

Multi-Criteria Decision Analysis

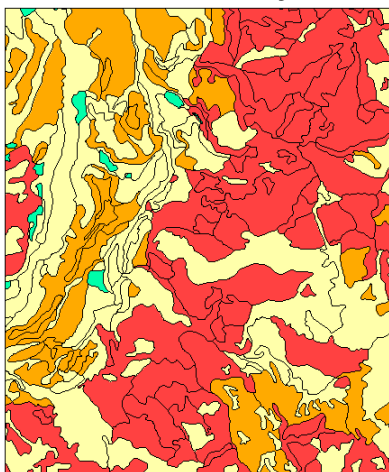
Multi-criteria decision analysis (MCDA) is a quantitative approach to evaluating decision problems that involve multiple variables (criteria). You can apply MCDA to a set of spatial objects in TNTmips using the GeoFormula process.

A new MCDA script-creation wizard for the GeoFormula process prompts you for input parameters and automatically generates a script. (See the plate "GeoFormula Creation Wizard for an introduction to this interface.) The wizard uses the most commonly used form of MCDA, a weighted linear combination method. You first assign a "relative importance" weighting factor to each of the spatial objects. For each input object you are also prompted to select or set up a table of numerical scores for the different "conditions" depicted in the object. The conditions are specified by the

values for a polygon attribute in a vector object or by cell values or cell value ranges in a raster object. You assign scores to indicate either the relative benefit or relative cost associated with a particular condition. The MCDA script computes an overall score for each output cell location by multiplying the weighting factor for each object by the object score for that location and summing the products from all of the input objects.

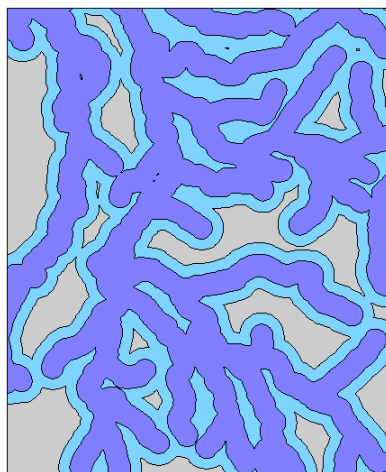
The MCDA example shown here concerns identifying areas of a forest where clearcut logging should be avoided due to potential adverse effects on streams from sediment runoff. The criteria objects used are a vector soil map scored by soil erodibility, a vector map of stream buffer zones, and a raster showing average annual rainfall.

Criterion 1: (weight = 40 %)
Soil Erodibility



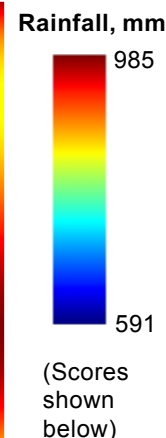
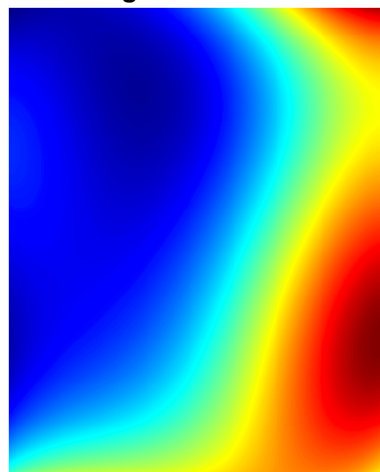
Vector Polygon Category	Score
Severe	100
Moderate	60
Slight	10
None	0

Criterion 2: (weight = 35%)
Buffer Distance from Streams



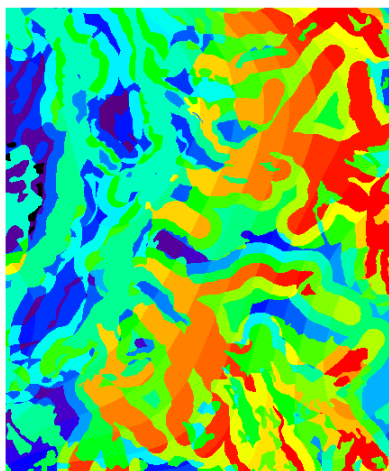
Vector Polygon Category	Score
<250 m	100
250 to 500 m	50
>500 m	10

Criterion 3: (weight = 25%)
Average Annual Rainfall



Raster Value Range	Score
946 - 985	100
906 - 946	90
867 - 906	80
827 - 867	70
788 - 827	60
749 - 788	50
709 - 749	40
670 - 709	30
630 - 670	20
591 - 630	10

Output MCDA Raster (shown with a rainbow color palette)



92-100	45-54
82-91	36-44
73-81	27-35
64-72	17-26
55-63	8-16

Scores for all input objects in this example were set up to indicate relative cost (hazard). The higher MCDA values therefore indicate areas of greater potential hazard to streams from clearcutting. This map could then be used to delineate zones where clearcutting would be prohibited.

Objects	Values	Script	Output
weight_RAINFALL			0.300000
weight_BUFFER			0.300000
weight_SOILS			0.400000

The relative weight values can be edited on the Values panel, allowing you to easily run several MCDA models and compare the results.



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GeoFormula Object Combinations
File Edit Insert Syntax Help
Objects Values Script Output
score = 0
score += weight_RAINFALL * RAINFALL_MCASCORE.Score
score += weight_BUFFER * BUFFER_Poly.SCORES.Score
score += weight_SOILS * SOILS_Poly.EROSW_SCORES.score
return (score)
    
```