SOILS VULNERABILITY OF CATCHMENT ALMAŞ AT GEOMORPHOLOGIC CONTEMPORARY PROCESSES

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ABSTRACT. Soils vulnerability of the Catchment Almas geomorphologic processes. Almas Basin, signed lower lithologic Miocene soils deposits, shows six classes: Cernisols, Cambisols, Luvisols, Hydrosols, Pelisols, Protosols (after SRTS, 2003). The largest share is attributed to Luvisols class (60%), followed by undeveloped soil represented by Protosols and Antrisols (15%), followed by the remaining classes with lower weights: Cambisols (13%), Cernisols (7%), Pelisols (4%), Hydrosols (1%). Contemporary geomorphological processes (surface and deep erosion, mass movements) change agricultural areas and forest ratio or flow out of economic network tens of hectares annually. Soil vulnerability to the manifestation of these processes is expressed by disturbing soil horizons, coastal springs appearance and growth of the adjoining excess moisture, soil sealing productive by dropping or by alienation..

Key-words: *Almas catchment soils, vulnerability, geomorphological processes, land use.*

1. INTRODUCTION

Lithology, relief morphometry (hypsometric, slope, exhibition), climate, hydrography, vegetation, land use causes and influence the evolution of geomorphological processes within the study region.

Generated by a complex of factors, geomorphological processes are continuously acting, changing geographical landscape structure and functions through soil degradation processes in particular.

The main objective of our scientific approach is represented by identifying these processes, discovering the causes that generate them, their mechanism and tendency of evolution, in order to take measures to prevent and combat their negative effects.

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1.1. Study area

Almas basin is located in the northwest (Figura1), in the marginal unit of the Transylvanian Depression, making the transition between the unit platform of Plateau Someşana and the Meses Mountains orogen. Almaşului and Agrij Valleys (two valleys almost parallel) helped to finalize the morphology of Almaş-Agrij Holocene. This is the "*last western edge component of the Transylvanian Depression, well defined units by higher units on all its sides*" (Pop, 2001, p. 106).

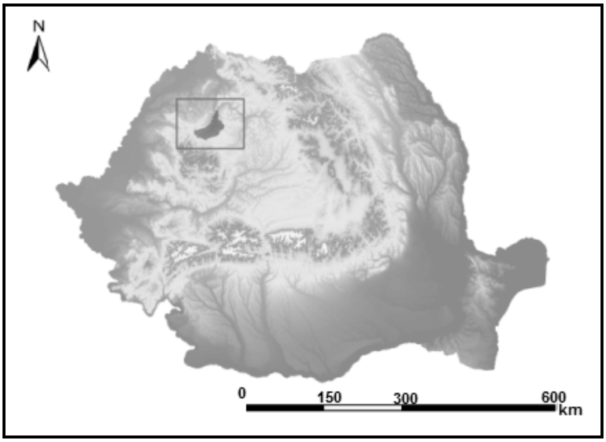

Figure 1. The geographical position of Almaş Basin

The geographical position of Almaş Basin has been greatly discussed in relation to the Repede Cris River in the geographical literature of the last century (Savu, Al., Orghidan, N., Posea, Gr.). Most issues are related to the river catchment and watersheds migration.

The western limit is marked by Almas-Agrij watershed and the east boundary is the watershed between the valleys Almaşului Valley: Nadaş, Borşa Lonea (all belonging to the basin of the Somes Mic) and Girbou (belonging to the Someş River).

Southern boundary to basin Crişului Repede River, is highlighted by a narrow interfluves attacked by an accelerated erosion from Almăşan Streams, watershed being already pierced by Sfăraş and Secăria Streams. Almaşului tributary valleys are characterized by pronounced regressive erosion, advancing visible to Huedin Depression, being sustained by a base of local lowest erosion (subsidence area in Jibou).

Confluence with the Somes River, in the northern basin, and out of depression, changes relationships between Almas River and geological and lithological structure, phase reflected in the basin width reduction at lower Miocene deposits, Aquitanian-Eggenburgian (Krézsek & Bally, 2006 Filipescu, 2011).

2. METHODOLOGY

Soil map was made through ArcGIS (ArcMap 10.1) software, 1:25 000 scales. Soil classification is in line with the nomenclature SRTS (Romanian System of Soil Taxonomy), 2003. The preparation of this study required the analysis of materials and data from the Land Cadastre and Qualitative Cadastre of archives OCOTA SĂLAJ and situation plans with scales between 1: 10,000 and plan scale 1: 100,000, information taken from the Institute for Land Improvement Studies and Projects, National Land Development Branch Tisza-Somes Territorial Branch Salaj. Territories inventoried have been reported with territorial administrative units with surface contained wholly within the basin (Table 2). Total area inventoried, based on the territory of municipalities, was 9 534 hectares.

3. RESULTS AND DISCUSSION

Almas Basin (814.5 km²), circumscribed to lithological Miocene deposits presents a climate variability shelter conditioned by shelter role exercised by Meses Mountains, Openness to northwest influences of North Atlantic circulation or Somes Plateau and Mountains Vladesei neighborhood. These influences are reflected in the hydrological regime of rivers, river beds and slopes morph dynamics, vegetation coverage and type of vegetation, the soil type and land usage.

Land use constitutes a premise in soil degradation, facilitating surface and in depth erosion, mass movement processes on slopes, meadows and excess moisture in narrow valleys.

Hydrographic Almas Basin with an area of 81,450 hectares, comprises six classes of soil: Cernisols, Cambisols, Luvisols, Hydrosols, Pelisols, Protisols (after Romanian System of Soil Taxonomy, 2003). The largest share is attributed to Luvisols class, followed by undeveloped soils, represented by Protisols and Antrisols, followed by the remaining classes with lower weights: Cambisols, Cernisols, Pelisols, Hydrosols (Table 1).

Table 1. Characteristics of soil classes Hydrographic Almaş Basin

Class of soil	Area		Properties		
	ha	%	Humus content (%)	pH	Texture
Cernisols	5900	7	(4-6)	5,5-7,5	Lito clay,clay
Cambisols	10700	13	3	5,5-7,7	clayish
Luvisols	48600	60	2,0-4,0	5,0-7,0	Vary
Pelisols	3400	4	2,0-4,0	5,0-6,0	Lito clay,clay
Hydrosols	500	1	4,0-5,0	5,7-6,8	Vary
Undeveloped soils (Protisols and Antrisols)	12400	15	3	1,5-2,0	Vary

Luvisols are most widespread in the basin (60 %, 48 600 hectares), being arranged in strips almost parallel with the main tributaries of Almaş (Fig. 2).

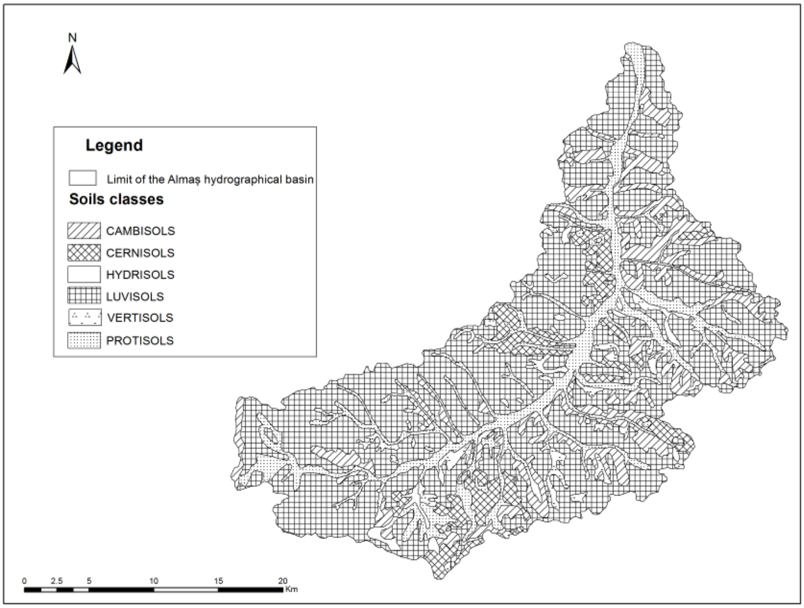

Figure 2. Soil map of the Almaş Basin

Land use in this case, includes farmland (grown of cereals), orchards, while in the Piedmont Parameseşan, forest: *Quercus, Fagus*. The channels and gullies are common in these soils and shows depths up to 0,5 m for large channels and 3-10 m for ravens, and in the case of steep ravines sometimes appear subsidence shore. Isolated, one can find wooden ravens. To ensure the stability of banks ravines recommended grading manipulation, seeding with herbs, protective plantations, and ravines slope correction recommended silt fences, sills and dams.

Areas with marl and marl- clay deposits located near the surface, determine infiltration of storm water to the level of these deposits, feeding aquifers and increased plasticity clay-marl and clay packages, favoring superficial deposits mass movement. Predominate recent landslides, active, generally superficial (< 2 m). Landslides usually occur on very strong and excessively eroded soils, particularly in estate and hearth localities: Cutiş, Tăud, Mesteacănu, and the valleys Ursului, Râtului, Voina. Recommendations: capture coastal sources fencing areas with active landslides and their use as hay until stable.

Undeveloped and cropped soils occupy an area of 12 400 hectares (15 % from the surface of the basin), include in the region protisols (litho, regosols, alluvial protisols) and antrisols (erodisols). Alluvial soils are present in floodplain areas, both Almaş and its tributaries. Land use is shown, in particular, arable lands and sometimes on pastures and hayfields. The position of these soils, in the floodplain areas makes them vulnerable to flooding and excess moisture. Alluvial protisols occur frequently along alluvial soils. This class includes highly eroded soils, requiring combat erosion works and at the same time, prevention actions.

Third class of soil is the share of cambisoils (13 %, 10 700 hectare2) and occupies raised areas of Piedmont Paramesesan and Almaș-Agrij interfluve. In terms of use are covered by forests, meadows and pastures.

Lower weights have cernisols (7 %, 5 900 hectares) under forest (*Quercus, Fagus*) , steppe grasslands with *Agrotis* and *Poa*, fruit trees, grape-vine, pelisols (4 %, 3 400 hectares) and Hydrisols (1 %, 500 hectars).

Hydrisols are present in rarely flood plains and sloping hillsides and the works are recommended to combat excess moisture.

Analysis of land use in the catchment Almas revealed the existence of 11 different land uses. According to the database CORINE Land Cover 2006, agricultural land holds 44 970 hectares (54 %) from the basin area, forest fund holds 32 200 hectares (40 %), and other land uses occupy 4 280 hectares (6 %) (fig. 3).

The importance of analyzing the use of land in this study assumes that, improper use of land may create a vulnerability to soil to ***contemporary geomorphologic processes***.

Large area occupied by agricultural land (Figura 4) require more attention on the relationship soil-use categories, from several points of view: edaphic coating protection, ability of land to be as desire, and the sustainable and effective development..

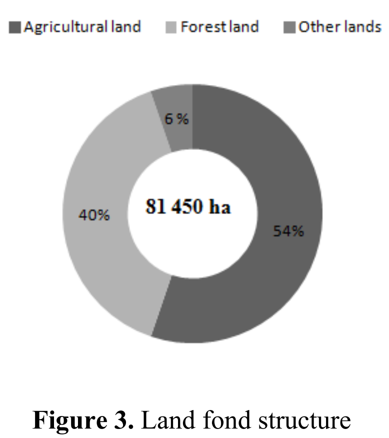

Figure 3. Land fond structure

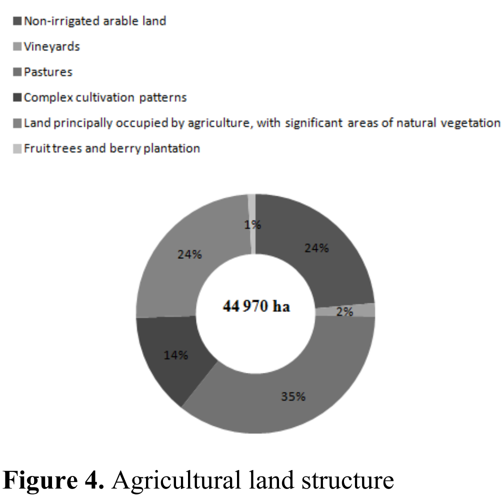

Figure 4. Agricultural land structure

Landslides in the Almaş Basin are common opposite slopes cuestas. These slopes generally have elevated slopes and Nord exposure favors the development of landslides, compared with the slopes exposed to the south and west that are affected by the erosion of rain. The most typical landslides occur at Racâș, Bălan, Sâmpetru Almașului, Sântă Mărie. Smaller proportions landslides occur in Gâlgău, Valea Dragului, Valea Ugruțiului, Valea Sâncraiu Almașului, Valea Petrinzel, Pârâul Peșterii, etc.

Reported to the inventoried area were identified the main forms of soil degradation and weights of the area occupied by them taken into consideration (Figure 5).

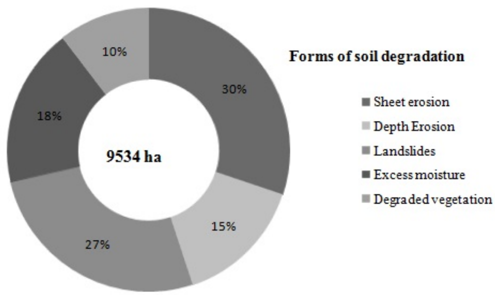

Figure 5. Weight forms of soil degradation in Almaşului Basin

The analysis revealed the following: most of the investigated area is affected by surface erosion (30 %, 2870 hectares). The identified surface erosion forms were as follows: trickles itself, inconsiderable ditches about 0-3 cm and small ditches about 3-20 cm. The effect of surface erosion has manifested by removing the upper horizon of soil and appearance to day of the bedrock . These effects can be observed, especially at the top level of deforested slopes. The most affected area by surface erosion was identified in Hida (815 hectare), followed by Fildu de Jos (767 hectares) and the less affected area in Zimbor (13 hectares).

Morphometric, geological, climatic peculiarities, the land usage favors the action of landslides, resulting also from the large area (27%, 2524 hectares) where they occur. Most landslides, lenticular and superficial kind were identified within the following villages: Cuzăplac (645 hectares), Dragu(436 hectare), Hida (403 hectares).

Depth erosion affects an area of 1413 hectares (15% of the area taken into consideration). The identified depth erosion forms were large trickles, large ditches and cloughes, which are prodominante. The ditches and the cloughes are generally active , with depths up to 0.5 m high for large ditches and 3 to 10 m for cloughes, where in the case of cloughes with steep margins, appear margin drifts. Isolated, the are also wooded cloughes. Hida comes into the first place as affected area (493 hectares), followed by Bălan (250 hectares) and Cuzăplac (179 hectares).

Establishing strategies to combat soil erosion required statistical inventory of degraded lands, mainly those affected by surface erosion (strong and excessive), deep erosion, active landslides, semi stabilized (with major potential for reactivation) and lands with permanent excess moisture (due to natural and anthropogenic factors), requiring ecological reconstruction. We conducted an evaluation marks degradation types and subtypes on three classes of evaluation, with a minimum score of 5 and a maximum of 60 (Table 2).

Table 2. Soil degradation processes of evaluation classes*

The village's territory	Inv. area	Surface erosion			Depth Erosion			Landslides			Excess moisture		Deg Veg.
		I	II	III	I	II	III	I	II	III	I	II	III
Almaş	8	-	-	4	-	-	-	-	-	-	-	-	-
Bălan	1612	329	110	3	187	60	3	235	84	13	128	109	350
Cuzăplac	1561	191	60		137	42		536	109		405	51	-
Dragu	928	218	-	-	97	16	--	310	113	13	161	-	-
Fildu de Jos	1564	255	397	115	40	89		115	95		18	98	342
Hida	2763	570	160	85	348	54	91	340	55	8	490	173	265
Sânmihaiu	604	78	45		115,5	26		172	37		103	-	7
Zimbor	293		13	-	46	28		98	87	-	-	-	15

**(Source: National Land Development Branch Tisza-Somes Territorial Branch Salaj).*

In the case of surface erosion, land quality index was performed as follows: First class, with a score of 30 (erosion affecting different objectives and damages downstream) , second class score 20 (affects agricultural land and causes damage downstream but does not affect objectives), third class, score 10 (affects only agricultural land without causing damage does not affect downstream objectives) . In the case of depth erosion, first class, has a score of 60 (causes damages and affects social and economic objectives (accumulations, communication means), second class score 50 (harm but does not affect socio- economic objectives), second class, score 4 (slope). For landslides, first class score 50 (assets that have a high degree of risk which affect the economic and social objectives that have a great potential of development and accumulation), second class score 40 (medium development risk which affect agricultural land but produce downstream damages), third class , score 30 (active and semistabilizate which affect agricultural land and not cause damage downstream).

5. CONCLUSIONS

The presence of litho logic formations consisting of poorly permeable or porous rocks, represented the most by clay-marl complex with intercalations of sand and gravel, which encloses aquifers, which, sectioned by hydrographic network, determine the vulnerability of soils to surface and depth erosion and gravitational processes, particular, landslides.

Soil vulnerability at geomorphological processes is also enhanced by applying inappropriate agrotechnics, using of inappropriate measures, making plowing from the hill in the valley, irrational overgrazing, irrational forest clearing, associated with the relief, and in areas with clay-marl and clay deposits located close surface, infiltration of storm water bring the level of these deposits to aquifer layers formation and increased plasticity clay-marl and clay packages, favoring sliding surface deposits.

The vulnerability of soils in the catchment Almaş derive from their properties and the manner of their interaction with the rest of anthropogenic soil and weather factors, the soil being always exposed to erosion.

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