INTRODUCING PHYSICAL GEOGRAPHY

THE DISCIPLINE OF GEOGRAPHY

Geography is concerned with the physical and human processes that differentiate places on Earth and make them unique.

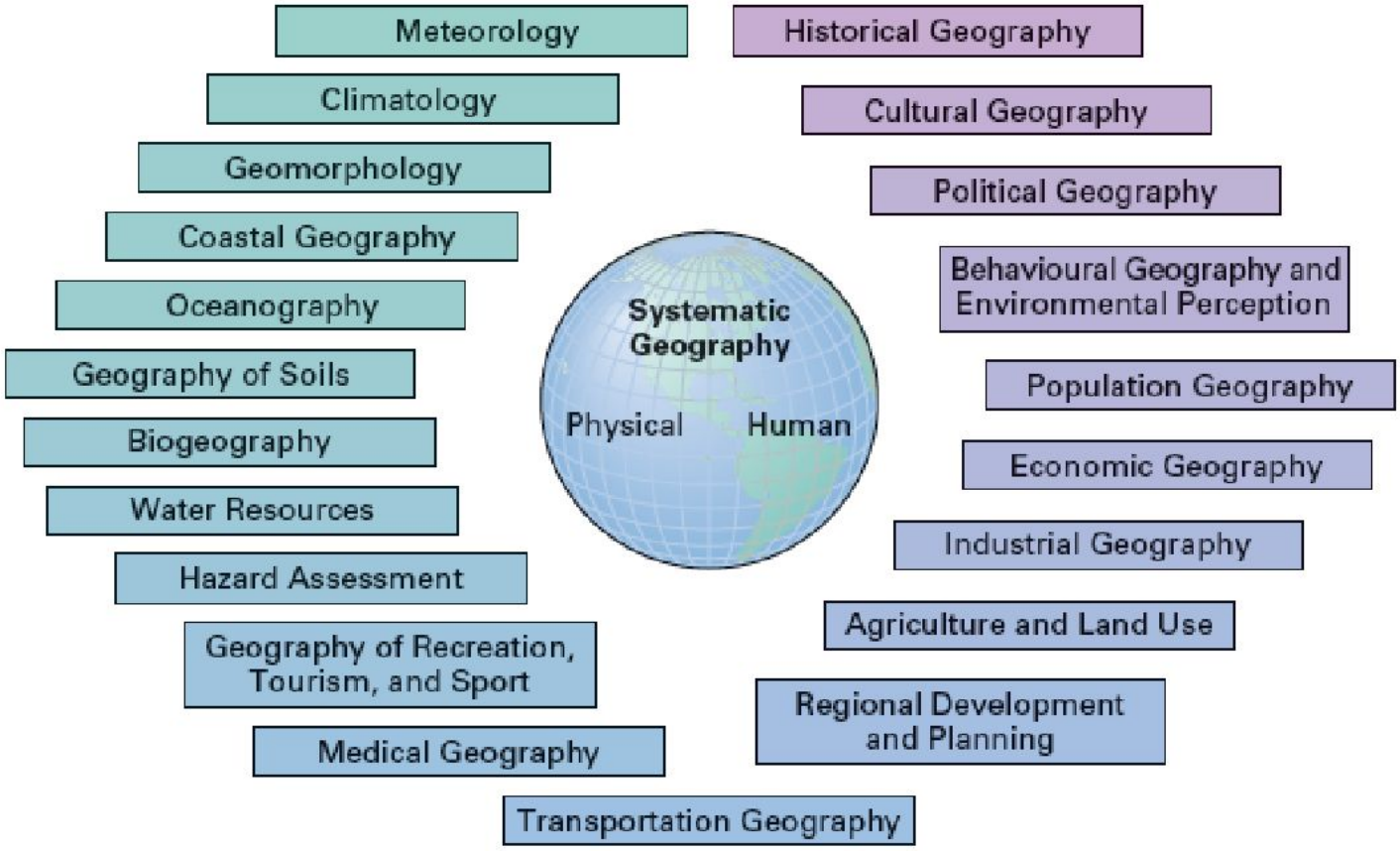
In this way, geography provides a fundamental understanding of the spatial connections among human activities as they relate to the Earth's physical landscape.

THE DISCIPLINE OF GEOGRAPHY

Systematic geography is often divided into two broad areas – human and physical geography.

Human geography deals with social, economic, and behavioral processes that differentiate places.

Physical geography covers the atmosphere, terrestrial and maritime environments on local, regional, and global scales.



1.1 FIELDS OF SYSTEMATIC GEOGRAPHY

THE DISCIPLINE OF GEOGRAPHY

Meteorology deals primarily with the processes that cause short-term fluctuations in those properties of the atmosphere that form the basis of daily weather reports (Chapters 3 to 7).

Climatology describes the results of these processes in terms of their variability in space and time (Chapters 8 to 10).

Geomorphology is the science of Earth surface processes and landforms (Chapters 11 to 18).

THE DISCIPLINE OF GEOGRAPHY

Geography of soils includes the study of the distribution of soil types and properties and the processes of soil formation (Chapter 19).

Biogeography is the study of the distribution of organisms and the processes that produce these spatial patterns (Chapters 20 and 21).

THE DISCIPLINE OF GEOGRAPHY

Water resources encompasses the basic study of location, distribution and movement of water (Chapters 15 and 16).

THE DISCIPLINE OF GEOGRAPHY

An understanding of physical processes, such as floods, earthquakes, and landslides, provides the background for assessing the impact of natural hazards.

1.5 FRANK SLIDE The town of Frank lies at the foot of Turtle Mountain in southern Alberta. Turtle Mountain comprises limestone thrust over weaker sedimentary rocks, including coal. In the early morning hours of April 29, 1903, more than 80 million tons (30 million m^3) of rock collapsed from the north face and buried part of the town.

Tools in Geography

Geographic Information Systems (GIS) are spatial databases that rely on computer analysis and manipulation to display up-to-date spatial information (Chapter 2).

Tools in Geography

A map is used to display spatial information.

The art and science of map-making is called cartography (Chapter 2).

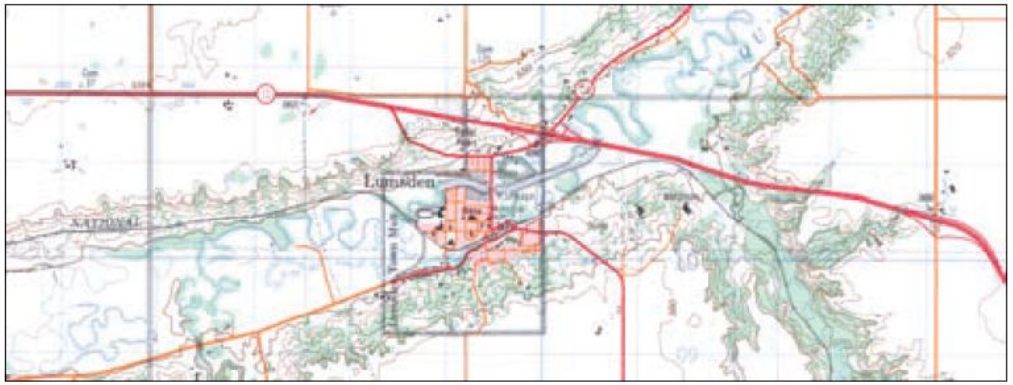
Tools in Geography

Another important technique for acquiring spatial information is remote sensing, in which aircraft or spacecraft provide images of the Earth's surface (Chapter 3).

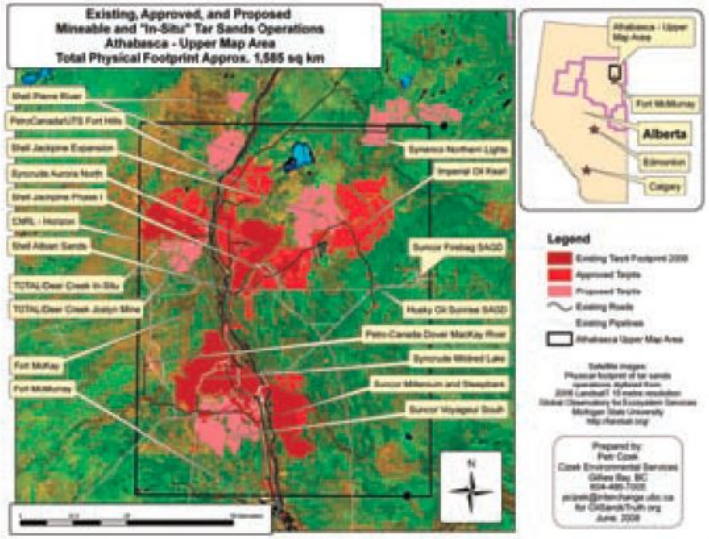
Tools in Geography

Using mathematics and computers to model geographic processes is a powerful approach to understanding both natural and human phenomena.

Statistics provide methods to analyze data to assess differences, trends, and patterns.



(a)



(b)

(c)

1.4 TOOLS OF PHYSICAL GEOGRAPHY (a) **Maps** Maps display geographic information in printed form. (b) **Geographic Information Systems (GIS)** Computer programs that store and manipulate geographic data are essential to modern applications of geography. (c) **Remote Sensing** Remote sensing includes observing the Earth from the perspective of an aircraft or spacecraft. This scene shows the bright blue and green swirls of phytoplankton blooms throughout Lake Erie and Lake Ontario and less extensively the other Great Lakes, captured by the Moderate Resolution Imaging Spectroradiometer (MODIS) aboard NASA's Aqua (EOS PM) satellite.

Global Climate Change

Over the past decade, many scientists have come to the opinion that human activity has begun to change the Earth's climate.

1.6 ATHABASCA TAR SANDS The Athabasca oil sands in northern Alberta consist of oil-rich bitumen mixed with sand and clays. The near-surface deposits, which are about 50 m thick, occur at a depth of about 75 m in an area of about 3,400 km^2.

Fly By: 57° 01' N; 111° 38' W

ENVIRONMENT, AND GLOBAL CLIMATE CHANGE

Biodiversity

The diversity of Earth's plants and animals which is an immensely valuable resource (Chapters 21 and 22).

ENVIRONMENT, AND GLOBAL CLIMATE CHANGE

Pollution

Unchecked human activity can cause environmental pollution in the context of air and water (Chapters 4 and 15).

1.7 BP OIL SPILL In April 2010, an explosion on the Deepwater Horizon drilling rig in the Gulf of Mexico resulted in the largest accidental marine oil spill in history. The leak was not capped until July 2010, after releasing approximately 4.9 million barrels of oil into the Gulf over a period of 87 days.

ENVIRONMENT, AND GLOBAL CLIMATE CHANGE

Extreme events

Floods, fires, hurricanes, and earthquakes, have great and long-lasting impacts on human and natural systems.

ORGANIZING INFORMATION IN PHYSICAL GEOGRAPHY

Recurring principals and ideas in physical geography are used to organize our accumulated knowledge into realms which encompass the major components of the planet.

Lithosphere

Atmosphere

Hydrosphere

Biosphere

1.8 The scenery of the Rocky Mountains provides fine examples of the union of Earth's four great realms.

ORGANIZING INFORMATION IN PHYSICAL GEOGRAPHY

Scales in Physical Geography

- Global
- Continental
- Regional
- Local
- Individual

1.9 Different scales of time and space contribute to the landscape features in Death Valley, California.

ORGANIZING INFORMATION IN PHYSICAL GEOGRAPHY

Systems in Physical Geography

A systems approach emphasizes how and where matter and energy flow in natural systems.

1.13 Rilling and gullying, as seen here at Drumheller, Alberta, is a positive feedback process that accelerates as more water is captured by the developing channel system.

1.14 Clouds provide both positive and negative feedback controls on global temperature.

ORGANIZING INFORMATION IN PHYSICAL GEOGRAPHY

Flow systems describe how matter and energy move from one location to another over time.

Flow systems have a structure of interconnected pathways and require a power source (energy: kinetic, mechanical, heat, radiant, potential, stored, chemical).

ORGANIZING INFORMATION IN PHYSICAL GEOGRAPHY

Open and Closed Flow Systems

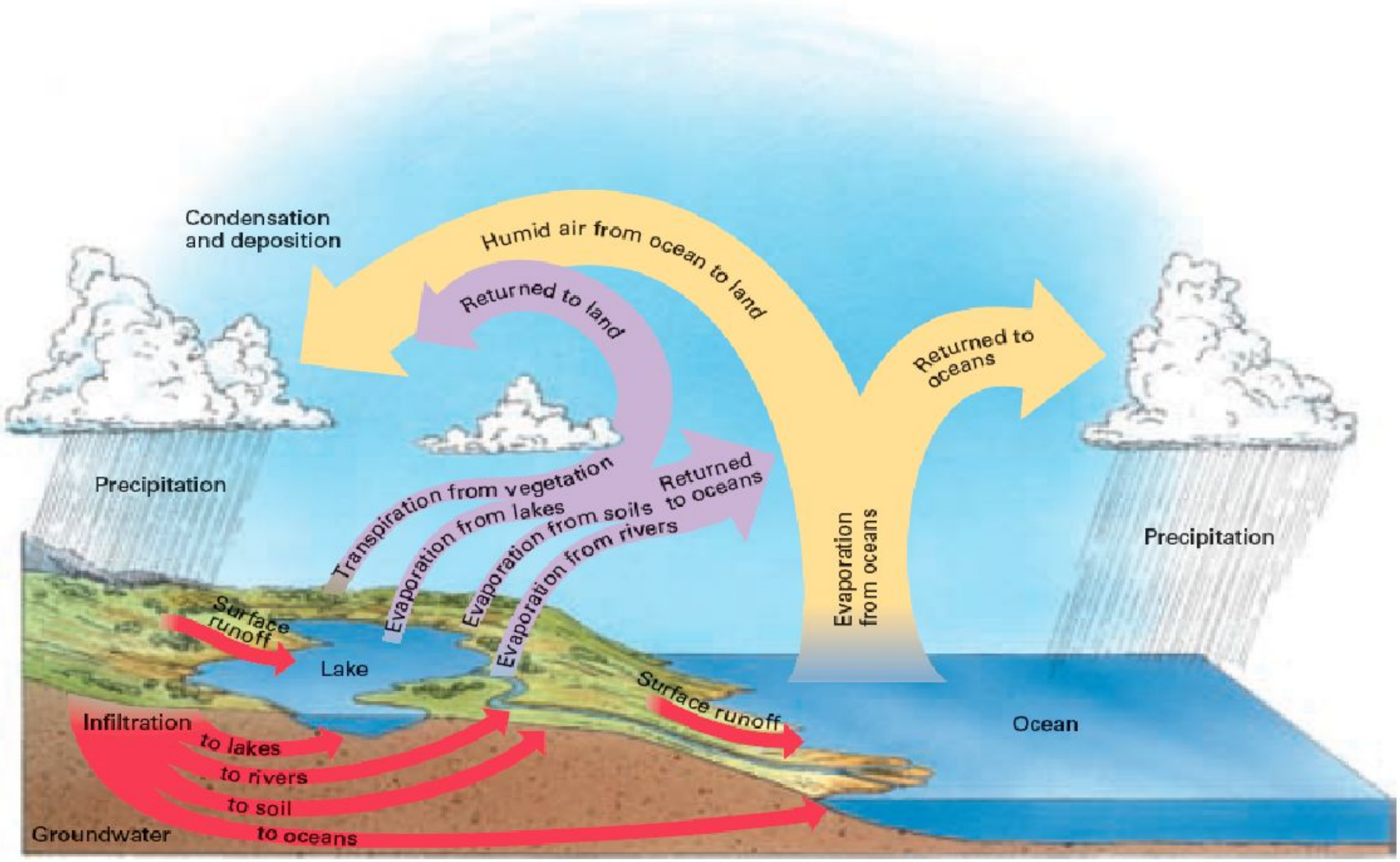
Flow systems have inputs and outputs.

Some flow systems are open since they have inputs and outputs of energy and matter.

Some flow systems are closed in which materials move endlessly in a series of interconnected paths or loops (hydrologic cycle).

ORGANIZING INFORMATION IN PHYSICAL GEOGRAPHY

The hydrologic cycle, in which water circulates between the biosphere, atmosphere, lithosphere, and hydrosphere, is and example of a closed system in physical geography.



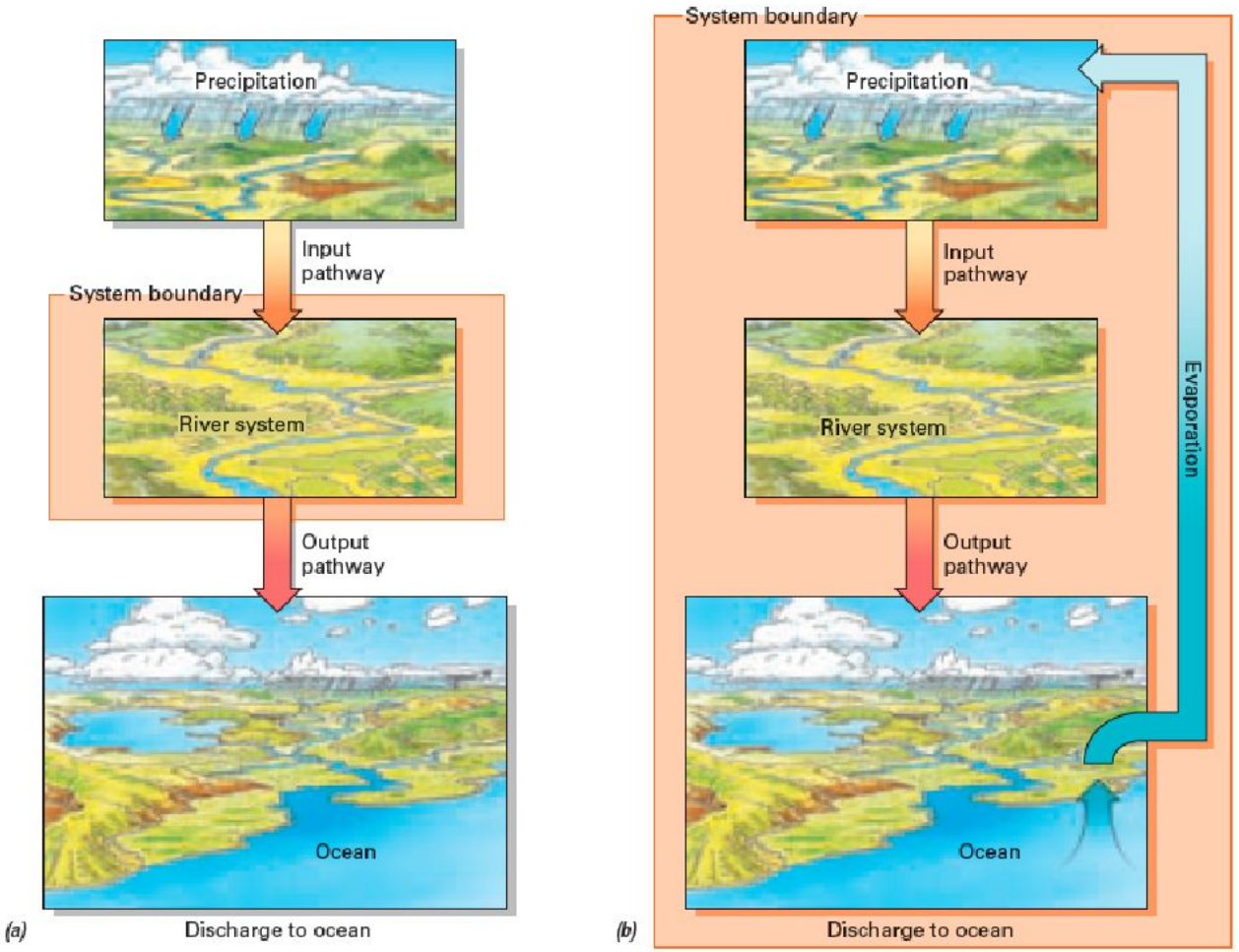
1.11 **THE HYDROLOGIC CYCLE** The hydrologic cycle traces the various paths of water from oceans, through the atmosphere, to land, and its return to oceans.

ORGANIZING INFORMATION IN PHYSICAL GEOGRAPHY

Feedback and Equilibrium in Flow Systems

Flow system feedback occurs when the flow in one pathway acts either to reduce or increase the flow in another pathway.

Flow system equilibrium refers to a steady condition in which the flow rates in a system's various pathways do not change significantly.



1.12 A RIVER SYSTEM AS A FLOW SYSTEM The river is an open flow system in (a) because water enters and leaves at specific points in the network. When the boundary is moved to enclose the entire Earth and its atmosphere (b), the system becomes a closed, global flow system—the hydrologic cycle.

ORGANIZING INFORMATION IN PHYSICAL GEOGRAPHY

Time Cycles

Any system, whether open or closed, can undergo a change in flow rate (time cycle) of energy or matter within its pathways.

1.15 The undercut form of this marine stack at Hopewell Rocks, New Brunswick, illustrates the range of the tidal cycle on the Bay of Fundy.

A Look Ahead

The various concepts introduced in this chapter are explored further in the following chapter.