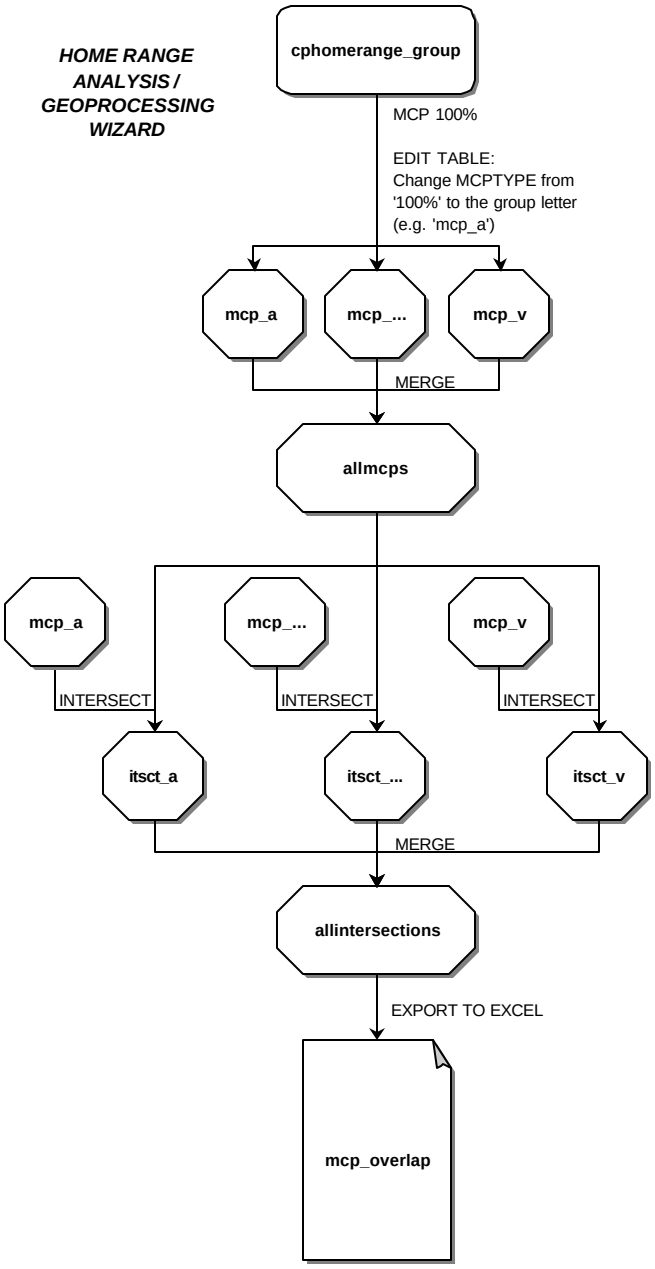
Calculating Polygon (Home Range) Overlap using ArcView 3.2

This instruction set shows you how to calculate how much of each home range polygon overlaps with other home range polygons. In the example given here, MCP home range polygons are the original data themes provided for the overlay and areal calculation to answer the following question:



How much does each home range polygon overlap with other home range polygons?

These instructions may be adapted for any application where you need to find out the area of polygons where themes intersect (overlap), but apply specifically to obtaining the proportion of home range polygon overlap. The following is meant to guide you through the six-step process of obtaining the area, using ArcView and the appropriate extensions:

A. Establish an ArcView project
B. Create MCP home range polygons from point locations
C. Edit the tables
D. Overlay/merge all MCP polygons
E. Overlay/intersect merged polygons with each individual polygon
F. Combine overlapping polygons and export table as .dbf to do calculations in Excel

Setting up the XTools default to automatically calculate area in the desired units, means that this field will be added to your theme's table each time geoprocessing occurs (very handy). Also, note that creating the areas of overlap is really done in three steps (Parts C through E).

The example file names used here are:

ORIGINAL DATA THEMES

Cphmrange_group.dbf a dBASE file containing the roost locations (points) of bat groups

CREATED DATA THEMES

MCP_a.shp a polygon shapefile resulting from the MCP home range calculation of selected Group 'a' points in Cphmrange_group.dbf

MCP_….shp a polygon shapefile resulting from the MCP home range calculation of selected Group '…' points in Cphmrange_group.dbf

All_mcp.shp a polygon shapefile resulting from the merge of all MCPs

Intersect_a.shp a polygon shapefile resulting from the overlay/intersect of MCP_a.shp with All_mcp.shp

Intersect_….shp a polygon shapefile resulting from the overlay/intersect of MCP_….shp with All_mcp.shp

All_intersect.shp a polygon shapefile resulting from the merge of all intersected MCPs

A. Establish an ArcView Project

It is assumed that you are familiar with the basics of ArcView projects and displaying data themes.

Part I: Add the required extensions

1. Establish your ArcView project (i.e. add the required data themes to a View, set the map and distance units in View Properties, etc.)
2. Choose FILE → EXTENSIONS and add the following extensions:
   Geoprocessing Wizard
   XTools
   Home Range Analysis
3. Set up the required XTools defaults:
   - map and distance units at 1, 2, and 3 – 'Meters'
   - area outputs at 4 – 'Hectares'
   - always calculate Area, Perimeter, Length at 6 – 'Yes'
4. Click Close

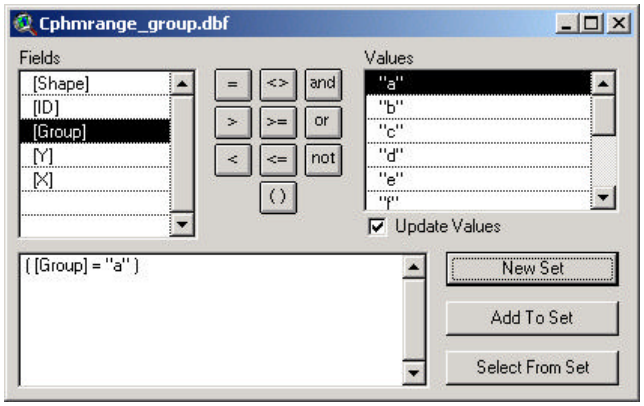
Part II: Add the tabular theme data

5. Add the **Cphmrange_group.dbf** table
6. Choose VIEW → ADD EVENT THEME…
7. Select **Cphmrange_group.dbf** and fill in the X and Y fields; Click OK

B. Create MCP Home Range Polygons from Point Locations

The theme's query function is used to select groups of points that are then turned into home ranges by connecting the outermost points using the Minimum Convex Polygon (MCP) method. You may also opt to use an alternative home range method.

1. Make the **Cphmrange_group.dbf** the active theme
2. Select each group's point locations:
   - Choose THEME → QUERY
   - Select Fields – '*Group*'
   - Double click on the "="
   - Select Values = '*a*' (or whichever group you are working on)
   - Click on New Set



3. Choose HOME RANGE → MCP 100%
4. Rename the newly created polygon shapefile, e.g. **Mcp_a.shp**

> *You can **rename** a shapefile by different methods:*
> *Choose THEME → CONVERT TO SHAPEFILE… and follow the prompts*
> *OR*
> *Delete the theme from the view and choose FILE → MANAGE DATA SOURCES… then select the file and click on the Rename button*
> *(Remember to add this renamed theme back to your view!)*

5. Repeat steps 2 through 4 until all groups have a home range created
6. Choose THEME → CLEAR SELECTED FEATURES

C. Edit the Tables

Adding the MCP group name to each of the tables at this early stage will help later in identifying the home ranges that intersect (overlap) with each other.

1. Make **Mcp_a.shp** the active theme
2. Choose THEME → TABLE…
3. Choose TABLE → START EDITING
4. Click on the Edit Tool and then click in the *Mcptype* cell (where it says 100%)
5. Change '100%' to '*mcp_a*' (i.e. the name of the group)
6. Choose TABLE → STOP EDITING
7. Save edits – '*Yes*'
8. Close the table
9. Repeat 1 through 9 for each of the home ranges

D. Overlay/Merge All MCP Polygons

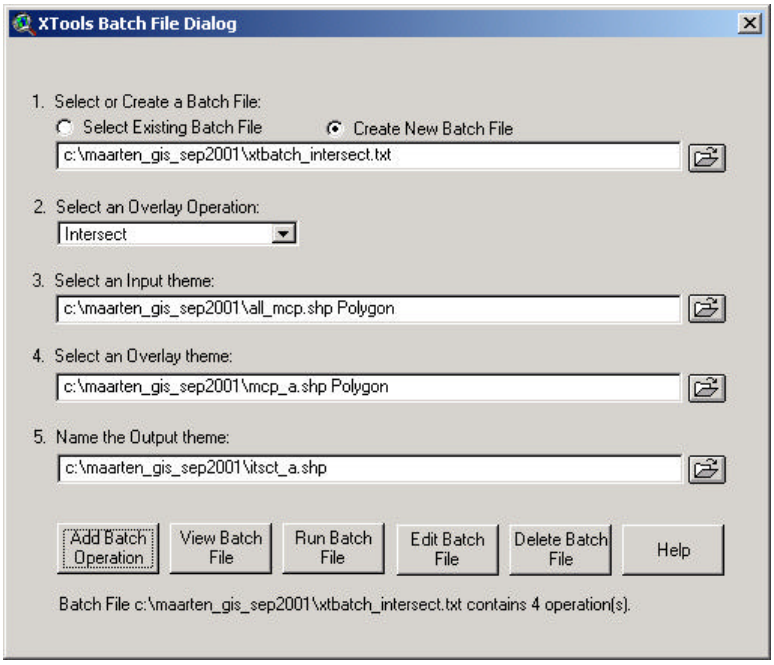
Combining all the MCP polygons into one theme makes it easier to automate the intersection overlays in Part E.

1. Choose VIEW → GEOPROCESSING WIZARD…
2. Select *Merge themes together*; Click Next
3. While holding the SHIFT key (for multiple selections) select **Mcp_a.shp** through **Mcp….shp** as the input themes; Click OK
4. Specify a directory and name for the new polygon theme that will be generated (e.g. **All_mcps.shp**); Click Finish

E. Overlay/Intersect the Merged Polygons with Each Individual Polygon

You may use the Geoprocessing Wizard to intersect each polygon with the **All_mcps.shp** theme, but this can only be done one at a time. XTools provides a batch overlay that will speed this step up.

1. Choose XTOOLS → XTOOLS BATCH OVERLAY
2. Click on Create new Batch File



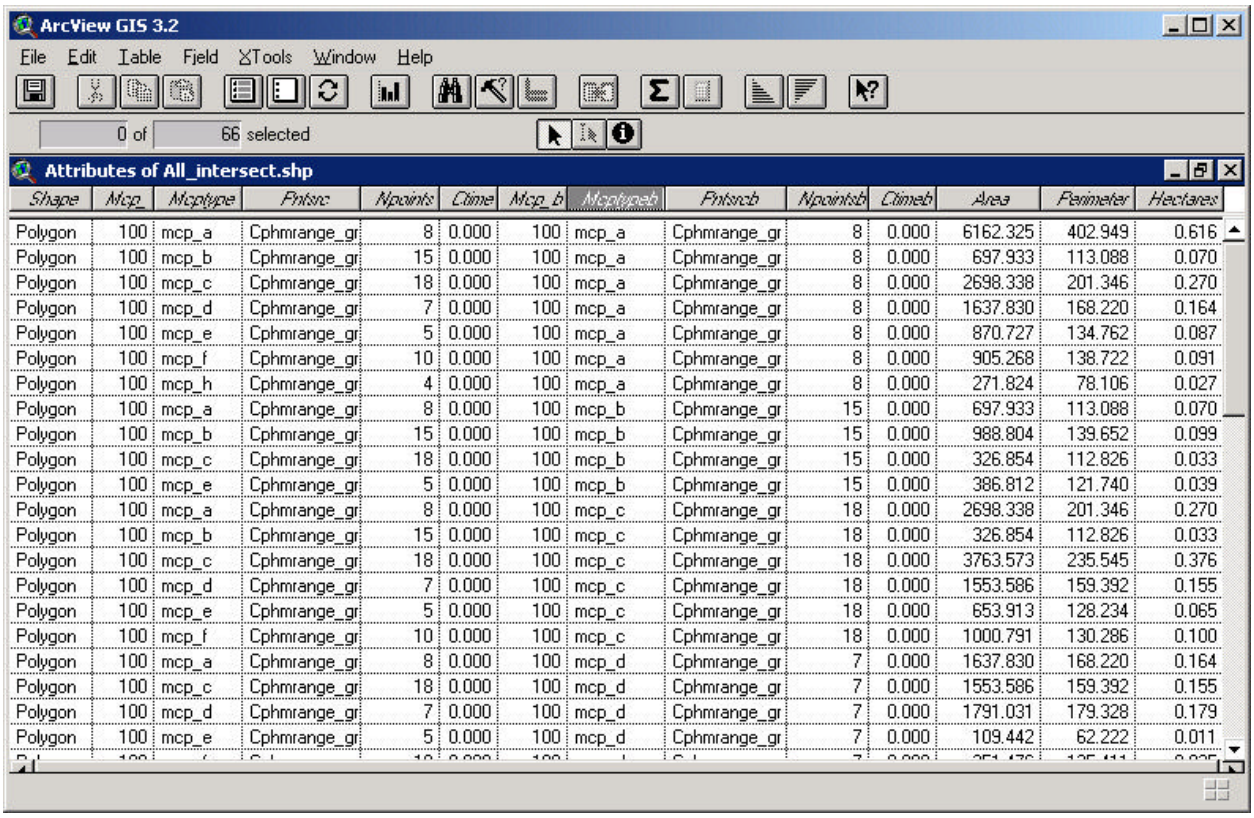
3. Specify a directory and name for the new batch file that will be created (e.g. **XTBatch_intersect.txt**)
4. Select input theme – **All_mcps.shp**
5. Select overlay theme – **Mcp_a.shp**
6. Specify a directory and name for the output theme (e.g. **Itsct_a.shp**)
7. Click Add Batch Operation
8. Repeat from 5 but change the overlay and output theme names until all MCP themes have been intersected

Click on Help if you need more information on batch overlays in XTools; Click on View Batch File if you want to check it; Open the text file in Notepad if you need to change anything

9. Click on Run Batch File

F. Combine Overlapping Polygons and Export Table as .dbf to do Calculations in Excel

1. Choose VIEW → GEOPROCESSING WIZARD…
2. Select *Merge themes together*; Click Next
3. Select **ltsct_a.shp** through **ltsct….shp** as the input themes; Click OK
4. Specify a directory and name for the new polygon theme that will be generated (e.g. **All_intersections.shp**); Click Finish
5. Make **All_intersections.shp** the active theme
6. Open the table (choose THEME → TABLE…)
7. Choose FILE → EXPORT…
8. Select your preferred export format (dBASE, INFO table, Delimited Text)
9. In the next menu assign a directory and name for the table file that will be generated; Click OK



Shape	Mcp_	Mcptype	Pntsrc	Npoints	Climate	Mcp_b	Mcptypeb	Pntsrcb	Npointsb	Climateb	Area	Perimeter	Hectares
Polygon	100	mcp_a	Cphmrange_gr	8	0.000	100	mcp_a	Cphmrange_gr	8	0.000	6162.325	402.949	0.616
Polygon	100	mcp_b	Cphmrange_gr	15	0.000	100	mcp_a	Cphmrange_gr	8	0.000	697.933	113.088	0.070
Polygon	100	mcp_c	Cphmrange_gr	18	0.000	100	mcp_a	Cphmrange_gr	8	0.000	2698.338	201.346	0.270
Polygon	100	mcp_d	Cphmrange_gr	7	0.000	100	mcp_a	Cphmrange_gr	8	0.000	1637.830	168.220	0.164
Polygon	100	mcp_e	Cphmrange_gr	5	0.000	100	mcp_a	Cphmrange_gr	8	0.000	870.727	134.762	0.087
Polygon	100	mcp_f	Cphmrange_gr	10	0.000	100	mcp_a	Cphmrange_gr	8	0.000	905.268	138.722	0.091
Polygon	100	mcp_h	Cphmrange_gr	4	0.000	100	mcp_a	Cphmrange_gr	8	0.000	271.824	78.106	0.027
Polygon	100	mcp_a	Cphmrange_gr	8	0.000	100	mcp_b	Cphmrange_gr	15	0.000	697.933	113.088	0.070
Polygon	100	mcp_b	Cphmrange_gr	15	0.000	100	mcp_b	Cphmrange_gr	15	0.000	988.804	139.652	0.099
Polygon	100	mcp_c	Cphmrange_gr	18	0.000	100	mcp_b	Cphmrange_gr	15	0.000	326.854	112.826	0.033
Polygon	100	mcp_e	Cphmrange_gr	5	0.000	100	mcp_b	Cphmrange_gr	15	0.000	386.812	121.740	0.039
Polygon	100	mcp_a	Cphmrange_gr	8	0.000	100	mcp_c	Cphmrange_gr	18	0.000	2698.338	201.346	0.270
Polygon	100	mcp_b	Cphmrange_gr	15	0.000	100	mcp_c	Cphmrange_gr	18	0.000	326.854	112.826	0.033
Polygon	100	mcp_c	Cphmrange_gr	18	0.000	100	mcp_c	Cphmrange_gr	18	0.000	3763.573	235.545	0.376
Polygon	100	mcp_d	Cphmrange_gr	7	0.000	100	mcp_c	Cphmrange_gr	18	0.000	1553.586	159.392	0.155
Polygon	100	mcp_e	Cphmrange_gr	5	0.000	100	mcp_c	Cphmrange_gr	18	0.000	653.913	128.234	0.065
Polygon	100	mcp_f	Cphmrange_gr	10	0.000	100	mcp_c	Cphmrange_gr	18	0.000	1000.791	130.286	0.100
Polygon	100	mcp_a	Cphmrange_gr	8	0.000	100	mcp_d	Cphmrange_gr	7	0.000	1637.830	168.220	0.164
Polygon	100	mcp_c	Cphmrange_gr	18	0.000	100	mcp_d	Cphmrange_gr	7	0.000	1553.586	159.392	0.155
Polygon	100	mcp_d	Cphmrange_gr	7	0.000	100	mcp_d	Cphmrange_gr	7	0.000	1791.031	179.328	0.179
Polygon	100	mcp_e	Cphmrange_gr	5	0.000	100	mcp_d	Cphmrange_gr	7	0.000	109.442	62.222	0.011

Note: ***Mcptype*** indicates the home range polygon that overlaps with ***Mcptypeb*** home range polygon. For example, you can see that in the first record **mcp_a** (***Mcptype*** field) overlaps with **mcp_a** (***Mcptypeb*** field) and has an area of 6162.325 sq m. Of course **mcp_a** overlaps with itself and this information tells you the total area of **mcp_a**. In the second record **mcp_b** overlaps with **mcp_a** and has an area of 697.933 sq m. Dividing the ***Area*** field by the area of ***Mcptypeb*** (where the polygon intersects with itself or obtained from the *Attributes of Mcp_all.shp* table) provides you with the % overlap.