HRE: The Home Range Extension for ArcView™

(Beta Test Version 0.9, July 1998)

Tutorial Guide

Angus P. Carr and Arthur R. Rodgers

Centre for Northern Forest Ecosystem Research

Ontario Ministry of Natural Resources

Table Of Contents

Introduction

Welcome to the tutorial for the Home Range Extension (HRE) for ArcView. This tutorial will take you through a typical session of home range analysis. The data for this tutorial came on the distribution diskette, or in the archive.

The tutorial is organized as a series of exercises. Each exercise is a coherent set of activities you are likely to need;

Exercise 1 is a description of how to get your data into ArcView.

Exercise 2 describes how to explore and analyze animal movements.

Exercise 3 is a description of how to create polygons to represent animal home ranges.

Exercise 4 describes how to analyze the polygons produced in Exercise 3 to produce reportable results.

What this tutorial is

This tutorial is a step-by-step walkthrough of a session of home range analysis, using the HRE. It should be easy to follow. Reference is made to the user manual that accompanied the software (Rodgers and Carr 1998), so you will be more able to relate the material here to the software manual.

What this tutorial isn't

This tutorial is not an introduction to home range analysis, wildlife studies, ArcView, Geographical Information Systems, Windows (95 or NT), or anything other than the HRE software.

Who should follow the tutorial

This tutorial is directed at first-time users of the HRE. Users of the HRE are expected to understand basic wildlife telemetry issues, and what a home range is. Since the use of geographical information systems (GIS) is not completely widespread among the wildlife research community, some basic concepts will be discussed. The previous use of ArcView is not expected. If you have used ArcView before, so much the better.

Further Reading

ESRI® (1996) "Using ArcView GIS", will help you understand the software package upon which the HRE has been built. It is recommended reading for anyone who has not used a GIS, and recommended skimming for previous users of a GIS. It covers basic concepts and software-specific material quite well.

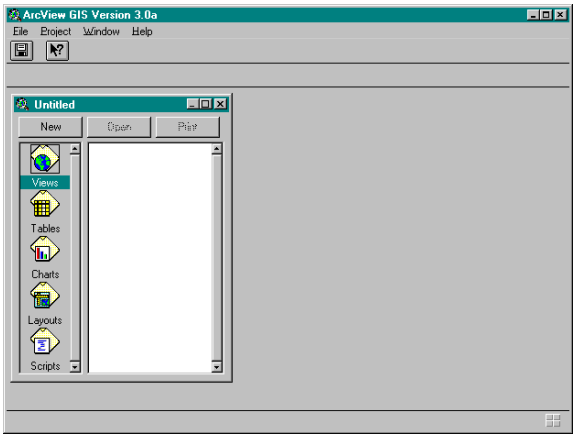
White and Garrott (1990), "Analysis of wildlife radio-tracking data" reviewed most methods of home range analysis and their limitations. Recent kernel methods are described in detail by Silverman (1986), "Density estimation for statistics and data analysis". See the references cited in the HRE User's Manual (Rodgers and Carr 1998) for additional sources of information.

Exercise 1 - Starting a Project

In this exercise, we will discuss the starting point with any software: "How do I get my data in?" The software has been installed, and seems to run… but now what does it do?

Open a Project, Load HRE

Double click on the ArcView icon on your desktop, or launch ArcView from the Start Menu. The screen you see will look more or less like this:



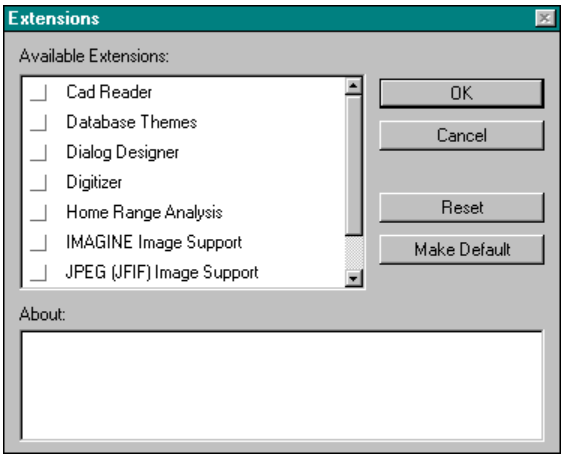
You must pay attention to three main screen elements here. The *Menu Bar* contains the menus, like the File menu, Project menu, etc. Whenever you open a window in ArcView, the menu bar changes to reflect the context of the application. New menus might appear, new menu items might appear, or existing menu items might be made available when they were not before.

The second screen element to keep an eye on is the button bar. This is immediately below the menu bar. It is also context-sensitive. In this picture, there are two items on it: *Save Project* () and *Context Help* ().

The third screen element shown here is the Project window. This is the document you will open, save, and work in. Eventually, it will contain references to information about where an animal has been, what habitat is present, and any other information you choose to manipulate within the Project. An important thing to remember is that a Project file contains references to information, but it does not contain very much information itself. This will be clearer by the end of the exercise.

Within the Project window, there are five icons. These represent the various types of data representations available in ArcView. We will usually work with a View. A View shows information to the user in a way that is intended to be manipulated, looked at, and queried. A Table shows information in a tabular form, and can be manipulated and queried too. Charts offer a method of presenting data in a graphical form. A Layout is intended for preparing maps with all the associated marginalia, using Views, Tables, or Charts as map elements. Scripts are used to automate procedures and create new abilities for ArcView.

When you open ArcView without a Project, only the default extensions are loaded. That probably does not include the Home Range Extension (HRE). You should add the HRE to the collection of loaded extensions so that the commands are available in ArcView. Choose *Extensions* from the *File* menu. A dialog will pop up, more or less like this:



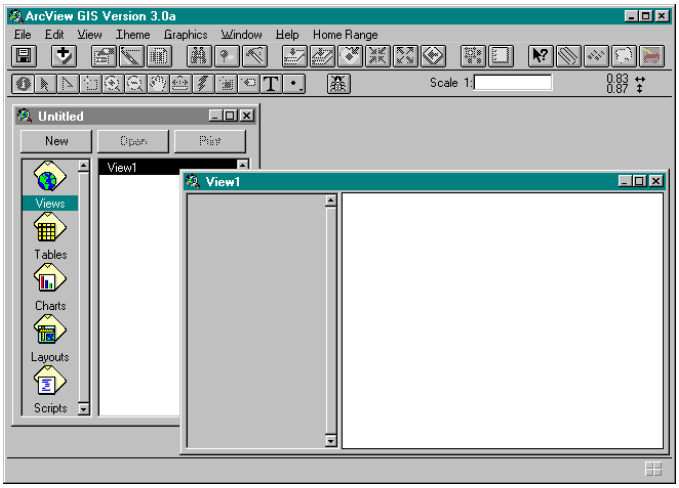
To find out more about an extension, click its name. To enable an extension, click the small box to the left of the name. A check mark will appear. If you would like the set of extensions you have chosen to load every time you load ArcView, click *Make Default*. For now, click the box next to *Home Range Analysis* and then click *OK*.

What to do:

1. Open ArcView, either from the desktop, or the Start menu.
2. Choose *Extensions* from the *File* menu. In the dialog that appears, choose the *Home Range Analysis* option. Click OK.

Create a New View

Our Project needs a View so we can look at data from the tutorial data set. Creating a new View is quite easy. Click the *View* icon in the Project window, and then click the *New* button. Your ArcView window will resemble this:



A new screen element has appeared. Immediately below the button bar, the tool bar is now populated by a collection of tools. Tools look like buttons, but they are different. Buttons act immediately. Tools require further user interaction. For instance, the *Save Project* () button will save the Project as soon as you click it (try it). The *Zoom In* () tool will wait for you to click in the main part of the View. The other difference between the two is that a tool will remain activated after you click it, whereas a button will act once and then turn off.

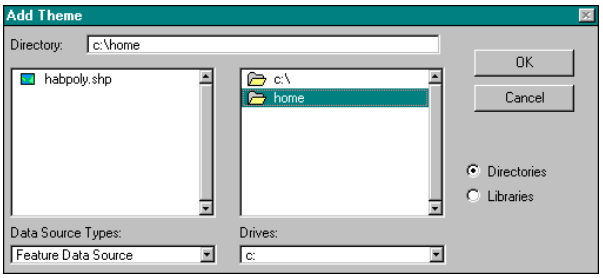
You should stop now and look at all the new buttons on the button bar and the tools on the tool bar. Take the time to wave your mouse slowly across every button or tool. A yellow "tool tip" will pop up to describe the button or tool. Another message shows up in the message bar at the bottom of the screen. The same can be done with the menus.

What to Do:

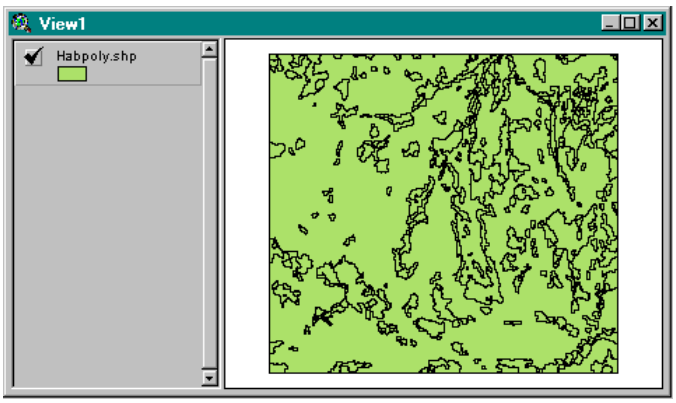
1. Create a new View by clicking the *View* icon in the Project window, then click the *New* button.

Add a Theme (Habitat Polygons)

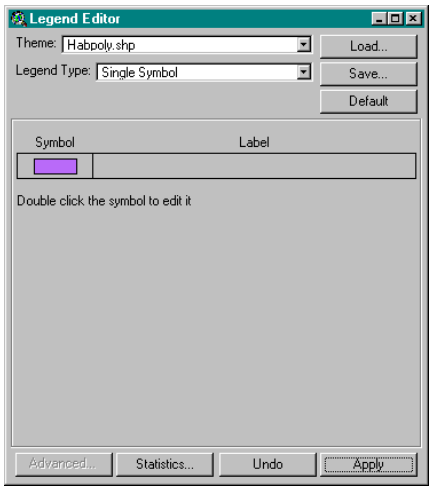
Let's put some stuff in the View. First, we'll use the normal ArcView way to do it, using the *Add Theme* () button. Click the *Add Theme* () button, and a dialog box will pop up:



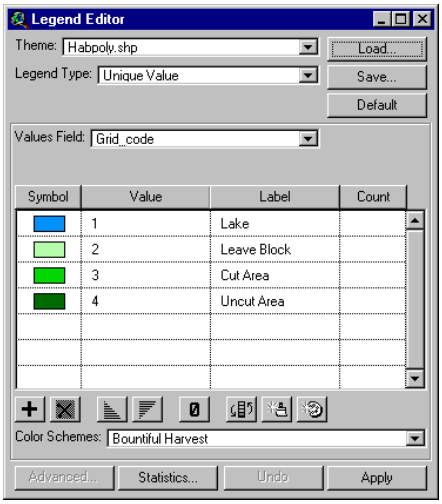
Find the Theme "habpoly.shp" in the list. The install Script for the HRE announced where the sample data files were installed. If you don't know where "habpoly.shp" is, then you could use the Find function on the Windows Start menu. Once you select "habpoly.shp", click the *OK* button. The new Theme will appear in the View. Once it does, click the small box beside the word "habpoly.shp" to make the Theme visible:



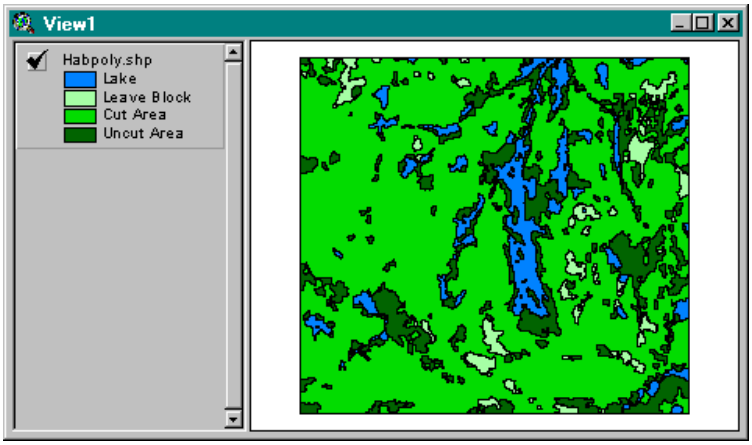
"That's all nice, but what does this map show?" you might ask. Or "Why are all the polygons the same colour?" ArcView hasn't been told what the polygons represent. It just has a set of lines. The Theme needs a Legend that describes to the user what is what. You could make a Legend yourself, but there is a Legend for this Theme in the sample data. Click the *Edit Legend* () button, which will pop up the Legend Editor:



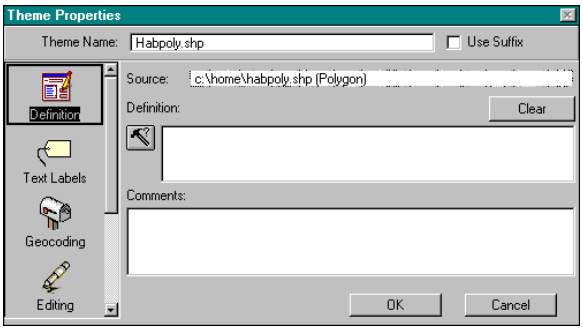
Click the *Load* button in the Legend Editor. A dialog box similar to the previous one will pop up. Find the file "habpoly.avl" and click *OK*. Another box will pop up. Click *OK* there too. The corresponding Legend for "habpoly.shp" now appears in the Legend Editor dialog box:



Click *Apply* in the Legend Editor to apply the Legend to the Theme in the View. Your Theme should now be pretty colours of green and blue to help you understand what the polygons are:



Legends are very important in ArcView. Get to know the Legend Editor. Poke around in it. You won't break anything by just pushing a few buttons. Try double-clicking a colour box to see what happens. Remember to press the *Apply* button. Once you are happy you understand the Legend Editor, you can reload the colours for "habpoly.shp" by repeating the steps above to load a Legend.



"habpoly.shp" is not a very descriptive title. To change the name of the Theme, click the *Theme Properties* () button to get the properties for the "habpoly.shp" Theme. In the *Theme Name* box, type an appropriate name, like "Vegetation". Click *OK*. The name of the Theme in the Legend has changed.

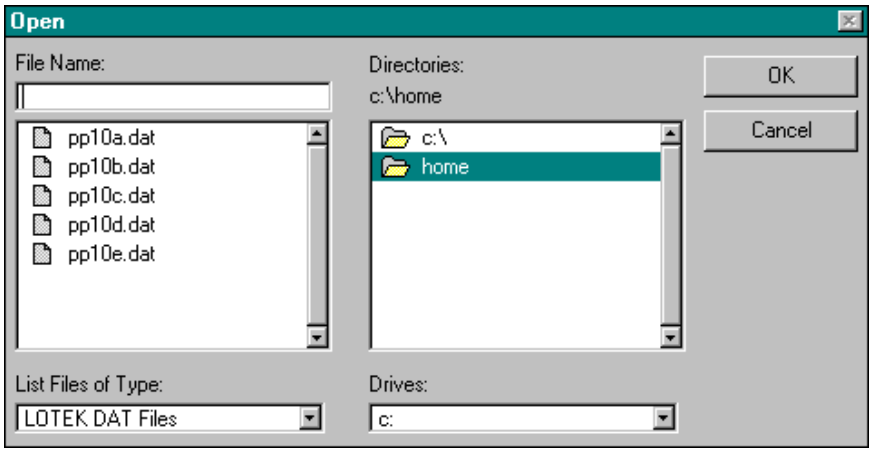
What to Do:

1. Click the *Add Theme* () button and find "habpoly.shp".
2. Click the *Edit Legend* () button, then the *Load* button. Load "habpoly.avl". Click *OK*, then *OK* again. Click *Apply*.
3. Click the *Theme Properties* () button, change the entry in *Theme Name*, and click *OK*.

Add fix data from DAT files

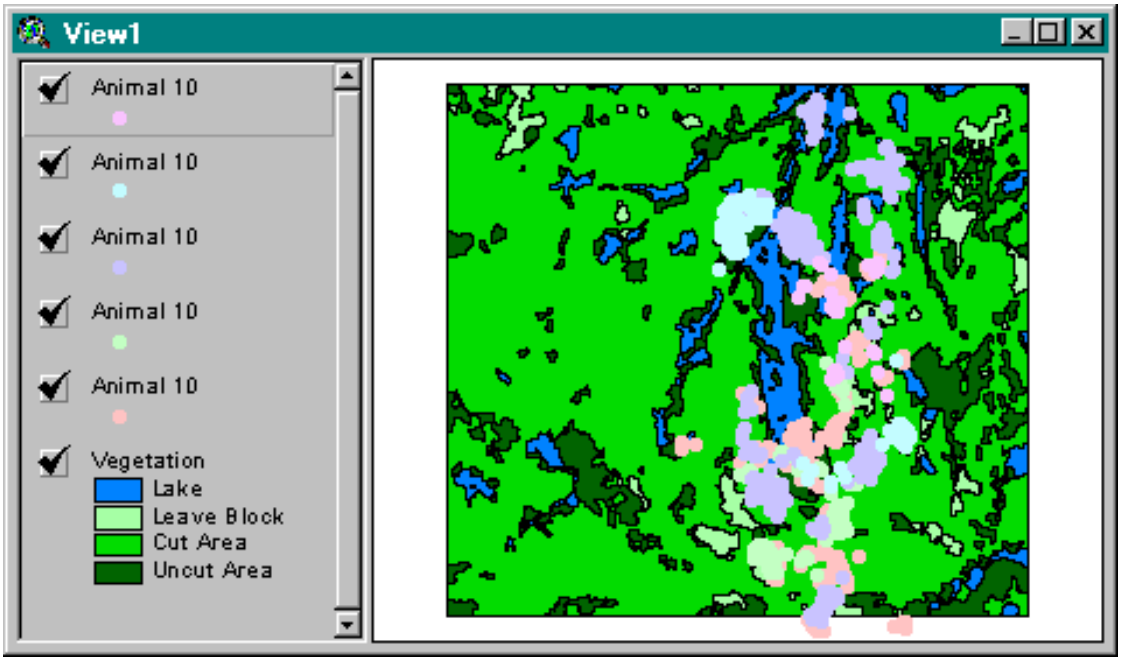
We have included for this tutorial some data from LOTEK GPS collars. The animal wearing the collar was a moose in Northwestern Ontario, South of the town of Dryden.

To import these data, choose *Import Fix Data* from the *Home Range* menu. A dialog will pop up, showing DAT files. Choose one or more, and click *OK*. To choose more than one file, hold down the SHIFT key on the keyboard while you select files.



ArcView needs to know whether to convert the latitude and longitude data in the DAT files using the spheroid based on NAD27, or NAD83. It will ask in a dialog box. If you do not know which spheroid your other map data is based on, now is the time to find out. The tutorial map data are based on the NAD27 spheroid.

All of the DAT files you selected will be imported, converted into a form ArcView can deal with and put into the View, which should look more or less like this:



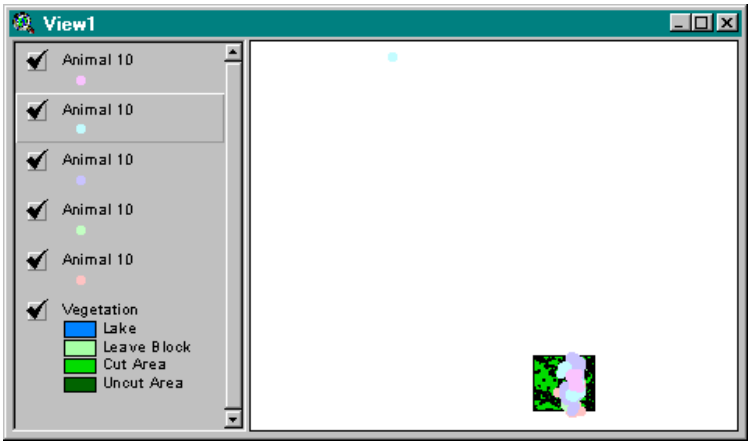
To make the points stand out against the background Theme, edit the Legend of each set until you are happy with them. It is important that you be able to see your data.

What to Do:

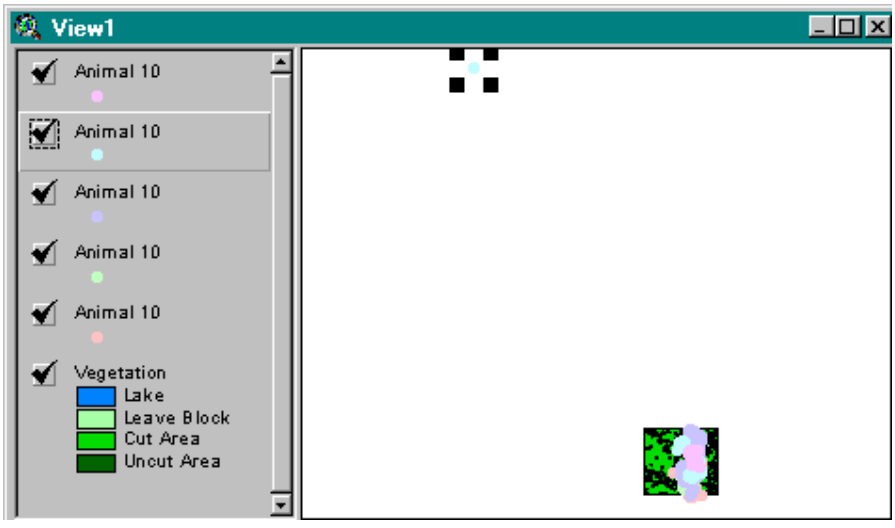
1. Choose *Import Fix Data* from the *Home Range* menu. Select one or more DAT files.

Edit data points

If you don't look too closely, the points we have brought in look good. They seem to be distributed around the margins of the lake and the moose appears to be using cover that is spread about. However, there is one erroneous point in the sample files. A fix is taken when the collars are initialized and tested in Dryden before they are deployed. To see this, click the *Zoom to Full Extent* () button. If you look towards the top of the View, you will see a single point, very distant from the main body of points. That point is in Dryden, at about 10pm, March 2nd, 1994. The next point is about 72km away, and was taken 37 hours later. The point in Dryden is spurious, and we must remove it before we do anything further.



Choose the Theme named "Animal 10" that uses the same colour as the point in Dryden. Click the *Identify* () button. Try to click the point in Dryden. If ArcView beeps, the point is not in that Theme. If ArcView pops up the Identify box with a description of a point, then the point is in the Theme you have chosen. Choose *Start Editing* from the *Theme* menu. Click the *Select Feature* () tool. Click and hold the mouse button in the View above and to the left of the spurious point. Drag a selection box down and to the right to surround the point. Four small black squares will appear. Press the *Delete* key on the keyboard. The point will disappear. Choose *Stop Editing* from the *Theme* menu. ArcView will ask if you would like to save the edits. The answer is *Yes*. When you are finished, use the *Zoom to Full Extent* () button to see the remaining points up close again.



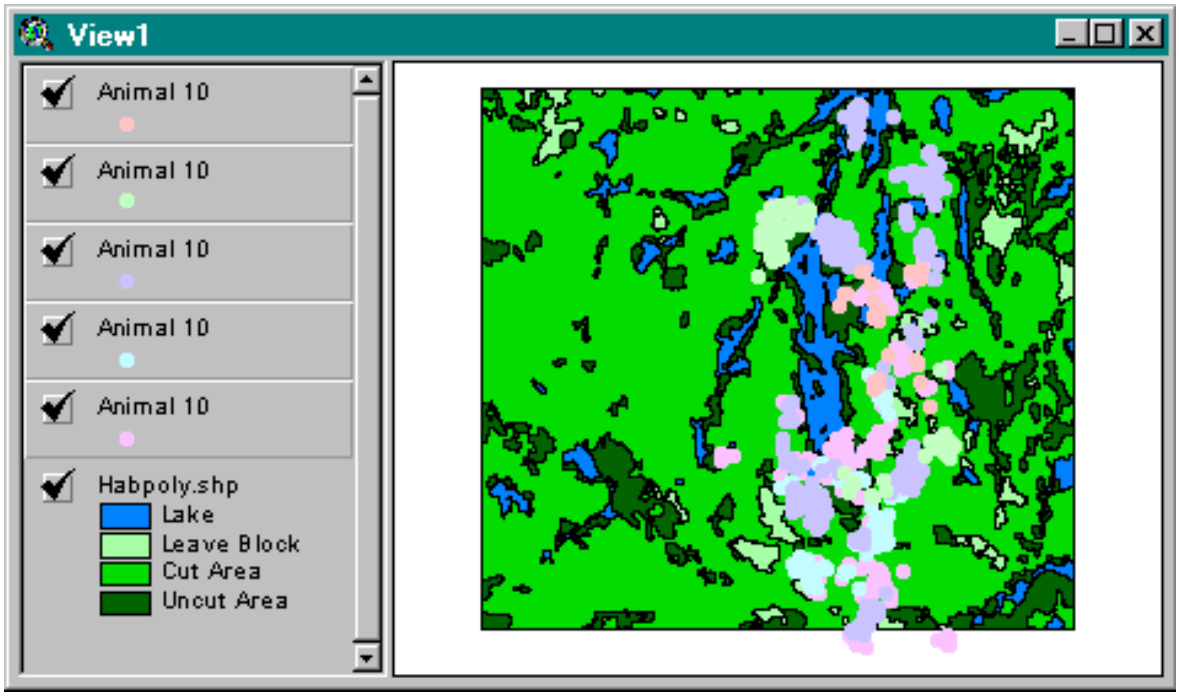
What to Do:

1. Click the *Zoom to Full Extent* () button.
2. Choose the Theme that holds the point.
3. Choose *Start Editing* from the *Theme* menu.
4. Select the point to delete with the *Select Feature* () tool.
5. Press the *Delete* key.
6. Choose *Stop Editing* from the *Theme* menu.
7. Click the *Zoom to Full Extent* () button again.

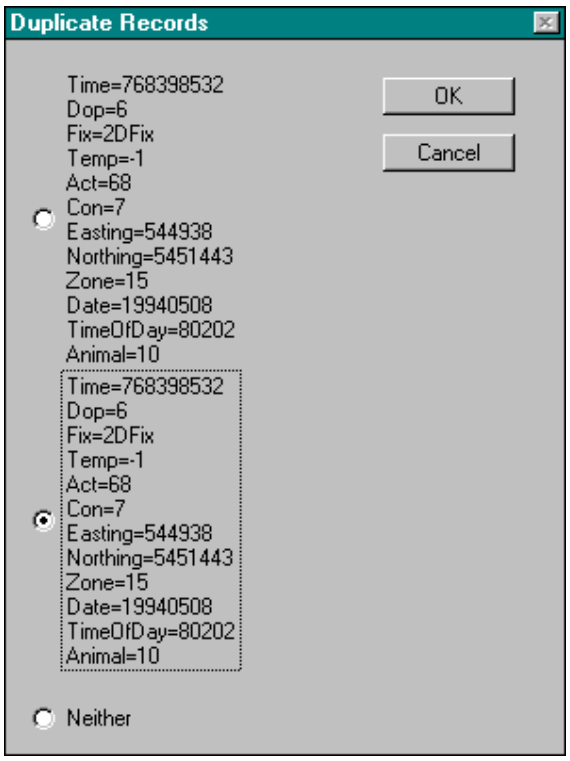
Merging points for an animal

The data in this tutorial are all derived from one animal. That animal's collar was downloaded several times in the season for which we have supplied data. That is why there are several files. We would like to generate information for the animal's entire movement pattern, not just for two months at a time. We have to combine the data from the five Themes, and put it all in one Theme.

ArcView needs to know which Themes we would like to merge. Choose the five Themes named "Animal 10". To choose more than one Theme at a time, hold the SHIFT key while selecting Themes. There will be a box around each "active" Theme.



Choose *Merge Coverages* from the *Home Range* menu. The Themes will be merged together, sorted, and checked for duplicates. If there are any duplicates (and there are in the tutorial data set), a dialog box will pop up. The dialog prompts you for a record to drop. The attributes of the two may differ if, for example, one of them is an incomplete record from an aborted download. It doesn't matter which you choose, in this case. It is a good idea to choose one, although if the duplicate is appropriate for your circumstances, choose *Neither*. When you have chosen a record to drop, click *OK*.



What to Do:

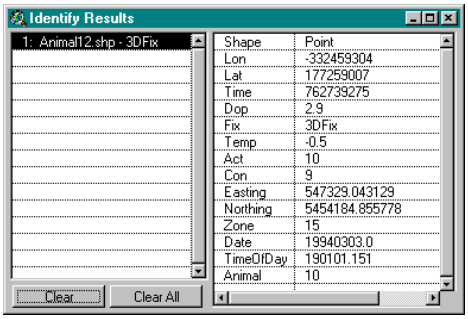
1. Select all five "Animal 10" Themes.
2. Choose *Merge Coverages* from the *Home Range* menu.
3. Choose among the duplicates, and hit *OK*.

Query existing data

There are two common ways to look at your data. You can use the *Identify* () tool, or use the various Table functions by clicking the *Open Theme Table* () button. The *Identify* tool is for pointing at something in the View and asking, "What is this?" The Table functions give you a look at your data in a non-spatial way, showing all the attributes of all the points. We will discuss both types of Queries in this tutorial.

The Identify tool

The *Identify* () tool is a very simple spatial Query tool. Click the tool in, and then click on a feature in the active Theme (the one with the outline around its name). An Identify Results box will appear, describing the feature and its attributes. The *Clear* and *Clear All* buttons will clear the identify box. They do not clear the feature from the View.



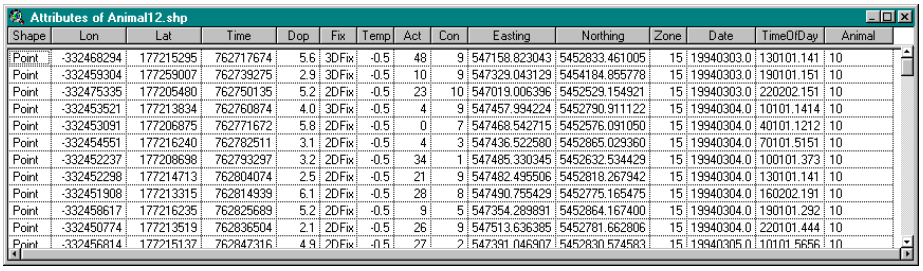
What to Do:

1. Click the *Identify* () tool.
2. Click a feature in the active Theme.

Tables

Tables are on par with Views as a way of looking at your data. When you click on the *Open Theme Table* () button, you are creating a new Table which will appear in the Project if you click the Project's Table icon. A Table can be sorted, selected, queried, and browsed. You can edit a Theme through its Table. When you select records in the Table, they become selected in the View.

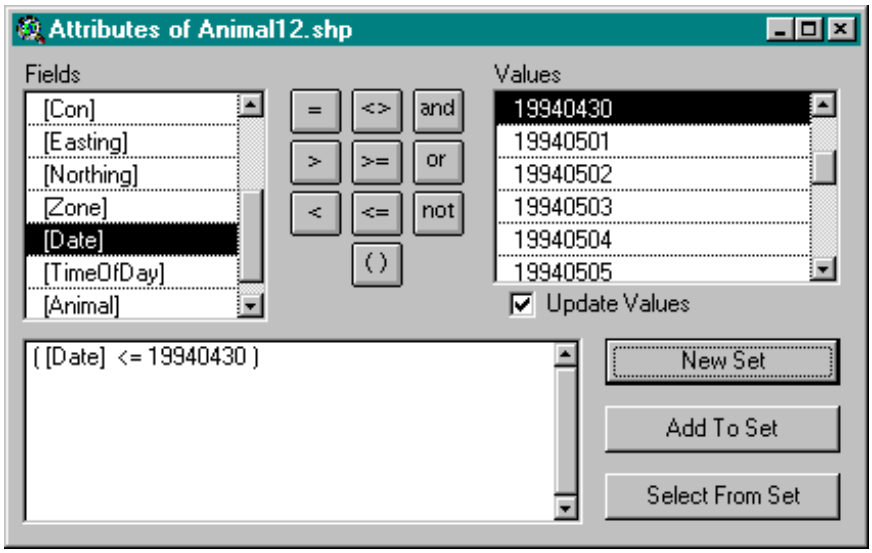
Choose one Theme and make it active. Click the *Open Theme Table* () button. The Table that is created has the name of the Theme prefaced by "Attributes of". Make sure the *Select* () tool is pressed in. Click on a record. It should turn yellow in the Table and in the View. To select multiple records, use the SHIFT key when you click on each record.



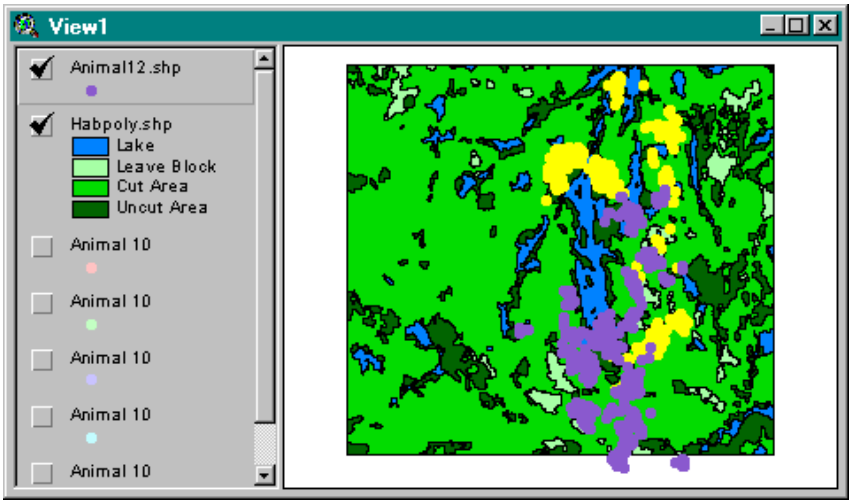
Shape	Lon	Lat	Time	Dop	Fix	Temp	Act	Con	Easting	Northing	Zone	Date	TimeOfDay	Animal
Point	-332468294	177215295	762717674	5.6	3DFix	-0.5	48	9	547158.823043	5452833.461005	15	19940303.0	130101.141	10
Point	-332459304	177259007	762739275	2.9	3DFix	-0.5	10	9	547329.043129	5454184.855778	15	19940303.0	190101.151	10
Point	-332475335	177205480	762750135	5.2	2DFix	-0.5	23	10	547019.006396	5452529.154921	15	19940303.0	220202.151	10
Point	-332453521	177213834	762760874	4.0	3DFix	-0.5	4	9	547457.994224	5452790.911122	15	19940304.0	10101.1414	10
Point	-332453091	177206875	762771672	5.8	2DFix	-0.5	0	7	547468.542715	5452576.091050	15	19940304.0	40101.1212	10
Point	-332454551	177216240	762782511	3.1	2DFix	-0.5	4	3	547436.522580	5452865.029360	15	19940304.0	70101.5151	10
Point	-332452237	177208698	762793297	3.2	2DFix	-0.5	34	1	547485.330345	5452632.534429	15	19940304.0	100101.373	10
Point	-332452298	177214713	762804074	2.5	2DFix	-0.5	21	9	547482.495506	5452818.267942	15	19940304.0	130101.141	10
Point	-332451908	177213315	762814939	6.1	2DFix	-0.5	28	8	547490.755429	5452775.165475	15	19940304.0	160202.191	10
Point	-332458617	177216235	762825689	5.2	2DFix	-0.5	9	5	547354.289891	5452864.167400	15	19940304.0	190101.292	10
Point	-332450774	177213519	762836504	2.1	2DFix	-0.5	26	9	547513.636385	5452781.662806	15	19940304.0	220101.444	10
Point	-332456814	177215137	762847316	4.9	2DFix	-0.5	27	2	547391.046907	5452830.574583	15	19940305.0	10101.5656	10

Another way to look at your data is by a Query. Queries use a logical expression to identify records and select them. The *Query Builder* () is available in a View and in a Table, but it makes a little more sense when you look at the Table window.

Click the *Query Builder* () button. A dialog like this one should appear:



A Query about spring fixes might be useful, so let's ask for fixes from before May 1994. We want to Query based on the date, so double-click *Date* in the left-hand box. Click a relationship (try <=) in the middle. Last, double-click on a date in the right-hand box. In the bottom box will be your Query: "([Date] <= 19940430)". It means "All dates before or equal to April 30, 1994". Click the *New Set* button. The first 370 records in the Theme will be highlighted. If you click on the View, you will see a selection of bright yellow points. These are the points from before May 1994.



If you no longer want a selection, or want to set the selection to none, choose the *Clear Selected Features* ( ) button.

What to Do:

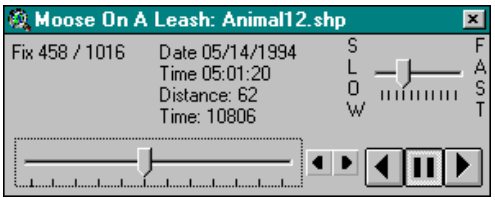
1. Click the *Open Theme Table* ( ) button.
2. Click the *Query Builder* ( ) button.
3. Enter "([Date] <= 19940430)" in the Query box at the bottom.
4. Click *New Set*.
5. Clear the selection with the *Clear Selected Features* ( ) button.

Exercise 2 - Animal Movements

In addition to basic ArcView queries, the HRE provides an exploratory data analysis tool called "Moose On A Leash" that allows you to step through selected points one-at-a-time and determine the distance moved and elapsed time between consecutive fixes. However, you may want to determine and save multiple interfix distances and times to calculate average distance moved between fixes, speed of movement, total distance moved in a given period, etc. You will learn to use both of these methods of examining animal movements in this exercise.

Data Animation - "Moose On A Leash"

"Moose On A Leash" (MOAL) is a data animation tool. It will show you interactively where the animal went over time. The purpose of this tool is to show the movements of the animal, not just the positions. It adds a third dimension (time) to the View. To use MOAL, click the Moose On A Leash () button, or choose *Display Travel* from the *Home Range* menu.



The main MOAL dialog is simple. It has "VCR-like" controls (), a speed control (), a slider bar to indicate and set position (), and some accessory information. You can change the selection of points during your use of MOAL, and it will be reflected in the dialog. A first step is to drag the position slider tab around. Keep an eye on the View. A flashing blob will show you where the point described in the MOAL dialog is, and a line will connect it to the previous point. The distance and time shown in the dialog box are the distance and time between the point selected and the immediately preceding point. The speed control sets the time of flashing. The slowest time is annoyingly slow, and the fastest time is annoyingly fast. Choose a flashing speed to meet your needs.

The "VCR-like" controls are for automated "playing" or "rewinding" the points. If you click either play () or rewind (), the points will flash in order, one at a time. Press pause () to stop the sequence. Due to the way ArcView checks for mouse clicks, the pause button may not get "clicked" when you click it. You may need to click the pause button repeatedly.

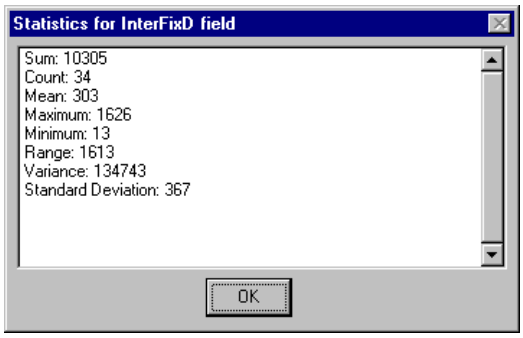
What to Do:

1. Click the Moose On A Leash () button.
2. Use the Slider bar () to show individual points.
3. Use the VCR controls () to automatically show a sequence of points.

Calculating Interfix Distances and Times

The HRE makes it easy to calculate the distance and amount of time between consecutive fixes. Click on the Theme you want to use to make it active, then click the *Open Theme Table* () button. Choose *Start Editing* from the *Table* menu. You can now select *Calculate Interfix Distances* or *Calculate Interfix Time* from the *Field* menu. Each of these options will add 2 columns to the Table: distance or time between consecutive fixes in the file and cumulative distance or time for all fixes. Now select *Stop Editing* from the *Table* menu. When you are asked if you would like to save the edits, click *Yes*.

You can calculate some simple summary statistics of interfix distance and time while the Theme Table is still open. For example, click on the "InterFixD" field name in the Table. Choose *Statistics* from the *Field* menu and an information box will pop up that looks something like this:



What to Do:

1. Click the *Open Theme Table* () button.
2. Choose *Start Editing* from the *Table* menu.
3. Select *Calculate Interfix Distances* or *Calculate Interfix Time* from the *Field* menu.
4. Choose *Stop Editing* from the *Table* menu.
5. Click on a field name, then choose *Statistics* from the *Field* menu.

Exercise 3 - Creating Home Range polygons

In this exercise, you will take the fix points you imported in Exercise 1, and create polygons that indicate the size and position of the home range of the animal. These polygons represent the areas in which the animal is found.

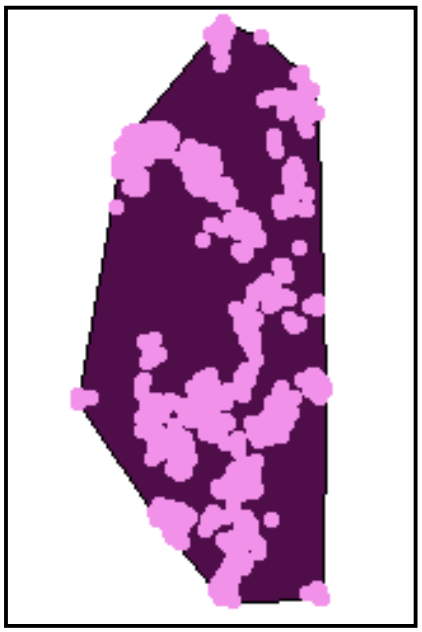
There are two main methods of generating home range polygons from animal fixes in the HRE. The older method is the minimum convex polygon method. The more recent one is the kernel method. They will both operate on the selection of points made in the View, or if there is no selection, they will work on the whole Theme.

Minimum Convex Polygons

A Minimum Convex Polygon (MCP) is created around a set of points so that the line of the polygon goes around the outside edge of the set of points. The polygon is called a convex polygon because it has no interior angles greater than 180°. It is a minimum convex polygon because it is the smallest polygon that fits the convex conditions.

The MCP can be calculated for one Theme of points at a time, or you can combine multiple Themes of points to create a set of polygons in one new Theme. To use multiple Themes, have several Themes selected when you run the MCP procedure. We will do only one Theme at a time.

Make a point Theme active, like one of the "Animal 10" Themes, or the aggregate Theme you created in the **"Merging points for an animal"** section in Exercise 1. Select the *Clear Selected Features* () button to make sure that all the points will get used. Select *MCP 100%* from the *Home Range* menu to create the polygon from all the points in the point Theme. You should end up with something that looks like this:



If you are interested in a subset of the points, instead of all the points, use the *Select Feature* () tool or the *Query Builder* () button to select the subset to analyze. Only the points highlighted in yellow will be used in the creation of the polygon.

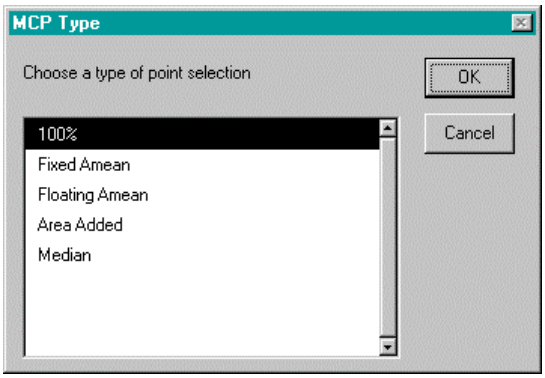
What to Do:

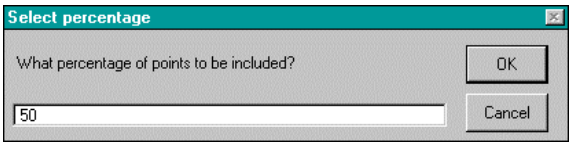
1. Select a Theme containing points.
2. Click the *Clear Selected Features* () button.
3. Choose *MCP 100%* from the *Home Range* menu.

Percentage MCP

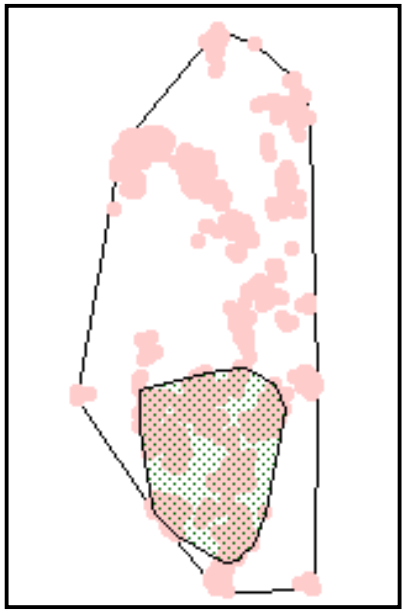
Minimum Convex Polygons are inherently non-responsive to the structure of the data inside the polygon. They respond only to the outlying points. One way to counteract this influence of the "outliers" is to use a reduced set of the points, representing perhaps 50% of the points taken for the animal. There are many ways to choose which points to ignore. Refer to the HRE User's Manual for a list of the possibilities available. For this tutorial, we will use the Floating Arithmetic Mean (Floating Amean) method, because it is reasonably fast.

Make a Theme with point features active by clicking on the Legend. Click the *Clear Selected Features* () button to make sure you are using all the points in the Theme. Choose *Percentage MCP* from the *Home Range* menu. A dialog will ask you which automated point selection method you would like to use. Choose *Floating Amean* and click *OK*. Another dialog will ask you to indicate a percentage of points to use. Type 50 and click *OK*.





After a pause (potentially quite long), the results will look something like this:



What to Do:

1. Select a Theme containing points.
2. Click the *Clear Selected Features* () button.
3. Choose *Percentage MCP* from the *Home Range* menu.
4. Choose a point selection technique from the list.
5. Choose a percentage of points.

Kernel Polygons

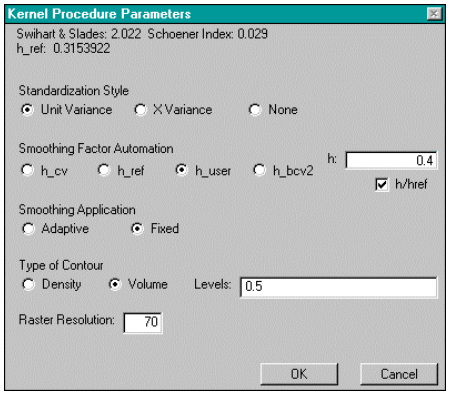
The kernel method of delineating home range polygons is statistically much more complex than the minimum convex polygon method. The method can be visualized by imagining a bump that looks like a bell curve. This bump is placed over each of the points in the Theme. The sum is calculated for all places in the View, and then contours are derived from the sum. The product in ArcView is a set of polygons that describe where the moose spends a certain amount of its time.

There are several options available in the HRE concerning kernels. For this tutorial, we will take a simple path, and do a fixed kernel using a smoothing factor of $0.4*h_{ref}$. For full descriptions of the meanings of these terms, please refer to the HRE User's Manual.

Start by selecting a Theme, and then click the *Clear Selected Features* () button to make sure you are referring to all the points in the Theme. Choose *Kernel Analysis* from the *Home Range* menu. A dialog box will pop up. In this dialog are all the parameters you can set for kernel methods.

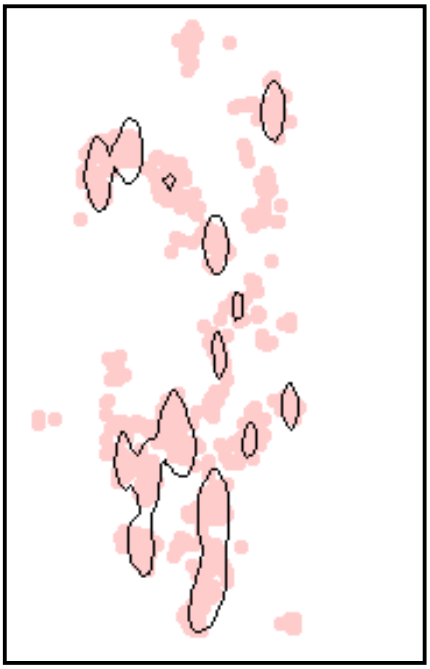
At the top of the dialog are the Swihart and Slade index of independence and the Schoener index. These are for your information, and are calculated from the raw data. The statement of h_{ref} at the top is also for information.

Click the *h_user* button, and then type 0.4 in the *h* box. Click the *Fixed* kernel button to select the type of smoothing. Leave the checkbox below the *h* box checked. In the *Levels* box, type 0.5. Click *OK*.



The meanings of all of these options are described in the HRE User's Manual, with a short description of the statistics involved.

After a pause, the dialog box will clear, and a new Theme will be in the View. These are your kernel method home range contours. The volume inside the contour is equivalent to the area under the curve in a univariate case. The total volume is always equal to 1.0. The volume contours show the area where a moose spends *x* amount of its' time, where *x* represents the volume label of the contour. In this example, the moose spends at least 50% of its' time inside the 0.5 volume contour. For most applications of this procedure, the 50% volume contour will have much less than 50% of the area of the 100% contour. Using the 50% volume contour as the indicator of home range would suggest that this moose has several centres of activity, with short periods of time spent moving between them.



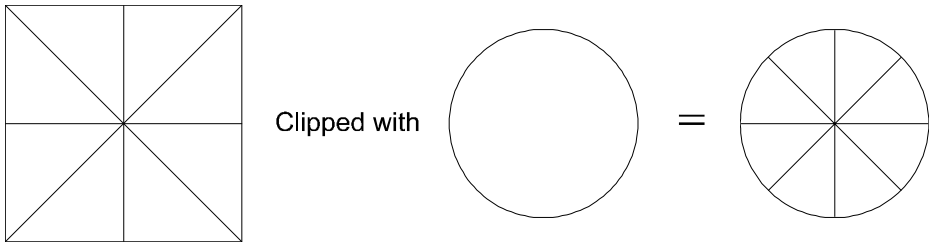
What to Do:

1. Select a Theme containing points.
2. Click the *Clear Selected Features* () button.
3. Choose *Kernel Analysis* from the *Home Range* menu.
4. Choose *h_user* and type 0.4 in the *h* box.
5. Select *Fixed* kernel.
6. Type 0.5 in the *Levels* box.

Exercise 4 - Manipulating Home Range Polygons

In this exercise, you will take a step in relating the home range polygons to other spatially explicit data, like habitat polygons. These are classic Geographical Information System (GIS) functions. We have prepared some GIS functions within the HRE. Other GIS functions are available within ArcView, some of which are derived from other extensions (like the Xtools Extension available from http://www.odf.state.or.us/sfgis/Documents/Xtools.htm).

This exercise builds on what you learned in Exercises 1 and 3. If you had trouble with the concepts and procedures explained there, or with the ArcView interface, take some time to review and become familiar with that material. This exercise will be much less frustrating.



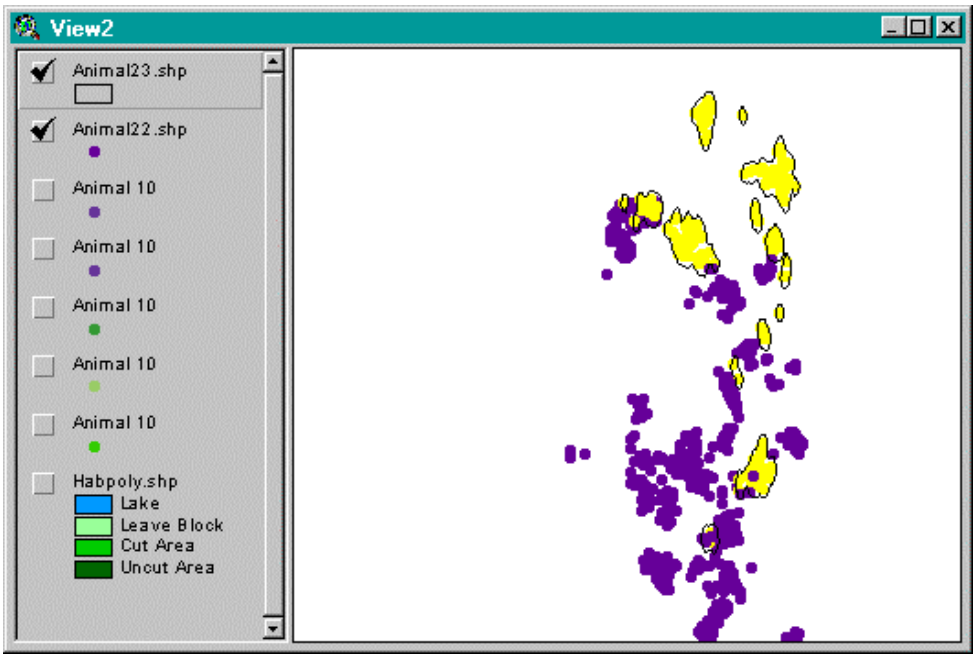
The functions we will discuss are known as "clipping" functions. A clipping function is usually described as a "cookie cutter". A typical clipping function is shown here:

The circle is the clipping shape; the square is the shape being clipped. When we do a habitat analysis within home range polygons, or when we do a range overlap analysis, we are doing precisely this.

Habitat analysis

To do a habitat analysis, we need a clipping polygon, and a Theme to clip. Suppose the question you would like answered is "In what habitat is the moose in April?" We shall use a 95% volume contour from the fixes in April, using an adaptive kernel technique. The habitat map you imported in Exercise 1 will be used as the source of habitat information.

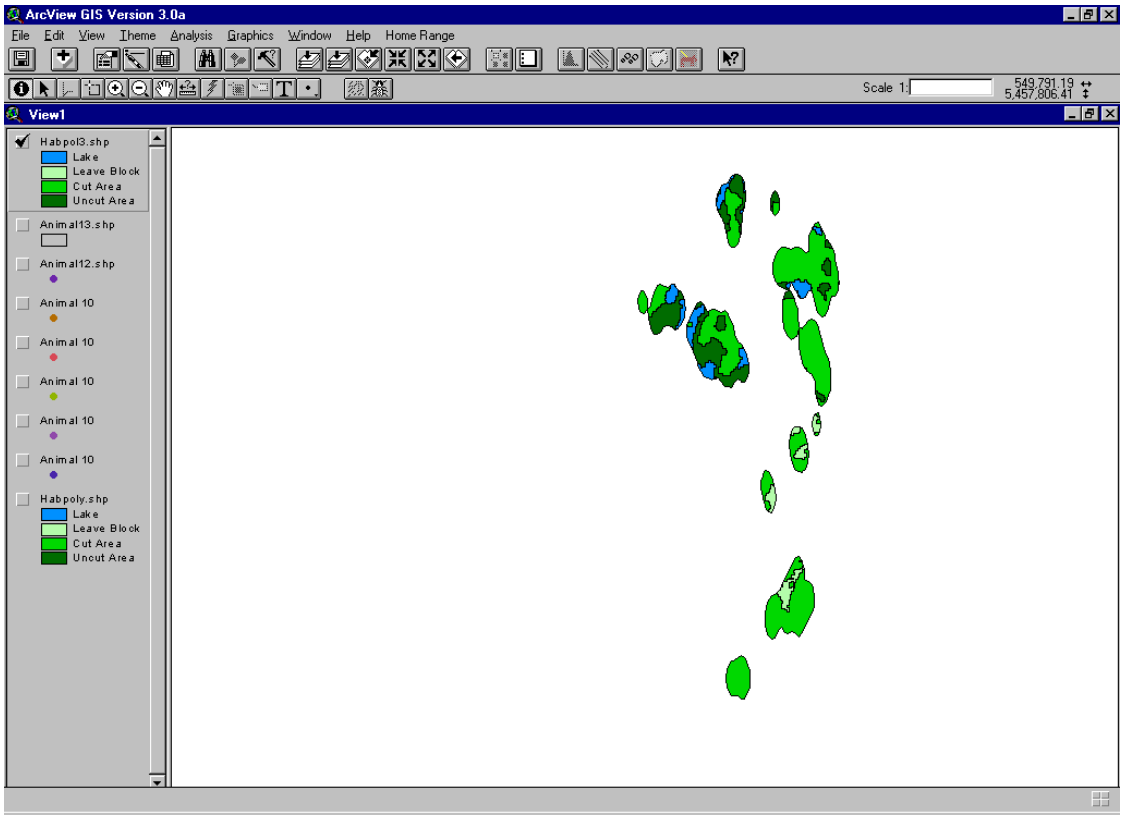
To make the clipping polygon, select the Theme that you combined in Exercise 1 from all the DAT files. Click the *Query Builder* () button and use the Query `((Date]>19940331) and ([Date]<19940501))` to select all the points from April. If you do not know how to do this, please refer to Exercise 1. Once the Query is done, do an adaptive kernel estimate of home range size, using volume contouring. Specify the LSCV choice of smoothing parameter (*h_cv*), and put 0.95 in the *Levels* box. The View should look something like this:



The tight smoothing parameter will produce a line very close to the points as you see them on the screen. This is quite a small set of polygons, with an area of 490 ha. To find out more about the polygons, use the *Identify* () tool to Query them.

Now make the home range polygon Theme and the habitat Theme active (Use the SHIFT key to make more than one Theme active). A shaded box will appear around the two Themes. To clip the habitat Theme, choose *Clip Theme* from the *Home Range* menu. A Dialog box will appear to ask which Theme is the clipping Theme. Choose the home range polygon Theme and press *OK*. A new Theme will be created, with the same Legend as the clipped Theme, but in the shape of the clipping Theme.

If you "turn off" all of the other Themes (i.e., uncheck the boxes next to each one), the new Theme should look something like this:



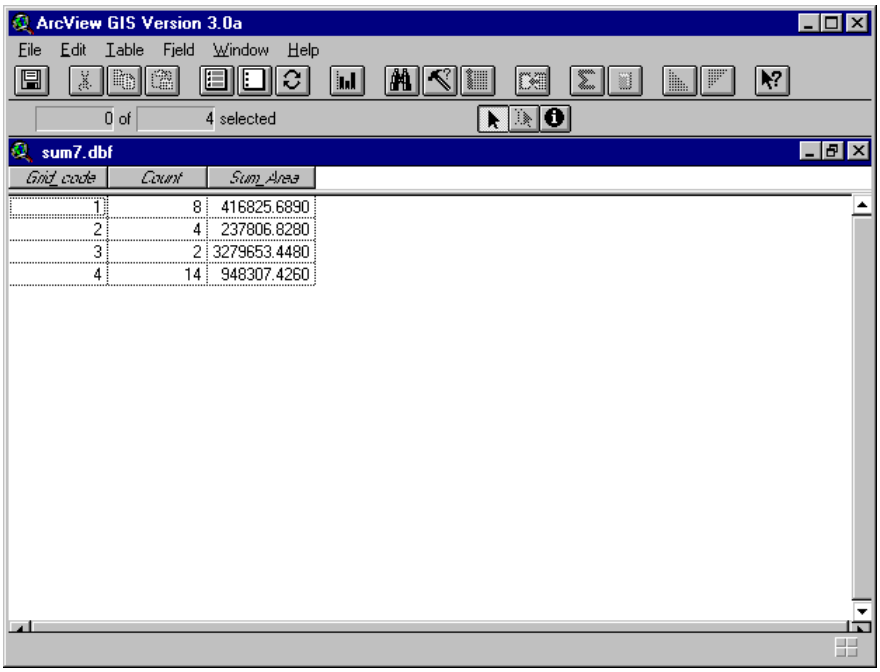
As you can see, the habitat types within each contour of the home range polygon are now visible. You can make the same sorts of Queries here as you could in previous exercises, using the *Query Builder* () button, the *Identify* () tool, or the *Open Theme Table* () button.

What to Do:

1. Make the home range polygon Theme and the habitat Theme active.
2. Choose *Clip Theme* from the *Home Range* menu.
3. Choose the home range polygon Theme and press *OK*.
4. "Turn off" all of the other Themes.

Calculating Areas of Habitats in Home Ranges

To calculate areas of several polygons at once, make the clipped habitat Theme active then open the Theme Table. Click on the top of the column labelled "Grid_code" (these are the codes used by ArcView to identify the different habitat types in the Theme), then choose *Summarize* from the *Field* menu. A Dialog box will appear in which you can specify what it is that you want to summarize. Click on the drop down arrow next to the "Field" box and select "Area". Similarly, click on the drop down arrow next to the "Summarize by" box and choose "Sum". Click on *Add*, then *OK*, to produce a new .dbf file with the total areas of each habitat type in the home range:



This new file will appear under the *Tables* icon in the Project window and can be saved with the project when you exit ArcView.

What to Do:

1. Make the clipped habitat Theme active and open its Theme Table.
2. Click on the top of the column labelled *Grid_code*.
3. Choose *Summarize* from the *Field* menu.
4. Select "Area" in the "Field" drop down box.
5. Select "Sum" in the "Summarize by" drop down box
6. Click on *Add*, then *OK*.

References

(ESRI) Environmental Systems Research Institute. 1996. Using ArcView GIS. Environmental Systems Research Institute, Inc., Redlands, CA. 350 pp.

Rodgers, A. R. and A. P. Carr. 1998. HRE: the home range extension for ArcView. Users Manual. Ont. Min. Nat. Resour., Thunder Bay, ON. 36pp.

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