Geoprocessing (map overlay) exercise - Rabbit prediction map

Notes to the instructor

(Version for ArcGIS 9.3, May 2010)

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Hi there, fellow GIS instructor!

In case you want to use this exercise here's some more info for you. I've run this exercise in my GIS course for a couple of years but this is the first time I'm making it available for others and there are bound to be things I overlooked, didn't spell out clearly enough etc. I've recently redone and rechecked the exercise and it does work on ArcGIS 9.3 but that could, of course, change in future versions (especially with Arc 10 coming up!). You're welcome to modify anything as you see fit for your course (e.g., put a more geological spin on it), feel free to email me if you need help!

The **students** folder contains all the data (shapefiles and online-link lyr files) together with **rabbit_start.mxd** and the step by-step instructions. I left the instructions in Word format with all the screenshots it's a pretty big file so may want to convert it to a pdf.

The **instructor** folder contains the same data as the students folder plus any additional shapefile that are created during the exercise. Open **rabbit_final.mxd** to get the final version of the exercise that includes all layers and the final map layout. The folder also contains a solutions Word file (**Solutions.doc**).

I use this exercise as a large take home exercise about 2/3 into my intro GIS class, directly after going over vector geoprocessing (map overlay) operations. This exercise does not require any specific geoscience background; I deliberately use the fictional analysis scenario in a planning/ business setting to make the process easy to understand. I also find that its fun for most students to emulate a GIS "job" even if the setup is make-believe.

All the GIS data needed is provided as shapefiles: sighting locations, roads, towns and forest (as part of land use). Other than for the extraction of the forest polygons, the feature's attribute values don't play any role, they are purely "givers of shape" for the map overlay operations that follow. There are some rasters but they are only online data links that can be used to display the hillshade of the terrain and/or the topomap, etc., there's no "processing" of these rasters needed for the exercise.

I've come up with two very simple, theoretical rules for predicting where these new rabbits should exist, depending purely on the location of roads, towns and forest. Basically, the rules postulate that a) the rabbits "like" to be inside forests or within a certain distance (i.e. the good zone, with a high probability of spotting rabbits) and that they b) fear human-influenced areas, defined to be in or around roads and towns (the bad zone, with, theoretically, no chance of encountering a rabbit, at least in a un-flattened state). While these rules attempt model the animal's "behavior" to provide a sort of habitat prediction, they are extremely simple e.g., they involve only buffer zones with straight-line distances. The only slight complexity arises from the

fact that a) some of the good and bad zones actually overlap, in this case bad wins, and b) that there are some parts within the predefine area of interest that turn out to neither good nor bad, they are declared to be neutral, with a small chance of encountering a curious but not suicidal rabbit there.

There are two main parts to the exercise, in part 1 (steps A to D) the students use geoprocessing operations to create a spatial representation of these rules using buffering, erasing and union. The overall process resembles assembling a sort of jigsaw puzzle of polygons that cover the area of interest and fit into each other. For those using the ArcView license, there's a problem as they don't get to use the Erase tool (they can use Clip but that won't work for this particular case). They can, however, perform a union and manually select and save the "right" parts to emulate the Erase tool. If you know that your students won't have Erase you need to either provide the result or make sure they understand how to use Union instead (see the Solutions.doc file for more).

In part 2 (steps E and F) they practice using different types of spatial joins for a qualitative and quantitative spatial analysis of the actual locations. For my class, this is a very valuable refresher of the tricky topic of spatial joins which we've done in detail earlier. Although it only involves point/point or point/polygon joins, it would likely confuse students who have not dealt with spatial joins before. They key for getting the desired join is to analyze the requirements for each join: Simple or summarized? Distance or inside? Which layer is the source and destination?

A polygon (zone) to point (sightings) join can be used to find if (how many?) there are any factual sightings that contradict the rules (there are a few that are too close to a road/town). One could expand on that and ask the students to speculate if that means the whole model is wrong (sort of – at the very least it should use a finer probabilistic setup with ranges from 0 to 100% rather than simple binary rules) and how it could be fixed (one could lower the distance for the road/town buffer until they do not include any sightings).

The rest of the spatial joins is based on the four tour start locations from which four different tour companies plan to start guided bunny tours and the sighting locations only. This allows the students to compare those companies and to manually (graphically) partition the total area into four partitions for each company (based on distance of sightings to its tour start). This could be done properly with a spatial partitioning tool (Thiessen Polygons) but I keep in simple and have the students simply draw lines on the map by hand.

Finally, the students make a map (step G) that summarizes and presents the results. This may involve a lot of fiddling with the sizes and positions of the different layout elements and can become a fairly involved cartographic exercise by itself but my aim here is simply to force ste students to deal with the many ingredients and practice laying them out in ArcMap. I've provided examples my map (which admittedly isn't very complex) but that should not be taken as the required layout- other (cartographically superior) solutions are very possible.

This is not a tutorial exercise for beginners and I deliberately didn't do a lot of hand holding ("click here and you should see this …") in the instructions of each step. However, I've put a lot of screenshots in the instructions; in my experience showing what the end of a step should look

like communicates the required process better than an elaborate text description. It also provides one form of solution so that the students know if they are on track. Regarding grading, I require them to describe and document their individual way of getting to the shown solution, usually requires via a series of screenshots and put captions on them.

Good Luck!

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