UNIVERSITY "AL. I. CUZA" IAŞI
FACULTY OF GEOGRAPHY AND GEOLOGY
Department of Geography

Mr. / Ms.

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We are pleased to announce that in **15.12.2012, 10.00,** in the **B8 amphitheater** of the Faculty of Geography and Geology of the „Alexandru Ioan Cuza" University of Iaşi will take place the public defending of the doctoral thesis entitled ***„Jijioara Basin – geomorphological study"***, elaborated by **Balan Cristina-Gianina,** with the purpose of obtaining the scientific title of **PhD in Geography**.

The doctoral commission has the following members:

President:

Adrian Grozavu, Associate professor, PhD, Vice-dean of the Faculty of Geography and Geology, University „Alexandru Ioan Cuza" Iaşi;

Scientific coordinator:

Ion Ioniţă, professor eng., PhD, Department of Geography, Faculty of Geography and Geology, University „Alexandru Ioan Cuza" Iaşi;

Referents:

Emil Vespremeanu, professor, PhD, University of Bucharest;

Ioan Aurel Irimuş, professor, PhD, „Babeş-Bolyai" University of Cluj-Napoca;

Eugen Rusu, professor, PhD, University „Alexandru Ioan Cuza" Iaşi.

With this occasion we are sending the abstract of the PhD thesis and invite you to participate to the public defense.

Contents:

1. Introductory aspects

1.1. Purpose of the work

The present paper, entitled "***Jijioara Basin –geomorphological study***" represents the results obtained during the doctoral studies period.

From a didactic viewpoint, the work has a double purpose: a fundamental one regarding the knowledge of the genesis and evolution of the landscape from Jijioara basin, of the main relief types and forms, the occurrence and intensity of present geomorphological processes (soil erosion by water and wind, sedimentation, landslides) and a second, applicative one, which involves the study of the main relief types and forms as well as of the other components which result in the distinct landscape of this basin. This second purpose will make up the basis for the planning and organization of social and economical activities, mainly agricultural ones, since the organization and management of soil erosion measures is a priority of applied geomorphology. In this sense are identified the actions taken up to this moment for controlling surface erosion, and first of all is pursued the identification of the modalities of rational terrain utilization in Jijioara basin.

1.2. Geographical position and limits

The hydrographic basin of Jijioara is situated in the eastern part of Romania, in the central-eastern part of the Moldavian Plateau, more exactly in the southern part of a subunit named Moldavian Plain by *Băcăuanu V*. (1964), Jijia-Bahlui Hilly Plain by *Martiniuc C*. (1955) and Jijia's Hilly Plain by *Ungureanu Al*. (1993).

Jijioara basin occupies a northern-central position in Iaşi County, including the territories of nine communes: Plugari (Boroşoaia village), Scobinţi, Şipote, Coarnele Caprei (Coarnele Caprei and Arama villages), Focuri (Focuri and Fântânele villages), Gropniţa (Bulbucani, Gropniţa, Forăşti, Mălăeşti, Sîngeri, Săveni), Belceşti, Movileni (Potîngeni, Movileni, Larga-Jijia), Româneşti.

From a hydrographic viewpoint, it neighbors to north, north-east and east the basin of Miletin, to east-south-east the basin of Jijia and south and west that of Bahlui.

Jijioara is a right-side tributary of Jijia, the confluence taking place near Larga-Jijia. It has a maximum length of 32.4 km on the NNW-SSE direction and a maximum width of 15 km from west to east on the line that passes south of Coarnele Caprei and Săveni. The studied basin has a surface of 244.93 km² (24,493 ha), which represents 3.06% of the territory of the Jijia's Hilly Plain. In conclusion we consider that although hidrologically Jijioara is one of the small rivers of Romania, it still represents an excellent area for the study of landforms and geomorphological processes.

1.3. Specific work methods

In the elaboration of the thesis have been used both classic and modern (such as Geographical Information Systems and remote sensing) methods. As a consequence almost all the maps from the present work have been realized using the TNT Mips v.6.9 software, with the help of which have been manually extracted and digitized the contour levels from the digital

cartographic database made up of topographic maps scaled 1:5000, editions 1973, 1980, 1978 in Stereo-70 projection. These allow for a better detailing of the landforms, as well as for the determination of terrain degradation processes such as landslides and gullying from the mentioned graphic materials.

At the basin level have been drawn different maps at a pixel resolution of 5x5 m, such as those of hypsometry, slope, aspect, drainage network, landscape fragmentation, geology and geomorphology.

The geographic position of the basin has been obtained by using the SRTM raster of the Romanian territory from which was cut off the studied area. Later on this raster has been overimposed the basin limit and those of the main landscape units of the Moldavian Plateau.

The geological map was realized departing from the geological map of Romania scaled 1:200,000. The climatic maps were drawn using the data from the 1961-2009 period from A.N.M. Bucureşti –C.M.R. Iaşi.

The land use maps have been obtained by extracting information from the ANCPI aerial images (edition 2005-2006) and by using the rasters elaborated in the Corine Land Cover project (2000-2006, European Environmental Agency).

The advantages of using methods of the GIS type stand first of all in the quantitative and qualitative processing of the spatial information, with the purpose of deciphering their spatial distribution and identifying new information for diverse practical applications.

1.4. Review of the research on the studied area

In the review of researches on the study area were included both works of general character as well as those of local reference. In this way has been processed useful information from the papers that approach the entire Moldavian Plateau or the entire surface of the country.

The first works are those of descriptive character included in chronicles and historical papers about Moldavia (*Grigore Ureche, Ion Neculce, Dimitrie Cantemir, Eudoxiu Hurmuzachi, Codrescu Th., Odobescu Al., Haşdeu B. P.* etc).

Important contributions to the study of the Moldavian Plateau have had a series of authors, among them *Cobălcescu Gr. (1982), Simionescu I. (1902, 1903), Sevastos R. (1903, 1909, 1922), David M. (1920, 1922, 1923, 1931, 1933, 1935), Văscăuţanu Th. (1929), Macarovici N. (1950, 1958), Jeanrenaud P. (1961,1963, 1965, 1966, 1969, 1971), Ionesi L. (1989, 1994), Brânzilă M. (1999), Grasu C. (2002).*

The geomorphological aspects have been approached by *Martiniuc C., Băcăuanu V. (1961, 1982), Băcăuanu V. (1968, 1977, 1980), Barbu N. (1985), Ioniţă I. (1985, 1990, 1992, 1997, 1999, 2000, 2005, 2007, 2008, 2010*), *Moţoc M.(1975), A. Popa (1968, 1971, 1973, 1977), Pujină D. (1997, 2008), Pujină L.(1998), Hurjui C. et al. (2000, 2008, 2010), Rădoane Maria, Rădoane N., Ichim I. (1992,1995,1999), Surdeanu V. (1990, 1999).*

2.General considerations on the relief origin and evolution

The present landscape of the Jijioara basin is the result of the interaction between internal (geological) and external (physico-geographical – climatic, hydrologic, biotic, pedologic) factors.

2.1. Endogene factors (paleogeographical evolution and geological composition)

Geostructurally, the basin of Jijioara is located on the Moldavian Platform, which represents a part of the south-western margin of the large Eastern European Platform.

In what regards evolution, the geology of the Moldavian Platform is characterized by two major stages. The first one, of mobile geosyncline area, has ended with the formation of the crystalline basement. The second stage, of cratonization and stable evolution as platform, led to the formation of the present sedimentary cover (L. Ionesi, 1989, 1994).

With a depth that varies from hundreds of meters to 1.5 km, the sedimentary cover has in its composition deposits that belong to the Upper Vendian, Paleozoic, Cretaceous, Paleocene, Eocene, Upper Badenian and Sarmatian. From the analysis of the stratigraphic data have been identified three sedimentary mega-cycles separated by three long periods of exondation: Upper Vendian – Devonian; Cretaceous - Paleocene – Middle Eocene and Upper Badenian – Meotian.

The deposits of Upper Sarmatian (Basarabian) occupy most of the area and have the most important vertical development among the mentioned deposits. In the Jijioara basin the position of the generally clayey facies with intercalations of sands is directly involved in the recent morpho-dynamics of the slopes, making up the deposits on which deluvial covers were formed.

Besides the formations of the last sedimentary cycles we need to mention the recent, Quaternary deposits (eluvial, deluvial, coluvial, proluvial, aluvium).

2.2. The external, physico-geographical factors that have contributed to the modeling of the present landscape

2.2.1. Climatic factors

The present aspect of the landscape from Jijioara basin has been influenced not only by endogene factors (lithology, structure) but also by climatic conditions. The influence of climatic conditions manifests also on the geomorphological processes, especially through the rainfall quantity and thermal variations.

Air temperature underlines the excessive aspects of the climate in the study area. The mean temperature for the 1961-2006 period has been of 9.47º C. The mean monthly amplitudes are high, reaching values of 23.5°C at Iaşi.

Such information underlines the excessive character of the climate in this part of the country, characterized by extreme values of temperature. These values are important and from a geomorphological viewpoint, having reflex in the weathering of the superficial material and thus in its mobilization. We also

need to mention the influence of the freeze-thaw cycles in the evolution of landslides and gullies.

Rainfalls represent the climatic element that influences relief very much. From the analysis of the data regarding rainfall for the 1961-2006 period for the stations from Iaşi, Podu Iloaie, Cotnari and Botoşani, it can be seen that mean annual rainfall quantities reach 557.8 mm.

In the warm season (April - September) are registered 60-70% of the annual sum, the rainfall often having a torrential character. In the cold season, respectively October-January is registered 30-40% of the total rainfall quantity.

2.2.2. Hydrological factors

The present aspect of the relief from the study region is due mostly to the hydrologic factor, respectively to the river network that through erosion, transport and accumulation has permanently modified the landscape's physiognomy.

The most important water course that drains the territory is Jijioara, together with its tributaries. The total length of the drainage network is of 308 km. Reported to the surface of the study area, of 244 km^2, results a drainage density of 1.25 km/ km^2. The alimentation type of the rivers is from rainfalls and snow melting, which gives the hydrographic network a torrential character *(Ujvari I., 1972),* situation which explains the small and irregular discharge during the year.

On the main course, but also on the main tributaries have been emplaced hydrotechnical management works: 8 permanent and 15 temporary reservoirs: Budăi, Movileni, Bulbucani, Fântânele, Boroşoaia etc.

2.2.3. Biotic factors

Vegetation plays a protective role for the relief against terrain degradation, being a veritable buffer between the morphogenetic agents and the internal agents.

The study area is situated in a silvo-steppe region, at the dryer limit with steppe influences. The vegetation is made of associations with *Festuca vallesiaca* in complex with small forests of oak, hornbeam and elm (*Mititelu et al., 1994).*

The extrazonal, intrazonal and azonal vegetation associations are represented in the territory by several vegetation types such as palustrine or halophyte.

2.2.4. Soil cover factors

The soils specific to the basin of Jijioara belong to the hilly plain area, in which although the relief is less varied, the soil cover presents a significant diversity caused by the mezo- or microrelief forms, as well as by the varied lithology or due to the influences of the underground water or frequent landslides.

In this area have evolved mainly fertile soils from the Chernisols class, respectively Chernozems and Phaeozems, which occupy over 70% of the surface. Besides these, the other soil types (Hidrisols, Salsodisols, Protisols, Anthrisols) participate with reduced proportions in the sol cover.

2.2.5. The anthropic factor

Most of the times, anthropic activities have a negative role manifested through deforestation or fallowing large surfaces with the purpose of increasing the surface of agricultural terrains, building habitats and houses in vulnerable areas, to which is added the traditional modality of conducting tillage on slopes on the highest declivity, uphill and downhill, this being an important cause in accelerating terrain degradation processes. Still, there are also positive influences of the human activities, represented at the level of Jijioara basin by the hydrotechnical works, which have the role to eliminate the danger of floods for localities; slope terracing, the cultivation on slopes of straw crops in alternation with weeding crops, the introduction in crop rotations of perennial (meliorative) crops, methods that contribute to a decrease in soil erosion.

3.Morphometric and morphographic characterization

3.1. Morphographic characterization

The hydrographic basin of Jijioara is located in the central south-eastern part of the Jijia's Hilly Plain. The shape of the basin is elongated, on the NNW-SSE direction.

The main inter-stream hilltops are those that make up the limit of the basin with the basins of Miletin at north, north-east and Bahlui at west and south.

Along the main hilltops that make up the limit between the study basins and the neighboring ones, there is a series of secondary hilltops. A characteristic of the inter-stream hilltops is their parallelism due to the reconsequent character of the tributaries from the left part of Jijioara and the obsequent ones from the right side, mainly after the confluence of the main tributaries.

Although Zbanţul brook is a tributary of Jijioara, it looks like an independent basin. The much narrowed floodplain by the deluvial processes from both slopes, choking the river valley, indicates the fact that it is much younger than Jijioara. The initial direction of the brook has been from west to east, as it is at the present moment in the middle and upper course. Instead, in the upper course the brook changed its direction, evolving towards south, because towards west the path was blocked by Jijioara's tributaries. Although Zbanţ has been probably channeled towards Jijioara, the two basins are studied together because they are connected at the present moment.

Jijioara valley, from its formation and up to the confluence with Jijia, is oriented from west to east between Coarnele Caprei and Larga Jijia. It has a length of 17 kilometers, being a typical subsequent valley with an asymmetrical profile, specific to the 1st order structural asymmetry. The left bank represent a cuesta dip slope with south-western exposition, while the right one is a cuesta escarpment with north-eastern exposition, totally covered in landslide deluvium in different stages of evolution, most of them stabilized. In the lower basin the cuesta escarpment is almost unitary, being very weakly fragmented by small obsequent tributaries.

In the context of a typically subsequent valley such as Jijioara, one would expect that its left side, initially cuesta dip slope of generally southern exposition, to be much more developed in relation to the right side, initially cuesta escarpment with northern exposition.

As a consequence, if at the limited level of the Jijioara valley (including the fluvial terraces) the asymmetry is evident; at the basin level this asymmetry is blurred. It is visible is the upper part (upstream Focuri), while in the middle and especially lower basin the right side is much more developed (the area of the previous cuesta escarpment is much more extended than the left side, having a length of up to 8 km in comparison to the 1 km of the later). This situation can be explained by the fact that Jijia has a jagged direction, the consequent and subsequent sectors alternating. In the eastern part of Jijioara basin, before the confluence with Jijia, the valley's direction is west to east, Jijia's floodplain permanently extending and consuming the dip slope of Jijioara.

Analyzing both the slope exposition map and the histogram of the same raster it can be seen that the slopes have a dominant north-eastern (21.63%) and south-western (18.47 %) exposition.

3.2. Morphometric characterization

3.2.1. Hypsometry

The relief of the Jijioara basin develops between 194.35 m in the north-west of the area, in Piștea Hill and 40 m in the south-east, near the confluence with Jijia. it has higher altitudes towards the hilltops dividing this basin from the neighboring ones and lower ones towards the center and the south-eastern part of the basin, consequence of the general slope of the geological strata on NW-SE direction.

The relief characterized by altitudes lower than 50m occupies only 1.62 % of the basin's surface, being met only in the central-eastern part, more exactly in Jijioara's floodplain, downstream the confluence with Lopătoaia brook and up to its flowing into Jijia.

Analyzing the histogram representing basin altitudes on classes, it can be seen that the altitudes between 75 and 150 m occupy the largest part of the basin. Thus, taken together the classes 75 - 100 m, 100 - 125 m, 125- 150 m hold 72.9 % of the entire basin.

3.2.2. Slopes

The maximum frequency occurs in the case of the 5-10º class, with a proportion of 33.94%, characteristic to most of the deluvial slopes, mainly cuesta escarpments but also some degraded dip slopes. On the second place are the terrains with declivities of 2º-5º, with a percentage of 32.69%, where are included the weakly degraded cuesta dip slopes, but also surfaces on which have previously executed soil erosion control measures, more exactly terracing. We can also add the inter-stream hilltops shaped as small rounded sculptural plateaus. The surfaces with declivities higher than 15º occupy 3.02% of the area surface (class 15-20º - 2.67%, class 20-30º-0.34%, class >30º-0.01%), and are met on strongly degraded cuesta escarpments, affected by landslides in different

stages of evolution and on small erosion basins. These strongly degraded surfaces occupy 739 ha.

3.2.3. Relief vertical fragmentation

The mean value of relief vertical fragmentation is of 62.4 m. Almost 6% of the basin surface presents a fragmentation smaller than 40 m, while the high values, of over 80 m, characterize 24% of the basin. The medium values, of 40-80 m, detain the maximum percentage of 70 %.

The maximum value of relief energy, of 118.16 m, is met east of Focuri, on the right side of Boroşoaia. In general values larger than 100 m are met on the cuesta escarpments and in the small erosional basins covered by landslides. The minimum value of relief energy is registered near the confluence between Jijioara and Jijia.

4. Main relief types and forms

In the Jijioara basin can be identified relief types specific to the platform regions, such as sculptural relief (88.1%) and accumulation forms (11.9%), the proper structural relief being weekly expressed.

4.1. Structural relief

In the Jijioara basin we cannot mention typical structural-lithologic landforms, due to the lack of geological formations resistant to erosion. In exchange, we can talk about the network of valleys formed in the monocline structure.

4.1.2. Valley types conditioned by the geological structure

In the basin of Jijioara can be distinguished subsequent, obsequent and reconsequent valleys. *The consequent ones* have no occurrence in the area, the courses oriented according to the strata inclination being the reconsequent ones, because they evolve on a inferior plane compared to the consequent ones. These valleys are associated to the left side tributaries of Jijioara: Boziana and Lopătoaia.

The subsequent valleys have an approximately perpendicular direction in relation to the general strata inclination. In this category are included Jijioara, as well as its tributaries Boroşoaia and Paiul.

The obsequent valleys are characterized by a reverse direction in relation to the geological strata inclination. These valleys are met on north-facing cuesta escarpments: Valea Carului, Valea Barbuşica etc.

4.2. Sculptural (denudational) relief in generally monoclyne structure

The dominant note of the relief in the study area is given by the sculptural character (denudational) which is manifested on the background of a monoclyne structure. As forms it includes both interstream divides as well as slopes with variable declivities.

4.2.1. Intestream divides hilltops represent 14.4% of the total relief forms. These landforms are largely developed as rolling hills, hills and low plateaus, easily ball-pointed or inclined according to the geological structure.

The interstream hilltops formed on the clayey-marly deposits present a convex transversal profile, being less affected by degradation processes. A second type is represented by narrow interstream hilltops, which usually occur as small ridges inside erosional basins.

4.2.2. Slopes

The large majority of slopes plays the role of cuesta escarpments or dip slopes.

The 1st order structural asymmetry is characteristic for the north-facing cuesta escarpments associated to typical subsequent valleys (oriented E-W). These have a smaller percentage than the west-facing cuestas, occupying smaller surfaces and having higher declivities (>25º).

The 2nd order structural asymmetry is associated to reconsequent (resequent) and evolved obsequent valleys. Most of these valleys present a clearly asymmetric profile, with the left slope having the role of cuesta west-facing escarpment, and the right one as a eastern-facing dip slope.

4.2.2.3 Small erosional basins (landslide amphitheatres)

In the Jijioara basin a specific feature is given by the presence of small erosional basins (landslide amphitheaters) of different dimensions.

The occurrence at surface of underground waters and the active erosion exerted by the superficial discharge of torrential waters offers favorable conditions for the occurrence of such landforms *(V. Băcăuanu, 1968).* Their formation is linked to the deepening of an initial gully, after which interfere other geomorphological processes such as surface erosion and landslides, on the background of a dominant clayey-sandy geology and the action of other factors (climatic, biotic, anthropic etc.).

Although most of these basins are affected by present geomorphological processes, especially landslides of different dimensions, they have been used in the past for locating villages (such as Gropniţa), either for planting vineyards and orchards after slope terracing (H. Borosoaia).

4.2.2.4. Cuesta dip slopes

The left bank of Jijioara is the most typical cuesta dip slope from the basin, having a general southern exposition, revealing the 1st order structural asymmetry. Although fragmented by some reconsequent courses, the small declivities (maximum 12 degrees) as well as the high degree of uniformity that characterizes it make it an area proper for settlements and agriculture.

4.3. Fluvial accumulation relief

Alluvial floodplains represent the lowest landforms from the study area and the youngest ones (Holocene). They represent about 8.1% of the basin surface.

Terraces. Jijioara's evolution has been regressive, in relation to the geological deposits. Thus we consider that the initial course has been at the altitude of 170 m (a terrace of 120 m relative altitude), moment after which, in its evolution, the river deepened and gradually evolved towards the right side on a length of 3-4 km, reaching the present position. In its evolution, it created

several terraces, strongly affected by coluvionation and thus hard to identify in the field in the lack of laboratory analyses.

Glacises are favored as occurrence by the lack of forest vegetation, fact that allowed the weathering, decomposition and sheet erosion at a rapid rate. Gully erosion is not characteristic for these landforms.

Alluvial (coluvial, proluvial) fans are quite frequent, being favored by the sandy-loamy or loamy-clayey-sandy materials, yet they have relatively small surfaces and modest heights (1-3 m).

4.4. Anthropic relief

Due to the agricultural productive potential of the area, for the more thorough utilization of agricultural terrains during the 50s-60s were executed a series of erosion control works and terracing (mainly for vineyard and orchard plantations). After 1989, agro-terraces have begun to be degraded by coluvionation from the upper parts of the slope, and locally by gullying.

5. Present geomorphological processes

5.1. Surface erosion

The role of surface erosion is an important one, being observed a differentiation among arable terrains according to the existing vegetation (and according to the development stage and the degree of soil surface covering with vegetation, meaning the measure in which plants can intercept or no rain drops).

On the cuesta dip slopes, which in general have a uniform inclination, the process has a high efficiency mainly in the middle third, and the dislocated materials are redistributed in the lower third of the slope. On the heterogeneous slopes with agricultural use, surface erosion is more intense in the convex sectors, where soil color tends to be yellowish. On the slopes used as pastures, but covered with herbaceous vegetation, the process has a lower intensity because the vegetation protects the soil. Erosion is more intense in the areas of cuesta escarpments, where overgrazing is practiced and herbaceous vegetation is sparse.

The quite low values of erosion are due also to the characteristics of the soils from the territory, which generally belong to Chernisols.

5.2. Gully erosion

Gully erosion is weakly represented in Jijioara basin, being situated after surface erosion and landslides as intensity of manifestation of geomorphological processes. This fact is due to the dominance of the clayey-marly Barasabian geology. The most frequent forms associated to gully erosion present in Jijioara basin are large rills, followed by slope gullies, discontinuous and of small dimensions, present on the cuesta escarpments with a higher sand percentage in the composition, and by valley-bottom gullies. Most of the slope gullies met in the basin are formed on the old uphill roads that have deepened and eventually transformed into gullies.

Using the topographical plan 1:5000 and the aerial images from 2006, and also through field validation, in the Jijioara basin have been identified 696

gullies, both on slopes and valley-bottoms. The GIS analysis of the gully distribution at the basin level indicates that the surface affected by gully erosion is of 92.81 ha, which represents 0.37 % of the total.

Although the number is quite high, it can be seen that the surface affected by gully erosion is reduced, as a consequence of the measures of soil protection against erosion applied before 1990.

5.3. Landslides

Landslides find good occurrence conditions in the Jijia's Hilly Plain, their extension and frequency being signaled long time ago. In the basin of Jijioara, they are the most characteristic process, impressing through their development, dimension and specific landscape. At the same time, they contribute to a decrease in the agricultural potential of the territories affected by such processes.

At the level of the entire basin, 7455.3 ha, representing 30.43% are occupied by landslides, of which active are 12.15 % (2978.34 ha) and stabilized 18.28% (4477.03 ha).

A part of the old landslides from this basin are characterized by huge displaced masses, which have behind them depressionary areas where small brooks have formed. In the Jijioara basin large landslides can be seen at Cioplea (right bank of Recea valley), Halta Movileni (on the right bank of Ursoaia valley from Zbanţul basin), Brânză Roşie (on the left side of the homonymous valley), Focuri (on the right bank of Lacul Negru valley). Even if not of them have such large dimensions, landslides are very frequent.

In the studied area, landslides are processes specific to most of the cuesta escarpments, both in the case of the generally north-facing (N, NE, NW) ones where landslides occupy 1300 ha - 43.63% of the total of active landslides and 1550 ha – 34.63% of the old stabilized ones and in that of western-facing ones, in which case active landslides occupy 1197 ha (40.19%) and the stabilized ones 1853 ha (25.30 % of the total).

5.4. Sedimentation processes

The sedimentation processes represent the final stage of the erosional cycle, when the solid material detached and transported from the higher areas of the basin is deposited in the lower ones, of lower declivities, corresponding to floodplains.

The intensity of this process is moderate, of 2 cm/year, as results from the studies regarding floodplain or reservoirs' clogging conducted in similar basins from Jijia's Hilly Plain through the technique of determining the ^{137}Cs isotope in alluvium samples by Ioniță I. et.al. (2000).

The main causes of the intensity of the process are the high resistance to erosion of the soils and the mainly clayey substratum, to which is added the influence of the anti-erosion management.

6.Land utilization

The surfaces with agricultural use from the studied area occupy about 90% of the total basin surface (21840 ha). Thus, only 10% of this area is occupied by other uses - 2653 ha. This situation denotes a major change of the initial natural vegetation, more exactly its replacement with agricultural terrains and pastures. This shows that the basic occupation of the population that lives in the villages from this hydrographic basin is represented by crop cultivation and cattle raising.

The dominant proportion is detained by arable terrains, which occupy 13775 ha (56.24%), meaning more than half of the basin surface. These are dominantly situated on hilltops (85.83%) and of cuesta dip slopes (77.39%), where declivities are lower and the slope length higher, but also on glacises (44.95%), duet o the higher fertility of the soils from these landforms. During time the surfaces occupied by agricultural terrains, including the less favorable ones, have increased, leading to the intensification and acceleration of degradation of slope terrains, such is the case of cuesta escarpments or of the small erosion basins occupied by agricultural terrains (43.69%, respectively 32.18%). This situation has occurred in spite of the fact that slope declivity does not favor agriculture and the incidence of geomorphological processes in these areas is high.

The second category as percentage is that of pastures and meadows, separated into simple or mixed with scrubs, which together occupy 7990 ha, meaning almost 33%. Most of the pastures from Jijioara basin are unreclaimed, being in an accentuated degradation state (due to overgrazing and the occurrence of animal paths or the abandonment of terracing of the high declivity terrains, which were during the past occupied by orchards or vineyard plantations and have become pastures through their fallowing).

They are distributed mainly on terrains with moderate and high declivities, frequently affected by surface erosion or bay landslides. This is especially the case of the terrains characterized by erosional basins, occupied in the past by orchards or vineyards and which presently are fallowed and transformed into pastures (61.48%), of the floodplains of Jijioara and its tributaries (61.19%), but also of the north and west-facing cuesta escarpments (49.86).

At the present moment, orchards and vineyard plantations occupy very small percentages from the total surface of the study area (less than 1%), duet o the aforementioned changes.

Regarding the terrains with other uses, it can be said that they detain reduced percentages from the total surface of the basin – approximately 11% (2653 ha). The terrains occupied by settlements sum up 1710 ha in 2006, approximately 7% of the basins' surface.

6.Conclusions

The relief of Jijioara basin is a typical sculptural plain one, specific to the Jijia's Hilly Plain, where a clear contrast occurs between the overall monotony of the interstream hilltops and the aspect of the slopes. This relief has

reached the present appearance after a long evolution which took place from the Middle Sarmatian and up to present, as a consequence of the favorable conditions offered by this territory for the activity of modeling factors.

The lithologic formations on which the relief of Jijioara basin was modeled are clayey-marly with sandy intercalations, rocks which are less resistant to the action of denudative factors. This explains and the low altitudes from this area, 73% of the basin having altitudes between 75-150 m. The lower absolute altitudes are due to the intense evolution of the relief, to the well-developed drainage network and to the geological composition dominated by clays and marls.

The sedimentary formations are disposed in a general monoclyne structure, characterized by a general inclination of the strata with 7-8 m/km on a NNW-SSE direction.

The climate is temperate continental, specific to the area of the Jijia's Hilly Plain, with a thermal mean around 9°C and rainfall of approximately 550 mm/year. Summers are droughty and warm, while the winters are harsh. The excesse nuance is given by the high thermal amplitudes during the year as well as by the alternation of droughts and rainy periods.

In what regards natural vegetation conditions, the study area is situated in the silvo-steppe region, with elements of eastern European vegetation. Natural vegetation has suffered important modifications as a consequence of human intervention. This situation has had a negative influence on the landforms, leading to an acceleration of the terrain degradation processes duet o the lack of natural vegetative cover.

Unfortunately, although they can also have a positive effect, anthropic activities have led to negative influences through the roads emplaced uphill and downhill and by conducting agricultural works on slopes on the direction of the highest declivities.

The drainage network has a semi-permanent character, with large variations in what regards discharge (drainage depletion, floods and inundations). There is an important number of ponds, and can also be met a number of water surfaces with temporary character in the micro-depressions formed by subsidence on interstream hilltops or located besides landslides on the cuesta escarpments.

The reservoir dams met on the valleys from the basin, the numerous clogged reservoirs, the damming of floodable areas from the floodplains of Jijioara and its tributaries, the drainage of wetlands, the consolidation of slopes through different technical means, the construction of cut-and-fills for roads etc. are actions that significantly influence the factors that contribute to landscape modeling.

The soil cover is dominated by fertile soils, with good humus content, from the class of Chernisols (Chernozems and Phaeozems).

The dominant relief in the study area is the sculptural one, represented by interstream hilltops and deluvial slopes with role of cuesta escarpments and dip slopes. A characteristic of the interstream hilltops is their parallelism, duet o the reconsequent character of Jijioara's left side and the obsequence from the

right side, mainly after the confluence of the main tributaries. Slopes occupy the largest part of the study basin, and usually have a different aspect according to the role they play, respectively cuesta escarpment or dip slope. The floodplains, except the main one, present an appreciable width, although they have small lengths. The dominance of the Sarmatian clayey and marly facies with sandy intercalations on which the landforms of Jijioara basin have formed is reflected in the petrographic composition of the colluvial and proluvial fans. Both the alluvial fans and glacises are formed of clayey-sandy materials.

The lithologic composition dominated by the presence of soft rocks, the general monoclyne geological structure, together with the frame of physico-geographical conditions have influenced the present morphology. The evolution of the rhythm of degradation of the terrains from the Jijioara basin is strongly connected to the evolution of the structure of land use, Jijia's Hilly Plain being completely deforested. The anthropic activities have a positive impact through the measures of controlling soil erosion, but also a negative one through the uphill and downhill roads and conducting tillage works on slopes on the direction of the highest declivity.

In the conditions of a dominant clayey-marly facies we witness the formation of a relief with a largely rolling aspect, with elongated hilltops whose altitudes do not exceed 200 m and which occur repeatedly in the basin, giving the impression that they belonged to a unitary plateau that has been fragmented by river valleys, thus of a premature ageing. Jijioara has evolved regressively, moving towards right and at the same time deepening. We consider that its main course was located at an altitude of 170 m, at the present level of the plateaus, and then gradually the course has deepened and migrated to the right on a distance of 3-4 km, reaching its present position. The terraces that Jijioara formed in its evolution are of small dimensions, and have not been preserved intact, being affected by glacisization.

Landslides, surface erosion and gully erosion are processes specific to the basin of Jijioara, due to the clayey lithology that favors runoff and surface erosion, leading to a relatively uniform decrease in the overall altitude. Still, the geomorphological processes more often met in the basin are landslides of different types from the cuesta escarpments, many of them stabilized. Surface erosion impresses through its extension. Also have been evidenced a series of small discontinuous gullies (due to the clayey deposits with intercalations of sands) which are the initiators of associated geomorphological processes – landfalls and landslides. This is the motive for which these gullies cannot maintain the initial configuration for a long period of time. Another process is floodplain aggradation and reservoir clogging, although in this basin the sedimentation rate is quite small. I. Ionita (2000) has estimated using the 137-Cs isotope a mean sedimentation rate of 2 cm / year for the Jijia Hilly Plain.

As a consequence, the dominant geomorphological processes for the surfaces with slopes lower than 5º are the accumulative ones, while the destructive processes, especially in this area where surface erosion dominates, are manifested with a reduced intensity.

In general, the relief developed of clayey rocks in the conditions of a temperate continental climate with excessive tendencies is characterized by smooth lines, large valleys with wet bottom, a large variety of deluviale processes: surface erosion, gullying, landslides. Because of the permanent changes that occur at the landscape scale, of largely developed surface erosion, of the multitude of landslides, we witness an early ageing of the relief, proved by the position at a lower altitude level than the one it formed at.

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