Chapter 1 Elemental Geosystems
The Essentials of Geography

Books and resources

- TEXTBOOK: *Elemental Geosystems, 6/E*, By Christopherson
- LAB BOOK: *Encounter Geosystems* by Christopherson and Thomsen
- Web search: “Earth Science Centralia”
- www.mygeoscienceplace.com

Essentials of Geosystems

- Define geography, and physical geography in particular.
- Describe systems analysis, open and closed systems, feedback information, and system operations, and relate these concepts to Earth systems.
- Explain Earth’s reference grid: latitude and longitude, plus latitudinal geographic zones and time.
- Define cartography and mapping basics: map scale and map projections.
- Describe remote sensing and explain geographic information system (GIS) as tools used in geographic analysis.

Geography (from geo, "Earth," and graphein, "to write") is the science that studies relationships among geographic areas, natural systems, society, cultural activities, and the interdependence of all these over space.

"spatial" refers to the nature and character of physical space

Physical geography - examination of natural environments: the nature of physical elements and processes; their distribution and interrelationships

Five spatial themes of geography: location, place, movement, regions, human-Earth relationships

Spatial scale

Harlequin frog, p. 14

F-5 tornado destruction in Greensburg, Kansas, 2007.
Relationships between physical geography and human/cultural geography. Note list of organizations on p. 4.

The Scientific Method

**Hypothesis** = educated guess; (important role is to be testable)

**Scientific theory** = widely accepted explanation of a natural phenomenon that fits all the data

Open system – matter and energy transformed

Earth is an open system wrt Sun’s E and closed wrt resources and matter

The leaf, a natural open system. Light + CO₂ + H₂O + nutrients = O₂ + carbs (sugars) through photosynthesis.

System equilibrium: steady state vs. dynamic; tipping points are thresholds where conditions can change abruptly.

Mount Pinatubo 1991 eruption
Earth’s four main environmental spheres

Eratosthenes in 247 BC calculated Earth’s circumference at 28,738 mi (close to 24,860!!!)

Parallels of latitude
Latitudinal geographic zones

Meridians of longitude

Small circles and great circles

A plane intersecting the globe along a great circle divides the globe into equal halves and passes through its center.

A plane that intersects the globe along a small circle splits the globe into unequal sections—this plane does not pass through the center of the globe.
Clock times determine longitude

Triangulation via GPS satellites, p. 20

GPS on Mount Everest

Using GPS

Earth's coordinate system

Modern international time zones

International date line ~ 180°
Projections

Mercator ~ “true shape” (AD 1569); advantage = “thumb line” of constant direction is straight. Areas are bogus—exaggerated at poles.
Rhumb line = shortest distance but in a constant direction (on Mercator projection)

Remote sensing, p. 28

Kluchevskoi volcano
Sept. 1994

Radar image of same eruption as in previous slide, 1994
June 26, 2002
Terra image of Kamchatka

Radarsat mosaic

GOES 12
first image from, 23.300 mi

GOES = geostationary operational environmental satellites

EROS data center in Sioux Falls SD; 
http://edc.usgs.gov

GIS

(b) Land-cover map, Washington state
Table 1.1

A Few Geography Organizations

<table>
<thead>
<tr>
<th>Organization</th>
<th>URL Address</th>
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<tbody>
<tr>
<td>American Geographical Society</td>
<td><a href="http://www.americangeo.org/">http://www.americangeo.org/</a></td>
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<tr>
<td>Association of American Geographers*</td>
<td><a href="http://www.aag.org/">http://www.aag.org/</a></td>
</tr>
<tr>
<td>National Geographic Society</td>
<td><a href="http://www.nationalgeo.org/">http://www.nationalgeo.org/</a></td>
</tr>
<tr>
<td>Canadian Association of Geographers</td>
<td><a href="http://www.canadageo.org/">http://www.canadageo.org/</a></td>
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<tr>
<td>Royal Canadian Geographical Society</td>
<td><a href="http://www.rcgs.org/">http://www.rcgs.org/</a></td>
</tr>
<tr>
<td>Institute of American Geographers</td>
<td><a href="http://www.iag.org/">http://www.iag.org/</a></td>
</tr>
<tr>
<td>Australian Geographic Teachers Association</td>
<td><a href="http://www.agta.org/">http://www.agta.org/</a></td>
</tr>
<tr>
<td>European Geography Association</td>
<td><a href="http://www.eugeo.org/">http://www.eugeo.org/</a></td>
</tr>
<tr>
<td>Royal Geographical Society, Institute of British Geographers</td>
<td><a href="http://www.rgs.org/">http://www.rgs.org/</a></td>
</tr>
</tbody>
</table>

*Includes regional branches East Lakes, Great Plains/ Rocky Mountains, Midwest Atlantic, Midwest, New England - Lawrence Valley, Pacific - Carolinas - West, Southwest, Southeast, West Lakes.

In this table, a URL is provided for each organization.

(c) Probability map for spread of West Nile virus

Table 1.2

Sample Representative Fractions and Written Scales for Small-, Medium-, and Large-Scale Maps

<table>
<thead>
<tr>
<th>System Size</th>
<th>Representative Fraction</th>
<th>Written Scale</th>
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<tbody>
<tr>
<td>English</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small</td>
<td>1:3,160,000</td>
<td>1 in. = 50 mi</td>
</tr>
<tr>
<td></td>
<td>1:1,000,000</td>
<td>1 in. = 16 mi</td>
</tr>
<tr>
<td></td>
<td>1:250,000</td>
<td>1 in. = 4 mi</td>
</tr>
<tr>
<td>Medium</td>
<td>1:125,000</td>
<td>1 in. = 2 mi</td>
</tr>
<tr>
<td></td>
<td>1:63,360</td>
<td>1 in. = 1 mi</td>
</tr>
<tr>
<td></td>
<td>(or 1:62,500)</td>
<td></td>
</tr>
<tr>
<td>Large</td>
<td>1:24,000</td>
<td>1 in. = 2000 ft</td>
</tr>
<tr>
<td>Metric</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small</td>
<td>1:1,000,000</td>
<td>1 cm = 10.0 km</td>
</tr>
<tr>
<td>Medium</td>
<td>1:25,000</td>
<td>1 cm = 0.25 km</td>
</tr>
<tr>
<td>Large</td>
<td>1:10,000</td>
<td>1 cm = 0.10 km</td>
</tr>
</tbody>
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