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Collecting Multiple Point Features Referenced to a Single Geographic Position in ArcPad

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Field Tech GIS for Foresters:
Collecting Multiple Point Features Referenced to a Single Geographic Position in ArcPad

By Jason Grogan, I-Kuai Hung, and Yanli Zhang

Foresters of all types have long been faced with the need to map tree stem locations (and other objects) with high levels of relative accuracy. That is, the most important factor is each tree's location relative to one another, rather than individual accuracy on the Earth's surface. Researchers, urban foresters, and others often wrestle with the problem of producing highly accurate stem maps in difficult GPS environments. Even with today's submeter accurate GPS receivers, it is often difficult to produce a map that correctly reflects the spatial relationship among multiple objects spaced closely together. For example: if two trees three feet apart are mapped to one-meter accuracy, it is possible for each position to be "highly" accurate, yet the resulting map may have the trees incorrectly placed relative to one another or another feature such as a sidewalk. The methodology discussed here allows for the collection of multiple point features referenced to a single GPS location (or existing GIS feature). With careful implementation, this method ensures collected locations will be correctly located in relation to each other, and geo-referenced to the precision of the reference position.

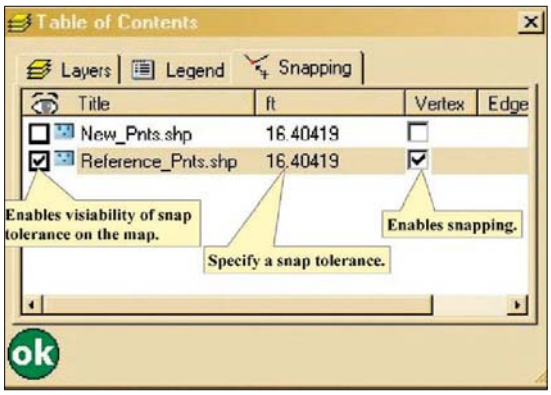

Figure 1. Shows the Snapping tab within the ArcPad table of contents. Snap tolerance visibility (first check box) and enable snapping (second check box) are enabled for the reference point layer (Reference_Pnts.shp).

This simple technique begins with a single reference point mapped with desired precision and accuracy (either using GPS or other means, such as digitizing from aerial photography). The rest of the point features collected will be based on the bearing and distance to the reference point. The use of "snapping" will ensure that you always reference the exact same location. We utilize ESRI's ArcPad® 8.0 (SP3) software for the process, but earlier versions also are compatible. A quality laser rangefinder is helpful; at a minimum a compass and measuring tape are required.

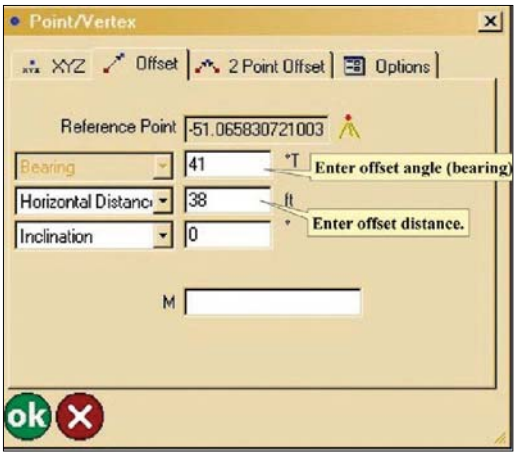

Figure 2. Shows the ArcPad Edit toolbar with editing enabled, point feature type selected to allow digitizing of a new feature, and Offset Feature enabled to allow for entering offset values for the new feature location.

Begin by setting up an ArcPad map for field data collection. If you have collected highly accurate positions you wish to use as reference position(s), load this data into the map. The new positions may be collected into the same layer (shapefile or APX) as the reference position or into a separate layer. Either create a new layer (shapefile or AXF) or load a previously created layer into the map to store the new positions. Start by enabling snapping for the reference point layer (open the table of contents and go to the Snapping tab). Click the check box below Vertex for your reference layer. You may also specify a snap tolerance (how close the new point must be to the existing point before the software automatically "snaps" the new feature to the existing point location) by typing the desired number in the field directly to the right of the layer title. If you wish, you can enable snap tolerance visibility, which makes the area in which you can click visible on the map. In order for the point to snap to the reference point, click the check box to the left of the reference layer (Figure 1).

Next, from the Edit toolbar, enable editing for the layer you are collecting features into and toggle on the offset feature by clicking the Offset button (Figure 2).

If you are collecting a new position for your reference position, first make the reference layer editable, then connect to the GPS and collect the reference position. Once the reference position is collected, enable editing on the "new feature" layer and disconnect from the GPS. Enable the point feature type on the Edit toolbar. You are now ready to begin collecting features referenced to a single position.

Click on the reference point on the map (be sure to click within the snap tolerance) to digitize a new point. The Point/Vertex dialogue box should pop up. Using your laser rangefinder (or compass and tape) measure the distance and direction from the reference point to the feature you wish to map. Enter the bearing and horizontal distance on the Offset tab (Figure 3).

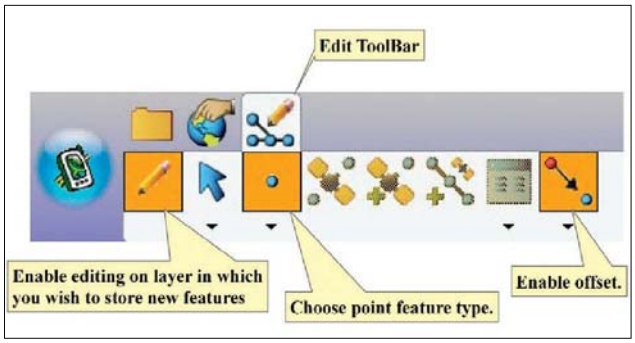

Figure 3. The Offset tab on the Point/Vertex dialogue opens when Offset Feature is enabled and a new feature is digitized, allowing for entry of the offset values.

Once you've entered the offset information, click OK on the bottom of the Point/Vertex dialogue to record the offset position. The Feature Properties dialogue will open, allowing you to enter attribute information for the newly collected feature. Once attribute information is entered, click OK to save the point feature. A new point feature should appear on your map based on the distance and direction from the reference point specified by the offset (Figure 4). Repeat this process as many times as necessary to map all desired locations. The only limitation to the number of features that may be collected from a single reference location is the ability to see the desired features from the reference location in the field. The accuracy of collected locations is dependent on the accuracy of the reference position, direction measurement, and offset distance measurement. If precision angle and distance measurements are collected, accuracy should closely mimic that of the original reference location.

Numerous other applications are available for GPS data collection; it is likely that the methodology described in this article could be adapted to these applications. If you've used another application that can apply this methodology or similar methods for mapping multiple objects referenced to a single position, we'd like to hear from you.

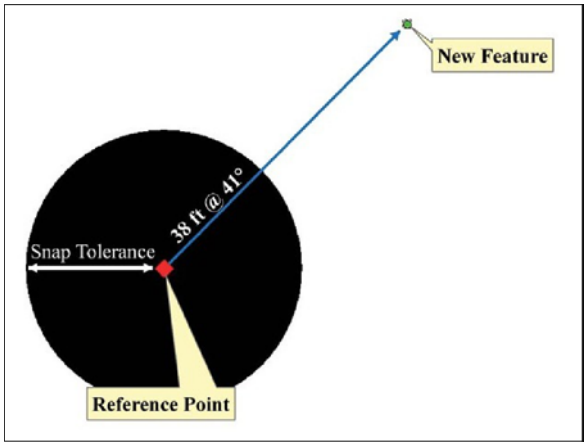

Figure 4. The reference position along with the associated snap tolerance and the new feature created by specifying a distance and direction from the reference point.

ArcPad: Mobile GIS

ArcPad is ESRI's mobile GIS application that allows users to take their GIS to the field. Data may be captured using GPS, range finders, and other peripheral devices. Traditional GPS and GIS functionality are combined in a mobile application. You'll find more information about ArcPad at www.esri.com/software/arcgis/arcpad/index.html.

Editor's note: **Do you have a GIS or GPS technique to share with other SAF members? Let me know.—Steve Wilent, (503) 622-3033, wilents@safnet.org.**

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