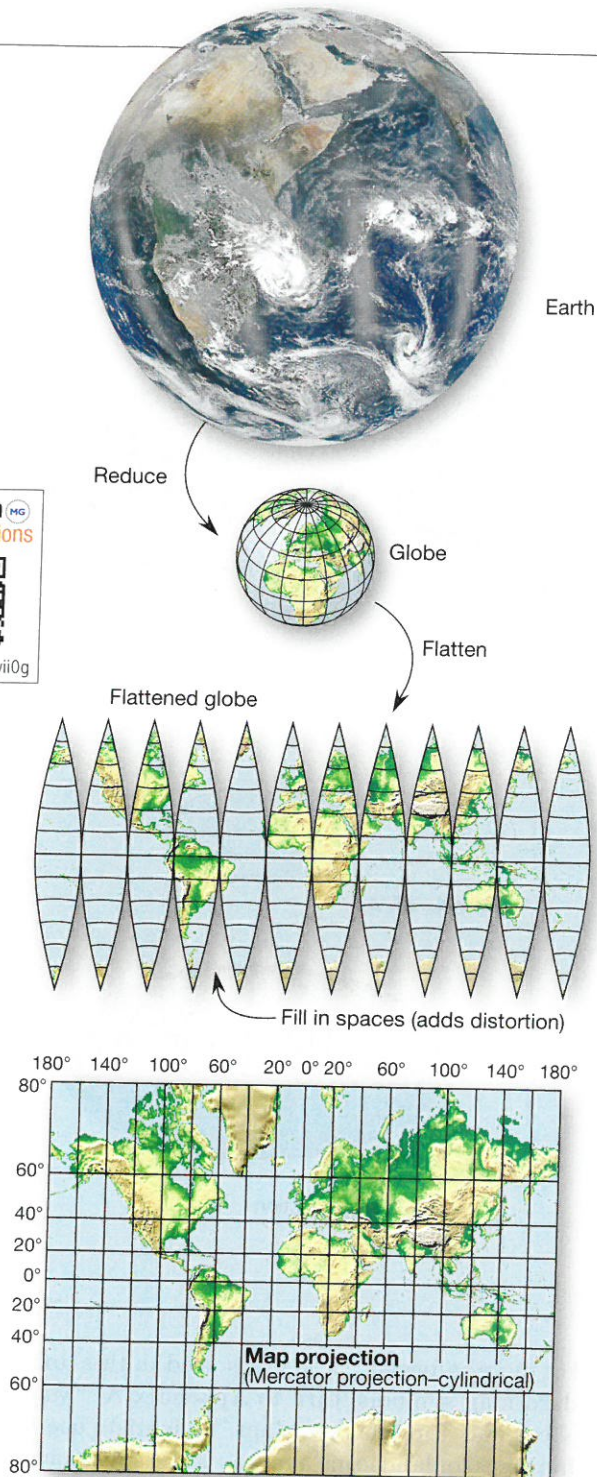




▲Figure 1.18 From globe to flat map. Conversion of the globe to a flat map projection requires a decision about which properties to preserve and the amount of distortion that is acceptable. [NASA/NOAA/GSFC/Suomi NPP/VIIRS/Norman Kuring.]

Equal Area or True Shape? The best map projection is always determined by the intended use of the map. The major decisions in selecting a map projection involve the properties of **equal area** (equivalence) and **true shape** (conformality). A decision favoring one property sacrifices the other, for they cannot be shown together on the same flat map.

If a cartographer selects equal area as the desired trait—for example, for a map showing the distribution of world climates—then true shape must be sacrificed by stretching and shearing, which allow parallels and meridians to cross at other than right angles. On an equal-area map, a coin covers the same amount of surface area no matter where you place it on the map. In contrast, if a cartographer selects the property of true shape, such as for a map used for navigational purposes, then equal area must be sacrificed, and the scale will actually change from one region of the map to another.

Classes of Projections Figure 1.19 illustrates four classes of map projections and the perspective from which each class is generated. Despite the fact that modern cartographic technology uses mathematical constructions and computer-assisted graphics, we still use the word *projection*. The term comes from times past, when geographers actually projected the shadow of a wire-skeleton globe onto a geometric surface, such as a *cylinder*, *plane*, or *cone*. The wires represented parallels, meridians, and outlines of the continents. A light source casts a shadow pattern of these lines from the globe onto the chosen geometric surface.

The main map projection classes include the cylindrical, planar (also called azimuthal), and conic. Another class of projections, which cannot be derived from this physical-perspective approach, is the nonperspective oval shape. Still other projections derive from purely mathematical calculations.

With projections, the contact line or contact point between the wire globe and the projection surface—a *standard line* or *standard point*—is the only place where all globe properties are preserved. Thus, a *standard parallel* or *standard meridian* is a standard line true to scale along its entire length without any distortion. Areas away from this critical tangent line or point become increasingly distorted. Consequently, this line or point of accurate spatial properties should be centered by the cartographer on the area of interest.

The commonly used **Mercator projection** (invented by Gerardus Mercator in 1569) is a cylindrical projection (Figure 1.19a). The Mercator is a conformal projection, with meridians appearing as equally spaced straight lines and parallels appearing as straight lines that are spaced closer together near the equator. The poles are infinitely stretched, with the 84th N parallel and 84th S parallel fixed at the same length as that of the equator. Note in Figures 1.18 and 1.19a that the Mercator projection is cut off near the 80th parallel in each hemisphere because of the severe distortion at higher latitudes.

Unfortunately, Mercator classroom maps present false notions of the size (area) of midlatitude and poleward landmasses. A dramatic example on the Mercator projection is Greenland, which looks bigger than all of South America. In reality, Greenland is an island only one-eighth the size of South America and is actually 20% smaller than Argentina alone.