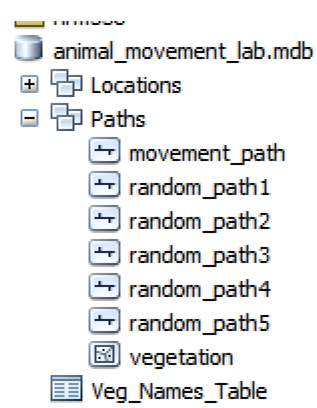
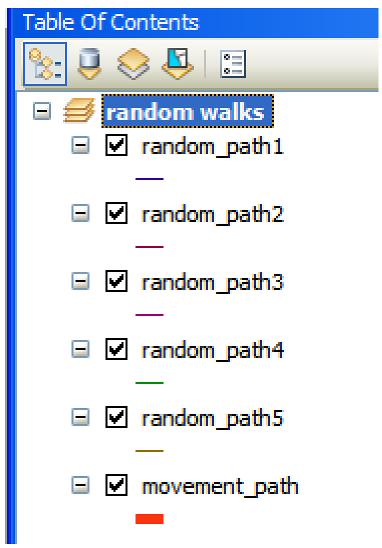
NRM 435 Lab#8 Animal Movement

Donwload and unzip the geodatabase for this lab from ***animal_movement_lab.mdb*** at: http://dverbyla.net/nrm435/data/

Random Paths

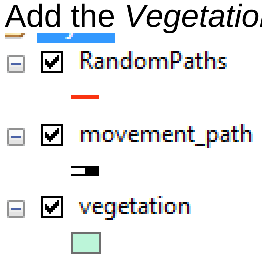
A random path is a path created by randomly distributing the original path line segments, such that the random path start at the same point and end at the same point as the original movement path. We created 5 random paths that start and end in the same location as the animal movement path layer. Add the line feature classes *movement_path* and the five *random_path* feature classes.

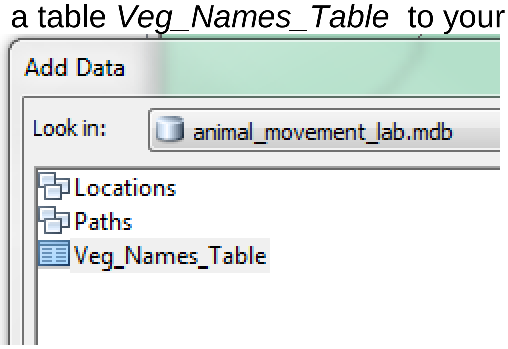




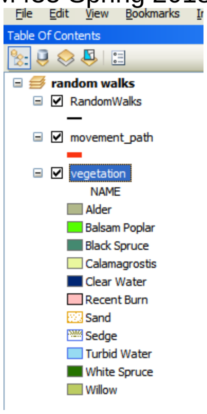
Use the ***Merge*** tool in ArcToolbox to merge your five random path line layers into one line feature class…

Add the *Vegetation* polygon layer and a table *Veg_Names_Table* to your data frame:





Use the ***Join Field*** tool to join the table to your polygon layer and use the names in assigning symbology.



For each vegetation type, what is the total length of each path?
What was the percentage by vegetation type?

Use the ***Intersect*** tool to determine the animal path line by vegetation type.

movement_path_Intersect

Shape *	NAME	Shape_Length
Polyline	Alder	484.515422
Polyline	Balsam Poplar	366.353998
Polyline	Balsam Poplar	193.68838
Polyline	Black Spruce	172.228247
Polyline	Black Spruce	322.055688
Polyline	Calamagrostis	62.747493
Polyline	Recent Burn	164.210873
Polyline	Sedge	276.375789
Polyline	Sedge	834.000855
Polyline	White Spruce	986.371355
Polyline	White Spruce	246.072891
Polyline	White Spruce	38.235772
Polyline	Willow	256.823454
Polyline	Willow	42.729518

Then use the ***Summary Statistics*** or ***Frequency*** geoprocessing tool to determine total line length by vegetation name. Finally, compute the percentage of path in each vegetation type in a new field named *Percent*.

movement_path_stats

NAME	Percent
Alder	10.9
Balsam Poplar	12.6
Black Spruce	11.1
Calamagrostis	1.4
Recent Burn	3.7
Sedge	25
White Spruce	28.6
Willow	6.7

Field
Percent
Statistics:
Count: 8
Minimum: 1.411195
Maximum: 28.577664
Sum: 100
Mean: 12.5
Standard Deviation: 9.

Check that sum of percent is 100

Looks like the animal does not like water and was in White Spruce or Sedge about half the time.

Now how does that compare with the random walks?

First ***Intersect*** your random paths layer with the vegetation polygon layer.

Then determine the total length of each path in each vegetation type by using the ***Frequency*** tool or ***Summary Statistics*** tool .
And compute the percent within each vegetation type:

random_path_stats

NAME	Percent
Willow	17.7
White Spruce	15.4
Sedge	15.1
Balsam Poplar	10.1
Calamagrostis	9.2
Recent Burn	9.1
Alder	8.8
Black Spruce	8.8
Turbid Water	5.9

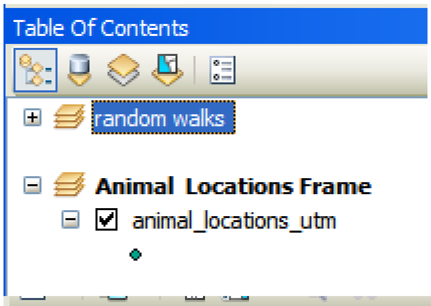
movement_path_stats

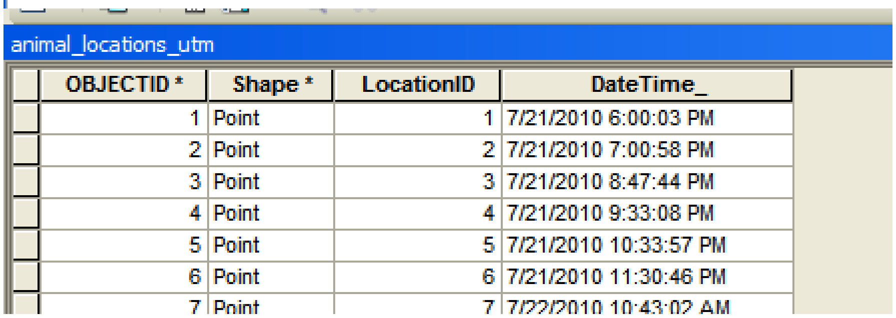
NAME	Percent
White Spruce	28.6
Sedge	25
Balsam Poplar	12.6
Black Spruce	11.1
Alder	10.9
Willow	6.7
Recent Burn	3.7
Calamagrostis	1.4

Notice that the random paths were in turbid water 5.9 percent of the time and the animal was never in turbid water. The animal path was in White Spruce and Sedge more than the random paths. The animal seemed to avoid Calamagrostis (1.4 versus 9.2%), Recent Burn (3.7 versus 9.1%) and Willow (6.7 versus 17.7%) relative to the random paths.

Travel Time and Distance

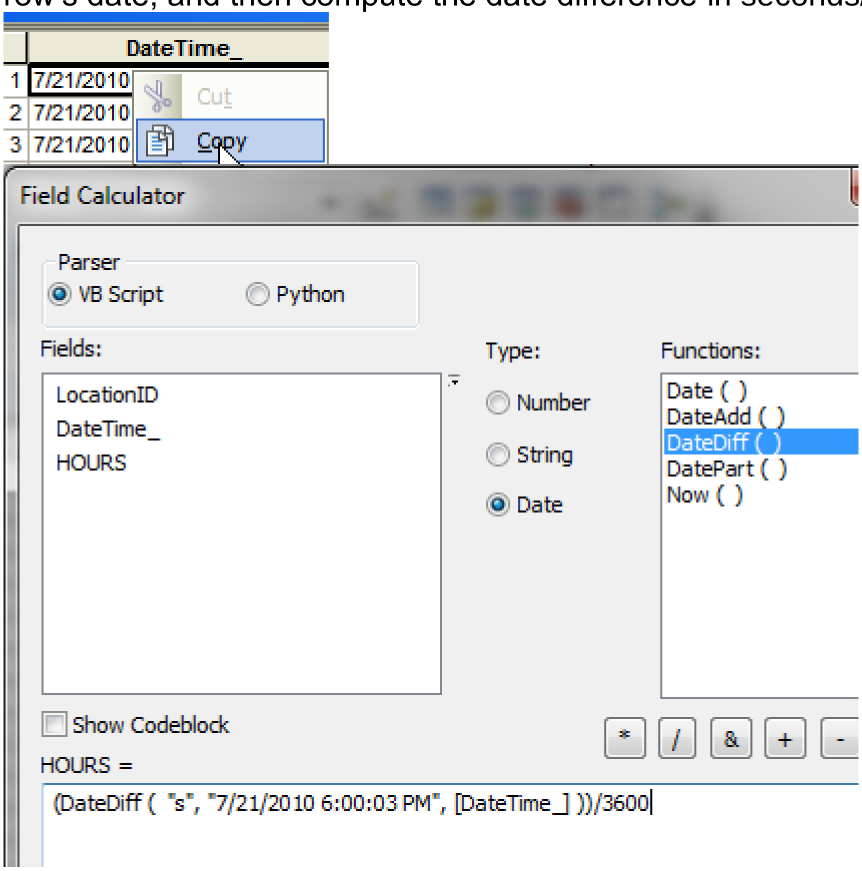
Insert a new data frame. Add the point layer ***Animal_locations_utm.shp*** to a new data frame.




animal_locations_utm

OBJECTID *	Shape *	LocationID	DateTime_
1	Point	1	7/21/2010 6:00:03 PM
2	Point	2	7/21/2010 7:00:58 PM
3	Point	3	7/21/2010 8:47:44 PM
4	Point	4	7/21/2010 9:33:08 PM
5	Point	5	7/21/2010 10:33:57 PM
6	Point	6	7/21/2010 11:30:46 PM
7	Point	7	7/22/2010 10:43:02 AM

We want the cumulative travel time in hours, so add a double precision field for hours.
The ***DateDiff*** visual basic function can return the difference between two dates …so copy the first row's date, and then compute the date difference in seconds/3600 to convert to hours …



LocationID	DateTime_	HOURS
1	7/21/2010 6:00:03 PM	0.000000
2	7/21/2010 7:00:58 PM	1.015278
3	7/21/2010 8:47:44 PM	2.794722
4	7/21/2010 9:33:08 PM	3.551389
5	7/21/2010 10:33:57 PM	4.565000

The Hours field has the cumulative time in hours since the first location.

We also want the time between each location. Add a date field and use the Calculate End Time geoprocessing tool to populate that with the time from the next location.

LocationID	DateTime_	ENDTIME
1	7/21/2010 6:00:03 PM	7/21/2010 7:00:58 PM
2	7/21/2010 7:00:58 PM	7/21/2010 8:47:44 PM
3	7/21/2010 8:47:44 PM	7/21/2010 9:33:08 PM

Then add a double precison field Hours2 and compute the time between locations in hours:

```
Hours2 =
(DateDiff ( "s", [DateTime_], [ENDTIME] ))/3600
```

HOURS	Hours2
0.000000	1.015278
1.015278	1.779444
2.794722	0.756667
3.551389	1.013611

3,040.8833	72.123333
3,113.0066	0

note for the last location we do not know the time to the next location…

We also want to know the distance traveled between locations in meters. Check on the Tracking Analyst extension and use the Track Intervals to Features geoprocessing tool…

Track Intervals To Feature (Tracking Analyst)

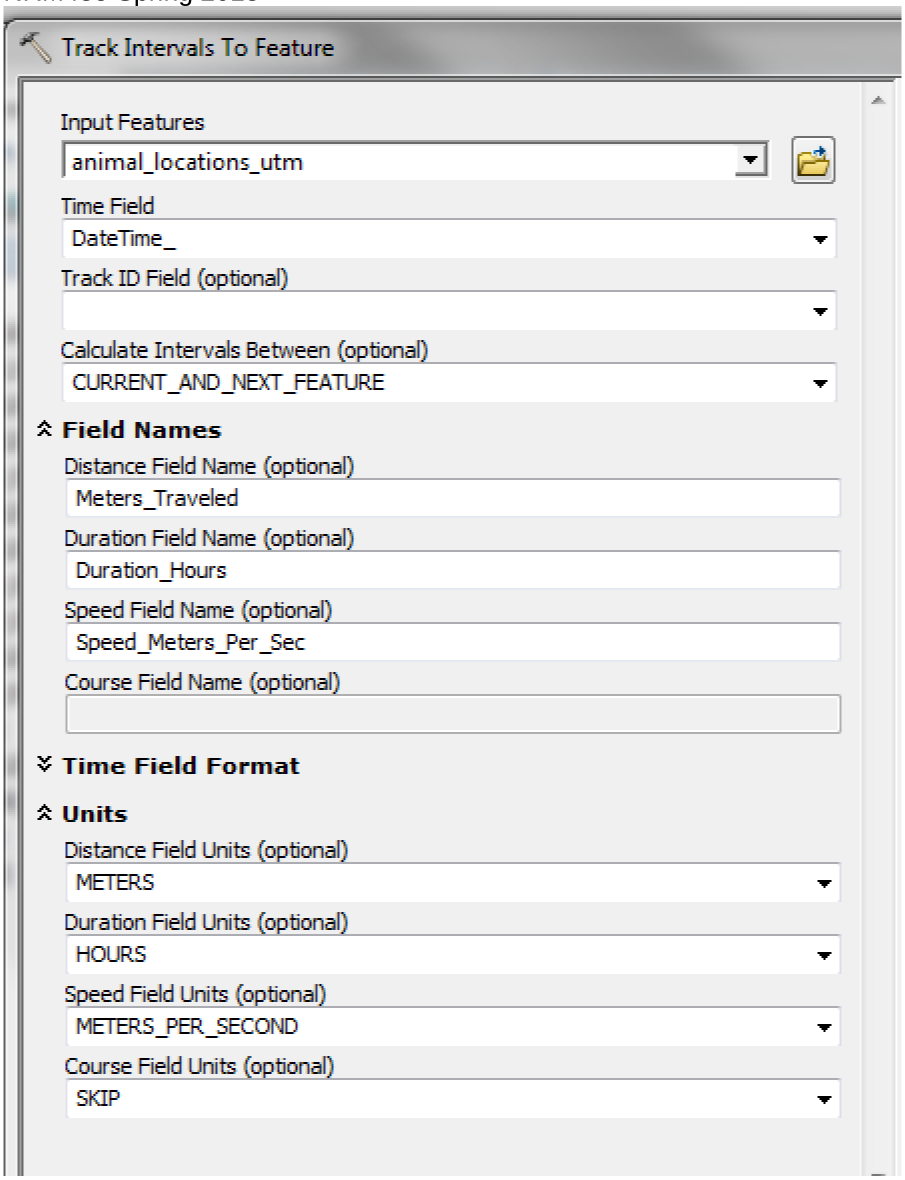
ArcGIS 10.3

License Level: Basic Standard Advanced Locate topic

Summary

Calculates values that are computed from the difference between successively ordered features in a track. New fields are added to the input feature class or layer to store the calculated values (distance, duration, speed, and course).

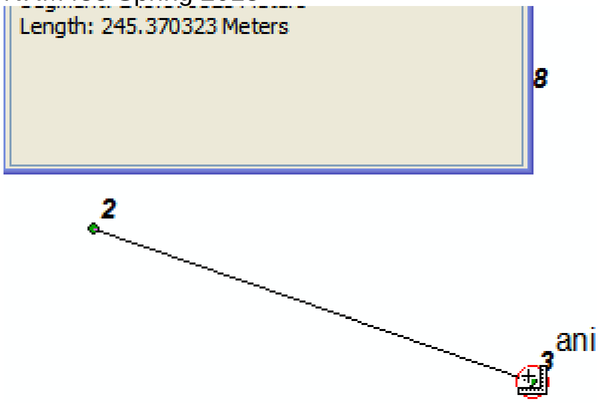
Illustration



Notice that our Hours2 is equal to the Duration_HRS field:

Hours2	Duration_Hours	Meters_Traveled	Speed_Meters_Per_Sec
1.015278	1.015278	221.309439	0.06055
1.779444	1.779444	245.370323	0.038303
0.756667	0.756667	138.353509	0.050791
1.013611	1.013611	160.574114	0.044005

Use the measure tool to measure distance between location 2 and 3… ***245.37 meters***



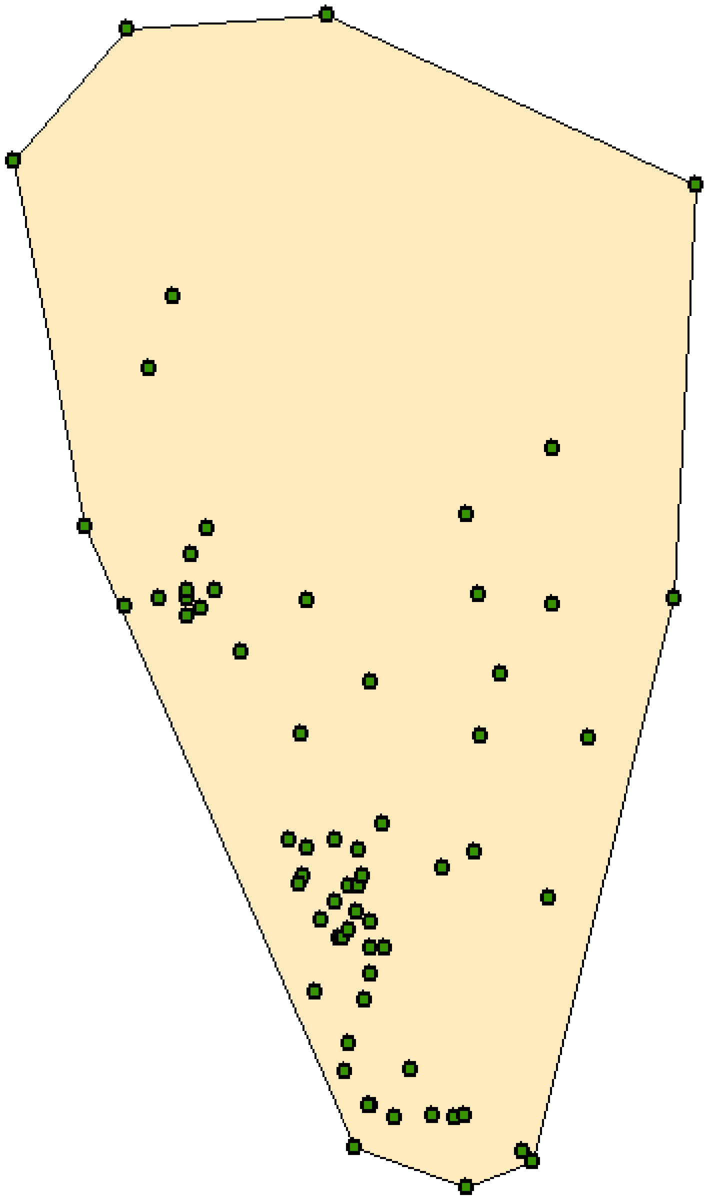
What was the minimum, maximum speed and distance between animal locations?

animal_locations_utm_Statist

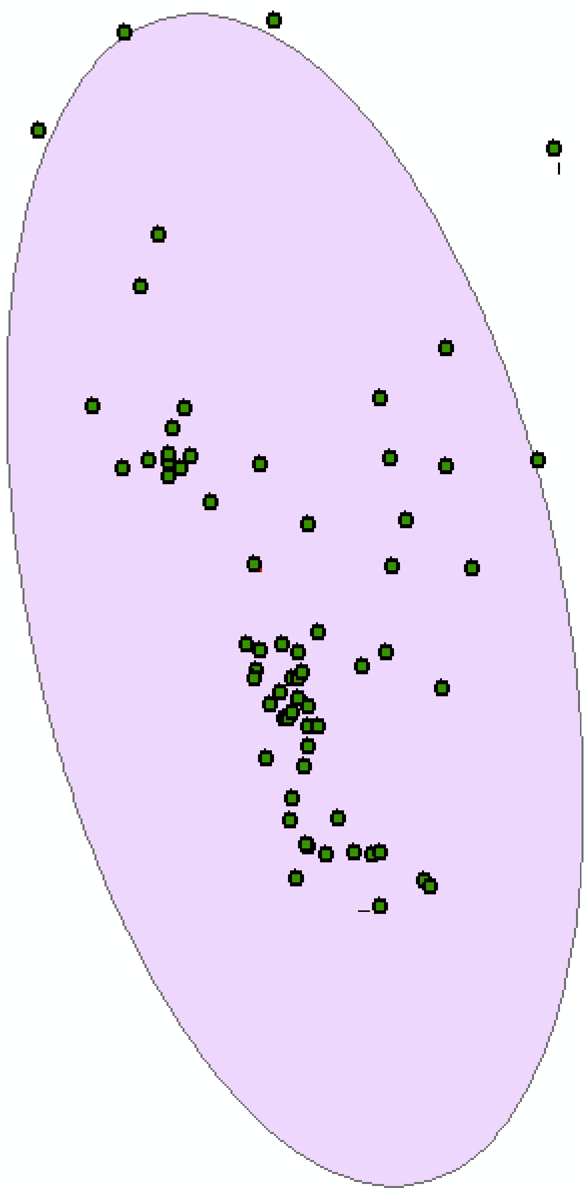
FREQUENCY	MIN_Meters_Traveled	MAX_Meters_Traveled	MIN_Speed_Meters_Per_Sec	MAX_Speed_Meters_Per_Sec
66	18.990527	2045.306809	0.000127	0.205145

Minimum Convex Polygons

Minimum convex polygons are sometimes used in wildlife habitat studies. They are polygons constructed by connected the peripheral animal locations. Use the ***Minimum Bounding Geometry tool*** to create a convex hull polygon from your animal location points.



Another way to characterize location is using the ***Directional Distribution*** tool. If the locations are normally distributed, approximately 95 percent of the locations will be within 2 standard deviations of the mean location.



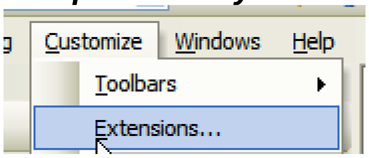
What percentage of locations are within the ellipse? 61 of 66 locations = 92.4%

Home Range Utitization Distributions

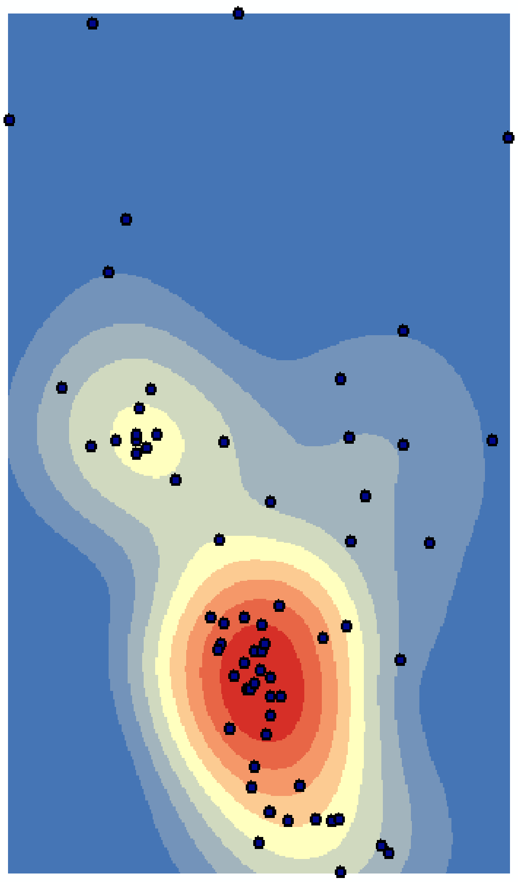
Earlier in the semester, we interpolated point quantities using the IDW and Kringing geoprocessing tools. We can not use these with locations, since we have no quantity to interpolate.

Kernel density estimates are typically used to estimate densities based on locations. The locations might be wildfire hot spots from remote sensing, an animal's location from GPS collar,etc.

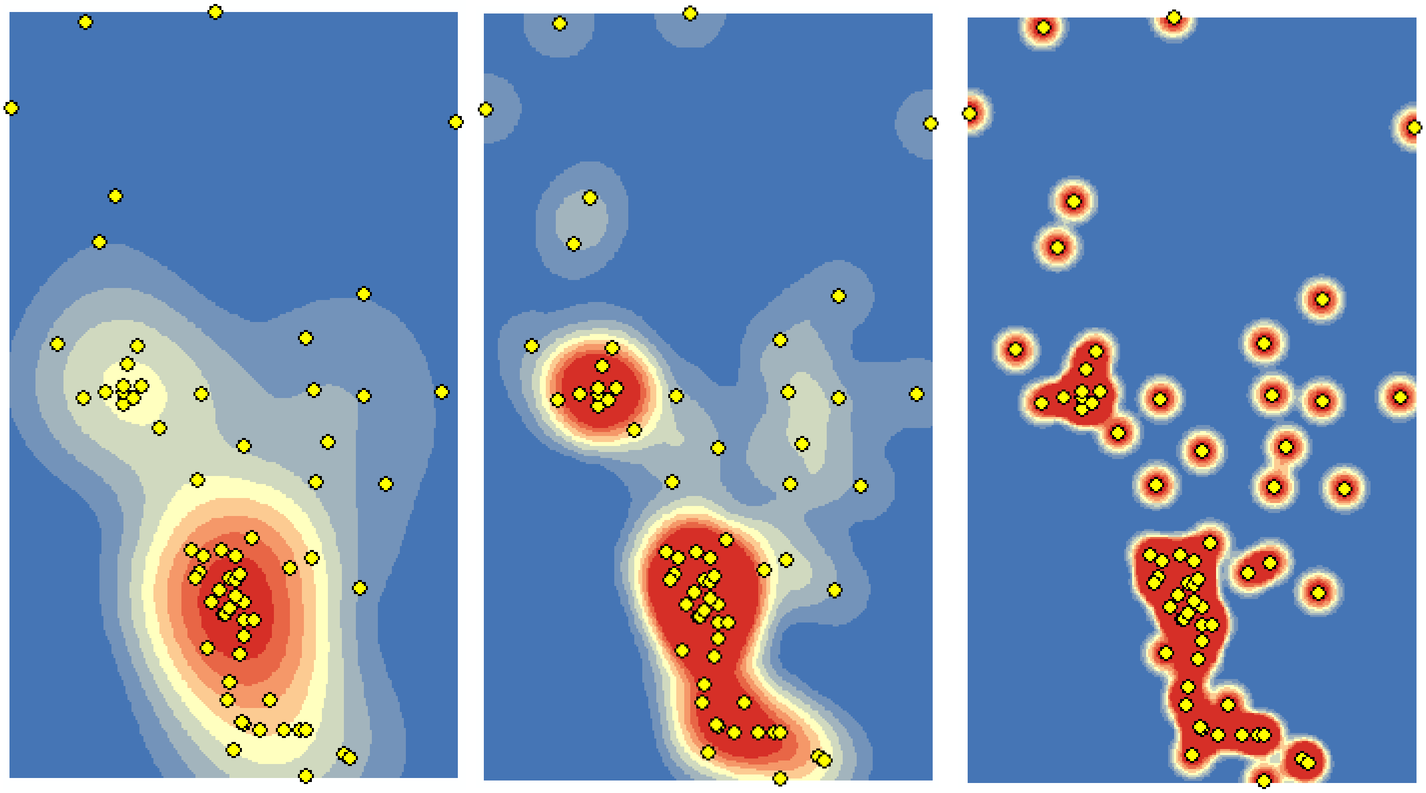
The Kernel Density Estimation creates a raster representing kernel density, so you must have the ***Spatial Analyst extension*** for working with rasters.



Use the ***Kernel Density*** tool to create a raster with 5-meter pixels (cell-size), using a search radius of 500 meters. Notice that the highest density occurs in areas where location points are clustered.



Repeat the process, this time using a ***search radius of 250 meters*** and an output pixel size of 5 meters. And a ***search radious of 100 meters***, and an output pixel size of 5 meters. Note that the kernel density is dependent on the search radius size used.



Each 5 meter cell has the estimated number of animal locations per square kilometer.

Symbolize your 500m search radius output with a defined interval of 20.