Babeş-Bolyai University, Cluj Napoca
THE INSTITUTE OF DOCTORAL STUDIES

Morphometric and risk assessment of mountain trails in the Gurghiu Mountains for the purpose of pursuing sport and leisure activities (moto adventure, 4x4 adventure, mountain bike)

Summary

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Keywords
Adventure tourism, off-road vehicles (ORVs), mountain trails, risk classes, difficulty of mountain trails.

Synthesis

Summary:

1. General Aspects

1.1. Purpose and objectives of the thesis

Modern tourism is constantly changing and adapting to the technical evolution of today's highly technologically advanced society. With the emergence and accessibility of the general public to the modern means of travel, a new category of tourists, namely those who use ORVs (off-road vehicles), appeared especially in the last 10-20 years. This explosion of the last few years of the niche tourism segment, which is extremely low in our country, consisting of Moto Adventure, 4x4 adventure and Mountain Bike, whose deployment is now largely chaotic and too little monitored and regulated, which can lead a negative impact on the environment.

In this way, there is a need for the existence of rules and, above all, of the tools necessary for the safe development of both the human factor involved and the minimal impact that this activity may have on the ecosystems in which it takes place. This work is an instrument for covering this instrumental vacuum in developing these types of adventure tourism through ORVs.

The use of these risk and difficulty classes for ORVs as well as the low-value investment needed to create virtual platforms as the main tools in these types of activities opens a multitude of practical applications of this study through the possibility of creating specific maps of applications for smartphones, roadbooks for racing rally races, etc.

1.2. Geographical location of the Gurghiu Mountains, geographical characteristics of the area under study as a factor favoring the practice of analyzed adventure sports, geographical boundaries and regionalization

The Gurghiu Mountains are part of the Western Carpathian chain and are placed in the Moldavian - Transylvanian Carpathians. The Gurghiu Mountains are situated between the Mureş Gorge, to the north, and the Sicaş Pass (Lebanon), at the beginning of Târnava Mare, in the south.

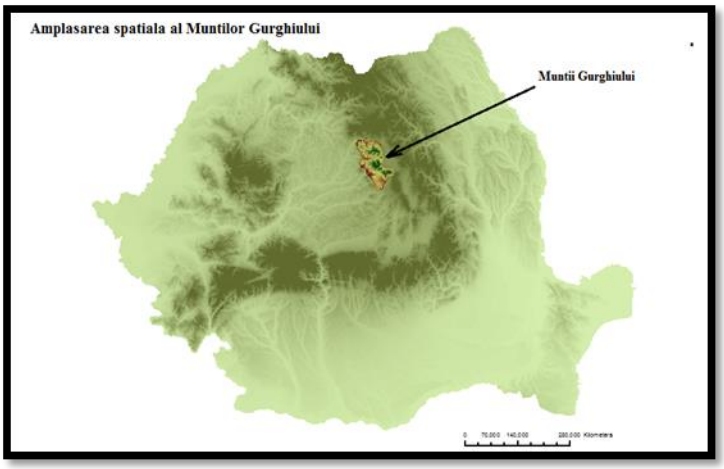

Fig.1 The spatial location of the Gurghiu Mountains Fig.2 Geographical region of the Gurghiu Mountains

1.3. Areas of interest from the point of view of infrastructure in the Gurghiu Mountains

Analyzing the specifications of the types of tourism studied, such as moto adventure, 4x4 adventure and moutain bike, the technical and logistical needs of the practice of these types of tourism have to be taken into account. In this way, in the case of the Gurghiu Mountains, the orientation and structuring of the tourist routes must take into account, and at the same time depend to a great extent, the existing infrastructure, which leads to the creation of tourist "lines", which basically connect the areas with accommodation and services near the Gurghiu Mountains by the objectives represented by the natural potential of the trails.

Thus, in the analyzed area, we identified the following 7 polygons (Fig. 3), which have tourist accommodation capacities or areas with more or less complete tourist infrastructure, but with an infrastructure that allows basic camps or sports competitions.

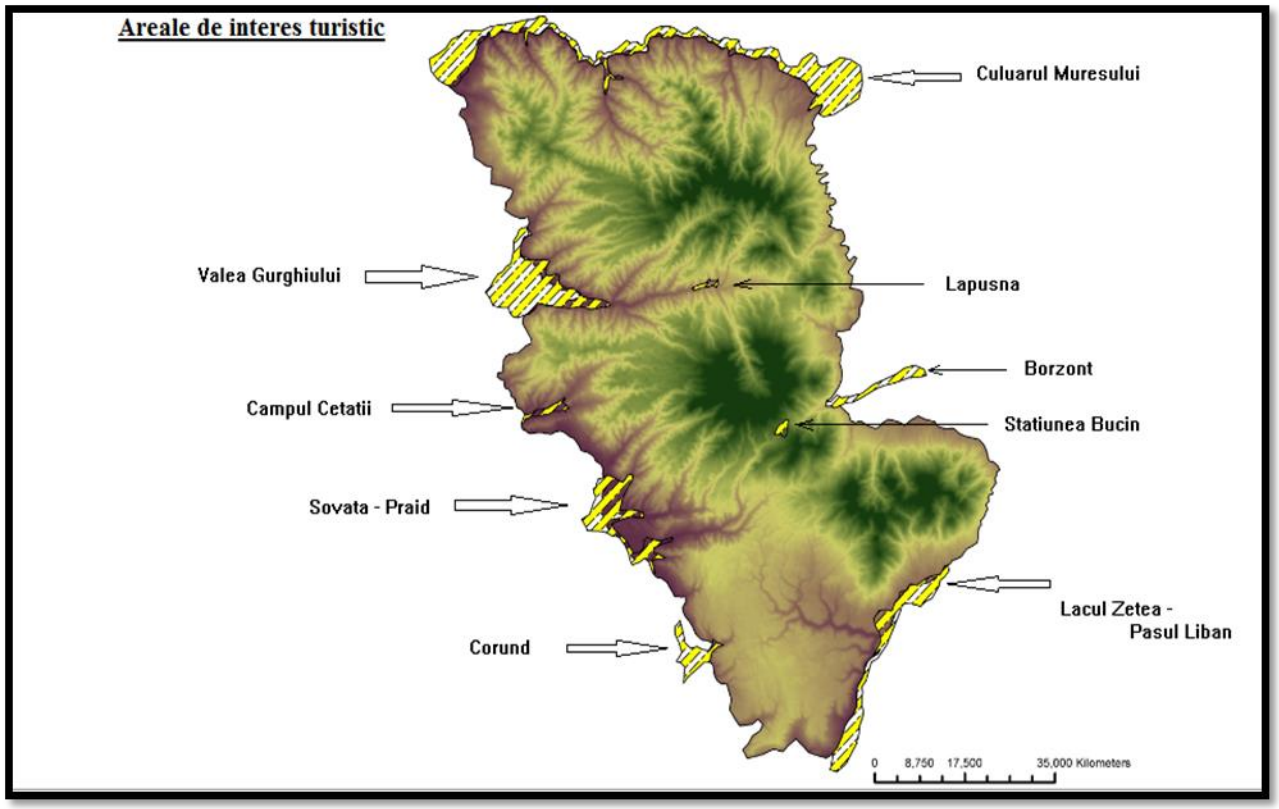

Fig.3 Areas of touristic interest of the Gurghiu Mountains

2. The notion of touristic capitalization, the touristic potential of the volcanic relief in the Gurghiu Mountains.

In order to identify the opportunities for the development of these recreational activities, we take into consideration the following field of analysis in terms of tourist exploration of the Gurghiu Mountains related to adventure sports:

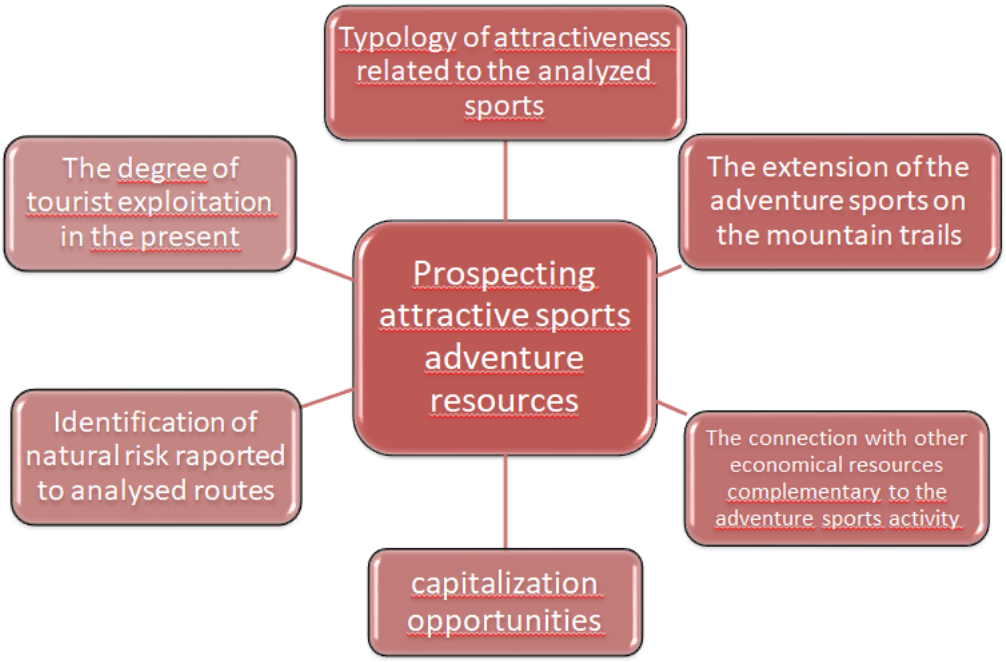

Fig.4 Field of analysis in terms of tourist prospecting

3. Natural risks and use of G.I.S. in order to evaluate the mountain trails. Criteria for determining degrees of difficulty - Analysis of current tourist routes and the potential given by the use of GIS in the mapping of new routes; the risks of current routes.

Establishing new tourist routes through G.P.S. receiver by the owner are made in field trips with G.P.S. (Garmin 62S). After the field data collection, was followed the transfer and conversion of these data into GI S compatible programs.

3.1. The natural risks that current routes are exposed to

Taking into account the geomorphological specificity of the studied area and the morphometry and geology of the Gurghiu Mountains as well as of the climatic zone, we distinguish the following categories of risks which directly influence the current tourist routes analyzed in this study: natural hazards and risks of anthropogenic origin. Risks of natural origin are represented by geomorphological risks, climatic risks, geomorphology and pedology, and the presence of macrophages along mountain routes.

4. Criteria taken into account in the evaluation of the moto and 4x4 adventure and moutainbike routes: - Criterion given by the morphometry of the relief :, Criterion given by the nature of the running surfaces of the trails, Criterion given by the climatic factors

4.1 Criterion given by relief morphometry

The slopes along the trails; the slope as a limiting factor is accentuated by the presence of low-adhesion runways (unstable rocks, large diameter rocks, moisture-affected soil), which emphasizes the influence of the slopes surfaces on the degree of difficulty of framing a route.

Thus we encounter the following degrees of slope difficulty:

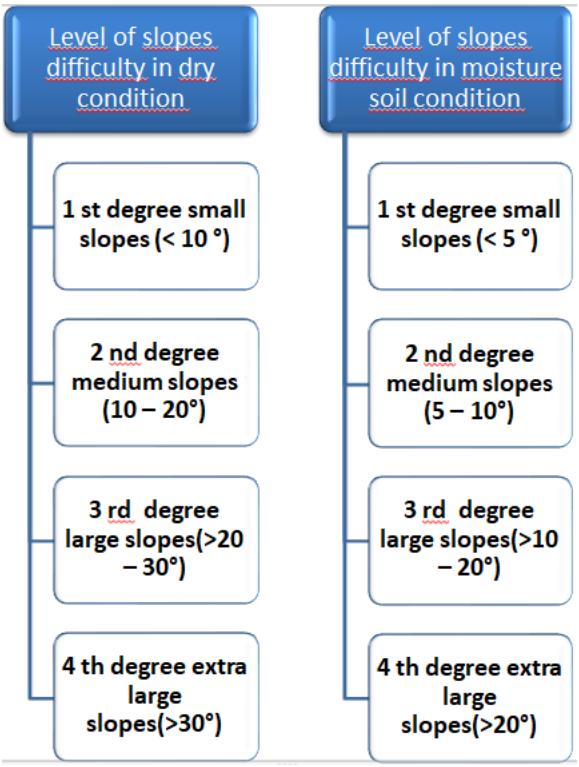

Fig.5 Level of slopes difficulty in dry and moisture soil conditions

It is the most sensitive parameter in finalizing the difficulty classes of the analyzed routes because it directly changes the most important coefficient that influences the safety of running on the mountain routes to these categories (ORVs and mountain biking), especially adhesion. We can also say that the degree of adhesion of a route is one of the main limiting factors of access to a touristic route to these classes. Of course, adhesion is primarily influenced by the nature of running surfaces, but we can not reduce it to these criteria only because other external factors such as weather, morphological, anthropic ones, etc. are involved.

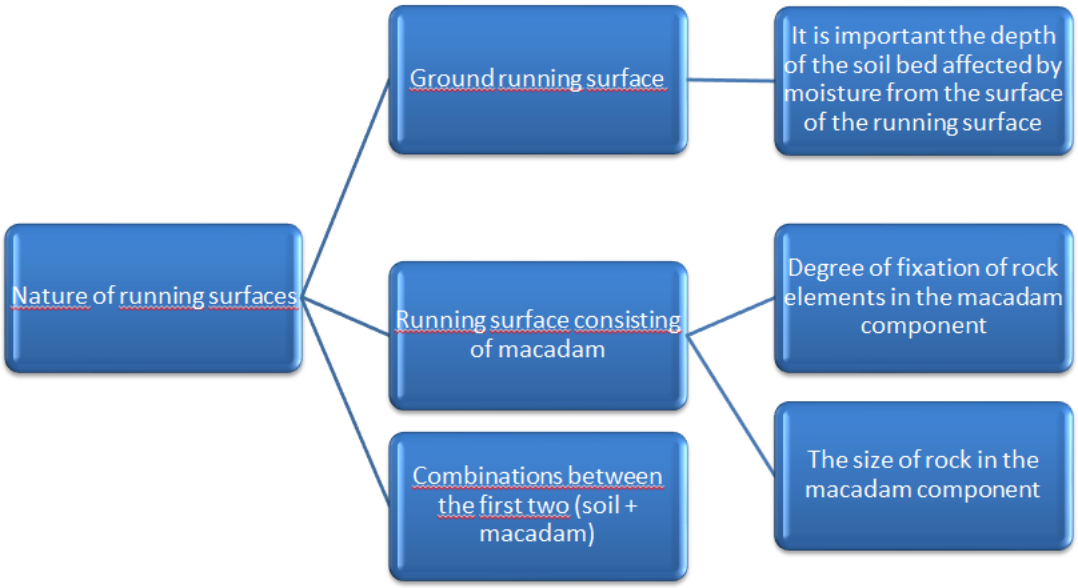

Fig.6 Characteristics to be considered in the assessment of running surfaces

We therefore observe the following 3 types of running surface:

a. running surface made of soil in the moto adventure and mountainbike class:

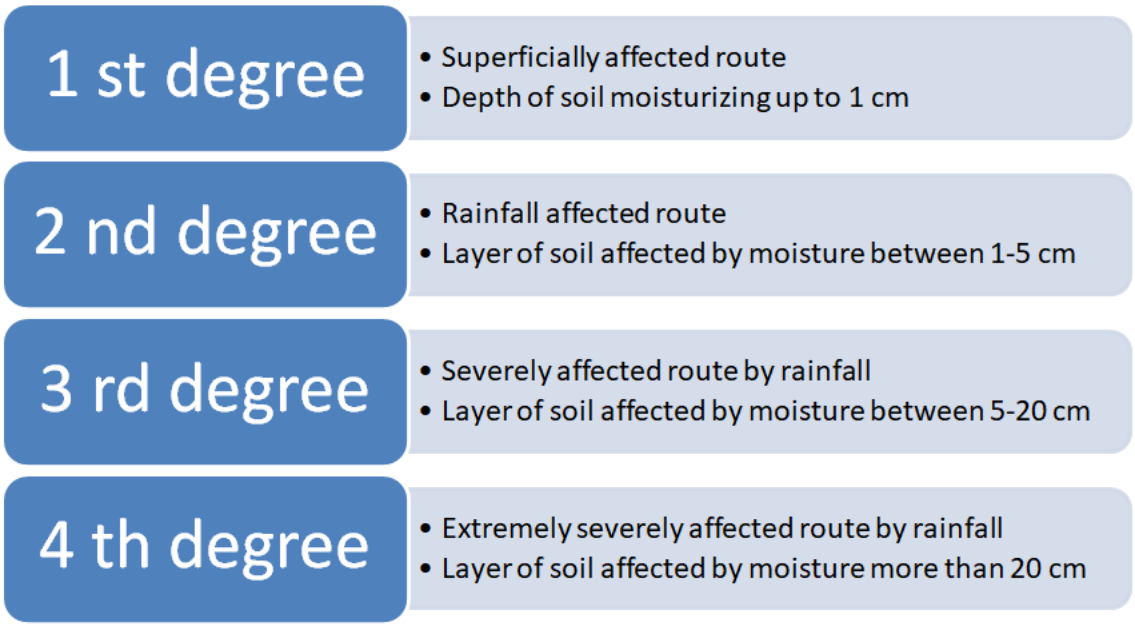

Fig. 7 Difficulty degree of running surfaces made of soil according to their moisturizing level, moto adventure class and mountain bike

The percentage of influence on adherence relative to the analyzed sports differs between the two-wheel and the four-wheel classes so that in the 4x4 adventure class we have a whole different fit because of the 4-wheel drive and increased adhesion / stability / weights.
Gradients of difficulty in the 4x4 class running surface:

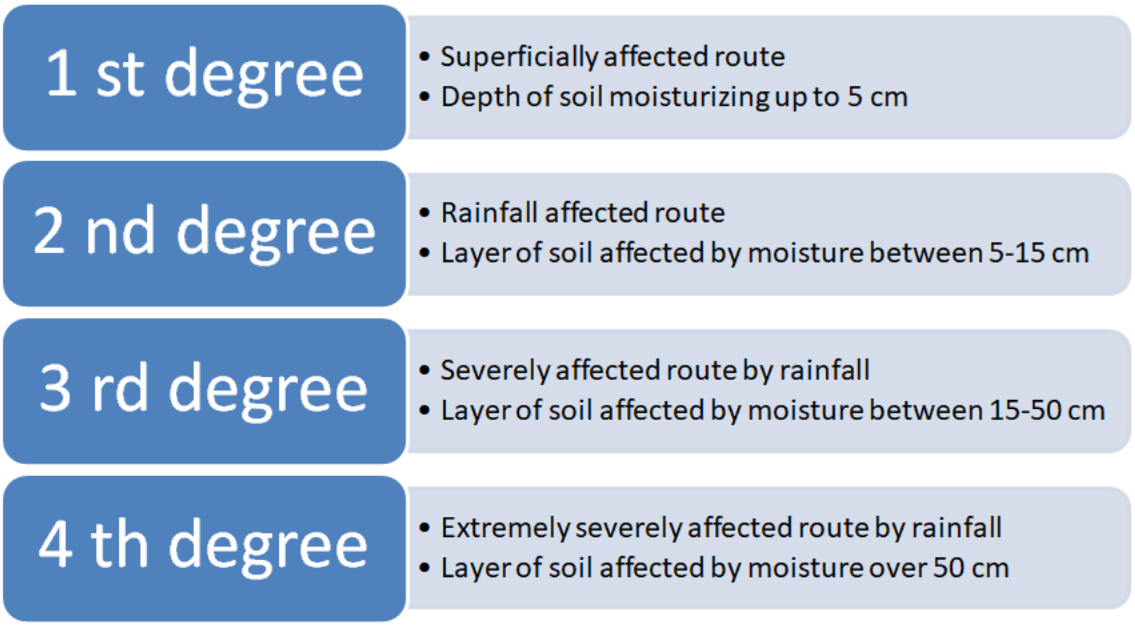

Fig. 8 Difficulty degree of running surfaces made of soil according to their moisturizing level, 4x4 adventure class

b. Routes showing the running surface consisting of rock fragments (macadam forest roads)

The most important aspect to be observed for the quality of the macadam is the degree of attachment of the rock fragments entering the rolling surface composition and secondly the dimensions of these fragments. Also, based on our experience and field practice, we issued the following classifications:

Classification of the degree of fixation of elements composed of rock fragments of macadam:

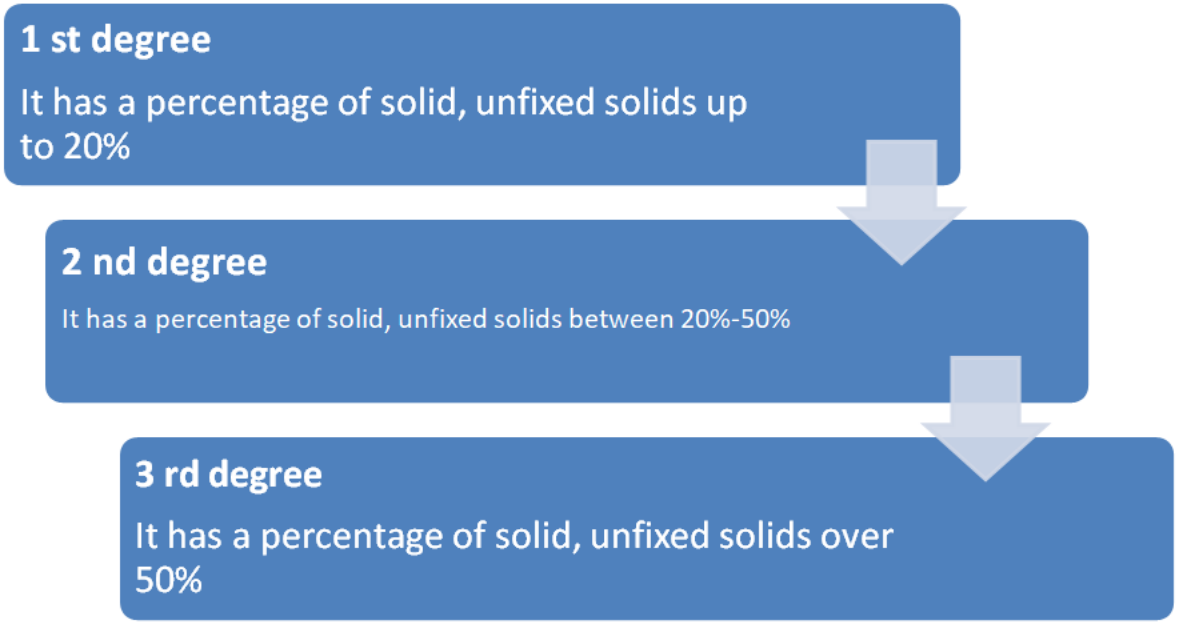

Fig. 9 The degree of fixation of elements composed of rock fragments of macadam

From the point of view of the diameters of the rocks into the macadam composition we have the following degrees:

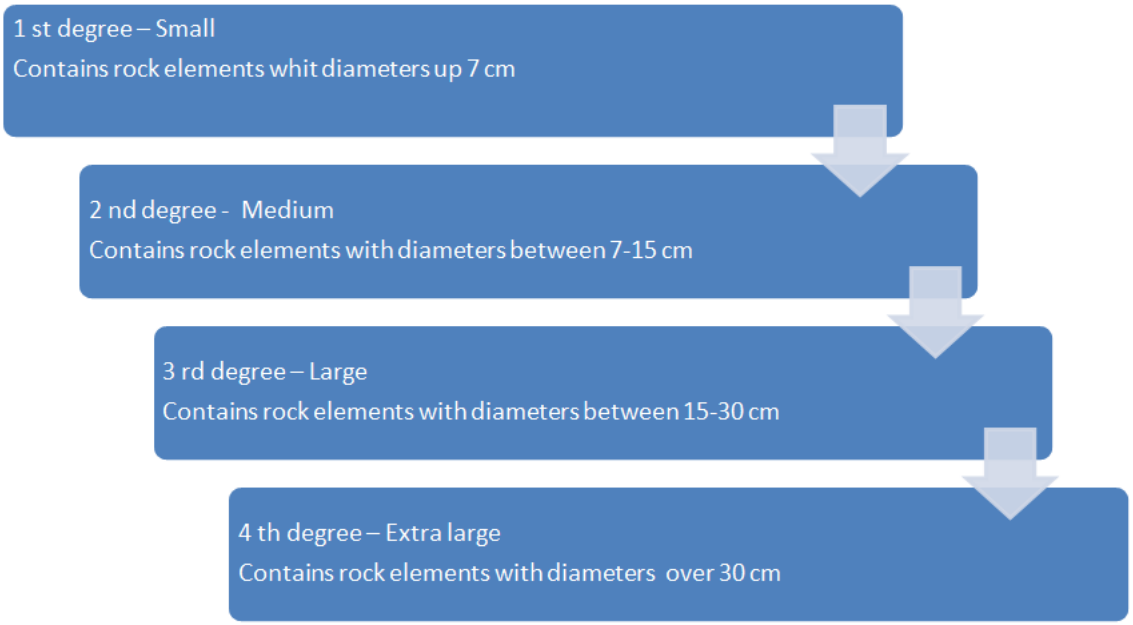

Fig. 10 Grades of risk due to the size of component parts of running surfaces made of macadam

Special frames:

Due to the complexity of the relief, a special category is the case where we encounter running surfaces made up of the soil containing unfixed rock elements.

5. Use of GIS in the mapping and analysis of mountain trails according to the specificity of moto-adventure, 4x4 adventure, moutain bike - Moto Adventure routes, 4x4, mountainbike.

In the extended form of the paper in this chapter is analyzed individually through the GIS and Google Earth techniques all the routes identified in the area under analysis in the three classes considered in this study.

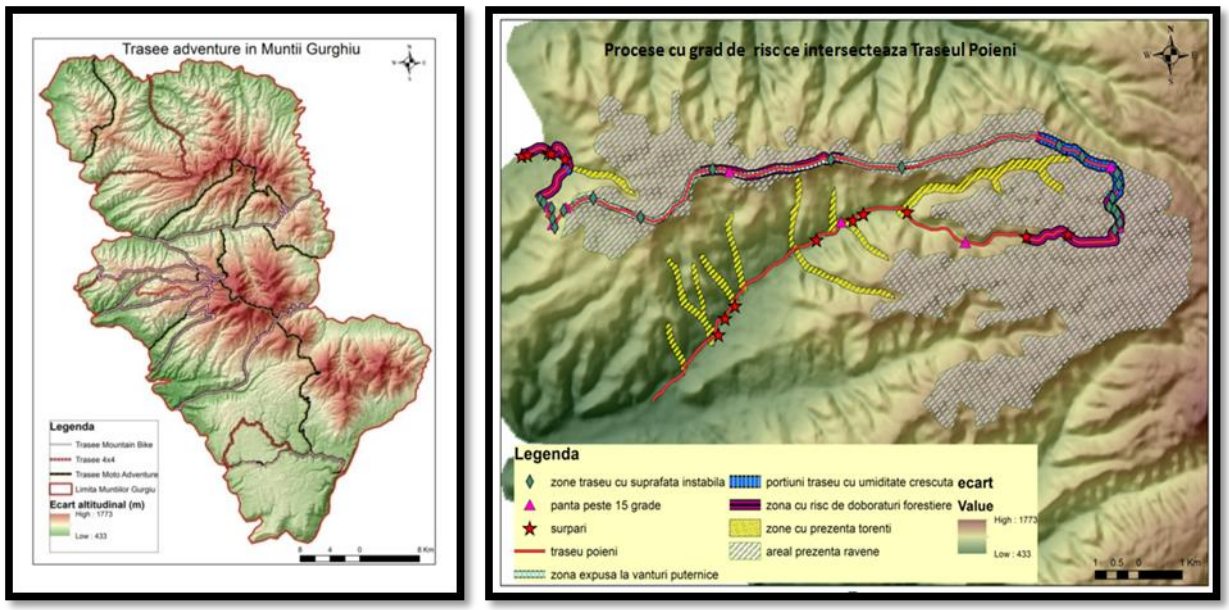

Fig.13 Map of routes dedicated to adventure sports in the Gurghiu Mountains. Fig.14 Risk analysis

6. Quantification of natural risks on mountain routes

The biggest impact in the evolution of the sloping geometry is the mass movement processes, landslides, crashes, spills, rock avalanches, devotional flows, etc.

6.1 Weather- climatic risks caused of torrential rains, floods, fog:

In the extended form of the thesis in order to have an image of the climatic specificity of the Gurghiu Mountains and its impact on the adventure sports under study, it was made a detailed analysis of the monthly precipitation quantities, of the days with a snow cover of a year, the thickness of the snow layer, the air temperature, the relative humidity and the monthly average of the days with fog using data from Bucin Meteorological Station, Gurghiu Mountains.

On a brief assessment of the climatic conditions specific to the analyzed area we can say that the Gurghiu Mountains are climate-friendly for the development of the tourist act, in this case the adventure

Referring to the specifics of the study in this paper and to the risk analysis of mountain trails, the main categories of climate risks that influence adventure sports are: violent weather phenomena, heavy rainfall, strong winds, low temperatures, fog, days with snow, the others having a secondary impact.

7. Case study. Analysis of natural and anthropogenic risk factors through G.I.S., mapping and analysis of the Poieni route from the point of practicing adventure sports

I have selected the Poieni route, Gurghiu Mountains trekking trail because it is suitable for all types of adventure tourism analyzed in this thesis moto adventure, 4x4 adventure and moutain bike as well as due to the natural spectacle that we encounter along route.

Fig. 15,16 Spatial development of Poieni route from Gurghiu Mountains

The area traversed by the Poieni route follows immediately after the start the upper course of the Orşova Stream on a hardwood forest vegetation sector followed by the secular beaks Gurghiu, Obârşia and Prislop (fig.45), followed by the Copriana ridge, Brediţel, Tigla, Deniş, on the vegetal floor of spruce (fig.17). The next part of the trail crosses coniferous, mixed and beech forests along the upper course of Nirajul Mare to the tourist village of Câmpul Cetăţii.

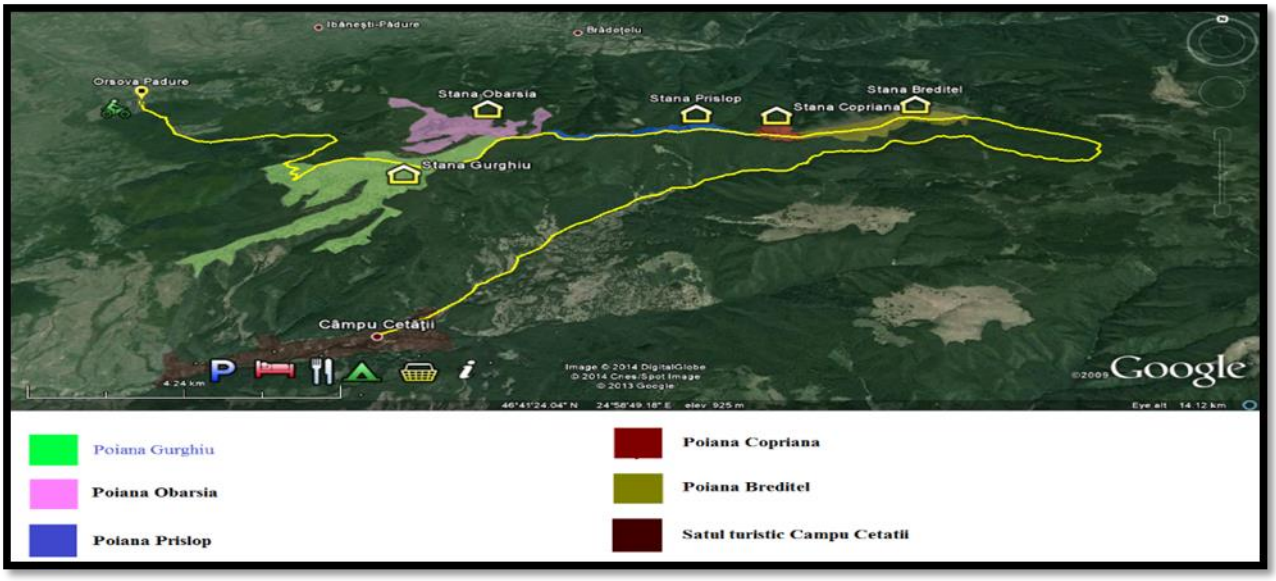

Fig. 17 The poles of the ridge crossed by the Poieni route

The trail has a length of about 32 km and an altitude of about 600 m (Fig.18), passing the specific vegetation floors represented by the deciduous forests, mixed forests, ridge poles with secular beagles, ridges of the ridge situated on the floor of the spruce .

The Poieni trail can be safely traveled within 2 to 4 hours, depending on climatic conditions and riders' experience.

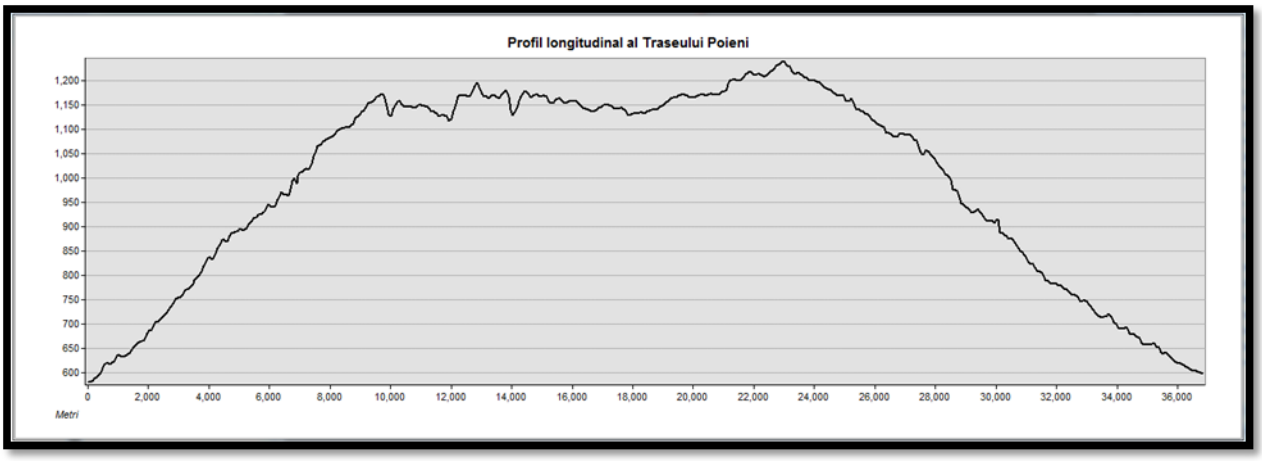

Fig.18 Longitudinal profile of the Poieni route

In the extended form of the thesis we have a thorough analysis of the description of the Poieni route in terms of the use of the route in the rally-raid sports competitions and the creation of the roadbook (moto-adventure class) taking into account that the roadbook is the main instrument navigation of these types of sports competitions.

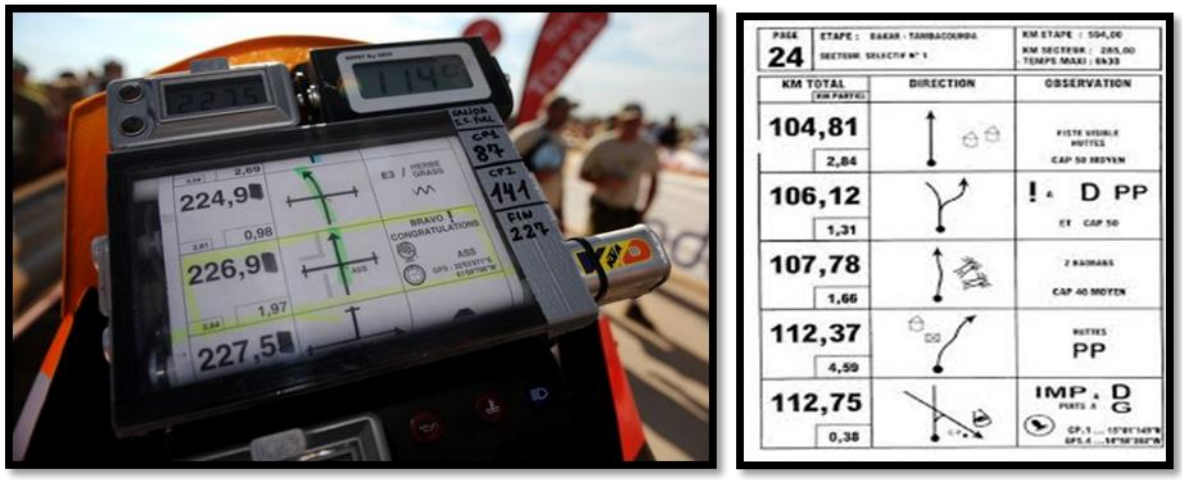

Fig.19,20 Road book and road book graphics in the Moto category, Dakar Rally source

Fig.21,22 Roadbook and graphics in the 4x4 category, the Transsiberia Rally source

As a novelty proposed by this study is the road bookmarking alongside the classical information contained in the road book, the general risk class in which the traveled segment falls, as well as the slope degrees, the degree of fixation of the elements in the composition, of the degree of humidity. In this way riders will be able to manage their race strategies more effectively.

Therefore, the analysis of natural risks in the field and their mapping in G.I.S. allows us to create a new generation of more complex and accurate road books in rendering the peculiarities and specificities of the route of a raid rally.

8. Conclusions

Due to the relatively low level of anthroposis, the Gurghiu Mountains have a huge potential in terms of the tourist exploitation of adventure sports due to relief morphometry, the biogeographic potential represented by the well preserved fauna and vegetation, and the ethnographic features of the area.

This potential, in order to be exploited rationally and efficiently, needs "instruments" specific to the development of the tourist act. We are addressing a niche segment, adventure and sport tourism, in particular moto adventure, 4x4 adventure and moutain bike, where the tourist and tourist-material base fall on a second level, with promotion tools, as well as those related to rider safety and environmental protection. This thesis creates the methodology needed to fill this gap in the literature on the methodology of classifying adventure routes, organizing and grading in these classes.

Therefore, this paper will successfully cover a database for the development of the adventurous travel document by providing comprehensive maps and information on exposure to the natural hazards of adventure trails through G.I.S. necessary for the development of this type of tourism in the Gurghiu Mountains. At the same time, these analyzes will lead to the existence of an accurate computer base for the creation of highly navigable Road Bookbooks. Last but not least, the classifications issued in this study will be the basis for smartphone termination and monitoring applications.

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