Mapping Point Locations along Drill Pad Surveys

These instructions enable you to create point shapefiles of sampling locations along a drill pad. You need to install the extension **Distance and Azimuth Tools** created by Jeff Jenness AND **Animal Movement** created by the USGS (available at http://arcscripts.esri.com/). Using MS Excel and ESRI ArcView 3.x software, you perform the following:

- in MS Excel – input field data and calculate angles/distances
- export to dBase
- in ArcView – add table as event theme
- use Distance and Azimuth extension to calculate adjusted locations and plot as point shapefiles
- use Animal Movement to create a minimum convex polygon of the drill pad

Extra instructions are included at the end to create polygon shapefiles of the drill pads.

ORIGINAL DATA

Drillpad.xls	an MS Excel spreadsheet of field data with the following critical fields: **DPNumber, Species, LeftRight, DistAlongLine, Azimuth, SampleDist, SampleAngle, UTM_N_E, Dimension, ShiftRadians, X_UTM, Y_UTM, DimX, DimY, DeltaX, DeltaY, X, Y**

CREATED DATA

Drillpad.dbf	exported spreadsheet of formatted, critical fields
StartPts.shp	shapefile created from the Drillpad.dbf Event
LinePts.shp	shapefile created from mapping points using Distance/Azimuth tool on the Samples event theme with the fields: **DistAlongLine** and **Azimuth**
SamplePts.shp	shapefile created from mapping points using Distance/Azimuth tool on the Linepts.shp theme with the fields: **SampleDist** and **SampleAngle**
EndPts.shp	shapefile created from mapping points using Distance/Azimuth tool on the Samples event theme with the fields: **DimY** and **Azimuth**

The following table should help you understand the various field attributes required for use in ArcView 3.x.

Field	Definition
DPNumber	The drill pad number; e.g. DP01
Species	Four letter code as recorded from the data sheet
LeftRight	"R" or "L" recorded from data sheet to indicate position of observation
DistAlongLine	The location along edge of drill pad
Azimuth	The compass direction walked along edge of drill pad
SampleDist	The perpendicular distance from the edge of the sample observation
SampleAngle	The perpendicular angle from the edge of the sample observation – tricky calculation!
UTM_N_E	Renaming of the original "Location UTM" field (the GPS point)
Dimension	Renaming of the original "Drill pad dimension" field
ShiftRadians	The azimuth in radians (for use in the delta calculations)
X_UTM	Extraction of the easting from "UTM_N_E"
Y_UTM	Extraction of the northing from "UTM_N_E"
DimX	Extraction of the X dimension from "Dimension"
DimY	Extraction of the Y dimension from "Dimension"
DeltaX	Change in X position through trigonometric calculation and "LeftRight"
DeltaY	Change in Y position through trigonometric calculation and "LeftRight"
X	Start (actual) easting position
Y	Start (actual) northing position

Steps in MS Excel

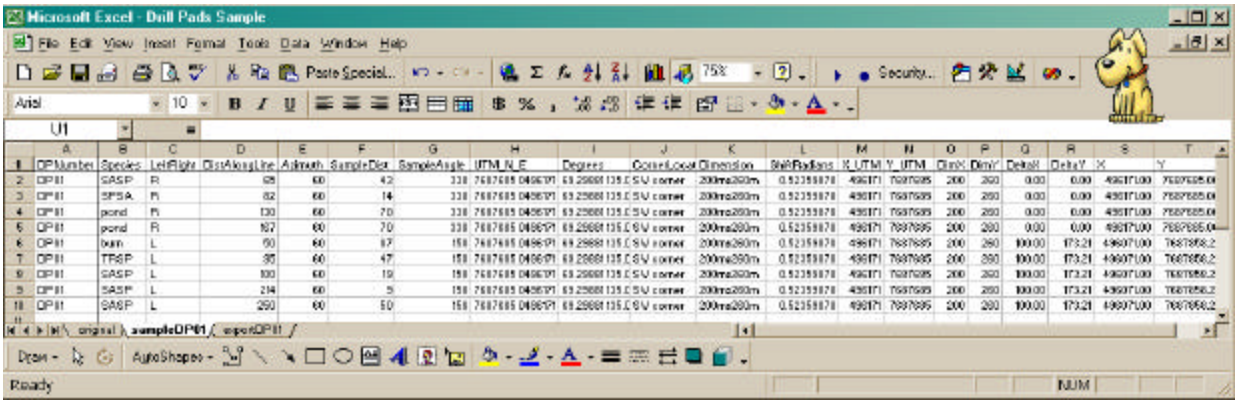
1. Open **Drillpad.xls** in MS Excel
2. Carefully check records for data quality, omissions, etc.
3. Make sure column headings do NOT contain spaces
4. Correct as necessary
5. Transpose the species data so that there is a record for each observation (this may require reading off the data sheet)

Calculate the new required fields:

6. Add the following new required fields to new columns and calculate as follows:

New Column Heading	Function
X_UTM	= VALUE(RIGHT(UTM_N_E,7)))
Y_UTM	=VALUE(LEFT(UTM_N_E,7))
LeftRight	Record this from the data sheet
SampleAngle	= IF(LeftRight="R",360-(90-Azimuth),(90+Azimuth))
ShiftRadians	= PI()/180*(90-Azimuth)
DimX	=VALUE(LEFT(Dimension,3))
DimY	=VALUE(MID(Dimension,6,3))
DeltaX	=IF(LeftRight="R",0,SIN(ShiftRadians)*DimX)
DeltaY	=IF(LeftRight="R",0,(DimX*COS(ShiftRadians)))
X	=X_UTM - DeltaX
Y	=Y_UTM + DeltaY

★ *Substitute the corresponding cell values in place of the field names!*
★ ***SampleAngle*** *equation may be different – use equations appropriate to the data at hand as the above may not always work because of the azimuth!!!*

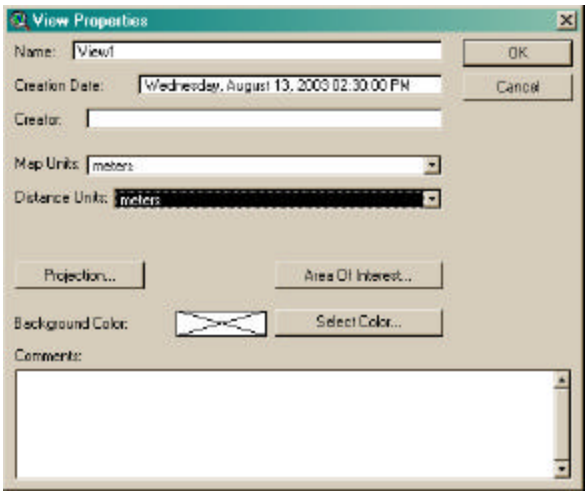


7. COPY and PASTE each formula in the rest of the corresponding column cells

Format and export to dBase:

8. Optionally, add a unique field – e.g. **ID** – and fill with sequential unique numbers
9. Optionally, copy and PASTE VALUES into a new worksheet
10. Format the columns with appropriate number types, decimals, etc.
11. SAVE the spreadsheet
12. SAVE AS a dBase file; e.g. **Drillpad01.dbf**
13. Close MS Excel

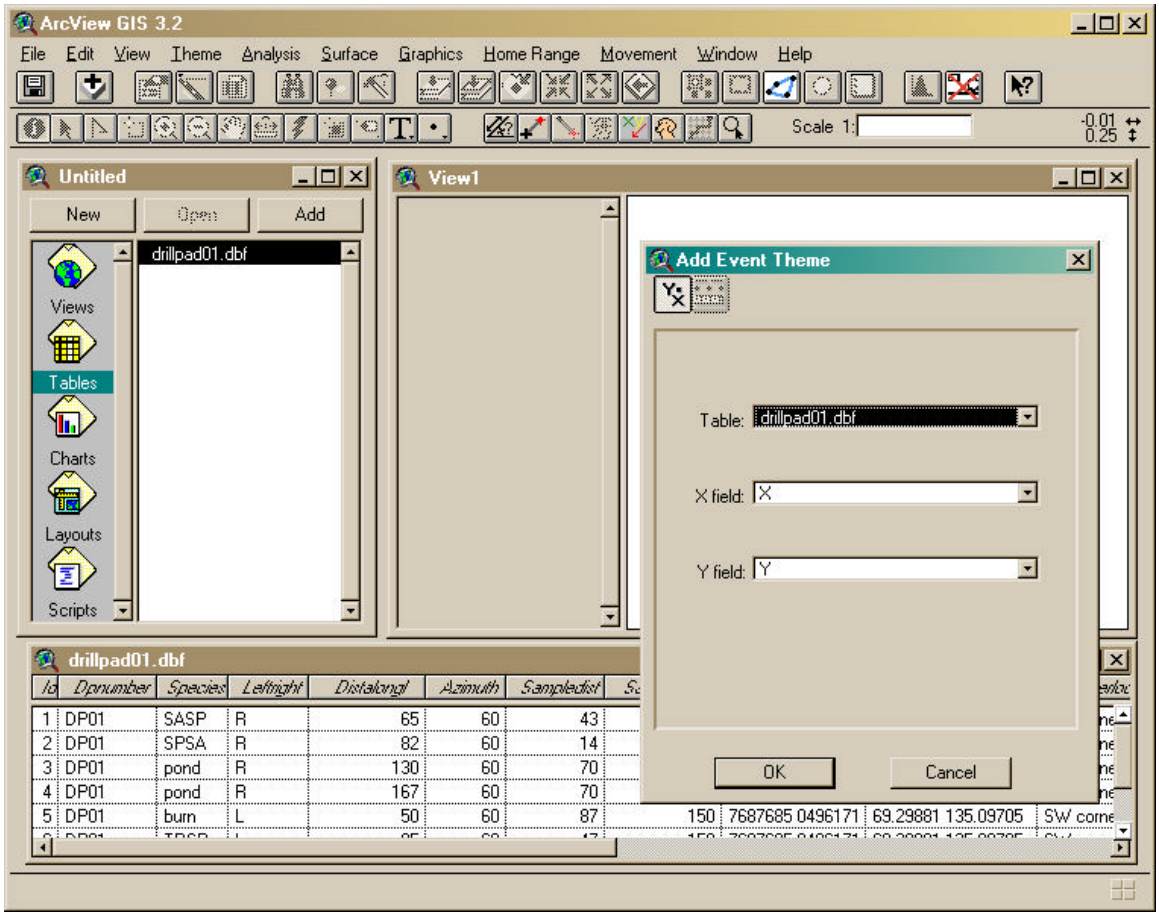
Steps in ArcView 3.x:



1. Start a new project in ArcView 3.x
2. Open a new View but do not add any data yet
3. Choose VIEW → PROPERTIES and set the Map and Distance Units = **meters**
4. Add the ***Distance and Azimuth Tools*** extension (choose FILE → EXTENSIONS and click on the tool and then click OK)

Add the points as an event theme:

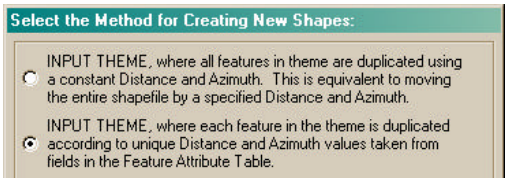
5. In the Table GUI, add the **Drillpad01.dbf** as a Table
6. In the View GUI, choose VIEW → ADD EVENT THEME
7. Select the appropriate **X** and **Y** fields for **Drillpad01.dbf** and click OK



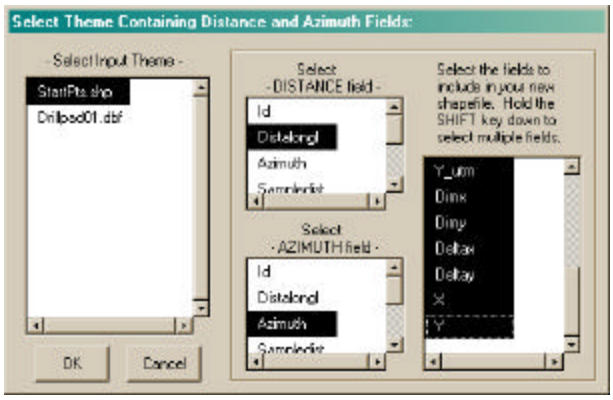
8. Turn the event theme on
9. Make the event theme active
10. Choose THEME → CONVERT TO SHAPEFILE
11. Save as **StartPts.shp**
12. Add the new shapefile to the view
13. Save the project

Create new point shapefiles for sampling locations (2-step process):

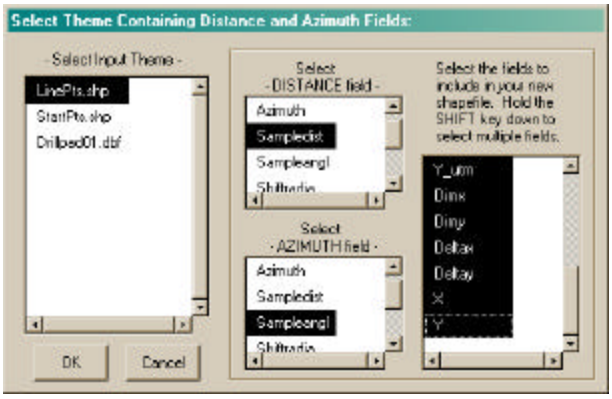
14. Click on the DISTANCE/AZIMUTH TOOLS button 



15. Select the second method for creating the new shapefile based on *unique Distance and Azimuth values taken from fields in the Feature Attribute Table*
16. Click OK



17. Select **StartPts.shp** as the input
18. Select **Distalongl** as the DISTANCE field
19. Select **Azimuth** as the AZIMUTH field
20. Hold the shift key to select all fields for output
21. Click OK
22. Type a name for the output shapefile; e.g. **LinePts.shp**
23. Click OK
24. Click on the DISTANCE/AZIMUTH TOOLS button

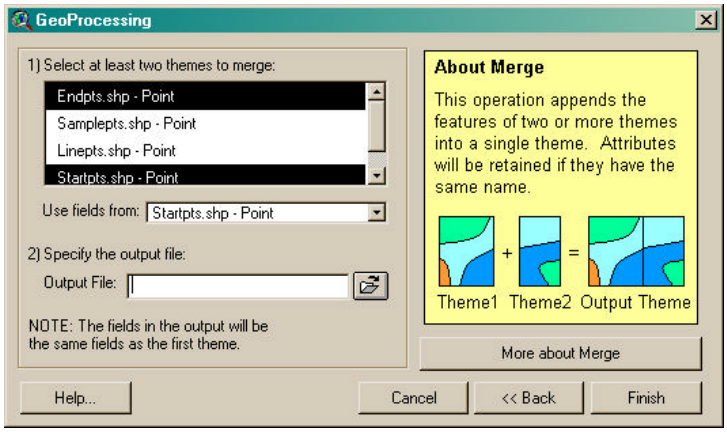


25. Using the same method (second choice), create a new shapefile using the following parameters:
    - Input Theme: **LinePts.shp**
    - DISTANCE Field: **Sampledist**
    - AZIMUTH Field: **Sampleangle**
    - Select all fields for ouput to new shapefile
    - Output name: **SamplePts.shp**
26. Click OK

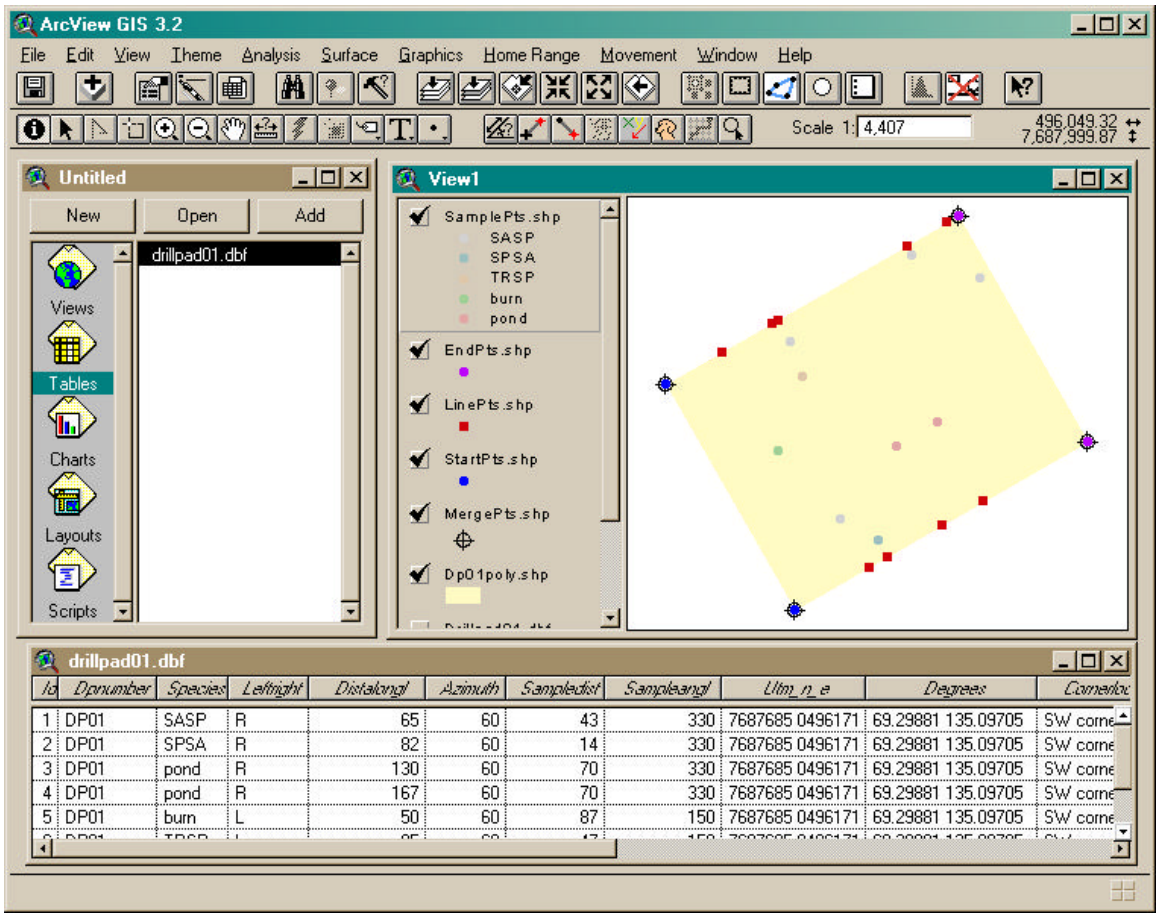
Extra Steps in ArcView

To create a polygon shapefile for each drill pad, you need start and end points merged into one file. Simply create a new shapefile of the end points from the original **Drillpad.dbf** event theme, then merge with the start points, and finally join using Animal Movement's MCP tool.

1. Add in the ***GeoProcessing*** extension
2. Click on the DISTANCE/AZIMUTH TOOLS button
3. Using the same method as above, create a new shapefile using the following parameters:
    - Input Theme: **Drillpad01.dbf**
    - DISTANCE Field: **DimY**
    - AZIMUTH Field: **Azimuth**
    - Output all fields
    - Output name: **EndPts.shp**
4. Click OK
5. Choose VIEW → GEOPROCESSING WIZARD



6. Select MERGE as the operation and click NEXT
7. Select **EndPts.shp** and **StartPts.shp** as the themes to merge (use either fields)
8. Save to a new output name: e.g. **MergePts.shp**
9. Click FINISH
10. Add and make **MergePts.shp** the active theme
11. Choose HOME RANGE → MINIMUM CONVEX POLYGON
12. Enter an output name; e.g. **DP01poly.shp**
13. Click OK



★ REPEAT for another drill pad. You may find that the geometry and angles get a little tricky with certain azimuths for the drill pads. You will need to carefully check that the plotted sample locations match with those on the data sheets – perhaps a very laborious process but not nearly so as on-screen digitizing (which is also less accurate)!