THE PROPOSAL OF LANDSCAPE ARRANGEMENTS AS AN EFFECT OF FLOODS IN THE SLOVAK RURAL REGIONS (CASE STUDY OF THE VILLAGE CHĽABA)

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ABSTRACT

Man, with his activities, has consciously or unconsciously influenced the country; he has changed its features and flows of energy there. The direct consequences of extreme dynamical changes have influenced not only the country itself, but also life in the rural regions mostly. This effect on the geographical position emphasizes the human activities in Slovak conditions. In the frame of the natural processes within the landscape we focused on the research of flood phenomenon in the southwest Slovakia region. We have created a case study for the affected areas of the village Chľaba. We explored the impacts of the damage range on the landscape structure as well as the consequential changes of human activities in endangered rural territories. The research in the frame of this case study might bring a more realistic view on the influenced Slovak areas which regularly suffer from floods. The main target of our research was to intercept the actual situation in the time of maximal floods level and shortly proceeding it, in the chosen area of the Danube river, the Ipeľ river, their fork and cartographical visualisation of the situation at the time of maximal flood levels. But the most important result of the research will be a deduction of such proposal conclusions, which could lead to the new and more operative flood protection arrangements in this part of Slovak rural border space. An added value of the paper is the creation of a flood hazard map proposal, which might be used with the intentions of a flood protection management plan and its practical application as to the prevention of negative flood impacts on endangered regions, such as this one belongs to.

Key words: floods, inundation area, landscape utilisation changes, flood protection arrangements, flood hazard management, the village of chľaba.

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INTRODUCTION

Man, with his activities, has consciously or unconsciously influenced the country; he has changed its features and flows of energy there. This fact makes conditions to other changes, which have often negative consequences for men. Such an example is also a known and reported phenomenon of floods. It is accelerated mostly as a result of man's activities, which have an impact on a country's hydrological cycle (Gallay, 2010). The increased amount of water in a country, either surface - flowing down, or locally gathered on a specified place, could as a result endanger other continuous activities. This may in paradox cause the following negative current phenomenon - the aridity.

Global climatic changes are nowadays connected mostly with an appearance of several anomalies of natural processes. These processes may seem on the surface "unprotected" rural country sides as extraordinary ones. The direct consequences of extreme dynamical changes have an influence not only on the country itself, but also on the life in the rural (less protected) regions. This effect emphasizes the geographical result of human activities in Slovak conditions. For more human sectors (e.g. agriculture, forestry, environment protection) may have the secondary reasons caused by the hydrological changes of the same, or of even more importance, than primary climatic changes. The exposal of such hydro - climatic change may appear in the country on one side by the occurrence more often of rainstorms, therefore leading to the occurrence of sudden extreme floods, more intense than past floods in Middle Europe (Danihlík, Trizna, 2005).

The floods themselves create a contemporary phenomenon in many inundation areas of water flow and also have caused an extreme problem in the last decades. The thousand - year floods aren't any extraordinary supernormal fact. Flooding now has generally repeated itself approximately every 10 years. In our chosen territory it seems to repeat itself at the rate of every 4 years, with gentle flooding every 2 years.

We created a case study for the most part of flood affected areas of the village Chľaba (cadastral territory of Chľaba, further c.t. Chľaba). We explored the impacts of the damage range on the landscape structure changes as well as consequential changes of human activities in endangered rural marginal territories on the example of the SW Slovakia region. The research in the frame of this case study might bring a more realistic view on the rural or even marginal Slovak areas, which regularly suffer from floods. The research areas are exactly allocated by the Map 1 in the chosen distance of the Danube river, Ipeľ river and their fork (we distinguished four model areas in c.t. Chľaba). Webelieve, that the research in the frame of this case study might bring a more accurate view on the marginal Slovak areas, which regularly suffer from floods.

The main target of our research was to intercept the actual situation in the time of maximal flood levels and shortly after and get a cartographical visualisation of the situation in the time of maximal flood levels (actual water - line after maximal floods). The most important result of the research will be a deduction of such proposal conclusions, which could lead to the new and more operative flood protection arrangements in this part of Slovak rural border space. An added value of the paper is the creation of a flood hazard map proposal, which might be used with the intentions of a flood protection management plan and its practical application as to the prevention of bad floods and the impacts on endangered regions such as this one.

MATERIAL AND METHODS

The process of floods arises from 3 main reasons.

- The first one is defined in the § 2, art.1 of the Act No. 7/2010 Coll. on the Floods protection. If the river - basin doesn't have enough capacity, so that it can't carry over the whole high - flood - water wave, the huge amount of water is discharged from the basin and overflows to the surrounding inundation areas. The example in our chosen territory in c.t. of Chľaba is an area, which was overflowed at the fork where the rivers Danube and Ipeľ converge. The 2 example is the model area No. 3 and 4 (Map 2), when the river Ipeľ was hugely overflowed from 2 to 3 km forward of the fork (Fig. 1, Fig. 3).

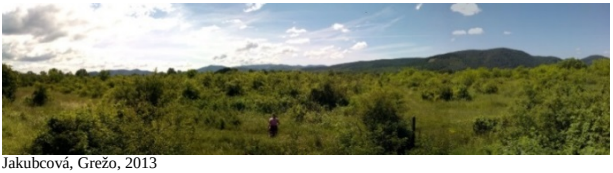

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Fig. 1 A view near the fork of the rivers Danube and Ipeľ (previous fruit grove, now unused and under flooding)

- The second reason may be the internal waters. These waters arise on specified territories from rain falls or snow - melt, then these waters are unable flow away freely from such territories and therefore they create floods. Examples of these are in such huge territories are lowlands or plains, enclosed areas or bigger terrain - depressions.

- The third reason of flood arising may be an increase of the subsurface water level or even discharging of it on the terrain surface.

- The result of the combination of the mentioned last 2 points above in our territory is the model area No. 1 and 2 (Map 2). This is a characteristic by the relative distance from the water lines themselves (from the rivers Danube and Ipeľ), but it is also wholly covered by huge amounts of water. The terrain in this model area is flooded and looks like a marshland (Fig. 2, Fig. 3). In these places the total disposal of the fields and the agricultural production as well are visible. In the years when there are no extreme floods in c.t. Chľaba, these territories are characteristically productive for crops.

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Fig. 2 A panoramatic view on the river Danube in the time of maximal flooding

- The forth reason of floods is a process of suffusion. This geomorphological process may cause the declination of the surface (subsidence) or its other deformations, and in some cases may lead to slope gradient erosion. In this way there arises geomorphological forms e.g. suffusion - depressions (on the river flood - plain terrace). In our territory there is clearly visible this process in the model part No. 3 (Map 2).

Other than natural conditional changes in the country, landscape cover changes, landscape structure changes and changes in the field of human land utilisation, the phenomenon floods cause also a huge range of administrative, proceeding or even legal problems. We cannot forget the embarrassments concerning the logistics of these areas, problems with the traffic and other important constraints. It is almost impossible during this time of extreme flooding and extraordinary situations here thus to attend regularly the work places (into the Hungarian villages, or not even to the Štúrovo town, nor to the Esztergom city), then considerable problems with necessary health or emergency practices (Hoško, 2011). In the coherence of these problems was created in the Slovak legislative system the term of extraordinary situation and such endangered places are so protected by the law, by not in the sense of realistic practise (Betuš, 2011).

According to the work of Minár, Tremboš (1994), natural disasters in Slovakia are monitored and can also be quantified by the method of original synthesis of many published approaches. In the chosen territory we may use predominantly a synthesis of these factors:

Partially:

a/ the risk of accelerated wind erosion,

b/ the risk of scour hole erosion,

Completely:

e/ floodwater hazard,

f/ waterlogged soil risk, risk of creating more unnatural boggy lands.

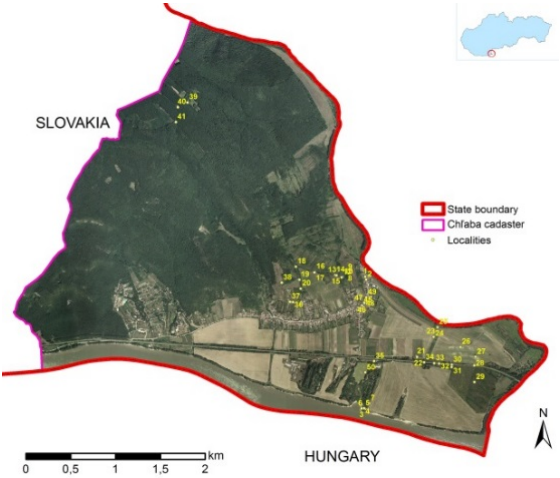
Floodwater hazard expresses the probability of territory threats in the inundation areas by several high frequency floods. This natural threat makes some constraints or even neglects many of human activities in the landscape, i.e. the arable soil utilisation, public or local roads building, house - building and industrial possibilities, etc., including public structures, which have to be preventively protected by law against the 100 - year, or even 1000 - year water flood. This important fact should be approximate by the form of some concrete arrangements in building standards, regulations in the landscape ecological planning for every specified municipality problem and the whole this according to the Act No. 50/1976 Coll. On the territorial planning and building regulations in the last years.

An algorithm of flood hazard evaluation was provided and published by the authors Trizna, Minár, Tremboš in 1993 and this task was further elaborated in the work of Trizna (1994). We tried in our paper with the modified mentioned algorithm and with local specifics allowing to the creation of our approach, which the result would be a proposal of a new flood hazard map (Map 3). This map shows us the total slopped territory in June 2013 in comparison to the average water level in basin.

The flood hazard (potential threats caused by flooding) is continuously and closely connected with the risks of short term or long term flooded areas. This fact then stems from influences of the limits of landscape intensity utilisation. This practise is in reality a very complicated function with a huge amount of variable quantities and factors (including those, which are not able to correctly be quantified (Miklós, Kozová, Ružička et al. 1986).

As for our own research we tried to modify the existing methods and also fill it in with our own approaches. We have continued with following steps and opinions:

- We identified the state of floods first in the terrain by walking the whole distances of the slopped water line of both rivers. We in the same way drew the whole new water line to our actual maps on a larger scale directly in the terrain. We did this step at a time of maximal flooding and also the 1st and 2nd day after culmination, and then we checked the changes 3 and 4 days after water culmination (Map 1).



Grežo, Jakubcová, 2013; source of orto-photo data: EUROSENSE, s.r.o.

Map 1The research points in terrain (with numbers of chosen and measured localities) in the cadastral territory of Chľaba

- We then followed with the choice of some key points in the country itself, which are most important as for the horizontal and vertical point of view and also as for the shape of water lines and key point in the relief of slopped country (Map 1). At these key points we wrote down some specified lists, we identified them with electronic route location. We took in the slopped terrain 45 points, of which we used 29 for our purposes. We further identified their geographic location with the help of GPS.
- We obtained layers of the orto-photo data and images, which we had referenced to the GEO systems and identified them with our results. We then created thenewdigital actual water – line path in the time of maximal flooding there.
- We are still creating a geo-database (in table excel forms), which might be connected with other graphical applications (included GIS), filled in with actual photo-documentation of the exact location in time and space (Fig. 1 - 3).
- This database will be ever enriched with new forms of cataloguing and other actual information from this territory. Included will be an identification of the landscape structures and their changes (to the level of landscape components) and with the landscape utilisation changes of human diverse activities (Fig. 3).

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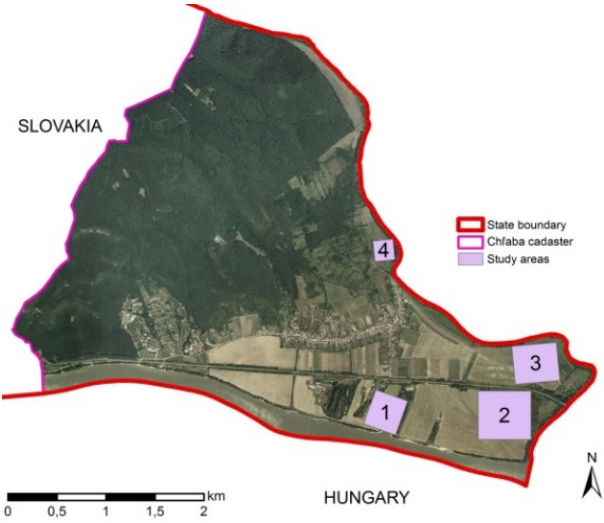
Fig. 3 A panoramatic view from the Burdamountain of the rivers Danube, Ipeľ and their fork and the slopped area

- In the same way we proceeded in each of the 4 model areas of relevant rivers of the Danube and Ipeľ in cadastral territory ofChľaba (Map 2).



Grežo, Jakubcová, 2013; source of orto-photo data: EUROSENSE, s.r.o.

Map 2 The specified model areas dedicated after research of floods monitoring in the cadastral territory of Chľaba

In the discussion and conclusion we tried to summarise and create a conjunction and synthesis of our research outputs, with the knowledge about this kind of marginal country sides and also with the talks of important problems with the inhabitants and municipality participants. These results we compared and contrasted with other similar studies and methods from other territories. This areas in Chľaba are the part of Slovak marginal territory, but the outputs could also be generalized on other similar rural territories in Slovakia with similar physical conditions.

In the conclusion we proposed the real landscape arrangement changes in this marginal territory with the protection of its traditional forms and without bigger damages on the human life there. These proposals were made on the base of the measurements and results of Map 3.

RESULT AND DISCUSSION

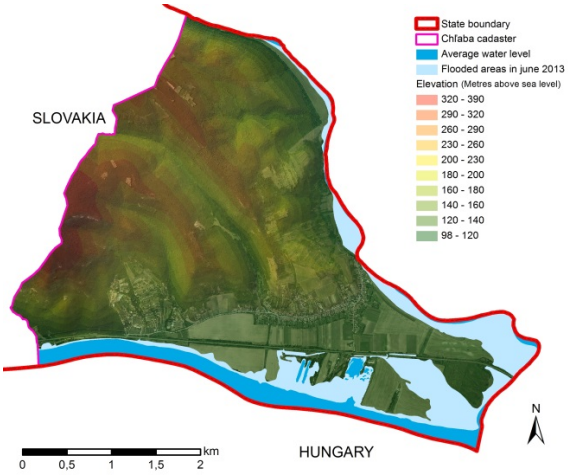
Floods are an extraordinary natural event. They used to be very sudden, dynamical and with an effect on almost the whole of Slovak territories. They may cause different problems tothe economy, social consequences or may even have traumatic effects on human lives. Many kinds of climatic or hydrological prognosis alarms and such changes with negative impacts on human activities could

occur more often and in higher intensities. Knowledge which research in this area bringsforth is for that reason very important and uses a concentrated analysis, interdisciplinary knowledge changes, and a correct description of systematic practical arrangements. The following step would be correct, if the legislative, administrative, and organisation apparatus would work and could accept the obtained scientific knowledge and put them into the practice (Hoško, 2011, results of the lists of interviews with participants and heads of municipalities, 2012, 2013).

For this final step it is absolutely necessary for the complex knowledge of the situation, circumstances, terrain (with detailed terrain reconnaissance, good basic documents, data, and accurately detailed maps from each of the affected territories). This preparation of new actual documents was our endeavour as well. This may help also if quick action is necessary, and that is why the prevention is more important than the following procedures themselves. To this purpose this case study can be of help.

The reasons and consequences nowadays are different. They may start from the global and macro regional reasons, which the small region cannot influence at all. Furthermore there are reason on the regional levels with the consistent transfer on local features and relief textures. But original influence could have also many sectors of human activities (second sector) and in the tertiary sphere (administrative apparatus, monitoring and management of municipalities and regions).In this paper, the main output is the knowledge of fact, that in our chosen territory of c.t. Chľaba there become usual the appearances of hundred years floods nowadays every 4 year probably. They may get a level like in June 2013 (Map 3).

In this time was the maximal extraordinary water level exactly displayed with pale blue colour in Map 3 and was presented in the GIS environment. The normal acreage of water level in c.t. Chľaba in common year is calculated on 108.00 hectares. In June 2013 in the time of extraordinary floods in c.t. Chľaba the total acreage of flooded areas was 258.00 hectares, what is 2.4 times bigger area of water surface in c.t. Chľaba, then it uses to be in normal year. This way, the parcels which were in year 2013 under the water and normally they are utilized as fields, meadows, vineyards, or fruit groves, are almost whole destroyed and also almost the whole harvest and crop was damaged with them (Map 3).



Grežo, Jakubcová, 2013; source of orto-photo data: EUROSENSE, s.r.o.

Map 3 Actual water - line changes in the time of maximal flooding and the slopped areas in the village of Chľaba (July 2013)

In general, there are visible tendencies of most of the water flows and their drainage basins as follows:

- There was markedly decreased the natural water-bearing capacity in inundation areas, which is the influence of contamination and pollution of many main water flows in Slovakia,
- In those territories, where is a condition of high level ground waters, and this increases also the risk of potential flood frequency in relevant years,
- The natural purification capacity of water flows also decreased which expressed the bad quality of water and its ability to keep water in the river basin,
- All these processes force and accelerate the erosion and consequently this as a feedback causes often negative landscape structural changes in disadvantages to the amount of arable and agricultural soil and its changes on the temporal or permanent slopped areas (new marshlands arise).

The general outcomes (constraints) then are as follows:

- Decrease of an amount of clean drinking water sources or their pollution
- An inherent reduction of ecological functions of water flows and consequently may come to the degradation of natural water and wetland ecosystems.

The arrangements how to make well - operating systems of prevention can be divided into these groups (Betuš, 2011):

1. Systematic and administrative arrangements:
   - The territorial units which belongs to the endangered areas are necessary to be equipped with technical facilities including functional radio connections, etc.
   - To find a way how the endangered regions (municipalities) could draw some financial and material resources for the building up of well-functioning systems and for being prepared for extraordinary situations, when they arise.
   - To renew the voluntary human activities, if relevant.
2. Landscape ecological and territory planning arrangements:
   - The analysis of ecological reasons is very complicated and different. The reason of extreme flooding can be the extreme long terming and intensive rains, or a sudden melt of snow with the combination of disturbed disability of the country to dam the water. Huge amounts of concrete or asphalt surfaces contribute to the accelerating of rain outflowand also to the dehumidification of soil under these surfaces. The second great impact in not direct. It is caused by the heating and increasing of the temperature in such surfaces and around them. Drained out soil in agricultural land also behaves in itself like an impenetrable waterproof film and this phenomenon accelerates the process of erosion. Watergates and places under the bridges happen also to be very risky places in times of flooding. If these technical problems and reasons cannot be solved more quickly, then it is a fact that the general result of the damaged countryside will no longer be able to take in more water nor even retain it.

CONCLUSIONS

As a result of the new attitude in this paper, we suppose that all new anti-flooding projects have to be focused on the harmony with the water keeping arrangements in all endangered inundation areas as well as on decreasing of potential erosion processes. Fullfilling this purpose, we suppose that the municipalities themselves would prepare proposals on the creation of concrete projects in cadastral territories, because they know their terrain conditions the best.

I would also be good, if the previous methods of rain and surface water protection in the country would continuously change and respect the following principles:

- To gather the rain and surface water in the country in situ in the most possible amount through ways of realisation space, anti-erosion arrangements, and also by way of complex systematic space arrangements of the whole water-basin ability to keep water during the whole year.
- From the surface water flows, we should leave out from the territory only the natural rests of waters in each of these areas.

In these mentioned logical steps it is the principle of anti-flooding prevention and continuously the particular principle of climatic changeelimination and the water balance in such protected territories may have bigger chance to stabilize, or even to get better.

The participants of relevant municipalities characterize these possible factors and impacts on the country (interviews with participants, 2012, 2013):

- Financial, systematic- organisational factors and human factors. For example: damages, financial outcomes on all rescue actions which are necessary during the flooding time are very big and seem to be always bigger. This causes existential problems with the municipality budgets and thus their ability to act in time.

- Educational factor, propagation and information. For example: information about potential floodingin time is insufficient. The same goes for the ability to prepare for this event in time. The difference in approach in each region and the non-homogenous attitude in affected regions cause problems in their cooperation and coordination of all protection activities.
- Realisation factors and concrete rescue actions in the terrain – the reaction itself.For example: the access of rescue teams themselves is very complicated as a result of flooded roads (they often have to use only terrain routes through the forests etc.) and then also the operational factor of these teams is hindered.

The added value of our paper could be in the frame of § 6 and § 7- 8, art. 4 and 5,of the Act. No. 7/2010 Coll.on the Floods protection in the last years (Map 3), the proposal of flood hazard (or risk) map area. After the creation of the exact map basic documentation and its continuous actualisation and completion, they could be a good part of the document Plan of flood management hazard, i.e. for purposes of preventative evaluation of these risks in these types of Slovak ruralendangered territories, such e.g.aswe the village of Chľabapresent in this paper.

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