Animal Space Use Workshop

Lab No. 5 Animal Space Use Analysis Program

Software by Jon Horne -- Problem set by Oz Garton

Jon Horne wrote a powerful software program called Animal Space Use as part of his PhD project that is now available from Oz Garton's population_ecology web site in version 1.3: http://www.cnr.uidaho.edu/population_ecology/animal_space_use.htm

If the zipped files have not been installed onto your computer system run the installation and make the additional changes required if you are running the software under Windows 7 (See Installation in Windows 7 notes.txt).

1. Start Animal Space Use 1.3 by double clicking the icon for the software and click **Next** so that you can first select an analysis on data that are temporally independent.
2. Select a home range analysis without observation bias.
3. Choose to input a **Text File**.
4. **Load** the Input Locations File by opening the example data set **borealowl.txt** consisting of 22 locations for a boreal owl (*Aegolius funereus*) studied by Greg and Pat Hayward and Oz Garton in Chamberlain Basin of River of No Return Wilderness, Idaho in the breeding season 1985. Once the locations are loaded you can click **Next** to proceed to comparing and estimating models of home range.
5. Begin your full analysis by evaluating the 4 parametric models of home range. Compare the 4 models in their ability to model the home range locations for this bird: uniform distribution of use within a circular boundary (**exponential power** model), random movements out from a central location (**bivariate normal** centered on the nest in this case), circular home range with 2 centers of activity (**2-mode bivariate circle mix**) and random movements out from 2 centers of activity (**2-mode bivariate normal mix**).

Question 1. Which of these 4 models would provide the best estimate of the bird's probability density function of use during this period based on classic information criterion (AICc)? How much better is this model of space use than other choices? What does this tell you about the biology of this bird? How would your conclusions of the best model differ if you used negative log likelihood or likelihood cross validation as the criterion for selecting the best model?

6. Return to the **Previous** screen and compare the use of the 2 kernel estimators to these 4 parametric home range models.

Question 2. Would a fixed kernel or an adaptive kernel density estimator describe the density of locations better for this boreal owl? What does these models of home range tell you about the biology of this boreal owl during this nesting period? How do they compare as models of home range to the 4 parametric home range estimators? What would you use to estimate home range size and space use for this nesting boreal owl?

7. Return to the **Previous** screen and **Estimate home range size** using the **Fixed Kernel** home range estimator.
8. **View graph of CVh and LSCVh** functions for the **fixed kernel** by having it **Draw Graph** with default values for Low and High. Then redraw the graph after enlarging the range of values from Low to High such that you get to see the full shape of CVh and LSCVh across a full range so that you are certain that you have found the global minima for each graph. [Note you may have to redraw the graph numerous times until you are certain you have captured the minima for each graph, i.e. each graph has a declining and rising leg in view.] Be sure to write down the values of smoothing parameter estimated by the 3 alternative approaches.

Question 3. What are the implications of the graphs of CVh and LSCVh for your analysis of home range for this female owl if you chose to use a fixed kernel density estimator? Which are the values of smoothing parameter that you would get if you chose to use CVh, versus LSCVh, versus h_ref? How would your choice of smoothing parameter impact your comparisons to other researcher's estimates of home range size for boreal owls from other regions?

9. Select some of the models (atleast one parametric and one kernel) and estimate pdf of the utilization distribution (home range) and output them for display and further analysis in Arc GIS.
10. **Exit** the program and **restart** it for a new analysis and this time select **serially correlated data** as are gathered with satellite telemetry using GPS or ptt technology.
11. Select **text** file input and open the **caribouBB199933.txt** file which contains 66 observations for a caribou migrating in Alaska in 1999. If you take a look at this text file in notepad you will see that it contains x-,y-coordinates for each location and a sequential time as well as a measure of location error expressed in the same units as the location data.
12. Begin the Brownian bridge analysis by clicking **Estimate** Brownian bridge parameters. Make a note of the Brownian bridge variance and its square root and think about whether that value (distance in meters) seems reasonable to describe the distance that caribou wander off of a straight-line path half-way through a 14 hour period of migration. If it doesn't seem reasonable there may have been an error in data input or something that needs to be corrected prior to further analysis.
13. **Enter a maximum time limit** of 5 or 6 intervals (**3000** minutes in this case) and Calculate probability of occurrence over a grid which will be stored as a grid of values laid over your locations and stored as a comma-delimited text file with the name you assign it for later display in Arc GIS. Note that you can modify the minimum and maximum x, y coordinates of the grid as well as the distance between grid points for the table produced. In this case, change the distance between grid points to 300 meters.

Question 4. If the Brownian bridge model of locations for this caribou is estimating a pdf is it modeling her home range? If not, what does it describe. How do you think longer time or shorter time intervals between locations would change the pdf for this caribou? How would larger location errors for each location change the resulting pdf? How does the pdf produced by the Brownian bridge model compare to a parametric home range or density of locations pdf for this caribou?