DIFPOLMINE CONFERENCE

GIS based mapping of pollution in the Toka valley - Gyöngyöroroszi

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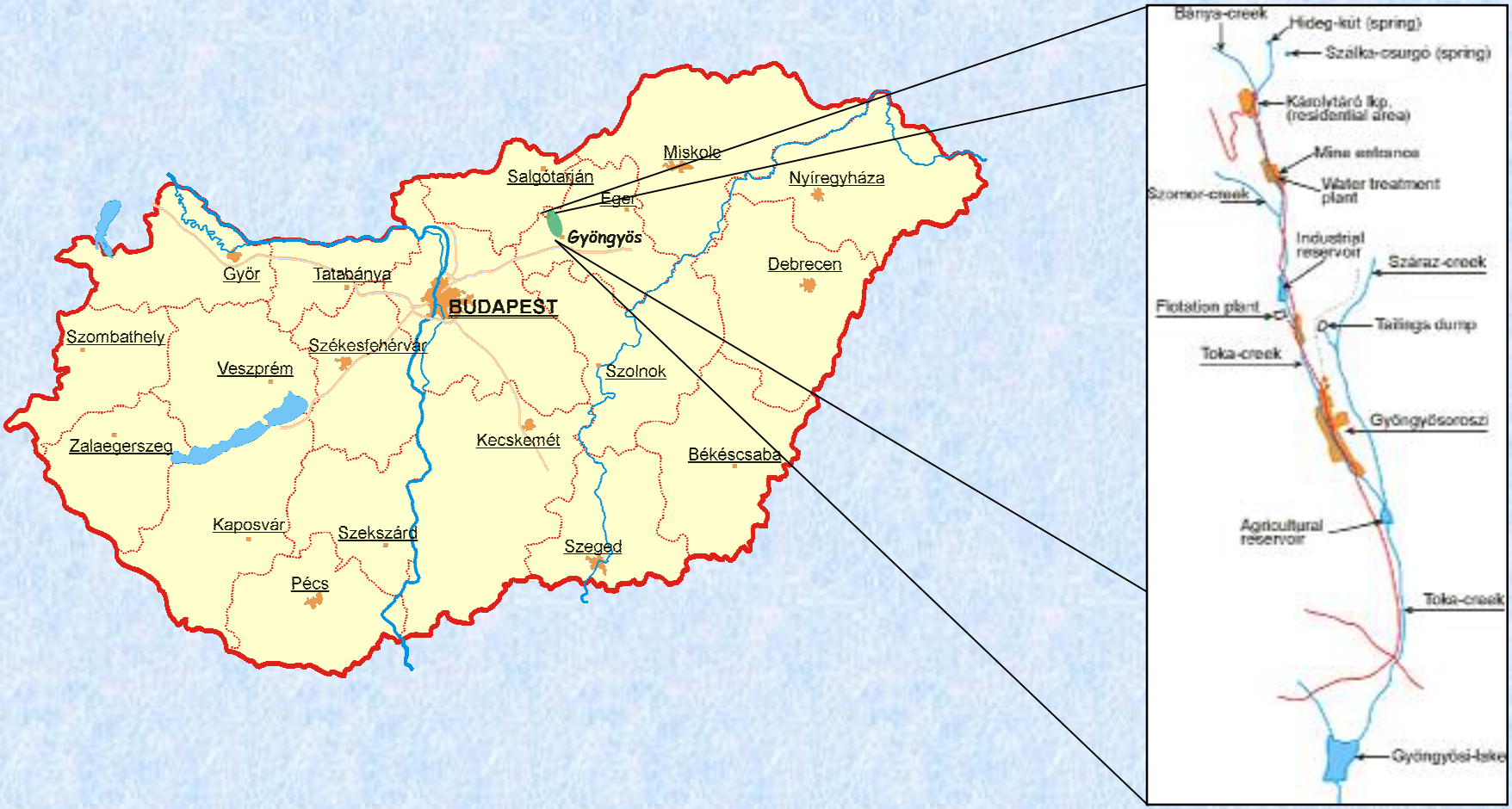
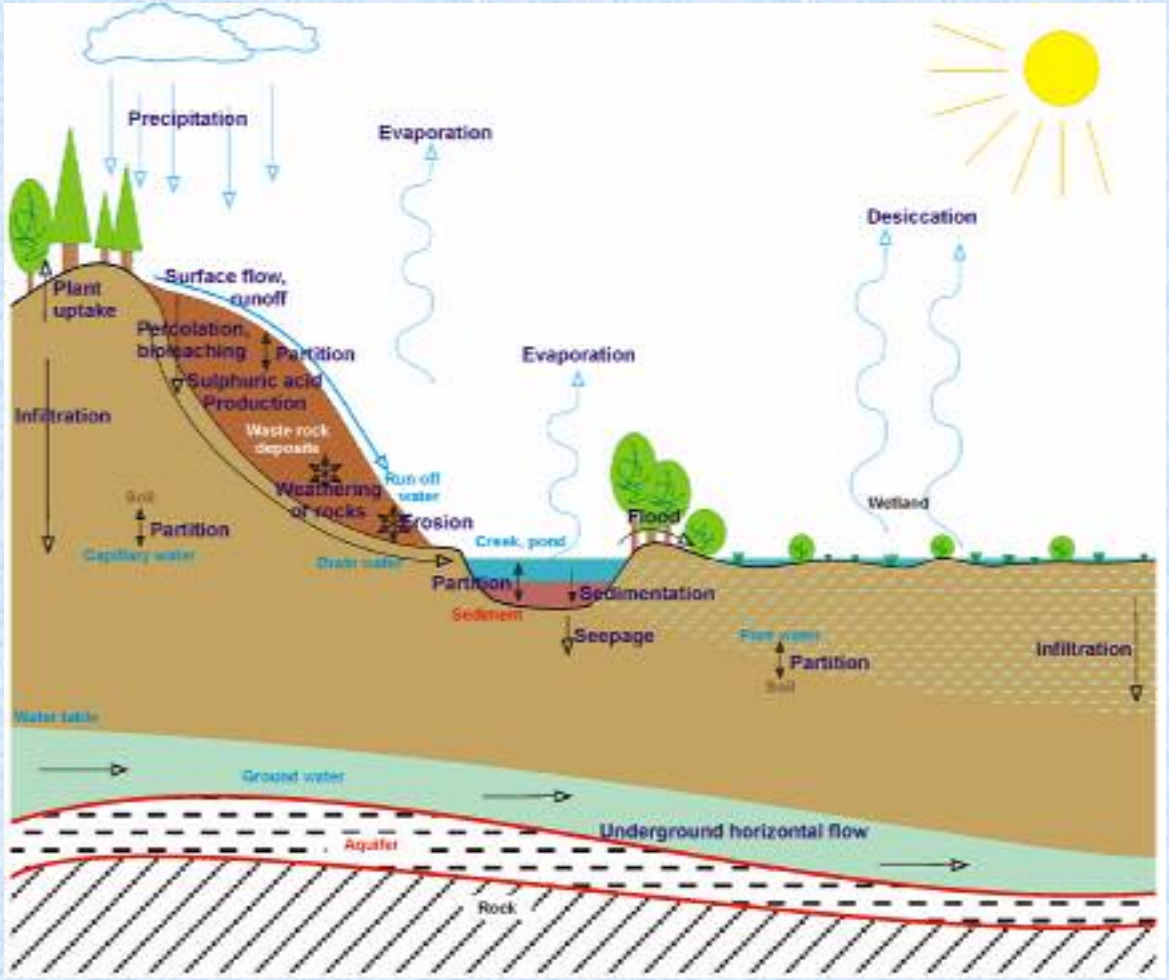
The studied area

Abandoned zinc and lead mine



Risk model

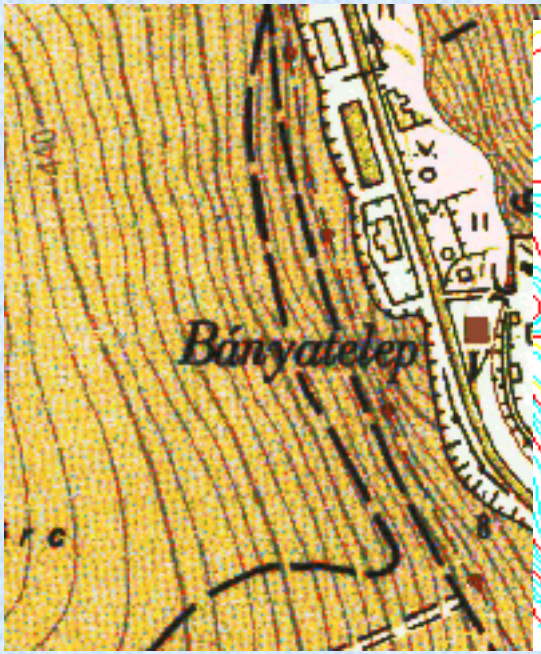


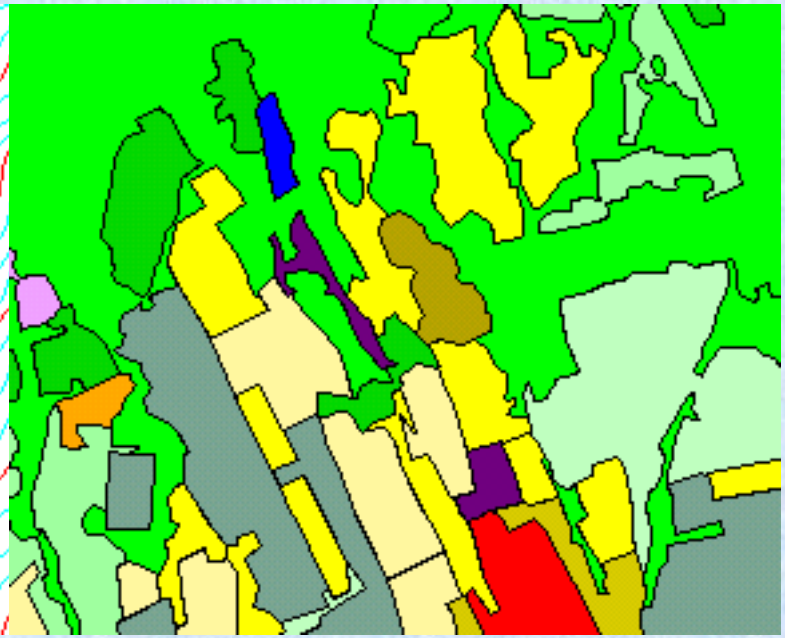
Processes:

- precipitation (rain + condense)
- infiltration,
- seepage
- weathering of rocks
- sulphuric acid production
- percolation, leaching
- underground horizontal flow,
- **runoff, surface flow**
- sedimentation,
- partition,
- evaporation,
- plant uptake,
- desiccation,
- flooding,
- **erosion**

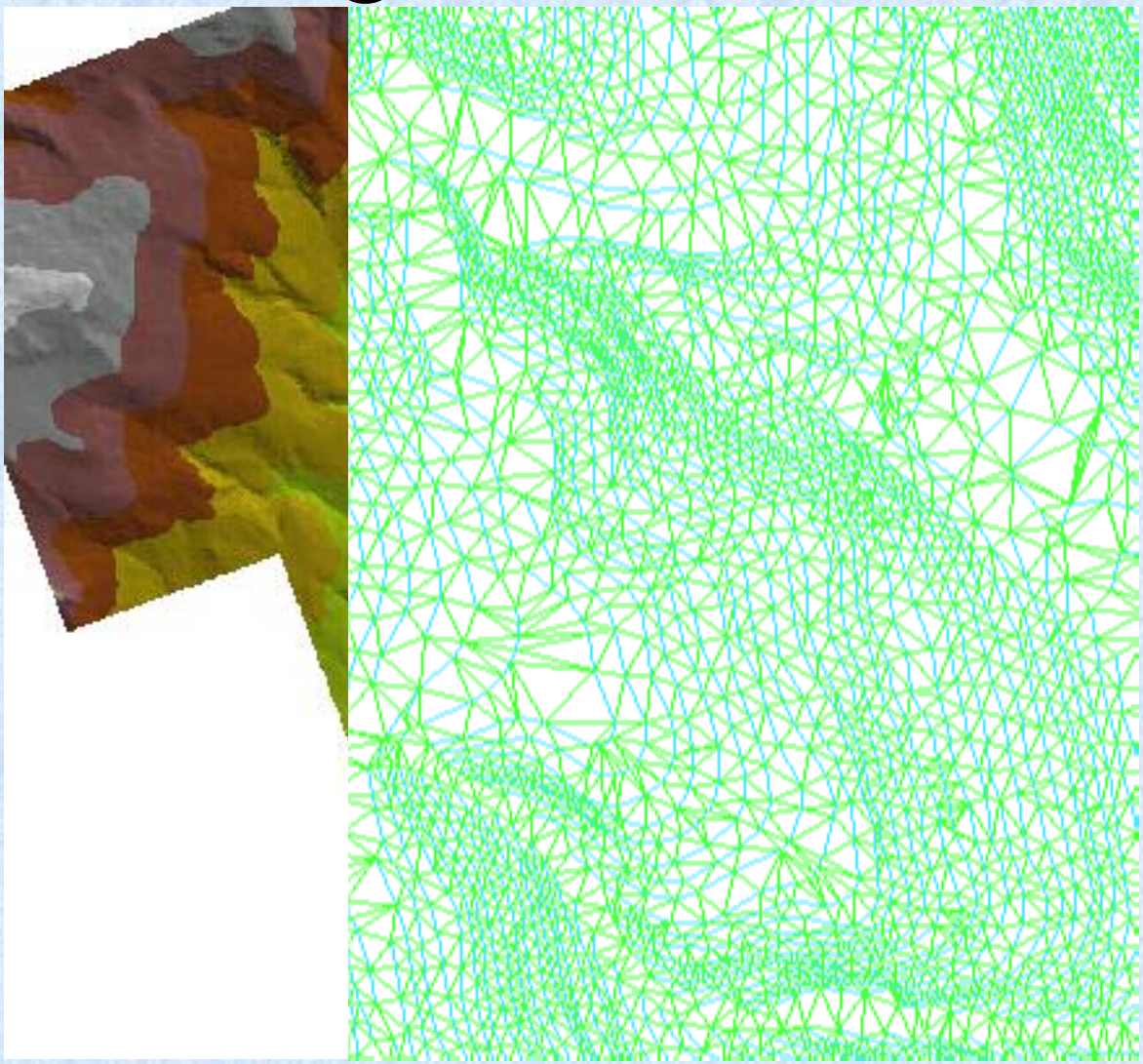
Used maps

- 1:10000 topographical maps, geotiff 300 dpi, 5 sheets (FÖMI)
- 3D contour lines, AutoCAD R14 DXF format (FÖMI)
- 1:50000 Corine land cover database, ESRI Shape format (FÖMI)



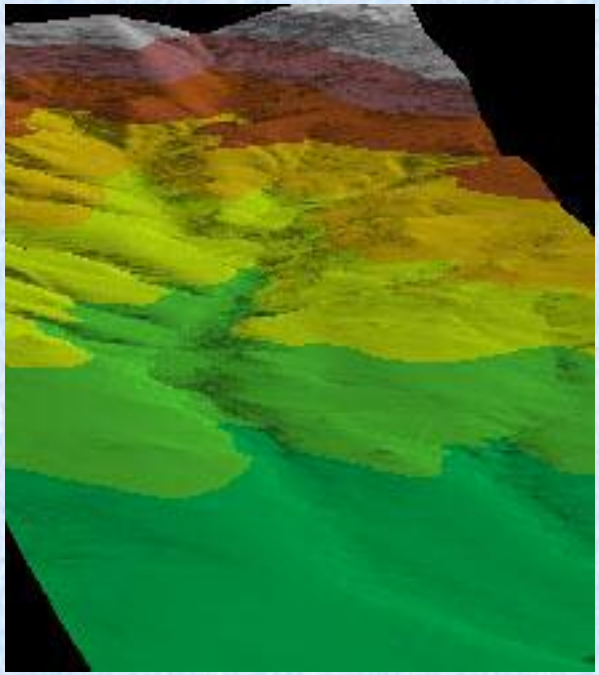
Digital Terrain Model (DTM)



TIN model

132108 points

262942 triangles

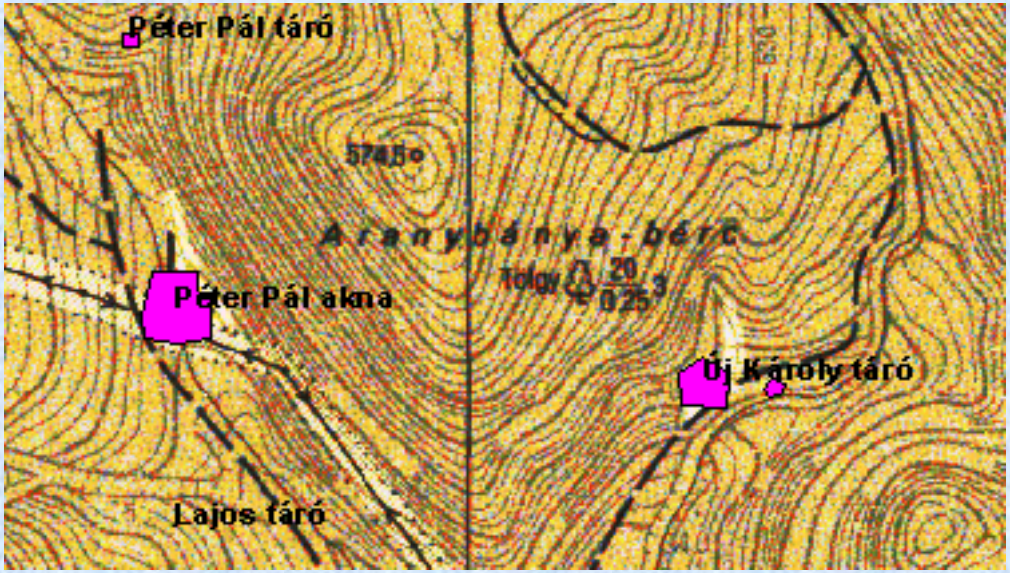


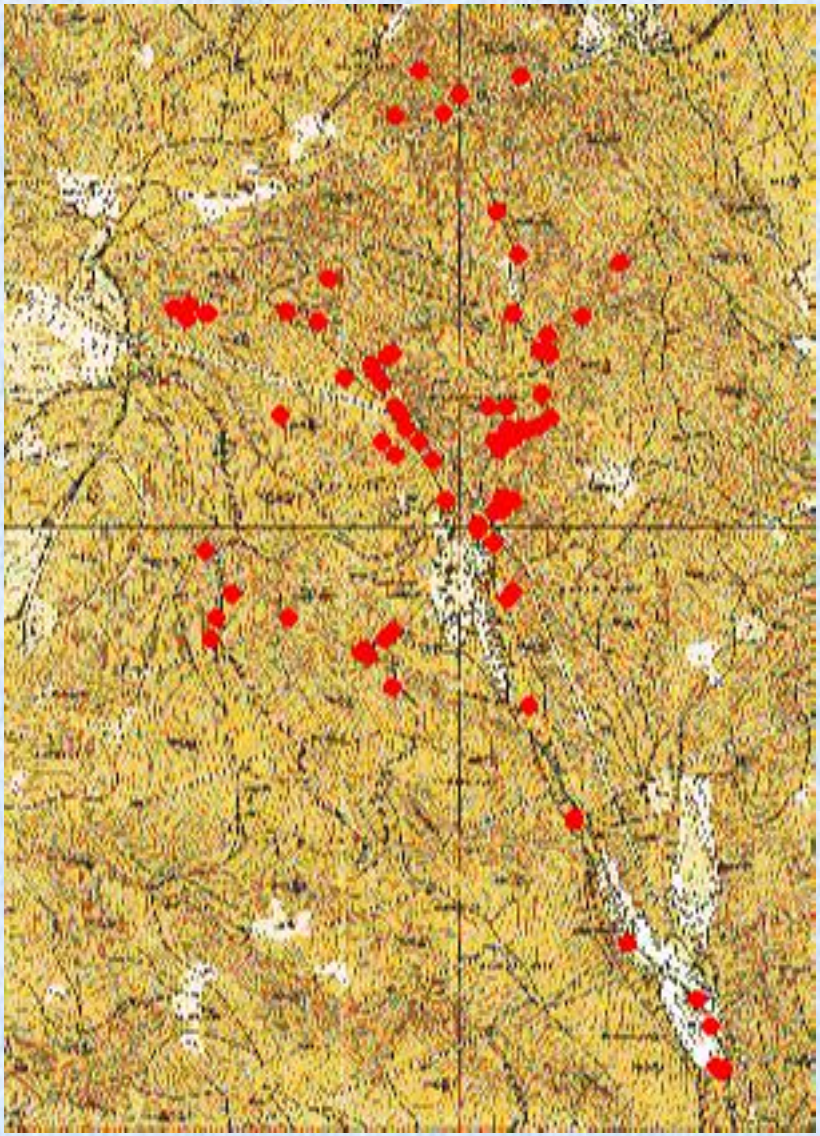
Onsite data

Garmin GPS

Soil, water samples,
position of waste dumps
(As, Zn, Pb, Cu, pH)

WGS 84 to EOV transformation





Scenario

Preparation for hydrological modelling

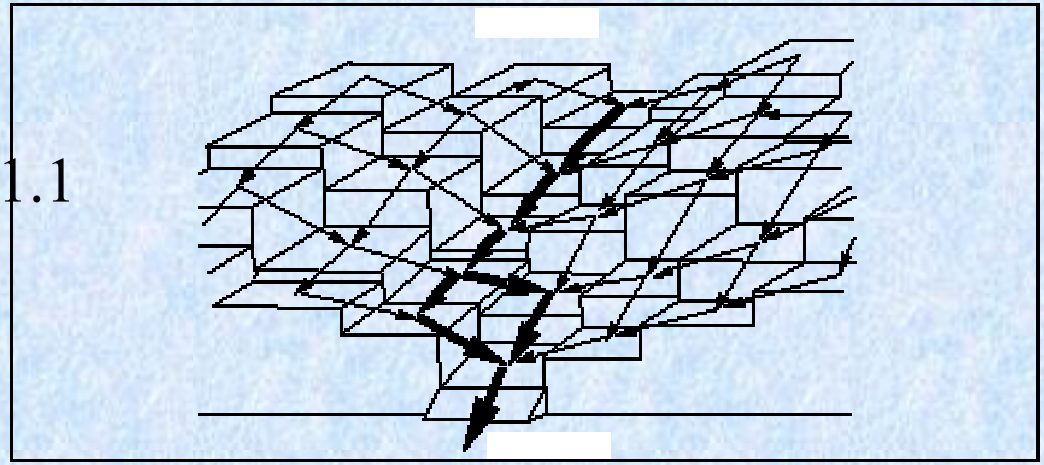
Data conversion from TIN to GRID model

10 meters resolution (1337 x 795 cells)

Correcting model area to coincide watershed of Toka creek

Sinks filling

ArcView 3.1,
Spatial analyst,
3D analyst,
Hydrological modelling V1.1



Flow directions

32	64	128
16	X	1
8	4	2

Codes

Calculated from the DTM grid

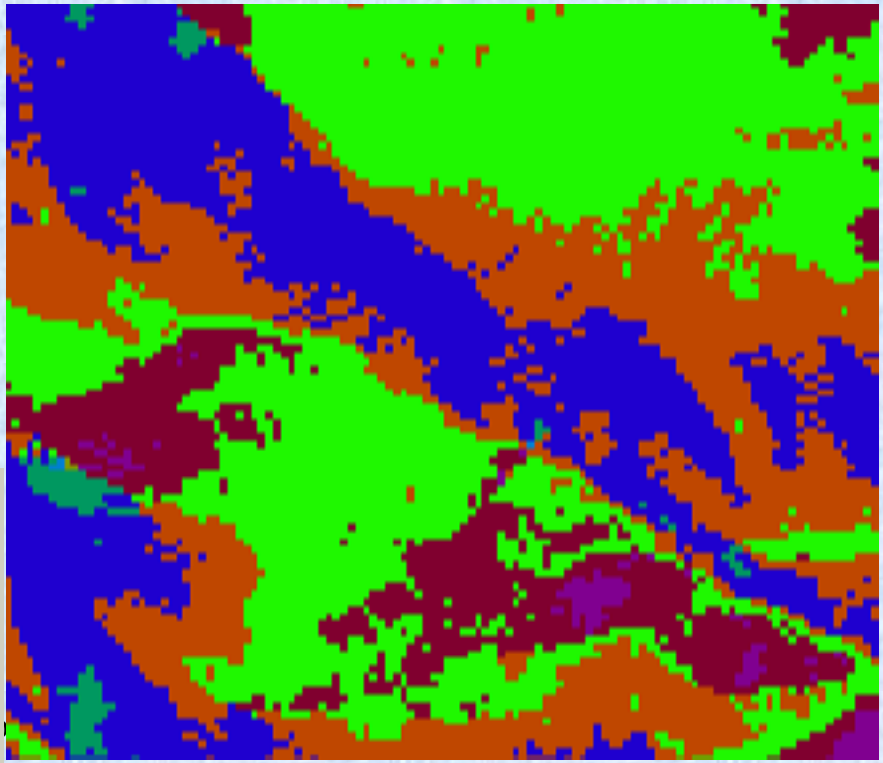
Each cell gets the direction code of the lowest neighbouring cell

78	72	69	71	58	49
74	67	56	49	46	50
69	53	44	37	38	48
64	58	55	22	31	24
68	61	47	21	16	19
74	53	34	12	11	12

Elevations

2	2	2	4	4	8
2	2	2	4	4	8
1	1	2	4	8	4
128	128	1	2	4	8
2	2	1	4	4	4
1	1	1	1	4	16

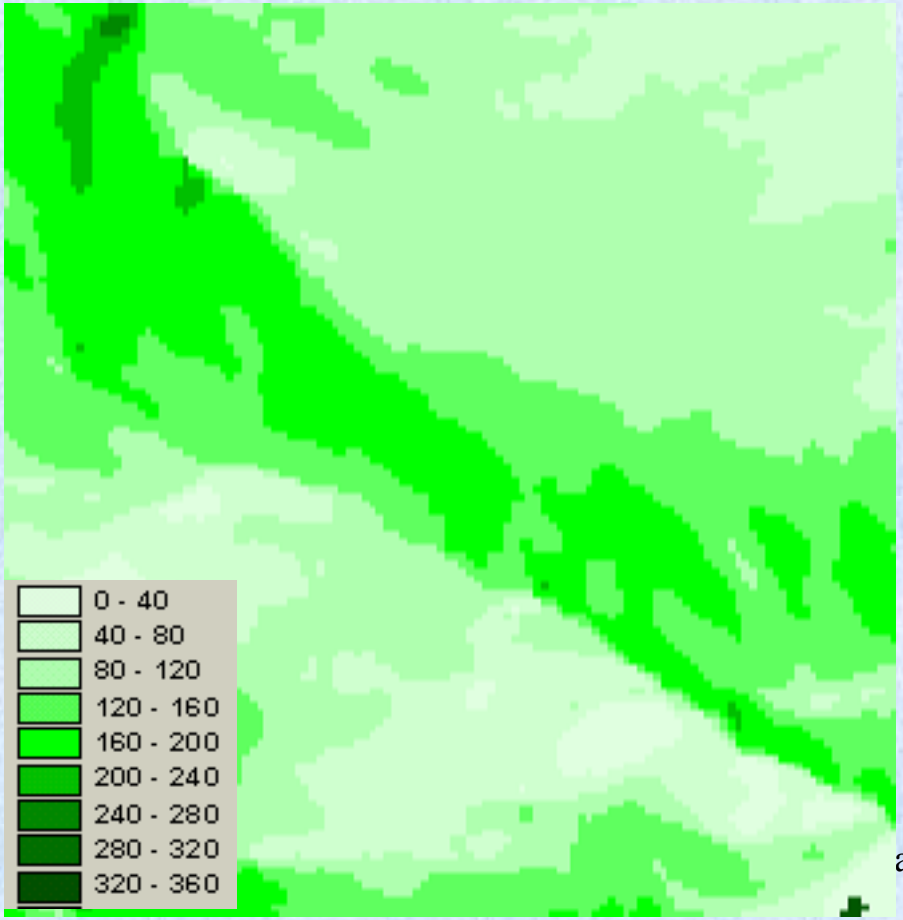
Directions



Other derived data

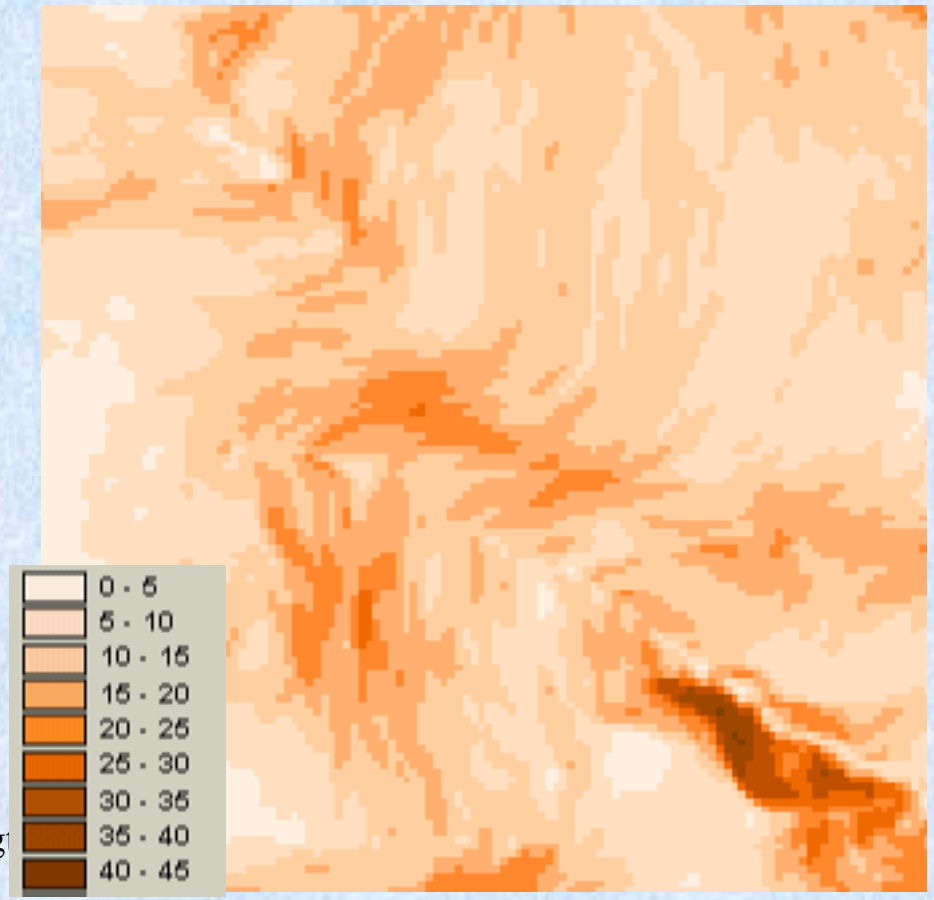
Aspect (0 – North, 90 –East)

Aspect identifies the steepest down-slope direction from each cell to its neighbors.



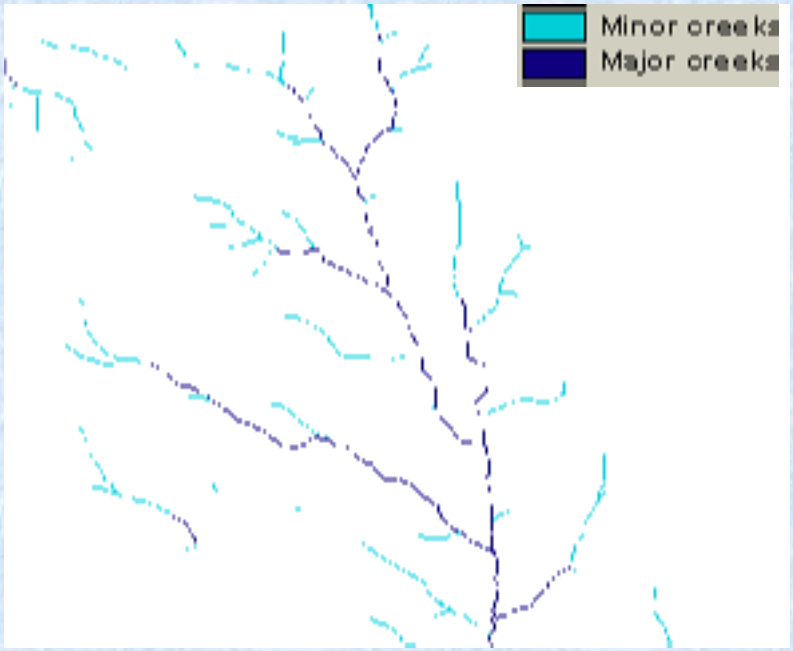
Slope (degree)

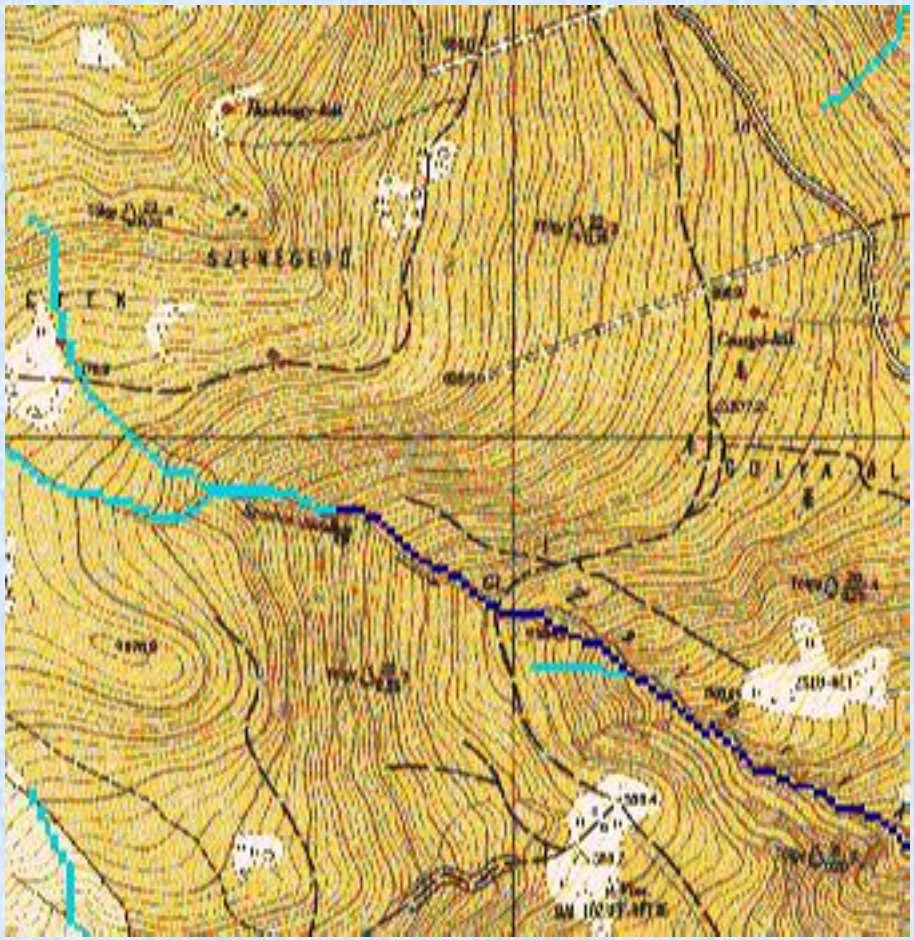
identifies the slope, or maximum rate of change, from each cell to its neighbors



Surface flow

Flow accumulation

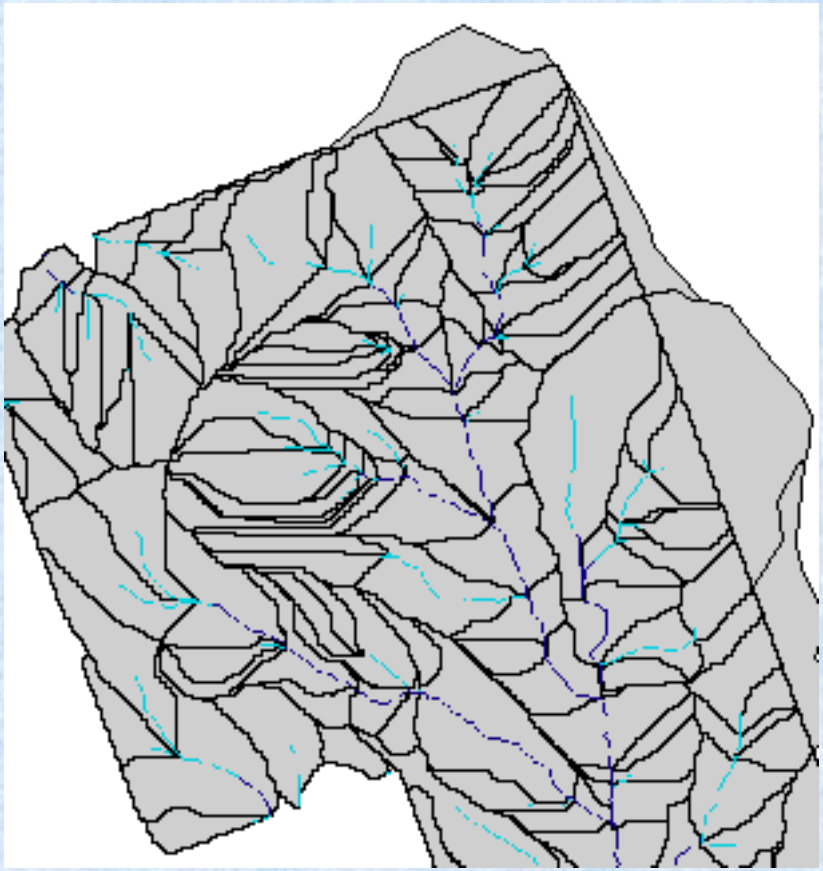




5-50 km^2 watershed

above 50 km^2 watershed

Watersheds



Derived from flow directions

Manual corrections

Watershed area above waste dumps
Correlation between area and danger

Name	Area of pit-heap	Area of watershed
Lujza táró	36.00	1200
Péter Pál táró	100.00	200
Péter Pál akna	2031.82	**959500**
Katalin táró	532.99	11700
Lajos táró	1.82	200
55-ös feltörés	172.53	4800
Károly táró	400.00	**261000**
Szálka csurgó táró	121.71	800
Pelyhes táró	102.57	2700
Pelyhes 2	200.77	700
Új Károly táró	1124.43	32000

Other risk parameters

Weighted sum along the flow direction

Danger = f (a,b,c,d,…) empirical formula

Grid algebra – mathematical operations between overlapping cells of different grids

Function of time cannot be modelled this way

We have reached the limits of ArcView Spatial analyst and 3D analyst

Simple erosion modelling

$$Y = R * K * S * C * P,$$

Where

- *R* describes rain intensities,
- *K* relates to soil texture,
- *S* relate to slopes,
- *C* describes the vegetation coverage and
- *P* relates to agricultural practice, if any.

All these variables are defined in grids.

What is next?

Buying special software (high cost)

Developing own software (much time)

Using GRASS

Erosion modelling