Geoprocessing (map overlay) exercise - Rabbit prediction map

Step-by-step student instructions

(Version for ArcGIS 9.3, May 2010)

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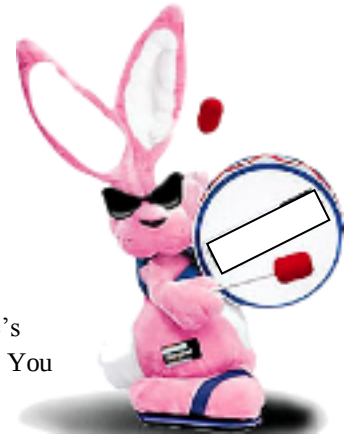


In this activity you will perform a spatial analysis of a fiticious species of rabits using ArcGIS's geoprocessing (map overlay operations) functionality using layers of vector data (shape files). You will also use different types of spatial joins and create a final map in layout mode.

Description:

A new rabbit species, possibly escaped from the secret lab of a well known battery manufacturer, has recently been spotted at certain locations in southern Iowa. Guided rabbit-spotting tours for curious tourists are in the planning stage. As a GIS specialist you've been tasked by several small local tour companies to help predict rabbit sightings as a basis for planning the guided tours. The locations of confirmed rabbit sightings have been entered into a GIS layer. The famous rabbitologist Dr. Erwin Hasenpfeffer has worked out two simple rules for generally predicting locations for this new rabbit species. However, you will first need to independently verify the validity of these two rules by comparing the locations of actual sightings in your area with his predictions. If his rules are reliable, you could use them to create a map that predicts rabbit sightings (i.e. shows areas in which they occur with a high probability). This map would help each of the four the rabbit-spotting tour companies to efficiently plan their tours.

Theoretical background:

Dr. Hasenpfeffer's model for predicting rabbits is based on two rules:

b) The new rabbits live primarily inside forests and venture at most **1000 m** outside of it.

a) They are shy and stay **at least 500 from roads** and **2000 m from cities**, even if they are technically less than 1000 m away from of a forest.

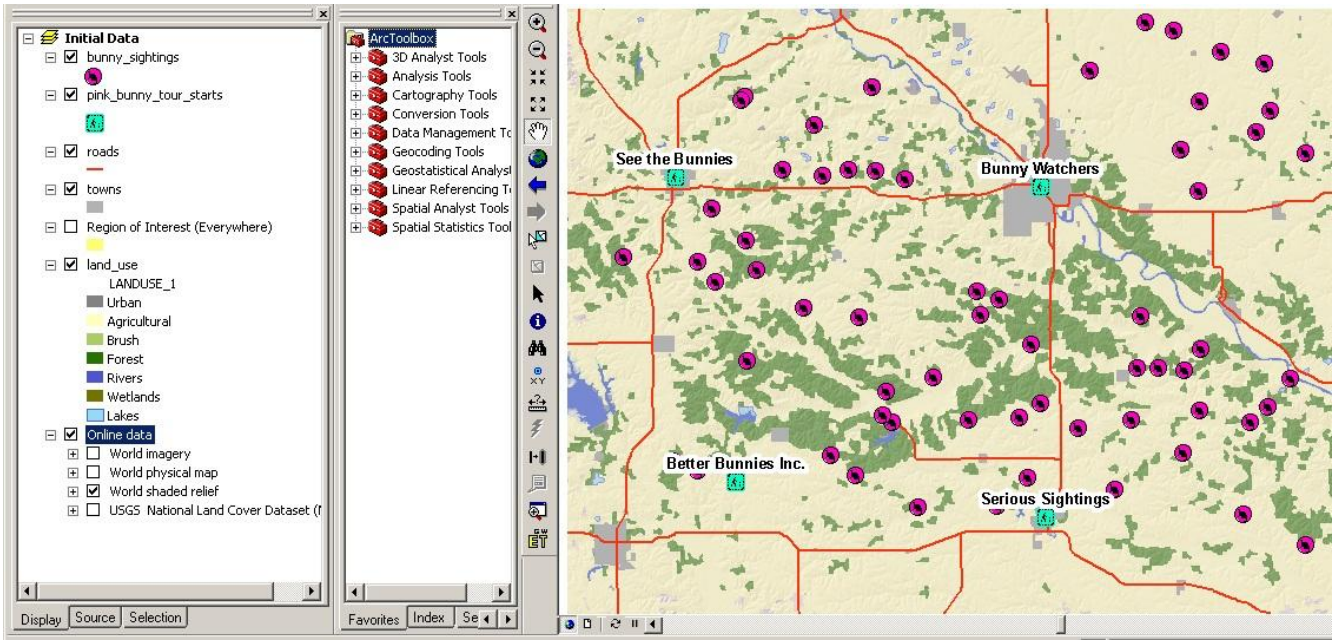
Data (see rabbit_start.mxd):

- bunny_sightings.shp - points showing documented rabbit sightings
- bunny_tour_starts – locations from which each company has decided to start their tour
- roads.shp – lines indicating roads
- towns.shp – polygons defining the location (outline) of towns
- land_use.shp – polygons showing types of land, however, you are only interested in those polygons indicating Forest
- Region of Interest (Elsewhere.shp) – polygon defining the area of interest for you work
- Optional: Online data - several layers connecting to online maps, including USGS topo map, aerial maps, hill shade)

Instructions:

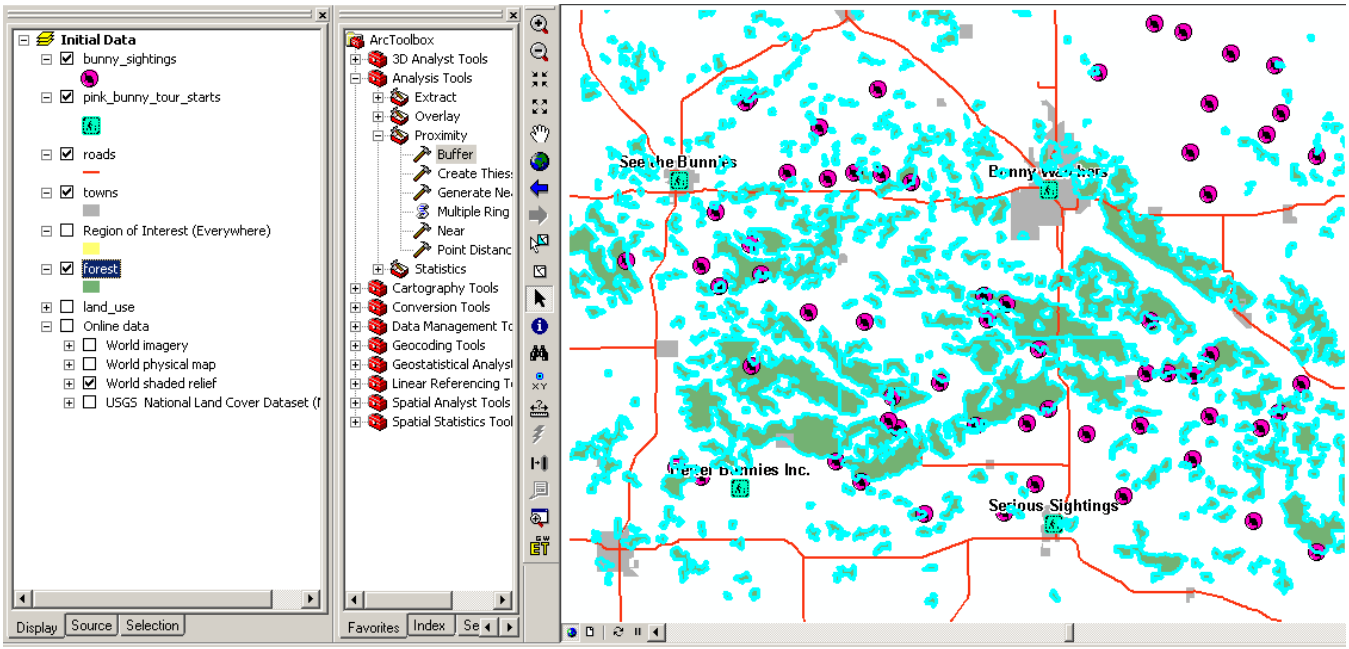
Unzip data.zip into a folder and open rabbit_start.mxd. Answer the questions from steps A to G (some have sub-steps); document your process for each step, including screenshots, inside a Word (or Open office) document. Save a new mxd file after each of the six steps as rabbit_A.mxd, etc, so you can go back if something goes wrong.. Examples of how each step should look are given below, however, you do not have to perfectly "duplicate" this, you're free to use your own colors, etc. Finally create a separate jpg file showing you results map (step G). Hand in the Word document and the jpg file.

After loading rabbit_start.mxd you should see this:

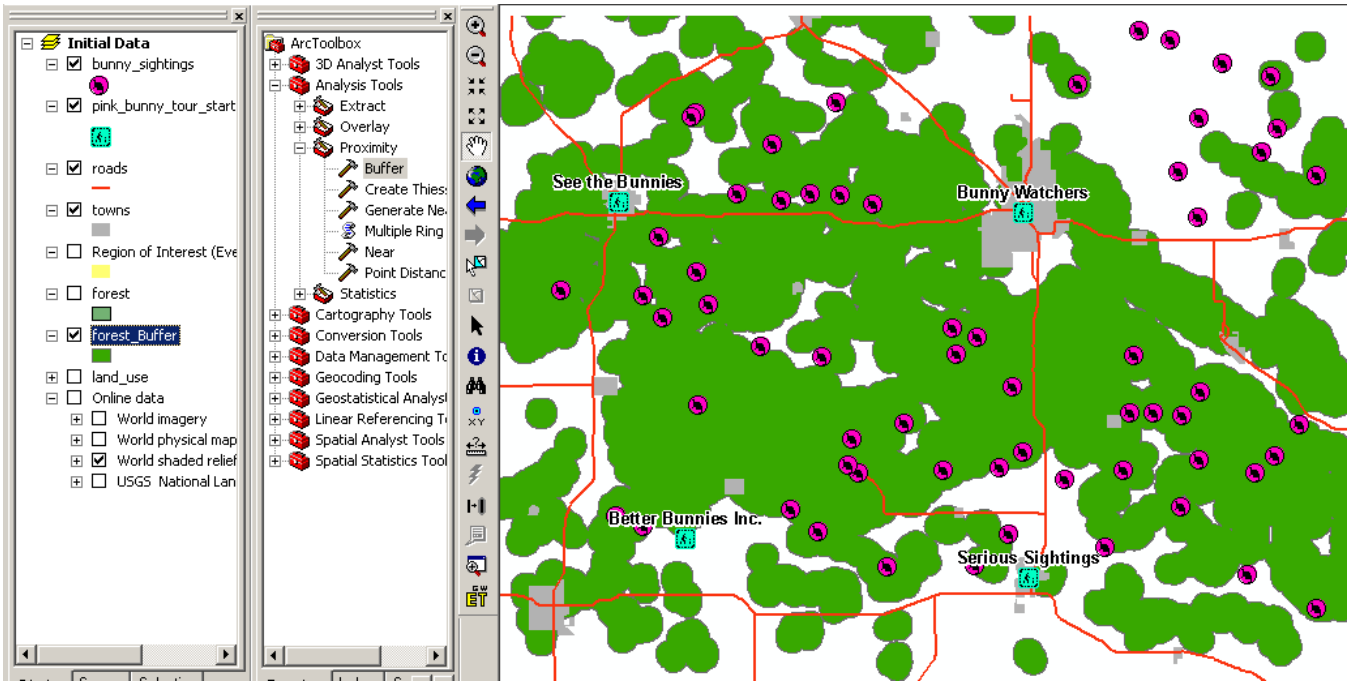


A) Create a dissolved 1000 m buffer around forest (3 pts)

- Figure out how which LANDUSE_1 value corresponds to Forest (value: _____)
- Run a SQL query (select by attribute) to select all the Forest polygons from land_use.
- Create a layer from the selection (forest) or use data - export and save it as a shape file (forest.shp)

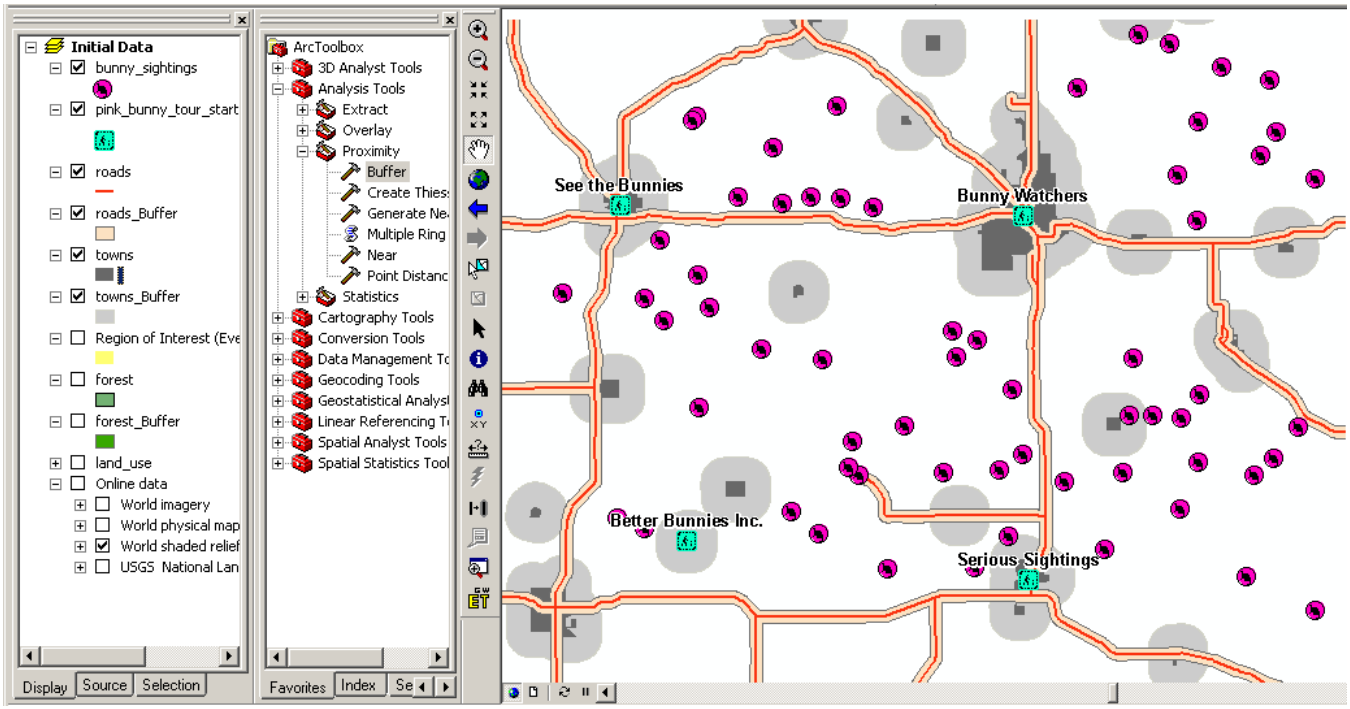


- Now perform a dissolved 1000m buffer operation (Buffer tool) and call it **forest_buf.shp:**



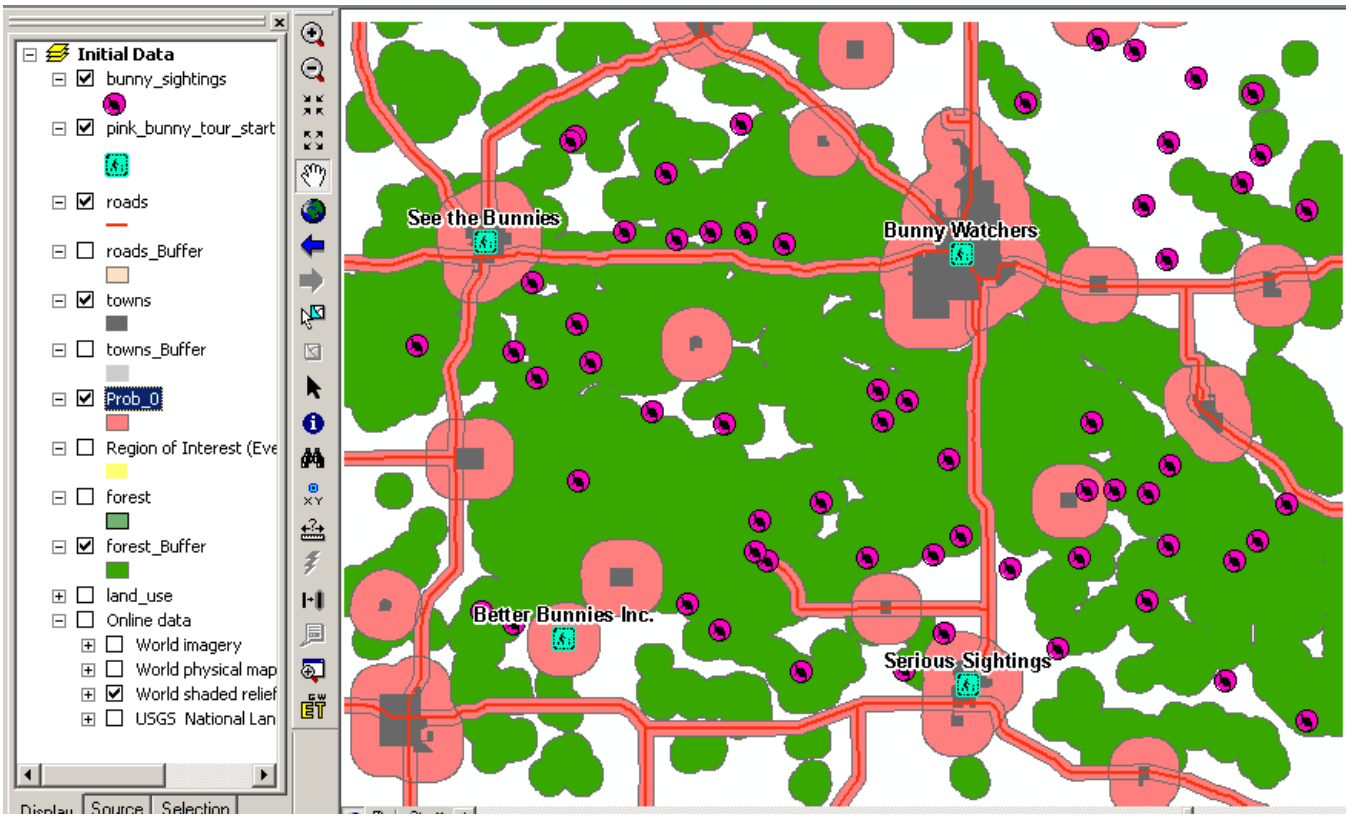
B1) Create a dissolved 500 m buffer around roads and call **it road_buf.shp**, 1 pt

B2) Create a dissolved 2000 m buffer around towns and call **it town_buf.sh**p. 1 pt



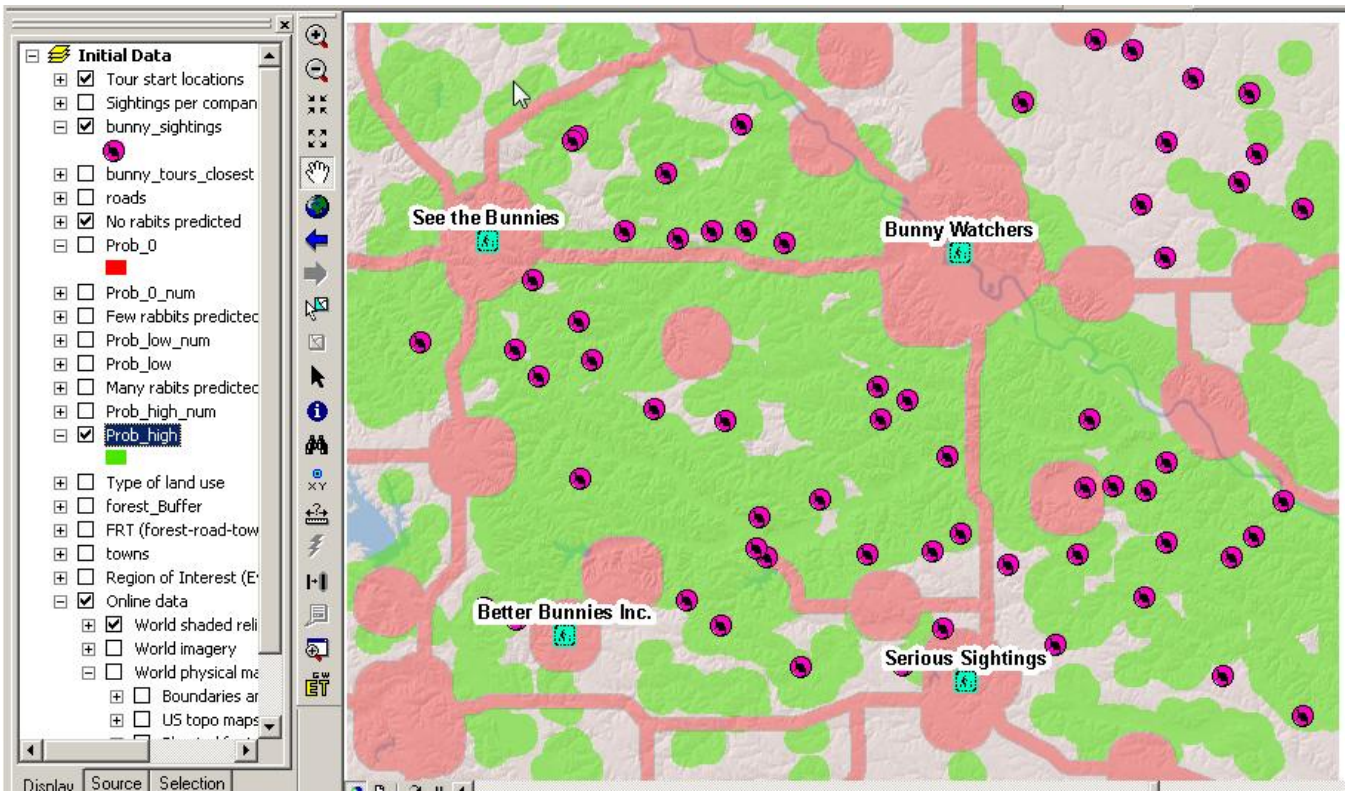
B3) Using a geoprocessing method, create a layer the combines the shapes of the road and the town buffer. Call it **Prob_0.shp** (for "Probability is 0" i.e., one should **never** encounter a rabbit within these polygons!). 2 pts

Which method did you use? _____



C) Unfortunately your Prob_0.shp now "overlaps" with the forest_buffer layer**,** to see this make Prob_0 semi transparent:

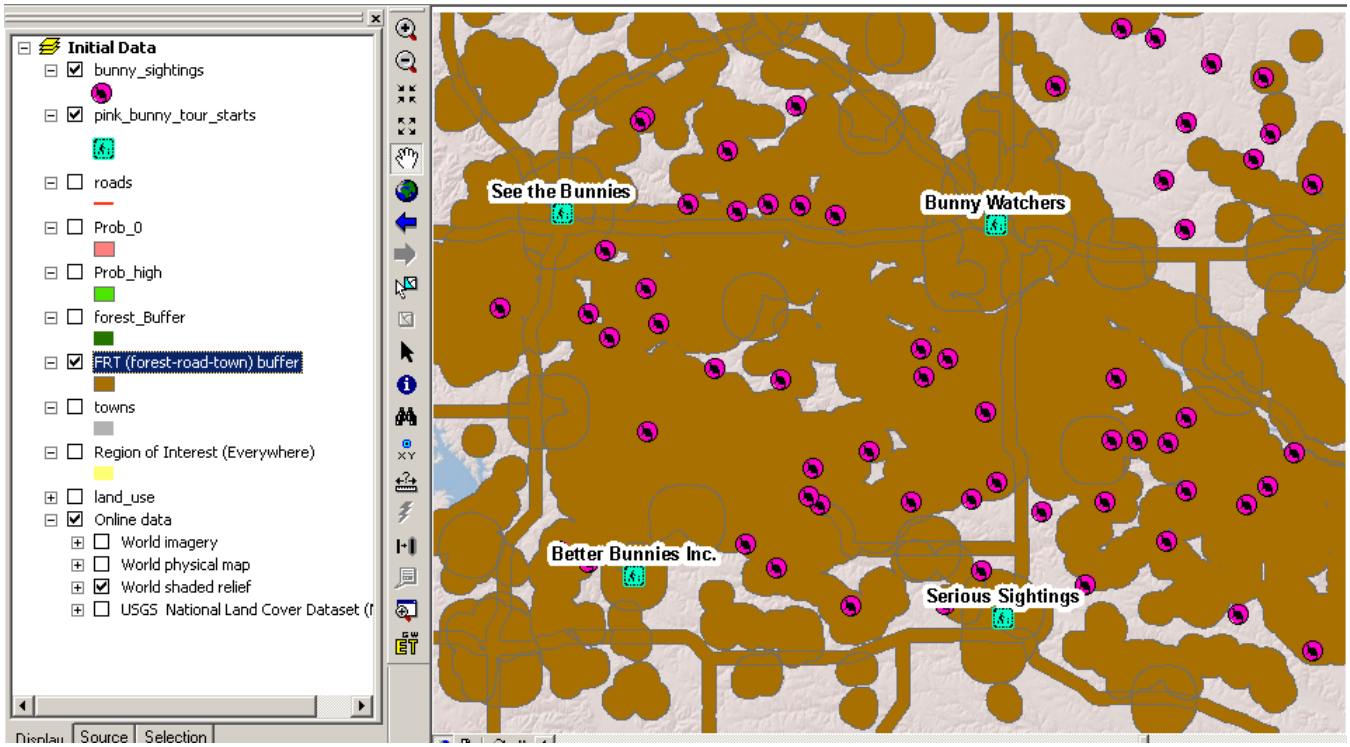
As shyness wins out in Dr. Hasenpfeffer's rules, you need to first erase the **Prob_0.shp** layer from the forest_buf layer before you can continue. Call the resulting layer **Prob_high.shp** (for "high probability for rabbit encounters") (2 pts)



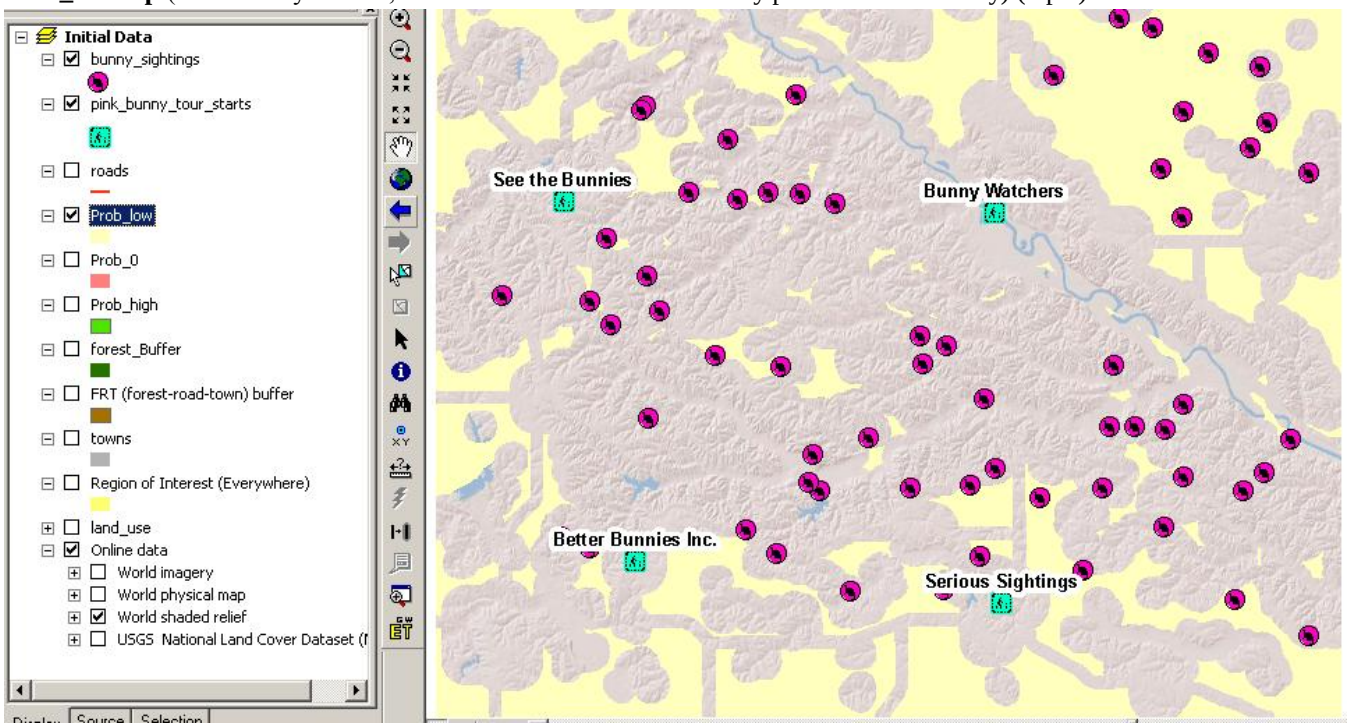
Note: The Erase tool is only available if you are running ArcGIS with the ArcEditor license. If you have the (less powerful) ArcView license you need to work around this by using a union and get rid of the "wrong features", i.e. you need to keep only those forest buffer polygons that are NOT part of Prob_0, and save these polygons as Prob_high.shp. (1 extra point for figuring this out, if you get stuck and can't proceed, ask me for the Prob_high.shp file)

D) Dr. Hasenpfeffer's rules have given you a probability for areas that are inside the road/ town buffer and areas that are inside forest buffers, but this still leaves some parts of your region undefined. Seeing that there are a few rabbit sightings in these parts, you decide to simply assign them a "low probability".

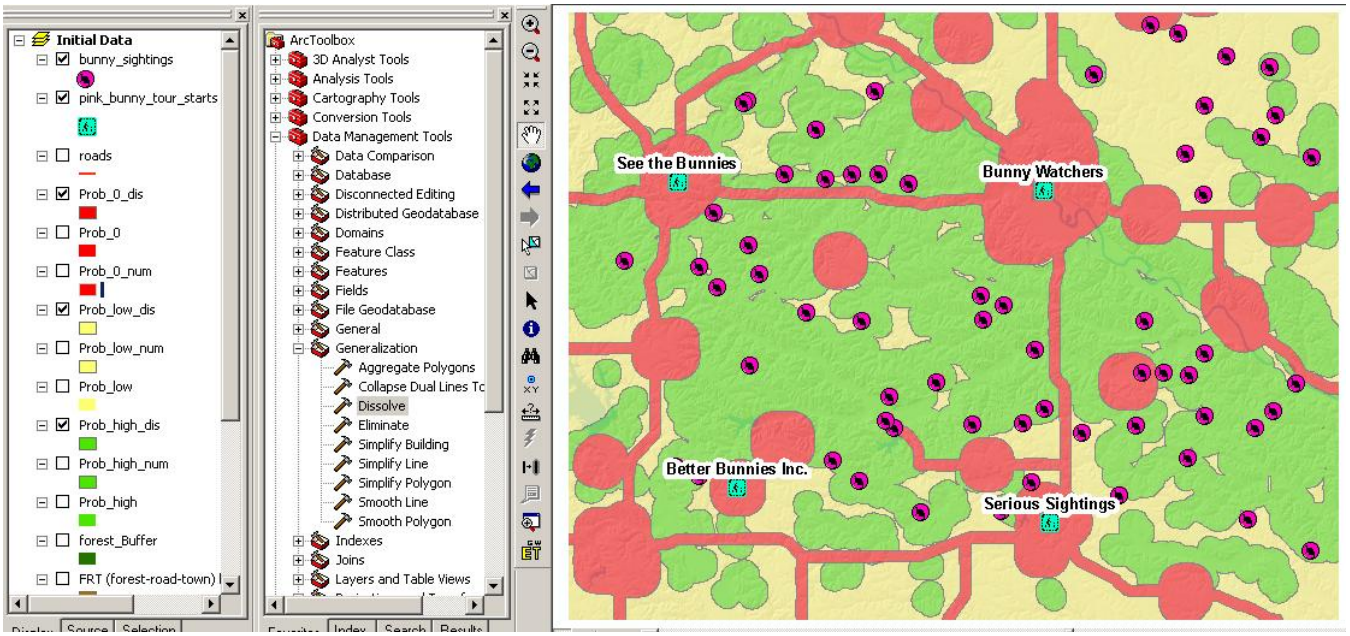
First, create a helper layer called **FRT** (forest-road-town) that combines forest_buf and Prob_0. (2 pts)



Second, erase the FRT layer from the Region of Interest layer (which completely covers your area) and call the result **Prob_low.shp** ("Probability is low", rabbit encounters are theoretically possible but no likely) (2 pts)



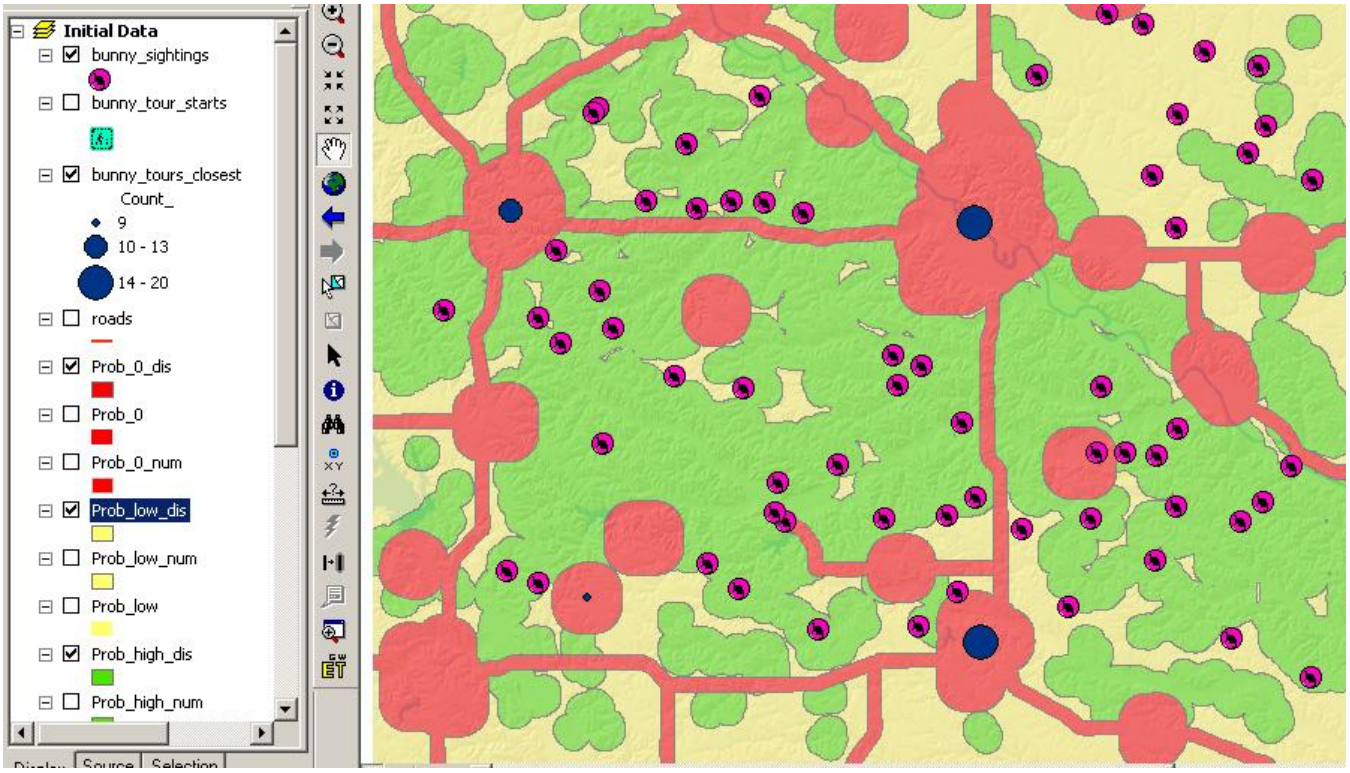
E1) If you haven't done so yet, dissolve the Prob_0, Prob_low and Prob_High layers (they are called _dis here) and color them according to their probability. Check, that all the pieces indeed fit into each other like a jigsaw puzzles i.e. that there are no gaps or overlaps! (2 pts)



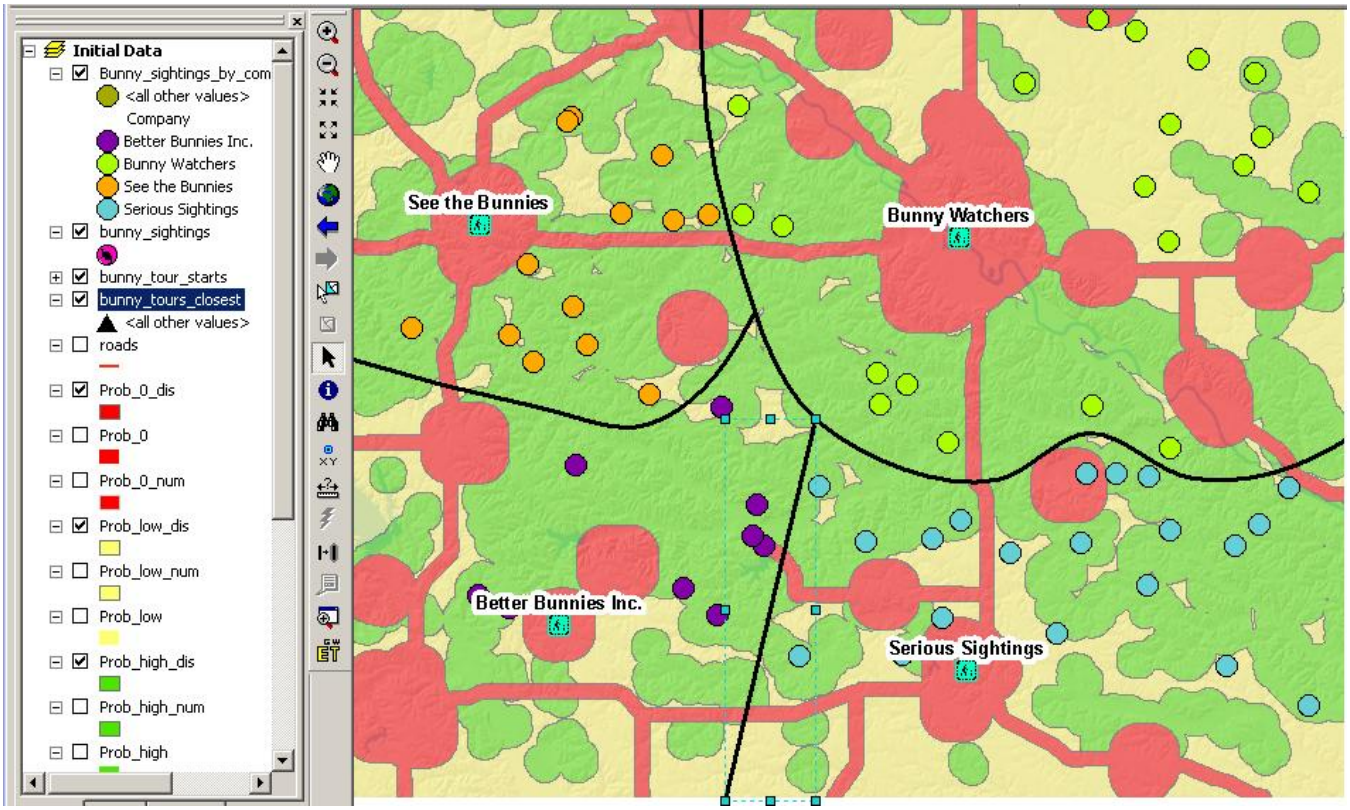
E2) For each of these three Prob layers, create a new layer with _num (for number of rabbits) added to its name (e.g. Prob_0_num) that "knows" how many sighting were made.
(What type of spatial join did you use to create this "smarter" layer? _____ _____ join) .
How many rabbits were sighted in are in each area? (Prob_0: ___ Prob_low: ___ Prob_high: ___) (3 pts)

E3) Use a select-by-location (spatial select) to select those rabbit sightings that **contradict** Dr. Hasenpfeffer's rule, i.e., sightings that, in fact, occur inside Prob_0. Show the selection in a screen shot (2 pts).

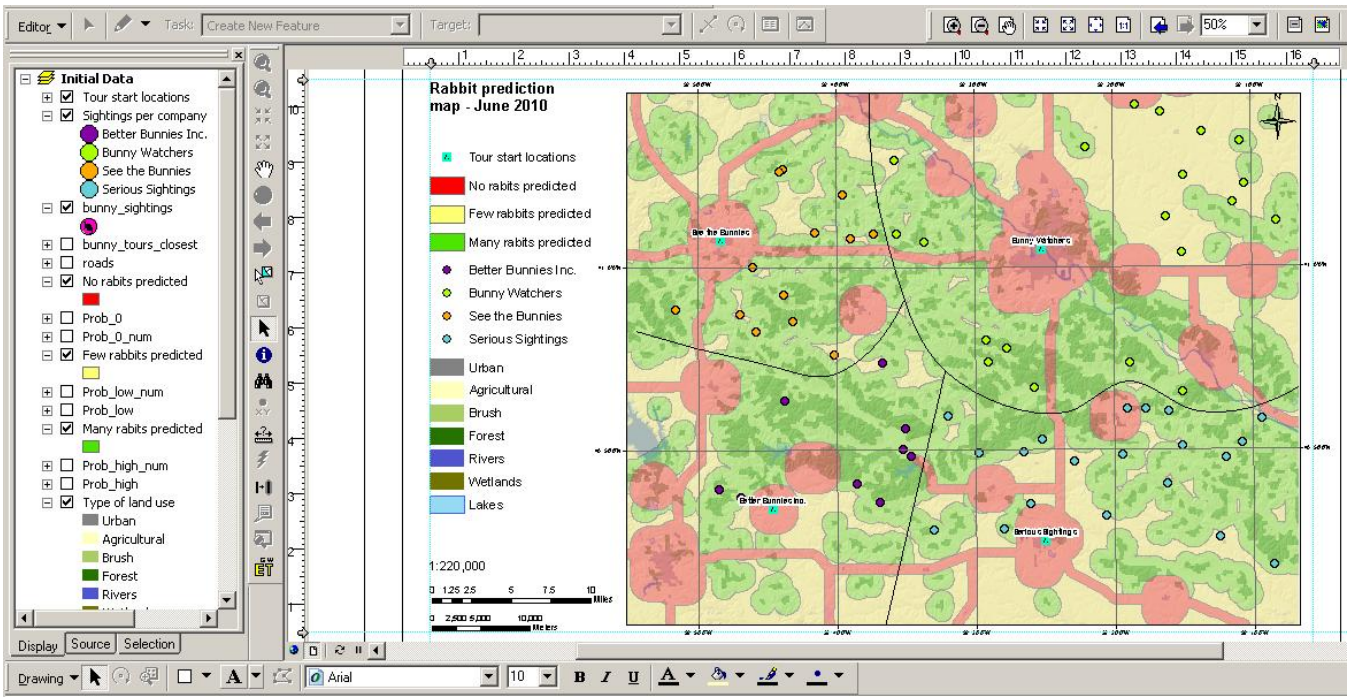
F1) Create a layer called **rabbit_tours_closest.shp** that counts how many of the sightings are closest to each tour company **(**make sure to use the correct type of spatial join!). Show a table with the **total number** of the closest rabbit sightings and the **average distance of these sightings.** (3 pts)



F2) Using another spatial join (call it bunny_sightings_by_company.shp), make a map showing which sightings "belong" to each company (via color or symbol type). Manually draw approximate partitions for each company's share of the area on the map (3 pts)



G) Create 1:240,000 scale map on Tabloid size paper, similar to the example below. Include a title legend, a North arrow, scale number and bar(s). Use a fixed scale and add a 10 minute latitude/longitude grid. Watch for good layout with sufficient spacing! In file File – Export Map, save as a 96 dpi jpg and hand it in with your (4 pts):



Point Breakdown:

A: 3 pts
B: 4 pts
C: 2 pts
D: 4 pts
E: 7 pts
F: 6 pts
G: 4 pts
Total: 30 pts