# **Tutorial 6 – GPS/Point Shapefile Creation**

#### The objectives of this tutorial include:

- 1. Converting GPS field collected point information into a shapefile
- 2. Creating a shapefile from a simple x,y coordinate text file
- 3. Learning how to do a point-and-polygon overlay

Before beginning the tutorial, please COPY the Lab6 archive to your server folder and unpack it.

#### Introduction

Many of the tasks below describe how to create vector data sets. Whereas last week we learned how to create **polygon features** via heads-up digitizing, this week we explore a variety of other methods available to us to create spatial data. The focus this week is **point features** and the tutorial will illustrate how you can produce them via one of two different methods. In addition, part four describes a way to combine point and polygon attribute information. This last part will be critical to this week's exercise.

#### Part 1: Creating a shapefile from raw X,Y coordinates

On occasion, you may obtain a list of point locations in the form of raw X, Y data from your GIS client and websites, and you wish to plot them on ArcMap. The following are point features distributed around Colgate campus. Your task is to create a point shapefile using these data.

ID	x	У
6	456354	4740774
8	456248	4740744
9	456188	4740680
10	456234	4740588
20	456128	4740607
21	456146	4740488
22	456055	4740545
23	456103	4740722
24	456209	4740919
29	456096	4740841
25	456290	4740946
26	456305	4740975
27	456480	4740853
28	456450	4740587
99	456459	4740762

Question: What coordinate systems do you think these points are recorded in? Why?

Important: when you obtain X,Y data like these, it is critical that you know/learn what coordinate systems the data are recorded in. Without the information, the point data may be wrongly plotted in ArcMap. Imagine what would happen if points recorded in UTM (in thousands of meters) are plotted as geographic coordinate systems (in decimal degrees or DMS). In the above table, the data are in UTM NAD83 Zone 18N.

How does one make a shapefile from such data?

Create a tab-delimited or comma-delimited text file (.csv) in Excel. I usually create three columns: an ID, the X, and the Y coordinate. I place the names of these columns in the first row of the file. You can cut and paste this information, which is in Colgate\_xy.rtf in the Lab folder, into Excel if you'd like. Or you can simply re-type the above data in Excel.

*Hint: remember that your column IDs must be shorter than ten characters, start with a letter and be alphanumeric (no spaces or symbols).* 

Open a new map document in ArcMap, and add the c\_10981028\_24\_19200\_4bd\_2008.jp2 and c\_10981024\_24\_19200\_4bd\_2008.jp2 imagery.

Click the Add Data button and navigate to the csv file that contains the x,y data.

*Hint: remember that you need to close the file in Excel before adding it to ArcMap.* 

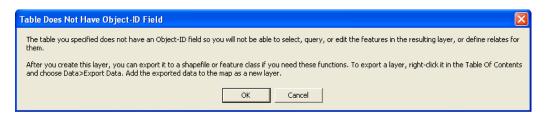
This file will now be displayed in the map legend window. You can look at the data by right-clicking on its name in the legend window and selecting the Open option.

If everything looks good, right-click on its name again and select "Display XY Data." You will be presented with a window similar to that shown below.

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Display XY Data		? 🗙
A table containing X and Y coordin map as a layer	ate data can be ad	ded to the
Choose a table from the map or bro	wse for another tab	ole:
Book1.csv		<b>–</b>
Specify the fields for the $\times$ and $\vee$	coordinates:	
× Field: x		-
Y Field: y		•
Coordinate System of Input Coord Description: Projected Coordinate System: Name: NAD_1983_UTM_Zon Geographic Coordinate System: Name: GCS_North_American_	e_18N	X
	_	
Show Details	L	Edit
Varn me if the resulting layer w	ill have restricted fu	unctionality
	OK	Cancel

Make sure the X Field is set on the name of your x coordinates and that the Y Field is set on the y coordinates. Click the edit button to set the projection to UTM NAD83 18N using the standard procedures. Click the OK button.

You may get an error message like the one below. This is not a problem, click ok.



A new file, called an Events Theme, is added to your legend and the points are displayed in the map window.

**Question:** what is an events layer? Be sure to use the help menu to learn about their use. If you don't understand make sure to ask your lab instructor.

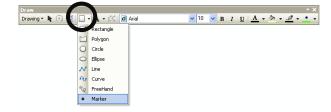
You can save this map as an official shapefile by right-clicking on the events name in the legend, selecting the data option, and then choosing export data. By saving it as a shapefile, you will be able to execute various ArcMap analysis tools.

Provide a name for this new shapefile and click OK. You will be asked whether you want to display the shapefile. Select yes. You should now see all of the points. The ID field is the point number.

### Part 2: Creating a shapefile from graphic elements

Every so often, someone calls me over to their computer and says: "I would like to create a new shapefile showing a few points that I can see on this map. Is there an easy way?" There is a new feature to ArcMap that makes this possible.

Add the "draw" toolbar to your map. This toolbar enables you to both perform cartography (as we have previously done) and add graphic elements to a map. If you click on the rectangle tool (circled below) you will see the other graphic elements that can be added.



Make sure the air photos are open in your map view. Look around the map and find 5 or 6 interesting points that you want to place in their own shapefile. Using the marker drawing tool, place points at these locations.

Note that these are added as simple graphics. In my example below I have added points for all the parking lots on campus.



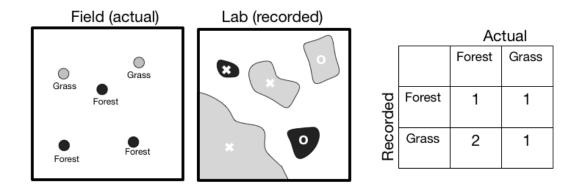
Once you have created the graphics you'd like to convert to features, select them (use shift-click or a selection box) and then right click on the title of the dataframe in the table of contents (likely entitled 'Layers' unless you have changed it. You will see an option for convert graphics to features.

A window similar to the one below will appear. Take notice of the various options that exist when using this tool (e.g. using only selected graphics, coordinate system options, and my favorite, 'delete graphics after conversion').

Convert Graphics To Features
Convert:
Point graphics
✓ Selected graphics only (3 selected)
Use the same coordinate system as:
) the <u>d</u> ata frame
O this layer's source data:
V
O the feature dataset you export the data into (only applies if you export to a feature dataset in a geodatabase)
⊙ the annotation groups in this data frame
Output shapefile or feature class:
C:\Documents and Settings\pscull\My Documents\ArcGIS\Default.gdb\Converted
Automatically delete graphics after conversion
OK Cancel

# Part 3 - Point-and-polygon overlay operations.

Sometimes it can be useful to know the attribute data for one polygon shapefile (or feature class) at specific locations defined by the points of a second shapefile (or feature class). This is a called a 'point-and-polygon' overlay operation. For instance, if we were performing an accuracy assessment of a classification we would collect field data (the truth) and we could convert those data into a shapefile (e.g. similar to Part 1 above), but we would also need to know our classified map values at the same points. Having both field-determined and lab-determined values then would enable us to build an error matrix (as discussed in class).



Add the shapefile "Stress" to your map. This is a polygon shapefile of the relative degree of stress present in the air around campus. These data have been haphazardly gathered in a completely unscientific manner over the course of the past 6 years as I have walked here and there going about my daily business. Areas identified as zone 5 are extremely stressful, whereas areas identified as 1 are low-stress. We can easily determine the stress zone of your 5 or 6 points you created in Part 2.

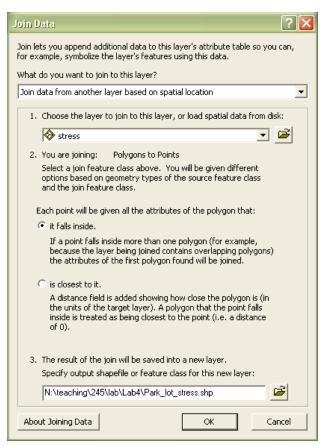
Make sure you symbolize the layer appropriately to view the data.

Question: where is the most stressful place on campus? What areas are less stressful?

In the table of contents right click on the point shapefile you created in Part 2 and select joins and relates -> join. At the top of the dialog window select 'Join data from another layer based on spatial location'. This will enable you to join the attributes from a polygon layer to a point layer.

In lab four we used this feature, but selected 'Join attributes from a table'. Your window should look similar to the one below. Change the output filename to something meaningful and click okay.

*Hint: you always right click on the layer that you want to join things to when using the join feature* 



This tool creates a new shapefile that will be added to your map. Open up the attribute table for the new shapefile. You should see the attributes from stress in your new point shapefile.

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Joi	in_Outp	ut_2						>
	FID	Shape	stress_FID	Name	FID_2	ld	StressZ	
Þ	0	Point	5		0	0	2	
	1	Point	1		3	0	1	
	2	Point	7		3	0	1	
	3	Point	2		15	0	3	
	4	Point	0		16	0	3	
	5	Point	6		17	0	2	
	6	Point	3		20	0	3	
	7	Point	4		26	0	3	
F	7	Point	4		26	0	3	

## 1. Appendix - Transferring your GPS information to the computer

<u>Should you end up using Geography's GPS units for your final project</u> the following instructions describe how to download the data you collect. This information is for future reference.

A special GPS serial communication cable and a program called *GPS Utility* are used to transfer data from the GPS unit to the computer. Using the serial cable, connect the GPS to the computer and turn on the GPS. Push the MENU button and scroll to Setup and push ENTER. Move to the NMEA option and make sure it is OFF. Also, check the baud rate and set it for 4800. These settings control the way in which the GPS communicates with the computer.

Each computer in the lab contains a program called *GPS Utility*. When you launch this program, you will see a screen similar to Fig. 1.

GPS Unitity (4.86) le GPS View Options	Window Help		
	Freeward	to GPS Utility	
IG 1			

Under the GPS menu, select setup. Make sure your settings match those shown in Fig. 2. The key settings are the GPS make/interface model, type/family, and baud rate. Click OK

Interface Setup
Choose Interface Options
GPS make/Interface mode Type/Family
Magellan 🛛 generic 🗸
Com Port number 1 Check Baud rate 4800 Check Auto save data on download Max PC-GPS clock error (secs) 999 (995 to inhis cynchronization) 99 GPS Sample time (secs) 2 Auto Track Log files per Day 24 x 1 hrs V
NMEA Send options
Prefix \$GP Decimal places 3
Time (mSecs) 100
On Connect
Tracking setup
Cancel ? Help

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FIG 2

Under the GPS menu, select Connect.

Finally, select 'download all' under the GPS menu. You will be given a confirm download window in which you should check the waypoints box (Fig. 3). Click OK. If all goes well, the points will be listed in a window similar to Fig. 4.

GPS Transfer			
Confirm DOWNLOAD from GPS			
✓ Waypoints			
Proximity Waypoints			
Routes			
Tracks			
Current Position/Time			
V OK X Cancel ? Help			

FIG 3

D         Coordinate         Alt(n)         Symbol         T[0]         Comment           0 CLN         N42'49 0970' W075'32.0300'         372.0         Default         I E           1 ATHR         N42'49 0810' W075'32.1120'         375.0         Default         I E           0 FELLED         N42'49 0810' W075'32.1220'         375.0         Default         I E           0 BDQ         N42'49 0860' W075'32.1220'         378.0         Default         I E           0 DEDQ         N42'49 060' W075'32.1220'         378.0         Default         I E           0 DEDQ         N42'49 0405' 32.1220'         378.0         Default         I E           0 DELCHP         N42'49 0405' 32.1220'         378.0         Default         I E           20FLCHP         N42'49 0405' 32.2200'         378.0         Default         I E           22CLOCK         N42'48 920' W075' 32.253' 362.0         Default         I E           22CLOCK         N42'48 960' W075' 32.2180'         353.0         Default         I E	- î
BATHR         N42'49.0810'         W075'32.1120'         375.0         Default         IE           DFEILED         N42'49.0450'         W075'32.1560'         374.0         Default         IE           DBEQ         N42'49.0450'         W075'32.1560'         374.0         Default         IE           DDEDQ         N42'49.0460'         W075'32.1220'         375.0         Default         IE           D0PLCHP         N42'49.060'         W075'32.200'         371.0         Default         IE           1BENCH         N42'48.9420'         W075'32.2530'         368.0         Default         IE           2CLOCK         N42'48.9720'         W075'32.2530'         362.0         Default         IE	- 3
FEILED         N42'49         0450'         W075'32.1560'         374.0         Default         IE           0BBQ         N42'49         960'         W075'32.1220'         375.0         Default         IE           0PLCHP         N42'49         960'         W075'32.1220'         371.0         Default         IE           1BENCH         N42'48         9420'         W075'32.2000'         371.0         Default         IE           2CLOCK         N42'48         920'         W075'32.2850'         378.0         Default         IE	
OBBQ         N42*49.9960' W075*32.1220'         375.0         Default         I E           OPLCHP         N42*49.0060' W075*32.2000'         371.0         Default         I E           IBENCH         N42*48.9420' W075*32.1850'         378.0         Default         I E           CLOCK         N42*48.9720' W075*32.2530'         362.0         Default         I E	-
OPEICHE         N42'49.0060'         W075'32.2000'         371.0         Default         IE           IBENCH         N42'48.9420'         W075'32.1850'         378.0         Default         IE           CLOCK         N42'48.9420'         W075'32.2530'         362.0         Default         IE	- 1
IBENCH         N42*48.9420' W075*32.1850'         378.0         Default         I E           2CLOCK         N42*48.9720' W075*32.2530'         362.0         Default         I E	-
2CLOCK N42'48.9720' W075'32.2530' 362.0 Default I E	-11
	-11
4CASE N42*49.1320' W075*32.2240' 344.0 Default IE	-11
4CMBLEN N42*49.1750' W075*32.1420' 348.0 Default IE	-11
42.00.00 W W12*40 1000' W075 22.1420 340.0 Default 1 E	×
	>

FIG 4

The GPS Utility software has the capacity to display your x and y locations in a variety of coordinate systems. You can do this by clicking on the button in the upper right of the table (see Figure 5).

				Info.	UTM/UPS (E/N)	WGS 84
D	Coordinate	Alt(n)	Symbol	TC	Lat-Long	<u> </u>
OLIN	18T 456355 4740774	372.0	Default	IF	Mercator	
LATHR	18T 456248 4740745	375.0	Default		<ul> <li>UTM/UPS</li> </ul>	
FELLED	18T 456188 4740679	374.0	Default	IF	1 British grid	
OBBQ	18T 456234 4740588	375.0	Default	IF	2 German grid	
OPICHP	18T 456127 4740607	371.0	Default	IF	5 Sweden User Grid D.dddddd	
1BENCH	18T 456147 4740488	378.0	Default	IF		
2CLOCK	18T 456055 4740545	362.0	Default	IF		
3STAIRS	18T 456102 4740722	353.0	Default	IF		
4CASE	18T 456096 4740840	344.0	Default	IF		
4EMBLEM	18T 456208 4740919	348.0	Default	IF		~
CODUCAU	10T 4E6200 474004E	0.010	D-f1+	тτ	D M S.ss	>
				_	Maidenhead	
					Eastings/Northings	
					<ul> <li>Cascings/Northings</li> </ul>	

FIG 5

If you simply want to save this information as a text file that can be opened and edited in Excel, select Save As under the file menu. However, there is a way to save the waypoints as a shapefile using the Save/Export Options (FIG 6). When finished, you will need to define the projection using the Arc Tools.

Save / Export / Print Options		
Filename: C:\scull\geocache.sh Save/Export/Print What Hidden Waypoint Wormal Highlighted Save/Export General DBF/SHP, DXF, MIF		Field Separator ⓒ Space ○ Comma ○ Tab
Format Shape fileset (SHP +SH Warning: Some detailed information may	HX, DBF)	
WPT BTF TBK PLT as TXT (ASCIL	Google Earth Altitude clamped to ground Altitude offset (m)	Tracks as ✓ Trackpoints ✓ Path
Magellan route mode As last opened file Meridian Evologist	NMEA options  Force WGS84 datum Name Length Add Checksum  Wpt comment	Track Raw Data ✓ Altitude ✓ Timestamp ✓ Information
Export As Close	e X Cancel	? Help

FIG 6

Make sure you have the Shapefile fileset selected. Also, deselect the "Tracks" box. If the 'Waypoints' option isn't available at the top, you may need to navigate to the 'dfb/shp, dvf, mif' tab (see circle below) and select points in the lower left in order to turn on the option to select waypoints. Click off polylines and polygons. Your window should look like Figure 7 below.

Save / Export / Print Options	X
Filename: C:\scull\geocac Save/Export/Print What Hidden V Wa Normal Highlighted Save/Export General DBF/SHP, DXF, P	aypoints Tracks Field Separator Space Comma Tab
DBF/DXF High Resolution     DBF/SHP files	Include MIF Bounds DXF
Save *.PRJ file with DBF/SHP	✓ Symbols. Size:         50         Layer Name           ✓ Text 1.         Size:         100         0
Shape (SHP)	✓ Text 2. Size: 80 Text Offset 60
Polylines     Polygons	Size/offset units Maximum extent/10000  V  Description
	Close X Cancel ? Help

FIG 7

Everything else should be fine. Click the Export As... button and provide a file name and location.