LAND DEGRADATION IN THE IARA HYDROGRAPHIC BASIN

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Abstract. ***Land degradation in the Iara hydrographic basin.*** The hydrographic basin of the Iara River, a former mining area (territory imposed over the Iara Depression) presents numerous locations with degraded lands following the mining activity (in the former exploitation points at Făgetu Ierii, Mașca, Măgura Ierii, Băișoara), as well the development of massive deforestations in the upper sector of the Iara River (upstream of Valea Ierii commune). On medium and long term, these degraded lands are and will be included in ecological protection and conservation projects, so that, for example, the former mining points can be introduced in the tourist circuits. We mention that currently there is already a trend in this regard, in countries such as Poland, Slovakia, where former mining operations are included in tourist circuits, and tourist numbers are increasing in these locations (example - Silesia region). Thus, the transition must be made from the former Iara mining area, to a tourist area in which we hope that tourism will become the main economic activity. We add that, at present, there is only one exploitation point (of industrial dacite - in Băișoara locality), and tourism is relatively in an incipient phase (in Iara commune), while in Băișoara and Valea Ierii communes tourism is much more developed compared to Iara. On the other hand, there are many degraded lands following the geomorphological processes within the Iara Depression (landslides, ravines, gully erosion) in Iara, Făgetu Ierii, Agriș, Valea Agrișului, the low area of Băisoara (overlapping the Iara Depression). Thus, in the present study we aimed to classify degraded lands from the Iara river basin in two categories, namely: degraded lands caused by anthropogenic intervention, and degraded lands generated by geomorphological processes (practically based on a natural cause). For this GIS technology was used, to achieve the classification of degraded lands; also prior and after the use of GIS technology, numerous field trips were made to gather information, take pictures, take soil samples, as well as for confronting the reality in the field, following the creation of the cartographic material.

Keywords: degraded lands, geomorphological processes, Iara Depression, Iara River Basin, ArcGis, Corine Land Cover (CLC).

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1. INTRODUCTION AND STUDY AREA

The Iara river basin is located in the southern part of Cluj County, at the interference of the Gilău - Muntele Mare Massif with the Iara Depression. The study area has a high tourist and geomorphological potential which, at present, is improperly exploited. The relief, a support of territorial development, in this case could represent also an answer, there are many locations that arouse the interest of tourists in the area: Muntele Băișorii resort, Buscat tourist complex, Iara River Valley, Bonudreasa Reservoir, Surduc Gorge, and so on.

The Iara River basin is characterized by a complex geographical landscape, starting with the depression area (Iara Depression), meadows (Iara river), valley areas (Iara River valley, very spectacular between Băișoara and Valea Ierii localities, as well as upstream of the Valea Ierii U.A.T), gorges (Surduc gorge, Buru gorge - at the confluence with the Arieș river) and culminating with the high mountain area (highest altitude being Buscat Peak, at 1676 m). We must mention that the Iara River represents a crucial functional axis for the study area.

From a political - administrative point of view, the hydrographic basin of the Iara River overlaps the administrative territory of three administrative - territorial units, respectively: Iara, Băișoara and Valea Ierii. The objective of the present study is to carry out an introspection (from a geomorphological and tourist point of view) within the hydrographic basin of the Iara River and, subsequently, to classify the lands from the study area, in degraded lands, respectively non-degraded lands.

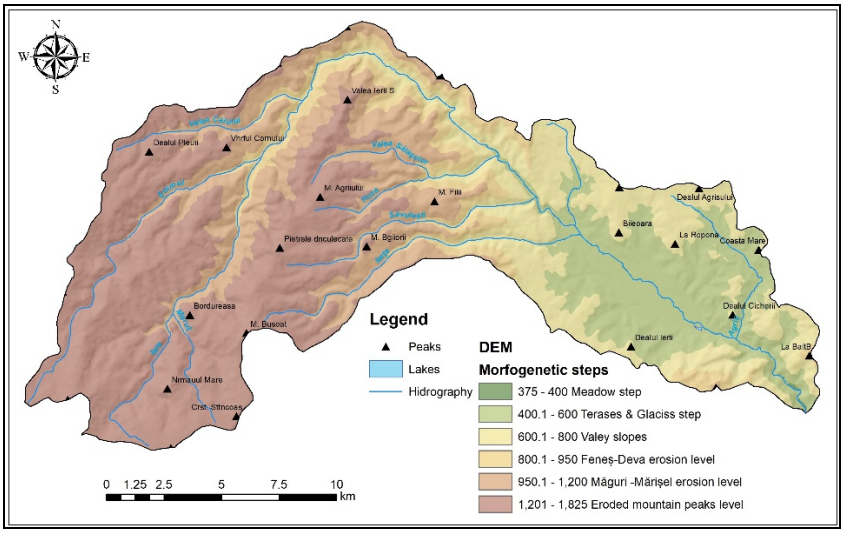

Fig. 1. Map of morphogenetic steps in the hydrographic basin of the Iara River.

The main resources in the region's subsoil (quartz sands, dacite, skarn, silver, lead) played a key role in the economic development of the Băișoara and Iara administrative - territorial units until 1996.

Fig. 2. Dacite industrial exploitation quarry (Băișoara)

It is important to emphasize that until 1996 in the Iara Depression there were several mining points, at present there is only one quarry for the exploitation of industrial dacite in Băișoara commune. This raw material is used for the national transport infrastructure, in the construction of roads and highways (example: Transylvania Highway, Gilău - Câmpia Turzii section). We must mention also the fact that until 1996, mining was the main field of activity for the male population in the Iara Depression, and after 1996 there was an economic decline, followed by a post-industrial period (1996-2016); as a result, the unemployment rate among the population (especially the male population) and the emigration rate have increased. We mention that at present, in Romania, many factories have stopped their activity, and the subsoil resources used in various fields of activity are imported (from China, Brazil – it is imported iron, etc.).

Fig. 3. Degraded lands at Făgetu Ierii locality (former exploitation of quartz sands).

As a result of the mining activity in the Iara River hydrographic basin, numerous degraded lands and tailings dumps resulted, these having a strong negative impact on the environment (considering that they are not conserved and greened). We hope that this study will be useful in terms of the spatial planning policy, which is a real support for local authorities in the perimeter under investigation: Băișoara, Iara and Valea Ierii. Thus, projects can be carried out for conservation, greening and protection of the affected areas following the mining activity and the presence of geomorphological processes (tailings dumps, tailings ponds, landslides, ravines, runoffs, etc.), and subsequently, these areas could be introduced in tourist circuits.

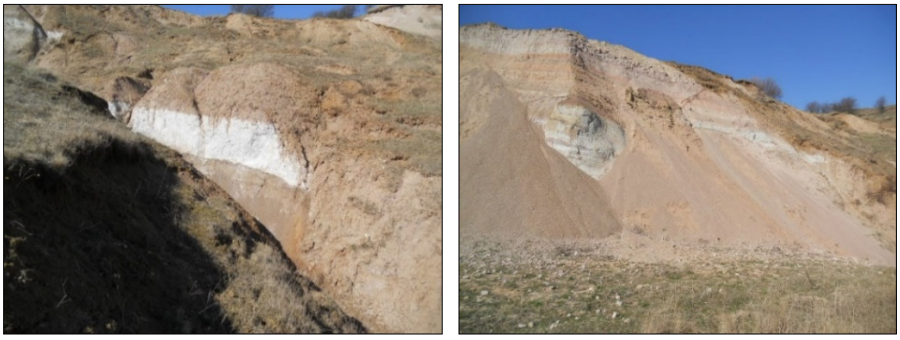

Fig. 4. Degraded lands in Făgetu Ierii locality (former exploitation of quartz sands).

We mention that by doing a detailed analysis of the current situation in the hydrographic basin of the Iara River, we can say that, although in the past the researched area was a mining area (as mentioned before, until 1996 - mining was the main field of activity) at present, the local economy is based on small and medium enterprises in areas like tourism, trade and services, and the trend of economic development of the localities in the three communes is directed towards non-polluting areas of activity (especially tourism). For this stands the area's tourist potential (of natural and anthropogenic origin), high and diversified, as well as the increase of the touristic demand (given the proximity of the main tourists' origin pole - Cluj-Napoca). Lately, it is noted that the tourist demand comes also from other areas besides Cluj County, more precisely from the neighbouring counties (Sălaj, Bihor, Alba, etc.). In this sense, through the implemented and future projects in the field of tourism, we hope that the tourist resorts Muntele Băișorii and Buscat will pass from the rank of local interest resorts to the rank of regional interest, and later national resorts. We mention that along with sports and weekend tourism (practiced in the resorts of Muntele Băișorii and Buscat), in the hydrographic basin of the Iara River can be practiced several types and forms of tourism, respectively: rural tourism, agrotourism, cyclotourism etc.

Regarding the geomorphological processes in the researched area, we can say, following research and specialized analysis, that the Iara Depression is affected by these hazardous geomorphological processes (given the geological constitution of the Iara Depression - composed of lower Eocene clays). In the scientific literature there are several authors who researched the geomorphological characteristics of the Iara Depression. Thus, the Iara Depression's area is characterized by medium and high landslides probability – this is mentioned in studies aimed at classifying the landslide probability classes in the Transylvanian Depression (Mac and Tudoran, 1977; Surdeanu et al., 1998; Petrea et al., 2014) or the entire national territory (Bălteanu and Micu, 2009). In addition, another study (PhD thesis) of more recent, entitled *Iara - Hășdate Depression. Territory planning study*, conducted by Moldovan Ciprian Sandu, captures an analysis of the situation existing at that time (2014) and provides a set of measures regarding future landscaping.

Constantin, Veronica (2011) makes a study of applied geography of mining areas in the Apuseni Mountains, which captures the main features of the area under investigation, namely: physical and geographical analysis of the area, the main mining points (their past and current state), as well as economic aspects of the administrative-territorial units.

Thus, for the geomorphological analysis from the point of view of the landscaping and the development of the tourist phenomenon, as detailed as possible for the Iara hydrographic basin, will help to make the most correct decisions and later transform the ideas into concrete development projects. In this sense, the analysis at micro and macroscalar level of the present issues implies a zoning of the territory using qualitative and quantitative criteria (Benedek and Man, 2016).

M. S. Luca (2015) wrote a monograph of Băișoara commune, in which she captures the main defining elements of the administrative - territorial unit (she was the locality mayor for 16 years). Earlier L. L. Naghiu et al. (2007) made a study in which they analysed the main factors that contribute to the water pollution in the Iara River basin. Thus, the authors established several points from where they took water samples, subsequently performing their analysis in the laboratory in order to determine the factors that lead to pollution. We consider that the study has an increased utility, which in the future can serve as support for local authorities to issue water protection projects in the perimeter under analysis, as well as the environment. Many of the studies identified were monographic type and focused mainly on tourism.

Through the analysis of the cartographic material (satellite images, maps made through G.I.S software) and through the numerous field trips, to confront the geographical reality with the cartographic materials, the degraded lands from the Iara River basin were identified.

We mention that the degraded lands in the Iara hydrographic basin periodically change their configuration, so the study extends over a longer period (for better monitoring of degraded lands - following deforestation activities, geomorphological processes, waste storage in places not arranged in this sense, etc.).

Fig. 5. Degraded lands in Valea Ierii locality

Deforestation in the mountain area (the territory superimposed on the administrative - territorial units of Valea Ierii and Băișoara) resulted in numerous degraded lands.

At the level of the entire Iara hydrographic basin, it can be stated that within the three administrative - territorial units (Băișoara, Iara and Valea Ierii) there is a transition from industrial activities (especially mining) to tourism and related fields (services, transport etc.). Thus, we can say that in the future the local economy will be cleaner (green), and the environment will be less endangered (in this way we hope to reduce the share of degraded land).

2. RESEARCH METHODOLOGY

G.I.S. played a vital role in identifying degraded land in the Iara River basin (it was practically indispensable). Thus, following the numerous field trips, and later, the consultation of topographic maps (made in the 1970s) we were able to produce, through G.I.S, the necessary cartographic material.

The Corine Land Cover (CLC) database played a key role in realising the land use maps in the perimeter under analysis, we also used various

Copernicus High Resolution Layers and European Soil Data Centre (ESDAC) data to identify spatially the degraded land areas.

Another useful indirect information in the process of creating y=the necessary cartographic materials were the Hammond's regional landform classes. We mention it's utility especially in the analysis of geomorphological processes.

Moreover, the method of direct observation in the field was absolutely necessary to identify susceptible points (locations affected by geomorphological processes or lands degraded as a result of anthropogenic activity) and to observe, along the way, the changes.

Thus, following the aforementioned techniques, we hope that this study will be more accurate and useful in the process of protection and conservation of affected areas (degraded land) and in the land use planning phase (towards tourism).

3. RESULTS

After analysing the areas land use data (Corine Land Cover 2000-2018) we must present some general conception (Fig. 6.). The main land use type in the area is forest management, in the study period the forested area changed only in small percentage, in the entire period it was between 55-60 %. Regarding land use (Fig. 6), changes can be observed between 2000 and 2018, as follows:

- Decreasing the share of coniferous forests, increasing the share of deciduous forests.
- Surface growth of secondary pastures (created as a result of deforestation).
- Decreasing areas occupied by pastures.
- Increasing arable land, non-irrigated and complex cultivation patterns and also the transitional lands between agricultural and natural vegetations.

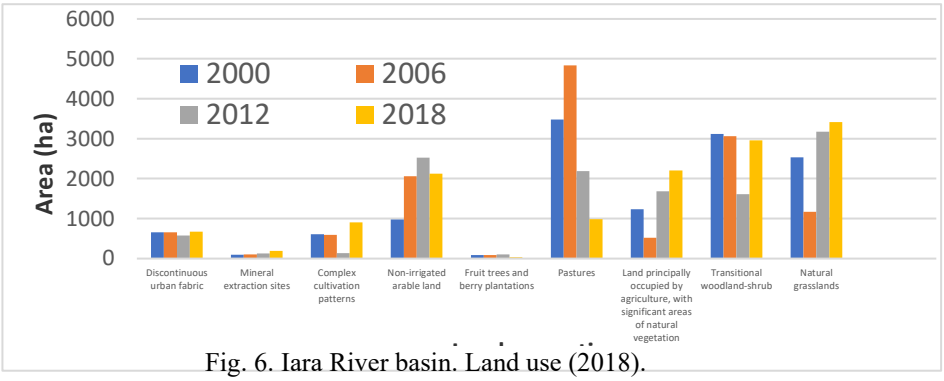

Fig. 6. Iara River basin. Land use (2018).

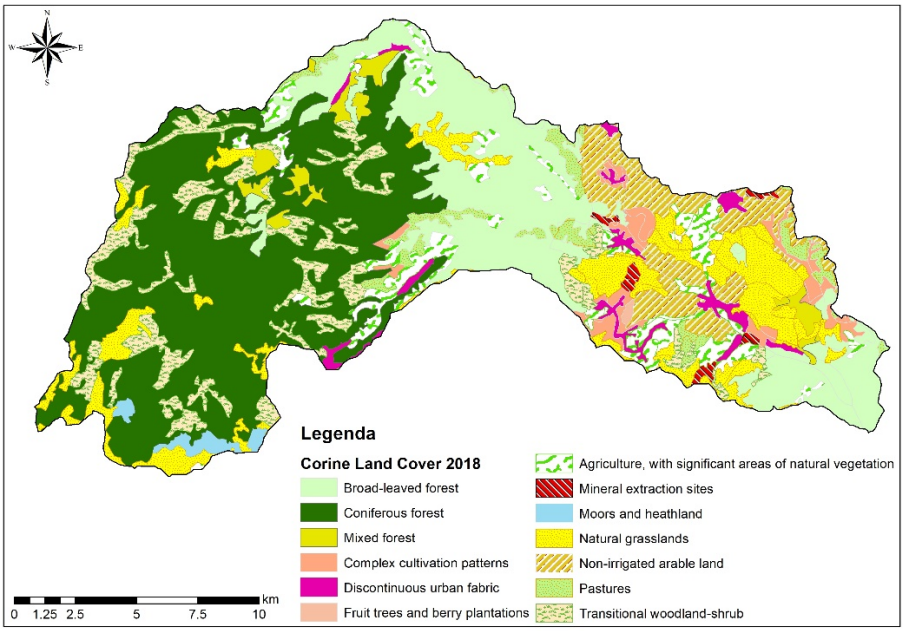

Fig. 7. Iara River basin. Land use map (2018).

Spatially the most variegated land use can be observed in the Iara depression this is due to the fact that here we find the most significant anthropical influence on the landscape. Mineral extraction sites alongside huge arable lands (Fig. 7) are clearly the most exposed areas to erosion and general land degradation. Here also the slope values and the geological/lithological characteristics are predisposed to contemporary geomorphological processes (Rus et al., 2018), which are one of the most important sources of degraded lands (69 hectares of area affected by landslides, over 100 ravines and significant gully erosion).

From the analysis of the active processes map (Fig. 8) it can be observed that most of the degraded lands from the researched area are identified in the perimeter of the Iara Depression (in Iara and Băișoara localities). This aspect is explicable due to the conformation of the relief from the Iara Depression, which allowed the development of numerous economic activities, with a major impact on land degradation (eg: tailings dumps, tailings ponds - resulting from mining and quarrying, etc.).

Considering the fact that, at present, there is only one quarry for the exploitation of industrial dacite in Băișoara, we hope that the share of degraded lands in the area subject to research will decrease. We mention that, for the degraded lands, the measures of their protection and conservation will be taken gradually.

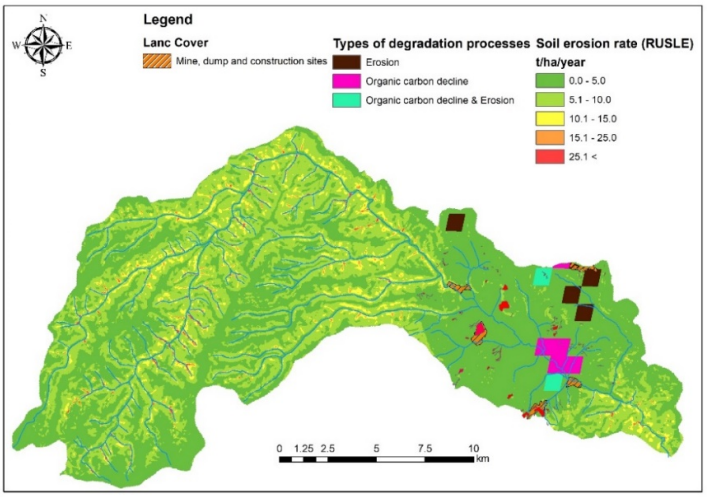

Fig. 8 Soil erosion (RUSLE) and land degradation processes (ESDAC)

From the analysis of the geomorphological map (Fig. 9) it can be seen that the eastern part of the researched area, respectively the Iara Depression represents the most affected perimeter in terms of degraded lands (through landslides, ravines, tailings dumps and ponds settling, and last but not least through agro-terraces, resulting from agricultural activities).

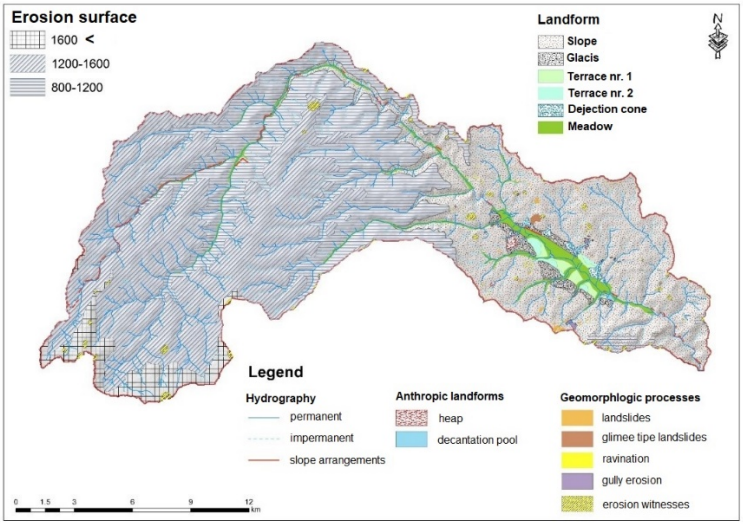

Fig. 9. Iara River basin. Geomorphological map

4. CONCLUSIONS

The Iara River basin can be considered a former mining area (mining and extraction of subsoil resources - in quarry or underground - being the main field of economic activity until 1996), and, as a consequence of this aspect, can be identified numerous degraded lands (especially in the Iara Depression, tailings dumps, tailings ponds and agro-terraces being the evidence of this aspect). Another anthropic factor that generated numerous degraded lands in the territory under analysis is represented by deforestation, which affected the areas within the communes of Băișoara and Valea Ierii (in the perimeter under analysis, severe floods took place over time, more precisely in 1977 and 2005, in Valea Ierii locality-later, dam and protection works were carried out on the banks of the Iara River - in Valea Ierii locality and upstream on the tributaries of the mountainous area of the Iara River). If the degraded lands mentioned above had as a generating factor the human, anthropic activity, developed over time, there were also natural factors, which contributed to the degradation of the lands (geological substrate, composed of Lower Eocene striped clays - which led at the appearance of landslides, of ravines - in the Iara Depression).

In support of identifying degraded lands within the river basin of the river Iara were: ArcGis software, Hammond, CLC 2000, CLC 2012 and CLC 2018, orthophoto plans, geological maps, topographic maps, numerous field trips to confront the reality on the ground, consulting a bibliographies and similar specialized studies, focused on other regions, etc.

We mention that some of the degraded lands (respectively tailings dumps and former ore mining locations) can be introduced in the tourist circuits, but for this approach it is necessary previously the action of greening and conservation of these degraded lands. A similar model of reconversion (economic, from mining to tourism) was made in the region of Upper Silesia and, we believe, that model can be implemented within the river basin of the river Iara.

As a general idea, at present, the economic activities carried out in the Iara River basin are in a period of transition, from the extractive industry of local resources (carried out with intensity until 1996, in many locations in the area subject to research, and at present only in a single point, in Băișoara - industrial dacite exploitation) towards economic activities mainly from the tertiary field (tourism and related services, trade, etc.). We mention that, at a low level (family level and small associations), agriculture is also practiced, respectively animal breeding. Thus, a closer analysis of this economic trend, it can be concluded that in the U.A.Ts in the Iara River basin, less polluting economic activities are carried out and, implicitly, the share of degraded lands will decrease.

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