SUMMARY

of the doctoral thesis entitled:

RESEARCH ON THE EROSION PROCESSES AND ASSESSMENT OF THE ALLUVIUM SOURCES IN THE HYDROGRAPHIC BASIN OF THE TATA VALLEY (DEALU FRUMOS), A TRIBUTARY OF THE IALOMITA RIVER

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The doctoral thesis entitled "*Research on the erosion processes and assessment of the alluvium sources in the hydrographic basin of the Tata valley (Dealu Frumos), a tributary of the Ialomita river*" deals with the complex process of soil degradation, which manifested itself and continues to manifest itself through phenomena of surface erosion, gully erosion, torrential erosion as well as the importance of monitoring these phenomena with the help of Geographical Information Systems (G.I.S.) and wants to bring a scientific contribution to the research carried out in Romania, in the last period of time.

The doctoral thesis represents the results of the research carried out in the period 2018-2022, the main topic of the doctoral thesis being represented by the own research carried out on the agricultural lands degraded by surface and deep erosion phenomena located in the hydrographic basin of Tata valley (Dealu Frumos).

The research activity was carried out in accordance with the proposed objective, starting with a rigorous documentation and inventory of the basic scientific data existing in the specialized literature, with strict reference to agricultural lands degraded by surface erosion, gully erosion, both globally and nationally.

The doctoral thesis is structured into 2 distinct parts, on 6 chapters, as follows: **Section I**, titled *Bibliographic Study*, which contains 2 chapters, respectively **Section II**, titled *Personal Research*, which includes 4 chapters.

The first two chapters of ***Section I*** of the doctoral thesis are intended to present the current state of research on the degradation processes of agricultural land subject to soil erosion phenomena, as well as the presentation of the natural framework of the

Tata Valley hydrographic basin (Dealu Frumos), in which the actual research activity was carried out.

Chapter I – *THE CURRENT STATE OF RESEARCH ON SHEET AND GULLY EROSION PHENOMENA ON GLOBAL AND NATIONAL LEVEL* – we made a short incursion into research related to the phenomenon of soil erosion both at international and national level, we highlighted the results of research in the field, presented in the volumes of scientific conferences and symposia, in specialized books by nationally and internationally recognized authors, in scientific articles and reference doctoral theses, considering the worldwide increasingly higher interest in the field of erosion and conservation in the context of an effective sustainable development on a planetary scale, the topic of soil degradation by water erosion being considered as a strictly topical one.

Chapter II – *DESCRIPTION OF THE NATURAL FRAMEWORK OF THE TATA VALLEY HYDROGRAPHIC BASIN (DEALU FRUMOS)* – where we made a detailed presentation of the natural framework in which we carried out the research activity to highlight the phenomena of agricultural land degradation through surface and gully erosion phenomena, as well as the erosion of the stream banks and talweg of the Tata stream.

We compiled the database necessary to carry out the research work: climatic data, pedological data, geological data, geomorphological data, hydrological data and data on natural vegetation, as well as the use of land and built space.

Section II of the thesis is intended for own research carried out within the study area in the period 2018-2022, regarding soil erosion processes, manifested in the Tata valley hydrographic basin (Dealu Frumos).

Chapter III – *EXPERIMENTAL STUDY ON THE COMPLEX PROCESSES OF SOIL EROSION IN H.B. OF TATA VALLEY (DEALU FRUMOS)* – represents the reference chapter of the doctoral thesis through which I adopted the experimental scientific research method based on an experimental model (runoff plots), located in the middle area of the Tata valley hydrographic basin.

In this chapter, in the first stage of research, all existing land management works in the watershed of Tata valley (Dealu Frumos) are identified and inventoried.

In the second stage of the research, the phases of the actual experimental research are presented, which were carried out during the study period 2018-2022, with the help of runoff plots for the soil erosion control, runoff that were located on the right slope of the Tata valley hydrographic basin (Dealu Frumos).

The experimental plots were set up according to the model of the existing runoff plots at the Soil Erosion Research Station in Aldeni, Buzau county, but on a much smaller scale. Within the experimental area, we set up 4 plots for the control of surface runoff and soil erosion with different land use, provided downstream with containers for the collection of runoff (water + eroded soil).

The dynamics of the erosion processes manifested in the period 2018-2022, as well as the amounts of soil loss on the 4 runoff plots were permanently monitorized, depending on the amount and intensity of precipitation fallen in the hydrographic basin of Tata valley (Dealu Frumos).

After each rainfall that exceeded the value of 12,7 l/m^2, the existing samples were collected in the receptacles of the 4 runoff plots, in order to quantify the amount of eroded material.

The determination of the amount of eroded material at the level of the hydrographic basin of Tata valley (Dealu Frumos) was made taking into account the land use categories located on the 4 runoff plots.

Therefore, the results obtained for the total amount of soil loss in the period 2018-2022, which occurred through surface erosion for plot no. 1 „hayland", was 0,164 t/ha.year.

For plot no. 2, the land use category "pasture", the results obtained for the total amount of soil loss for the period 2018-2022, was 0,152 t/ha.year.

The total amount of soil loss, which occurred through surface erosion for the period 2018-2022, for plot no. 3 „hayland (clover)" had a value of 0,175 t/ha.year.

The highest value in terms of the total amount of soil loss, for the period 2018-2022, was recorded on plot no. 4 „bare soil", respectively 0,296 t/ha.year.

The lower values of the amounts of soil loss through surface erosion at the level of the experimental plots for the years 2020 and 2021, compared to the years 2018, 2019 and 2022, were mainly due to the reduced rainfall regime, otherwise the recorded amounts would have been much higher due to the increasing of the erosion phenomenon, especially on plot no. 4 (bare soil).

In order to quantify the nutrients that were lost on the experimental plots, agrochemical samples were taken throughout the research period, which were analyzed and interpreted in the laboratory stage and consisted in performing the following chemical analyses: soil pH, humus or organic matter content (%), nitrogen content (nitrogen index - I.N.-%), total $CaCO_3$ content (%), degree of saturation in bases (V %), mobile phosphorus content (ppm) and mobile potassium content (ppm).

The results obtained from the analyses carried out on the experimental plots during the 5 years were satisfactory and it was found, for example, that the plots no. 1 (hayland), no. 2 (pasture) and no. 3 (hayland-clover) on which either legumes or grasses predominate, losses of nutrients (humus, nitrogen, phosphorus, potassium) were much lower compared to the plot no. 4 (bare soil) where, in the absence of the vegetation cover, there were significant decreases in the supply of humus in particular but also nitrogen.

Chapter IV – *THE USE OF GEOGRAPHIC INFORMATION SYSTEMS FOR THE ASSESSMENT OF SHEET AND GULLY EROSION IN THE H.B. OF VALEA TATA (DEALU FRUMOS)* – we presented the databases necessary for the research through numerical modeling, but especially the calculation stages in order to quantify the erosion rate and

the maximum flow from Tata Valley hydrographic basin (Dealu Frumos) using the IntErO semi-quantitative model.

The use of the IntErO model in small hydrographic basins, such as the surface area as well as Tata valley hydrographic basin, has been successfully demonstrated in other small hydrographic basins, the mathematical model being an innovative model, which has been successfully applied in many European countries.

From the analysis of the thematic maps that show the use categories of agricultural land, in the time period 2018-2022, a change was found in the use categories of agricultural land as well as an extension of the soil erosion phenomena manifested on the surfaces of agricultural land, which led me to apply the IntErO semi-quantitative model with different input parameters (2018/2022) to perform a comparative analysis of the degree of erosion according to the maximum flow rate, for the period 2018-2022.

Thus, the results obtained in terms of the amount of soil eroded from the agricultural land surfaces located in the Tata valley (Dealu Frumos) hydrographic basin - (Wgod) calculated for the year 2018 was 5601,3797 $m^3/year^{-1}$ while the coefficient of retention (R_u) had the value of 0,238, which means that a percentage of 23,8% of the total eroded material reaches the emissary, the remaining 76,2% being deposited on the slopes and in the hydrographic network of the hydrographic basin.

For the year 2022, the amount of soil eroded from the agricultural land surfaces located in the Tata valley hydrographic basin (Dealu Frumos) - (Wgod) is much higher compared to the year 2018, having the value of 13820,8674 $m^3/year^{-1}$, while the coefficient of retention (R_u) had the same value of 0,238, which means that a percentage of 23,8% of the total eroded material reaches the emissary, the remaining 76,2% being deposited on the slopes and in the hydrographic network of the hydrographic basin.

With the help of the IntErO model, we also carried out a scenario regarding the prediction of the erosion phenomenon manifested at the scale of the Tata valley hydrographic basin (Dealu Frumos) for the next 20 years, in the event that land management works are not carried out to reduce or stop triggering factors.

The simulation was carried out according to the change in meteorological parameters, parameters related to the categories of agricultural land use (f_s, f_t, f_g) and erosion coefficients, especially the *Xa* coefficient and the φ coefficient from the IntErO modeling program.

The obtained results indicated an intensification of the soil erosion phenomenon within the hydrographic basin studied, in the absence of intervention through anti-erosion measures. Thus, the values of the real soil loss coefficient ($Ggod/km^2$) for the simulation carried out, had the value of 434,71 m^3/km^2, which indicates a strong intensity of the soil erosion phenomenon on agricultural lands, surface erosion being predominant.

The results obtained with the help of the IntErO mathematical model, validated the values obtained based on the experimental model applied in Chapter III, the obtained results being very close.

Chapter V – *THE IMPACT OF SHEET AND GULLY EROSION PHENOMENA IN THE H.B. OF TATA VALLEY (DEALU FRUMOS) ON THE CLOGGING OF THE PUCIOASA RESERVOIR* – appeared as an acute necessity, considering the high degree of clogging of the Pucioasa accumulation in order to highlight the percentage contribution of the alluvium coming from the Tata valley hydrographic basin (Dealu Frumos) on the clogging of the water accumulation.

The results obtained from the bathymetry carried out in 2022 indicated an annual clogging rate of 1,62% and a total clogging percentage of approximately 79% for the time interval 1979-2022.

The degree of clogging of the accumulation, at the level of 2022, increased by 2,6% compared to 2016, which indicates a progressive evolution of the clogging phenomenon.

The second stage was represented by the approximate calculation of the total amount of alluvial material washed from the Tata valley hydrographic basin (Dealu Frumos) in the period 1979-2022.

In conclusion, during the analyzed period 2018 - 2022, the amount of soil loss on the slopes of the Tata Valley hydrographic basin (Dealu Frumos) was 6225 m^3, which represents 2,64% of the total amount of sediments deposited in the accumulation basin of Pucioasa water accumulation, and the amount of sediments resulting from the torrential erosion of the Tata stream (Dealu Frumos), represents 0.63% of the total volume that contributed to clogging the accumulation.

Chapter VI – *GENERAL CONCLUSIONS AND RECOMMENDATIONS* – is the final chapter dedicated to the conclusions and especially the recommendations, for the complex development strategy of the Tata valley (Dealu Frumos) hydrographic basin, as well as for all the hydrographic basins in hilly areas.

A series of measures considered to be very important for mitigating surface and gully erosion phenomena, manifested on lands with predominantly agricultural use, are proposed, in the current context of climate change and the intensification of the negative impact of human activity.

During the research period, a number of 4 scientific articles were achieved as first author and 9 scientific articles as co-author, all of them being within the research field, supported in conferences and also published in specialized magazines, which are included in the *List of Publications*.