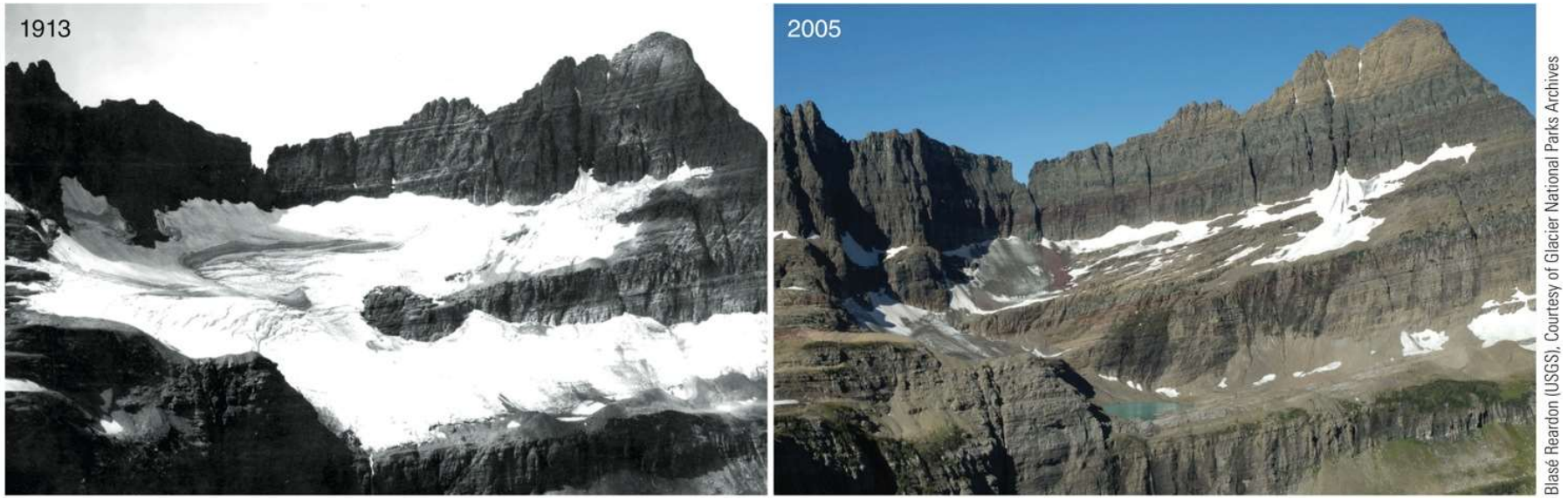
What physical geographic characteristics of this place can you extract from the image?

NASA Robert Simon/Chris Elvidge, NOAA, NGDC

Can you locate and propose possible explanations for two patterns and two distributions in this scene?

Major Perspectives in Physical Geography (cont'd.)

- Natural regions
  - Change in size and shape over time
  - Have transitional or indistinct boundaries
  - Are spatially modeled for analysis, explanation, and understanding



Aiden (USGS), Courtesy of Glacier National Parks Archives

Blasé Reardon (USGS), Courtesy of Glacier National Parks Archives

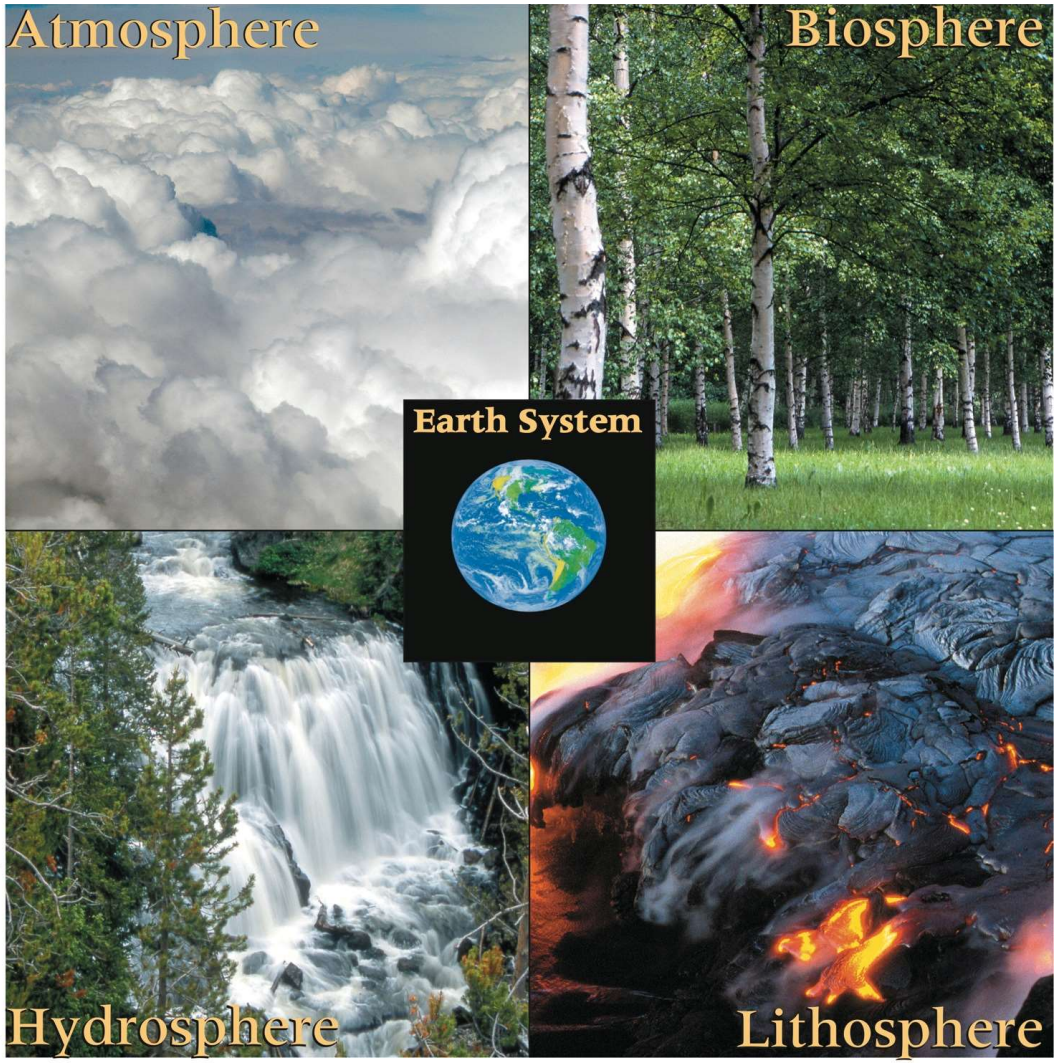
What other kinds of environmental change might require long-term observation and recording of evidence?

Major Perspectives in Physical Geography (cont'd.)

- The Earth system
  - What is a system?
  - Variables
  - Subsystems

Major Perspectives in Physical Geography (cont'd.)

- Earth's four major subsystems
  - Atmosphere
  - Lithosphere
  - Hydrosphere
  - Biosphere

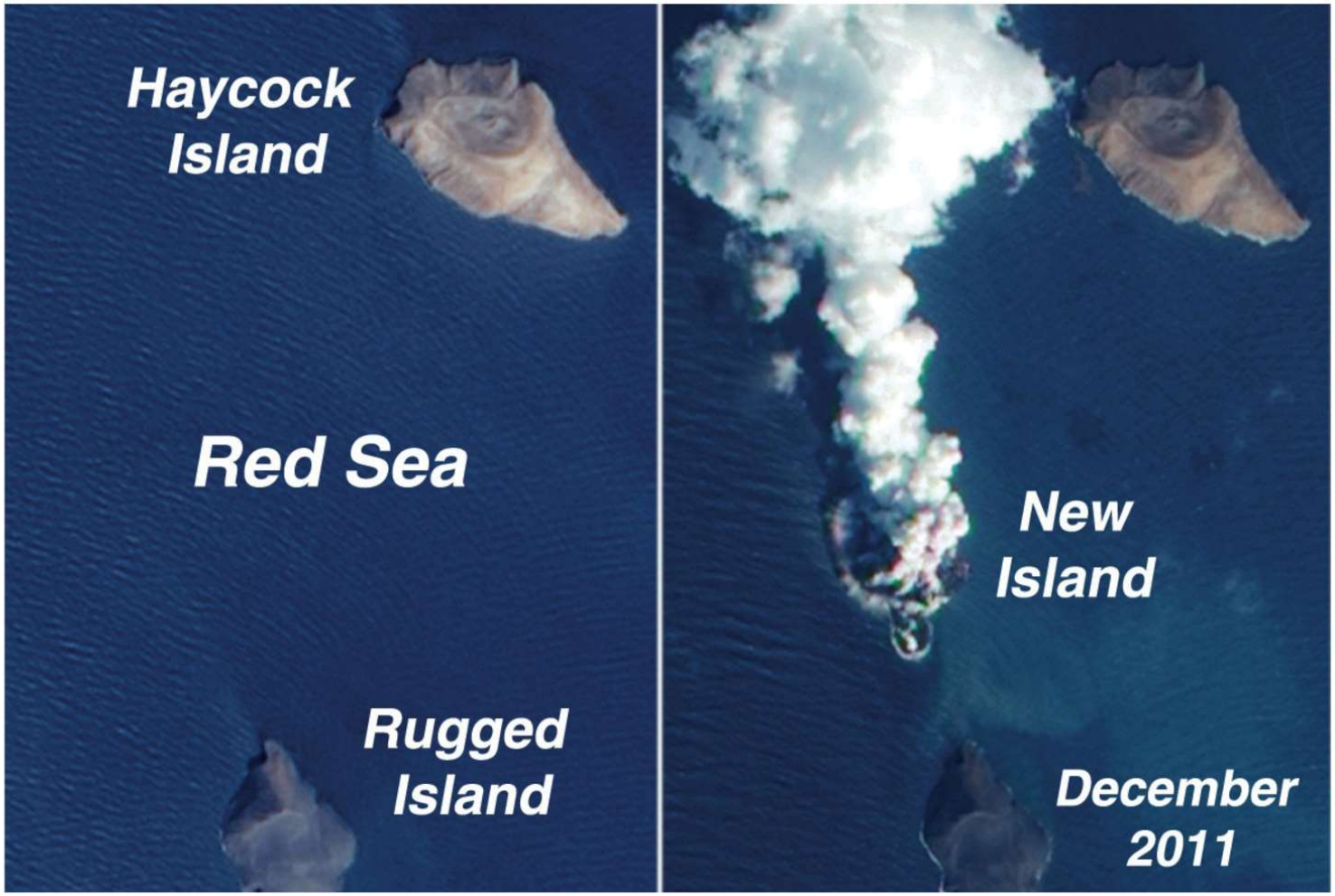


All, © Dr. Parvinder S. Sethi; center inset, NASA

How do these systems overlap? For example, how does the atmosphere overlap with the hydrosphere, or with the biosphere?

Major Perspectives in Physical Geography (cont'd.)

- Earth's impacts
  - Dynamic
    - Examples: seasons, ocean tides, earthquakes, floods, and volcanic eruptions
  - Long-term changes
    - Examples: climate change, drought cycles, spread of deserts, erosion of coastlines, and major changes in river systems
  - Natural or human-induced changes



NASA

Once this volcanic island cools, what other environmental changes could slowly begin to take place?

Major Perspectives in Physical Geography (cont'd.)

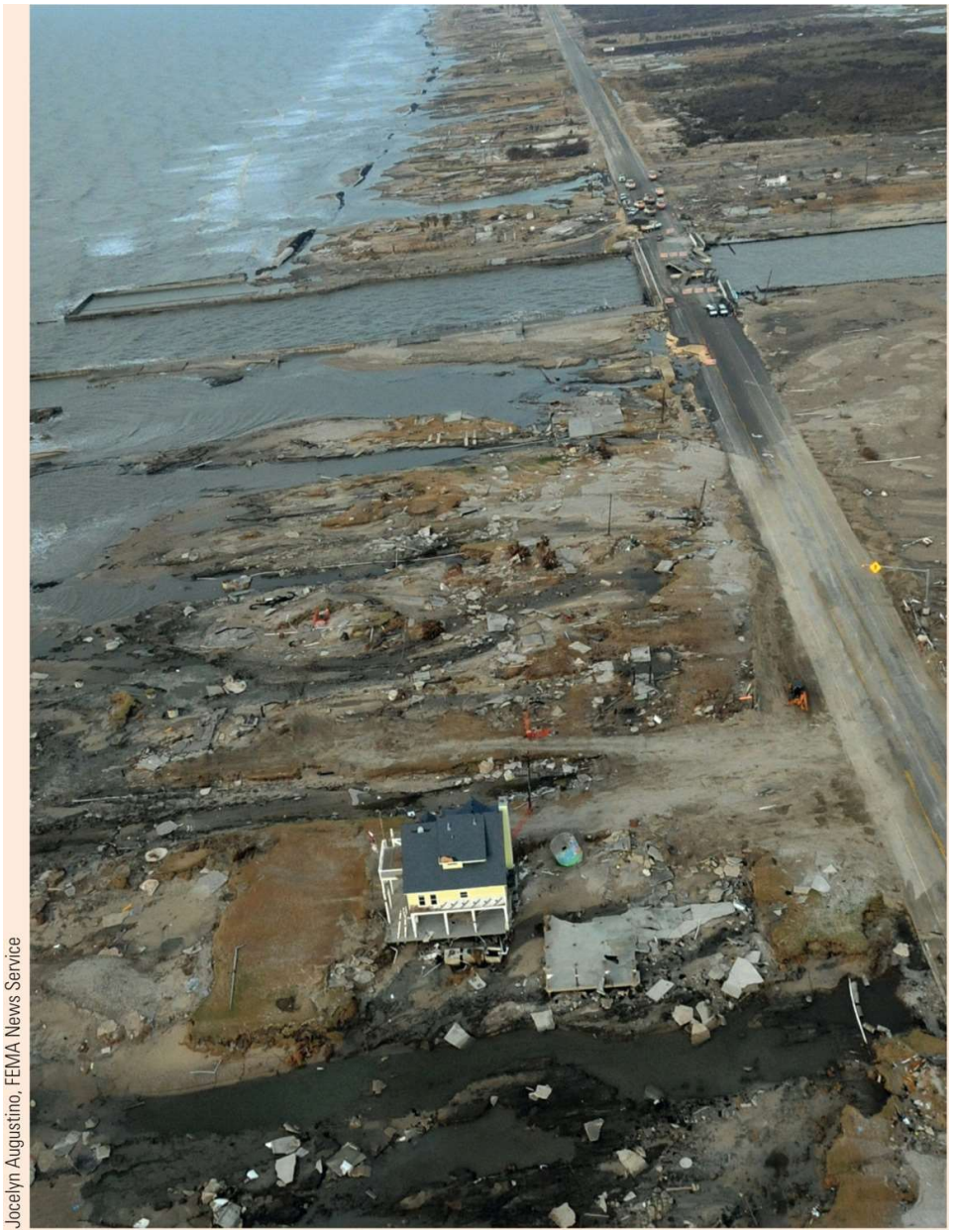
- The environmental perspective
  - How do we define *environment*?
    - Using a holistic approach
  - Ecology: study of relationships between organisms and their environments
  - Ecosystem: involves dynamic relationships

Major Perspectives in Physical Geography (cont'd.)

- Human–environment interactions
  - Environmental hazards
    - Volcanic eruptions
    - Hurricane Sandy (2012)
    - Earthquake in Japan (2011)
    - Hurricane Ike (2008)

The Environmental Perspective

Can you cite some examples of natural processes that can affect the area where you live?



Jocelyn Augustino, FEMA News Service

Major Perspectives in Physical Geography (cont'd.)

- Human–environment interactions
  - Environment degradation
    - What steps can be taken to counter environmental
    - threats?
    - What are the causes of these threats?
    - What can I do to help solve environmental problems?
    - What will we leave for future generations?

The Environmental Perspective

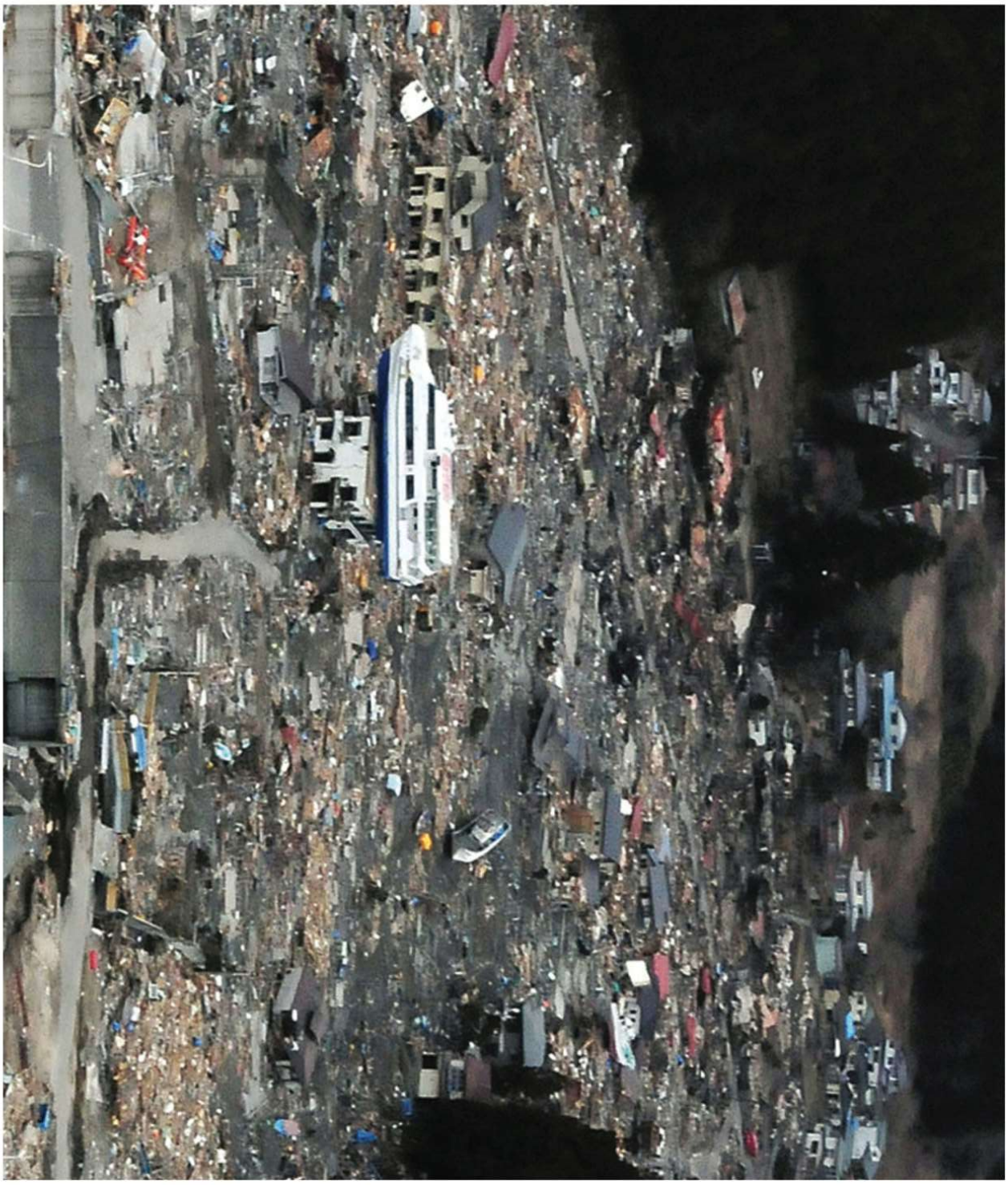
What are some examples of how humans have affected the environment where you live?

Major Perspectives in Physical Geography (cont'd.)

- Human–environment interactions
  - Natural hazards
  - Environmental degradation
    - Example: pollution

U.S. Navy photo by Mass Communication Specialist 3rd Class Alexander Tidd/Released

(a)



FEMA/Patsy Lynch

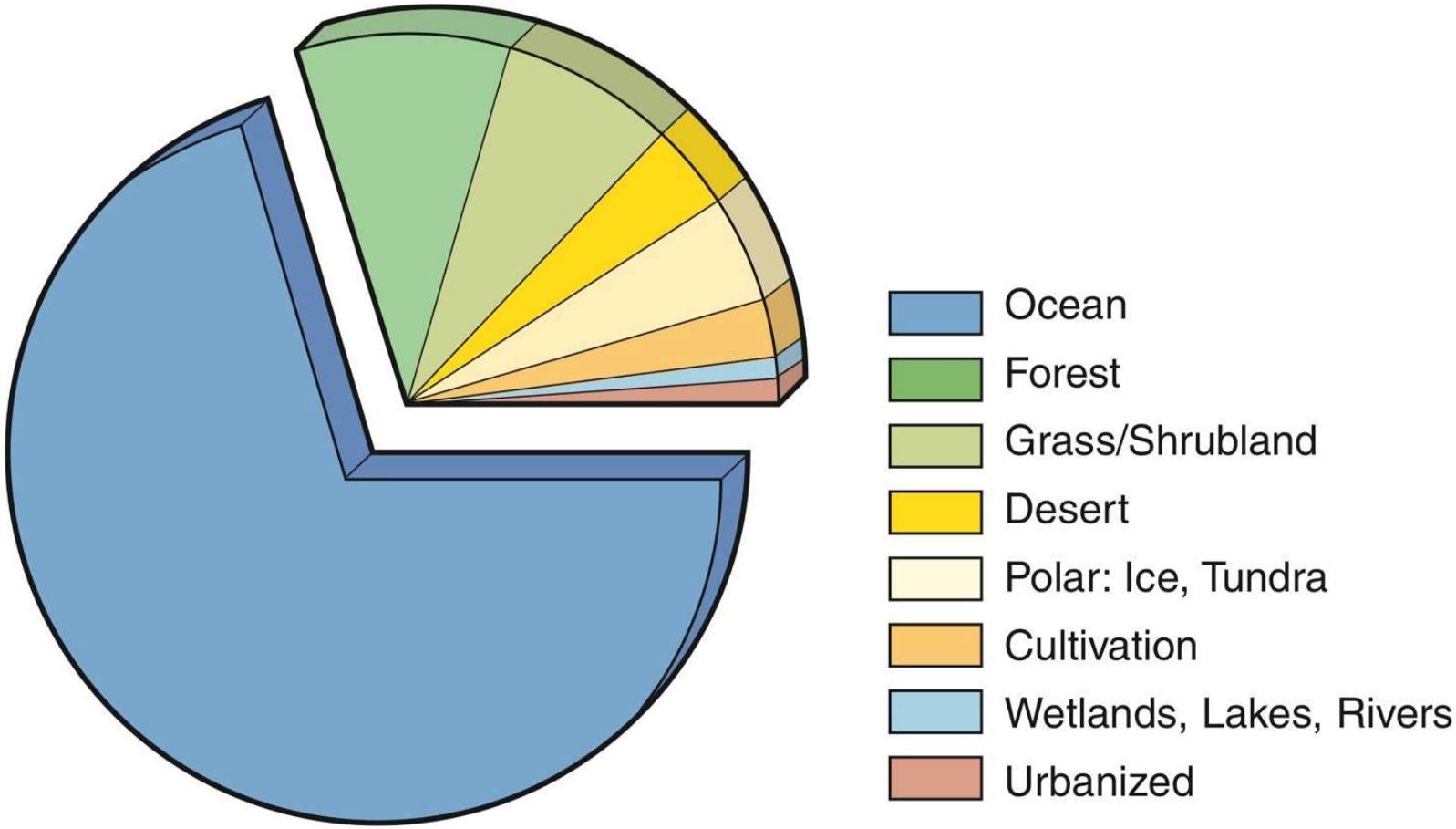
(b)

Major Perspectives in Physical Geography (cont'd.)

- A life-support system
  - A set of interrelated components necessary for the existence of living organisms
  - Natural resources: depletion is a concern
  - World population threshold
  - Sustainable living

What do the limited resources on space vehicles suggest about our environmental situation on Earth?

NASA



What options do we have for future settlement of Earth's lands?

Models and Systems

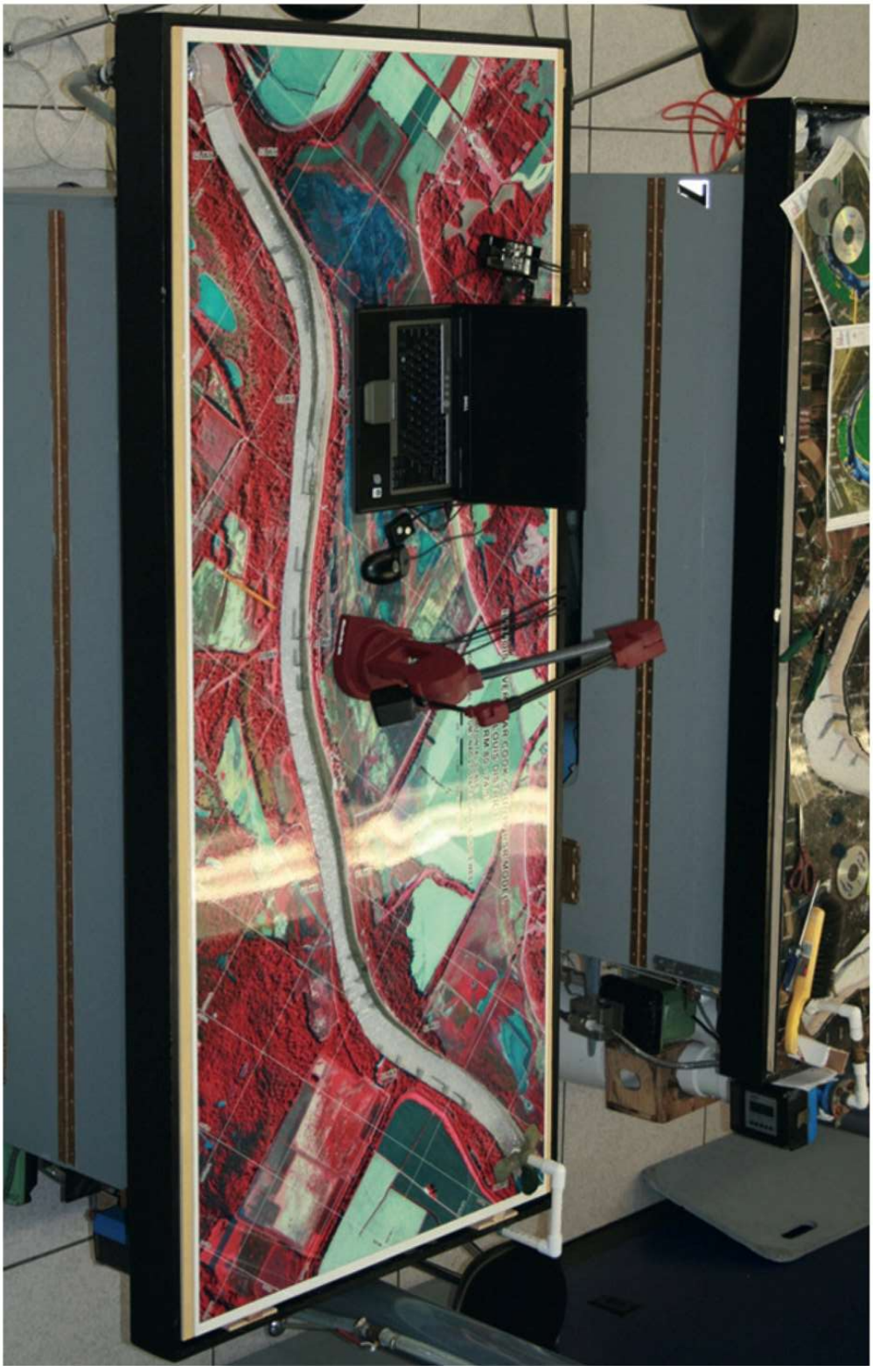
- What is a model?
- Types of models
  - Pictorial and graphic models
  - Visualizations: computer-generated
  - Physical models
  - Mathematical and statistical models
  - Conceptual model: mental map

NASA

(a)

U.S. Army Corps of Engineers

(a)

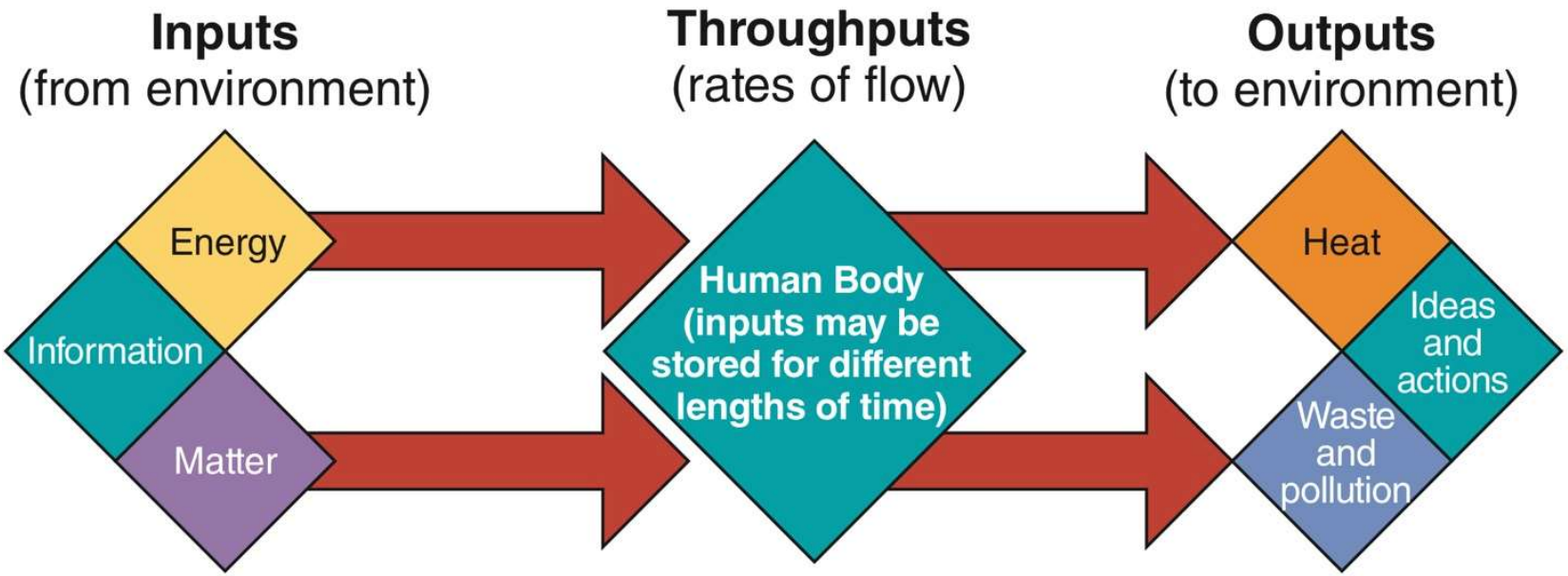


Models and Systems (cont'd.)

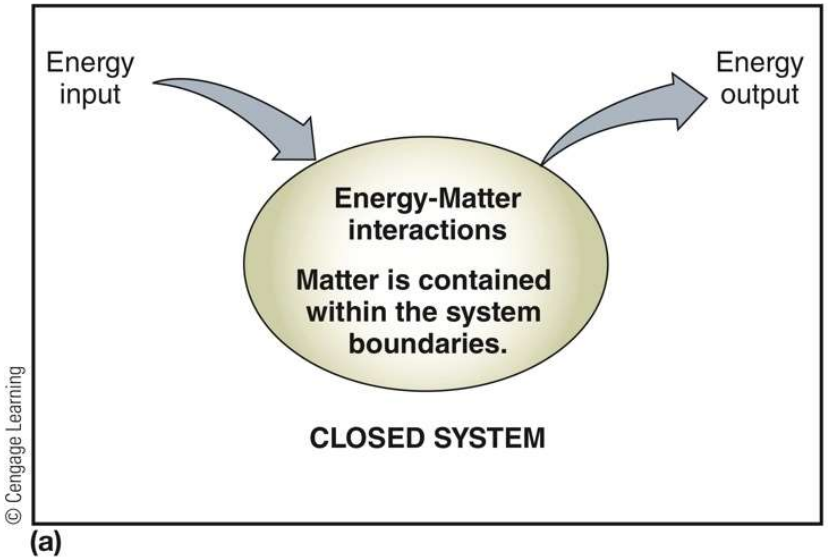
- Systems analysis
  1. Clearly define the system
  2. Inventory the system's important parts and processes
  3. Examine how each of the parts and processes interact with one another
  4. Determine how the interactions affect the operation of the system

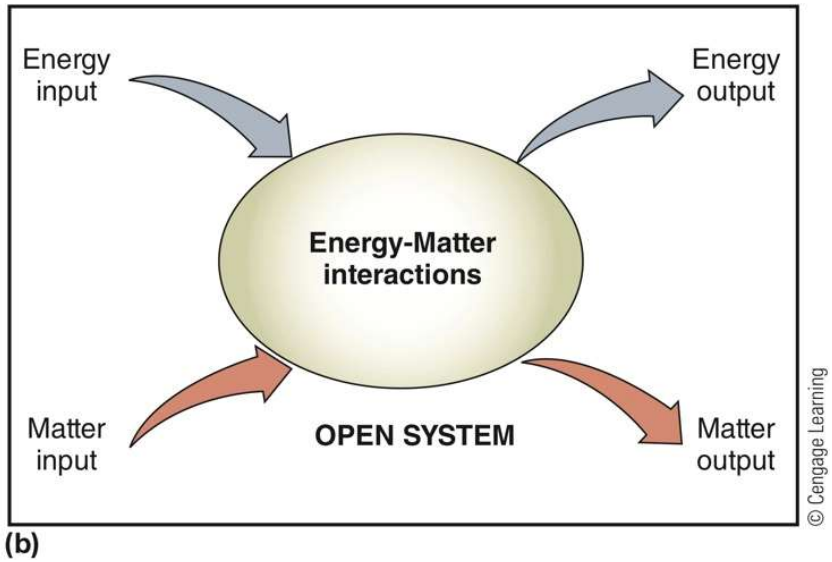
Models and Systems (cont'd.)

- How systems work
  - Systems model
  - Inputs
  - Outputs
  - Closed system
  - Open system



What characteristics of the human body as a system are similar to the Earth as a system?

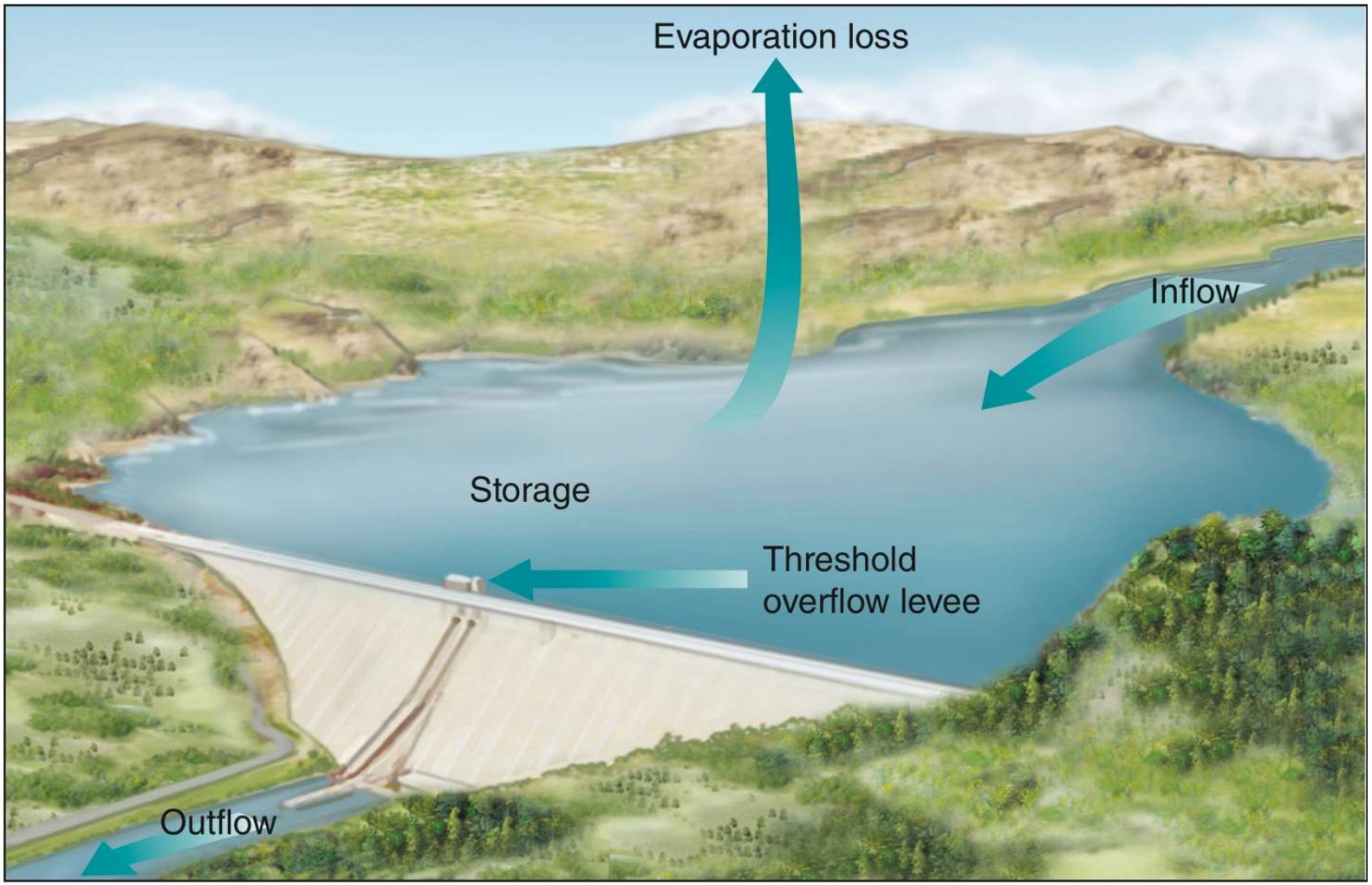


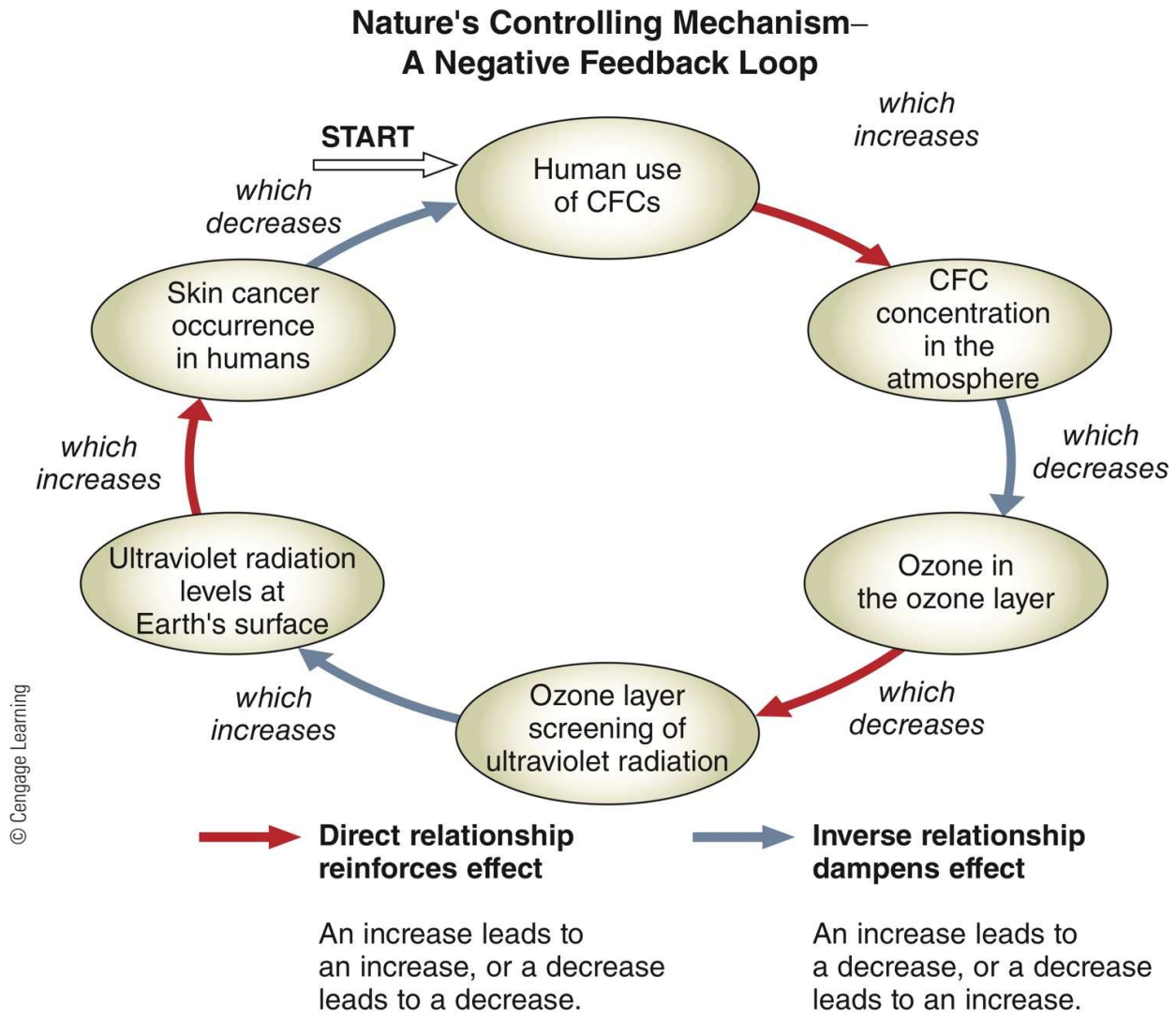


Think of an example of an open system, and outline some of the matter–energy inputs and outputs involved in such a system.

Models and Systems (cont'd.)

- Equilibrium in Earth systems
  - Inputs entering the system are balanced by outputs
  - Dynamic equilibrium is the norm
  - Feedback
    - Negative feedback
    - Positive feedback
    - Feedback loop
  - Thresholds: tipping points

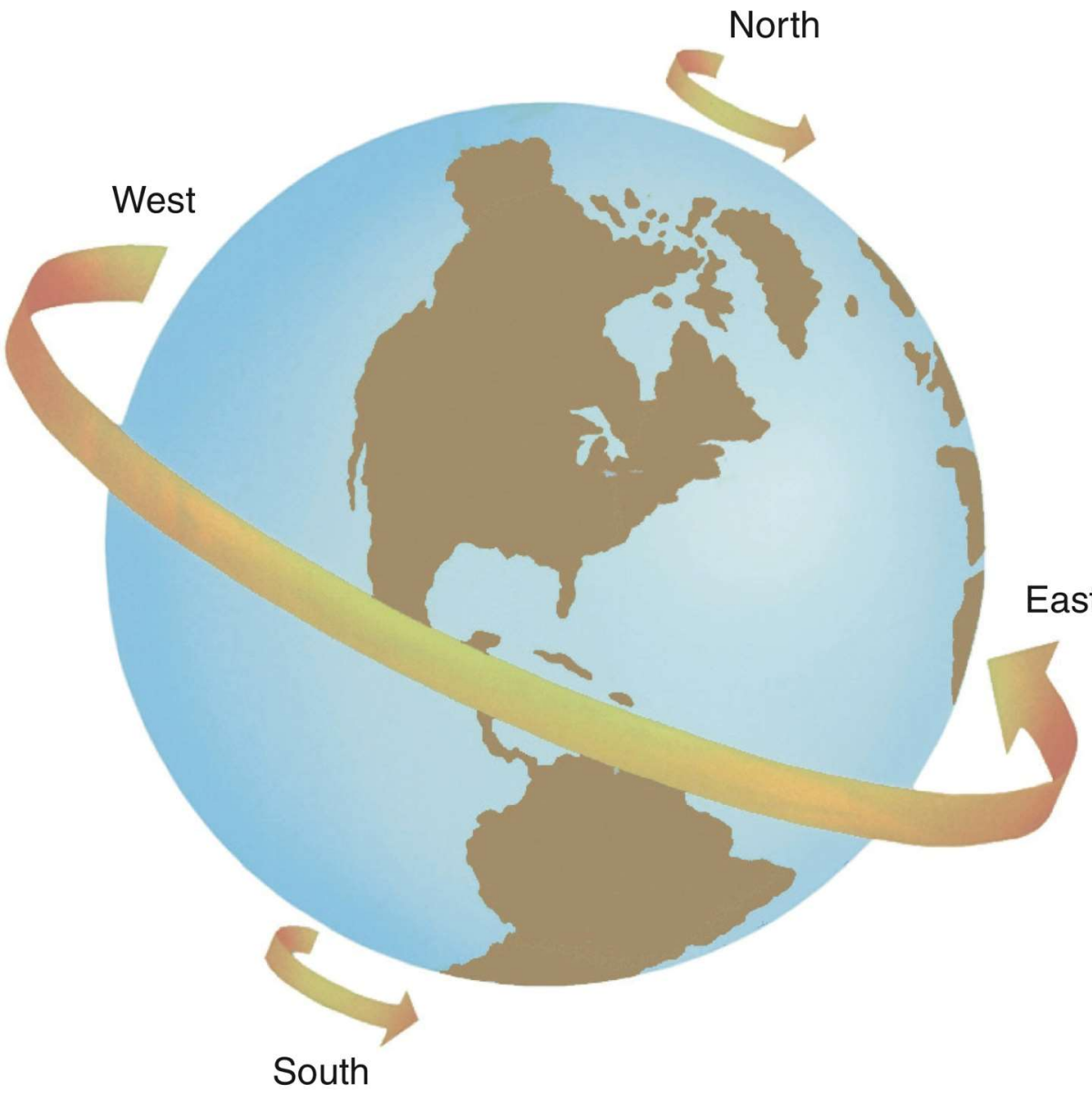




What might be the potential (extreme) alternative resulting from a lack of corrective action by humans?

The Earth in Space

- Earth's movement
  - Galactic movement
  - Rotation: one complete turn with respect to the sun in 24 hours
    - Earth's axis
    - Circle of illumination
    - Linear velocity: highest at the equator



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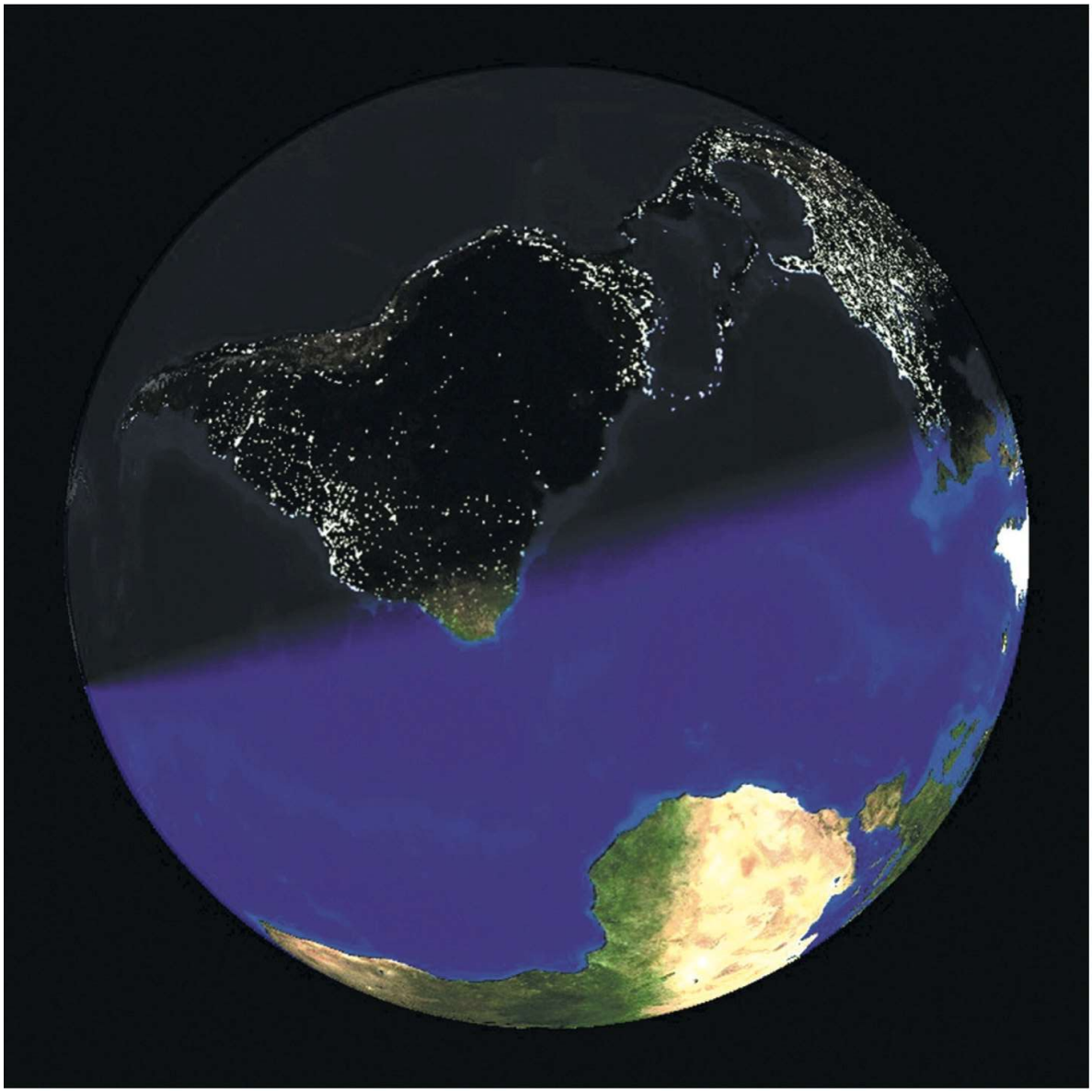
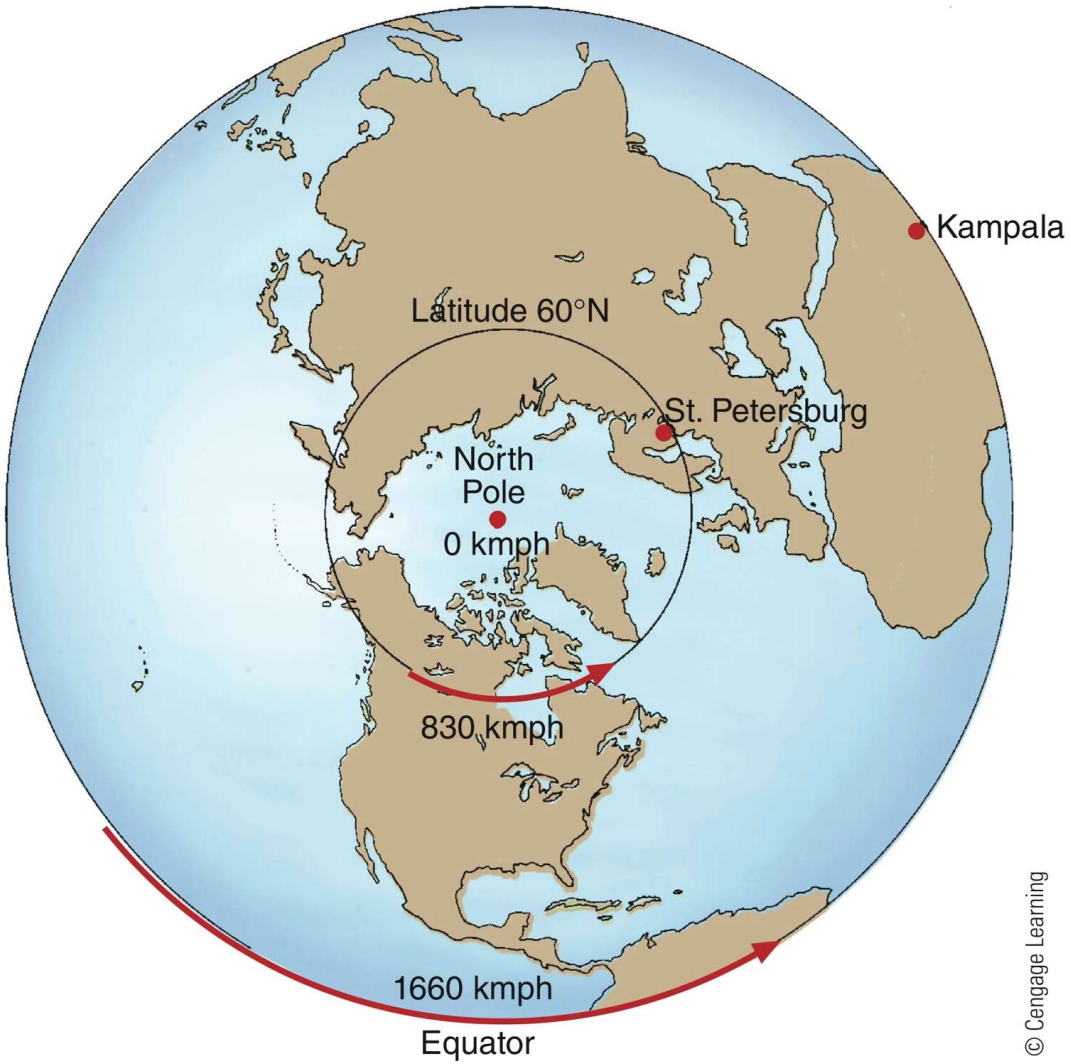
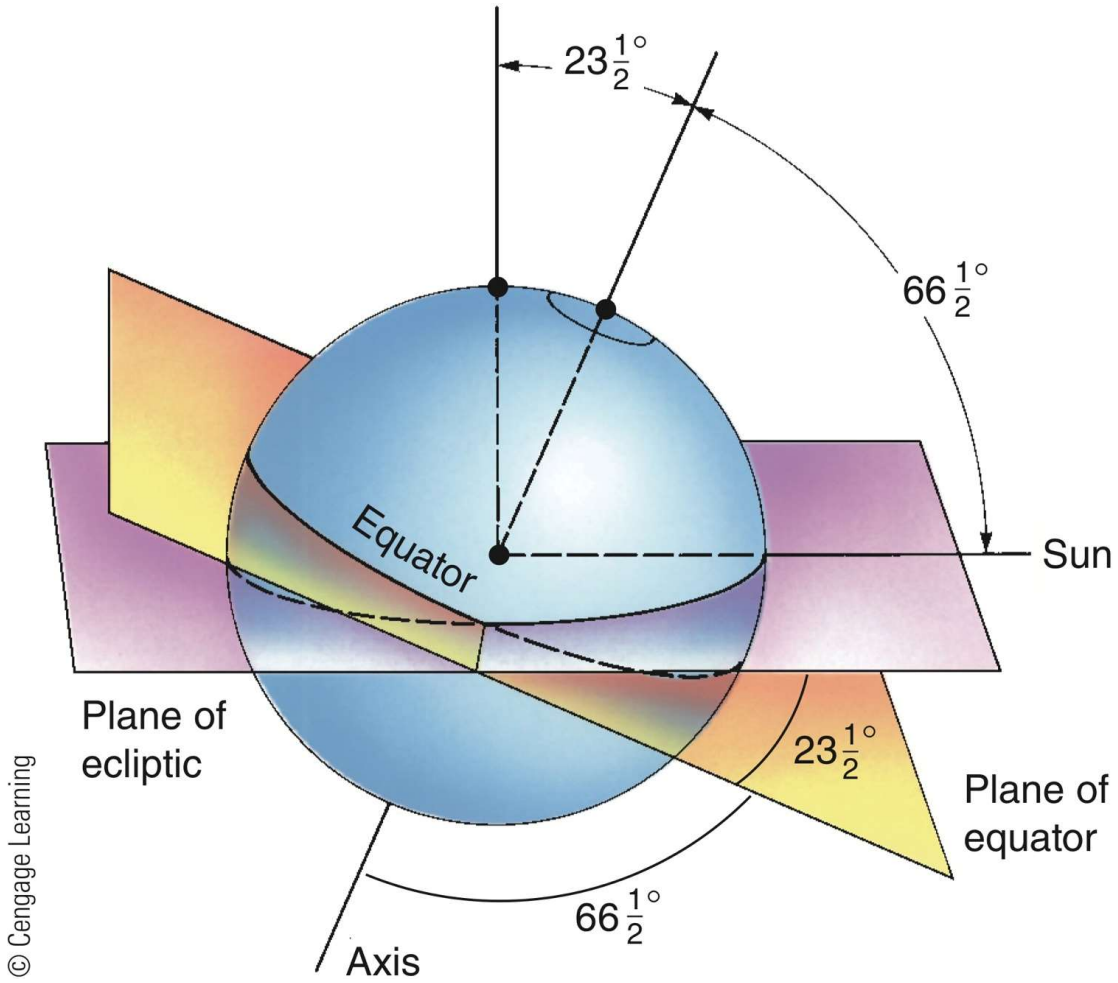




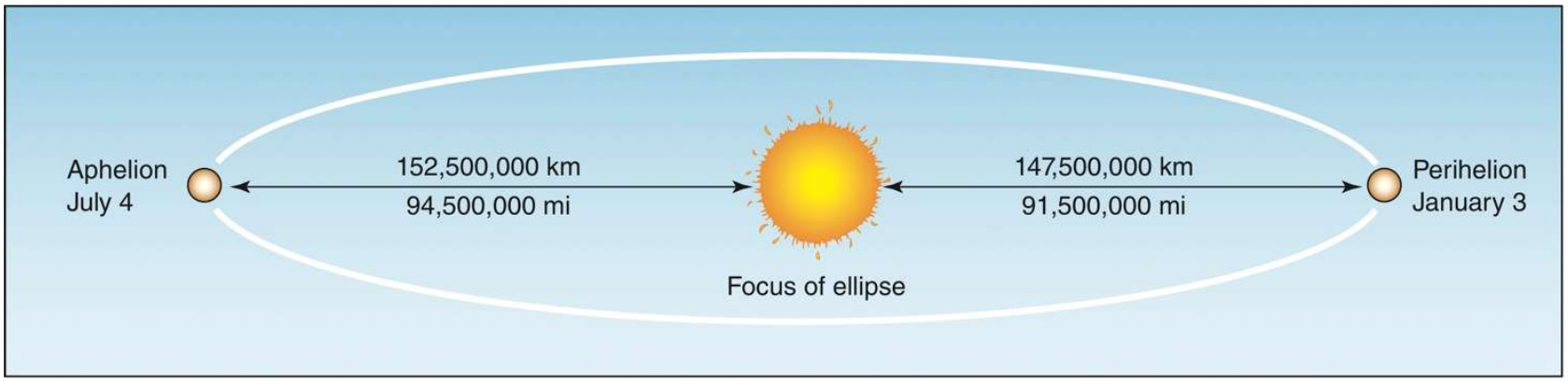
How much faster does a point on the equator move than a point at 60°N latitude?

The Earth in Space (cont'd.)

- Earth's movement
  - Revolution: elliptical orbit around the sun
    - Perihelion, aphelion
  - Plane of the ecliptic
  - Angle of inclination
  - Parallelism
- Milankovitch cycles



How many degrees is Earth's axis tilted from the vertical?



When is Earth closest to the sun?

Physical Geography and You

- Understanding physical geography
  - Helps us to assess environmental conditions, analyze the factors involved, and make informed choices
  - Encourages us to seek explanations; gather information; and use geographic skills, tools, and knowledge to solve problems

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Physical Geography: Earth Environments and Systems

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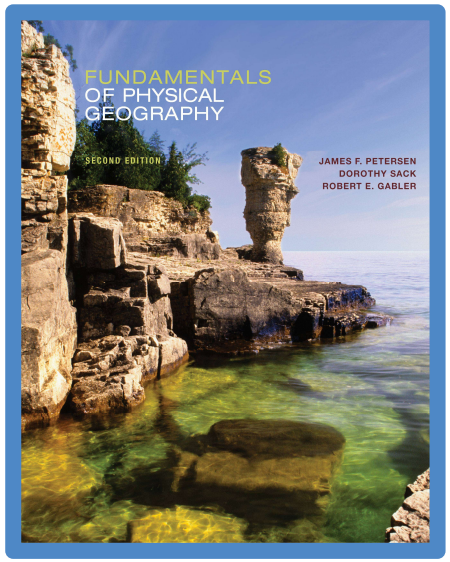

- Peterson
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