

GEO/EVS 423 EVS 523

Exercise 4 - Linking GPS to ArcGIS

Most applications of GIS to field work involves using ArcGIS (or similar GIS software) to access existing databases. These databases tend to be so complex that they are difficult to build, and they tend not to be rebuilt often. There is, for example, a good reason that full Census data are redone only at 10-year intervals!

There is one exception, however, that we must consider. That is the use of GPS devices to plot tracks and sample sites. Both are critical parts of field work in all field sciences, and it is important that field-oriented students know not only how to use a GPS but also how to transfer the data from a handheld unit to a GIS map.

For this exercise, students are welcome to use any handheld GPS they happen to have available to them. Most smartphones have GPS modules that can be accessed by appropriate applications. The instructions given here are for the BGES department's Garmin GPS60 and GPS62 handhelds and an application that we have discovered for Android smartphones. The recommended application for Android smartphones is GPS Essentials. It will do almost everything that the dedicated handheld will do, and it is more convenient for those of you with Android smartphones. We have not encountered equivalent software for iOS phones (i.e. Apple iPhones), but it is possible that such apps do exist.

Recording and Plotting Tracks and Waypoints

A track is a record of the trail traversed by the GPS from one place to another. You will create a track on a GPS, either around Cleveland State or in your own neighborhood and then transfer it to ArcGIS in the Remote Sensing Laboratory. To do so, follow these steps, which apply to all devices:

1. Be sure that your GPS device is set to UTM.
 - a. On the GPS60, press the "Menu" button twice to go to the main menu. Move the cursor to "Setup" using the rocker. Hit "Enter." Move the cursor to "Units" using the rocker, and hit "Enter." If the first field does not say "UTM UPS," hit "Enter" and move the cursor down to "UTM UPS" and hit "Enter" again. The Map Datum should be "WGS 84." The other fields can be pretty much anything you want, but it's easiest to use either English or Metric units consistently. When your device is set correctly, hit "Quit" twice to return to the main menu.
 - b. On GPS Essentials, click on "Settings" and scroll down to "Position Format." Click on UTM so that its radio button is picked.

2. Initiate your track.
 - a. On the GPS60, Move the cursor to "Tracks" and hit "Enter." Be sure that the "On" button next to the Track Log field is highlighted. If it isn't, move the cursor to "On" and press "Enter." First move the cursor to "Clear" and hit "Enter." When asked if you want to clear the track log, choose to do so. Then move the cursor to "Setup" and hit "Enter." Take a look at your options. For this exercise, you should probably choose "Most Often" for your interval, but you don't have to. You may want to experiment with more than one track to see what the difference is. Think about whether you want to assign points by distance or time, and choose accordingly. Be sure that the "Wrap When Full" checkbox is checked. When your track is set up, hit "Quit" until you get to the map page.
 - b. On GPS Essentials, pick the "Tracks" icon on the main GPS Essentials index page. If you want to clear your device to start fresh, pick the "tracks" icon – it's in the upper left corner of your screen and looks like a small version of the "tracks" icon from the index page. The stored tracks will be listed. If you want to delete all tracks, pick your device's

edit icon and choose “Clear.” If you want to delete an individual track, pick it, then pick your device’s edit icon and choose “Clear.” To start recording your track, pick the record button from the tracks menu – it’s the small red button on the lower right part of your screen.

3. Now start walking, driving, bicycling, or taking the bus. This part is the same for all devices.
4. If you reach a particular point that you wish to note, mark it.
 - a. On the GP60, hit “Mark” and then “Enter.” Take note of the name of the waypoint identified by your device.
 - b. On GPS Essentials, go to the app’s main index page, and pick “Waypoints.” When the window describing the location of your waypoint opens, you can pick the waypoint icon (It looks like a green blob next to a star) and enter a name for your waypoint in the dialog box that opens.
5. When you are done, save your track log.
 - a. On the GP60, return to the “Tracks” page on the GPS, and move the cursor to “Save.” Click on “Enter” and choose to save the entire track. Your track and any waypoints you have marked will be saved under the date.
 - b. On GPS Essentials, pick the stop icon (which has replaced the record icon) on the tracks index page. Verify the name of your track.
6. At this point, you can transfer your track and associated waypoints to ArcGIS.
 - a. If you used the GP60, take the device to the Remote Sensing Laboratory, and plug it into a computer on which the Garmin Trip and Waypoint Manager has been installed. Initialize the Garmin software (it is called MapSource). Click on the “Receive from Device” icon (it looks like a computer with an arrow pointing up). After a second or two it should find your device. Be sure that the “Tracks” and “Waypoints” checkboxes are checked, and hit “Receive.” When you hear the beep, you can hit “OK.” Your track will appear on the working area of the screen, with waypoints shown as flags. Save your active track as a GPX file. Click on “File” -> “Save As” on the Menu bar. Select GPX as the “Save as type:” and give your track a name. Make sure that the data are being saved with a UTM reference system and accept the defaults. ArcGIS can import GPX files.
 - b. If you used GPS Essentials, go to the tracks index page, and pick your device’s edit icon. Choose “Export.” You will be able to export your track file either as a KML file (suitable for Google Earth) or as a GPX File. Choose to save your track as a GPX1.1 file. Connect your device to a computer in the Remote Sensing laboratory and indicate that it will be connected as mass storage. Open the “My Computer” icon, and navigate to your device’s GPS Essentials storage directory. Copy your track GPX file to your X: drive.
7. Open ArcGIS, and open the toolbox. Choose the Conversion Tools -> From GPS -> GPX to Features tool, and create the track feature, using the GPX file as the input. You may need to add spatial reference data (i.e. UTM zone 17N). Add an aerial photograph of the area so that you can verify that your track is what you thought it was and that your waypoints are what you thought they were.

Recording and Plotting Sample Sites

Recording sample sites is very similar to recording tracks, except that they are individual points rather than waypoints along a polyline.

1. Insure that your GPS device is set for UTM as in step 1, above.
2. Find your first sample site. Hit "Mark" and then "Enter." Continue to do this for all other sample sites.
3. At this point, you can transfer your track and associated waypoints to ArcGIS. Take your GPS device to the Remote Sensing Laboratory, and plug it into a computer on which the Garmin Trip and Waypoint Manager has been installed.
4. Initialize the Garmin software (it is called MapSource). Click on the "Receive from Device" icon (it looks like a computer with an arrow pointing up). After a second or two it should find your device. Be sure that the "Waypoints" checkbox is checked, and hit "Receive." When you hear the beep, you can hit "OK." Your waypoints will appear on the working area of the screen as flags.
5. Save your active track as a DXF file. Click on "File" -> "Save As" on the Menu bar. Select DXF as the "Save as type:" and give your track a name. Make sure that the data are being saved with a UTM reference system and accept the defaults. ArcGIS can read DXF files.
6. Open ArcGIS, and add your waypoints as a dataset. You may need to add spatial reference data (i.e. UTM zone 17N). Add an aerial photograph of the area so that you can verify that your sample sites are what you thought they were.

Assignment

Record a track of at least 1/4 mile, either around Cleveland State University or in your own neighborhood. It should have at least 3-4 waypoints representing interesting features. Transfer the track to a GPF file, read it into ArcGIS, and show the track superimposed over an aerial photograph of the same area. Print the map.

Record at least 4-5 sample sites in the same general area in which you took your track. Transfer the track to a DXF file, read it into ArcGIS, and show the track superimposed over an aerial photograph of the same area. Print the map.

Portfolio

- 4-1 Your map of your trace of 1/4 mile or more superimposed over an aerial photograph of the same area.
- 4-2 Your map of at least 4-5 sample sites in the same general area, again superimposed over an aerial photograph