Tourist Activities-Disturbance Factors of Natural Environment in Ciucaș Massif

Luminița Costina SĂFTOIU¹, Anca Victorina MUNTEANU

¹ University of Bucharest, Faculty of Geography, No1, N. Bălcescu Avenue, 010041, Bucharest, Romania

Abstract: The study outlines how tourism activities can disturb the natural environment in Ciucaș Massif. Methods used are based on bibliographic research and GIS analysis of morphometric features. Results show that the Ciucaș Massif, as one of the most important mountain in central Romania, is made of conglomerates, which lend specific features to topography. Having several natural sights (The Old Ladies Council, The Sphinx of Bratocea, Zăganului Ridge) this massif is declared a protected natural area. The geomorphologic processes: compactions, mudflows, the deepening of tourist paths, rills and gully erosion have a negative impact on the landscape and even on the entire environment, causing erosion and loss of soil and vegetation. Also, the increased number of tourist accommodation facilities and 21 marked tourist trails have resulted in shrinking of forest areas, hayfields and pastures. These numerous changes which occur in this mountain area, lead, in time, to radical, irreversible changes and can affect the local economic development.

Key words: disturbance, tourist activities, tourist infrastructure, environmental impact, Ciucaș Massif.

1. Introduction

The main purpose of tourist activities is the deployment of recreational facilities in an area with tourism potential. Tourist actions, which lead, naturally or consciously, to the degradation of tourist heritage, are represented by the natural disturbance of the surface areas of tourist interest. The effects may be particularly important to all environmental components.

Ciucaș Massif is a mountain region with rich natural resources capitalized by tourist trails, which connect adjacent areas with the high ridge. Uncontrolled use of these paths without special protective arrangements has led, over the time, to a serie of geomorphologic processes, typical for highland area.

The goal of this study is to present the disruptive factors of the natural environment and tourist activities that influence the development and evolution of current geomorphologic processes. The touristic activities cause geomorphologic processes that

¹ Corresponding author: Luminita Costina SĂFTOIU, E-mail: luminitacostina@yahoo.com
lead to strong erosion, which has a negative impact on the environment (vegetation, landscape elements).

The situation in these mountains is similar to other mountainous areas. Therefore, these topics have been discussed and debated thoroughly in the literature (Berkessy, 2007; Ciangă and Dezsi, 2003; Cocean, 2008; Hübl et al. 2002; Eng, Van Pelt, 2010; Gheorghe, 2009; Linc et al., 2011; Marchi et al., 2010; Munteanu 2008, Munteanu et al. 2012; Nedelea et al. 2009; Pandi, 2006; Vlaicu 2010; Voiculescu, 2002, 2009; Voiculescu et al., 2012), which emphasis that kind this type of problems occur in every mountain region and the effect is always the same: the environmental degradation.

2. Methodology of research

In order to analyze this issue, we focused on several works that approach it in various Romanian mountain massifs (Ciangă and Dezsi, 2003) or in other countries’ massifs (Berkessy, 2007; Hübl et al. 2002; Eng, Van Pelt, 2010; Pandi, 2006).

The problems of erosion in Ciucas Massif are similar to those occurring in Bucegi Mountains, where they became more serious after the approval of ropeway installations. It also represents a major problem in the development of different types of tourism (Voiculescu, 2009 et. al; Voiculescu and Vuia, 2004; Voiculescu et al., 2012). Although in the Ciucas Massif we can find attractive characteristics due to the increased negotiability to different structural and lithological typology and to the presence of sloped areas, however we cannot compare it with Bucegi Mountains.

As well as in Piatra Craiului Range, we may discuss about the presence and effects of avalanches on tourist activities debated by several authors (Munteanu, 2008, 2009; Munteanu and Moțoiu, 2006; Munteanu et al. 2012, 2013). These studied processes can be compared with those from Făgăraș Mountains, which were also analyzed by various research topics, including the tourist activities and morphological elements (Gheorghe, 2009; Nedelea and Oprea, 2008, Nedelea et al., 2009; Voiculescu, 2002, 2009 et al) or those focused on Apuseni Mountains (Cocean, 2008; Linc et al., 2011; Vlaicu 2010) about the complex effects of tourist activities on the environment.

Another important input for this study came from some research about the way in which the geomorphologic elements shape the landscape and the effects they have on natural elements or the way they settle along the tourist areas in international literature (Marchi et al., 2012; Raczkowska, 2006; Starkel, 2006;) or in Romania (Munteanu, 2009; Nedelea and Oprea, 2008; Voiculescu, 2009, b; Voiculescu and Vuia, 2004; Vlaicu, 2010).

We have also consulted different materials about the geological and geomorphological elements addressing this area (Ielenicz, 1973, 1982, 1984), as well as information from specialized tourism literature (Niculescu, 1977, 1986).
In order to identify the disruptive factors of the natural environment of the Ciucaș Mts. we used topographic maps (1: 25 000), tourist maps, ortophotoplans and the results of our researches in the field.

The analysis of morphometric maps were made by processing the information from the topographic maps of scale 1: 25 000 (1981). By processing them with Arc GIS 9.3 we came up with some thematic maps: a touristic map and several maps showing the morphodynamic elements. In order to study the factors that influence current evolution, we made use of hypsometric map and gradient map, which were correlated with tourist elements. The information were organized in lists and analyzed.

We also took into consideration the factors related to the distribution of vegetation and the presence of other anthropogenic activities, which contribute to greater degradation of the landscape. The data were correlated with the information collected in the field.

3. Discussions

The Ciucas Massif is a part of the Eastern Carpathians, having great tourist potential and being considered one of the most important mountain massifs in central Romania. It consists predominantly of conglomerates that give a specific residual relief, with many bizarre forms that are very attractive.
Figure 1. Ciucaș Massif. Geographical position.

It is bounded by the valleys of Teleajăn and Buzău to the east, Cheia Depression and Berii Valley, which continues northward to the upper course of Teleajăn River up to Bratocea (1,263 m), beyond which lies Babarunca, the tributary of Târlung River. There, the Zizin and Dâlghiu watersheds are located to the northern boundary (Figure 1). This area is very attractive for tourists, as it has high altitudes, the most outstanding being the Ciucaș Peak (1,954 m).

Tourist activities

Ciucaș Massif is located at the Carpathian Curvature (Figure 1), which causes certain isolation from the Carpathian tourist areas (Făgăraș, Bucegi, and Piatra Craiului). However, the national road DN 1A, in the western part, offers good accessibility, through the Bucharest-Ploiești-Brașov road, which is one of the main access routes. This leads to a growth of tourist activities in the west area and to a stronger impact on the paths starting from these places. The impact is also high for the paths making the connection between the access areas and the various sights: isolated cliffs, peaks, ridges, The Old Ladies Council, the Sphinx of Bratocea, Big Tiglăi and Small Tiglăi, Gropșoarele-Zăganului Ridge, and Bratocea-Ciucaș Ridge.

The most frequent tourist activities occur during weekends. People come for recreational and hiking reasons, because almost all trails are easily accessible, only five trails have areas of great difficulty. Even the cable installations equipment is missing, the mountains are an attractive alternative for those seeking pure nature. Rocky places are good for climbing and in the Red Mountain paragliding can be practiced.

Another form of tourism is mountain biking developed on the forest tracks or along the valleys.

Hiking and tourist trails in Ciucaș Massif

In Ciucaș Massif there are 21 tourist paths (Table 1, Figure 2), with a uniform distribution. Most of them start from peripheral areas and continue to the high ridge, where the most important natural sights lie. The time needed to pass through this trails is medium to low. Their scroll is generally short or medium. Seven of these paths are prohibited during the winter, because of the risk of snow avalanches.

A considerable number of access paths (eleven) are situated on the western side. From Cheia Depression, situated in southeast, the most inhabited territory, start six routes heading to the high area. The Red Mountain chalet (1,288 m) is the highest place accessible by car, being the start for four trails. From Babarunca start two routes: one
from Podul Berii, Bratocea (here goes the ridge route, which continues to the west), and the other one to Tesla bridge.

**Figure 2.** Tourist trails and attractions in Ciucaș Massif.

Through Poiana Stânii, located to the southeast, pass four trails. In the east, there is only one route, which connects the ridges of the curvature side and passes through the Boncuța Corridor. From the Pîrșuca Chalet, situated in the northeast, starts one trail, while from the Dălghiu, situated in the northeast, start two trails.

Six of the routes lead the Ciucaș Chalet (recently renovated and reopened to the public), which is located at the highest altitude (1,690 m), on the southern slope of Chirușca Mount. This location gives it the advantage of being accessible from the Ciucaș peak and from Zăganului Ridge.

The analysis of the marked tourist trails in the Ciucaș Massif shows that they are unevenly spread, most of them being connected to the national road DN1A and fewer to other access roads. The human impact is lower in the areas where the paths are missing, but other economic activities endanger the landscape.

The evolution of current geomorphological processes leads to the destruction of the protected areas within the Natura 2000 network, (OG, 2008). In this context, we must
bring to attention five natural reserves, presented and studied in the literature, totaling an area of 18,104 ha. (Table 2, Figure 2). They give value to the scientific and tourist potential of Ciucaș Massif.

Table 1. Trails used in Ciucaș Massif

<table>
<thead>
<tr>
<th>No</th>
<th>Name of trails</th>
<th>Marking</th>
<th>Time</th>
<th>Difficulty rating</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cheia – Rosu Mount Chalet – Ciucaș Chalet</td>
<td>Yellow stripe</td>
<td>3 – 3,5 hours</td>
<td>Medium</td>
<td>Open all year round</td>
</tr>
<tr>
<td>2</td>
<td>Cheia – Culmea Gropsoarele-Zaganu – La Rascruce - Șaua Chirușca</td>
<td>Red cross</td>
<td>5 – 5,5 hours</td>
<td>Medium, difficult on Gropșoarele-Zăganu</td>
<td>Ban in winter</td>
</tr>
<tr>
<td>3</td>
<td>La Rascruce – Roșu Mount Chalet</td>
<td>Red triangle</td>
<td>2 – 2,5 hours</td>
<td>Medium</td>
<td>Ban in winter</td>
</tr>
<tr>
<td>4</td>
<td>Saua Chirușca – Ciucas Chalet</td>
<td>Red stripe</td>
<td>1,5 – 2 hours</td>
<td>Low</td>
<td>Open all year round</td>
</tr>
<tr>
<td>5</td>
<td>Cheia – Valea Berii – Ciucaș Chalet</td>
<td>Blue cross</td>
<td>3 – 3,5 hours</td>
<td>Low; between Ion Nicolae Pn. - Ciucaș Chalet, Peak difficult</td>
<td>Open all year round</td>
</tr>
<tr>
<td>6</td>
<td>Cheia – Cheile Cheitei – Valea Berii</td>
<td>Blue triangle</td>
<td>1 – 1,5 hours</td>
<td>Low</td>
<td>Open all year round</td>
</tr>
<tr>
<td>7</td>
<td>Muntele Rosu Chalet – Valea Berii</td>
<td>Red dot</td>
<td>1 hour</td>
<td>Low</td>
<td>Open all year round</td>
</tr>
<tr>
<td>8</td>
<td>Ciucaș Chalet - Ciucaș Peak - Culmea Bratocea – Pasul Bratoce</td>
<td>Red stripe</td>
<td>3,5 – 4 hours</td>
<td>Medium, difficult under Colții Bratocei - Ciucaș Peak</td>
<td>Ban in winter</td>
</tr>
<tr>
<td>9</td>
<td>Cheia – Pasul Bratocea</td>
<td>Blue stripe</td>
<td>2,5 – 3 hours</td>
<td>Low</td>
<td>Open all year round</td>
</tr>
<tr>
<td>10</td>
<td>La Rascruce – Valea Pârâului Alb – Poiana Valea Stânei</td>
<td>Blue triangle</td>
<td>2 – 2,5 hours</td>
<td>Medium</td>
<td>Ban in winter</td>
</tr>
<tr>
<td>11</td>
<td>Saua Chirușca – Cheile Văii Stânei – Poiana Valea Stânei</td>
<td>Blue stripe</td>
<td>3 – 3,5 hours</td>
<td>Medium</td>
<td>Ban in winter</td>
</tr>
<tr>
<td>12</td>
<td>Șaua Chirușca – Culmea Văii Stânei – Pasul Boncuta – Tabla Buții</td>
<td>Red stripe</td>
<td>4 – 4,5 hours</td>
<td>Medium</td>
<td>Open all year round</td>
</tr>
<tr>
<td>13</td>
<td>Poiana Valea Stânei – Tabla Buții – Heroes Cemetery</td>
<td>Red cross</td>
<td>2,5 – 3 hours</td>
<td>Low</td>
<td>Open all year round</td>
</tr>
<tr>
<td>14</td>
<td>Poiana Valea Stanei – Culmea Buzaiun - Cheia</td>
<td>Blue stripe</td>
<td>3 – 3,5 hours</td>
<td>Medium</td>
<td>Open all year round</td>
</tr>
<tr>
<td>15</td>
<td>Poiana Valea Stanei – Valea Paraului Sterp – Zaganu Peak</td>
<td>Blue triangle</td>
<td>2 – 2,5 hours</td>
<td>Medium, difficult on Culmea Zăganu</td>
<td>Ban in winter</td>
</tr>
<tr>
<td>16</td>
<td>Ciucaș Peak - Poiana Dalghiului – Vama Buzăului</td>
<td>Red cross</td>
<td>4 – 4,5 hours</td>
<td>Medium, difficult under Ciucaș Peak</td>
<td>Ban in winter</td>
</tr>
<tr>
<td>17</td>
<td>Ciucaș Chalet - Curnătăura Stanei – Valea Strambu – Vama Buzăului</td>
<td>Blue cross</td>
<td>5 – 6 hours</td>
<td>Medium</td>
<td>Open all year round</td>
</tr>
<tr>
<td>18</td>
<td>Ciucaș Chalet - Saua Tigarilor – Poiana Teslei – Podul Teslei</td>
<td>Red cross</td>
<td>5 – 5,5 hours</td>
<td>Medium</td>
<td>Open all year round</td>
</tr>
<tr>
<td>19</td>
<td>Chalet Băbarunca – Teslei Foot</td>
<td>Red stripe</td>
<td>0,5 – 1 hour</td>
<td>Low</td>
<td>Open all year round</td>
</tr>
</tbody>
</table>
Table 2. Protected areas in Ciucas Massif.

<table>
<thead>
<tr>
<th>Nr.</th>
<th>NAME OF PROTECTED AREA</th>
<th>TYPE OF PROTECTED AREA</th>
<th>SURFACE OF PROTECTED AREA / HA</th>
<th>TOTAL SURFACE OF PROTECTED AREA / HA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Area with Rhododendron in Ciucas Massif</td>
<td>Plant protected by law, declared a natural monument</td>
<td>2 ha</td>
<td>18,104 ha</td>
</tr>
<tr>
<td>2</td>
<td>Culmea Zăganului</td>
<td>Botanical and zoological endemic and rare plants</td>
<td>3 ha</td>
<td>&lt;none&gt;</td>
</tr>
<tr>
<td>3</td>
<td>Big Tigaile</td>
<td>Botanical and geological endemic or rare plants, calcicole and thermophilic and specific geological formations</td>
<td>3 ha</td>
<td>&lt;none&gt;</td>
</tr>
<tr>
<td>4</td>
<td>Jneapănul on Mount Bratocea</td>
<td>Plant protected by law</td>
<td>2 ha</td>
<td>&lt;none&gt;</td>
</tr>
<tr>
<td>5</td>
<td>Suvițele Berii</td>
<td>Plant associations with edelweiss</td>
<td>2 ha</td>
<td>&lt;none&gt;</td>
</tr>
</tbody>
</table>


Current geomorphologic processes

Geomorphologic processes and tourist activities lead to the degradation of the natural environment, which has resulted in radical changes. The negative impact on the landscape diminishes considerably the chance of development in the areas with a real natural and anthropogenic tourist potential.

The main factors contributing to the environment disruption

Geological elements are important tourist attractions, such as sverela isolated rocks: The Old Ladies Council, The Sphinx of Bratocea, The Dove, and The Tower of Goliath. They have different resistance to complex types of agents and the manifestation of current processes (Vlaicu, 2010). This fact is highlighted by the way how the geology and human activities have shaped the relief. The high area, at over 1,400 m, consists of Albian conglomerates (Middle Cretaceous), made up of sandy limestone covered by gravel and rounded fragments of limestone, sandstones, gneisses and crystalline schist, which explain the high altitudes and the typical landscape that attracts tourists. At the base of conglomerates are found reef limestone, as in the case of Mount Tesla.

The increased permeability facilitates water infiltration that leads to a high erosion of the substrate. Negative effects also appear in the areas where forest vegetation is missing and the substrate has been left without protection. In the middle part (1,100-1,200 m), we find sandstones alternating with marls and marly shale belonging to Lower Cretaceous, which have a lower resistance. At the bottom, there are marly shale
(Upper Cretaceous), and massive sandstones (Albian) that can be easily shaped (Niculescu, 1977).

In general, the items of geological consistency are prone to erosion. Therefore, tourist paths have gradually deepened in time. Hypsometry (Figure 3) shows a circular distribution of the relief structure presenting the general aspects of Ciukaș Mountains. Closely linked to these, is the strong connection between them and the tourist attractions, as well as the footpaths. The most important natural sights increase with altitude, but one can observe a decrease in the number of paths and in hypsometric surfaces. The upper part lying above 1,800 m is only 0.9% of the total area and corresponds to the highest peaks: Zăganu (1,817 m), Gropșoarele (1,883 m), Bratocea (1,862 m), and Ciukaș (1,954 m, the highest peak).

The second level, between 1,600-1,800 m, represents 6% and separates two high areas: Zăganu- Gropșoarele, with the Red Mountain to the west, as well as Stânceasa and Albele, to the east; and the Bratocea-Tigăile Mici and Tigăile Mari-Ciukaș-with an extension to the north, to Colții Nitrii. It highlights through its presence the most natural sights.

The next level between 1,400-1,600 m is covered by forest vegetation and occupies an area of 13%, which is at the basis of the previous level, the areas being connected through Chirușca; in the north we encounter Urlătoarea Mountain, in the east the Stâna Peak and in the west Tesla and Dungu. The paths that reach toward the tourist attractions lying in the upper part follow the ridges, joining them at these altitudes.

The level of 1,200-1,400 m accounts for 20% and links the main ridge with the western one that ends in Bratocea Pass (1,263 m), in Grohotîș Mountains.

Altitudes between 1,200-1,000 m are the most widespread-35% circling the ridges of the previous levels missing only in Bratocea Ridge to the west. It is the one that has the densest tourist paths.

The lower hypsometric level, between 800-1,000 m with a 25% percentage is better spread to the north, northeast, southwest, south, and southeast and less prevalent in the west. It is the most accessible, having the highest density of roads, channelled in particular along the hydrographic network.

The general orientation of the ridges is NE-SW for Bratocea-Ciukaș, with extension to NE-E-Urlătoarea, Strâmbu and Tesla-Dungu and Zaganu -Gropșoarele is N-S. There are secondary peaks and ridges towards all directions, the most important being the one that connects transversely SE-NW three heights trough Chirușca, Tigăilor, Teslei and extends to the east with the Valea Stânei Peak. Another morphodynamic element with a significant importance in the spread of tourist activities, as well as in the current processes is the slope aspect.

Insolation is a decisive factor in the development of tourism, especially in the mountainous areas generally colder, because, more often are preferred bright, heated
areas, with southern, South-eastern or western exposure. Due to this feature, here one can find the most important access points from the periphery toward the massif: Cheia, Valea Stânii, Babarunca chalet and Red Mountain chalet.

Figure 3. Hyposometryc Map of Ciucas Masiff

If we analyse the slope exposure of Ciucăș Mountains the eight categories of slope exposure have values of 10% to Southward and 14% to Easter and Western, grouped in following structure (Figure 4):
- sunny slopes (with southern and south-eastern aspect) have the lowest percentage-22%; they have the most significant comfort level and in the places where there is no vegetation the reflection factor is high; in general are more spread on Bratocea, Zaganu, Tesla (on the lower ridge) and on the secondary ridges that stem from other major peaks;
Figure 4. Orientation of slopes Map in Ciucas Massif

- **Semi-sunny slopes** (*south-western and eastern*) have a high percentage-27% and a broader expansion in the ridges stemming from Zăganului Peak, on the eastern side of Bratocea Ridge and the left slope of the Gârcinului Valley;  
- **Semi-shady slopes** (*north-eastern and western*) account for a high percentage-27%, and are more common in the north, on top of the Bratocea-Ciucas, Tesla-Dungu and Cămâșii ridges, and on the secondary slopes of Zăgan;  
- **Shady slopes** (*north-western and northern*) have a lower percentage-24%; these areas, where high moisture encourages current geomorphologic processes, have a negative impact on tourist activities. Here, the snow persists longer than in other areas. These
slopes are better represented in the northern part, at the extremities of the massif, under the Ciucăș, Bratocea, Albele and Câmășii peaks.

Insolation has a great impact on the rock disintegration processes, while south and southeast insolation contributes to avalanches. Snow melting is faster in sunny and semi-sunny areas, which fosters selective erosion.

By analysing the declivity map of Ciucăș Massif (figure 5) it can be observed that the most significant processes occur on the tourist trails that follow the slopes with values greater than 20 degrees. Most of the sights are found in areas with high declivity, a favourable condition for the development of the current processes. The analysis of gradient values shows that those over 60° and between 40 and 60° are least present, accounting for only 0.1 % to 3%; these can be found on the steepest mountains. The values between 30° and 40° represent 14% and all are found in areas with structural and lithological cliffs. Those between 30° and 40° and between 20° and 30°, which account for 26% occupy the second place in the gradient distribution of Ciucăș Massif. All these values are found around the main tourist attractions and on the most trodden paths. These areas are in the category of those who are affected by morphodynamic processes (gravitational processes like collapses and avalanches, as well as erosion processes).

Extreme events like heavy rainfalls in a short period of time and avalanches can quickly lead to the degradation of the area. The gradients between 10° and 20° are the most popular, representing 38%. They can be found around the peaks, of the upper area, along the connection ridges between the main peaks and in areas with deposits on their base. The lowest values (below 10°) are found in erosion areas and depressions, such as the Cheia Depression, Valea Stânii glade, Dălghiu glade and peripheral territories. Slope gradient strongly depends on fragmentation, which is given by the presence of hydrographic network, extremely widespread in spite of the fact that many streams run dry.

The values higher than 400 m on the Ciucăș and on the Zăganului – Gropșoarele ridges and over 800 m (Ielenicz, 1984) are responsible for terrain features, as well as for the significant morphodynamic potential, mirrored by the susceptibility to current geomorphologic processes.

These morphodynamic aspects offer a preview of the tourist potential of Ciucăș Massif and of its special landscapes. Another important element for the study area is the presence or absence of vegetation, which can have positive or negative effects.

All the morphodynamic factors of the Ciucăș Massif and the relations that exist between them influence other factors, as well as the geomorphologic processes and tourist infrastructure.
Examples of wasted trails

The development of mountain tourism has multiple effects on the ecosystems, resulting in changing the landscape, through degradation, soil erosion, morphological changes and pollution. These, in turn, lead to a decrease in the original tourist products (Ciăngă and Dezsi, 2003).

One can draw the conclusion that tourist activities in the study area can break down the natural environment. The 21 marked trails were analysed and grouped according to their location and current geomorphologic processes in four categories (Table 3).
Table 3. Types of marked trails (by location) in Ciucaș Massif

<table>
<thead>
<tr>
<th>TYPES OF MARKED TRAILS (by location)</th>
<th>NUMBER TRAILS</th>
<th>CHARACTERISTIC GEOMORPHOLOGICAL PROCESSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Massif limited</td>
<td>6</td>
<td>- Rock falls; rain wash; gullyng, and degradation affecting forest roads; gravitational processes; floods.</td>
</tr>
<tr>
<td>Of link the massif limited - tourist chalets</td>
<td>7</td>
<td>- Deepening and compaction; gully erosion-rills; sheep and cattle paths; gravitational processes.</td>
</tr>
<tr>
<td>Of link tourist chalets - crest</td>
<td>5</td>
<td>- Deepening and compaction; gully erosion-rills; sheep and cattle paths; gravitational; avalanche; rock sliding; mudflows.</td>
</tr>
<tr>
<td>Crest</td>
<td>3</td>
<td>- Avalanche; gravitational; deepening and compaction; mudflows; rock sliding; gully erosion; rills</td>
</tr>
<tr>
<td><strong>Total (nb.)</strong></td>
<td><strong>21</strong></td>
<td></td>
</tr>
</tbody>
</table>

Source: According to the authors’ evaluation.

The analysis of table no. 3 shows that in the first category are the paths at the mountain base, of which six are affected by mountain creeps, rill erosion, gullies (that lead to the degradation of forest roads) and floods. These offer accessibility to the inner part of the massif. Some of these paths are located in the valleys and along the forest roads, which are strongly degraded and have no facilities.

The second category is represented by the connection trails (e.g. the base of the massif-chalets), which are 7 in number along which there are processes of deepening and settling-torrential erosion (ditch) and gravitational processes-sheep and cattle trails. Most of them gradually pass from the forest to the grasslands, where chalets are located. Many of these grasslands are used for grazing and this is the reason why the density of the paths is higher.

The third category consists of those trails that connect the chalets to the ridges, which are five in number and are affected by specific processes like deepening and torrential erosion (ditch), sheep and cattle trails and gravitational processes-avalanches, detritus, mudflows.

The last category consists in three trails, which follow the two main peaks, Bratocea-Tigăile-Ciucas, Gropșoarele-Zăganu and also the third one which links them, passing through Chirușca. The presence in this area of the most important natural sights has led to a growth of gravitational processes such as avalanches, dynamic detritus, mudflow and the appearance of channels on these trails.

The one following the Bratocea ridge is marked with a red stripe; it starts from Bratocea Pass (1,263 m), and continues westwards, connecting with Predeluț in Pitch over Babes Mountain. The first part, which follows a forest road, is degraded, especially at the crossing of grasslands toward a sheep shelter. It continues with degraded windings and reaches the peak, after crossing forests and pastures. It passes through
Bratocei Sphinx and The Dove, then the grasslands furrowed by torrential streams, acting like avalanche corridors. On the high ridge, it deepens into the substrate. Then, it heads for Tigăile Mici, Bratocea Peak, Tigăilor Saddle, orienting itself towards Ciucas Peak, Big Tigăile, Chirușca Mountain, Chirușca Saddle, Albele Peak, Valea Stânei Peak, and Boncuța, and farther to Tabla Buții (Figure 6).

**Figure 6.** Intensification of vertical erosion.

The Gropșoarele-Zăganu ridge, although not the very high, is spectacular and attracts many tourists, especially in Red Mountain, where lies the chalet bearing the same name. Rhododendron (a protected plant in Red Mountain) pickers created a new trail network, which enhanced mudflows, compaction and the general degradation of the landscape. These paths are similar to those produced by grazing, the difference being that first ones occur both in the areas where rhododendron grows and in the grasslands that are found in-between (Figure 7).

The path between Tigăilor Saddle and Babarunca connects the secondary peaks with the western limit. Along it, there are areas prone to avalanches, as in the case of the high section, on both sides of the isolated cliffs (for instance, the Tower of Goliath). We can also find debris deposits on the route. From Teslei Saddle start two paths, the one that descends the ridge and ends up in Babarunca valley is affected in its last part by deforestation and road works.

The deforestations made centuries ago at the upper part of the forest in order to expand grass areas have increased the risk of avalanches (this habit is still practiced today by burning vegetation). The strongly steeped surfaces are either bare or covered by pastures. Along the narrow gullies avalanches may occur, which is why many paths are closed in winter.
The trails found in the areas where sheep are grazed (for instance, around the Zăganu sheep shelter and on Bratocea Ridge) are very compacted. These sheep paths can be seen, not only around sheep shelters but also over the grasslands. Therefore, the erosion is high (Figure 8).

The deforestations made centuries ago at the upper part of the forest in order to expand grass areas have increased the risk of avalanches (this habit is still practiced today by burning vegetation). The strongly inclined surfaces are either bare or covered by pastures. Along the narrow gullies avalanches may occur, which is why many paths are closed in winter. The trails found in the areas where sheep are grazed (for instance, around the Zăganu sheep shelter and on Bratocea Ridge) are very compacted. These sheep paths can be seen, not only around sheep shelters but also over the grasslands. Therefore, the erosion is high (Figure 8).

The permanent sheep shelters are situated in lower areas because at higher altitudes the water is missing.

So, cattle shift between the high pastures and the shelters, which affect not only the entire landscape, but also the tourist activities. Indirectly, the springs are places of tourist attraction (a representative spring is the Nicolae Ion Well in the Berii Valley), because they provide drinking water for people and animals, and therefore around them erosion processes are very intense.
Figure 8. Increased erosion and high avalanche risk after grazing and deforestation.

Also, along the routes that follow forest roads, typical forms of deepening occur, some of them getting deeper with every new rain. Here, gravitational processes are also present: flanks affected by rock falls and landslides.

Conclusions
Tourist activities in this massif are carried out along the trails with medium to low difficulty. This indicates a permanent tourist influence that encourages the current geomorphologic processes and leads to environment degradation.

It is advisable to develop special roads, to execute path maintenance works, and to reduce grazing activities and deforestation; plant gathering should be diminished or even banned completely. The grazing areas must be changed each year, in order to leave the old ones to recover. Last, but not least, people must be encouraged to practice ecological tourism, cycling and marathon.

References

112
Internationale Forschungsgesellschaft Interpraevent, Schriftenreihe 1, Handbuch 1, Klagenfurt.


25. Vlaicu, M., 2010), Aspects regarding the resistance to erosion of the rocks from valea iadului drainage basin, Analele Universitatii din Oradea – Seria Geografie, Tom XX, no. 1, p. 58-64.