

Buffers Everywhere but Where You Want Them?

Here is yet another Tips & Tricks column that comes by way of my GIS/Map Making Class at the University of Tampa. About mid-way through the semester, after we have gone through discussion of map projections and coordinate systems, we start on introductory spatial analyses with the introduction of the “buffer”. We construct buffers around points, lines, and polygons and use them to count objects within their limits.

In Figure 1, I started with some local hospitals (the blue “H”s) and Federal Qualified Health Centers (FQCHs: red crosses) in the Pittsburgh, PA area (blue polygon). Then I constructed a 3-mile buffer (orange, semi-transparent ovals) around each hospital to analyze the number of FQCHs within 3 miles of the hospitals. The data originated from the US Census Bureau in geographic coordinates (not a projection system), so when I specified a 3-mile buffer radius, the buf-

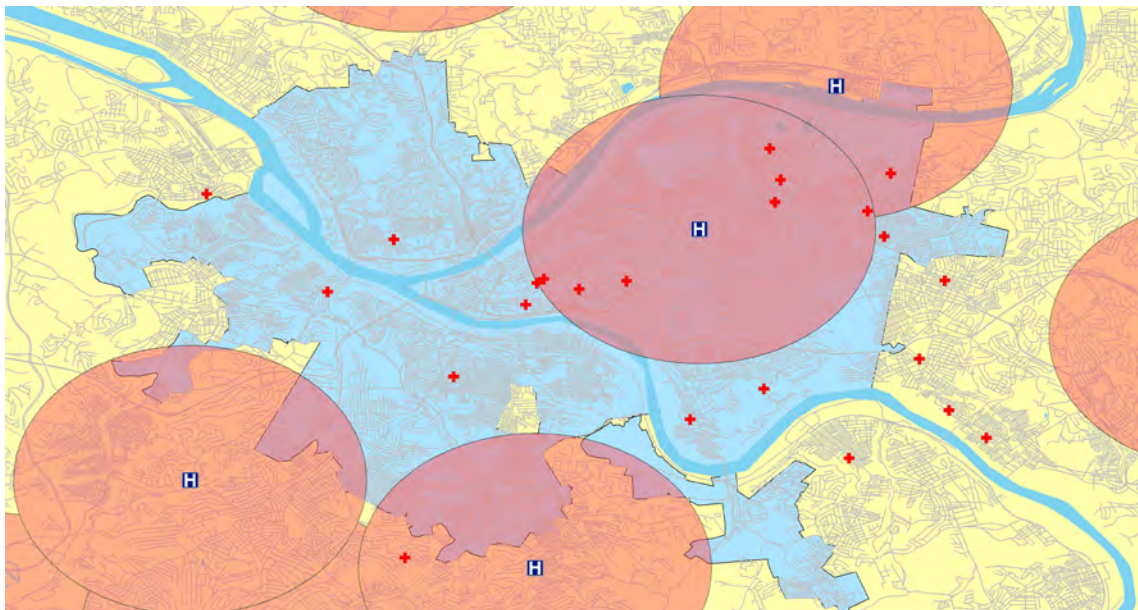


Figure 1. 3-mile Oval “buffers” around Hospitals resulting from the geographic coordinates (latitude/longitude) of the Hospital layer.

Creating buffers with any of the GIS software packages is easy; just find the tool (usually called, “Buffer”), identify the object to buffer, a buffer distance, set a few parameters (rounding, dissolved, etc.) and voila... a pretty instant spatial analysis. The buffer polygon can be used for spatial joins to count objects within, to select objects, and/or to clip other features. So, students gravitate to using and creating buffers for every analysis. However, in my classes, we generally start with some US Census Bureau data base map or some other layer that is in geographic coordinates, and therein lies the problem and this month’s tip... Remember to change the coordinate system and projection before your make a buffer. The following example is from ArcGIS Pro 2.9, but the issues are similar with all GIS software programs.

uffers appear as ovals with the major axis along the latitude and the minor axis along the longitude, in North America. This confuses students to no end; the buffers should be circles not ovals!

There are a few different approaches to making “circular” buffers, but they all revolve around having the data in a projected coordinate system. Hence, my GIS class does not make buffers until they understand projections.

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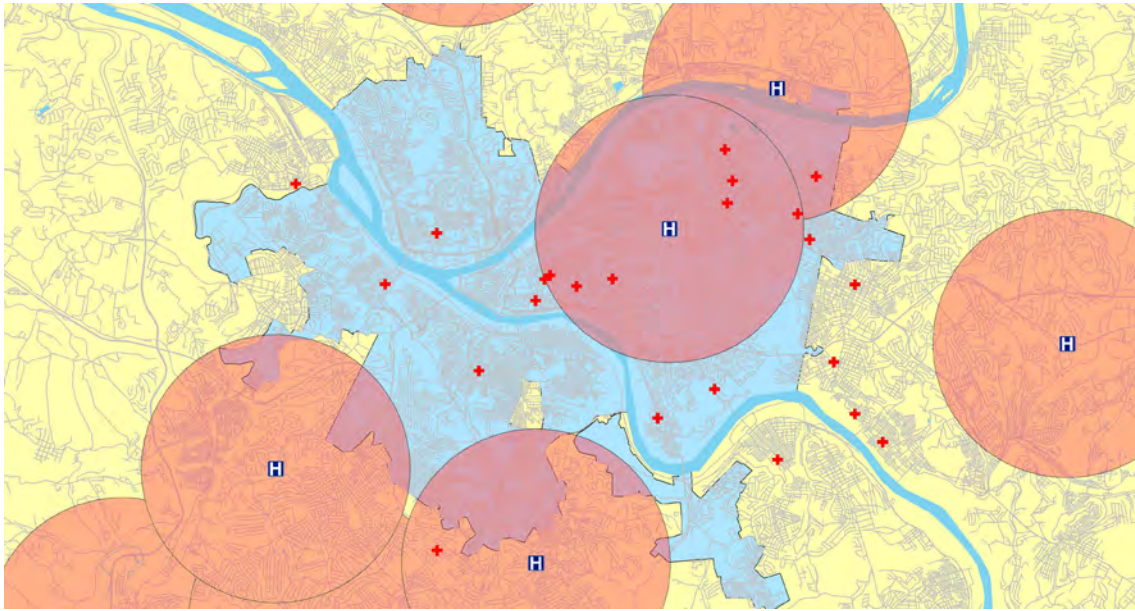


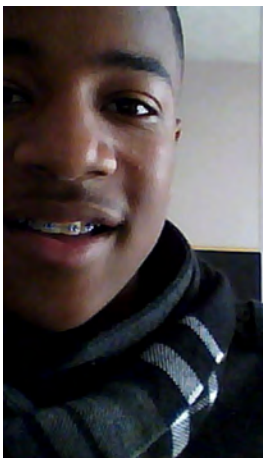
Figure 2. 3-mile circular “buffers” around Hospitals resulting from the projected coordinates (northings/eastings) of the Hospital layer.

TIP #1 — Project the source data BEFORE constructing the buffers. Most GIS software systems allow you to both specify a coordinate system (geographic or projected) for a data layer. In this case, the data layer should be defined as Geographic Coordinates with the North American Datum of 1983 (NAD83) or North American Datum of 1983 (2011). At most scales, the difference is negligible for our purposes. Then constructing the buffer using the appropriate geoprocessing tool will result in circular buffers as in Figure 2. In this case, I projected the geographic data into the Pennsylvania State Plane South (NAD 1983 (2011) FIPS 3702 (US Feet) coordinate system.

TIP #2 — Although not a preferred method, if you choose to maintain the DATA (point locations, buffers, etc.) in geographic coordinates, then you will get the same resulting map if you change the Data Frame coordinate system to the projected system. While the results will look the same, remember that distances may not be preserved by any on-the-fly projection calculations. So, for a “quick and dirty” map, just change the data frame coordinate system, but remember that the DATA are still in geographic coordinates.

Send your questions, comments, and tips to GISTT@ASPRS.org.

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Too young to drive the car? Perhaps! But not too young to be curious about geospatial sciences.

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