

Geographic Concepts and Themes

Five Themes of Geography

- The five themes were written in 1984 by the Joint Committee on Geographic Education of the National Council for Geographic Education (NCGE) and the Association of American Geographers (AAG).

Geographical Concepts Theme 1 Location

- **Location** – Every point on Earth has a specific location that is determined by an imaginary grid of lines denoting latitude and longitude (where something is located)
 1. Absolute location – use of an arbitrary grid system (ex. Latitude/longitude)
 2. Secondary location – relative position (ex. Denton is 35 miles from Dallas)
- **Locational Data** - What sets spatial databases apart from others is the requirement that the measurements are attached to some form of georeferencing system that enables you to examine the “where” dimension of the data.

Geographical Concepts Theme 2 Place

- All places have characteristics that give them meaning and character and distinguish them from other places on earth
- Geographers describe places by their physical and human characteristics
 - Physical characteristics include such elements as animal life, topography, geology
 - Human characteristics of the landscape can be noted in architecture, patterns of livelihood, land use and ownership, town planning, and communication and transportation networks
 - Languages, as well as religious and political ideologies, help shape the character of a place

Geographical Concepts Theme 3 Human/Environment Interaction

- Studying human/environment interaction, geographers look at all the effects—positive and negative—that occur when people interact with their surroundings
- Sometimes a human act, such as damming a river to prevent flooding or to provide irrigation, requires consideration of the potential consequences
 - Ex: Hoover Dam - changed the natural landscape, but it created a reservoir that helps provide water and electric power for the arid Southwest
- Natural Hazards – focus on environmental impact on humans from floods, earthquakes, volcanoes, hurricanes
- Technological Hazards occurring from nuclear waste, groundwater and air pollution, oil spills

Geographical Concepts Theme 4 Movement

- People interact with other people, places, and things almost every day of their lives
 - People travel from one place to another;
 - they communicate with each other;
 - and they rely upon products, information, and ideas that come from beyond their immediate environment
- Transfer of goods, people, ideas from one location to another, the spread (diffusion) of the HIV virus, the daily journey from work to home, migration from East to West, city to suburbs
- Geographers should be able to recognize where resources are located, who needs them, and how they are transported over the earth's surface

Geographical Concepts Theme 5 Region

- **Region** – A basic unit of geographic study is the region, an area on the earth's surface that is defined by certain unifying characteristics
- Unifying characteristics may be physical, human, or cultural – divide the world into manageable areas of study
 1. Formal region – one or more criteria that are used to mark off unique or different areas of the earth's surface. (ex. Climate and Soils Classification Systems, political boundaries, Rockies/Great Lakes)
 2. Functional region – region defined by a function, if the function goes away the region goes away (NCTCOG), natural disaster relief area, EPA FIFRA region
 3. Vernacular region – loosely defined by peoples perceptions (south, bible belt, middle east, metroplex)

Geographical Data

- Georeferencing Data
 1. point – x, y coordinates making use of some form of grid system
 2. line – connect series of points such as roads, boundaries, pipelines.
 3. area – polygon, closed set of lines, neighborhoods, census tracts, city council districts, and regions – are all types of areas defined by boundaries
- Georeferencing adds a powerful dimension to databases, represents value added in a database, and a key to applied geographic problem – solving.

Geographical Scale

- Scale – central to geographic inquiry
- Scale is about size, either relative or absolute and is relevant to space, time, and theme (nonspatial and nontemporal characteristics of human and natural phenomenon that geographers map and measure)
- Size of geographic area or region under study, determines the level of detail incorporated into research design, resolution of a grid system
- Three meanings of scale:
 - Cartographic scale – refers to the depicted size of a feature on a map relative to its actual size in the world
 - Analysis scale – refers to the size of the unit at which some problem is analyzed, such as at the county or state level
 - Phenomenon scale refers to the size at which human or physical earth structures or processes exist regardless of how they are studied or represented

Geographical Scale

- Cartographic Scale – given a map of fixed size, as the size of the represented earth surface gets larger the representative fractions get smaller
 - A large scale map shows a relatively small area of the earth, such as a neighborhood, city or county
 - A small scale map shows a relatively large area such as a state, country, or continent
 - Cartographic scale terminology is frequently thought to be counter intuitive when applied for analysis or phenomenon scale

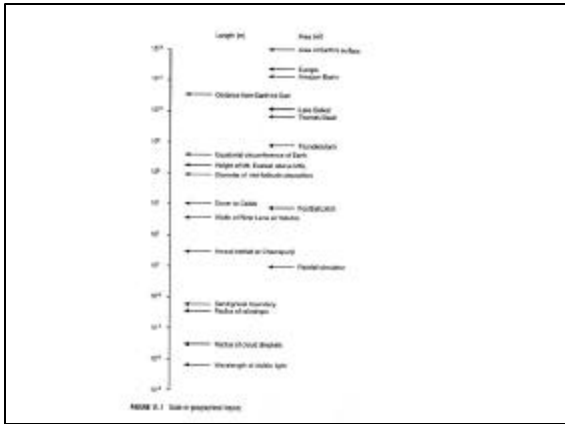
Geographical Scale

- Analysis scale – includes the size of the units in which phenomenon are measured and the size of the units into which measurements are aggregated for data analysis and mapping
 - Is essentially the scale of understanding of a geographic phenomenon, often referred to as resolution
 - Geographers often analyze phenomenon at what might be called available scale - the units that are presented in available data
 - Census boundaries, political boundaries, sample area boundaries
 - Given spatial units of a particular size, one can readily aggregate or combine them into larger units, but, it is not possible without additional information or theory to disaggregate them into smaller units

Geographical Scale

- Phenomenon scale – refers to the size at which geographic structures exist and over which geographic processes operate in the world.
 - It is the “true” scale of geographic phenomena
 - Numerous concepts in geography reflect the idea that phenomenon are scale dependent or are defined by their scale (i.e. vegetation stands are smaller than vegetation regions, linguistic dialects are distributed over smaller areas than languages)
 - Example of phenomenon scale

1. Macro –	Global	Region	City
2. Meso –	Country	State	Neighborhood
3. Micro -	State	Metro Area	Lot



Geographical Scale

- Two important questions regarding scale:
 - At what scale should the inquiry be focused?
 - How can findings at one scale be related to another?
- First question relates to "resolution" spatial scale at which we observe individual items of interest (analysis scale)
 - Remote sensing studies (resolution of satellite imagery)
 - Population studies (county, city, tract, block group, block)
 - Water related studies (basin, watershed, catchment, field, hillslope)

Geographical Scale

- The second question relates to the need to apply the results of one scale of analysis at a different scale. This may involve:
 - Upscaling – results from smaller areas to larger areas
 - Small catchment studies to large river basins
 - Downscaling – results from larger areas to smaller areas
 - Applying the results of the General Circulation Model (global scale model) to particular regions
- Generalizations at one level may not hold true at another
- Conclusions derived at one scale may be invalid at another

Geographical Scale

- There is usually a strong relationship between spatial and temporal scales
 - Generally as spatial scale increase, so does timescale of interest
- Short-term studies tend to focus on process dynamics, whereas long-term studies are more likely to involve statistical analysis of form and structure
 - In geomorphology this equates to the contrast of functional analysis of dynamic systems as opposed to historical studies of landform evolution
 - There is also a link between scale and causality...

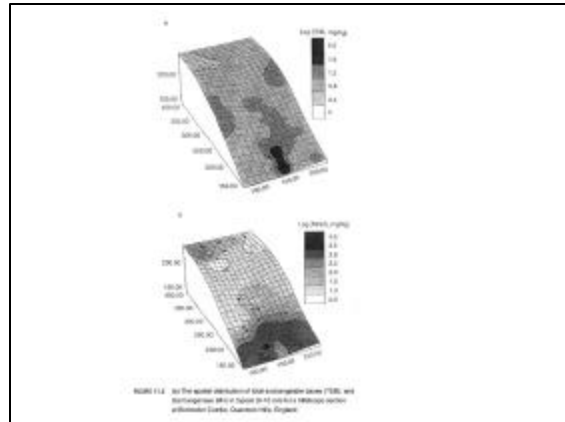
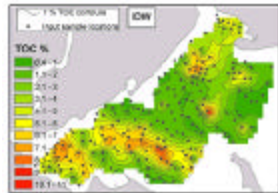
- At short time scale processes operate in fixed environment
 - Ex: water flow in a channel... at this scale form controls process (static equilibrium)
- At longer time scale processes are themselves variable
 - process now controls form; the system may be perturbed but the system will return to its characteristic state (steady state equilibrium)
- At even longer time scales characteristics like the long profile of a river will eventually change
 - Progressive evolution of a landform due to on going erosion (dynamic equilibrium)
 - Also the timescale at which major changes in climate can effect landform at the regional scale (advance and retreats of ice sheets over time)

TABLE 11.1 Approximate linkage between scales in studies of fluvial landforms

	Length scale (m)	Timescale (years)
Bed forms in sandy channels	0.1–10	0.1–1
Cross-sectional form	1–100	1–50
Bed forms in gravel-bed channels	1–100	5–100
Meander wavelength	10–500	10–1000
Reach gradient	100–1000	50–5000
Long profile analysis	1000–100 000	100–10 000

Upscaling

- Filtering – passes components of certain frequencies while excluding others
 - time series analysis techniques are applied to remove small scale noise to emphasize larger-scale patterns and trends
 - Trend surface mapping using kriging – geostatistical methods for surface interpolation (point data to surface profile)



Upscaling

- Nested Approaches – allows variations at different scales to be identified
 - Trend surface mapping of soils
 - 2 km – coarsening towards the north east, presumably wind blow deposits
 - 125-1000m – dune formations, features associated with dry epoch
 - 8m – sediment sorting under periglacial conditions
- Detailed sampling not always possible – two and three level nested approaches are sometimes used
 - Hydrograph analysis at hillslope, small catchment, large basin

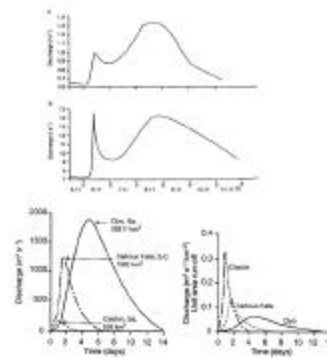


FIGURE 11.8. Passage of a flood wave along the Susquehanna River shown both at discharge and soil area runoff.

Upscaling - problems

- Computer simulation models – as scale increases, the spatial unit of interest gets larger and the process description gets simpler
- Major problem with hydrological research is how to upscale the results from the small scale to the large scale
- As the size of the basin increases, the important variables change
- Problems in upscaling erosion research
 - Real slopes behave differently than research plots
 - Deposition of eroded soils due to low foot slopes, vegetation buffers, and storage on floodplains and in channels
 - Erosion and sediment delivery to the outlet of a basin can be very different

TABLE 11.2. A sediment budget for Esau Creek, Wisconsin.

	1885-1888	1908-70	1970-80
Sources			
Net upland sheet and rill erosion	326	114	70
Upland gullies	73	64	19
Tributaries	62	55	9
Upper main valley	0	37	15
Sinks			
Upland valleys	35	38	9
Tributary valleys	87	0	25
Upper main valley	71	27	4
Lower main valley	258	136	51
Total sources	441	240	117
Total sink erosion sources	389	176	96
Net export to upper main valley	318	175	79
Net export to lower main valley	243	175	66
Sediment yield to Mississippi	36	36	37

Source: Based on Trimble (1996).

Downscaling

- Concerned with a reduction of scale to learn more about the dynamics being studied
- Often used in modeling approaches
- Ex: Global scale circulation models – necessary to develop regional scale models in order to forecast how global climate change will manifest itself on a smaller scale
 - Amazon basin – interaction of climate change and the impact of deforestation may have a significant effect on local rainfall and runoff
 - A complete removal of vegetation or rain forest could reduce evaporation by up to 20% and thereby decrease rainfall by up to 30% across the basin as a whole
 - Field studies reduce the spatial scale of investigation much further; plot studies in the Amazon have measured interception and evaporation rates to provide a basis for forecasting the effect of forest canopy removal

Scale Dilemma

“Whatever scale is selected, geographers have nevertheless always realized that results obtained at one scale are not enough. On the one hand, they will wish to delve beneath their current level of interest to understand more about the process mechanics of the system being studied, and at the same time, they will want to demonstrate the relevance of their work at the larger scale and to use results from one study to speculate about other places.”