ASPECTS REGARDING THE CAUSES DEGRADATION OF HYDROTECHNICS WORKS EXECUTED IN STREI WATERSHED

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Abstract

Torrential processes prove complex and extremely high variability, they can be synthetically characterized by a series of parameters and intra-parametrical relations, expressing different phenomena such as meteorological, hydrological or soil degradation, due to water or combination of these factors.

In order to promote a sustainable and competitive forestry, while preventing environmental degradation due to human activities, it is to be proposed, among other, a close monitoring of torrential watershed basins located in the forest area. This goal can only be achieved by spatial configuration of torrential formations, rehabilitation of existing works affected by floods or reinstatement of disused works.

Usually the effective operation of hydraulic works on a river network is to duration, lower than design time due to the occurrence of damage to their body.

Key words: hydrotechnic works, torrent correction, watershed, degradation

INTRODUCTION

Although torrential processes prove complex and extremely high variability, they can be synthetically characterized by a series of parameters and intra-parametrical relations, expressing different phenomena such as meteorological, hydrological or soil degradation, due to water or combination of these factors (Clinciu, Lazar, 1997).

In order to promote a sustainable and competitive forestry, while preventing environmental degradation due to human activities, it is to be proposed, among other, a close monitoring of torrential watershed basins located in the forest area. This goal can only be achieved by spatial configuration of torrential formations, rehabilitation of existing works affected by floods or reinstatement of disused works (Munteanu, Clinciu, 1982).

The complex functions and the role of the hydro-technical constructions, both transversal and longitudinal, are major, within the action meant to regulate the hydrological regime of floods, to install vegetation, combat erosion and protect settlements and roads flood. In the forest, these works are insufficient alongside driveways. Forest accessibility is a problem in Romania as long as 35% of the forests are considered difficult to be accessible, being found at a distance of more than 2 km from a permanent

transport route and the thickness index (6.69 m/ha) is much below the European average (30-40 m/ha) (Timofte, Timofte, 2016).

The presence of these works on the hydrographical network is felt immediately through the whole basin, from the confluence with the envoy to the lowest segment of the river bed due to the effect of river bed consolidation and leakage regulation (Mustăţea, 2005; Dîrja et al., 2002).

A known cause that contributes to early disruption of some hydrotechnic structures is necessary and appropriate, to prevent future similar situations.

MATERIAL AND METHOD

Because of the contact between the crystalline area and the sedimentary Mesozoic represented by limestone, in the upper Strei Basin one noticed the development of karst valleys, caves, sinkholes, potholes, gorges, slopes.

In the order to achieve the goal of the research, it was taken into consideration the following aspects, which also became the objectives of the research:

- hydrological study of torrential floods;
- research on the execution of works in order to both correct the torrents within the hydrographical basin of Strei, and to follow the behavior in time of works made within the torrent drainage network;
- monitoring of torrential floods effects on dams, of efficient operation of overflows and energy sinks.

Within the hydrographic basin of Strei Superior River the first works of torrents correction were performed in 1960, on Stoian Stream, at the same time with forest railroad waiver and opening of Strei forest road.

Most of torrent correction works within hydrographic basin of Strei were carried out during the 2002-2006 period. Currently, due to the dynamic of the torrential processes, the action to correct the torrents within Strei Basin continues, Rea Valley representing a model of a complex process recovery.

RESULTS AND DISCUSSION

The spatial configuration applied was one of mutual support work, most torrents being directed through a single duct which connects the local system of works and the interception area of the objective and a transversal work in the case of ravines or secondary valleys, or a system of works for the main torrential valleys.

The main works used within torrent planning in Strei basin are: sleepers, thresholds and dams with up to 5 meters height and management and water discharge channels. By typology and planning system, the following works can be named:

- sleepers, 28 out of which: 21 made at 2.0 m depth in the thalweg and 7 at 1.5 m. These represent 36% of all works.

- thresholds, 8, representing 10% out of the total number of works. 3 out of 8 are 1.5 m height and 5 are 1,0 m height.

- dams, 27, represent 35% of all works out of which: 5 are 2.0 m height, 4 – 2.5 m, 10 - 3.0 mi, 6 – 4.0 m and 2 are 5.0 m height.

- water discharge channels, 15, representing 19% out of all works, connecting the slab dam and the abutment bridge that crosses the forest road. Analysis of the number of works on height, is shown in Fig. 1.

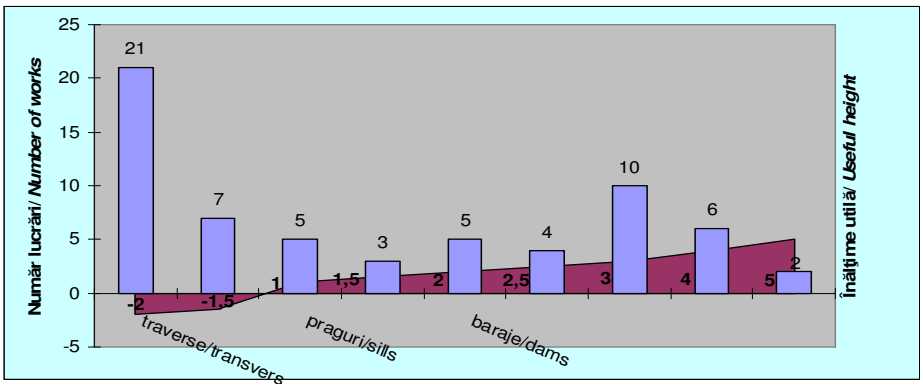

Fig. 1. Distribution of number of works according to height

The damages registered within the torrent correction works off Strei Basin, were grouped according to their nature of damage, the factor that leaded to their occurrence and the frequency in which they or parts of them were affected.

One identified and analyzed damages that affected the sustainability of the works, their safety and functionality.

According to the number of works made, most of them (24) are affected by slab clogging, the following being affected by ruptures (15).

According to the number of component parts affected, the damages are as it follows: 25 parts affected by cracks, 24 parts affected by ruptures or clogging and 22 parts affected by the lack of constructive elements.

In the case of the parts of works affected, the highest frequency was encountered in the 9.4 part (body discharged area) in 33 cases, followed by 9.10 part (slab) in 21 cases.

Situations like partial or total out of service of some torrential correction works are due to a sum of damages or to some malfunctioning

appeared during the period of time when the valleys were in the planning process. These works can no longer realize, partially or totally, the functions for which they were assigned (silt retention, bed river consolidation, water current blocking or directing etc.).

The correlation between the number of accidents occurred and the number of composing parts affected is very tight, because of the variation of hydro-engineering works number from a torrential valley to another and the fact that composing parts affected are also different in number from a valley to another.

The frequency of damages is presented in tabulated below (Table 1), indicating the number of works affected the number of constitutive parts affected, the ratio of these two parameters, and the most affected part.

Table 1

The frequency of the works damage

Type of damage	Key	Works affected NL	Number of parts of works affected NPA	NPA/NL	The most affected damages parts
Damages as affecting the durability and safety of works					
Cracks	F	12	25	2,33	9.4 – 9 cases
Breakages	R	15	24	1,60	9.4 – 10 cases
Infiltration	I	11	14	1,27	9.4 – 11 cases
Erosive damages	De	7	9	1,29	9.8 – 5 cases
Weatherings	Dz	8	13	1,62	7.4 – 5 cases
Undermining	Sr	6	7	1,16	9.20 – 4 cases
Damages that disrupts the functionality works					
Spillway obstruction	Bdv	13	13	1,0	9.8 – 13 cases
Clogging apron	Cr	24	24	1,0	9.10 – 17 cases
Unaccomplishment atterations	Nat	2	2	1,0	9.19 – 2 cases
Non accomplishment of some of the parts of works	Ne	8	22	2,75	9.14; 9.15; 9.16 7 cases each

The traverse or longitudinal hydro-engineering works used within the torrents correction action represent complementary means strictly necessary to install vegetation on the taken into consideration degradations, contributing thus to the consolidation of the hydrographic network. In order to determine the amount of the sediments stopped because of retention and consolidation, two important indicators were used, namely: direct retention and retention by consolidation.

- direct retention was ensured by transversal works with elevation height above 0.1 meters (thresholds and dams), expressed by the volume of alluvial deposits formed behind these works.

−retention by consolidation was ensured by both transversal and longitudinal works and it is expressed by the volume of sediments which could have been transported within the hydrographic network, if the correction works were not made.

Because of the repeated floods in the hydrographic basin of Strei, in most of the transversal hydro-engineering works interventions are demanded both by maintenance of the executed works as well as the execution of new works in order to retain the amount of silt resulting from torrential rains (Fig. 2).

The vegetation installed both naturally and by human activities on the alluvial deposits formed, while preserving the section of flow drainage, comes to support the completion of leakage correction systems and to restore forest ecosystems.

Fig. 2. Broken transverse, Jigorosita valley (a); Break in the body of discharged area of 15B 1,5 sill (b); Concrete weathering (c); Approns cloging (d) (foto. original)

Because of the recent period of torrential valleys planning within the hydrographic basin of Strei, and of the sustained torrential activity in the

area, forest vegetation, including pioneer species, do not find optimal conditions for installation and development.

CONCLUSIONS

Overall analysis of the obtained results, allows the selection of some important conclusions and useful recommendations for the on-site correction of torrents:

- Lack of maintenance of works have a negative influence in time on their behavior, registered damages aggravate or multiplying each torrential flood, with the possibility of their partial or total out of service and the destruction of the integrated system of which they belong to.
- Analyzing in detail each type of damage, from those affecting the operational safety and durability of works, it was noticed that cracks, ruptures and infiltrations affected especially the discharged body area, degradation by erosion affected the overflow, and the undermining of slip occurred in four situations.
- Exhaustion of silt retention capacity by transversal works, in a short period of time, is mainly due to the intensive exploitation of trees in the valley or to planning facilities to remove and bringing near the wooden material on the river course.

In order to increase the functionality duration of works and to reduce their damage, some practical recommendations were developed:

- Use only quality concrete within execution works, without using any local material (gravel and sand) in its preparation.
- Interfere the damaged works with recovery works of the constructive parts, in order to stop the degradation to which they are subjected.

Interfere with afforestation works of sediments sources, in order to reduce sediments transportation, if they are unstable or the woody vegetation cannot find proper conditions for a natural installation.

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