Supplementary Guidelines for ENVSOCTY 3GI3

Exercise 4

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Knowledge Check before working on E3

E4 Video + Overview Notes

“Weighted Sum/Overlay Demo March 14” Video

Slide 13: Modeling with Rasters I

1. Binary Constraints
    - Type of constraints
2. Binary Models
    - Examples
    - Advantages & Disadvantages

Slide 14: Multi-Criteria Decision Analysis Models (MCDA)

1. Definition
2. Framework
3. Components

Slide 15: Modeling with Rasters I

1. Data Transforming Approaches
2. Decision Rule
3. Locate Regions
4. Weighting: Ranking vs Rating

Slide 16: Standardization Appoaches

Proclamation

You should first view Patrick's *course slides*, *course videos*, *Exercise 4 Overview Notes (3GI3-W25)*, *EX4 - Instructions (3GI3-W25)*, *E4 Introductory Video*, *"Weighted Sum/Overlay Demo March 14" Video* before reading this **Supplementary Guidelines**.

These slides are only provided as tips that may help you deal with tasks and questions, but they should never become rigid workflow sheets to limit your imagination or inner drive to learn and explore things.

1. Binary Model

- For first 3 factors (i.e., Slope, Aspect, Curvature): what are the differences between their own tools (e.g., *Slope*) with *Surface Parameters*?
- For latter 4 factors (i.e., LSFactor, Landcover, Lithology, Clay), the coordinate systems or cell size are different from the first 4 factors derived from *"BasilDEM10"*, you should do something here.
- When using *Project Raster* to change coordinate systems or cell size, if the original raster is binary (e.g., raster after *Reclassify*), the sampling method of Nearest Neighbor is better than Bilinear sampling technique, why?
- As Lithology is a vector dataset, it's better to first use some vector tools (e.g., *Dissolve/Pairwise Dissolve*? *Select by* …?) to produce the desired types and then use a Conversion tool such as *Polygon to Raster* to convert it into Raster. Also, take care of coordinate systems and cell size!

1. Binary Model

- After 8 **binary** dataset of 8 factors are prepared, try both *Boolean And* and *Raster Calculator* tools to produce the final results. For the results of *Raster Calculator*, you may use *Reclassify* again to only keep the wanted area.
- When creating the maps, you could add “Terrain with Labels” in the Base Map to better display the specific regions’ names to help with identifying different areas and your analysis.

2. Weighted Overlay Model

- First, you should be setting up the **constraint map** using the lithology and land cover layers.
- And then, before dealing with each of the remaining 6 factors, make sure you first get back the specific values (e.g., slope, aspect) corresponding to the constrained areas from last step (*Raster Calculator*?). Think about why we do this? What will this affect our weighting settings later if we don't do this?
- There are different ways of giving weights, check course slides and videos.
- For the weights setting, check the references given in the instruction to reference other the weights. Remember to cite the reference in your answers.

Deliverable 1, 2, 5: Models (each 10 marks)

- All the models should be inserted to PDF as a single page.
- Model in ModelBuilder
    - Write **Labels** beside each step (yellow rectangles) and **Rename** the output files (green circles)
    - Everything must be linked together with arrows. If they miss the arrows, you can manually draw the arrows.
    - Don’t leave any parts in grey color
    - export it directly into a PDF/SVG and insert hem into PDF

Deliverable 1: TWI – steps in the TWI part from *a* to *g*

Deliverable 2: Binary model – specific steps for all 8 factors and the combining steps

- Since in D1 you already displayed the steps for TWI, so this part does not need to include those procedures again, but you **should** import the results of TWI as an input. Because all 8 factors should be displayed here and how they are combined to create the final results.

Deliverable 5: Weighted Overlay model – specific steps for all 8 factors and the combining steps

- Again, specific steps of TWI in D1 are not needed.

Deliverable 3: 1 Map of your Binary Model results (Susceptible lands to badland formation) (15 marks)

- Should be inserted to PDF as single pages.
- Map elements:
    - **Basic Elements (**refer to Map Rubrics on A2L**)**
        - ✓ Clear **boundary** line
        - ✓ Informative **title**
        - ✓ **Legend** (e.g., layer title…)
        - ✓ some form of **orientation**
        - ✓ a **scale** indicator (scale bar? texted scale ratio?)
        - ✓ **credits** (e.g., data source, projection (HCS/VCS) info, (c) your name, your institution, date of making the map, …)
    - Additional info for this map (in D6 it's required in the instruction but for D3 I would personally also make it required)
        - ✓ Concise descriptions of what kind of model and criteria of all 8 factors are applied. Do not include chunks of paragraphs to affect aesthetics. Make it concise and clear.
- Should think of **aesthetics**: are your maps good-looking?

Deliverable 4: Limitations of Binary Model (10 marks) & Improvement Suggestions (10 marks)

- Better to format your answers as: **Short key terms/phrases** + Supporting lines of arguments.
- Better arranged in bullet points.
- The limitations and suggestions could be coupled together, or not. Depends on you, as I think sometimes it's hard to provide a potent suggestion to a limitation.
- Hints:
    - Think of general characteristics of raw data (e.g., data quality) first
    - Second, think of the specific 8 factors (their commonalities and discrepancies). **This part should be more emphasized** as the question is asking the limitations of binary models (so you could contextualize your answers in comparing with the *weighted models (e.g., weighted sum, weighted overlay)*).

Deliverable 6: 1 Map of your Weighted Overlay Model (15 marks)

- Should be inserted to PDF as single pages.
- Refer to Map elements of D3
- *"Please ensure that you **do not use equal weightings** here. Use the **literature referenced** in this document to help think about what may be more important and what may be less important and apply 'logical' weights to them."*
- Additional requirements:
    - include in a **text box** the factor weightings you applied (listed as % Influence on the Weighted Overlay Tool)
    - highlight the **5 most prominent regions** of calanchi susceptibility using the ***Locate Regions*** tool → you could stack the results of this layer over the results of weighted overlay results → Also, you could indicate the susceptibility rankings of the five regions using notes or number indictors drawn on maps.
    - **Legend**: this one could have a more detailed legend than D3 as you must have lands in different categories of rankings.
- Aesthetics Matter!

Deliverable 7: one **paragraph summary** of how you standardized your layers (10 marks) & **justification** for the weights that you applied in the weighted overlay model

- Cite your reference.
- For the paragraph summary:
    - What method? Reclassification or Rescale?
    - For reclassification, which specific method? E.g., *Quantile, Natural Breaks*, *Equal Interval*…
    - For rescaling, which specific method? E.g, *Near, Large, Linear*…
- For the justification:
    - Where did you get the rankings/weights and what are them? You could even provide tables to show your rankings/weights.
    - Why did you choose this?

Final Submission

- 1 single PDF Document
  - ***Any map (always worth 15 marks) must be a full page, either in portrait or landscape depending on the orientation of the map!!!***
  - *Cover page contains: the exercise number and name (Exercise 4: Multi-Criteria Evaluation I), your name, submission date, and your TA's name.)*
  - *Use 12-point font, 1.5 spacing between lines and 1-inch borders*
  - *Correct all spelling and grammatical mistakes/issues*
- Due date: please submit to the Avenue Drop Box by **Monday, March 14, 2025 at 8:00AM.**