Potential Moisture Contents of Forests for the World

Holger Rode

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For my project I chose the trail system, Forests for the World, as my study area. Forests for the World is located in close proximity to the University of Northern British Columbia in Prince George. My goal was to determine the potential moisture content of the trails, by analyzing multiple factors. The focus here is not the outcome of the results, but the method used. In other words, the important thing is the accuracy of the method.

The data used include a DEM with 1 meter contour lines from the 1: 5000 city data of Prince George. Furthermore, multiple coverages such as trails, creeks, and wetlands of the study area were available.

From the contour lines I was able to create a tin coverage, and derived slope and aspect from the tin. In my analysis I included 5 factors that will influence the potential moisture content:
1.) Type of trail
2.) Slope (given in percent)
3.) Aspect
4.) Creek
5.) Wetland
An integer value is assigned to each factor that influences the potential moisture content.
The factors type of trail, slope, and aspect were further subdivided in order to make the project more realistic. For example, if the slope of a trail is very steep, then the water will be able to run off more easily than if the trail is flat. If the trail is facing south, then it will dry faster than if it were facing north. The higher the integer value, the more it contributes to the potential moisture content.

Here is the grading scheme of all the factors used:
Type of trail Trail_factor
Gravel 1
Greenway 3
Pathway 6
Trail 7
Route 8

Slope in percent Slope_factor
Slope >= 0 and Slope < 2 8
Slope >= 2 and Slope < 4 7
Slope >= 4 and Slope < 7 6
Slope >= 7 and Slope < 10 5
Slope >= 10 and Slope < 13 4
Slope >= 13 and Slope < 18 3
Slope >= 18 and Slope < 24 2
Slope >= 24 and Slope < 55 1
Slope > 90 0

Aspect Aspect_factor

Aspect > 315 or Aspect <= 45 (North) 9
Aspect > 45 and Aspect <= 135 (East) 5
Aspect > 135 and Aspect <= 225 (South) 2
Aspect > 225 and Aspect <= 315 (West) 3
Aspect = -1 (Flat surface) 1

Creek Creek_factor
Creek 18

Wetland Wetland_factor
Wetland 14

In order to make this project more realistic, I assigned different buffer sizes to each trail type, where gravel has the biggest buffer, and route has the smallest buffer. Every time a creek intersects with a trail type, I added a buffer around the creek. My final output is a map containing many polygons within the trail buffer, where each polygon will have an integer value called "Wet-factor" assigned to it. The Wet-factor is the sum of all the factors that lie within the polygon. The summing up is easily noticeable at the Insert A and Insert B in the map called "Potential Moisture Conditions of the Forests for the World". Insert B shows how the trail is dry and as the trail moves into the wetland the wet-factor increases and then increases further as the trails move into the creek buffer. Insert A shows nicely how only slope and aspect influence the Wet-factor and separate the same trail type into the first three classes. Finally, the Wet-factor has been classified into 6 classes. The range of each class has been chosen to enhance the display of the output.

The project had 16 general steps:

1.) Define study area by creating a boundary coverage.
2.) Clip all coverage to the boundary coverage.
3.) Create a tin from contour coverage
4.) Insert a new item into the trails.aat table called buf_size.
5.) Assign buffer distances to each trail type and place the value in item buf_size.
6.) Buffer creek coverage.
7.) Create a tin coverage from contour coverage.
8.) Derive slope and aspect coverage from tin coverage and call it slope coverage.
9.) Clip creek_buff, wetland and slope coverages to the buffered trail coverage.
10.) Insert a new item into creek, wetland and slope attribute table.
11.) Assign a value in the new item based on a reference item within the table; this value will indicate how much the record will contribute to the potential moisture content.
12.) Union all the clipped coverage into a result table.
13.) Insert two new items into the result table called Wet-Factor and Class.
14.) Add up all factors that contribute to the Potential Wetness Content and insert the result below the item called Wet-Factor.
15.) Come up with a useful classification scheme based on the Wet-factor and denote it in the column called Class.
16.) Make a map to display the results.

The challenge with this project was to include multiple factors, combine them, and provide a coherent result. Originally I had planned to do the project using only ARC/INFO, but for certain tasks ARCVIEW was more effective. Furthermore, I wanted to perform redundant tasks using an AML. The AML I wrote allowed me to insert an item into an attribute table, and then to populate the item values of the newly inserted column based on an existing item within the same table.

This project resulted in two outputs. Firstly, a table of all polygons that lie within the buffered trails. The

polygons represent the surface area of a uniform Wet-factor. Each polygon has items that hold all the contribution factors to moisture content, as well as the information that helped us derive the factors. For example, if we decided that a slope of 16 degrees should not have the Slope-factor 3, rather 4, all the polygons with slope 16 degrees can be easily queried out and assigned the new factor value.
The second output is a map which shows how specific areas relate to other areas in moisture content.

The method used in this project has its benefits, as well as drawbacks. The advantage of this method is that it is universally applicable as long as a numeric value can be assigned to each contributing factor, and the sum of all factors leads to a numeric end result. The obvious drawback is that factors must be classified into a numeric range.
The final output could be enhanced by eliminating a few overlapping polygons. These resulted from the buffering of the different trail types and are visible at each intersection of different trail types. Furthermore, in the creek coverage non-existing creeks should have been removed.
It would be interesting to see how much easier the analysis part of the project would have been if the coverage had been converted to a raster system. Nevertheless, I learned a great deal in working on this project, and if I were to do it again I would be able to complete it in minimal amount of time.

I also include in my project:
- aml program for attribute table manipulation. It is appended to this report
- and a map called "Potential Moisture Conditions of the Forests for the World".