

# Aspects regarding the evolution of slope processes in the Izvoru Alb – Bicz territory (Neamț County) during 2005 – 2014

Costică BRÂNDUȘ<sup>1</sup>, Claudiu GAMAN<sup>2</sup>

**Abstract:** Izvoru Alb brook enters Izvoru Muntelui – Bicz reservoir on its right side, approximately 10 km from the dam. Its hydrographic basin is affected on both its sides by slope processes in different evolution stages. Dominant in terms of affected area are processes in a relative stable state, yet reactivations on local areas are quite frequent. During August 2005 a large landslide occurred in the lower part of the valley, on the right, partially affecting Izvoru Alb village. A debris flow of large dimensions has blocked the brook floodplain and caused the formation of a lake with a surface of 2.5 ha and depths of 2-3 up to 8 meters. Numerous households, terrains, electric power lines and roads have been flooded and destroyed. The research conducted in 2013 had as purpose establishing the later evolution of slope processes, the way in which the lake evolved, the environmental consequences as well as those social and natural inflicted upon the rural settlement. It was concluded that slope processes are in a relative stable state, but with a high potential of reactivation. The water from the lake has been almost completely evacuated following works of deepening the brook (only small ponds have remained). The affected households have been abandoned, the number of inhabitants in the village decreasing. Due to a lack of reparatory measures and financial support, the village can soon lose the character of permanent settlement.

**Keywords:** natural dam lake, effects on settlements, present state of landslides

## 1. Introduction and local characteristics

The study area coincides mostly with the territory of Izvoru Alb village, situated in the lower sector of Izvoru Alb valley, brook which flows into the Izvoru Muntelui – Bicz reservoir 10 km upstream the dam. Before the construction of the large dam reservoir in 1960, the village was situated almost completely in the area where the brook flew into Bistrița River. That area is now situated under the lake surface, the inhabitants being forced to relocate in the current position (Fig. 1).

Slope processes on the two sides of Izvoru Alb brook have been mentioned by locals from the beginning of the 20<sup>th</sup> century, described as a large landslide occurred in 1914 accompanied by the formation of a small temporary lake. Landslides have been later mentioned by Băncilă (1958) and studied by Donisă (1968) and Surdeanu (1975). More recently they have been studied by Brânduș et al. (2006) as a consequence of the reactivation of the landslides on the right slope of the brook and the formation of a natural dam lake in the village area. In fact the local reactivation of slope processes on both sides of the brook at different time spans and with different intensities is specific for the entire

Izvoru Alb basin. This is due to some extremely favorable natural (petrographic, morphometric, climatic) and anthropic factors (mainly the presence of the Izvoru Muntelui – Bicz reservoir).



Fig. 1 Geographic location of the study area

Among the natural favorable factors, mentioned also by Brânduș et al. (2006), we consider the lithological, morphometric and climatic ones as being the most important. The lithology is represented by a shale-clay-sandstone facies belonging to the Albian-Vraconian curbicortical

flysch (Izvoru Alb brook reaches in the spring area the base of the Ceahlău conglomerates). Considering the influence of morphometry, important are the relative relief, with mean values of 300 m on the territory of the village, and the high slope angle, with mean values of 7-15% and 15-

30% (Fig. 2). The mean annual rainfall exceeds 900 mm in the rainy years, while absolute maximum rainfall quantities can reach in the warm period of the year values that can sum up to 100-150 mm in 3-4 days (Fig. 3).

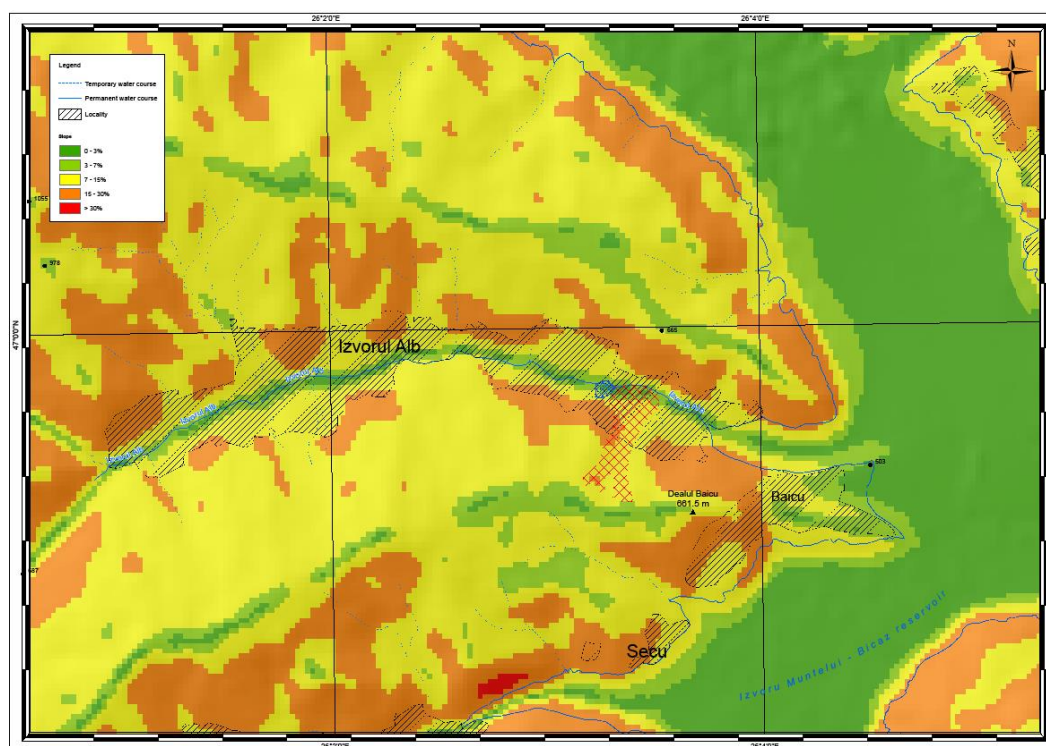


Fig. 2 Slope angle map

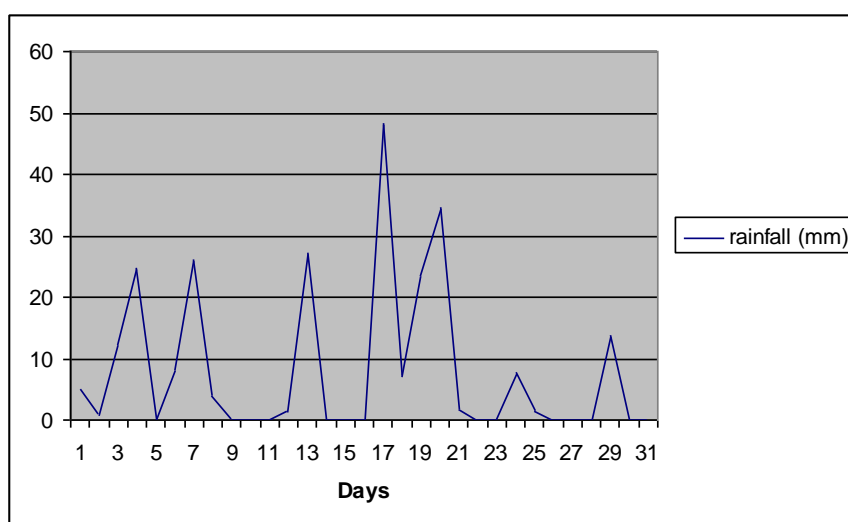


Fig. 3 Rainfall quantities recorded during August 1<sup>st</sup> -31<sup>st</sup> at Izvoru Alb

The anthropic favorable factors have become more varied and have intensified starting with the works at the Izvoru Muntelui - Bicăz reservoir in the 1950s and especially after the lake filling up to the maximum level from 1960. Among these factors the most important ones are the construction of new

roads on the slopes, without corresponding measures for preventing and mitigating slope processes, the intensification of deforestation in the Izvoru Alb basin, the diversification and intensification of irrational land use following the relocation of inhabitants and the extension of the

village territory upstream, the occurrence on slopes of buildings and insufficiently consolidated embankments etc. Also worth mentioning are the hydrotechnical works (valley steps, small dams etc.) executed in the lower sector of Izvoru Alb floodplain, with the purpose of stabilizing the thalweg and reducing solid discharge. These works have determined in the first decades a stabilization of the slope processes, but later, because of their degradation and getting out of use, they have caused the rapid deepening of the river thalweg and the occurrence of bank erosion processes that have led to landslide reactivations.

## 2. Materials and methods

Reinitiating the researches in the Izvoru Alb basin in 2013 had as main purpose the analysis of the way in which slope processes have evolved after their sudden reactivation of high intensity from 2005, as well as of the most important negative consequences.

Among the main geomorphologic processes that have taken place during 2005 and 2006, on August 16<sup>th</sup>-22<sup>nd</sup> 2005 have been registered abundant rainfall, when in the Izvoru Alb brook has been recorded a summed quantity of 125 mm. This led to a deepening of the brook's channel, followed by bank erosion on the right side with a level difference of 1 – 3 – 5 m (in different sectors of the floodplain). In the night of August 22<sup>nd</sup> at 2-3 PM (according to the information given by local people), a debris flow of large dimensions (length of 350-500 m, width of 100–150 m and a thickness of the landslide mass of 3–5–8 m) detached from a scarp situated in the upper third of the slope and suddenly collapsed, reaching with its forehead the brook floodplain. Blocking the floodplain, it determined the formation of a lake (in a period of 72 hours according to the locals), with an estimated surface of 2.5 ha, a mean depth of 2–3 m and maximum of 8 meters, and flooded households, agricultural terrains and roads (Fig. 4). According to the information from the inhabitants, in 2006 have taken place landslide reactivations locally, on small areas, as well as some material losses.



Fig. 4. The landslide that formed the natural lake in Izvoru Alb, August 2005

## 3. Results and Conclusions

Based on the detailed analysis, since May 2013, of the evolution of slope processes on the right side of the valley and of the effects on the micro-landforms especially in the inhabited sector of the Izvoru Alb village, of the changes in the brook's floodplain and of the evolution of the lake formed in 2005, as well as of the negative social and economical effects generated by the respective phenomenon, the following conclusions have been drawn:

- Regarding the slope geomorphological processes, a relative stability of the main debris has

been noted mass, which blocked the floodplain in 2005 causing the formation of the lake. By repeated measurements of some landmarks it was concluded that on the overall the main debris mass does not register movements. Yet, on areas of different dimensions situated in its vicinity have occurred new small depressions with temporary humidity excess and even ponds (hygrophilous and swamp vegetation), as well as micro-landforms such as furrows, small secondary scarps, cracks and bumps which are proof of small local horizontal and vertical movements (Figs. 5 a and b);





Fig. 5a. Hygrophilous vegetation on the right bank of Izvoru Alb brook, August 2013



Fig. 5b. Secondary scarps in the debris mass, August 2013

- The scarp area of the main debris mass is in a relative stable state, with new vegetation growing. The entire surface of the slope presents micro-landforms such as lenses and furrows, landslide mounds, cracks and small scarps, which demonstrate a real potential for slope processes reactivation in the debris mass, including a possible landslide similar to that of August 2005 (Fig. 6);

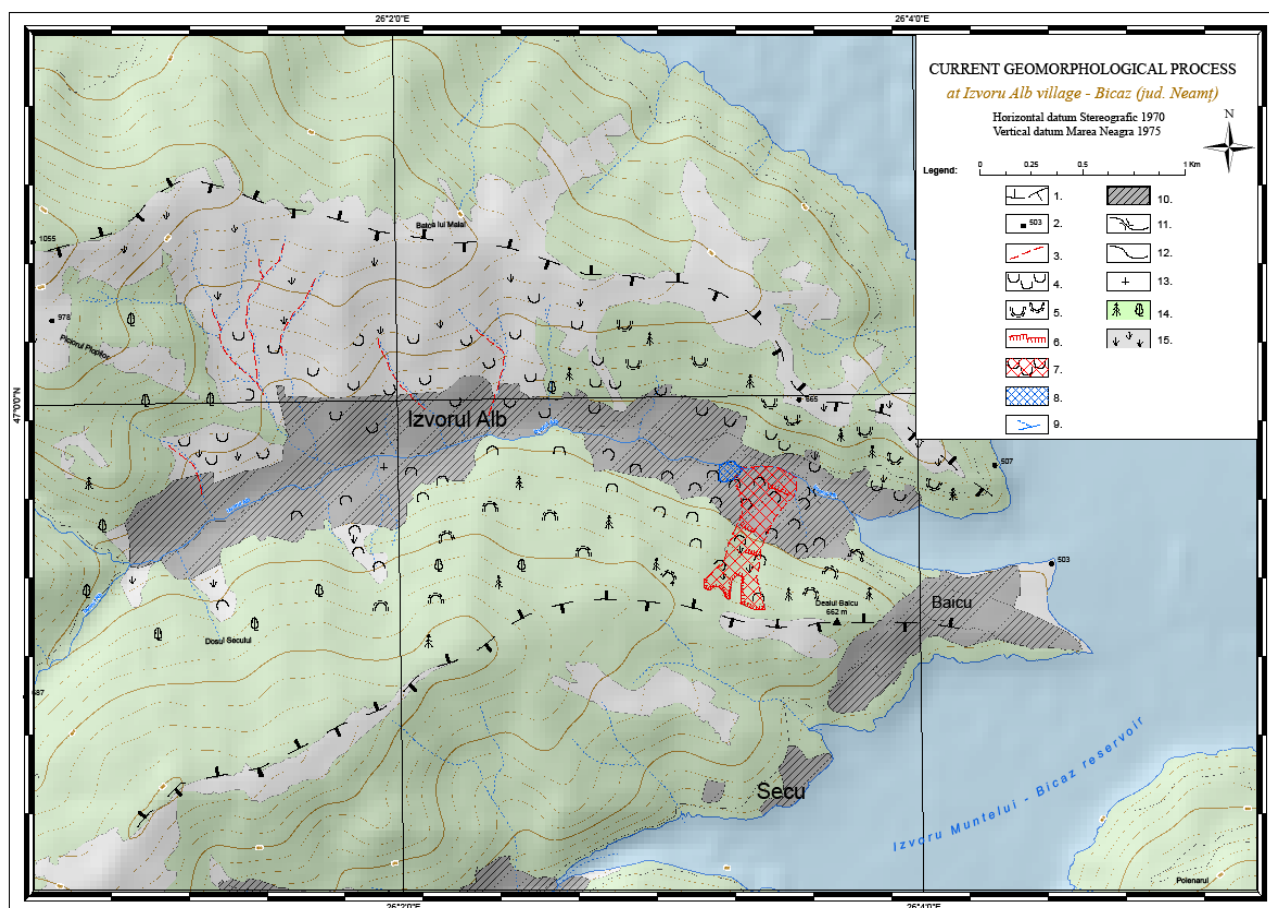


Fig. 6. Map of present geomorphological processes

Legend: 1 – interstream area, 2 – altitude mark, reactivated linear erosion, 3 – relatively stable landslides with periodic areal reactivations, 4 – relatively stable landslides evolving under forest vegetation, 5 – reactivated scarps, 6 – debris mass that blocked the floodplain of Izvoru Alb brook, 7 – the area of the previous natural dam lake formed in 2005, 8 – permanent and periodic river network, 9 – village limit, 10 – bridges, 11 – village road, 12 – church, 13 – broad leafed / coniferous forests, 14 – pastures and hayfields.

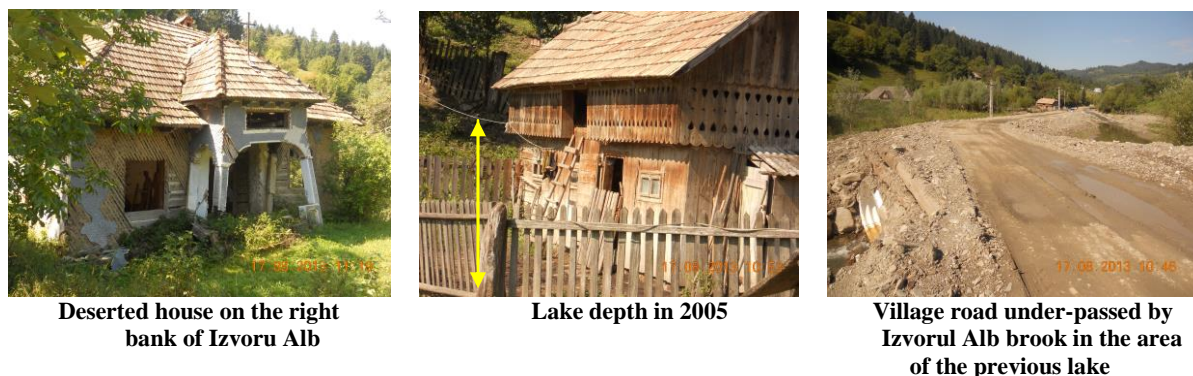


Fig. 7. Present situation of the study area / affected buildings (August 2013)

- Regarding the evolution of the lake and of its surface, we need to point out the total evacuation of the lake water (except some small ponds and areas with swamp vegetation) as a consequence of the locals digging an evacuation channel in the debris mass. The 2.5 ha previously occupied by the lake has been eliminated from any utilization. Also, most of the previous households and terrains are in the same situation (Fig. 7);

- Regarding the negative social and economical effects, it is important to mention the deserting by locals of 13 households in 2005 and another 4 in 2006, due to their flooding or damage by the landslides. Here are also included the inhabited

space, the terrains around the households used for crop growing, electrical network, fountains etc. Thus, Izvoru Alb, mentioned for the first time in 1458 in a document issued by Ștefan cel Mare as a group of houses situated at the confluence of Izvoru Alb with Bistrița, and then on the maps of Cantemir in 1717 and Bauer in 1772, is presently registered at the Bicaz mayor (of which it depends) with 129 households and an ageing population in a constant decline. According to some information from the locals, only 70 families are now permanently living in the village (Fig. 8).



Fig. 8. Inhabited households on the left bank of Izvoru Alb brook, August 2013

## REFERENCES

- BĂNCILĂ, I., (1958), *Geologia Carpaților Orientali*, Editura Științifică, București;  
 BOJOI, I., (1962), "Contribuții la studiul proceselor geomorfologice actuale din regiunea lacului de acumulare de la Bicaz", *An. Șt. Univ. „Al. I. Cuza” Iași*, (serie nouă), II, b, VIII;

- BRÂNDUȘ, C., MANOLACHE, I., CIUCANU, GH., (2006), "Endemic Landslides in the Izvoru Alb s Inhabited Area", *Rev. Geomorfologie*, nr. 8, București;
- DONISĂ, I., SURDEANU V., MIHĂILESCU FL. I., CĂRĂUȘI, I., APOPEI, V., (1979), "Modificări în sectorul mijlociu al văii Bistriței cauzate de amenajările hidrotehnice", *Lucr. Staț. „Stejarul”*, Geol. – Geogr., **VII**;
- DONISĂ, I., (1968), *Geomorfologia Văii Bistriței*, Editura Academiei, București;
- ICHIM, I., (1979), *Munții Stânișoara – Studiu geomorfologic*, Editura Academiei, București;
- MIHĂILESCU, I. FL., (2001), *Studiul climatic și microclimatic al văii râului Bistrița în sectorul montan al lacurilor de acumulare*, Edit. Ex Ponto, Constanța;
- RĂDOANE, M., (2004), *Dinamica reliefului în zona lacului Izvoru Muntelui*, Edit. Universității „Ștefan cel Mare”, Suceava;
- SURDEANU, V., (1987), *Studiul alunecărilor de teren din valea mijlocie a Bistriței (zona Munților flișului)*, Abstract of the PhD thesis, Iași;
- \* \* \*(1968), *Harta geologică a României*, Foaia Piatra Neamț, Institutul Geologic.

<sup>1</sup> Univ. „Ștefan cel Mare” Suceava,  
*Faculty of History and Geography, Department of Geography,*  
**13 Universitatii Str., 720229 Suceava, Romania.**  
brandus@atlas.usv.ro

<sup>2</sup> Univ. „Al. I. Cuza” Iași