**Alpine Fault Seismometer Location Finder documentation**

Rating Mapper

How it works:

Each of the following steps is timed and that time is sent to the arcmessage output

Step 1

Information from the tool input parameters is gathered and stored in an info object. Information on these inputs including their types can be seen in the tool metadata

Step 2

Buffers for the whole and right-hand side of the fault are made using the buffer tool and the fault feature class from the info object made in step one

Step 3

The road data gathered in step 1 is clipped to the size of the fault buffer made in step 2

Step 4

The clipped road data from step 3 is buffered

Step 5

The DOC land data gathered in step 1 is clipped to the fault buffer made in step 2

Step 6

The doc land data is made up of many different polygons that are separated based on irrelevant parameters and so these polygons are dissolved into a single feature

Step 7

The Geo map data gathered in step 1 is clipped to the fault buffer made in step 2

Step rate

A rating field is assigned to each feature class that will be merged into the output these classes are as follows:

* The buffered fault from step 2
* The buffered right-hand side of the fault from step 2
* The clipped and dissolved doc land from step 6
* The buffered roads from step 4
* The clipped geo map from step 7

Step 8

Each feature class listed in step 7 is given a rating (for feature classes with multiple polygons the rating is given to each polygon). The rating is based on its suitability as a location for a seismometer

Step 9

Each feature class listed in step 7 is merged together using union. This creates separate polygons in the unioned feature class that represent unique combinations of the feature classes that make up the union

Step 10

The polygons from step 9 in the unioned feature class are given total ratings calculated from the sum of the ratings of the feature classes that make them up.

Step 11

ArcGIS pro writes the outputs to the map. The outputs are the listed feature classes from step 7 and the unioned feature class from step 9 after step 10 has been applied.

Locations

How it works:

Step 1

The idealised points and rated polygon feature classes are obtained from the input parameters (more information on these in the tool metadata)

Step 2

A total score field is added to the polygon feature class from step one and best x coordinate, y coordinate, and rating fields are added to the idealised point feature class from step 1

Step 3

A search cursor iterates through each polygon from the rated polygon feature class from step 1.

*The following steps are for each polygon from the iteration above*

Step 3.1

The near tool is applied to the current polygon and the idealised points from step 1. This adds an x and y coordinate to each point that are the closest coordinates on the given polygon to each point. It also adds the distance between each point and the given polygon to a field in each point

Step 3.2

An update cursor iterates over each point in the feature class from step 1

*The following steps are for each point from the iteration above as well as the iteration for each polygon from step 3*

Step 3.2.1

A rating is given to the current polygon. This is calculated with the following formula

* Where T is the total rating and is stored in the polygon for the duration of one iteration from step 3.2
* D is the distance between the polygon and the point obtained in step 3.2
* S is the static rating of the polygon. This is a field from the polygon feature class from step 1

This formula is roughly thrown together to give a rating that depends roughly 50% on the distance to the idealised point and 50% on the static rating

Step 3.2.2

If the best x coordinate field has not been initialised, the values from the nearest x and nearest y fields are put into the best x and best y fields of the current point. Also, the best rating field is assigned the total rating calculated in step 3.2.1.

3.2.3

If the rating assigned to the polygon in step 3.2.1 is greater than the best rating currently stored in the point, the values from the nearest x and nearest y fields are put into the best x and best y fields of the current point. Also, the best rating field is assigned the total rating of the current polygon.

Step 4

The points are then iterated through again and a new point is made from the best\_x and best\_y fields

Step 5

The collection of points in step 4 are then made into a feature class and output as the best locations for seismometers.