Case study- Spatial risk assessment for incursion and spread of foot and mouth disease in Myanmar- Day 04

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1 Review

The processes to this point have completed SRA-GIS steps up to and including Step 4 (Figure 1.1). The final two steps involves combining the spatial risk layers into a single risk surface and critical evaluation of the final SRA map.

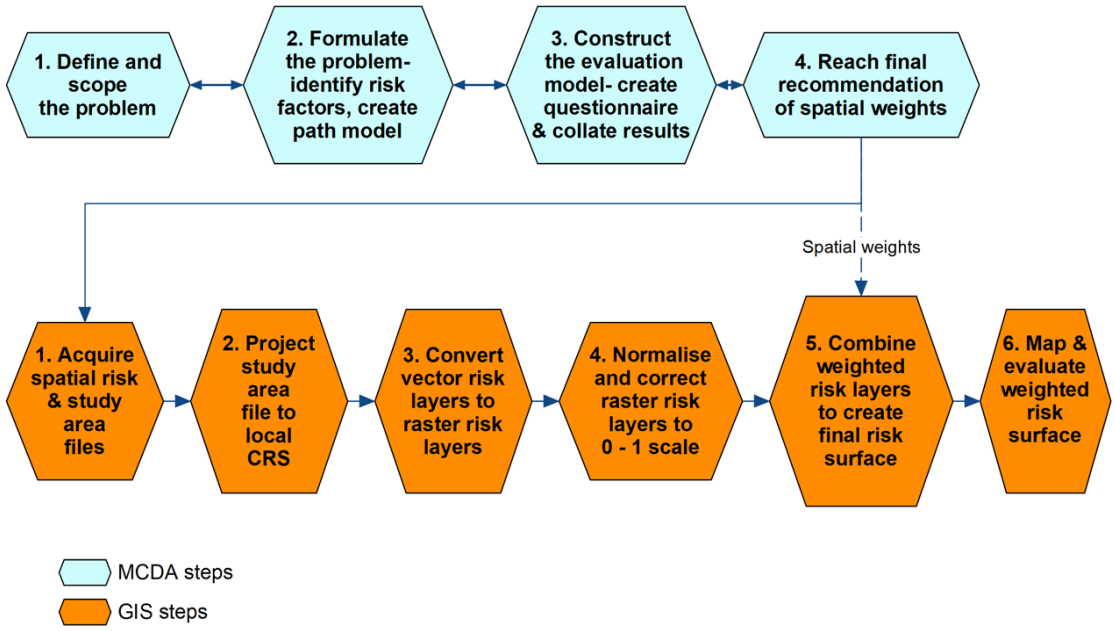

Figure 1.1: Spatial risk assessment steps

2 Create final raster risk layer

1. Apply MCDA weights to each final risk factor layer for FMD occurrence and add together to create a final raster layer. Use the following MCDA weights: Major roads = 0.18, Minor roads = 0.18, Cattle population density = 0.24, Pig population density = 0.18, Livestock markets = 0.40. See Figure 2.1.
    1. Menu Bar: Raster -> Raster Calculator -> Dialog box:
        1. Output layer: “RiskFactorWgtd” in "ResData-Final" folder
        2. Raster Calculator Expression: Add together weighted risk layers
        3. Click OK

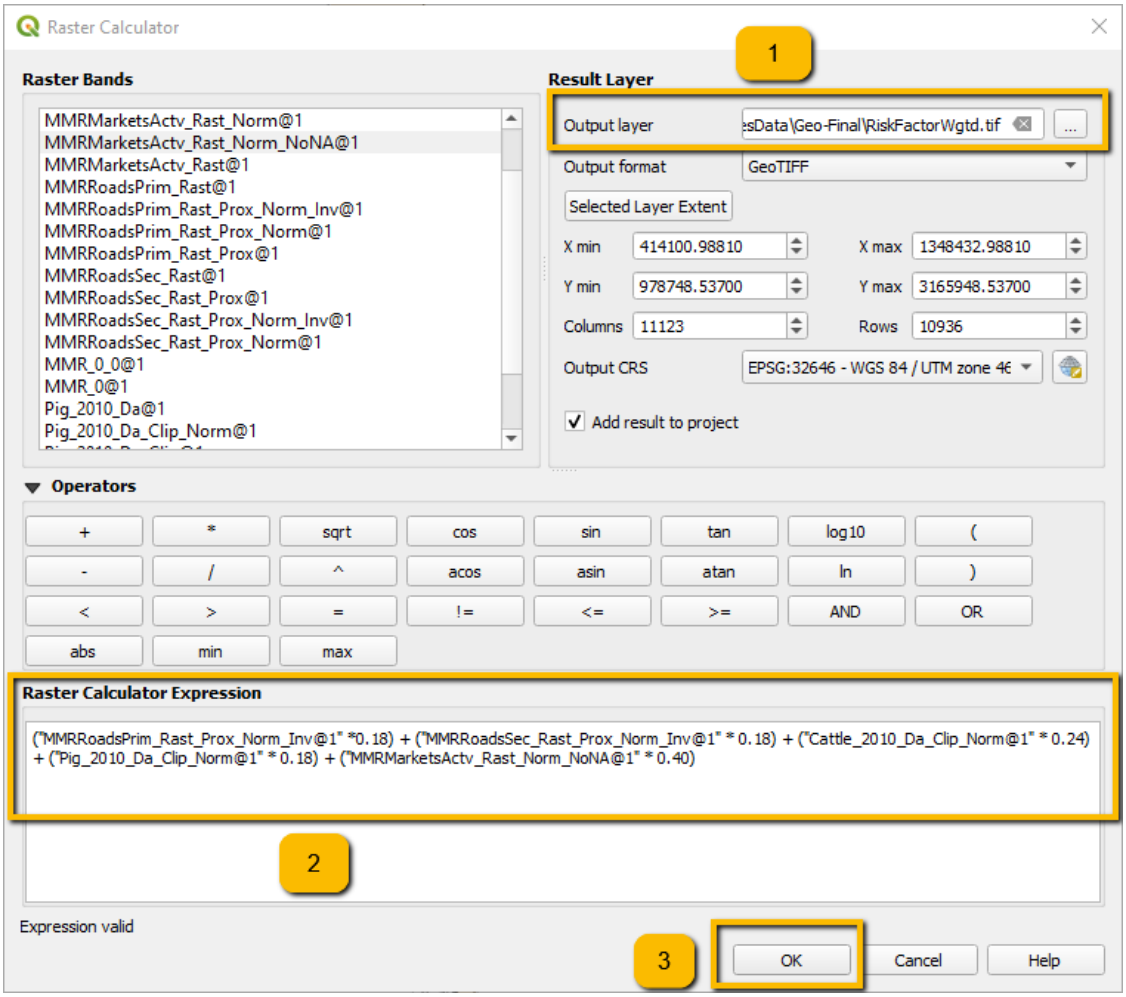

Figure 2.1: Combining weighted risk layers

2. Clip raster to the study area (see Figure Figure 2.2).
    1. Menu Bar: Raster -> Extraction -> Clip raster by mask layer… -> Dialog box:
        1. Input layer: “RiskFactorWgtd”
        2. Mask layer: MMR_0
        3. Click Run

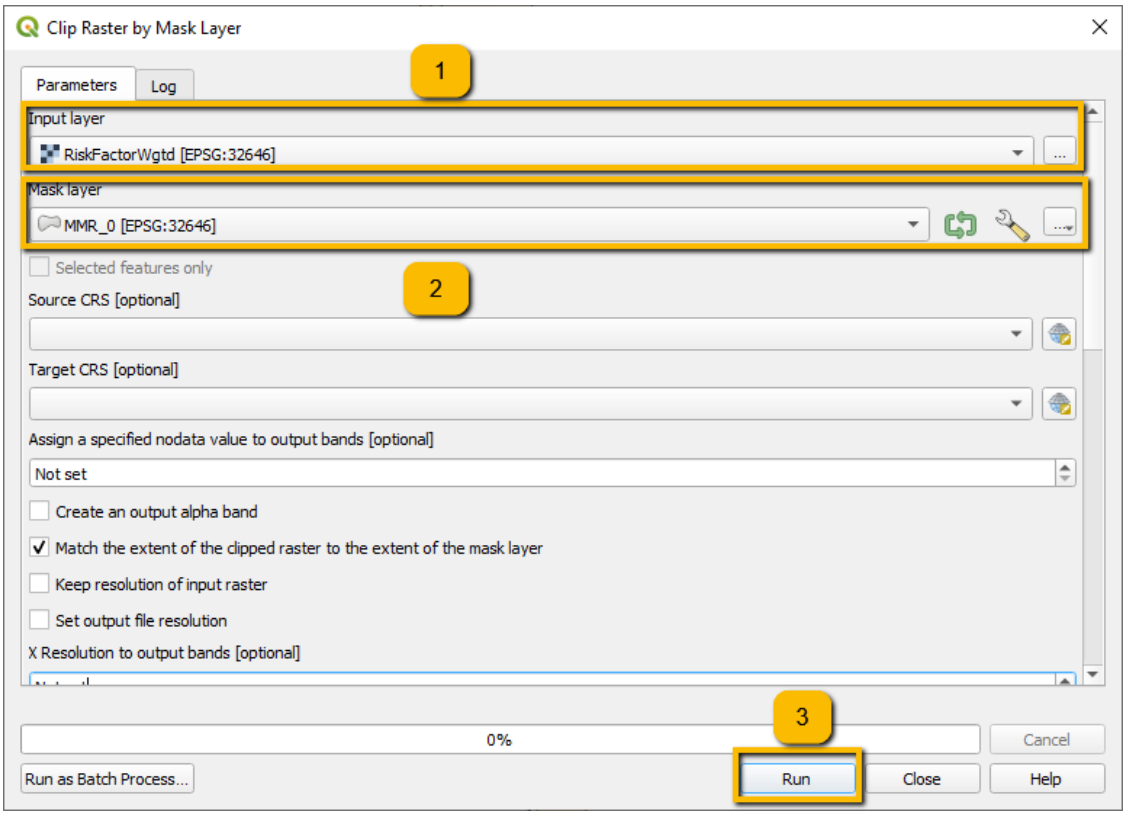

Figure 2.2: Clipping final raster risk surface to study boundary

2. (continued)
    2. Save clipped final risk factor layer with a new name
        1. Right click newly-created clipped RiskFactorLayer: Export -> Save As … Dialog box
            1. File name: “RiskFactorWgtd_clip” in "ResData-Final" folder
        2. View final risk map in map palette (see Figure 2.3)

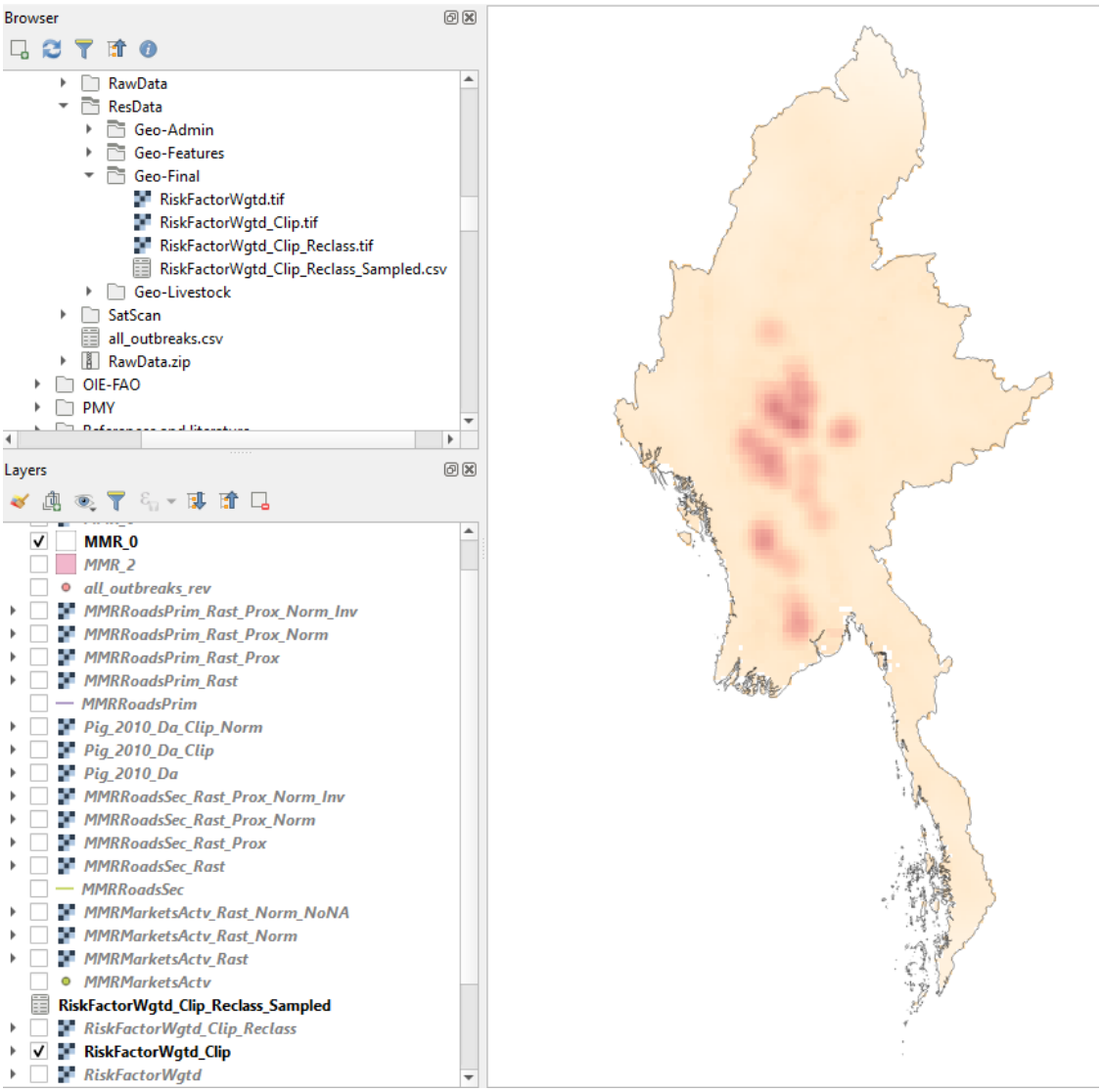

Figure 2.3: Clipping final raster risk surface to study boundary

3 Map and evaluate the weighted risk surface

1. Create a new shape file of FMD case locations to add to the final risk map to assess how accurately the final risk map has predicted the location of FMD case villages
    1. Copy locations of villages with FMD outbreaks (all_outbreaks_rev.csv) into the "-Features" folder with Windows File Explorer
    2. Click Open Source Data Manager on Toolbox Menu Bar -> Dialog box (Figure 3.1)
        1. Ensure "Delimited Text" option is highlighted
        2. Select Folder button and then file name
        3. Check default File Format and Record and Field Options are correct
        4. Check Geometry Definition settings are correct for the imported file

5. Click “Add”

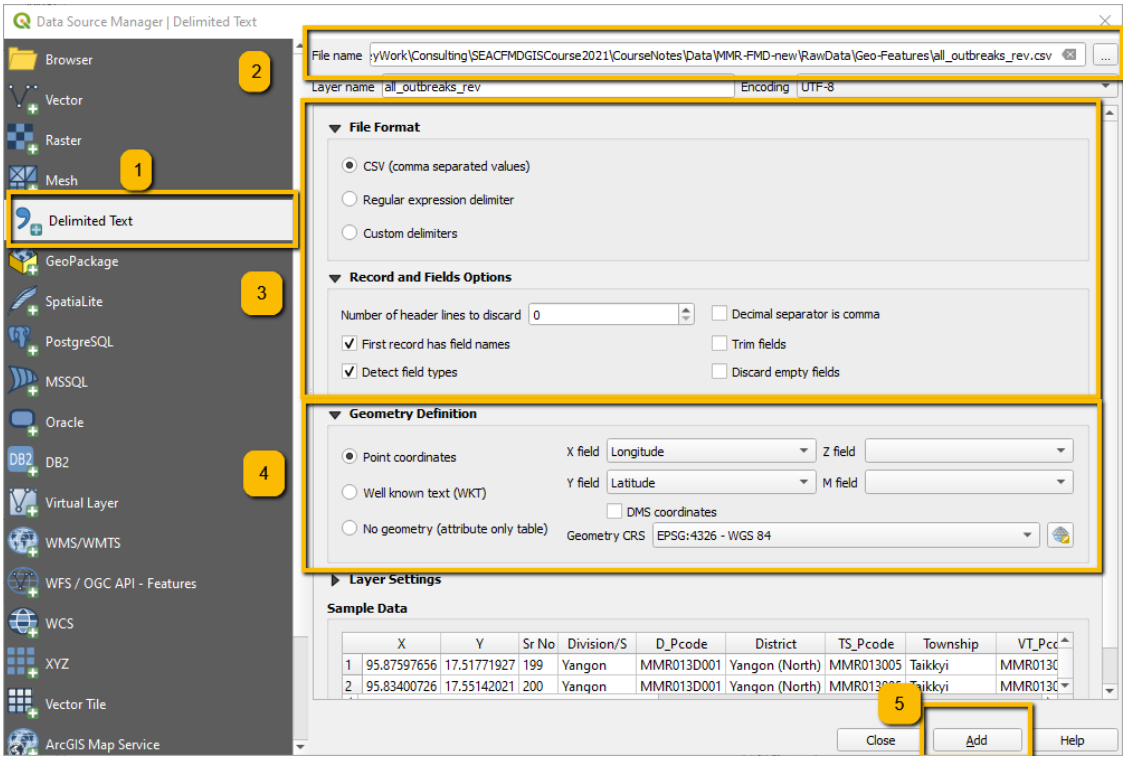

Figure 3.1: Import village outbreak locations and create a shape file

1. (continued)
    3. Reproject and save newly-added “all_outbreaks_rev” shape file
        1. In Layers Pane Highlight and right-click “all_outbreaks_rev”
        2. Select Export -> Save Features As … -> Dialog box (Figure 3.2)
            1. Select “ResData-Features" folder and file name”all_outbreaks_rev"
            2. CRS: Select Project CRS: EPSG:32646 - WGS 84 /UTM zone 46N
            3. Click OK

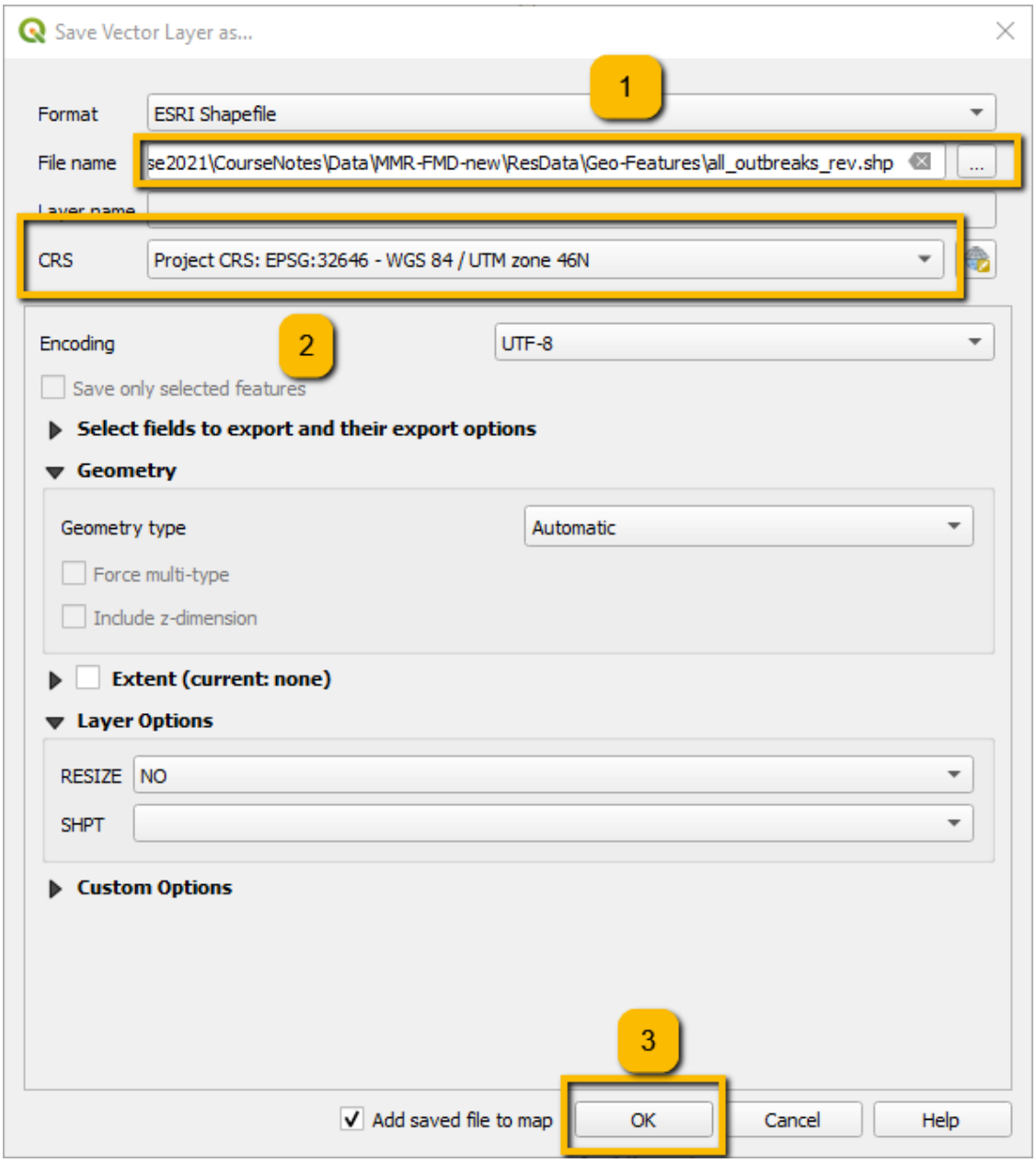

Figure 3.2: Reproject and save village outbreak locations shape file

1. (continued)
    4. Arrange map layers in Layers pane so that only the final weighted risk map clipped to the country boundary (RiskFactorWgtd_Clip) and the case locations are displayed (Figure 3.3).

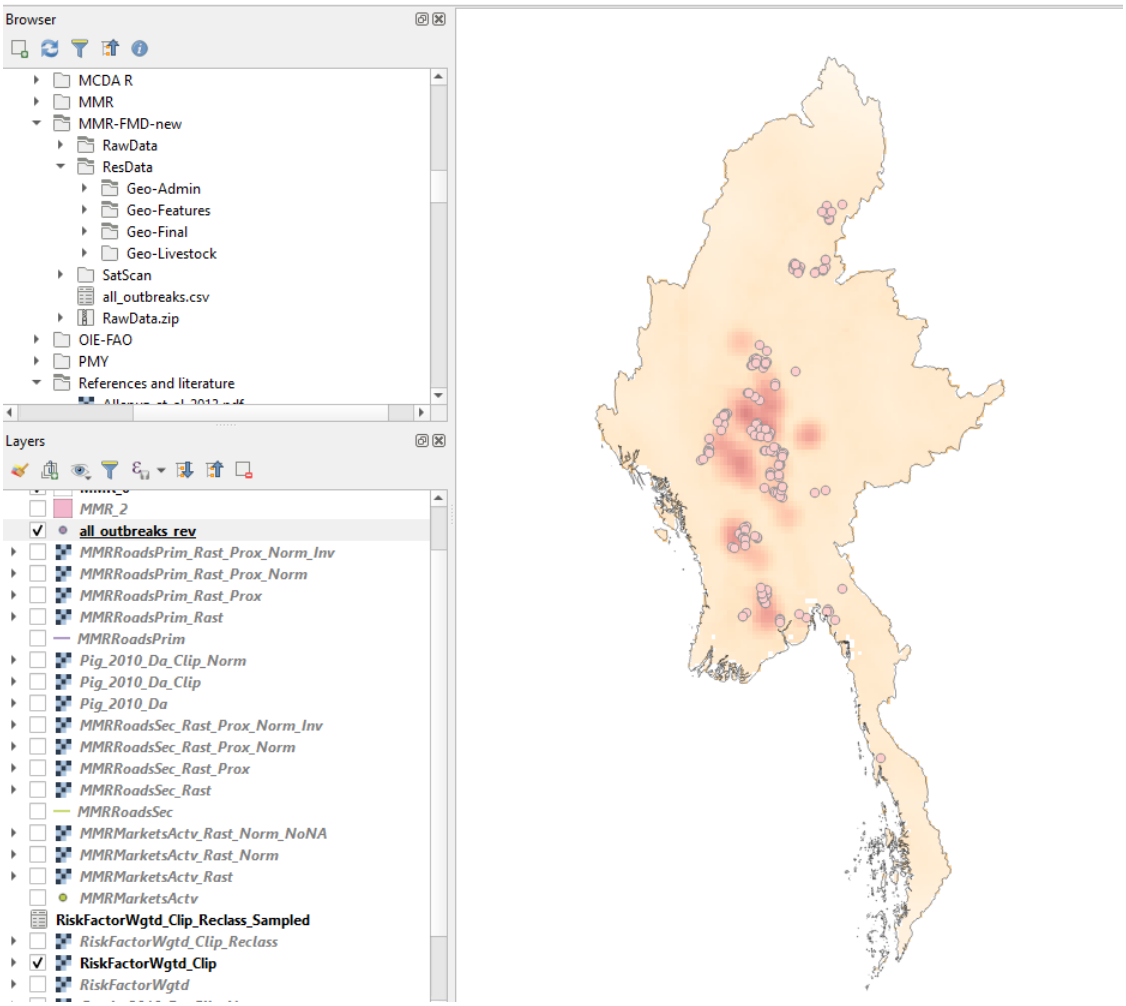

Figure 3.3: Reproject and save village outbreak locations shape file

2. Reclassify the final risk map into high (>= 0.5) and low (<=0.5) risk zones to make interpretation easier for decision-makers
    1. Processing Toolbox -> Raster analysis -> Reclassify by table (Double click) -> Dialog box (Figure 3.4).
        1. Raster layer: Select “RiskFactorWgtd_clip”

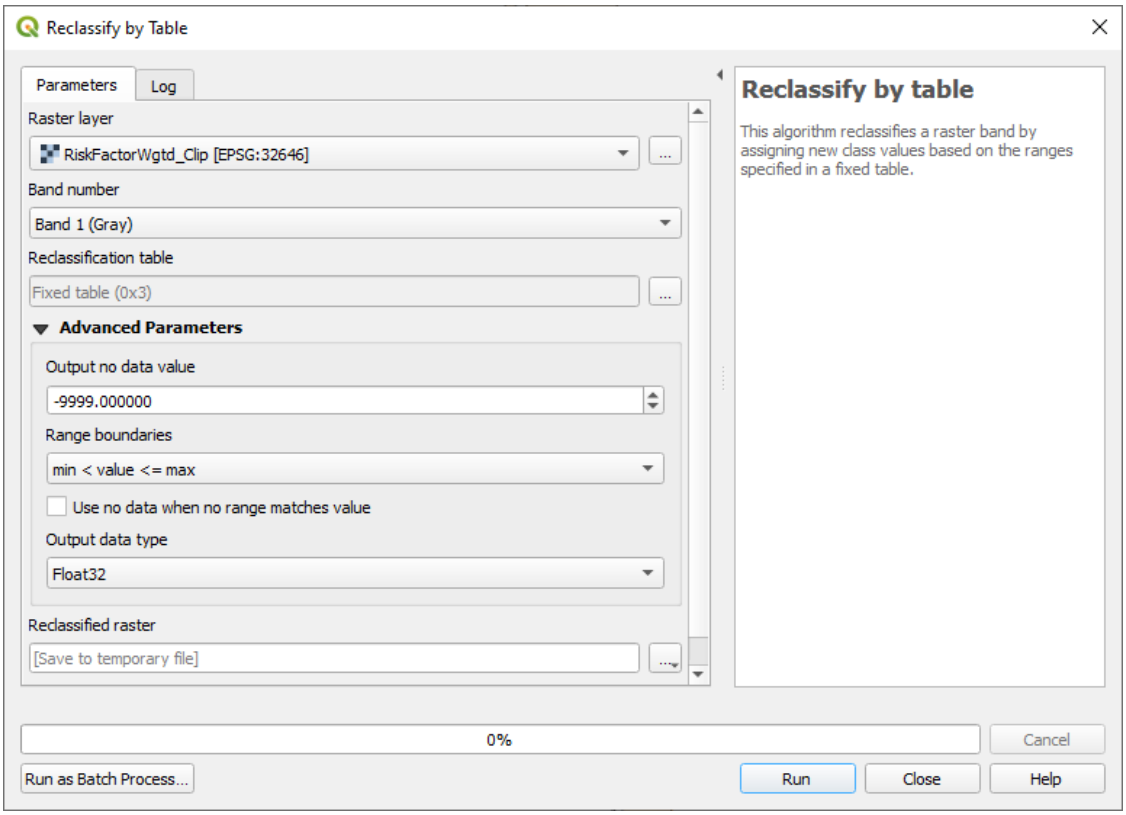

Figure 3.4: Raster reclassification dialog box

2.
    1. (continued)
        2. Reclassification table: Click "…" button to right and pop-up "Reclassification Table" appears (Figure 3.5)
            1. Click Add Row and double click in cells Minimum: 0, Maximum: 0.5, Value: 0
            2. Click Add Row and double click in cells Minimum: 0.5, Maximum: 1, Value: 1
            3. Click OK

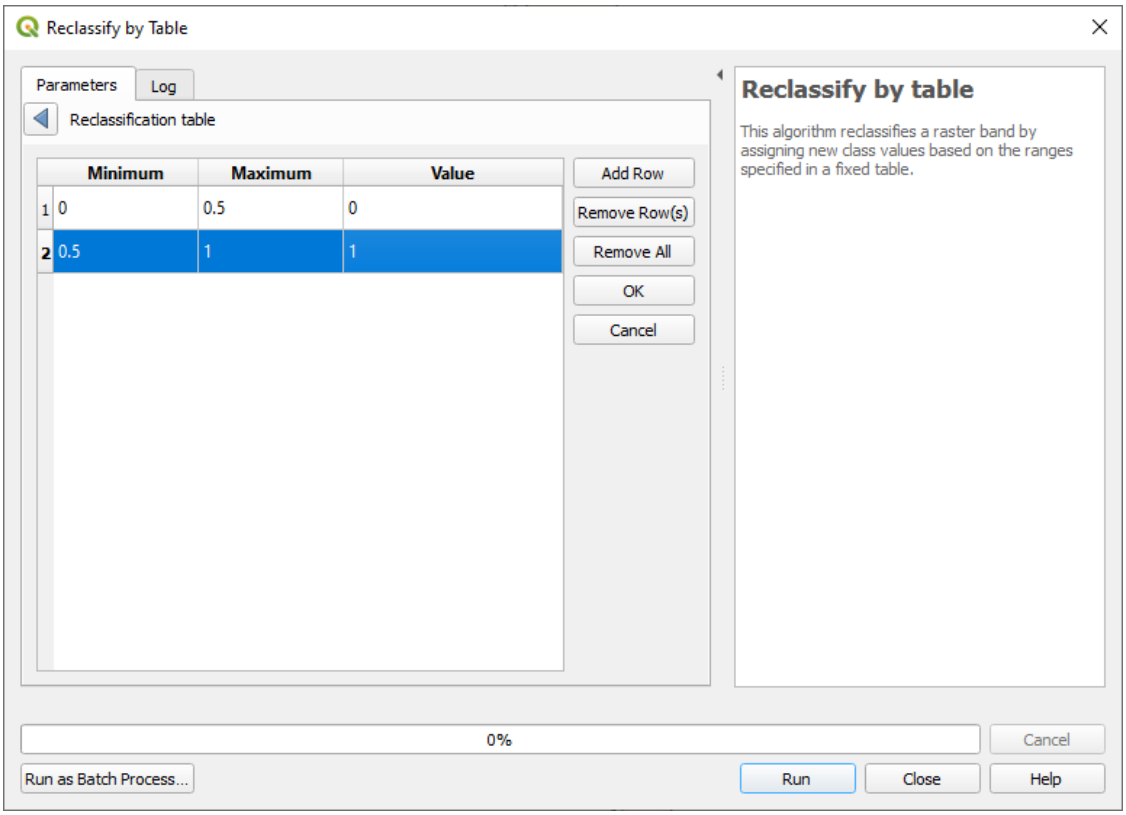

Figure 3.5: Raster reclassification table

2.
    1. (continued)
        3. Return to dialog box (Figure 3.6)
            1. Reclassified raster item: Click "…" button to right -> Save to file and rename the output file in the "ResData/Geo-Final/" folder as "RiskFactorWgtd_Clip_Reclass"
            2. Click Run
            3. Click Close

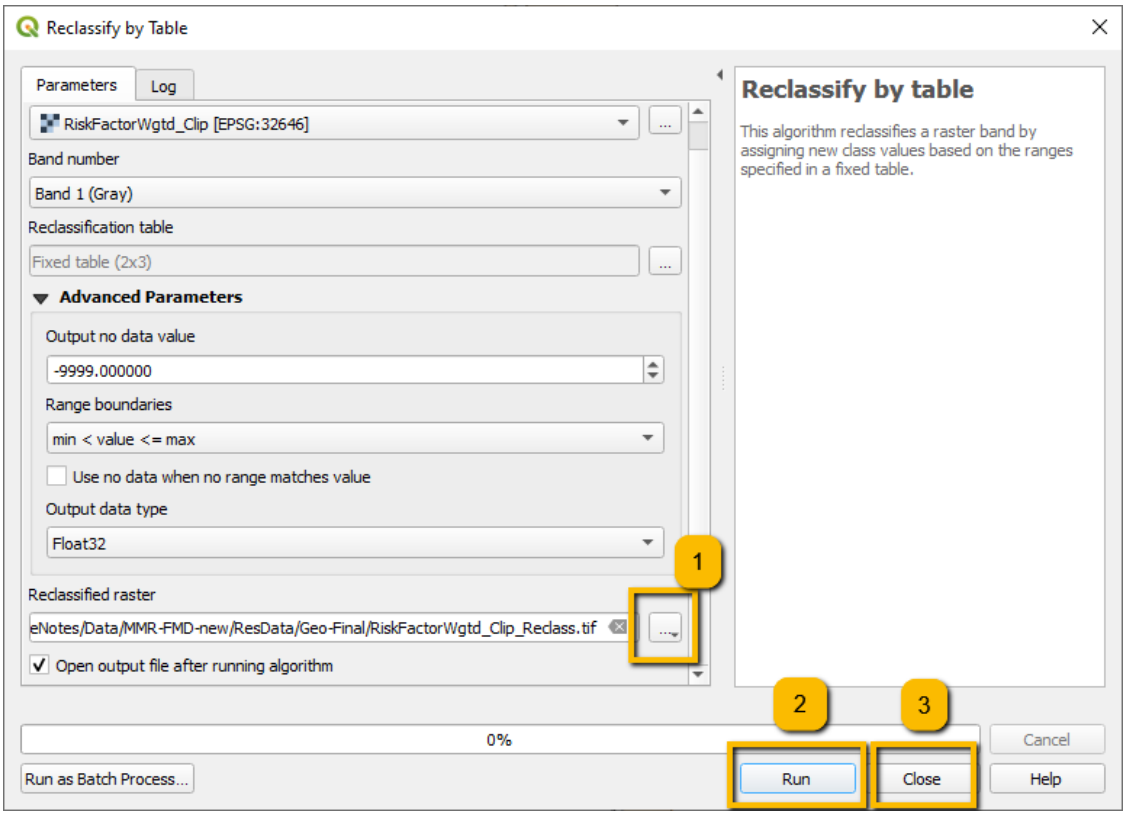

Figure 3.6: Rename and save reclassified file

3. Validate SRA map against recorded outbreaks/cases
    1. Calculate the proportion of outbreaks/cases in the high risk (risk probability >= 0.5) zone
        1. In Layers pane highlight “RiskFactorWgtd_Clip_Reclass”
        2. Processing Toolbox -> Raster analysis -> Sample Raster Values (double click) -> dialog box: (Figure 3.7)
            1. Input Layer -> Click “…” button to far right and select the projected vector layer for outbreak locations “all_outbreaks_rev [EPSG:32646]” in the “ResData/Geo-Features/” folder
            2. Raster layer: “RiskFactorWgtd_Clip_Reclass [EPSG:32646]”
            3. Sampled: Save to file: Create a new CSV file of the results of this analysis in ResData/Geo-Final: RiskFactorWgtd_Clip_Reclass_Sampled.csv
            4. Click “Run” and then “Close”

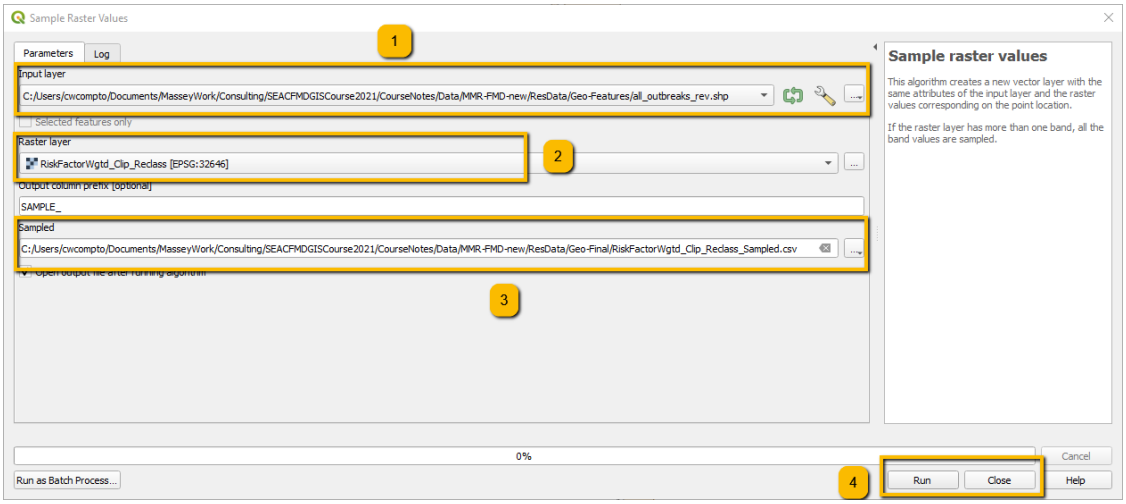

Figure 3.7: Rename and save outbreak location csv file with villages classified as present in high or low risk zones

3.

1. (continued)
    3. Open "RiskFactorWgtd_Clip_Reclass_Sampled.csv" (will be Read-Only)
        1. Count the number of rows for which there is no Longitude and Latitude value, and therefore no result in the SAMPLE_1 column by filtering for Blanks (n = 10) then Clear Filter
        2. In cell below last row of column "SAMPLE_1" insert a function to sum all the values in the column (sum = 70)
        3. Calculate the number of rows with non-missing coordinates (188 - 10 = 178)
        4. Proportion of proportion of outbreaks/cases in the high risk (risk probability >= 0.5) zone = 70/178 = 39%

Exercise 3.1 (Critically evaluate of the spatial risk assessment map) Questions:

1. Are the most important risk factors for which information is available for accounted for in the SRA map?
2. Of the risk factors evaluated, could the parameters be changed to improve the accuracy of the SRA map e.g. diameter of smoothing of heat map of livestock markets density?
3. Is there a possibility of information/reporting bias affecting our SRA map?
4. What additional data could be gathered to improve our SRA?