# Calculating KDE Homeranges

1. Get appropriate subset of the Encounters table for homerange work.
   1. Locations with Easting == 600000 and Northing == 3950000 are for the vet and should be excluded from homerange calculations, as should all “Holding Pen” records and records of Translocatees before they were moved (often with SiteNames that include the word “Ivanpah”, but intersect with the site boundaries to get them all).
   2. Identify a reasonable date range to use. For instance, as of July 2012, I don’t think it is reasonable to compare homeranges for the east and west control groups because the east group has relocations beginning in April 2011 while the west group doesn’t have relocations until October 2011. Since the tortoises are relocated only once per week, the difference in the number of relocations influences the homerange size. So I might use only the records since October 2011. Similarly, homeranges for the resident group might be computed using only the records before (if there are enough) or after the introduction of the translocatees.
2. Plot the locations of the remaining encounters to identify any gross errors. Make note of any records that need to be verified or corrected and any that are discarded.
3. Create a shapefile containing the cleaned set of locations with corresponding Tortoise IDs.
4. Identify a list of individuals that have sufficient data for fitting a kernel density. A list of Tortoise IDs will be needed for the GME tool scripts.
5. Run GME scripts to compute the kdes, find the isopleths, compute the area captured by the isopleths, and add the TortoiseID to the isopleth files.
   1. The output file from running the script will contain the bandwidth parameters used for each tortoise. Keep a copy of this file so that you have the bandwidth information. It would probably be worthwhile to write a script to pull the smoothing parameter values from the output file, but I haven’t done so.
6. Open all the polygon homerange files in Arc and simply look at them, probably together with the cleaned locations shapefile. Generally, a huge polygon means there’s a location error for that tortoise, which can be found by identifying the TortoiseID for the polygon, then selecting that Tortoise’s locations and looking for something fishy.
   1. Make notes about the bad locations so they can be fixed.
   2. If you need a “final” homerange before database corrections can be made, omit the offending record/location from the location shapefile used to generate the KDEs and rerun the KDE for that tortoise. If the work is preliminary, it’s probably okay to just exclude that Tortoise’s homerange from further analysis.
   3. If you need to rerun a KDE, you will need to either provide different names for the various files that are generated (the raster, polyline, and polygon files) or delete the old ones using ArcCatalog before running the GME tool again. (If a file that GME tool tries to write already exists, it doesn’t overwrite the old file, but instead throws an error message and exits.)
7. In Arc, use the Toolbox/General/Merge command to merge all the (good) polygon isopleth files into a single shapefile.
8. Join the Demographics table to the combined isopleths file using your favorite tool (Arc, R, Access).

# GME Script

# GME code for computing KDEs

# put list of Tortoise IDs here

#(each needs enough records to compute a kernel density estimate)

ids <- c(BS01, BS179, BS265, BS289, BS29, BS291, BS293, BS294, BS310, BS32, BS37, BS58, BS94 );

# ids as strings

# same list, but with double quotes because I can't see

# an easier way to handle the strings below

idss <- c("BS01", "BS179", "BS265", "BS289", "BS29", "BS291", "BS293", "BS294", "BS310", "BS32", "BS37", "BS58", "BS94" );

for (i in 1:length(ids))

{

# compute the kde as a raster, have option to change bandwidth method and cell size

# cell size of 1 (1 meter by 1 meter) is quite small; increasing it will speed up computations

kde(in=”E:\Projects\BrightSource\_Ivanpah\data\working\HomeRange\2016\Encounters\_gt25.shp”,

out=paste(”E:\Projects\BrightSource\_Ivanpah\data\working\HomeRange\2016\kde\_”, ids[i], ”.img”),

bandwidth=”CVh”, cellsize=1, where=paste("TortoiseID = ‘",ids[i],"’"));

# compute isopleths, both as polyline files and as polygon files

isopleth(in=paste(”E:\Projects\BrightSource\_Ivanpah\data\working\HomeRange\2016\kde\_”,ids[i],".img"),

out=paste(”E:\Projects\BrightSource\_Ivanpah\data\working\HomeRange\2016\isopleths\_polyline\ud\_”,ids[i],".shp"),

poly=paste(”E:\Projects\BrightSource\_Ivanpah\data\working\HomeRange\2016\isopleths\_polygon\udpoly\_”,ids[i],".shp"),

quantiles=0.95);

# add areas to polygon isopleths, area will be in ha, perimeter will be in m

addarea(in=paste(”E:\Projects\BrightSource\_Ivanpah\data\working\HomeRange\2016\isopleths\_polygon\udpoly\_”,ids[i],".shp"),

area=”area”,

perim=”perim”,

areaunits=”hect”);

# add TortoiseID to polygon isopleths

addcodedfield(in=paste(”E:\Projects\BrightSource\_Ivanpah\data\working\HomeRange\2016\isopleths\_polygon\udpoly\_”,ids[i],".shp"),

field="TortoiseID",

fieldtype="STRING",

constant=idss[i]);

}

# Notes about analysis of homeranges

* There are two distinct groups within the “Control” type, those in the eastern range with TortoiseIDs between BS500 and BS538, and those in the western range, with TortoiseIDs of BS539 and larger. Data collection on the eastern group started in April 2011; on the western group started in October 2011. Evidently the habitats are also different, as are the space use and sharing patterns. These groups should be analyzed separately.
* Homerange analyses will be influenced by the tortoise group (East Controls, West Controls, Residents, and Translocatees) and sex (Male, Female, Unknown/Juvenile). They might also be influenced by tortoise size, though a preliminary look suggests associations between tortoise size and homerange size are extremely weak after group and sex are accounted for.