GEOG 482/582 I GIScience II I FALL 2015

ASSIGNMENT 4: TSUNAMI EVACUATION

Objective: The recent article in the New Yorker magazine regarding the next big earthquake that is to hit the Pacific coast of North America has got Oregon rethinking its tsunami planning. Lincoln County City has hired you to come up with a new plan for where to locate safety zones in coastal towns that are expected to experience the worst impacts from a potential tsunami. In developing this plan, you will:

- gain experience with converting spatial data models
- learn how perform arithmetic functions on raster data
- become proficient in conducting a multi-criteria evaluation

Learning Outcome: At the end of this lab you should be comfortable performing the following tasks:

- working between vector and raster spatial data models
- standardizing raster datasets for use in a GIS model
- assigning weights to spatial variables
- conducting a multi-criteria evaluation for recommending suitable locations

Deliverables:

A 1000 word paper with the following components:

- **Introduction**: 250 words describing (i) why it is important to study tsunami evacuation and (ii) why GIS MCE is a suitable method to employ. Citations are a necessity.
- **Methods**: 300 words describing the methods you undertook to produce results (do not mention software). Include a diagram that illustrates your overall methodological framework.
- **Results**: Maps and figures that demonstrate where evacuation safety zones should be located based on your recommendations. Include a 300-word narrative that describes your results.
- **Conclusion**: 150 words that summarize your research study and explain the contributions of your research to the literature on tsunami evacuation and preparedness.
- **References**: does not count against overall word count.

INSTRUCTIONS

PART 1: COLLECT AND ORGANIZING DATA

1. Create geodatabase in ArcCatalog and set it as default.
2. Extract Lincoln county from the Oregon County shapefil.
3. Clip roads, rivers, streams and water bodies to Lincoln County. Hint: to save time, create a batch process by right-clicking on the tool and selecting Batch.
4. Remove any water bodies that would not be impacted by a tsunami (HINT: use the Select tool).
5. Extract the cells from the DEM that fall with Lincoln County using the county as a mask.

Now you have your Lincoln County data.

PART 2: CREATE VARIABLES AS RASTER DATA MODELS

The next step is to identify the areas that are at risk of being affected by the tsunami.

6. Visit a credible source such as NOAA to determine the distance from water features that are considered safe from a tsunami. Create buffers around your water feature datasets using this distance to define your buffers.

The next step is to determine a suitable study area within which you will be recommending tsunami safety zones.

7. Estimate how far the average individual can travel on foot before a tsunami makes landfall.
8. Create a path distance raster from the water bodies dataset. Use the value from step 7 for the maximum distance. The result will be your new study site area.
9. Extract the study site from your DEM by using the raster created in step 8 as your Mask.

The next step is to estimate the distance from water features that will potentially be affected by the tsunami. The objective here is that you want to recommend safety zones that are far away from these areas.

10. Create a path distance raster for rivers, streams and waterbodies by using the buffer datasets from Step 6 as your inputs. Your outputs should display a value of zero for those cells located in the buffers, and increasing values as you move farther away from the buffers. Be sure to conform the spatial characteristics of these rasters to the DEM for your study site created in Step 8.

Next, you want to ensure that the safety zones are not too far away from roads that will serve as the main corridor for people to travel on. You also want to determine how difficult it will be to travel from the areas of tsunami risk to other locations in the study area.

11. Create a path distance raster for roads. Set a suitable distance as the maximum distance (i.e. consider how far you can expect people to walk across non-road surfaces, and what these surfaces might look like).
12. Create a cost path raster that represent the cost of traveling from tsunami risk zones to other cells in the landscape. Use slope as the cost surface.

You should now have a raster dataset for your study area for elevation, cost surface of travel, distance to roads, distance to rivers, distance to streams, and distance to water bodies.

PART 3: STANDARDIZE VARIABLES

Next you will standardize each raster by converting them all to values of 0 (least suitable) to 1 (most suitable).

13. Use the raster calculator to convert each distance and cost raster to values of 0 to 1 (do not do this for your DEM). To do this, divide each rater by the maximum value in the dataset. After this step you may end up with a value 0 representing the most suitable cells for at least one of your variables. What should you do to fix this?
14. For the DEM, reclass the values to have a new value of 0 representing cells where safety zones should not be placed, and a new value of 1 for those cells where safety zones can be placed. You will have to determine the threshold by going to a reputable source such as NOAA.

PART 4: RUN MODEL AND ANALYZE RESULTS

You are now ready to create your multi-criteria evaluation model. Each raster data will serve as an input into your model representing each of the decision-making variables. You will build your own equations and include your own weights that will influence what variables are most important for determining where safety zones should be located.

15. Use model builder to create equations that specify how you will weight and combine your variables for conducting a weighted multi-criteria evaluation.
16. Where should the county place tsunami evacuation safety zones?

BONUS

17. Alter your weighting scheme to determine how weighting of variables impacts where the tsunami safe zones should be located. Provide results in your Results section (extra 100 words) and describe the impacts of weighting in your conclusion (extra 100 words).

GRADING

You will be graded based on the following criteria:

• Introduction	**10 POINTS**
• Methods	**10 POINTS**
• Results	**15 POINTS**
• Conclusion	**10 POINTS**
• References	**5 POINTS**
TOTAL	**50 POINTS**
• Bonus Section	**10 POINTS**

DUE DATE:
Monday Lab: November 16th 10am
Tuesday Lab: November 17th 10am
*Late submissions will be penalized 5% per day.