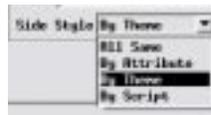
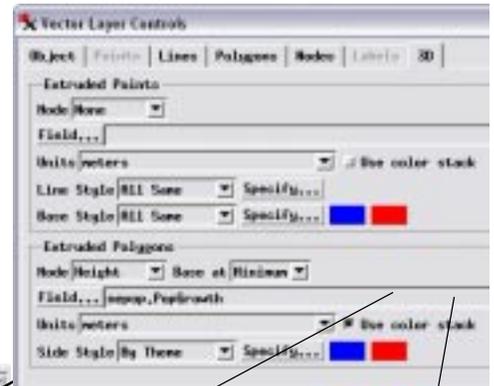


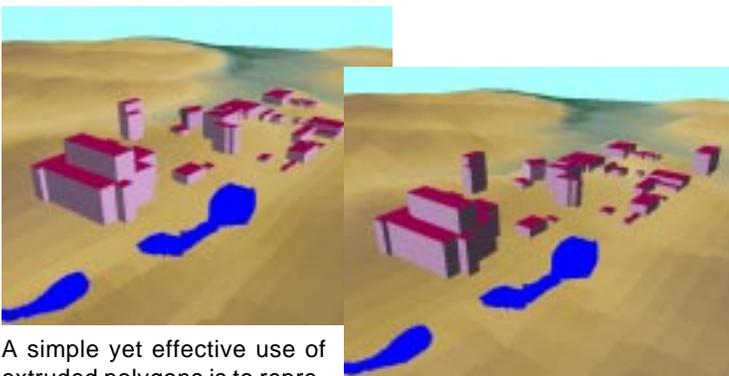
Extruded Polygons in 3D View

In 3D perspective views you can “extrude” 2D vector polygons into virtual solid objects extending above or below the surface, with automatic shading to enhance the 3D effect. The tops of extruded polygons are styled just like any polygon, using the settings on the Polygon tabbed panel in the Vector Layer Controls window. Other controls for creating and rendering the extruded polygons are found on the 3D tabbed panel. To turn on polygon extrusion, choose either Height or Elevation on the Mode menu and select a numerical field in an attached database table to supply the corresponding values. (Height mode specifies distance above or below the surface, while Elevation mode sets distance above or below sea level.) There are also a number of options for rendering the sides of the extruded polygons. You can set a single side color for all polygons (All Same style), assign various colors based on the relative values of any numeric attribute of the polygons (style By Theme), or assign

colors using other attribute information (style By Attribute or By Script). You can also create layers of different colors on the polygon sides in several ways by turning on the Use Color Stack toggle in combination with the By Theme or By Attribute side style options. The examples on these pages illustrate some of the many ways in which you can use these features to accentuate important spatial information in your vector objects.

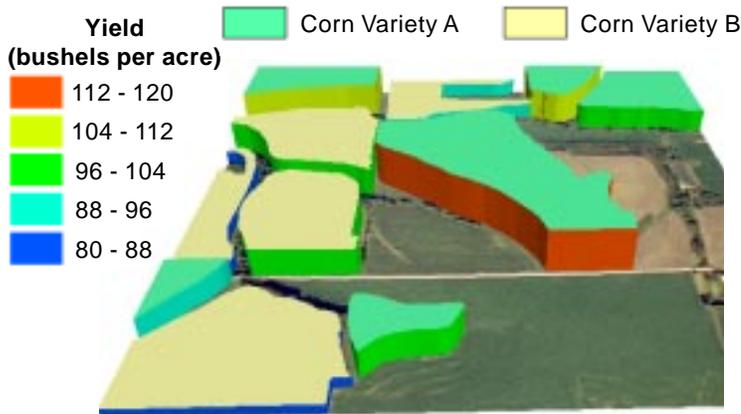
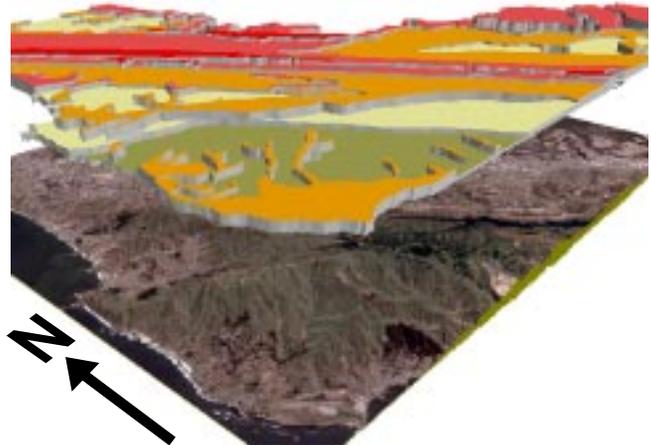


Wireframe colors:
Below surface Above Surface



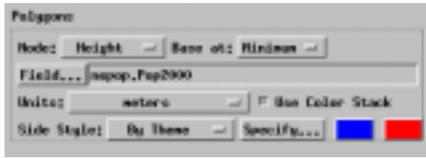
A simple yet effective use of extruded polygons is to represent buildings with differing heights. The building polygons shown above are all filled with the same color (burgundy roofs) and the Side Style is set to the All Same option, which allows you to choose a single color to use for the polygon sides. Use nested polygons with different heights to represent complex building shapes. You can vary the illumination direction as shown in the two views above by using the controls in the 3D Viewpoint Controls window. The blue ponds are polygons in a separate vector layer draped directly on the surface.

A perspective view of solid class polygons provides an effective way to emphasize differences between the classes. The differing fill colors and polygon heights in the illustration below indicate five categories of predicted ground shaking during an earthquake along the San Andreas fault. Polygon heights are proportional to increasing risk; the All Same option was used for the side style. The vector layer is draped on a flat surface layer to emphasize the height differences between the hazard classes, and that surface is offset above a DEM surface layer with a draped satellite image.

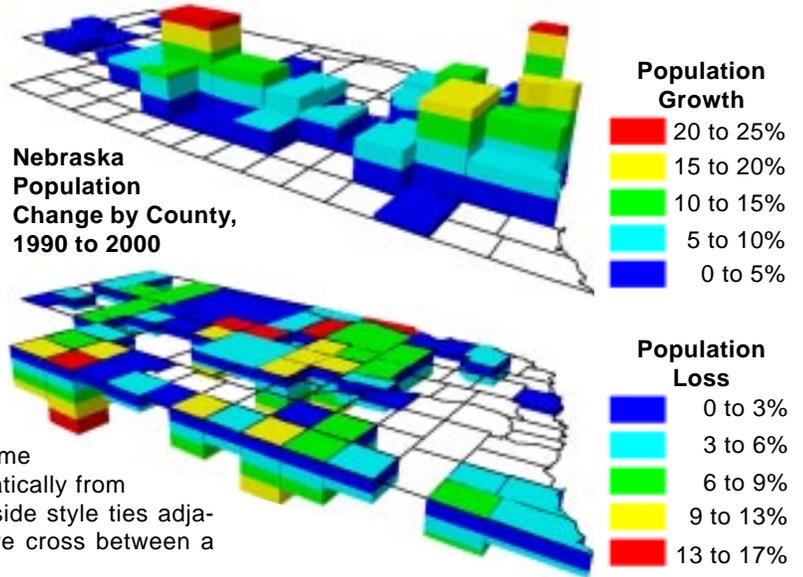


The polygons in the view to the left outline fields of corn with their fills styled By Attribute to indicate two corn varieties. The heights of the polygons are proportional to crop yield, and yield was also used to style the sides of the polygons By Theme. The Use Color Stack option was turned off, so each polygon has a single side color indicating the theme range that its yield falls within. Variety A obviously produced a higher range of yields overall. (No surface layer was used for the view, so the underlying surface is represented as a flat plane.)

The extruded county polygons in the two views to the right are shown without a surface layer, and have heights set from a population growth database field. Counties that gained population between 1990 and 2000 have a positive value in this field, while those that lost population have a negative value (and thus a negative height). The two groups of counties were selected separately for the two views using queries. In each

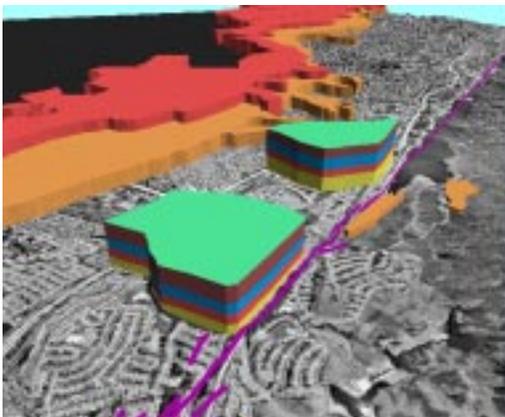


view the selected polygons are styled By Theme for both fill style (set on the Polygon panel) and side style (set on the 3D panel). The Use Color Stack option was turned on for both views. Using this option, each polygon's sides show a stacked set of theme class colors, with layer position and thickness set automatically from the numerical range of each theme class. The layered side style ties adjacent polygons together visually and produces an effective cross between a map and a 3D bar graph.



When you use the Height mode to specify the vertical dimension of extruded 2D polygons, the height is drawn relative to your choice of the minimum or maximum surface elevation on the polygon boundary. The Height mode works best when the polygon layer is displayed without a surface or with a low-relief surface. If the polygon layer is draped over a surface with significant relief, the bases of different polygons will be at different elevations, and the top of a “short”

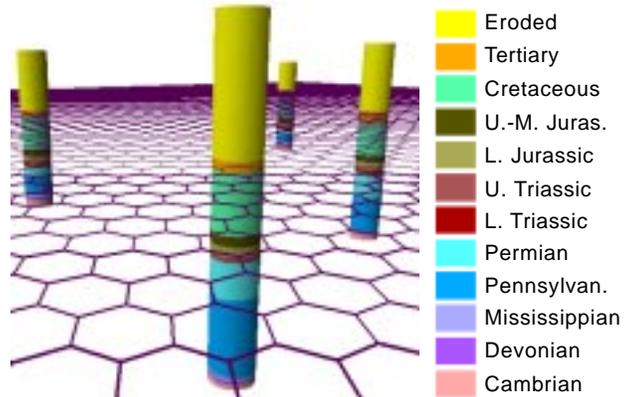
polygon may be elevated above that of a “taller” polygon downhill from it. The Elevation mode is a better choice in this instance, as the top (or bottom) of an extruded polygon is rendered at the designated elevation regardless of variations in elevation of the underlying surface. The top of an extruded polygon must be entirely above the underlying surface in order for the polygon to be rendered in solid view, however.



The 3D View to the left looks southeast along the San Andreas fault (purple line) south of San Francisco, California. The dark area in the distance (upper left) is San Francisco Bay. The view includes two vector drape layers with extruded 2D polygons. Areas of moderate (orange) and high (red) risk of ground liquefaction during an earthquake are shown by extruded polygons with elevations proportional to the relative risk. Both the tops and sides of these polygons are styled By Attribute using the same style assignment table with the Use Color Stack option turned off. Both the top and sides of each polygon are shown in the assigned class color.

Block Year	Pop1970	Pop2000	PopHeight
2	1370	229	169
2	1300	342	239
2	1390	505	354
2	2000	653	457
3	1370	120	94
3	1300	230	161
3	1390	343	249
3	2000	538	377

The two green polygons above represent census blocks. Each polygon has a separate attached record for each census from 1970 through 2000, with a field for the year and another for the population. Population increased steadily through this period for both blocks, so the 2000 population figure is the highest value for both. A computed field (PopHeight) scaled from the Population field was selected to set the heights of the extruded polygons. The process automatically searches for and uses the highest value in this field for each polygon to render the height. The polygon sides are styled By Attribute with the Use Color Stack option turned on. This choice uses all of the PopHeight values for each polygon to create a stack of color layers indicating cumulative population growth from 1970 (yellow) to 2000 (brown). A separate table with a unique record for each year (with the Year field set as the primary key) was used to assign styles for each census year. The two tables are related through the Year field in each.



The illustration above shows a hexagonal polygon drape indicating the ground surface and a separate vector layer with extruded circular polygons representing the location of oil wells. The side colors indicate the depth ranges of geologic strata encountered by each well; the yellow portion extending above the surface shows the estimated thickness of eroded strata at each. The sides were styled By Attribute using the Color Stack option.