30. Summary

In this chapter, we've explored several connotations of the term scale. Scale is synonymous with scope when it is used to describe the extent of a phenomenon. In this sense, "large scale" means "large area." Specialists in geographic information often use the term differently, however. **Map scale** refers to the relative sizes of features on a map and of corresponding objects on the ground. In this context, "large scale" implies "small area." Large scale also implies greater detail and greater accuracy, an important point to keep in mind when using maps as sources for GIS databases. Map scale is defined mathematically as the proportion of map distance to ground distance. I hope you are now prepared to use scale equations to calculate map scale.

Scale can also be thought of as a reference system for measurement. Locations on the globe are specified with reference to the **geographic coordinate system** of latitudes and longitudes. **Plane coordinates** are often preferred over geographic coordinates because they ease calculations of distance, area, and other quantities. Georeferenced plane coordinate systems like **UTM and SPC** are established by first flattening the graticule, then superimposing a plane coordinate grid. The mathematical equations used to transform geographic coordinates into plane coordinates are called **map projections**. Both plane and geographic coordinate system grids are related to approximations of the Earth's size and shape called **ellipsoids**. Relations between grids and ellipsoids are called **horizontal datums**.

Horizontal datum is an elusive concept for many GIS practitioners. It is relatively easy to visualize a horizontal datum in the context of unprojected geographic coordinates. Simply drape the latitude and longitude grid over an ellipsoid and there's your horizontal datum. It is harder to think about datum in the context of a projected coordinate grid like UTM and SPC, however. Think of it this way: First drape the latitude and longitude grid on an ellipsoid. Then project that grid to a 2-D plane surface. Then, superimpose a rectangular grid of eastings and northings over the projection, using control points to georegister the grids. There you have it--a projected coordinate grid based upon a horizontal datum.

Numerous coordinate systems, datums, and map projections are in use around the world. Because we often need to combine georeferenced data from various sources, GIS professionals need to be able to **georegister** two or more data sets that are based upon different coordinate systems, datums, and/or projections. **Transformations**, including coordinate transformations, datum transformations, and map projections, are the mathematical procedures used to bring diverse data into alignment. Characteristics of the coordinate systems, datums, and projections considered in this text are outlined in the following tables.

Coordinate systems referenced in this text

(many other national and local systems are in use)

Coordinate Systems Referenced

Coordinate System	Units	Extent	Projection Basis

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Coordinate System	Units	Extent	Projection Basis
Geographic	Angles (expressed as degrees, minutes, seconds or decimal degrees).	Global	None
UTM	Distances (meters)	Near-global (8430' N, 80° 30' S)	Unique Transverse Mercator projection for each of 60 zones
State Plane Coordinates	Distances (meters in SPCS 83, feet in SPCS 27)	U.S.	Unique Transverse Mercator or Lambert Conformal Conic projection for each of 123 zones (plus Oblique Mercator for Alaska panhandle)

Datums referenced in this text

(many other national and local systems are in use)

Datums referenced

Datum	Horizontal or vertical	Optimized for	Reference surface
NAD 27	Horizontal	North America	Clarke 1866 ellipsoid
NAD 83	Horizontal	North America	GRS 80 ellipsoid
WGS 84	Horizontal	World	WGS 84 ellipsoid
NAVD 88	Vertical	North America	Sea level measured at coastal tidal stations

Map projections referenced in this text

(many other national and local systems are in use)

Map projections referenced

Projection name	Properties preserved	Class	Distortion
Mercator	Conformal	Cylindrical	Area distortion increases with distance from standard parallel (typically equator).
Transverse Mercator	Conformal	Cylindrical	Area distortion increases with distance from standard meridian.
Lambert Conformal Conic	Conformal	Conic	Area distortion increases with distance from one or two standard parallels.
Plate Carrée (sometimes called "Geographic" projection)	Equidistant	Cylindrical	Area and shape distortion increases with distance from standard parallel (typically equator).
Albers Equal-Area Conic	Equivalent	Conic	Shape distortion increases with distance

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			from one or two standard parallels.

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‹ 29. Classifying Projection Methods | up | 31. Bibliography ›

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