Serious “Flash Flood” Risks in Rural Areas

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The assessment of flash floods in a certain area is extremely important, especially from the point of view of early warning and flood mitigation. This idea is supported by the analysis of the feedback of some small catchments to torrential rainfall, which have generated disastrous effects lately.

In order to identify and map the slope flood susceptibility in the vicinity of some rural areas, a GIS model was performed. It was meant *to interpolate* the data related to maximum discharges with 1% probability, which were calculated on second order catchments tributary to Someşul Mic river and *to define the degree of risk* in the area studied.

The database used to finalize the model consisted of alphanumeric and graphical data, commonly used with GIS, which are presented in table 1.

Table 1. Type of data used in the analysis.

Database	Database type
Maximum intensities of rainfall	numerical
Maximum discharge with 1% probability	numerical
Flood risk assessment on bare soil database	graphical
The territory inside the village in the area studied	graphical

In order to perform the analysis some steps are necessary: *catchment identification, calculation of the discharge with 1% probability for those catchments, interpolation of maximum discharge database and the GIS analysis.*

Catchment identification was automatically done using some ArcGIS functions – *stream definition, stream order* – on 16 small catchments of second order.

Calculation of the discharge with 1% probability was performed using the rational formula for maximum discharge because most of the catchments are larger than 10 km^2 (this formula is recommended for such areas). The results are presented in tables 2 and 3.

Table 2. The results for 1% probability discharge.

Catchment	Beliş	Căpuş	Chinteni	Gârbău	Irişoara	Leşu	Pietroasa	
Q1% (l/s/km2)	2.251,78	2.008,93	1.906,38	3.750,65	1.703,62	3.335,52	1.860,66	
Catchment	**P. Negru**	**Ponor**	**Popeşti**	**Şomtelecul**	**Feneş**	**Şard**	**Râşca**	**Răcătău**
Q1% (l/s/km2)	1.180,70	2.113,36	2.473,30	2.603,69	2.129,72	3.123,75	2.058,91	1.264,36

Interpolation of maximum discharge with 1% probability database can be realized by applying another interpolation on this database, either statistical or deterministic, according to the number of points the interpolation is based on.

GIS programs include a number of specific functions for interpolation. ArcGis - Spatial Analyst has some interpolation functions such as: *Spline, Kriging, IDW.*

In order to choose the interpolation function, we took into consideration both the number of points with available values, as well as their territorial distribution. On the basis of these two elements, we draw the conclusion that the best interpolation function is IDW form the ArcGIS, Spatial Analyst. IDW (Inverse Distance Weighting), figure 1, is based on the hypothesis that the influence of the value of a certain point on the value of another one is in inverse relation with the distance between the points.

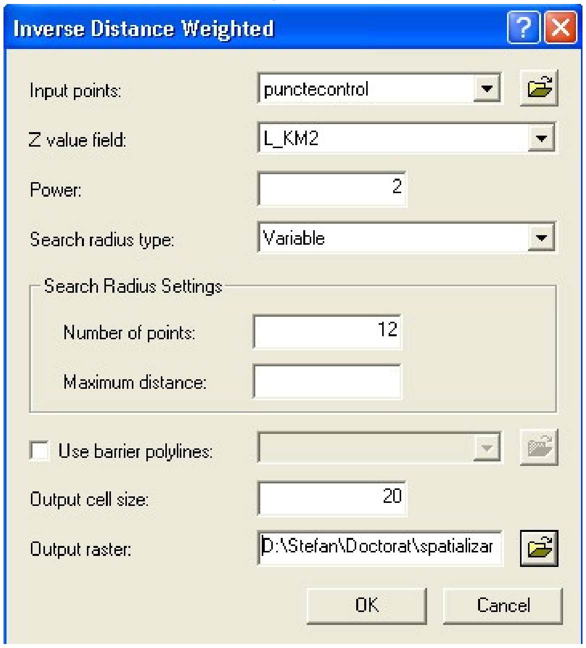

Figure 1. The pop-up window for IDW interpolation (ArcGIS).

The spatial analysis was meant to identify the flood prone areas. It was performed using the *raster calculator* function and the *spatial analyst* extension from ArcGIS.

The analysis of the alphanumerical grid database was accomplished by applying the spatial analysis equations, which resulted in a grid structure. It represented the basis for identifying flood prone areas.

The areas that are not prone to floods were given value 0; those areas prone to floods were given value 1. Because we use the interpolated discharges and the flood risk assessment on bare soil database as the basis of the analysis (Bilaşco, Şt., Haidu, I., 2006), we will use 1 as input factor in the spatial analysis equations.

The flood prone areas were divided in three categories: areas with low risk, medium risk and high risk, according to the following equations:

Low risk

[Discharge l/s/km^2] >= 1.180,70 & [Discharge l/s/km^2] <= 2.000,00 & [Soil risk] == 1

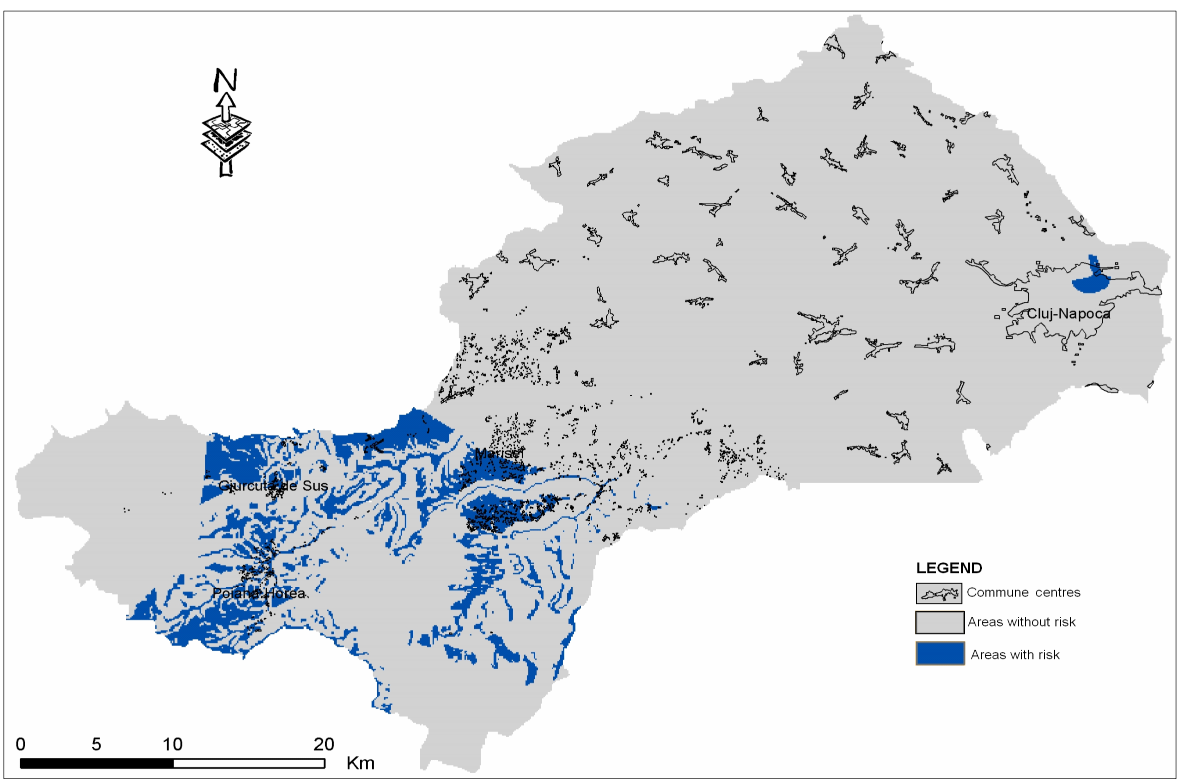

Figure 2. The areas with low flood risk in Someşul Mic superior basin.

Medium risk
[Discharge l/s/km^2] >= 2000.00 & [Discharge l/s/km^2] <= 3000.00 & [Soil risk] == 1

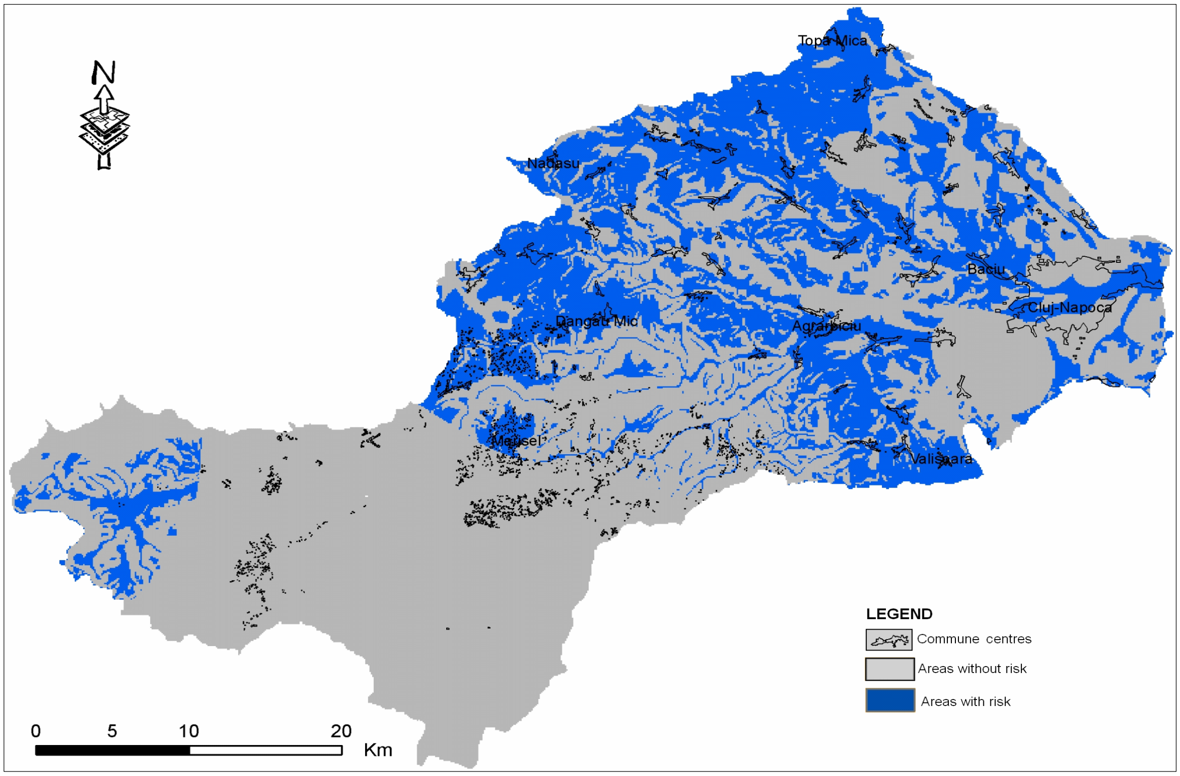

Figure 3. The areas with medium flood risk in Someşul Mic superior basin.

High risk
[Discharge l/s/km^2] >= 3.000.00 & [Discharge l/s/km^2] <= 3.750.65 & [Soil risk] == 1

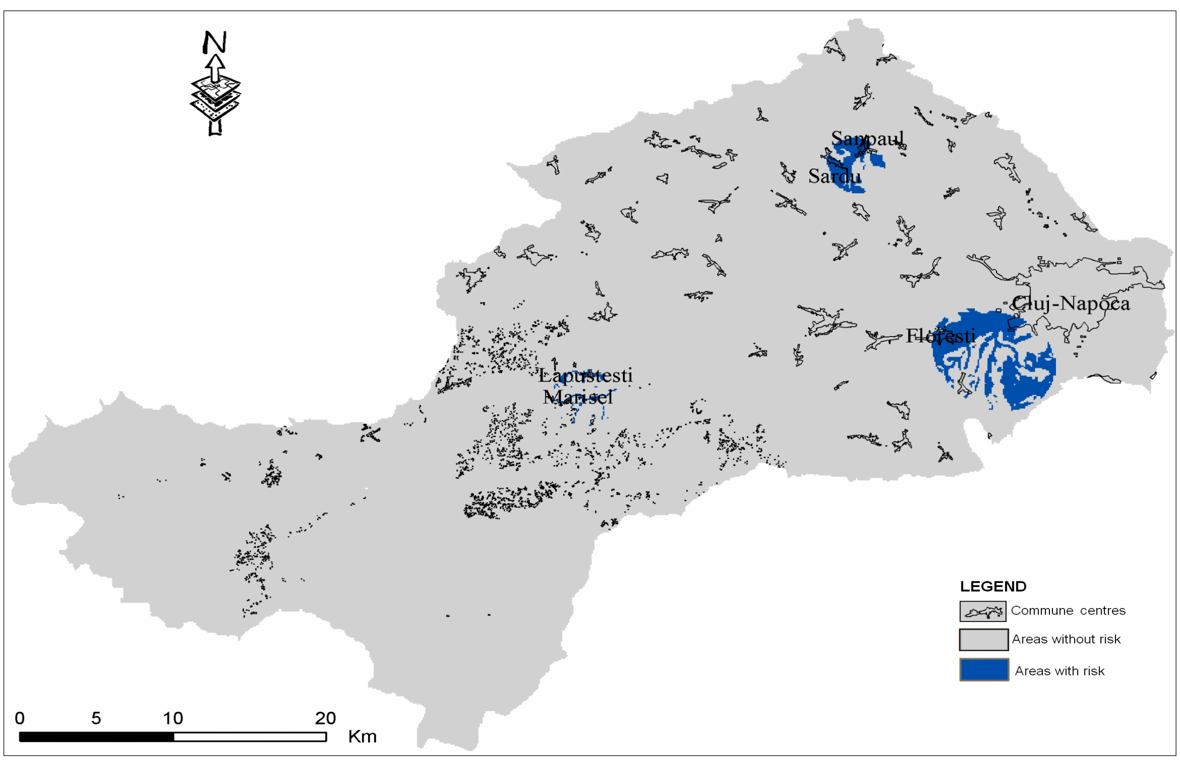

Figure 4. The areas with high flood risk in Someşul Mic superior basin.

According to the equations, the values for the maximum discharge (l/s/km^2) for *low risk* should range between 1180.70 and 2000, and the database for soils should be 1.

For *medium risk,* the values of maximum discharge should range between 2.000-3.000 l/s/km^2, and 1 for soil.

For *high risk,* the values of maximum discharge must be higher than 3.000 l/s/km^2 and lower than 3750,65 l/s/km^2, and 1 for soil.

The resulting database emphasizes three flood prone areas in the Someşul Mic catchment, which are presented in table 4.

Table 3. Flood prone areas.

Low risk	Medium risk	High risk
Giurcuța de Sus	Dângău Mic	Mărişel
Poiana Horea	Nadăşu	Sânpaul
Mărişel	Mărişel	Floreşti
	Topa Mică	Şardu

By analyzing the results (three maps and the table of the foold prone areas), one can notice that most of the localities have medium and high proneness to floods. Mărişel village has all the three degrees of risk because it is characterized by the presence of different types of landforms (mountains, hills and valleys).

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