

GPX Plug-in for ArcGIS 10.x

Background

GPX is now the universal exchange format between consumer or recreational GPS devices. Modern Garmin Personal Navigation Devices (PNDs) all now store waypoints, routes, and tracks in this format so it makes sense to develop a capability to connect directly to a Garmin and pull data directly into an ArcGIS map. This Plug-in provides this access by allowing direct connection to a Garmin, or access to any GPX format saved on disk. New in ArcGIS 10.1 is a tool (Toolbox / Conversion / From GPS) that converts one GPX file to a feature, but this Plug-in has more versatility since it creates on-the-fly feature classes for track points (points, lines and areas) as well as direct exposure of the data as a data type in Catalog. This tool has been tested in ArcGIS 10.0, 10.1, and 10.2.

Installation

The installation is very simple, but there is no single click installation package. By keeping the installation a “Do It Yourself” project, it remains flexible enough to support more computer configurations. See the section on Permissions for more information.

- 1) If you are on the NPS network, grab these instructions and zip file from \\165.83.60.59\GISData\GIS\ArcGIS10.0\Applications\GPX_Plugin or on the internet from IRMA (<https://irma.nps.gov/App/Reference/Profile/2203303>)
- 2) Unzip the download file into a stable local (not network) directory. I recommend **C:\Program Files\GPX Plugin** if you have permission to write to the system folders, otherwise create a folder in your personal workspace (c:\documents and settings\loginname on XP, or c:\users\loginname on Windows 7). In between the register/unregister process, ArcGIS will look for the plug-in in the folder where it was registered. If it is deleted or moved the plug-in will cease to function.
- 3) There should be two batch files (**reg.bat** and **unreg.bat**) provided with the plug-in (**GpxPlugin.dll**). These batch files will register and unregister the plug-in with ArcGIS. They must be in the same folder as the plug-in in order to work correctly.
- 4) Run reg.bat as a user with permission to write to the ArcGIS folders. (On windows 7 right click on **reg.bat** and select **Run as administrator**)
- 5) Open ArcCatalog and browse to a folder with a GPX file or use the Add Data command in ArcMap or ArcScene to browse to a GPX file.

Requirements

This plug in has been tested in 10.0, 10.1, and 10.2 environments.

GPS devices that have been tested including the Map76CSx, Map78s and Oregon 550T series.

You will need a mini USB to USB cable to connect the Garmin to the PC running this Plug-in. If a live connection is desired, the Garmin must first be recognized by your PC as a device. This may include installing the Garmin Communicator free software from Garmin (See <http://www8.garmin.com/products/communicator/>). If you are using this Plug-in to browse previously stored GPX files on a PC, you will need to connect to folder within the Catalog window inside ArcGIS to observe the data. A brief [workflow](#) has been added to this document outlining the steps.

NOTE: A Map76Csx (no longer in production, but still a favorite Garmin device) can only store GPX data onto a microSD card and only TRACK Points. More modern Garmins (Oregon 550T, GarminMap62 or GarminMap78 series), stores all waypoints and tracks first as GPX. See the [workflow](#) section to setup a Map76CSx to store track points as GPX format.

Uninstall

- 1) Close all ArcGIS Desktop applications (ArcMap, ArcCatalog and ArcScene)
- 2) Run the unreg.bat as a user (administrator) with permission to write to the ArcGIS folders.
- 3) Delete the provided files (GpxPlugin.dll, reg.bat, and unreg.bat)

Permissions

- The plug-in file (GpxPlugin.dll) can reside in any local (not network) folder to which you have write permission.
- The plug-in does not write to any personal or system folders.
- Neither the plug-in nor the registration (on ArcGIS 10+) needs permission to read or write from the windows registry.
- The registration requires write permission to **C:\Program Files (x86)\Common Files\ArcGIS\Desktop10.0\Configuration** (this path will vary slightly based on the location of your ArcMap installation, and the version installed)

Features

- Each GPX file is a feature dataset with one or more feature classes (waypoints, routes, route points, closed routes, tracks, track points, closed tracks) depending on the data in the GPX file.
- Routes and tracks are polyline features. However sometimes, they represent a polygon boundary, so the route and track data is also provided as a polygon by connecting the first point in the route/track to the last point. This polygon representation is provided in the closed route and closed track feature classes.
- View GPX files natively in ArcCatalog and ArcMap without any conversion software.
- View all attributes and use the attributes to symbolize, filter, and label data
- Easily export the GPX files to a shapefile or geodatabase
- Drag and drop the GPS feature classes from ArcCatalog to ArcMap

- The GPX parser will not fail on improperly formatted numbers or dates. Improperly formatted numbers or date attributes will be appear in the table view as missing values (null or no value). If the missing number is a lat or long, then the shape will be empty. A record for the attributes will be present in the table view, but the record will not draw on the map.

Limitations

- Tested with ArcGIS 10.0, 10.1, and 10.2. It should work with ArcGIS 9.x, however the registration process will different. If you want to test with ArcGIS 9.x, I would love to hear your results.
- GPX data by default is in GCS WGS84 (or better known as Decimal degrees, WGS84 datum). There is a 1.3 meter difference between WGS84 and the current version of NAD83, so it is strongly advised to consider transforming your Garmin GPX data into a Shapefile or Geodatabase feature class by implementing the NAD_1983_To_WGS_1984_5 datum shifter when storing/using data in GIS and web applications.
- Time stored in the attribute table is always UTC. This is either 9 hours ahead of current local Alaska Standard time (in the winter) or 8 hours ahead of current local time in the summer. A quick rule of thumb for Alaskan users collecting data in the summer months. Any time you collect data AFTER 4:00pm in the summer, it's the next day in UTC time (AK+8 = UTC). So be aware of this time issue. For instance, depending on Garmin device, tracks will be truncated at the top of midnight and stored as a new GPX file. Collect a tracklog before and after 4:00pm in Alaska in the summer, and you will have to manage two GPX tracklog files.
- If a feature has multiple link attributes, all but the first are ignored. Plan is to have link1,..., linkN as attributes. N is determined by the feature with the most links.
- If a feature has extensions, all the extensions appear in one xml text field. It would be nice to break this down into a separate attribute for each sub-element.
- GPX 1.0 elements 'url' and 'urlname' as well as any "private" elements are not recognized as attributes.
- All the attributes declared by the GPX 1.1 schema format are displayed in table view, even if they are not used by the GPX file being viewed. The plan is to limit the attributes to just those attributes being used.
- I am currently ignoring the name and type sub-elements of the link element
- The metadata element in the GPX 1.1 schema is ignored. Hopefully I can use this data to populate ArcGIS metadata in a future release.
- The plug-in will "claim" any files with the .gpx extension. If the file does not contain valid gpx data, then the dataset will appear empty. If the file is valid, but has no waypoints, no tracks and no routes, then it will correctly appear empty. If your file appears empty, but you think the file is a valid gpx file (with data), please validate it in accordance with the instructions at http://www.topografix.com/gpx_validation.asp. If the file validates, then you have discovered a limitation in the plug in. If you can send me a copy of your file, I will try to correct the plug-in.

- Closed routes and closed tracks are not 3-D surfaces. Even though the vertices have elevation, the derived polygon has a single elevation of zero.
- ArcCatalog does not display the Type/Size/Modified date, etc for the feature classes in the GPX file. These are file attributes, which are valid for the feature dataset (however ArcCatalog only displays these attributes for feature classes). Since the feature class is not a file, ArcCatalog cannot display anything. There is no ability in the Plug-in architecture to remedy this.
- Any extensions on a trkseg element are ignored. Track segments are individual polylines in a single multi-polyline (track) feature. In this way a track can contain multiple disconnected segments, which is the intent of the GPX format. However ArcGIS only allows attributes on the single track feature, not the constituent segments.
- Since GPX files are feature datasets (i.e. they contain multiple feature classes, just like a geodatabase), you cannot drag the GPX file from windows explorer and drop it onto ArcMap, just like you cannot drag and drop a geodatabase (*.mdb or *.gdb) onto ArcMap.
- Gpx Files (and all other plug-in datasources) are not recognized by geoprocessing tools.
- Export to other formats only works in ArcMap. ArcCatalog uses a geoprocessing tool.

A Typical Workflow

This demonstrates how to observe GPX data collected as a Track on a Map76CSx device. Since waypoints are not stored as GPX format on a Map76CSx, this will demonstrate only tracks that have been designated as stored on the data card internal to the device.

Field Setup: From Main Menu, select Tracks. Select Setup. Select Data Card Setup. Check the box “Log Track to Data Card”. You will immediately see a Track GPX file being created. The naming convention is YYYYMMDD.gpx. Because this is UTC time, this will be 9 or 8 hours AFTER the Local Alaska time (winter and summer respectively).

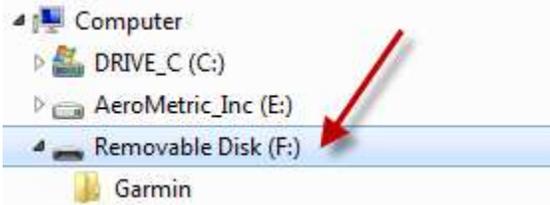
Field Collection: You would select the appropriate Tracklog collection method (Time, Distance Auto), and conduct your field survey. The GPX track points will be silently stored in the GPX file on the card AS WELL AS stored on the Garmin “harddrive” as an Active Track. Once 10,000 points are collected, then active tracklog will cease, while GPX tracklog collection continues. This is unlimited space. NOTE that new GPX files will be created at the first second after midnight on UTC time.

Now, when you finish your field collection, be sure to stop Track Collection, by selecting the OFF radio button on the main Track Log Page. IF YOU DO NOT STOP TRACK LOG COLLECTION, you are needlessly collecting erroneous data while inside a building. TURN off Tracks when done.

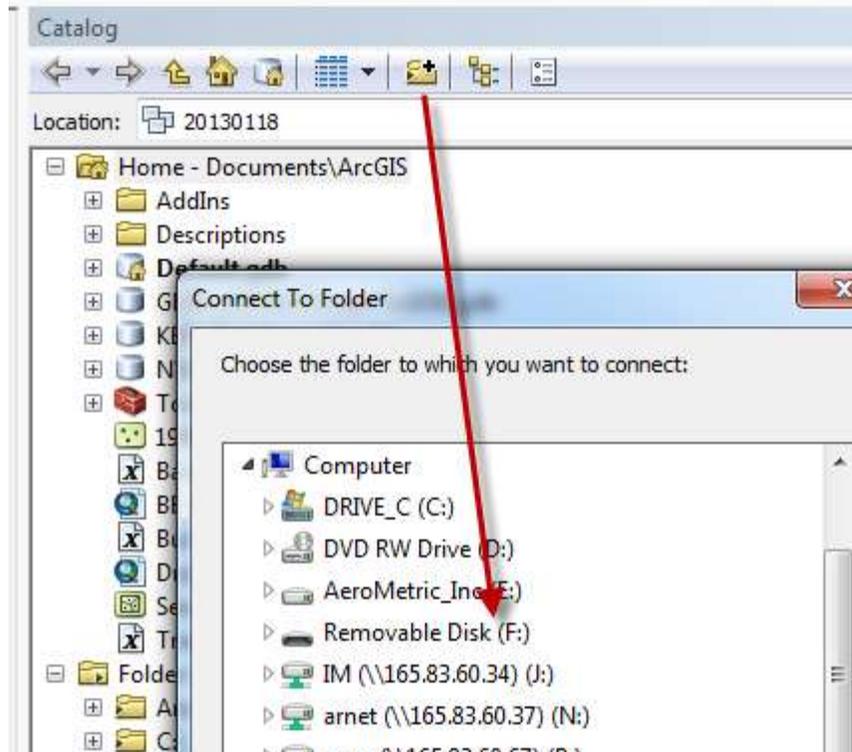
Now you are ready to run the GPX plugin in ArcGIS.

1. Open ArcGIS
2. Open the Catalog Window
3. Turn on Garmin and plug mini USB to PC
4. On the Map76CSx, press Menu menu. Select Setup.

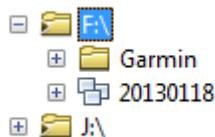
5. Select Interface and select the USB Mass Storage button on the bottom of the page.
6. Your Garmin will now be seen by your PC as an actual drive letter (F: or G: or H: etc).



7. Return to ArcMap and the Catalog Window. You must now make the appropriate drive letter as a folder connection. Click the Connect to folder icon and browse to the appropriate letter and press OK.



8. Now that ArcCatalog window can see the drive letter, expose the FeatureDataSet Icon and drag the GPX data into an ArcMap data window.



9. You will now see three feature classes TrackPoints, Tracks and Closed Tracks. Any of these "features" can be directly observed in an ArcMap Session. NOTE: As discussed above, you must recognize, GPX data is always in GCS (Decimal Degree) and WGS84 datum. When displaying these data with a NAD83 Base layers in an ArcMap dataframe, you must select the

Transformation button and select the appropriate transformation between NAD83 and WGS84. We recommend _5.

10. You can now export any of the features to a Geodatabase feature class or shapefile. By selecting Export you can immediately export these data to Alaskan Albers or UTM Zone 8 NAD83, by selecting the Data Frame button.

