Cornell University
Albert R. Mann Library

ArcGIS Tutorial: Adding Coordinate Data

Introduction

This tutorial describes how to import point data stored in a table as x y coordinates into a GIS and display it on a map. A common example is data collected with a global positioning systems (GPS) unit. This tutorial is not intended to provide instruction in GPS mapping or using a GPS. Those interested in learning more about these topics should consider enrolling in CSS 465, Global Positioning System course.

In this exercise, we'll take field-collected data downloaded from a GPS and edit it so it can be added to ArcMap. We'll preview and re-project some base map data (using ArcCatalog) so it is in the same projection as our point data. We'll use ArcMap to add our data to the base map, and edit it to produce a final map. The field-collected data are the coordinates for the locations of trees around the Cornell campus that were photographed and included in a photography exhibit by Matthew Pace ('07) at Mann Library. The base map data come from the City of Ithaca.

Copy Data from Classroom Files Server

All the data for this workshop are located on the **Classroom Files** server (accessible from any classroom computer -use the desktop shortcut to get there). It's important to have no spaces or special characters anywhere in the path directories of your data files. For this exercise,

- Open the **Classroom Files** server, and navigate to the **\GIS\ArcGIS_2** directory
- Copy **the entire GPS** folder (17 files in all) to **C:\WorkSpace** on your computer.

Part I. Data Collection and Editing

GPS configuration: It is important that datum and coordinate system of your data and the base map data are the same. Select a coordinate system and datum appropriate to your project, and make sure the GPS unit is set to collect data in your chosen coordinate system and datum. If you're using **longitude and latitude** (x y), these **should be expressed as decimal degrees (DD)** rather than degrees, minutes and seconds (DMS). You can convert DMS to DD later if you do not select DD before collecting data. Data for this exercise were collected in UTM (zone 18n), and the datum is NAD83. More information on coordinate systems can be found in ArcGIS Desktop Help.

If you use one of Mann Library's GPS units available for loan, other easier options may exist for converting and importing coordinate data directly from the unit. Information can be found on the GPS equipment page at http://mannlib.cornell.edu/equipment-software/equipment-loans/gps. Mann Library computers have software that can convert data directly to a shapefile, which can be used in ArcMap. Because users may obtain coordinate data from other units or from existing files, this tutorial takes a more generic approach and assumes that the data are in a text file or spreadsheet format and require editing to import into ArcMap.

Editing tabular data

Here are some general tips on formatting a table of GPS coordinates.

- If you're working in latitude and longitude, in the northern and western hemispheres, north latitudes are positive, and west longitudes are negative. You may need to edit values accordingly.
- If your latitude and longitude coordinates are in DM (degrees, minutes) or DMS (degrees, minutes, seconds), convert to decimal degrees (DD).
    - For DMS: DD = degrees + minutes/60 + seconds/3600
    - For DM: DD = degrees + minutes/60
- Data (i.e. coordinate) fields or columns should have a numeric format (make sure to allow an adequate number of decimal places if needed).
- Text fields or columns should have a text format.
- Shorten column headings to 10 characters or less, remove spaces and special characters and do not begin column headings with numbers.
- If you have problems importing .xls files, save tabular data in either .csv or .dbf format to import into ArcMap.

Exercise 1

In this part of the workshop, you'll edit a text file that includes downloaded GPS data, so it can be added to ArcMap. This file contains the data output from a Garmin GPS using MapSource (Garmin's software distributed with their GPS units) in columns A-S. In preparing this workshop, we added some additional information in columns T-W specific to our dataset.

1. From the Start menu, **open Microsoft Excel**

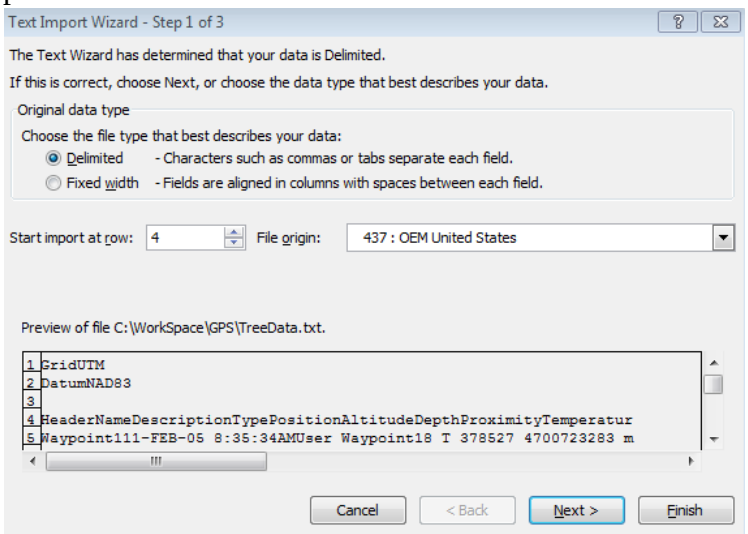
2. **Open** the **C:\WorkSpace\GPS\TreeData.txt** file. Select All Files in the lower right if you don't see it from the Open window.

A Text Import Wizard Dialogue box should open.

3. Make sure **Delimited** is selected, and

4. **Start import at row 4** (where headers begin).

5. **Click Finish.**



Notice that the UTM Zone (18) and X and Y coordinate data are in one column (Position) in this spreadsheet. To parse the coordinate data into separate columns:

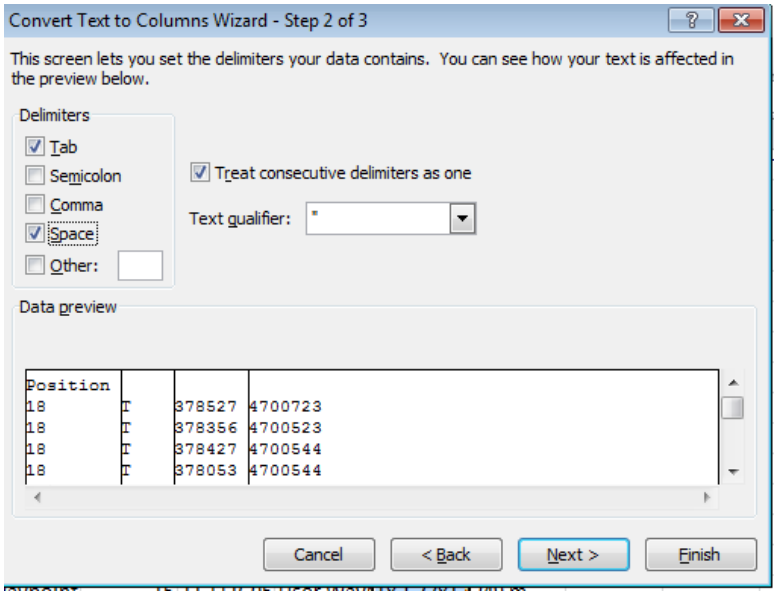
1. **Click** the top of the **Position column** (E) to highlight

2. From the **Data** tab, select **Text to Columns**

3. Select **Delimited File** Type

4. Click **Next**

5. Check the box labeled **Space**. Excel inserts dividers in between all the columns. The dialog box should look like this:



6. Click **Finish**, and **Yes** to replace contents of destination cells. Your four separated columns now are UTM zone, a column of T's, and two more columns of numbers.

7. **Rename** the column containing **6-digit numbers beginning with 37** (X, or Longitude coordinates) to **UTM_X**. Rename the column containing **7-digit numbers** beginning with 47 **UTM_Y**.

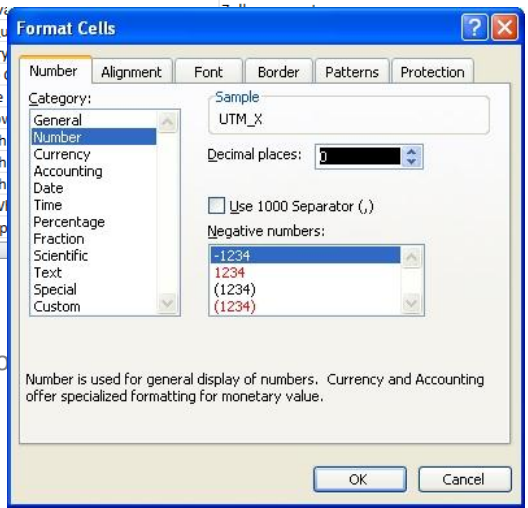
8. Delete any other extraneous columns. Select the Home tab, Highlight the rows or columns to delete then click **Delete > Delete Sheet Columns.**

9. Rename remaining headers with meaningful names of 10 characters or less, no spaces or special characters. Your table should look something like this:

	A	B	C	D	E	F	G
1	Name	Date	UTM_X	UTM_Y	Descript	CommonNm	Sci_Name
2	1	11-FEB-05 8:35:34AM	378527	4700723	Dean's Garden Japanese Maple	Japanese Maple	Acre palmatum pendula
3	2	11-FEB-05 8:41:34AM	378356	4700523	Tower Road Oak	Red Oak	Quercus rubrum
4	3	11-FEB-05 8:43:49AM	378427	4700544	Tower Road Oak	Red Oak	Quercus rubrum
5	4	11-FEB-05 8:48:48AM	378053	4700544	Ostrander Elm Tombstone	Ostrander Elm Tombstone	Ostrander Elm Tombstone
6	5	11-FEB-05 8:51:27AM	378106	4700544	A.D. White House Oak	White Oak	Quercus alba
7	6	11-FEB-05 8:51:54AM	378111	4700544	A.D. White House Oak	White Oak	Quercus alba
8	7	11-FEB-05 8:55:43AM	377980	4700671	Zelkova promenade	Zelkova	Zelkova serrata
9	8	11-FEB-05 8:56:31AM	377982	4700686	Zelkova promenade	Zelkova	Zelkova serrata
10	9	11-FEB-05 8:57:21AM	377986	4700728	Zelkova promenade	Zelkov	
11	10	11-FEB-05 8:59:45AM	377955	4700795	Arts Quad Oaks and Hickories	Arts Qu	
12	12	11-FEB-05 9:03:57AM	377764	4700728	Libe Slope Hickory	Hickory	
13	13	11-FEB-05 9:08:40AM	377729	4700417	Willard Straight Oak	White (	
14	14	11-FEB-05 9:17:25AM	378078	4700855	Baker Lab Purple European Beech	Purple	
15	15	11-FEB-05 9:20:34AM	378177	4700981	Triphammer Road Island Tree	unknov	
16	16	11-FEB-05 9:24:13AM	378320	4701158	Balch Courtyard English Elm	English	
17	17	11-FEB-05 9:24:43AM	378320	4701169	Balch Courtyard English Elm	English	
18	18	11-FEB-05 9:25:16AM	378343	4701179	Balch Courtyard English Elm	English	
19	20	11-FEB-05 9:34:27AM	378098	4700605	A.D. White House Oaks and Hickories	A.D. Wh	
20	21	11-FEB-05 9:37:41AM	378089	4700340	Statler Hotel Swamp White Oak	Swamp	

TreeData

Check and change the formats of data and text columns as needed. For both the **UTM_X and UTM_Y columns**,



10. Highlight each column, right click and select **Format > Cells**, and set format to **Number** with **0** decimal places. Set the format of all the **other columns** to **Text**.

11. Making sure you have no columns or rows highlighted, **save your file** to your WorkSpace directory as a **Excel 97-2003 Workbook (.xls) file** by choosing **File > Save As…** from the main menu and selecting the file type from the pull-down menu.

12. **Quit Excel**. You now have a table you can import into ArcMap.

Part III. Preparing a Basemap and Importing Data

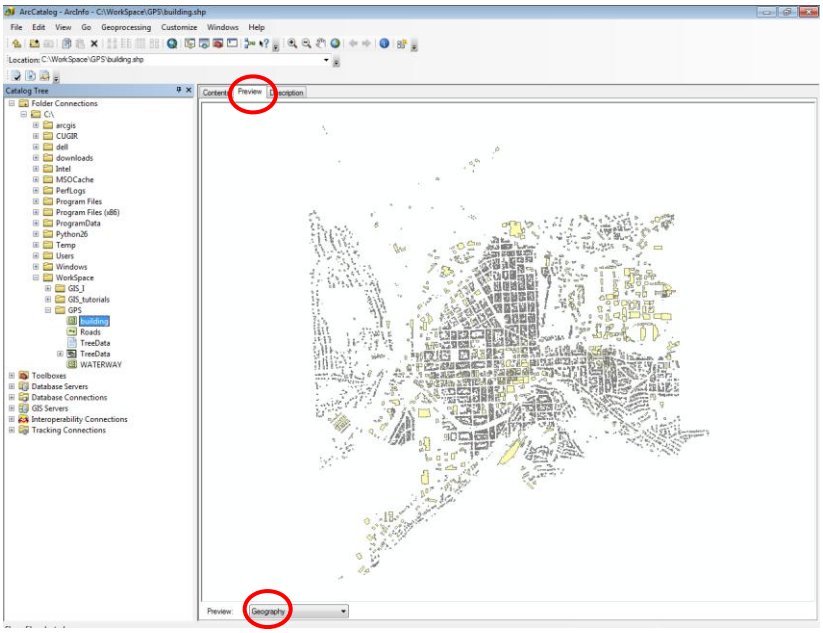
In this section we will preview and check the projection of our basemap data, reproject it to match our GPS data, and add our data to the map.

Section 1: Preview and reproject base map data in ArcCatalog

1. Start ArcCatalog (go to **START>All Programs>ArcGIS>ArcCatalog**).

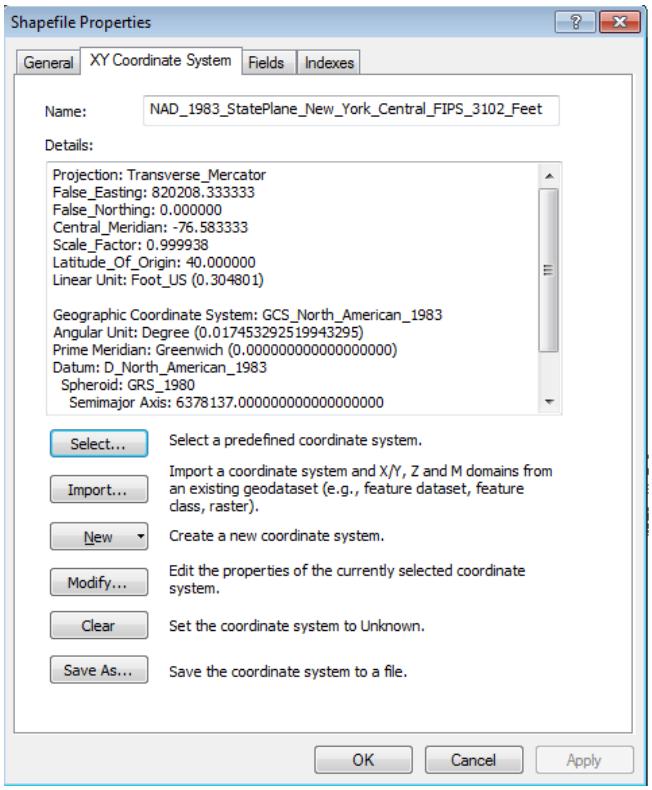
2. In the table of contents pane (left pane), navigate to your **C:\WorkSpace** folder and click on **building.shp** so it's highlighted.

3. You can see what the data looks like by selecting the **Preview** tab at the top of the right pane (select **Geography** on bottom drop down menu if needed).



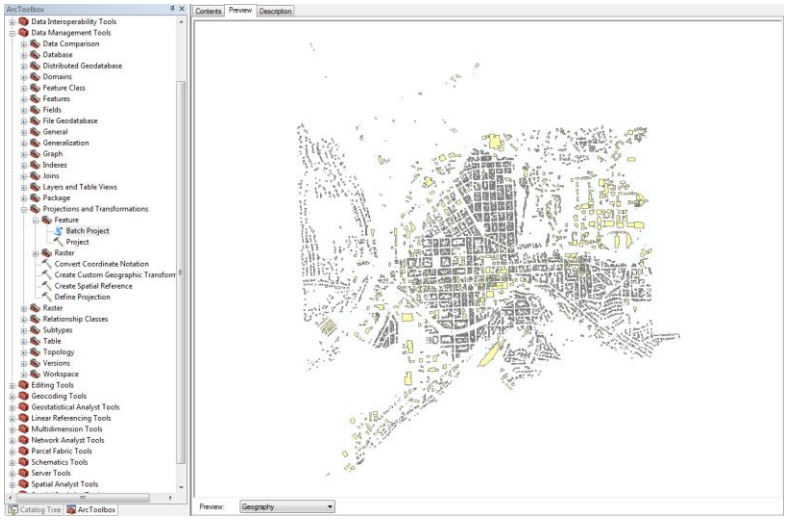
4. To check the building shapefile coordinate system:
   - Right click the **buildings.shp** file in the left pane,
   - Select Properties,
   - Select the **XY Coordinate System** tab. Note that the projection for this data (State Plane) differs from the one we used to collect our GPS data (UTM). The datum for this data set is the same as the one we used to collect GPS data: North American Datum of 1983, or NAD 83. **Click OK**.

5. Check the projection and datum of the other datasets (**roads.shp** and **waterway.shp**). They should be the same as the **building.shp** file.



We'll use the tools in ArcToolbox to reproject the basemap datasets. If not already open, start ArcToolbox by clicking on the red toolbox icon in the toolbar of ArcCatalog. This will open ArcToolbox as a new window. If not already docked to left side, double click top of ArcToolbox window to dock

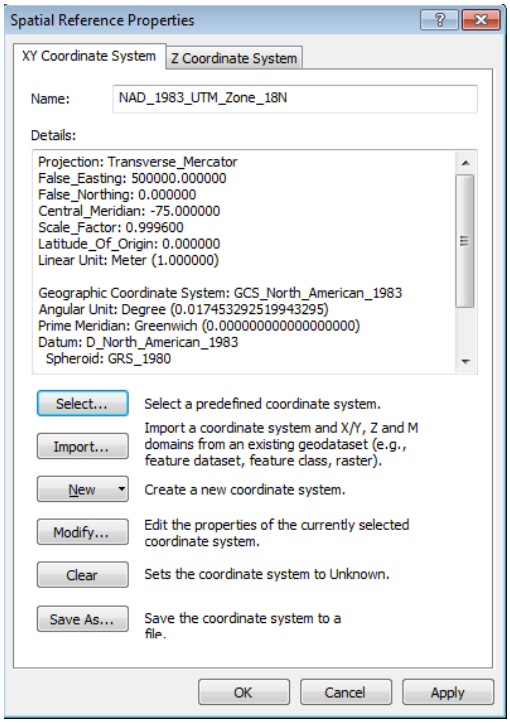
6. In the ArcToolbox pane, expand the **Data Management Tools** by clicking on the plus sign. Then expand **Projections and Transformations** > **Feature**, and select (double-click) **Batch Project**.



7. In the dialog box, for the **Input Feature** Class or Dataset, click folder icon and navigate to the **C:\WorkSpace\GPS** folder and select (holding down control key) the files you want to reproject (**building.shp, roads.shp** and **waterway.shp**). Click Add.

8. Select the **C:\WorkSpace\GPS** folder as the Output Workspace.

9. Click on the selector icon  to select the Output Coordinate System. In the **Spatial Reference Properties** dialog box, click on the **Select…** button, and make the following selections: **Projected coordinate systems**> **UTM**>**NAD 1983**> **NAD 1983 UTM Zone 18N.prj**. Then click **Add**. Your selections should now appear in the window of the dialog box.



10. Click **OK** to close, and **OK** to start the projection process. You should see a status message.

11. If you want, check the projection information for your new UTM projection datasets (auto-named **building_1.shp, Roads_1.shp** and **WATERWAY_1.shp** in ArcCatalog) by selecting the Catalog Tree tab in lower left 

12. **Quit** ArcCatalog.

Section 2: Add Spatial Data to ArcMap

1. Start ArcMap (go to **START**>**Programs**>**ArcGIS**>**ArcMap)**. Click **Cancel** or close the **Getting Started** window.
2. Maximize the window and dock (drag) any toolbars so they are out of the way.

3. To add your spatial data to the map view, click the **Add Data** button  . Navigate to your **C:\WorkSpace** folder and **select your reprojected files** (ones with trailing "**_1.shp**" suffix) (hold down the **Ctrl** key to select more than one). Once highlighted, Click Add.

4. Add your **TreeData.xls** file of GPS coordinates the same way, selecting the TreeData$ worksheet.

5. **Save** and name your map in the GPS folder.
6. Zoom in to the Cornell area using the magnifying glass tool:  .

To add your coordinates to the map,

7. Right click the TreeData$ layer in the Table of Content, select **Display XY Data**. Set the **X Field** to **UTM_X** and set the **Y Field** to **UTM_Y**.

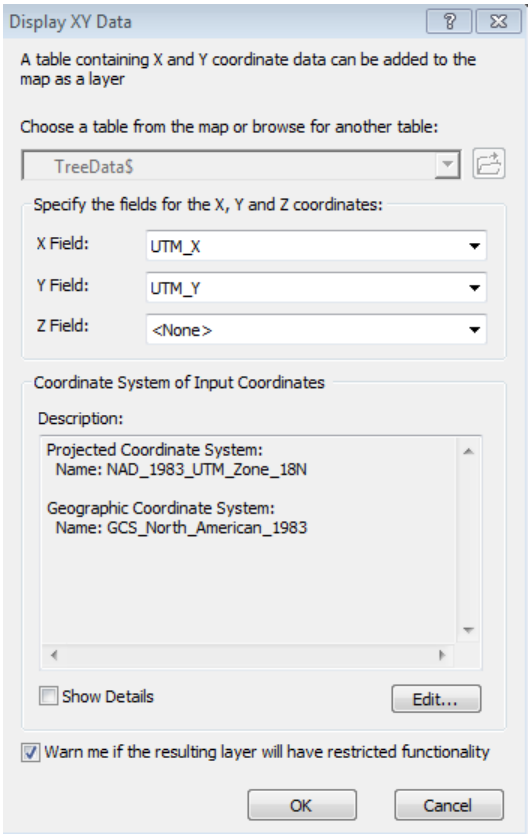
8. The coordinate system should be correct for this exercise.

9. Click **OK** to close the dialog. The **Add XY** dialog box should look like this:

10. Click **OK** to finish.

11. You will see a message stating the *Table Does Not Have an Object_ID field*. For this exercise we will be exporting to a shapefile, so Click **OK** to finish.

12. **Save** your map.



Notice your GPS points are now displayed on the basemap as *TreeData$ Events*.

While you've added the points to the map, you haven't created an actual data file that you can use in ArcMap the way you can use the other datasets. To create a geospatial data file from your points,

13. **Right-click on TreeData$ Events** and select **Data > Export Data**. You want to export **All Features**, so accept that as the default.

14. Save to your **WorkSpace\GPS** folder, give it a **name** (e.g. trees.shp), select **Shapefile** format and click OK. Say **Yes** when asked if you want to add it as a layer.

15. Right click the entire **TreeData.xls layer** and select **Remove.**

16. **Save** your map.

Part IV. Preparing the final map (optional)

In this last optional section, you'll use some of the cartographic tools in ArcMap to create a map with your GPS point data.

It would be helpful to display some type of information about the trees on the map.

1. Right-click on your trees shapefile and select **Properties**.

2. Click the **Labels** tab. Check the box that says **Label features in this layer**. In the pull-down menu under **Text string**, choose the field you want to display. The description, scientific, or common name would be a good choice. Make any changes you want to the font type, size, and color under **Text symbol**.

3. Click **OK**. If you are not satisfied with the placement of the labels, re-open the **Properties** dialog and select **Placement properties** under **Other options**. You can create a buffer around labels, choose to display overlapping labels (or not), and assign priority to features or labels for label placement.

4. Select the symbol you want to use for trees. Open the **Symbol selector** by clicking once on the trees point symbol in the table of contents. Make any changes you want to the symbol and click **OK**.

5. Experiment with changing the symbology for the other layers until you are satisfied with your map display.

6. When you are satisfied with the display, change to the **Layout view** by clicking on the layout view button at the lower left of the map window. 

7. In the layout view, look at the options available from the **Insert** menu at the top of the screen. You might want to insert a **Title**, some explanatory **Text**, or other pictures or objects. The **North arrow**, **Scale bar**, **Neatline**, and **Legend** choices will bring up a wizard or dialog box to guide you through the process of adding them to the layout view. From the File menu, select *Page and Print Setup* to adjust page size and orientation. Adjust size, extent, and orientation of the data frame as needed. Use these tools to complete your map to your satisfaction.