

CHAPTER 2 COORDINATE SYSTEMS

2.1 Geographic Coordinate System

2.1.1 Approximation of the Earth

2.1.2 Datum

Box 2.1 NGS BenchMark Database

2.2 Map Projections

Box 2.2 How to Measure Distances on the Earth's Surface

2.2.1 Types of Map Projections

2.2.2 Map Projection Parameters

2.3 Commonly Used Map Projections

2.3.1 Transverse Mercator

2.3.2 Lambert Conformal Conic

2.3.3 Albers Equal-Area Conic

2.3.4 Equidistant Conic

Box 2.3 Map Scale

2.4 Projected Coordinate Systems

2.4.1 The Universal Transverse Mercator (UTM) Grid System

2.4.2 The Universal Polar Stereographic (UPS) Grid System

2.4.3 The State Plane Coordinate (SPC) System

2.4.4 The Public Land Survey System (PLSS)

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2.5 Working with Coordinate Systems in GIS

2.5.1 Projection File

Box 2.4 A Projection File Example

2.5.2 Predefined Coordinate Systems

2.5.3 On-the-Fly Projection

Box 2.5 Coordinate Systems in ArcGIS

Key Concepts and Terms

Review Questions

Applications: Coordinate Systems

Task 1: Project a Feature Class from a Geographic to a Projected Coordinate System

Task 2: Import a Coordinate System

Task 3: Project a Shapefile by Using a Predefined Coordinate System

Task 4: Convert from One Coordinate System to Another

Challenge Question

References

Coordinate System

Two map layers are not going to register spatially unless they are based on the same coordinate system.

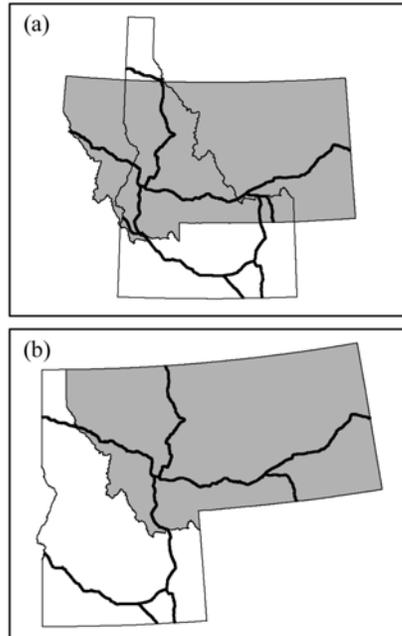


Figure 2.1
The top map shows the road networks in Idaho and Montana based on different coordinate systems. The bottom map shows the road networks based on the same coordinate system.

Geographic Coordinate System

- The geographic coordinate system is the location reference system for spatial features on the Earth's surface.
- The geographic coordinate system is defined by longitude and latitude.

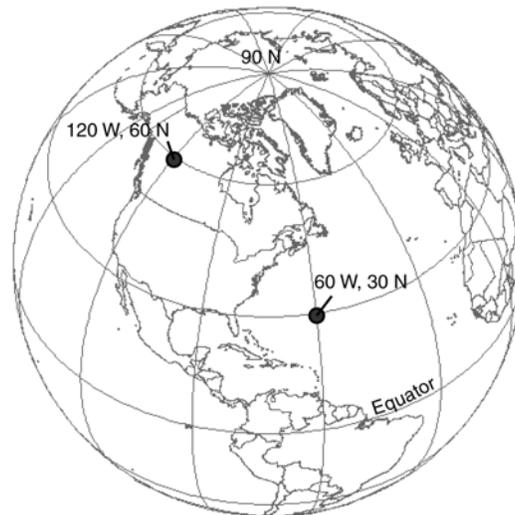


Figure 2.2
The geographic coordinate system.

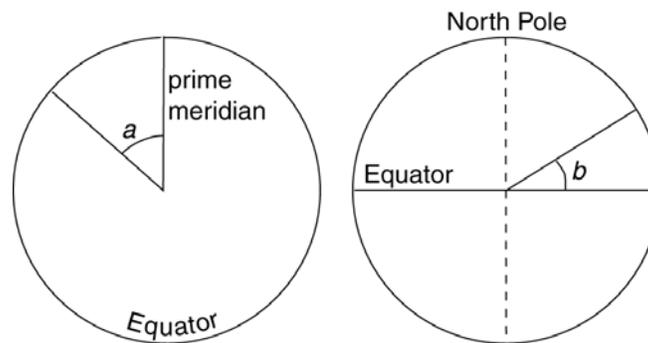
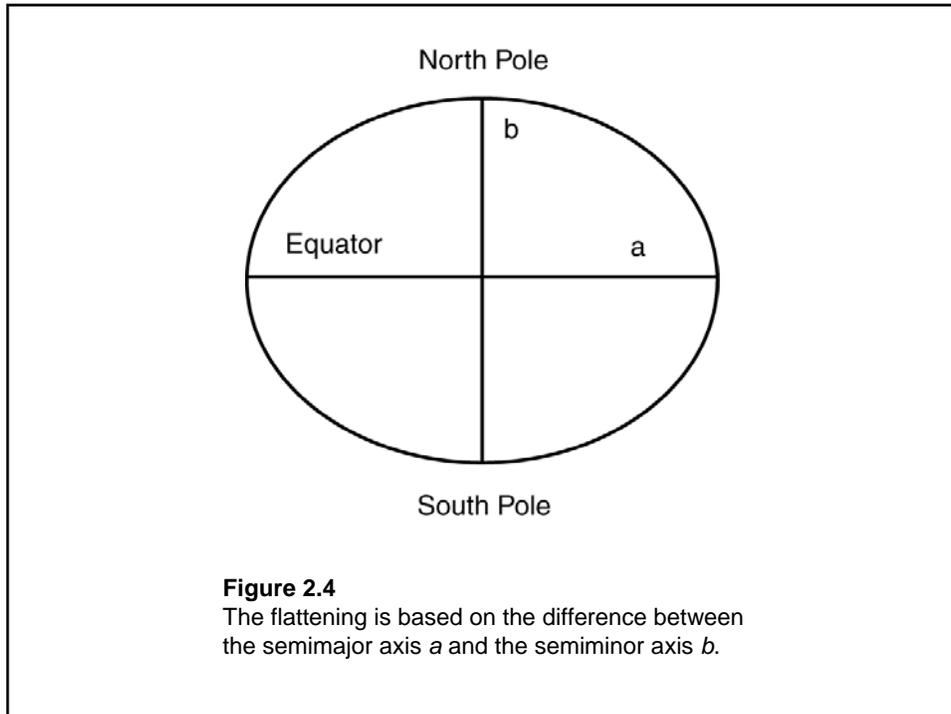


Figure 2.3

A longitude reading is represented by a on the left, and a latitude reading is represented by b on the right. Both longitude and latitude readings are angular measures.

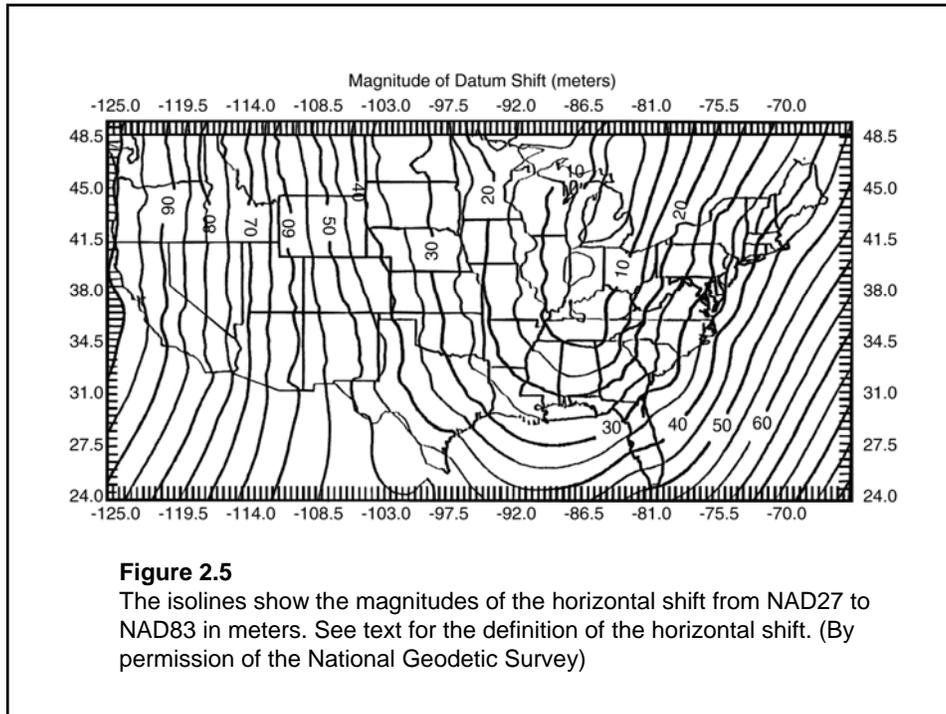
Approximation of the Earth

- The simplest model is a sphere, which is typically used in discussing map projections.
- The Earth is not a perfect sphere: the Earth is wider along the equator than between the poles. Therefore a better approximation to the shape of the Earth is a *spheroid*, also called *ellipsoid*, an ellipse rotated about its minor axis.



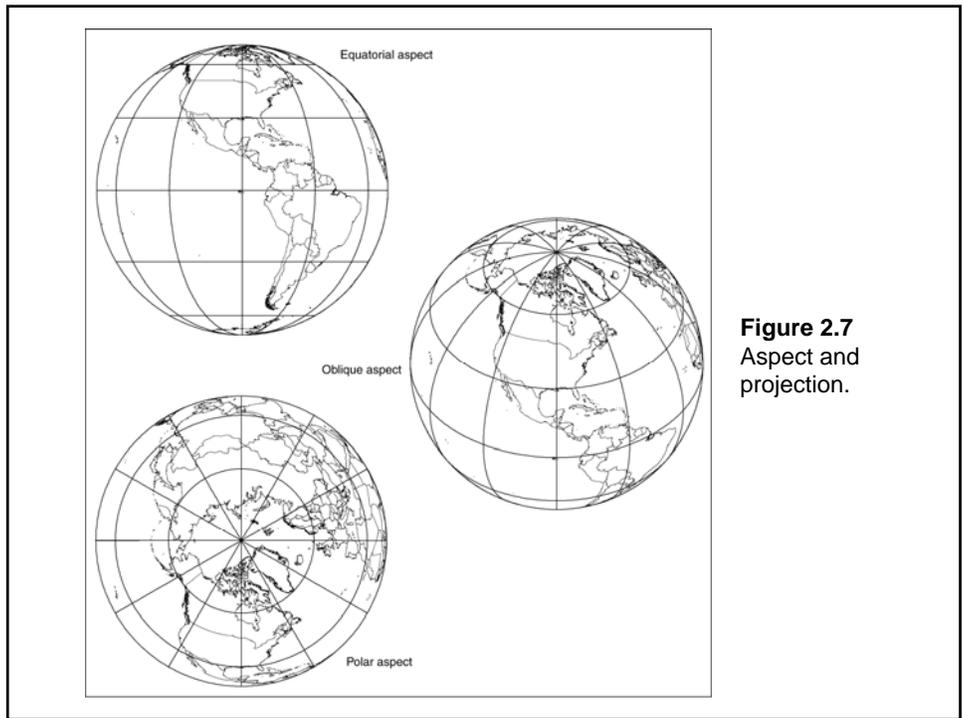
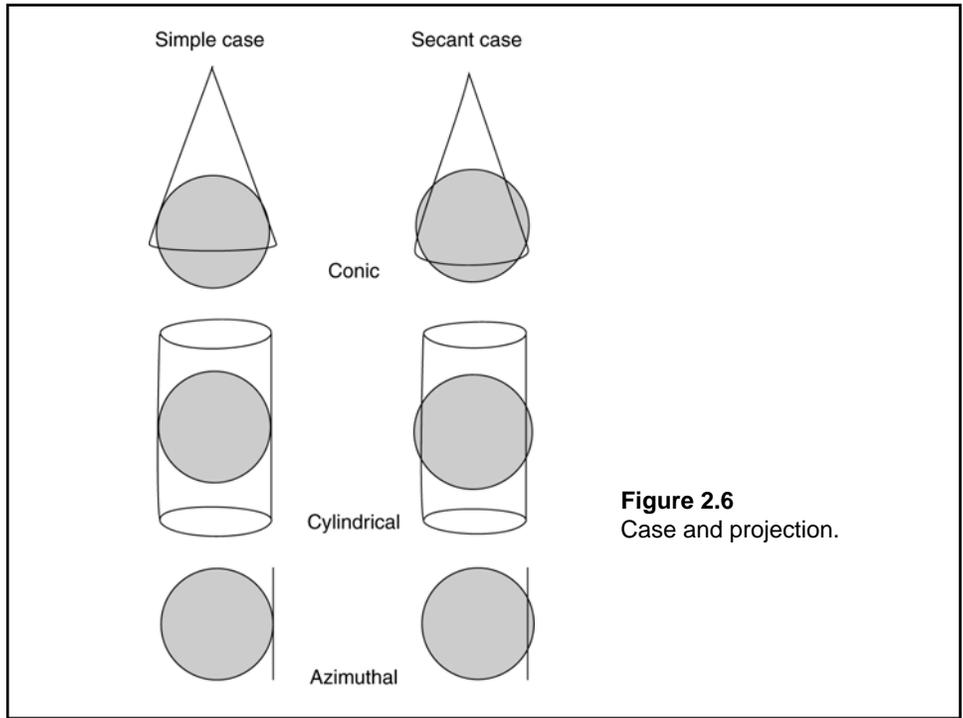
Datum

- A *datum* is a mathematical model of the Earth, which serves as the reference or base for calculating the geographic coordinates of a location.
- A shift of the datum will result in the shift of positions of points.



Map Projection

- A map projection is a systematic arrangement of parallels and meridians on a plane surface.
- Cartographers group map projections by the preserved property into conformal, equal area or equivalent, equidistant, and azimuthal or true direction.
- Cartographers also use a geometric object (a cylinder, cone, or plane) and a globe (i.e., a sphere) to illustrate how to construct a map projection.



Map Projection Parameters

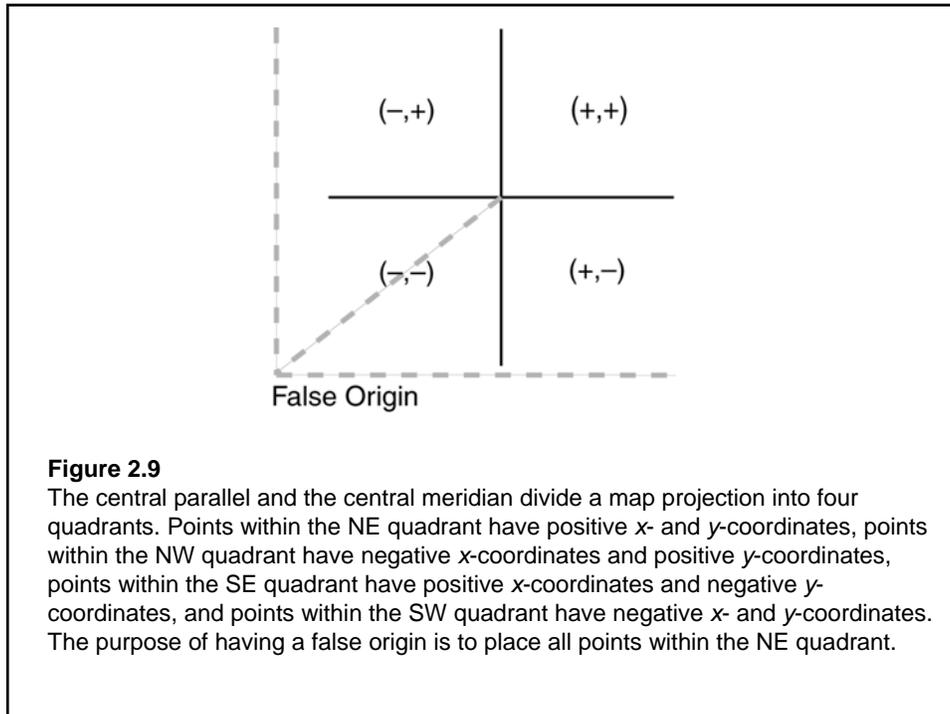
Map projection parameters include standard lines (standard parallels and standard meridians), principal scale, scale factor, central lines, false easting, and false northing.



Scale factor
a = 1.0000
b = 0.9996
c = 1.0000

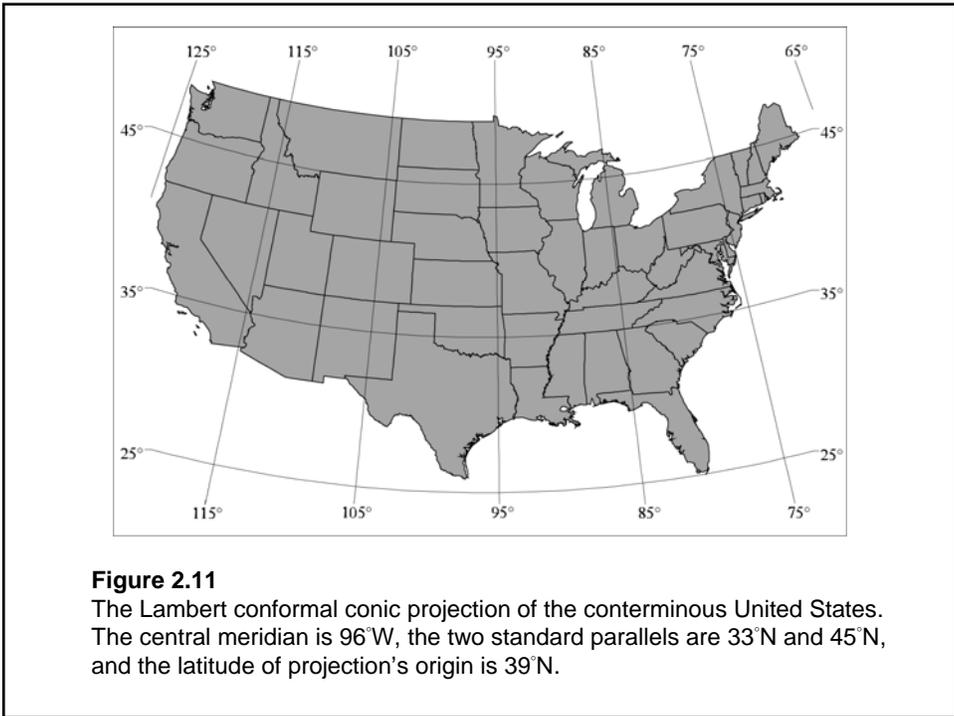
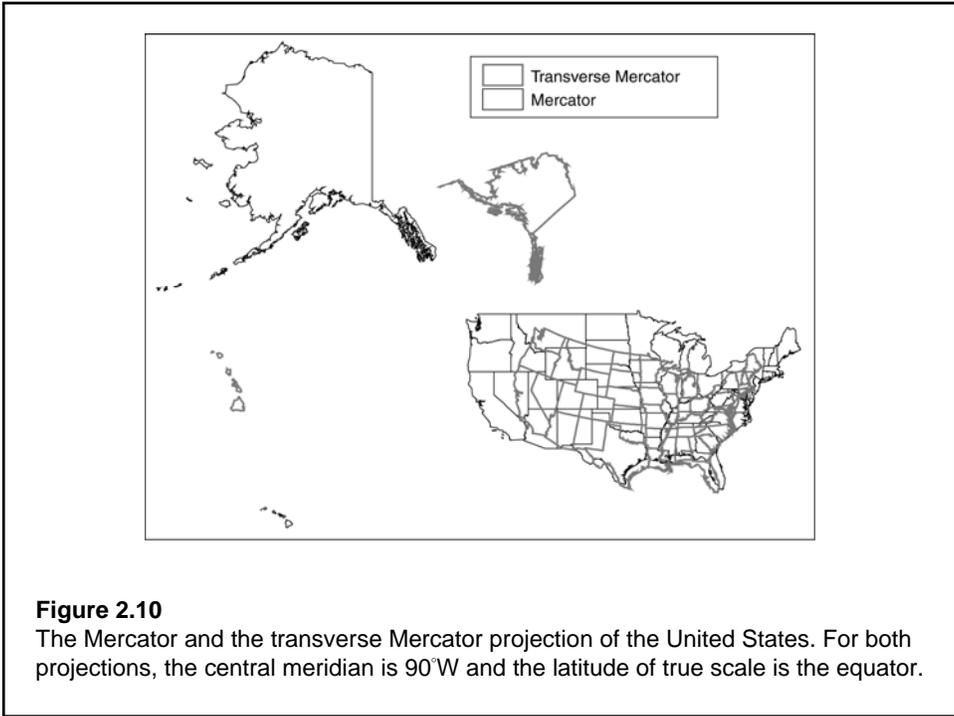
Figure 2.8

The central meridian in this secant case transverse Mercator projection has a scale factor of 0.9996. The two standard lines on either side of the central meridian have a scale factor of 1.0.



Commonly Used Map Projections

1. Transverse Mercator
2. Lambert conformal conic
3. Albers equal-area conic
4. Equidistant conic



Projected Coordinate Systems

1. The Universal Transverse Mercator (UTM) grid system
2. The Universal Polar Stereographic (UPS) grid system
3. The Public Land Survey System (PLSS)

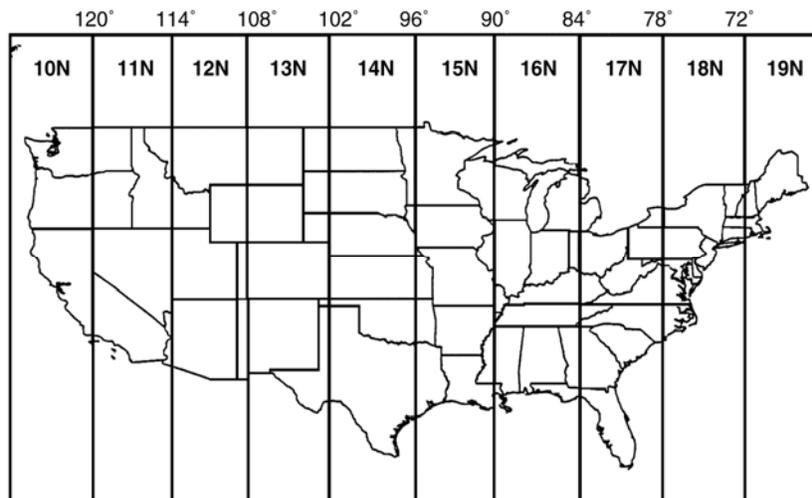


Figure 2.12
UTM zones range from zone 10N to 19N in the conterminous United States.

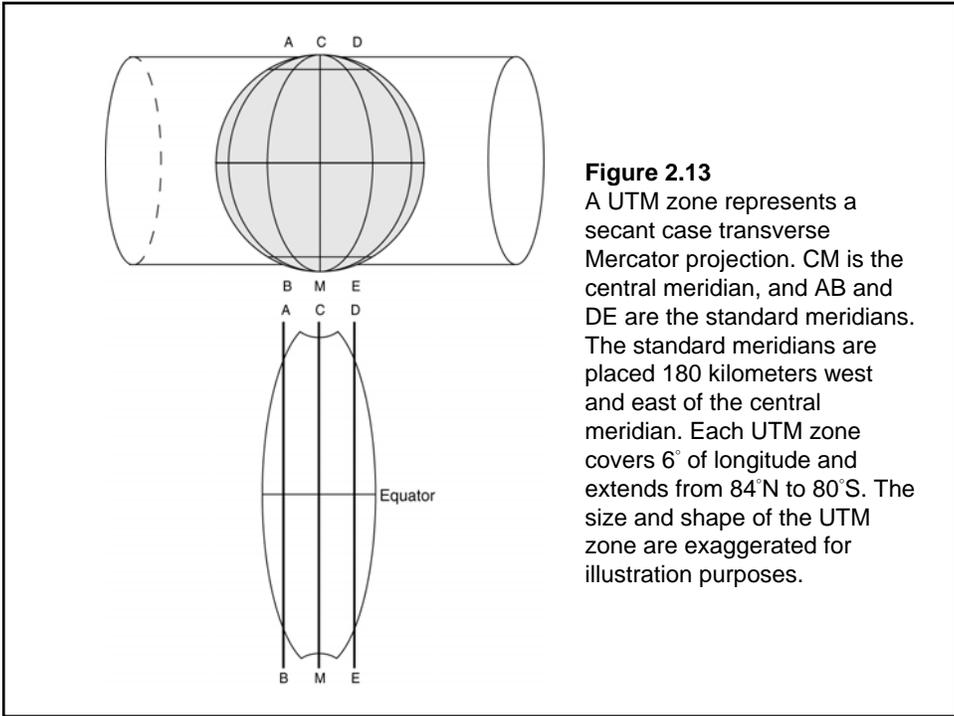


Figure 2.13
 A UTM zone represents a secant case transverse Mercator projection. CM is the central meridian, and AB and DE are the standard meridians. The standard meridians are placed 180 kilometers west and east of the central meridian. Each UTM zone covers 6° of longitude and extends from 84°N to 80°S. The size and shape of the UTM zone are exaggerated for illustration purposes.

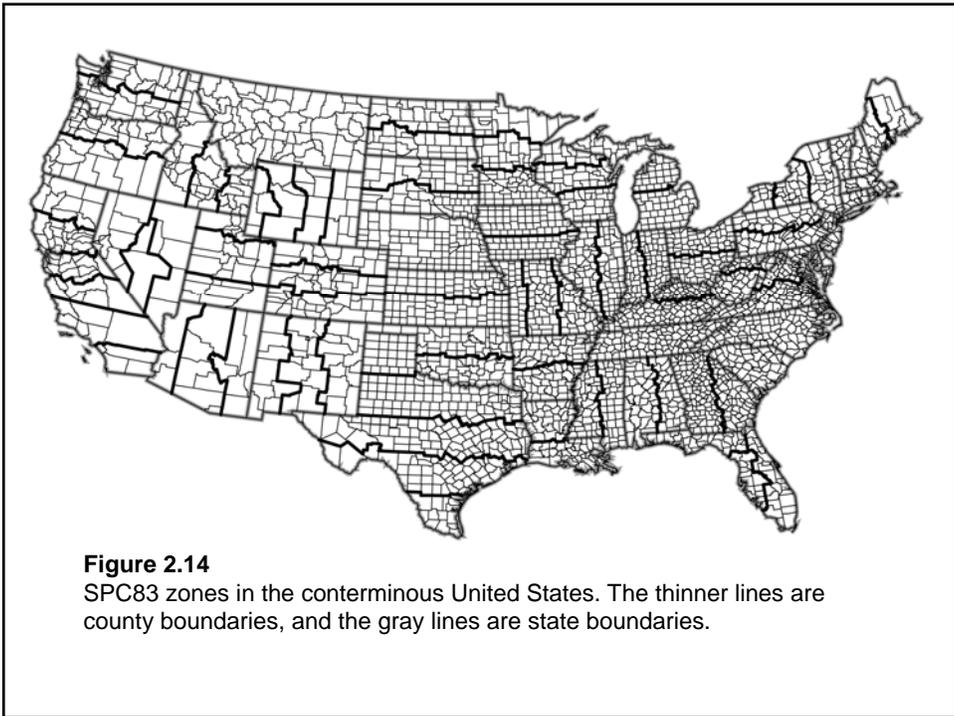
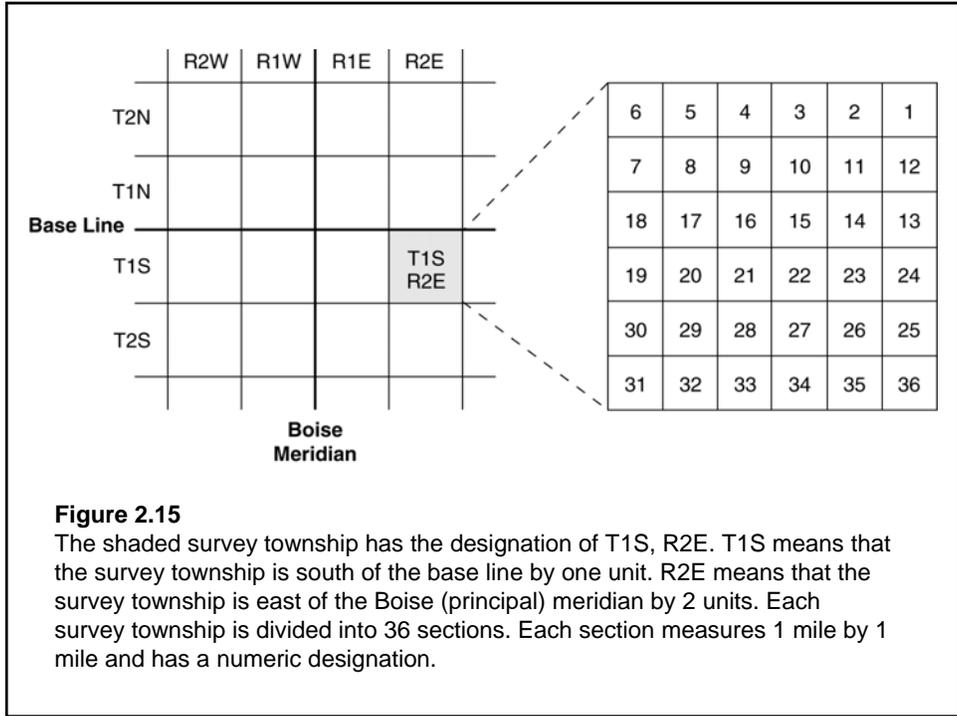


Figure 2.14
 SPC83 zones in the conterminous United States. The thinner lines are county boundaries, and the gray lines are state boundaries.



	Predefined	Custom
Geographic	NAD27, NAD83 (1986)	Datum transformation
Projected	UTM, State Plane	IDTM

Table 2.1 A classification of coordinate systems in GIS packages

National Geodetic Survey: Nadcon

<http://www.ngs.noaa.gov/TOOLS/Nadcon/Nadcon.html>

Bureau of Land Management: Geographic Coordinate Data Base

<http://www.blm.gov/gcdb/>

National Geodetic Survey

<http://www.ngs.noaa.gov/CORS/cors-data.html>

Geospatial One-stop

<http://geodata.gov/>

Geodesy for the Layman by R. K. Burkard

http://www.ngs.noaa.gov/PUBS_LIB/Geodesy4Layman/TR80003A.HTM#ZZ0/

Department of Defense World Geodetic System 1984: Its Definition and Relationships with Local Geodetic Systems

<http://earth-info.nga.mil/GandG/>

NGS BenchMark Database

<http://www.ngs.noaa.gov/cgi-bin/datasheet.prl?Type=DATASHEETS>