EAE5258 Geographical Information Systems for Environmental Science

Project: Identify a site for remote bush lodges

Objectives

Site selection is to identify the best site for some activity given the set of potential or feasible sites. The first step in this type of analysis is to identify potential sites according to a set of criteria. *You are going to conduct a project in this assignment which aims to use GIS to identify potential sites to build bush lodges as part of an ecotourism project in the northeastern part of South Africa, straddling the border of Mpumalanga and Northern Province*.

Project description

The project area includes part of Kruger National Park and private nature reserves bordering the western edge of the park. The area is well known for its abundant wildlife, including elephant, rhino, lion, leopard, and buffalo. It is also an area of great botanic diversity, including many unique species such as the Jackal Berry tree (*Diospyros mespiliformis*), which is usually found close to rivers. The photo below shows a scene in the project area.

[Source: Jacques Dommisse]

You need to consider the following five criteria for choosing a site on which to build a cluster of remote lodges:

1) The site should be scenic, convenient for wildlife viewing, and ecologically interesting. Locating the site close to streams or rivers (within 1 kilometre) will satisfy all of these conditions.

2) In addition, the site should be located in a wooded or grassland area.
3) Furthermore, the site should be located in an area that has not been degraded by human activities such as farming or residential use.
4) To limit their impact on the environment, the lodges will be built on stilts with poles driven deep into the ground and walkways between the various units. To minimise the possibility of soil erosion, they will only be built on areas with slope of less than 10 percent.
5) Temperatures in this area can soar over 40 degrees Celsius (104 degrees Fahrenheit). Therefore, the lodges should be built on slopes facing south or southeast to receive the least amount of sun (since South Africa is in the southern hemisphere).

The photo below shows a typical bush lodge located in the project area.

[Source: Jacques Dommisse]

Proposed methodology

You are provided with seven sets of spatial data:

- landuse – land uses in the project area
- landcover – land covers in the project area
- contour100 – contours with 100m contour interval in the project area
- projectarea – the boundary of the project area
- provinces – the boundaries of Mpumalanga and Northern Provinces
- rivers_mp – rivers in Mpumalanga Province
- rivers_no – rivers in Northern Province

The landcover layer is a raster layer in GRID format, and others are ArcView shapefiles in the vector data structure. All can be directly read into ArcGIS. These datasets are compressed into **assign_data.zip**, which is available in Moodle.

However, there are two issues with the data:

1) All the data layers do not have the same coordinate system.

   The landuse, landcover, contour100, and projectarea layers are projected data. These data share the same projected coordinate system: Africa Albers Equal Area Conic projection based on WGS84 datum, which has been optimized for South Africa. The unit of coordinates is metre. The spatial reference information with the landcover layer names the projected coordinate system as WGS_1984_Albers. They are the same.

   The provinces, rivers_mp, and rivers_no layers are not projected. Their coordinates are geographical coordinates in degree based on WGS84 datum. They all will need to be projected to match to the optimised Africa Albers Equal Area Conic using the projection file 'SA_Albers_Equal_Area_Conic.prj' contained in **assign_data.zip**. Refer to Practical 5 about how to project the unprojected data.

2) All the data layers do not cover the project area.

   The rivers_mp and rivers_no shapefiles each cover one province and will need to be merged to completely cover the project area.

The project may involve three stages:

(1) Examine and preprocess the existing data

This will involve projecting the unprojected data (refer to Practical 5), merge the rivers_mp and rivers_no shapefiles using **Append** tool (refer to Practical 2), clip the rivers to the extent of the project area using **Clip** tool (refer to Practical 4) and converting raster to vector or vice versa (refer to Practicals 3 and 5).

(2) Create new data for each criterion

This may involve building a DEM and deriving terrain features (refer to Practicals 4 and 5), reclassifying data layers (refer to Practical 3), generating buffers and combining data layers via overlay (refer to Practical 1 and Practical 3).

(3) Identify possible sites
This may involve spatial query or overlay analysis.

You may choose to use a vector approach or a raster approach.

Report

You are required to write a report, which

- provides background information about the project, including a literature review on GIS and site selection;
- describes how you prepare or transform data (such as projection and data structure transformation);
- reports your methodology for analysis in detail, more specifically,
    - choose between a vector approach and a raster approach and discusses your choice
    - detail the steps of the GIS analysis with the approach of your choice, including
        - what ArcGIS functions are used
        - how they are used
- presents the results, more specifically
    - present the maps derived for each criterion and the final map presenting the potential sites, and provide a brief description of each of these maps, including
        - what are presented on the map (i.e. what values or categories are presented)
        - a quantitative summary of the suitable areas as potential sites on each map according to the criterion or criteria
            - the total size of the suitable areas as potential sites AND/OR
            - the total number of the potential sites
- draws conclusions based on your results
- adds a list of references for literature review (no specific style is required as long as they are consistent)

All maps and charts or graphs to be included in the report should be suitably annotated and presented. The report should be written in a way that non-academic audiences can understand.

The report should not exceed 1500 words (excluding figures).