FACTORS AND DEGRADATION PROCESSES OF SOILS IN THE MIDDLE BASIN OF THE BEGA RIVER

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***Abstract**: Fertility, one of the fundamental characteristics of a soil, has developed over time along with the soils formation and evolution. A number of factors act upon the fertility, limiting and/or degradation processes represented by some soil characteristics and/or environmental factors that lead to its diminishment thus reducing the production capacity of such lands. Conservation of soil fertility implies identifying the limiting factors and the degradation processes, determining their degree of intensity and land area affected. Identification of soil units in the middle basin of the river Bega was based on existing data and Agrochemical Soil Survey Office. Because soil studies are developed by administrative territories, for the purpose of obtaining an overall situation of the middle basin of the river Bega, all types of soil surfaces, within their respective territories, were summarized. Limiting factors and degradation processes, specific to each soil unit, were later determined for the entire region, an area of 49522.37 ha. Very different physical and geographical conditions of the area studied, determined the formation of a complex range of soils, belonging to 6 classes and 13 types of soils. Bega River Middle Basin overlaps the hills area, typical of this area are luvisols (59.43%), hidrisols (10.22%), protisols (8.32%), on other not so extended areas there are cambisols, antrisols and pelisols. On the soils mentioned are acting one or more limiting factors of agricultural production: small reserves of humus, soil reaction, compactness, reduced edaphic useful volume, soil hardness, slope, surface and deep erosion, landslides, land covering (with rocks and boulders) and terrain (land) uniformity, excessive surface humidity and excessive phreatic humidity, each affecting differently the varying soil units. This paper presents the areas affected by each limiting factor relative to the total agricultural area, mentioning that a unit of soil is generally affected by the simultaneous action of several limiting factors and/or degradation processes.*

***Key words:** environment, fertility, limitations, productivity, quality*

INTRODUCTION

Fertility, fundamental characteristic of soils, has developed over time along with their formation and evolution. It involves "the best physical, chemical and biological soil properties, the abundance, or at least the existence of sufficient quantities of nutrients essential to plant life and the appropriate amount of water" (IANOŞ et al, 1997).

The soil fertility must be assessed according to the type of vegetation because "soil fertility is not limited in any case to its humus content, although it is sometimes decisive, it's the land that needs to meet specific requirements of plants formed in a specific environmental framework"(BORZA, 1997)

Upon the soil fertility act a number of limiting factors and/or degradation processes represented by some soil characteristics and/or environmental factors that lead to its decrease, thus reducing the production capacity of land under their influence.

Conservation of soil fertility imposes to identify limiting factors and degradation processes, determining their degree of intensity and land area affected. This analysis provides an overall picture of soil degradation processes, but also provide the necessary details to intervene then, through measures to prevent or improve.

MATERIAL AND METHODS

The study refers to the middle basin of the River Bega. Data on the soils of this area, were taken from soil studies developed over the years by OSPA Timisoara, soil classification was made according to SRCS 1980, therefore it was necessary to correlate with SRTS 2003. Also, soil studies were made by administrative territories (communal),and in order to obtain the area occupied by each soil type in the investigated region, it was necessary to summarize the soil surface units existing in the same administrative /communal territory. Degradation processes and limiting factors were determined separately for each unit of land, but to have an overview, they totaled all ground units affected by the action of each factor in the municipal territory and then in the region investigated.

RESULTS AND DISCUSSION

Very different physical and geographical conditions of the area studied, determined the formation of a complex range of soils, belonging to 6 classes and 13 types of soils (table 1)

Table1

Classes and types of soils in the middle basin of the Bega River

Class	Type of soil	ha	%
Luvisols	Preluvosol	2886,66	5,82
	Luvosol	26328,00	53,16
	Planosol	217,40	0,43
		29432,07	**59,43**
Cambisols	Eutricambosol	2972,33	6,00
	Districambosol	107,22	0,21
		3079,55	**6,21**
Hidrisols	Gleiosol	4222,02	8,52
	Stagnosol	843,97	1,70
		5065,99	**10,22**
Pelisols	Vertosol	**1091,85**	**2,21**
Antrisols	Erodosol	**2366,29**	**4,78**
Protisols	Litosol	205,14	0,41
	Regosol	797,74	1,61
	Aluviosol	2989,71	6,03
	Entiantrosol	127,64	0,25
		4120,23	**8,32**
Soil paths, ponds, ravines		**344,32**	**0,70**
Soils associations		**4016,70**	**8,11**
	TOTAL	**49522,37**	**100**

The studied region overlaps, mainly, to the hills area (altitude 150-400 m), therefore, the largest percentage of soils are luvisols (59.43%). In the plains and meadows were identified hidrisols (10.22%), and the more restricted areas, cambisols (6.21%) and pelisols (2.21%) The higher areas or major river beds protisols (8.32%) are present, by a relatively smaller percentage. On smaller areas have been identified antrisols, soil associations and soil paths, ponds and ravines (table 1). Upon these soils act one or more limiting factors and/or degradation processes, which lead to lower production capacity. Next we will present the limiting factors, how intensely they manifest and the affected areas, on the researched area.

Acidic soil reaction is limiting the 64.40% of the total area, moderate limitations (pH 5.1 to 5.4) having the highest rate (table 2) Thus, crops who are susceptible to acidic soil reactions are restricted here: alfalfa, sugar beet, barley, etc.

The low humus content is manifested on 90.24% of the investigated area. Soils with humus reserve between 61 to 120 t/ha (63.90%) are predominant, with moderate limitations (table 2). Highly severe and severe limitations occur on about 10% of the surface, due to the

presence of protisols, antrisols or associations in which they predominate. Demanding for the content of humus, are: vegetables, beet, potato, sunflower, alfalfa, clover, corn, etc., so this factor conditions the richness of their crop (BORZA, 1997).

Table 2

Limitations due to physical and chemical characteristics of soils

Limiting factor		Surface	
		ha	%
Acidity	Strong acidity (pH ≤ 5)	1676,93	3,38
	Moderate acidity(pH 5,1 – 5,4)	15374,25	31,04
	Reduced limitations (pH 5,5 – 5,8)	14839,64	29,96
	Total	**31890,18**	**64,40**
Humus reserve	Extremely low reserve of humus (≤ 30 t/ha)	187,3	0,37
	Very low reserve of humus (31-60 t/ha)	4887,38	9,86
	Moderate reserve of humus (61-120 t/ha)	31647,00	63,90
	Low reserve of humus (121-160 t/ha)	7968,66	16,09
	Total	**44690,34**	**90,24**
Fine texture	Moderate limitations (clay texture)	1921,68	3,88
	Low limitations (clay loam texture)	7740,34	15,63
	Total	**9662,00**	**19,51**
Compactness	Moderate limitations (soils strongly compacted)	10087,78	20,37
	Reduced limitations (soils moderatly compacted)	11677,35	23,58
	Total	**21765,13**	**43,95**
Edaphic low volume	Very severe limitations (extremely low)	229,79	0,46
	Severe limitations (very low)	198,42	0,40
	Moderate limitations (small)	510,72	1,03
	Low limitations (middle)	853,86	1,72
	Total	**1793,24**	**3,62**
Land carrying capacity	Very severe limitations	2222,93	4,50
	Moderate bearing land	7431,37	15,00
	Total	**9653,95**	**19,50**

The fine texture is a limiting factor on is 19.51% of the area analyzed, moderate limitations having a low share due to the small percentage of clay textured soils (Table 2), reduced limitations affect 15.63% of the surface, clay textured soils being present on larger areas (luvisols, vertisols, eutricambosoils, etc.). Fine textured soils, although rich in humus and having a high capacity to retain nutrients, plants don't always find optimal growth and development conditions because of the antagonistic water and air regime (NITA, 2004).

Edaphic low volume acts as limiting factor on small areas, 1793.24 hectares, that 3.62% of total area (Table 2), especially in higher areas where lithosols, regosols or associations of soil, where these predominate, have formed.

Land carrying capacity acts as limiting factor on 9653.95 hectares, that 19.50% of the total surface (table 2), but a larger percentage is owned by moderate limitations (15%) due to the presence of soils with temporary unsatisfactory load bearing of classes: luvisol, cambisol, hidrisol. The starting moment and the way in which of agricultural operations are performed, can be established according with the soil load bearing

Soil compactness is the limiting factor on 43.95% of the total area, where soils are moderately and strongly compacted (table 2). Compactness has negative effects on plants because it prevents the penetration of roots to deeper layers in the soil and creates a poor aero-hydric and nutritional regime (IANOŞ et al, 1997)

Terrain slope is limiting for 47.02% of the soils analyzed (Table 3), because much of the studied area overlaps a hilly area. On slopes with greater declivity, severe and very severe limitations are manifested (18%) and on lower slope areas, moderate limitations (9.33%).

Previous research highlights the influence of slope on the production capacity: increasing slope gradient decreases in most of cultures production

Erosion at the surface of soils studied (table 3) imposes severe limitations on 22.56% of the surface area and moderate limitations on a smaller percentage (9.85%) due to: factors such as slope, climate, degree of the homogeneity of the vegetation cover, some physical properties of soil or anthropogenic action (BLAGA et al, 2005).

Table 3

Limitations due to slope, erosion and land cover

Limiting factor		**Surface**	
		ha	**%**
Slope	Extremly severe limitations (≥100%)	30,11	0,06
	Very severe limitations (25,1-100%)	4549,25	9,19
	Severe limitations (20,1-25,0%)	3881,83	7,84
	Moderate limitations (15,1-20,0%)	4621,88	9,33
	Reduced limitations (5,1-15,0%)	10204,39	20,60
	Total	**23287,00**	**47,02**
Surface erosion	Severe limitations	11172,29	22,56
	Moderate limitations	4880,92	9,85
	Reduced limitations	6766,99	13,67
	Total	**22820,20**	**46,08**
Erosion depth		**9642,60**	**19,48**
Landslides		**11171,73**	**22,56**
Land covering or terrain uneveness	Very severe limitations (extremly uneven)	4409,25	8,90
	Severe limitations (very uneven)	5819,54	11,75
	Moderate limitations (moderatly uneven)	11337,89	22,89
	Reduced (slightly uneven)	11752,83	23,73
	Total	**33318,40**	**67,27**

Depth erosion. In the investigated area, land slope, periodic large quantities of precipitation, the presence of loose rocks or discontinuity of the vegetation, causes erosion depth, a phenomenon that affects an area 9642.60 hectares, representing 19.48% of the surface under study (table 3). Land affected by in depth erosion has deep unevenness that present difficulties in the use of agricultural machinery.

Landslides. Lands most exposed to these phenomena are located on high gradient slopes with porous rocks, less cohesive, placed over layers of impermeable rock, in areas with large amounts of rain falls. Due to the above conditions, the middle basin of the river Bega there are affected 11,171.53 hectares (22.56%), situation shown in table 3.

Land covering or terrain unevenness, ie bumps, rocks and/or boulders creates difficulties in performing mechanical work and contribute to a reduction of agricultural exploitation of such lands. This factor manifests on large areas (Table 3), respectively 67.27% of the total surface. The terrains extremely and very uneven sum up to an approximately 20% of the total, while the moderately uneven are about 22.89% of the total.

Excessive surface humidity is favored by environmental conditions in the studied area, this factor manifests relatively large area, 45.27% of the total, mostly are moderate and reduced limitations (table 4).

Excessive phreatic humidity manifests on 22.10% of the total area (Table 4), in the lowlands, with the groundwater near the surface. Out of this category of limitations, the highest rate belongs to reduced limitations, with the groundwater at a depth of 2,1 to 3,0 m and moderate limitations, with groundwater at a depth of 1,1 to 2,0 m.

Table 4

Limitations due to excessive humidity

Factorul limitativ		Suprafața	
		ha	%
Excessive surface humidity	Very severe limitations (extremely powerful)	934,75	1,88
	Severe limitations (very powerful)	2825,67	5,70
	Moderate limitations (powerful)	7893,44	15,93
	Reduced limitations (moderate)	10817,70	21,84
	Total	**22471,56**	**45,37**
Excessive phreatic humidity	Very severe limitations (≤0,5 m)	242,36	0,49
	Severe limitations (0,51-1,0 m)	1203,77	2,43
	Moderate limitations (1,1-2,0 m)	4121,53	8,32
	Reduced limitations (2,1-3,0 m)	5377,65	10,85
	Total	**10945,30**	**22,10**
Flooding by flood		**2140,00**	**4,32**

Inundability by overflowing affects only 4.32% of total soil (table 4), the investigated area specific measures have been taken to reduce the negative effects of this phenomenon.

CONCLUSIONS

In accordance with natural conditions, pedogenesis processes led to the formation of specific soils to the hilly area (luvisols, protisols, cambisols, antrisols, hidrisols) These soils, due to their characteristics and/or due to environmental factors, are subject to degradation processes of varying degrees of intensity, resulting in reduced production capacity, the largest areas are being affected by: small reserves of humus (90.24%), land covering or terrain uneveness (67.27%), acidic soil reaction (64 , 40%), and very steep land (47.02%), erosion at the surface (46.08%), advanced compactness (43.95%), etc..

The above mentioned shows the area affected by each factor limiting compared with the total area, however most of the soils studied are affected simultaneously by several fertility limiting factors.

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