

Supplementary

1. Conclusions

Much less areas without outflow were designated in forest areas and parks. The roofs of skyscrapers, such as “Manhattan” Gdansk, were not designated as such areas. Unfortunately, sink areas were sometimes designated on the site of existing buildings, as a result of the erroneous “removal” of land cover. At this point, it is important to note that the areas without outflow were not designated in forest areas and, if they did appeared, their number was incomparably smaller than that in the case of determining sinks with DSM.

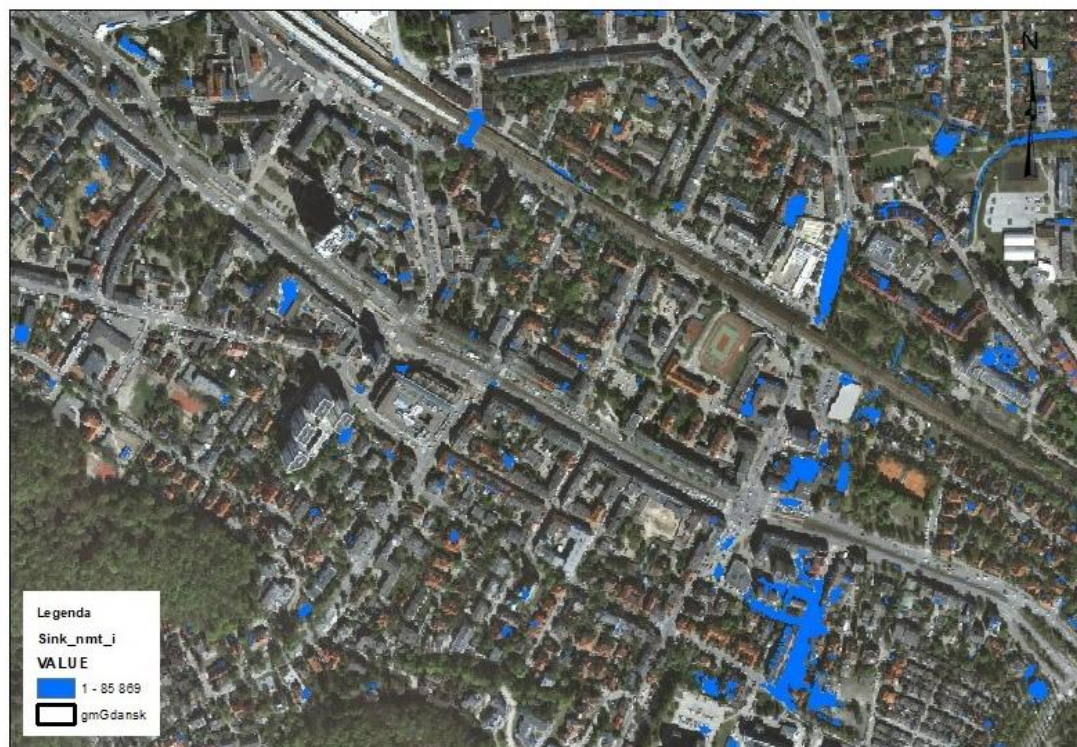


Figure S1. “Manhattan” in Gdansk according to the analysis in DTM 1 m x 1 m.

Comments

The sink raster named Sink_nmt_i was converted to the polygon format and named r_sn_nmti. The “Simplify polygons” option was not selected, as sinks, which have the shape of an input raster, were still operated on. The r_sn_nmti_simplify layer was generated containing polygons with simplified shapes (for comparison purposes).

Results

103,455 objects in the r_sn_nmti layer (polygon)

Elaboration of results for sink Sink_nmt_i

1. A Raster Layer Called r_sn_nmti Was Made from a Raster Named Sink_nmt_i (Sinks Flooded to a Height of 1m).

In the r_sn_nmti layer, the ID is a sequential number. However after using the dissolve function, one ID number will be assigned to several objects touching each other. So, after dissolving, the ID loses its justification and can be changed.

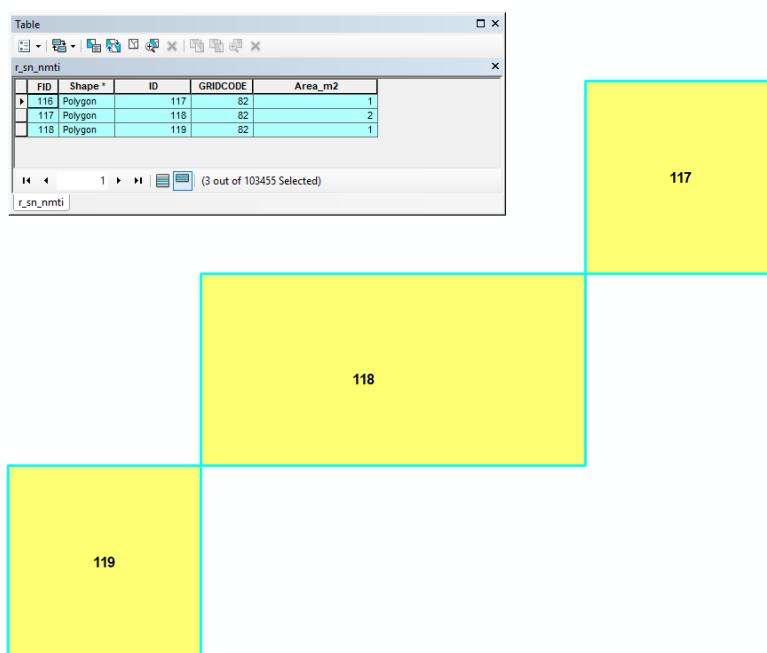


Figure S2. ID number before dissolve function (3 separate polygon objects: 117, 118, 118), but with the same GRIDCODE (82).

2. For the *r_sn_nmti* Polygon, the Dissolve Tool Was Used to Aggregate Touching Individual Polygons into one Feature. The Aggregating Field Was the Value of the GRIDCODE Field.

The name of the new training ground – was *r_sn_nmti_Diss*. The number of objects created after using the dissolve tool was 85,869, equal to the number of objects in the raster file named *Sink_nmt_i* (i.e., the "source" file created from the DTM), which means that the aggregation process was successful.

The number of objects in the *r_sn_nmti* layer before the dissolve tool was applied – was 103,455, while the number of objects in the new layer (named *r_sn_nmti_Diss*), after the tool was applied, was– 85,869.

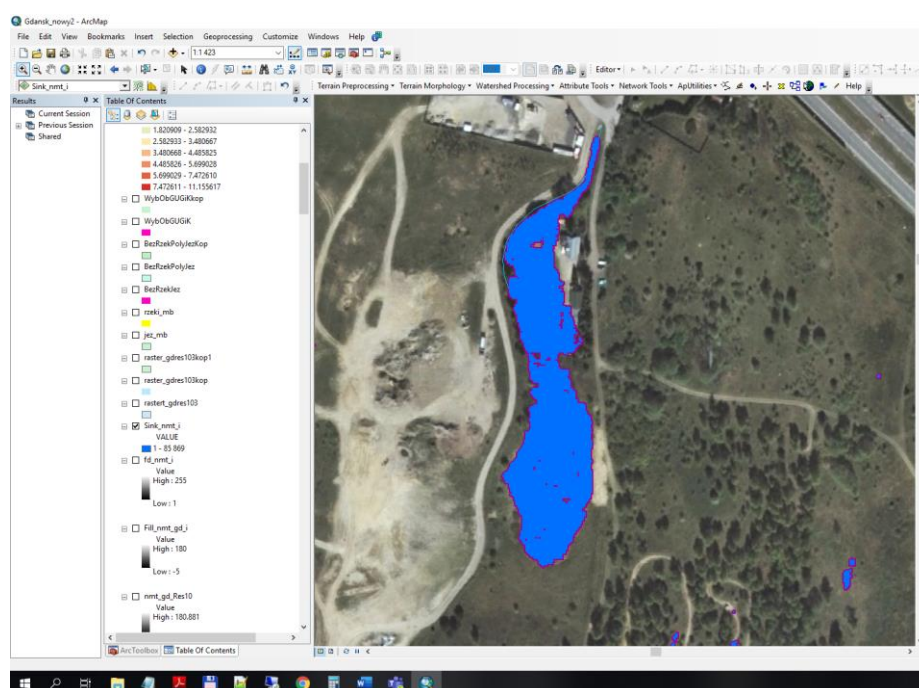


Figure S3. Example of object after the tool was applied.

3. Calculation of the Area of Polygons in the *r_sn_nmti_Diss* Layer Was Performed. Then, the Percentile Value to Find the Criterion of Removing Small Areas Was Calculated. The Function *Percentile.Excloc* (Right-Hand Closed) in Excel Was Used.

2. Result

We found that 2% of the areas had an area less than or equal to 37.7 m² and, so, 38 m² was assumed for GIS analyses. As a result, 73,692 objects (from 85,869) were removed and 12,177 areas without outflow remained.

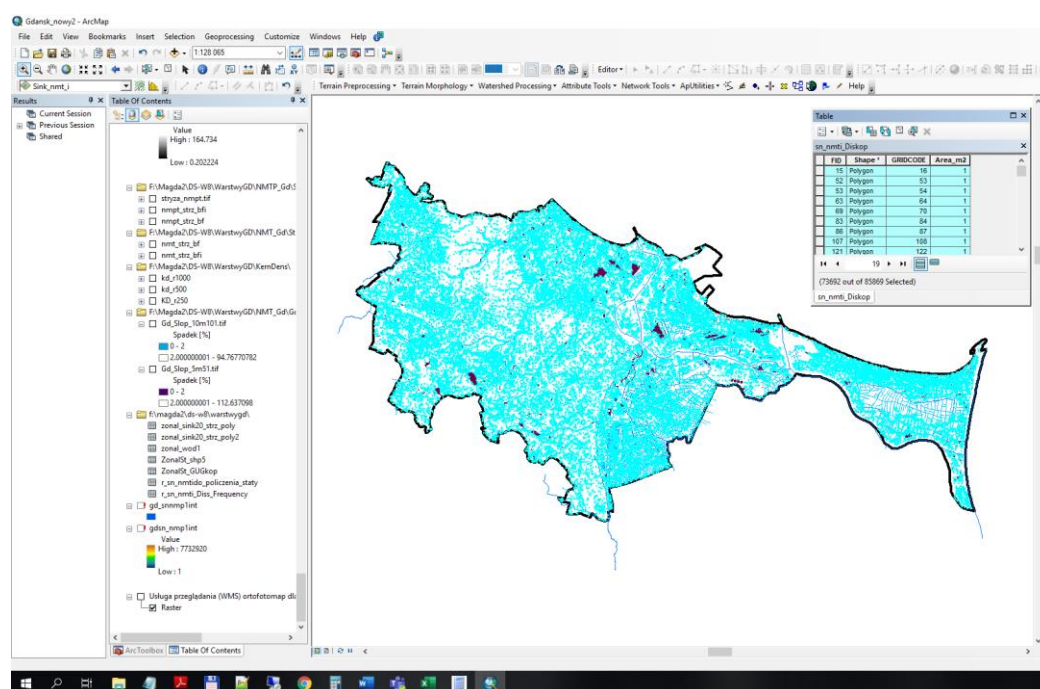


Figure S4. 2% of the areas had an area less than or equal to 37.7 m²; 38 m² was assumed for the GIS analyses.

1. *The Name of the Layer After Removing Areas Whose Area Was Less Than or Equal to 38 m² Was sn_nmti_Dis38.shp. A Total of 12,177 Non-Drainage Areas Remained. A Copy of This Was Created, Which Was Subject to Further Analysis.*

2. *Elimination of Surfaces Covered with Natural Waters*

Sinks were removed from the sn_nmti_Dis38k layer if their surface coincided with or was in contact with the water layers of the Polish Hydrographic Division Map (MPHP) and the Main Office of Geodesy and Cartography (GUGiK). The tool used was Selection/Select by location "intersect the source layer feature". Of the 12,177 areas without outflow (sinks), 10,080 areas remained after the removal of the areas designated by the above-mentioned tool.

3. Comments

A copy of the layer named sn_nmti_Dis38kk was created and further used. The subsequent analyses concerned the development of a model that removed surface water polygons from the layer of outflow areas. The layer jez_n_Gd (polygon) was selected for removal from the MPHP. The layers named OT_PTWP_A OT_PTWP_A Polygon and OT_BUZT_A OT_BUZT_A Polygon were selected from GUGiK for deletion.

sn_jez_n_Erase.shp: sink areas cut out with a layer jez_n_Gd

sn_jez_n_PTWP_Erase: sink areas cut out with OT_PTWP_A OT_PTWP_A Polygon

sn_jez_n_PTWP_BUZT_Erase: areas without outflow (sink) cut with layers of the above-mentioned and OT_BUZT_A OT_BUZT_A Polygon.

The name of the new layer was sn_jez_n_PTWP_BUZT_Erase.

The surface of areas without outflow before object removal was 6,349,092 m² (sn_nmti_Dis38).

The surface of areas without outflow after the removal of the objects was 6,294,219 m² (sn_jez_n_PTWP_BUZT_Erase). Thus, the area decreased by 54,873 m²

Elimination of Artifacts

Next, sn_erase_artefakty, a copy of the sn_jez_n_PTWP_BUZT_Erase layer, from which 1756 artifacts were manually removed, was formed. There were 8,253 sinks left (i.e., areas without outflow), which were converted into a point form (sn2_point: a point layer was created from the sn_erase_artefact layer) and the Kernel Density parameter was used, with parameters as follows: mesh size, 100 m; search radius, 250 m. The object grouping method used was Natural breaks (Jenks). Area_erase: the total area of the polygons of the areas without outflow after removing the surface water layers and reservoirs from the MPHP and GUGiK, as well as artifacts, was 5,994,305 m².

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