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DOCTORAL THESIS

(Summary)

COLOR
BRAN - RUCĂR - DRAGOSLAVELE
Study of applied geomorphology

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CONTENTS

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INTRODUCTION

The geomorphological literature on the Bran - Rucar - Dragoslavele Corridor is relatively vast and diverse, including in particular fundamental research aspects devoted to the deciphering of tectono-structural supports, polycyclic modeling, relief typology, denudational morphogenesis, reflection of the morphological component in the landscape, etc.

Taking into account recent trends in the literature on the geomorphology of mountain areas, more and more directed towards the research of recent morphodynamics and its impact on the functionality and quality of the environment as a whole (implicitly mountain), we start the present study by formulating the following *working hypothesis*: *Are there in the morphology and morphodynamics of the Bran - Rucăr - Dragoslavele corridor novel aspects, not investigated in previous researches, whose topicality and practical importance urgently demand their approach from another perspective?*

The conclusion that we have reached and that we intend to argue through the present study is an affirmative one since, at present, research on the geomorphological dimension of this mountain area should be oriented (in our opinion) mainly towards more pragmatic approaches that better emphasize the resource function of the relief and also the main threats and opportunities that operate in relation to the geomorphological component of the territorial system.

Consequently, the *overall objective of* the present approach is to *develop an applied geomorphology study* that will bring to the fore the functional values of the relief, namely how they could be optimally managed and valorized so as to generate a favorable feedback on the overall state of the territorial system from a socio-economic and cultural point of view.

The main argument that led us to the present study originates from the premise that the key geographical role of the Bran - Rucar - Dragoslavele Corridor, that of an intrinsic structural and functional axis of the Carpathian space with crucial importance for the adjacent areas, is constantly redefined according to the increasingly diversified and intense social command, consequently, this functional metamorphosis requires a more pragmatic approach in terms of approaching change in general. Recent processes such as the increasing degree of urban renewal in the corridor, land-use changes, in particular those resulting from changes in ownership status, administrative transformations, changes in land use, expansion of roads, etc., in addition to the natural aspects of landscape change, progress or diversification, they have also brought with them a certain territorial vulnerability, both of a biophysical nature (relief morphodynamics, river regime and interaction with the substrate, biological exploitation of the landscape, etc.)

and of a socio-economic nature (due to demographic decline, pressure on space, etc.). The increase in territorial vulnerability naturally calls for detailed, practical studies on land stability, the flooding of settlements, the safety of communication routes and other aspects, including an objective assessment of the natural hazards at the origin of these phenomena and the associated risks. This is all the more necessary as there are as yet no more extensive studies of an applied nature for the geographical unit which is the subject of the present study.

Another argument of a motivational nature derives from the fact that a perceptual change is becoming more and more evident among the local population and visitors alike, with a clear increase in interest in the values of natural and cultural tourism heritage. In addition to their traditional function as a tourist 'attraction', they are increasingly being identified not only as vectors of economic success but also as unusual ways of broadening individual horizons and gaining new cultural and spiritual experiences. In this context, it is very important to re-evaluate the relief as a tourist resource and, as a matter of priority, to draw up an inventory of all the categories of geosites that can considerably enhance the tourist function of the area.

The present approach aims, as a preamble, to update and enhance the knowledge acquired through regional geomorphological research focused on the classical directions of relief analysis from the perspective of fundamental knowledge (morphography, morphometry, morphogenesis and morphodynamics). *The preliminary picture, absolutely indispensable even at the risk of accepting some inherent redundancies of content, is significantly completed with new, pragmatic results* obtained by including analytical models of applied geomorphology on the mountain space under investigation.

In this context, we considered it opportune to summarize the results of the existing reference works in the local literature (in the first two chapters), complemented with numerous additional information included in the newly created, complex geographic and geomorphological database, stored in both vector and raster format, with easy, immediate access. The third chapter contains methodological considerations.

The second part of the study (chapters 4 and 5) contains a series of *novel elements* that highlight original personal contributions through the interpretation in GIS environment of some applied geomorphology issues that complement beneficially, in our opinion, the pre-existing knowledge about the geographical space of the Bran - Rucar - Dragoslavele Corridor. The substantiation of the original personal contribution, implicitly the argumentation of the working hypothesis from which we started, had in view the formulation and satisfaction of several *subsidiary objectives*, subordinated to the general objective of the thesis, such as:

1. Investigation of *morphodynamic potential* and *geomorphological risk*

Investigation of the *morphodynamic potential of* the relief in GIS environment, by correlating some physical characteristics (geodeclivity, lithology and altitude as hypsometric interval) with other natural and/or anthropic/anthropic features (related to land cover/land use) in order to delimit areas with a certain morphodynamic potential, by elaborating individualized maps by types or groups of geomorphological processes. The processes with high potential for manifestation, characteristic of the mountain area studied are: *torrentiality and runoff associated with surface scouring, snow and solifluction,* gelation *disaggregation, slump-rostogolitic collapse*, *alluvial accumulation in streambeds and siltation.* Added to these are *karstification*, which is ubiquitous in all environmental conditions, and rare *landslides* that develop over small areas.

The geomorphologic risk investigation is conceived as an analysis by translating into GIS environment the formula officially adopted by UNISDR (United Nations Office for Disaster Risk Reduction): Risk = Hazard * Vulnerability. For geomorphological risk assessment, hazard was defined by means of the morphodynamic potential (hazard-generating processes) and vulnerability by the qualitative and spatial assessment of the economic damage that could be produced. In this way, the most representative anthropogenic elements (urban areas, traffic routes and land with different categories of use) also become the most vulnerable.

2. Investigation of *morpho-hydric hazards* and *risks*

In order to spatially delimit the areas affected by rainfall runoff, the USLE (Universal Soil Loss Equation) model was applied to analyze the *susceptibility of the land to surface erosion*. The result of the quantitative analysis was the mean annual rate of surface soil erosion in tons/hectare.

The investigation of the *hydrological risk* was carried out through a case study that involved hydraulic modeling in the 1% flood band, in order to assess the financial risk for roads, land and related real estate structures subject to flood hazard in the sector of the Turcu River (Moieciu) between the hydrometric station Tohanu Nou and the upstream of the locality Moieciu de Sus, with a length of 20401 m. The case study carried out for this risk category will address the economic interests (including tourism) of the local communities involved, which are likely to be affected by the uncontrolled increase in building density towards the axis of the valley, especially in the last 3 decades.

3. *Inventorying, selection, evaluation, hierarchical and spatial distribution of geomorphosites, paleontological geosites and archaeospeosites* in the Transcarpathian corridor studied, according to a methodology adapted to the particularities of this relief subunit.

4. To formulate concrete planning and development proposals for the optimal management of the implications generated by the morphodynamics and morphology of the relief within the territorial complex.

We appreciate that the results provided by the deepening of the above-mentioned objectives, related to the present applied geomorphology study, will constitute a useful fund of information and recommendations for decision-makers with administrative responsibilities in public institutions in order to support planning-management and spatial planning decisions aimed at the appropriate management of geomorphic and morpho-hydric hazards and risks, of the resource values of the relief in the context of improving the structure and attractiveness of the region's tourist products, environmental protection, biodiversity conservation, etc.

GEOGRAPHICAL INDIVIDUALITY OF THE CORRIDOR BRAN - RUCĂR - DRAGOSLAVELE

Geographical location and boundaries of the Bran - Rucar - Dragoslavele Corridor

Concerning the geographical settlement of the Bran - Rucar - Dragoslavele Corridor (or Bran - Dragoslavele Corridor), in the specialized literature, two spatial classifications have been recorded and argued in the area of the Romanian Carpathian crown:

1. In the treatise entitled "Geografia României III. The Romanian Carpathians and the Transylvanian Depression", published by the Editura Academiei R. S. R. R. in 1987, the Carpathian relief subunit of the Bran - Rucar - Dragoslavele corridor (Velcea V. and Savu, 1982) is included in the physical-geographical unit of the Bucegi - Piatra Craiului Mountains of the Southern Carpathians. "Between the Iezer, Leaota, Bucegi and Piatra Craiului massifs there is a lower compartment, with majestic peaks, long summits and curves that frequently exceed 1100 m, but also with strongly encrusted valleys, with basins that insinuate themselves down to the base of the mountain, with pastoral settlements that are scattered on the interfluves and grouped in valleys" (Velcea V., Geografia României III, 1987, p. 255).

2. In the work entitled "The relief units of Romania I. Southern Carpathians and Banat Mountains" (Badea et al., 2001), the Carpathian relief sub-unit Culoarul Bran - Dragoslavele is included in the relief unit Munții Bucegi - Leaota (group of mountains): "Enclosed between the Piatra Craiului Mountains to the north-northwest, the Bucegi Massif and the Leaota Mountains to the southeast, and running NE - SV, the Bran - Dragoslavele Corridor extends over a length of 30 km and widths of 3 - 10 km" (Badea et al., 2001, p. 20). In the same paper it is stated that the Bucegi - Leaota Mountains are separated from the "Făgăraș - Iezer Mountains group by the Bran - Dragoslavele transversal corridor, an obvious discontinuity space, which connects the intramontane Depression of Brasov and the subcarpathian one of Câmpulung". At the same time it is emphasized that "due to their geomorphologic and geographic characteristics in general, the Bucegi - Leaota Mountains (together with the mentioned corridor) make the transition to the Eastern Carpathians, and their appearance is due to the Mesozoic sedimentary cover and structural units arranged SV - NE and vertically offset. ... On the other hand, the corridor presents enough common features with the Bucegii and the Leaota and, in spite of their lower heights, can be attached to them in the eastern group of the Southern Carpathians" (Badea et al., 2001, p. 12).

With regard to the names recorded in the geographical literature, the transverse depressional corridor belonging to the Southern Carpathians to which we refer, in addition to the two established names mentioned above, has also been named as: Platforma pliocenă (Martonne, 1907 and 1981 - translation into lb. Romanian), platforma brăneană (Orghidan, 1936), Ulucul Branului (Constantinescu, 1942), culoarul Bran - Rucar (Nedelcu and Dragomirescu, 1963), culoarul Branului (Mihăilescu, 1963 and 1969), culoarul depresionar Bran - Rucar (Nedelcu, 1965), Platforma Bran (Bârsan, 1969), Culoarul Rucar - Bran (Velcea V., Geografia României I, 1983, p. 607) and the Transcarpathian Corridor Bran - Rucar - Dragoslavele (Pătru I.G., 2001). "Drumul Carului", a homonym for a hamlet of the commune of Moieciu, situated on the hill, along the old medieval road and the present-day road, reinforces the existence and secular perpetuation of the circulation on the road and along the corridor.

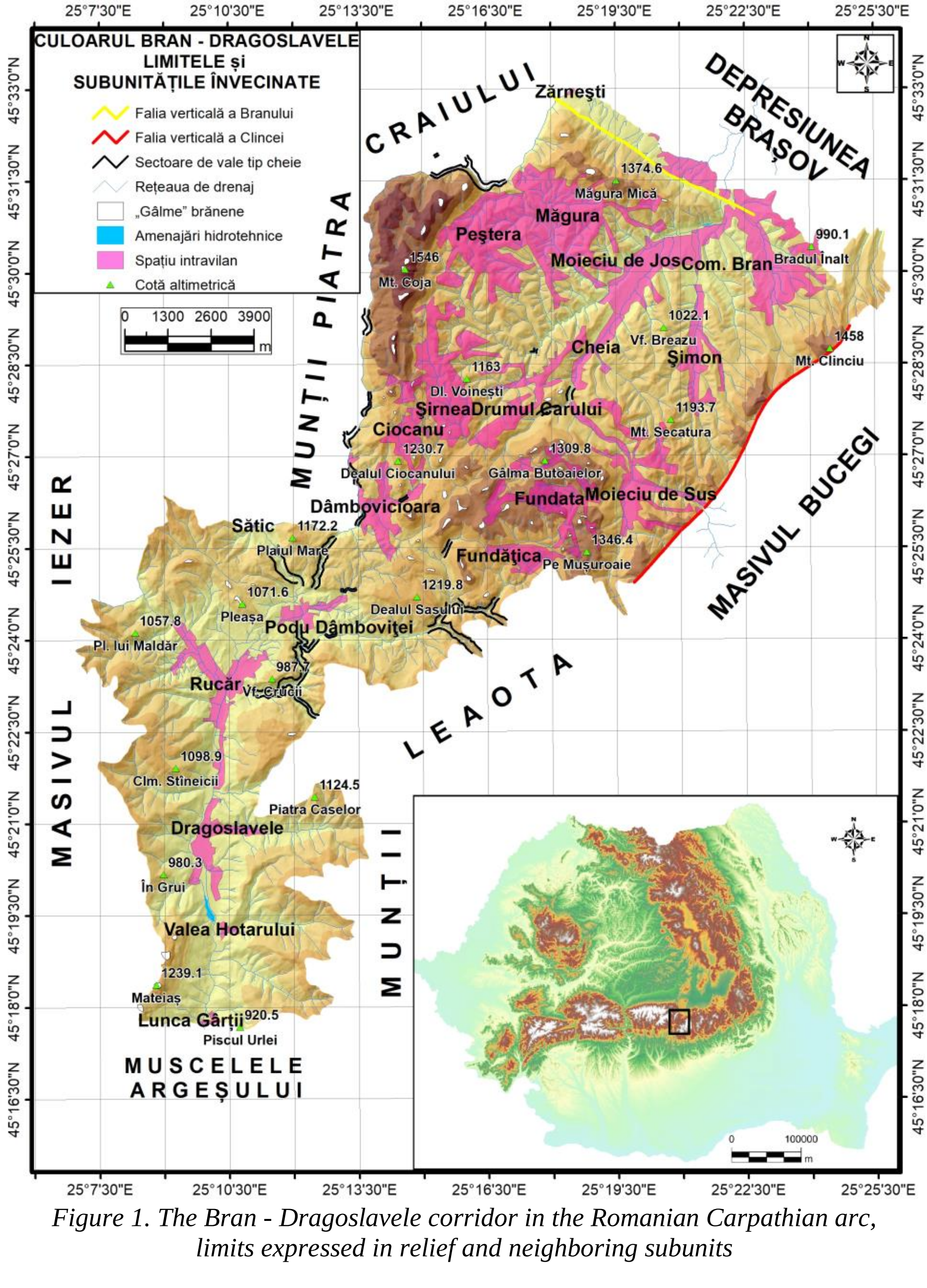


Figure 1. The Bran - Dragoslavele corridor in the Romanian Carpathian arc, limits expressed in relief and neighboring subunits

The boundaries of the Bran - Dragoslavele Corridor (Fig. 1) are generally well expressed in relief and landscape. Between them, the area of the studied relief subunit occupies 262 km², which represents 27.15% of the area of the Bucegi - Leaota Mountains and 0.39% of the area of the Romanian Carpathians.

The corridor, a veritable space of geographical discontinuity, orients its "uluculum" in a NE - SV direction, with a straight length (made up of the segments Bran - Rucar and Rucar - Lunca Gârții) of about 31.5 km. Its width varies from 4,2 km (in the narrow section south of Rucar and between the Dâmbovicioarei Gorge and the Rudărița Valley) to more than 13 km (in the northern section).

Geologic-geomorphologic characteristics

Geological conditions

The lithology of the Bran - Dragoslavele corridor (Fig. 2), according to the geological map of the R.S.R., scale 1:50000, sheets 110a Bârsa Fierului, 110b Zărnești, 110c Rucăr, 110d Moeciu and 128a Câmpulung Muscel, is represented by the following formations:

a. *The crystalline formations*, representative both for the neighboring massifs (Leaota, Bucegi and Piatra Craiului) and for the corridor bedrock, are constituted in two series: the Leaota Series (Călușu - Tămășel Complex and Lerești - Tămaș Complex) and the Cumpăna Series (Voinești - Păpușa area).

b. The *sedimentary cover* is represented by:

- *Jurassic formations*, corresponding to the Bajocian, Callovian, Oxfordian, Kimmeridgian and Tithonian stages. The most widespread Jurassic formations are the massive and benched Upper Jurassic massive and benched white limestones, which in some cases show sedimentary continuity up to the Lower Cretaceous (Valanginian). Numerous olistoliths, mostly composed of tithonic limestones, are disseminated mainly in the northern sector of the corridor (Maasurian Ridge - Dietrich's Rock);

- *The Lower Cretaceous formations* are represented mainly by the "Dâmbovicioara marls" (with cephalopods) of Neocomian (Hauterivian), Barremian and Lower Aptian (Bedoulian) age, which include the Urgonian facies. Formations of this age, located at the foot of the Bucegi Massif from the northern sector of the corridor, include: lower and middle Bucegi conglomerates, breccias and calcareous conglomerates of the Raciu type. The Coja and Măgurii peaks are partly composed of Gura Râului conglomerates;

- *The Upper Cretaceous formations* are represented by the vraconian sandstones, marls and limestones, but especially by the wide distribution of conglomerates with calcareous brecciated breccia of vraconian - lower cenoan age (Moieciu sector);

- *Paleogene formations* are represented north of the Branului fault, on a narrow strip;

- *The Villafranchian formations* are found in the structure of the Sohodol Piedmont whose horizons of gravels and sands with clay intercalations are arranged on the slopes that constitute the north-western foot of the Bucegi Massif;

- *The undivided Quaternary formations* are represented by deluvial and colluvial deposits of calcareous, conglomeratic and sandy loam nature;

- *Upper Pleistocene formations* include the fluvial terrace deposits along the Dâmbovița rivers (the Podu Dâmbovița Depression and the southern half of the gorge sector), the Turcu, Șimon rivers, and their confluence;

- *The Holocene formations* include: deluvial deposits, small areas with landslides with the possibility of reactivation on the Cenomanian marls of Rucar, deluvio-colluvial, proluvial deposits, as well as fluvial deposits of riverbeds.

The *overall geologic structure* in which the relief of the Bran - Dragoslavele corridor was embedded, among others, was included and recorded under the name "Dâmbovicioara corridor" (Patrulius, 1969). Among its four major structural components, described by geologist Dan Patrulius, two constitute the sub-basement of the relief subunit analyzed in the present research, and a third one, called "Tohan - Râșnov compartment", whose foundation is much lower than that of the "Rucăr - Bran compartment" (located to the south), has conditioned the relief evolution of the Moieciu sector of the Bran - Dragoslavele Corridor from the north. From south to north, the crustal depression that constitutes the above-mentioned geological structure, which is synclinal and oriented SV - NE, is composed of the following components:

- the Dragoslavele compartment, with crystalline bedrock in an elevated position, sharply delimited from the northern compartment by the transverse fault of the Rucar. The crystalline bedrock occurs in most of the compartment, its surface being only sporadically covered by sedimentary patches consisting of the vraconian sandstones of Mount Căpitanului, the kimmeridgian-tythonic limestones of Mount Mateiaș (1239 m) and the conglomerates with calcareous breccia (vraconian-cenomanian) of the Fundul Neagu area at the north-western foot of Mount Vârtoapele;

- The Rucar - Bran compartment, with a lower basement than the one named above, fragmented by numerous faults in its southern part, includes to the west the imposing Piatra Craiului syncline, whose eastern flank (Coja Ridge) is found in the western wing of the central

Moieciu sector of the Bran - Dragoslavele Corridor. This compartment is framed by the transverse faults of Rucar (to the south) and Bran (to the north of the Măgurii Ridge), the latter putting it in contact with the Tohan - Râșnov compartment (much lower) at a difference in level of about 600 - 700 m corresponding to the pitch of the vertical fault of Bran (Patrulius, 1969). In the Rucar - Bran compartment, the crystalline bedrock rarely occurs at daylight, supporting on almost the entire surface thick series of mainly carbonate deposits of Neo-Jurasic-Eocretaceous age, involved in a complex rupural structure. In places, transgressively arranged over limestones, or directly on the surface of the crystalline, there are also significant areas of Neocretaceous sedimentary cover.

Both the crystalline bedrock and the overlying sedimentary formations of the Bran - Dragoslavele Corridor are trapped in plicative tectonic structures such as synclines and anticlines, as well as in rupural structures such as faults, horsts and grabenes, within which tectonic abruptnesses are also found, all of them giving a distinct personality at least to the central sector of the studied relief subunit.

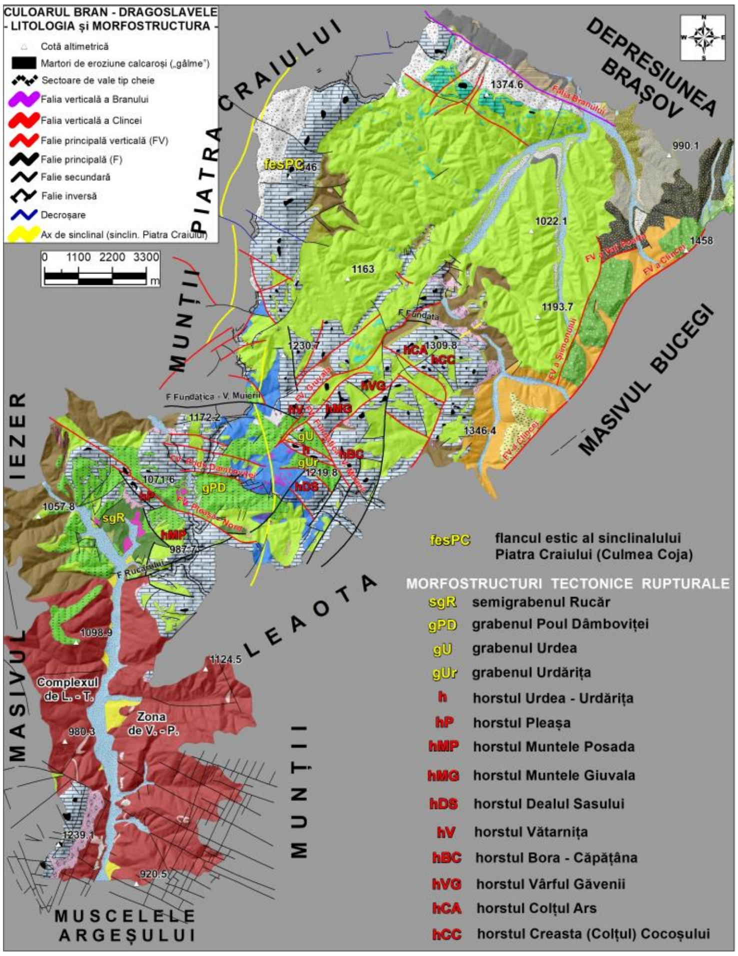
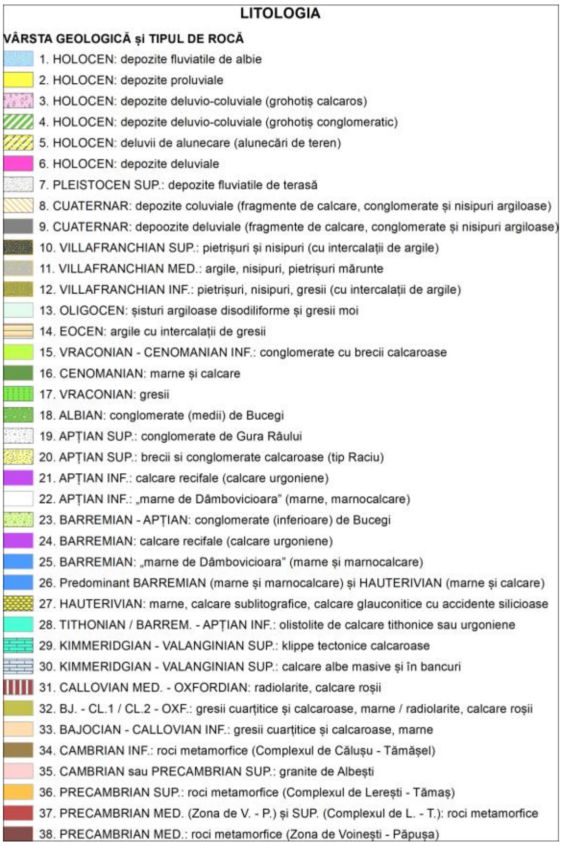


Figure 2. Bran - Dragoslavele corridor - lithology and morphology
(Processing after the Geological Map of the S. S. Romania, scale: 1:50000, 1971 - 1974)



Geomorphological constraints

Seen as a whole, the analyzed relief subunit appears as an area of discontinuity in the Carpathian mountain mass, with a synclinal (uluc) disposition imposed by the geological structural framework of the "Dâmbovicioara corridor", being one of the most representative transverse depressional corridors in the Southern Carpathians, linking the sub-Carpathian Argesian muscels and the Brașov Depression, in fact, between the historical-geographical provinces of Wallachia and Transylvania. The Bran - Dragoslavele corridor is drained by the upper Dâmbovița and Turcu or Moieciu (tributary of the Bârsei), basins with divergent orientation, interconnected on the watershed of the limestone "gullies" area by the Giuvala high pass (1262 m).

Regionalization of the relief of the Bran - Rucar - Dragoslavele Corridor. The physiognomy of the relief is not monotonous over the entire surface of the corridor, which led A. Bârsan (1969) to carry out the first regionalization of the relief, by naming and morphologically describing the "main subdivisions of the platform" (Bârsan, 1969): the Măgura - Peștera - Șirnea complex, the Drumul Carului interfluvium, the Șimon ridge, the Șimon - Poarta ridges, the Fundata platform, and to the northeast of the subunit, the Predeluț and Sohodol platforms. The altitudinal variation, the lithological diversity in which the valleys and interfluves evolved, the numerous rupture accidents that accentuated the fragmentation and slope, as well as the character of the valleys, introduced geological-geomorphological diversity, which is concretized by the highlighting of three divisions of the second order of the relief (Fig. 3), called sectors (Niculescu and Roată, 1995), each with elementary subunits (Ia ... Ic):

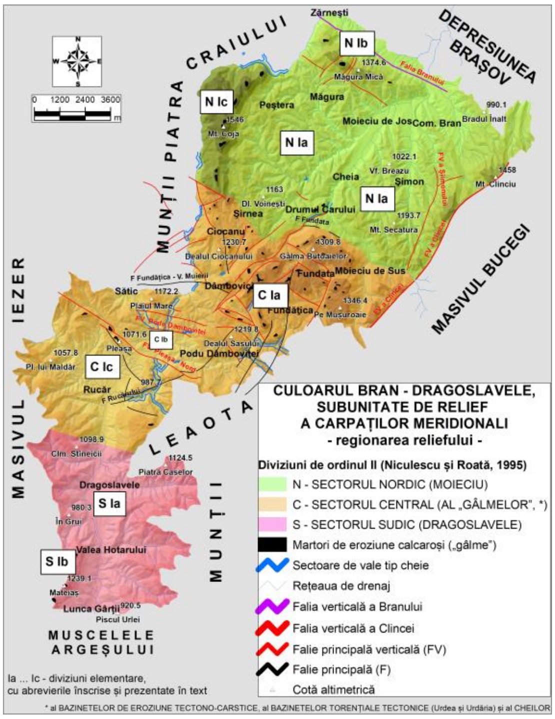


Figure 3. Bran - Dragoslavele corridor, relief regionalization (Source: Niculescu and Roată, 1995, with additions)

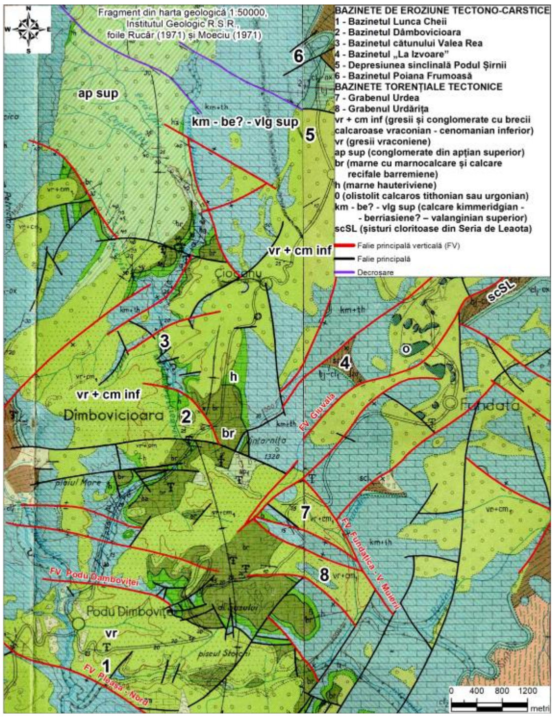


Figure 4. Tectonokarst erosional basins and tectonic torrential basins (Source base map: Geologic map of the R.S.R., scale 1:50000, sheets 110c Rucar L-35-87-C and 110d Moeciu L-35-87-D)

1. Northern sector (N) - *Moieciu*: N Ia. Moieciu erosion level of the Branului Platform; N Ib. Magura Peak (Vf. Magura Mica, 1374.6 m); N Ic. Coja Peak (Coja Mountain, 1546 m)
2. Central sector (C) - *of the "Gâlmelor", tectonokarst erosion basins, tectonic torrential basins (Urdea and Urdărița) and gorges*: C Ia. The subsector of the middle "Gâlmelor" and of the Fundata - Fundățica altitude depression; C Ib. Podu Dâmboviței depression (graben); C Ic. Depression (semigraben) Rucar
3. Southern sector (S) - *Dragoslavele*: S Ia. Dâmbovița gorge sector of the crystalline area, with the Dragoslavele depression (basin); S Ib. Mateiaș Mountain (Vf. Mateiaș, 1239,1 m)

The reflection of structure in morphology e. The sectors that make up the whole relief of the Bran - Dragoslavele corridor are distinct from a morphologic point of view, reflecting lithologic and structural differentiations. They reflect the stepwise descent of the crystalline bedrock towards the Brașov Depression (Patrulius, 1969). The major structural compartments are thus distinguished: Dragoslavele (up to the Rucar fault) and Rucar - Bran (up to the Bran fault), the latter being suspended in relation to the Tohan - Râșnov compartment (located northeast of the corridor boundary), as a consequence of subsessional movements in the Brașov Depression. These negative movements have also influenced the overall relief modeling of the Moieciu sector, so that the erosion levels in the Turcului basin show a much steeper slope (21‰ to the northeast) than those in the Dâmbovița basin (Niculescu and Roată, 1995).

The tectonics of the central part of the Bran - Dragoslavele corridor, complicated by numerous faults developed mainly longitudinally and quasi-transversally, highlights a major plicative structure (the eastern flank of the Piatra Craiului syncline identified in the Coja Ridge, with limestones in the flank of the ridge, emphasized by rounded peaks of the "gâlmă" type, at over 1400 m) and numerous other elementary structural components (Fig. 2 and fig. 4), of which more evident in the landscape are certain synclines, horsturi, grabens, tectono-erosive basins, tectonic abruptnesses and key sectors evolved on faults.

The major structure mentioned above, decrocut, faulted and sunken south of the Fundățica - Valea Muierii fault, can be recognized further south, in the axial zone, in the Sasului and Stoichii Hills (Patrulius, 1969). The western flank of the syncline, strongly straightened, is also visible to the outside of the corridor, in the imposing limestone markers of the Ghimbav Hills (1406.6 m) and Mount Vârtoapele or Piatra Dragoslavelor (1434 m), both in the Leaota Mountains (Murătoreanu, 2009), as well as in Mount Mateiaș (1239 m), at the contact with the Iezer Massif.

Horsturile are constituted as limestone blocks, modeled in the somital part, some of them having a rounded (Vârful Găvenii, 1388.1 m), conical (Vătarnița, 1320.3 m), quasi-horstontal plateau (Dealul Sasului, 1219.8 m) or slightly veiled (plateau Podul Dâmboviței north of the vertical fault of the same name). In the central sector of the corridor, more than 60 erosion markers have been inventoried, such as the *limestone cones on the Giuvala watershed*, called *'gâlme'* by the locals (Orghidan, 1936), or *"dâlme"* (Nedelcu and Dragomirescu, 1963), some of them being small calcareous (kimmeridgian - tithonic) structural masses of the horst type (Colțul Ars, Creasta Cocoșului, Vârful Găvenii, Bora - Căpățâna and so on.a.).

The Grabenele show in relief as deep depressions (Podu Dâmboviței, Rucăr and Urdea) or suspended depressions (Fundata - Fundățica), their common features being related to the sharp marginal contacts (tectonic abruptness, sometimes imposing) and the presence of Cretaceous rock cover in the hearth.

The reflection of the structure in the genesis and evolution of the morpho-hydrographic relief is evidenced by the numerous valley sectors developed along the fault (Niculescu and Roată, 1995), most of the key type valley sectors, especially those in the Dâmbovița basin, being conditioned by the pre-existence of these rupural trajectories (Constantinescu, 2009).

The overall monoclinal structure of the northern sector (Moieciu) differs substantially from that of the central sector of the corridor and is due to the transgressive disposition of the vraconian - Cenomanian conglomeratic sedimentary cover over almost the entire eojurasic - neocretaceous and crystalline edifice. This is the sector in which the erosion levels of the Brahnian surface predominate and in which the structure is inscribed only in the detailed relief forms (Niculescu and Roată, 1995), represented by numerous sedimentary klippe of Tithonic or Urgonian limestones (Patrulius, 1969) depicted as small and isolated massifs, sedimented by conglomerates with calcareous breccia, as well as by the tectonic calcareous tectonic klipps in the central-somital part of the Culm of the Măgurii (Fig. 5).

Figure 5. Vf. Gălbinarei (left) and Vf. Maggura Mica, 1374 m (center-right), isolated tectonic klippic klippage category of massive Neo-Jurassic - Eocretaceous white limestones, overlain and silted by conglomerates of Upper Albian - Cenomanian age

Morphotectonic and morphosculptural relief. This category of relief is well evidenced within the most extensive depressional landforms, represented by the tectono-erozive depressions Podu Dâmboviței, Rucăr and Dragoslavele.

The Podu Dâmboboviței depression at the confluence of the Dâmbovița with the Dâmbovicioara and the Cheii River, oriented NNV - SSE, corresponds to the homonymous graben clearly evidenced by tectonic abruptnesses to the north and south, with heights of 150 - 200 m. At the base of the fault scarps, trains and cones of (partly mobile) grogmatites are exposed. The deposits of poorly cemented vraconian sandstones have allowed the carving of an erosion level at an altitude of 850 - 900 m, well evidenced in the Stoichii Hill (Stoica Peak, 1005.1 m), along the ridge along the DNE 574 road. The deep deepening of the hydrographic network has created the famous epigenetic gorges of the Dâmbovița (Cheia Mare and Cheia Mica) and Dâmbovicioarei in the marginal limestone plateaus, and in the depression it has carved two terrace levels, the upper one at about 25 m and the lower one at 5 - 8 m. The riverbeds are relatively narrow. The large width of the Cheii riverbed within the basin of the same name is striking, which is due to the accumulation before and during the reshaping of its lower course.

The Rucăr depression, at the confluence of the Dâmbovița and Râușorul rivers, corresponds to the homonymous semigraben, delimited by faults only to the northwest, northeast and southeast. To the northeast, the Pleașa-Sud fault delimits it from the Pleașa horst (1071.6 m), a limestone structure separating the Podu Dâmboviței and Rucăr depressions. Within the depression glass, relatively soft and friable Cretaceous deposits (conglomerates, sandstones and marls) arranged in a synclinal structure (Patrulius, 1969) favored the sculpting of the depression. There is a high morphosculptural step (750 - 850 m), represented by rounded shoulders and peaks (Braniște Hill ridge, about 750 - 800 m), into which the Dâmbovița, Râușorul and Roghina rivers have sunk, forming the low step of the depression, represented by their wide riverbeds. Fixed, semi-fixed and mobile deluvio-colluvial deposits have accumulated in the form of a train that stretches from the entire slope of the Pleașa horst towards the depression, and the presence of Cenomanian marls in the summer of the depression represents a potential condition for the production or reactivation of shallow landslides in certain areas.

The Dragoslavele Depression at the confluence of the Dâmbovița and Valea Caselor is also a tectono-erosive depression, modeled in the crystalline schists of the Cumpăna Series (Voinești - Păpușa area), observable to the south and east of the depressional hearth, in contact with those of the Leaota Series (Lerești - Tămaș complex), observable to the north and west of the same hearth. The contact between the two crystalline formations, visible on the geologic map at a scale of 1:50000, is masked in the depressional area by the fluvial deposits of the riverbed and those of the large con terasat at the mouth of the Caselor Valley (a valley whose formation was conditioned by the existence of a longitudinal fault). The contact is marked by the fault (along which the Palaeozoic magmatite outcrops represented by the Albești Granites are visible) to the south-west of the depression, a fault which sinks beneath the sedimentary bedrock, but which most probably cuts through the underlying crystalline formations. This tectonic, structural and lithologic contact certainly conditioned the formation of the structural framework of the Dragoslavele Depression, which was later shaped by the sculpting of the Dâmbovița and Valea Caselor rivers. The large terrace of the Caselor Valley is arranged on two altitudinal steps, the lower one providing favorable conditions for the expansion of part of the Dragoslavele village. The wide and mature Dâmbovița riverbed is well alluviated and along it, at least until the river enters the Subcarpathians (Gârârții riverbed), there are clearly individualized agestre formed at the confluences with well calibrated tributaries (Sceaturei valley - on the right, Hotarului valley and Gârârții riverbed - on the left).

Morfosculptural relief of the gorges. *The Dâmbovița gorge in the mountainous sector south of Rucar* measures approximately 10,5 km between the confluence of the Râușorului and the Dâmbovița River to the north and the locality of Lunca Gârții to the south. It is cut into the crystalline bedrock of the Iezer and Leaota mountains, which gives the relief a relatively monotonous physiognomy, with gentle slopes descending in two or three leveling steps both towards the axis of the valley and towards the subcarpathian region. The overall monotony is interrupted by the appearance in the landscape of the marginal ridges of limestone erosion markers with imposing displays: Mount Mateiaș (1239 m) and Mount Vârtoapele (Piatra Dragoslavelor, 1434 m), fragments of the western flank of the hanging syncline of Pietrei Craiului.

The Turcului de la Bran gorge is carved into the vraconian - cenomanian conglomerates and insinuates itself among the olistoliths of the south-eastern flank of the Culm of the Măgurii . Although it is small in size, it appears as a real "gateway" of intra-Carpathian circulation. Situated east of the summit, on the right slope of the gorge, Dietrich's Cliff with Bran Castle, an erosion marker of the klippic category of white tithonic limestone, accompanied by calcareous breccias (Patrulius, 1969), stands out in an unusual vertical position, creating a classic 'island effect' in the landscape.

REPRESENTATIVE PREVIOUS RESEARCHES AND CURRENT STATE OF KNOWLEDGE OF THE BRAN - RUCĂR - DRAGOSLAVELE CORRIDOR

The analysis of the previous representative researches, published so far, with reference to the Bran - Rucar - Dragoslavele Corridor allows us to synthesize the current state of knowledge of this subunit of the Romanian Carpathians.

Research and geological studies carried out during the 20th century have allowed the accumulation of a rich inventory of knowledge and specific data intended to materialize in a real scientific support with obvious usefulness and applicability for geological and geomorphological studies that have been carried out until today, or will be undertaken. The first of these belong in particular to E. Jekelius (1926 and 1938) and N. Oncescu (1943). The work of the geologist N. Oncescu (1943) "*Région de Piatra Craiului-Bucegi. Étude géologique*" presents defining aspects of the tectonics of the corridor, stratigraphy and lithology. *The tectonics of the 'Dâmbovicioara corridor'* have been observed, deciphered in detail, described and brought to the light of knowledge in the geological literature, especially through the research carried out by the distinguished geologist D. Patrulius (1969). In his famous work "The Geology of the Bucegi Massif and the Dâmbovicioara corridor", the author clarifies a number of problems concerning the evolution of the Dâmbovicioara corridor as a unitary geostructural area and completes the data base concerning tectonics, stratigraphy and paleontology.

Geographical works of a summarizing nature. They also provide an overview of the Romanian or Carpathian relief. Within the physico-geographical approach, the relief of the Bran - Rucar - Dragoslavele corridor was described by its general aspects. *The major monographic works* and scientific references concerned with the characterization of the Bran - Rucar - Dragoslavele Corridor are: M. Iancu, A. Savu and I. Sârcu in Monografia geografică a Republicii Populare Române I. Geografia fizică (1960), V. Velcea in Geografia României I. Geografia fisica (1983) and V. Velcea in Geografia României III. Romanian Carpathians and Transylvanian Depression (1987). Other summarizing works belong to the authors Emm. de Martonne (1907 and 1981 - translation into Romanian under the care of V. Tufescu, Gh. Niculescu and Ș. Dragomirescu), V. Mihăilescu (1963, 1965 and 1969), N. Orghidan (1969), G. Posea et al. (1974 and 1976), A. Roșu (1980), Velcea V. and Savu (1982).

Main morphologic (geomorphologic) research and morphologic studies. The problem of the polycyclic leveling surfaces of the relief within the Bran - Dragoslavele Corridor, as well as those of the neighboring, higher mountain subunits, has been addressed by numerous geographers (and geologists) since the beginning of the 20th century.

In addition to the observations that concerned the study of the "Pliocene platform of Bran" (Orghidan, 1936 and 1942), N. Orghidan (1936) was also the pioneer of detailed research on the genesis and evolution of the "interesting forms of Podu Dâmboviței", the genesis of the "structural forms of the Magura group", the genesis of the "Șirne ponds", the evolution of the limestone relief within the "Fundata polia", including the "gullies on the Giuvalei line". Studies on the morphology and evolution of the karst relief, with detailed observations, were continued by geographers E. Nedelcu and Ș. Dragomirescu (1963), especially in the suspended depression of Fundata - Fundățica. M. Ielenicz (1986) dealt in detail with the genesis and evolution of the Rucăr and Podul Dâmboviței depressions and T. Constantinescu (1977, 1985, 1987, 1992, 2004-2005, 2009, Constantinescu and Dobrescu, 2006) completes the spectrum of karst studies in the Piatra Craiului Massif, including the valleys on the border with the Bran - Dragoslavele corridor. The karst geographer argued, among other things, the genesis and evolution of the hydrographic network in the combined area of Piatra Craiului Massif and the adjacent depressional corridor, in accordance with the paleogeographic evolution. It also proved the speleoepigenesis of numerous key-type valley sectors.

The most comprehensive and analytical study on the polycyclic modeling of the relief in the area of the Dran - Dragoslavele Corridor belongs to the geogaphs Gh. Niculescu and S. Roată (1995) who made detailed observations on the levels of erosion and stated the geomorphologic evolution of the corridor.

Climate studies. In the spectrum of works on observations and meteo-climatic analysis made by several authors (limited in terms of space and time of observations), the work of Elena Teodoreanu (1980) is remarkable for its methodological and scientific accuracy, which is an exhaustive analysis of the Rucar - Bran Corridor from the climatic and topoclimatic point of view, with data strings of some parameters valid for long periods: 1896 - 1970 (monthly and annual mean air temperatures) and 1921 - 1970 (multiannual mean precipitation amounts).

THEORETICAL UNDERPINNINGS OF RESEARCH: CONCEPTS AND METHODS

Databases used and resulting database. The main sources of documentation that provided *the databases used* in this paper and the *resulting database (vector data, raster data and attribute data)* have been summarized below. They are fully documented throughout the paper, within the methodologies implemented through GIS analysis and documented by source in the bibliographic list. The four GIS methodologies used, integrated in laborious analyses, have been described in detail (including the databases used and the resulting database) and schematized as follows:

- Table 1 shows the conditions for classifying the factors of the morphodynamic potential of the Bran - Dragoslavele Corridor. By algebraic intersection of the pixels of the thematic layers subject to analysis, pixel groupings were obtained that spatially outline the targeted morphodynamic potential. The 6 maps of the morphodynamic potential, rendered at a scale of 1:1200000, for the current geomorphologic processes or groups of geomorphologic processes representative of the low mountain area under study, were obtained;
- Figure 15 shows the methodological scheme of the implementation of the USLE model for the assessment of soil susceptibility to surface erosion in the Bran - Dragoslavele corridor;
- Figure 19 shows the methodological scheme of flood hazard and flood risk maps elaboration for the analyzed valley sector of the Turcu river;
- Table 3 shows the classification conditions of the environmental factors that determine the geomorphologic risk in the Bran - Dragoslavele corridor. By algebraic intersection of the pixels of the thematic layers under analysis, pixel groupings were obtained, which were subsequently reclassified into three geomorphologic risk classes.

The other databases used and the resulting database by processing the information collected, stored, selected and validated in the GIS environment are:

1. Topographic map at 1:25000 scale, published by the Military Topographic Directorate of MApN, 1974 - 1986 , with contour lines equidistant equal to 10 m (Source: mapsheets accessed from the Office of Secret Documents of the Faculty of Geography, "Babes-Boliay" University Cluj-Napoca). It provided by vectorization contours, topographic elevations (including toponymy taken as attribute data) and drainage network (including hydronymy), all these elements being useful for the realization of the continuous topographic database of the geographical research area, concretized by the generation of the digital elevation model (DEM). The DEM was generated with a spatial resolution of 10 m (5 m and 20 m) and a discretization error correction coefficient of 0.5 (or 1), by interpolating the leveling and drainage network.

The interpolation method implemented in the ArcGIS/ArcMap program is accessible through the Topo to Raster tool and was based on the ANUDEM program developed by Michael Hutchinson in 1988, 1989, 1996, 2000 and 2011 (Hutchinson et al., 2011). DEM with 10 m resolution facilitated the production of most of the thematic maps: hypsometry (relief steps), geodeclivity, relief energy, relief fragmentation depth, total topographic surface curvature, visibility analysis maps, etc. DEM with 5 m resolution (and discretization error correction coefficient having the value 0.5) facilitated the production of profiles and 1% flood band for the study sector related to the Turcu River valley. The DEM with 20 m resolution facilitated the realization of the slope length raster (LS topographic coefficient), according to the formula proposed by Mitasova et al., (1996), which was used in the USLE-based calculation of the mean annual rate of surface soil erosion.

2. Geologic map of the R. S. Romania at the scale: 1:50000 (sheets 110a Bârsa Fierului, 110b Zărnești, 110c Rucăr, 110d Moeciu and 128a Câmpulung Muscel), 1971 - 1974 (Source: Hatchet sheets accessed from the Office of Secret Documents of the Faculty of Geography, "Babes-Boliay" University Cluj-Napoca), provided areal information on lithologic typology (including their geologic age), as well as linear information designating fault system, decropping, synclinal axes, etc.a. Vectorization of all the above-mentioned elements allowed the conversion of the information into raster system, which was successfully used in the generation of maps (raster format) of morphodynamic potential and geomorphologic risk.

3. Map of the soils of the R.S.R. at a scale of 1:200000, sheets Brasov, 1975 and Targoviste, 1970 (Source: maps accessed from the Office of Secret Documents of the Faculty of Geography, "Babes-Boliay" University Cluj-Napoca) with the name SRCS (Romanian Soil Classification System), realized by I.C.C.P.A. Bucharest (Research Institute for Soil Science and Agrochemistry) and updated by Florea and Munteanu (2003) according to the latest FAO UNESCO SRTS 2003 (Romanian Soil Taxonomy System). It provided areal information on soil typology. The area vectorization allowed the conversion of the information into a raster system, which was used to assign the correction coefficient (S) for soil erodibility, which in turn was used in the USLE-based calculation of the mean annual rate of surface soil erosion.

4. Satellite imagery provided free of charge by the European Space Agency (Copernicus Program) or from Google Earth Pro:

- Sentinel-2 L1C satellite scene from January 31, 2018 (Fig. 10a), in visible spectrum and 10 m ground resolution (Source: https://custom-scripts.sentinel-hub.com/sentinel-2/ndsi-visualized/), was useful for extracting pixels representing snow cover. The thematic layer was used in the GIS analysis for the purpose of spatial rendering of the morphodynamic potential for snow and solifluction;

- Satellite images from dates 16.09.2019, 27.08.2020 and 21.09.2020 provided by Google Earth Pro application (Source: https://www.google.com/intl/ro/earth/versions/#earth-pro), with coverage for the entire 1% flood band area (Turcu river valley), allowed observations on land cover/land use for the purpose of assigning the bed roughness coefficient (Manning's). The same satellite scenes (World Imagery) facilitated the mapping of polygons (houses, outbuildings, etc.) in order to inventory the infrastructural categories in the 1% floodplain;

- The satellite image (World Imagery) of 16.09.2019 provided by Google Earth Pro application was used to correct/update the polygons of the CORINE Land Cover 2018 dataset;

- The satellite image from 23.02.2016 provided by Google Earth Pro application allowed highlighting the anthropic relief with trenches and artillery positions of the World War I Fortification of Dâmbovicioara - Dealul Sasului. The same image was able to clearly highlight the area of water catchment and infiltration on the surface of the karst plateau of the Piatra Galbenă Bridge, towards the Dobreștilor cave;

- The applications Google Earth Pro and Google Earth Web (Source: https://earth.google.com/web/) were used to topologize point vector information (GPS locations), linear information (roads with different road signs), areas (intra-vector information of the localities in the corridor area), and for numerous validations.

5. *The topographic map with contour equidistance of 20 m, but especially the mosaic of orthophotos with a spatial resolution of 0.5 m* provided by the National Agency for Cadastre and Real Estate Publicity (Source: https://geoportal.ancpi.ro/portal/apps/webappviewer/index.html?id=5fca89129f2f466882bb7c64e6fd3dd98#) allow remarkable observations on the accuracy of detail for validation purposes.

6. The Corine Land Cover 2018 vector dataset provided the land cover and land use areas for this paper. The conversion of the vector information into raster system, allowed the use of the valuable thematic layer in the generation of maps (raster format) of morphodynamic potential, of the one that depicts the geomorphologic risk, as well as in the assignment of the correction coefficient (C) according to vegetation type/structure and land use, used in turn in the USLE-based calculation of the mean annual rate of surface soil erosion.

7. The *boundaries in GIS format of the "Natura 2000" sites* and the *boundaries of the protected natural areas* were downloaded from the website of the Ministry of Environment, Water and Forest (https://www.mmediu.ro/categorie/date-gis/205), being used for clarifications related to spatialization (intersections of areas) in order to make proposals for the promotion of

geotourism and ecotourism in the Bran - Rucar - Dragoslavele Corridor by setting up thematic geotourism circuits, as well as by stating the possibility of establishing a new geological and geomorphological nature reserve.

8. *The cycle-tourist routes* in the area of the Bran - Dragoslavele Corridor have been integrated in the geotouristic maps, the vectorial information being taken from the Piatra Craiului National Park website (Source: https://www.pcrai.ro/trasee-bicicleta).

9. Market study on minimum values of real estate properties in Brasov and Covasna counties, 2021 (with minimum market values valid for 2020), Chamber of Notaries Publics Brasov (Source: http://www.unnpr.ro/files/expertize2021/CNPBrasov/ bv_si_cv_2021.pdf) has found it useful to assign minimum values expressed in Romanian lei (RON) for land, courtyards, residential buildings and household annexes, as well as for commercial, industrial, social-cultural infrastructure, or infrastructure with other than economic use, all within the 1% flood band.

10. Data on the *stable population by counties, municipalities, cities and component localities from the 2011 population census* (Source: http://www.recensamantromania.ro/rezultate-2/) and the *evolution of the resident population by counties and localities from 2011 to 2021* (Source: https://experience.arcgis.com/experience/acac13e423664c24a78be1679dd2c64c/?draft=true&org=HotNews) provided by the National Institute of Statistics were used to calculate the number of potentially affected inhabitants through exposure to flood hazard.

PROBLEMS OF APPLIED GEOMORPHOLOGY IN THE BRAN - RUCĂR - DRAGOSLAVELE CORRIDOR

Morpho-denudational potential

The Bran - Rucar - Dragoslavele corridor is individualized in the east of the Southern Carpathians by particular morphometric features. The geological and geomorphological peculiarities outline three relief sectors with a distinct mountain personality in the landscape, but unitary in morphometry and evolution.

The morphometric analysis based on the numerical elevation model of the terrain with a spatial resolution of 10 m, obtained by interpolation of the leveling extracted from the topographic map at a scale of 1:25000 confirmed the individuality of this mountainous area with low altitudes in relation to those of the neighboring mountain areas.

Interpretation of the results obtained by means of morphometric indicators was approached for each second-order division of the relief and presented in the analysis of the relief by sectors.

Staggered relief (relief hypsometry)

The complexity of the mountainous landscape of the Bran - Dragoslavele corridor is also to a large extent the result of the territorial variation of the relief altitude. In relation to the surface area of 262 km², the absolute amplitude of the relief elevation (according to the DEM based on contour lines with a 10 m equidistance, vectorized at a scale of 1:25000) measures 946 m between the peak of Mount Coja (1546 m) and the Dâmbovița river at Lunca Gârții (south of the confluence with the Mateiașului Valley).

The staging of the relief stages follows, in principle, the elevation layout of the erosion levels identified and mapped by Niculescu and Roată (1995) on the basis of the topographic map at 1:25000 scale, 1980-1982 edition and the geologic map at 1:50000 scale (1971-1972). The five relief stages were differentiated as follows:

- 600 - 900 m (26, 35%), the *step of the valley corridors (Dâmbovița - Râușorul and Turcu - Sbârcioara), of the depressional basins of the Dâmbovița course (Podu Dâmboviței, Rucăr and Dragoslavele), but also of the Sohodol piedmont whose fluvio-lacustrine deposits are located in the extension of the Moieciu level over which it is cut* (Niculescu and Roată, 2005). *The* pass deeply penetrates the sectors of the Dâmbovița and Dâmbovicioarei gorges (the first three downstream sectors, including the homonymous basin and the one corresponding to the "Valea Rea" hamlet), as well as those along the Cheii Valley (with the "Lunca Cheii" basin between them). In the Turcu River basin, this pass penetrates the tributary valleys of the

Moieciu de Jos - Bran sector. Within the same relief step, the Carpathian level of the Braniște valley (750 - 850 m, 900 m) can be identified along the Dâmbovița gorge in the form of shoulders or in the form of interfluvial fragments in the Stoichii Hill (Podu Dâmboviței depression) and Braniște Hill (at Rucar). From the evolutionary point of view, it is the relief corresponding to the lower level (of the valley shoulders) mentioned above, of Middle Pleistocene age (Niculescu and Roată, 2005);

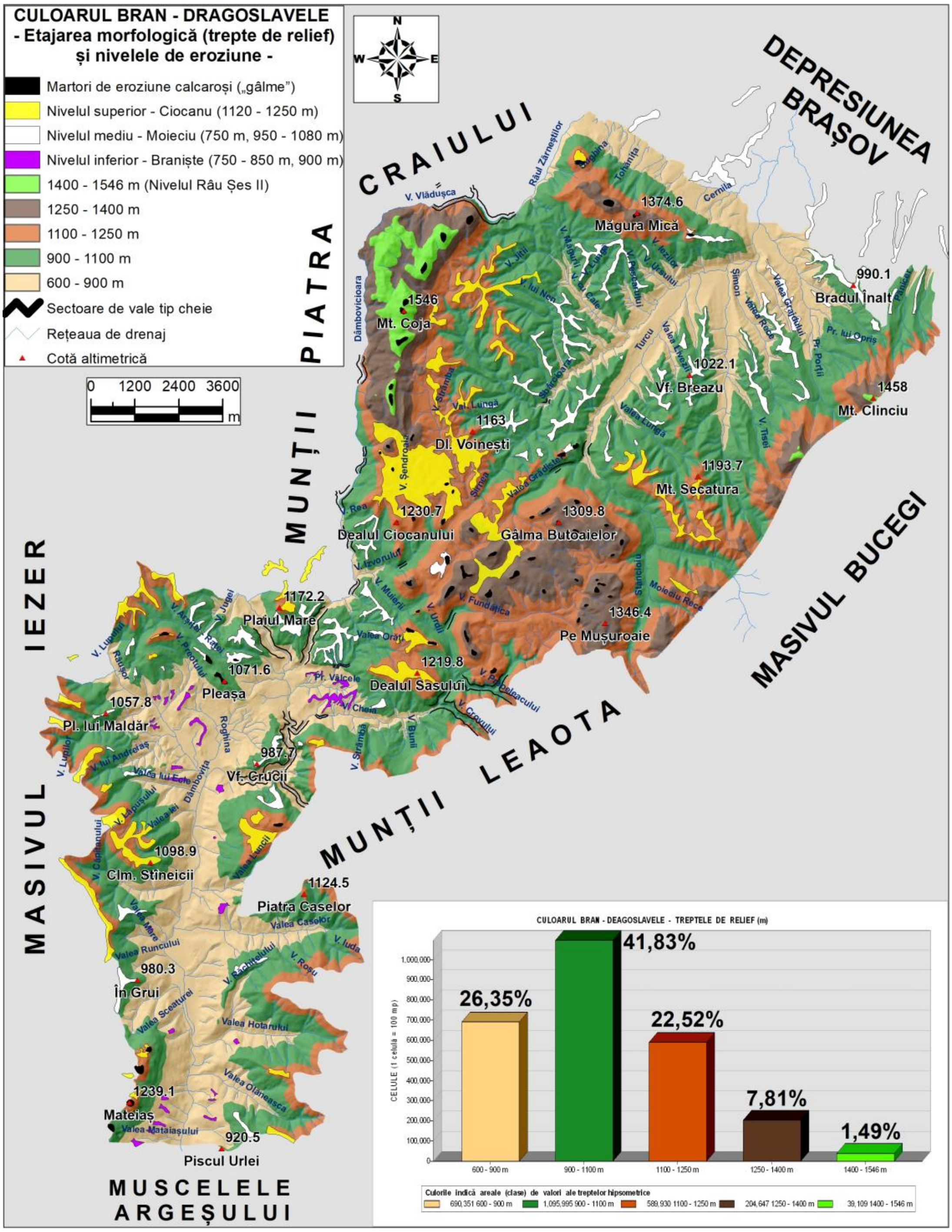


Figure 6. The Bran - Dragoslavele corridor - relief gradation and erosion levels

- 900 - 1100 m (41, 83%), the *relief step that includes the leveling surfaces of the Branului Platform, corresponding to the Moieciu level (950 - 1080 m, 8.24 km²),* with a Villafranchian - Lower Pleistocene age (Niculescu and Roată, 2005). The level extends predominantly in the northern sector of the corridor, within the interfluves of all direct tributaries of the Turcului, with confluence points located downstream of the Cheia de la Colțul Cheii (Fig. 6);

- 1100 - 1150 m (22, 52%), the *relief step that includes the most extensive leveling surfaces in the space of the Branului Platform, corresponding to the Ciocanu level (1120 - 1250 m, 12,49 km²),* realized in the most extensive modeling phase, framed in the late Miocene - Villafranchian (Niculescu and Roată, 2005). This level is best represented in the eponymous village area;

- 1250 - 1400 m, a *step of relief characteristic of the level of calcareous erosion markers of the type of the "gullies" of the Bražneni "gullies".* On its restricted surface (7.81% of the studied relief subunit area), only in the central sector of the intramontane corridor (Fundata - Fundățica - Ciocanu area) 38 "gorges" were inventoried, with the maximum altitude included in the altitudinal range 1250 - 1388 m (Găvenii Peak). This step of relief also includes rounded interfluves and slopes with domed slopes from the Coja and Măgurii peaks;

- 1400 - 1546 m (1, 49%), the *highest relief step, represented only in the Coja Ridge (synclinal flank),* whose rounded interfluvium has been interpreted as a remnant of the calcareous erosion level of the Șes II River, shaped for about 8 million years, in the Upper Miocene (Constantinescu, 2009).

Morphodynamic potential

Defining features of the current morphogenetic system

The current morphodynamic model *(postglacial, from the last 13 - 15 thousand years)* of the mountainous area corresponding to the Bran - Dragoslavele corridor includes the spatial structuring of the current modeling processes in close dependence on the morphodynamic and morphoclimatic factors involved. The characteristic present-day geomorphologic processes, usually associated, with alternating manifestations during a calendar year, can be grouped into altitudinal stages, being also influenced by human activities (agricultural, deforestation, quarrying, modification of riverbeds and flow regime of some rivers, expansion of rural habitat) imprinted for centuries in the landscape structure. The present-day modeling, superimposed on the cryonival substage of the Pleistocene detrital periglacial detrital stage (with inherited forms of erosion and accumulation), is currently in a context complicated by anthropogenic intervention, which can be summarized as follows:

I. The stage of alternating, *fluviotorential (with predominance of torrential erosion) and cryonival (nivation and solifluction, disaggregation by gelivation, associated with runoff),* at altitudes above 1100 m (1100 - 1546 m), influenced by traditional human activities with mountain specificity that have imposed, in the last three to four centuries, the extension of the pastoral domain, mainly through deforestation (runcuire, burning and grubbing) on the surfaces of the Ciocanu erosion level (in the area of Ciocanu - Șirnea - Peștera and Moieciu de Sus villages, Dealul Sasului - 1219.8 m, Plaiul Mare - 1172.2 m, the mouth of the Arşiței Valley, Muntele Căpitanului - 1198,4 m, Muntele Vârtoapele - Fundul Neagu, at ±1240,5 m), in the area of the peaks of Măgurii (1374,6 m), Coja (Muntele Coja, 1546 m) and Vârful Măgurei (1211,8 m) - Mateiaș (1239,1 m), the last one with activities related to the exploitation of limestones in quarries. In the area of the limestone 'gullies' in the central sector (Fundata - Fundățica - Ciocanu - Șirnea villages), on steep slopes unprotected by forest vegetation, there are processes of disaggregation by gelivation associated with collapse-rostogolification and karstification.

II. The fluviotorental modeling stage, corresponding to both compartments of the Bran - Dragoslavele transcarpathian corridor, at altitudes below about 1100 m, with the following particularities imposed by the anthropogenic intervention in the landscape:

a. *the subsurface of linear erosion (predominantly fluvial) and chemical alteration,* corresponding to forested areas, 44.56% of the surface of the Bran - Dragoslavele Corridor (Fig. 8), of which deciduous forests are more widespread (23.37%), followed by mixed forests (with dominant species of beech and spruce) and coniferous forests (10.43%).

b. *linear erosion (fluvial erosion, torrential erosion and runoff-reflow) and surface erosion* (analyzed by means of the USLE model), corresponding to areas cleared in order to extend the pastoral domain (pastures, meadows and secondary mountain meadows, 10.8%; grasslands with areas of natural vegetation - forest pastures and secondary meadows, 12.01%), mainly in the northern sector of the Bran - Dragoslavele Corridor, in the basins of the tributary valleys of the Turcu river, on the slopes adjacent to the interfluves of the Moieciu erosion level, as well as on its surfaces. The torrentiality and runoff (associated with areal erosion and shallow landslides) fulfill the potential conditions of manifestation also in the Dâmbovița river basin, especially in the areas of Podu Dâmboviței, Rucăr and Dragoslavele depressions (Fig. 9).

In the model, the wide riverbeds corresponding to the main valleys draining the mountain unit under analysis are considered: the Dâmbovița (downstream of the confluence with the Râușorul) and the Turcului (Moieciu de Sus - Bran sector), as areas with azonal processes: *erosion, transport and fluvial accumulation*. The alluviation of wide riverbeds with low gradient or at the confluences with well-calibrated tributary valleys (Râușorul, Valea lui Ecle, Valea Caselor - in the Dâmbovița basin, or Sbârârcioara, Șimon and Pârâul Porții - in the Turcului basin), are strongly influenced by the lateral inflow of the tributaries, especially during floods, by means of dejection cones, materials coming from the collapse-rostogolification of hard and semi-hard rocks, or as the break-up of banks made of poorly cohesive rocks, etc. Within the above-mentioned valley sectors, with potential for the accumulation of alluvium in the riverbeds and flooding (Fig. 13), the anthropogenic factor has also intervened through hydro-technical works that have changed the natural morphodynamics of the riverbeds: the Dragoslavele Polder on the Dâmbovița River, the water intake of the Bran 1 micro-hydropower plant on the Turcu River, as well as some works aimed at restoring the transport capacity of the riverbed, flood protection, etc.

The morphodynamic potential for karstification (Fig. 14), another azonal process, is specific to all calcareous areas in the Transcarpathian corridor, regardless of slope, altitude or land cover/land use.

Determining the morphodynamic potential of defining geomorphologic processes

The methodology approached (Mihai, 2005) for the spatial delimitation of the morphodynamic potential of each current relief modeling process (or associated processes) was carried out through GIS analysis coupled with the integration of a significant volume of geographic data extracted from various sources such as: the military topographic map at a scale of 1:25000 (elevations, contour lines, drainage network), the geological map of the R.S.S.R. at 1:50000 scale for lithological types (Fig. 7), Corine Land Cover 2018 vector dataset (land cover and land use areas), and Sentinel-2 L1C satellite image from January 31, 2018 (snow cover). The conversion of the vector data to raster format with 10 m spatial resolution resulted in the following thematic strata: slope (geodeclivity), rock (lithology), land cover/use (land use), elevation (hypsometric step) and "spatial distribution of snow cover".

The selection of pixel groupings according to the reclassifications for each morphodynamic factor (Table 1) was based on studies by authors who synthesized globally recognized information, such as the classification of slopes based on genetic criteria (Surdeanu, 1998), as well as on field observations made in different seasons from 2014 to 2023, in almost the entire region.

Table 1. Classification conditions of the factors of the morphodynamic potential in the Bran - Dragoslavele Corridor

PROCEDURES GEOMORPHOLOGIC CURRENT	**MORPHODYNAMIC FACTORS**			
	PANTA (geodeclivi-tatea)	**ROCK** (lithology)	**COVER / LAND USE**	**ALTITUDE** (hypsometric step)
Torrentiality and erosion (associated with areal erosion and rare shallow landslides) (6° - 20°)	6° - 10° (17°) (androire) 10° - 20° (> 20°) (downpour)	2, 3, 4, 5, 6, 8 - 20, 22, 23, 25 and 26	2, 3, 4, 5, 6, 7, 8 and 9	-
News and soliflux (3° - 20°)	3° - 6° (< 10°) (nivation) 6° - 20° (25°) (soliflux)	Lithology has been replaced by the thematic layer "spatial distribution of snow cover" (31.01.2018)	2, 3, 4, 5 and 6	over 1000 m, thus: - forms of nivation frequently occur at altitudes > 1100 m; - solifluction furrows frequently evident at altitudes > 1000 m
Unbundling	> 17°	-	2, 3, 4, 6, 8 and 9	1100 - 1546 m
Collapse and landslides	> 32°	- limestone: 21, 24, 27 - 30 - conglomerate: 15, 18, 19, 20 and 23 - tiles: 17	2, 3, 4, 5, 6, 8 and 9	- steep cliffs in sectors of gorges (< 1000 m); - lithologic, structural and tectonic abruptness (> 1000 m)
Silt accumulation in streambeds and flooding	< 3°	1	-	-
Carstify	-	limestone: 16, 21, 24, 27 - 30	-	-

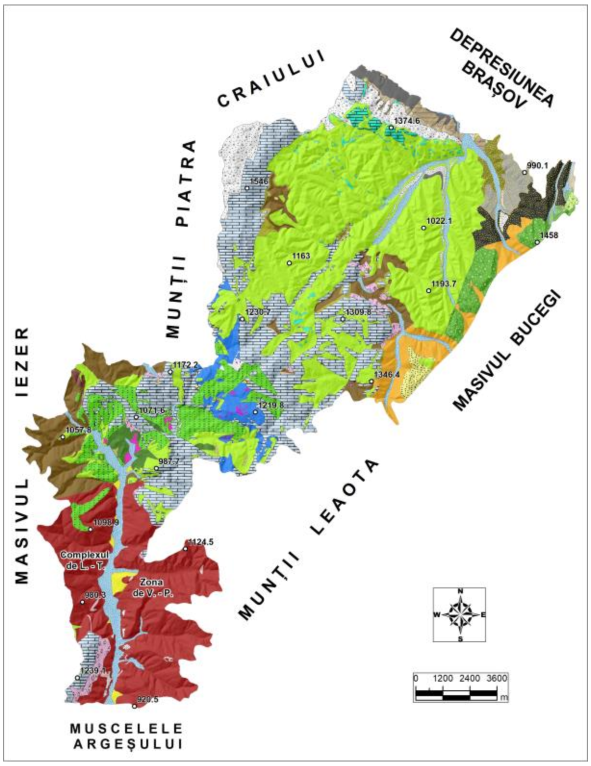


Figure 7. Lithology of the Bran - Dragoslavele Corridor (Processing after the Geological Map of R. S. Romania, scale: 1:50000, 1971 - 1974; the lithologic typology has been reproduced in the legend of figure 2)

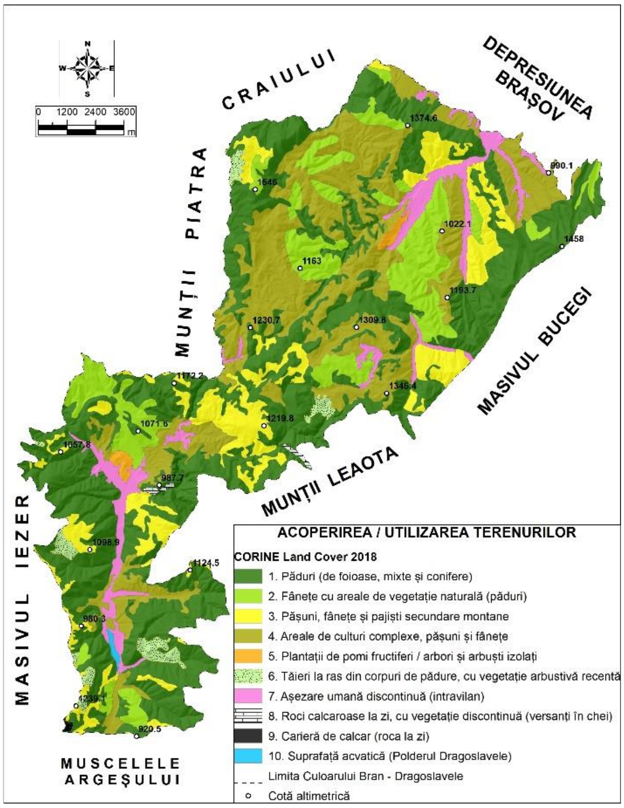


Figure 8. Land cover / land use in the Bran - Dragoslavele Corridor (Processing based on CORINE Land Cover database, 2018)

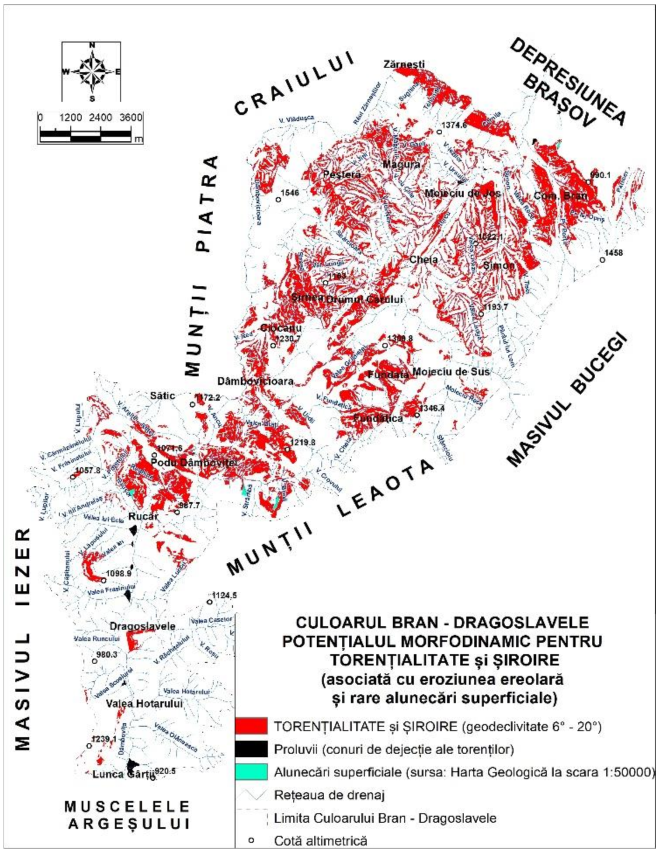


Figure 9. Morphodynamic potential for torrentiality and runoff (associated with areal erosion and rare shallow landslides)

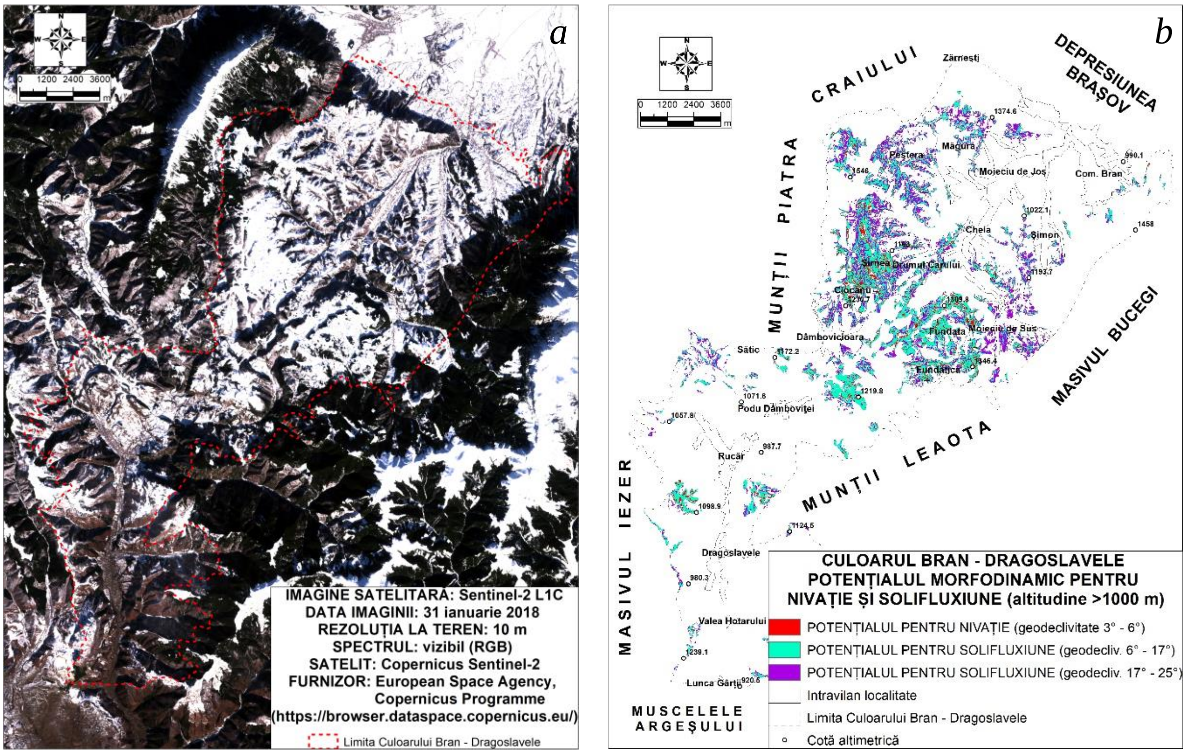


Figure 10. Bran - Dragoslavele corridor, spatial distribution of snow cover on January 31, 2018 (Source: https://browser.dataspace.copernicus.eu/) (a), thematic layer used in the analysis
GIS - morphodynamic potential for snow and solifluction (b)

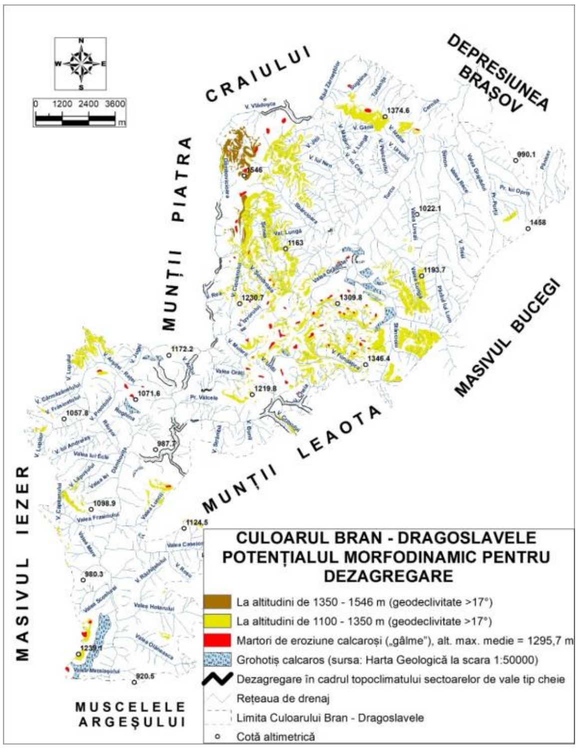


Figure 11. Morphodynamic potential for disaggregation

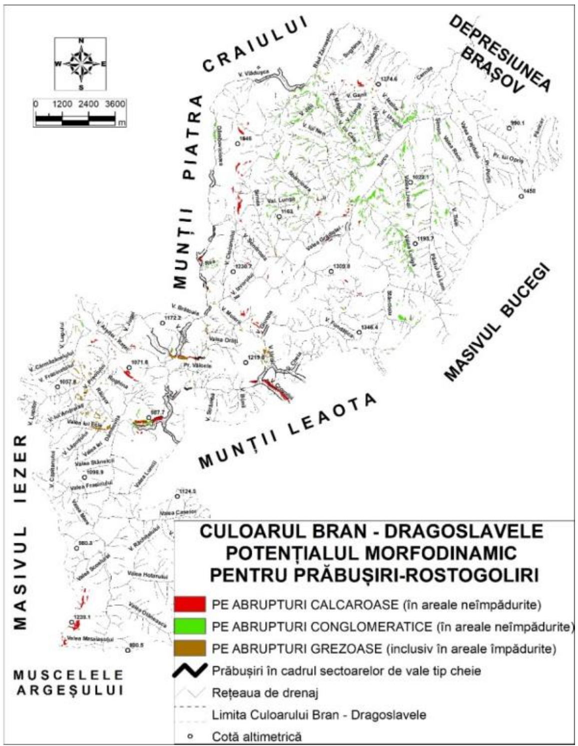


Figure 12. Morphododynamic potential for collapse-rostogenesis

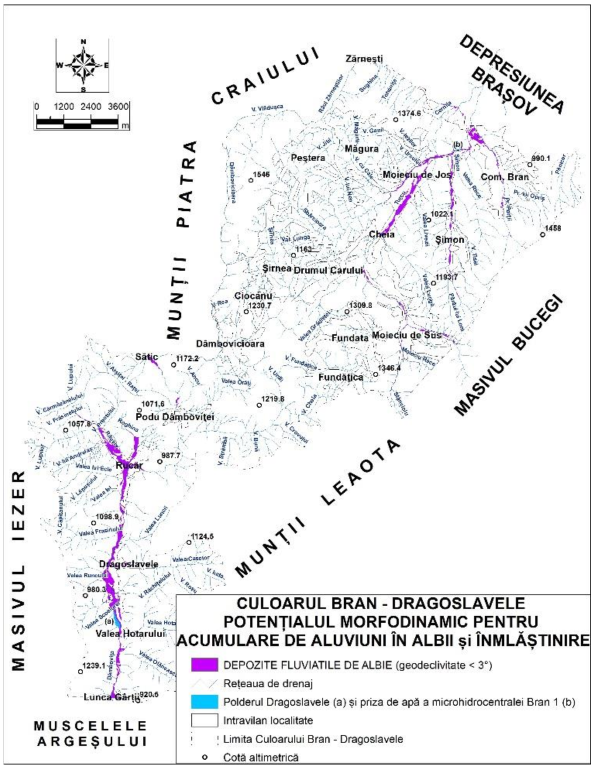


Figure 13. Morphodynamic potential for silt accumulation in streambeds and siltation

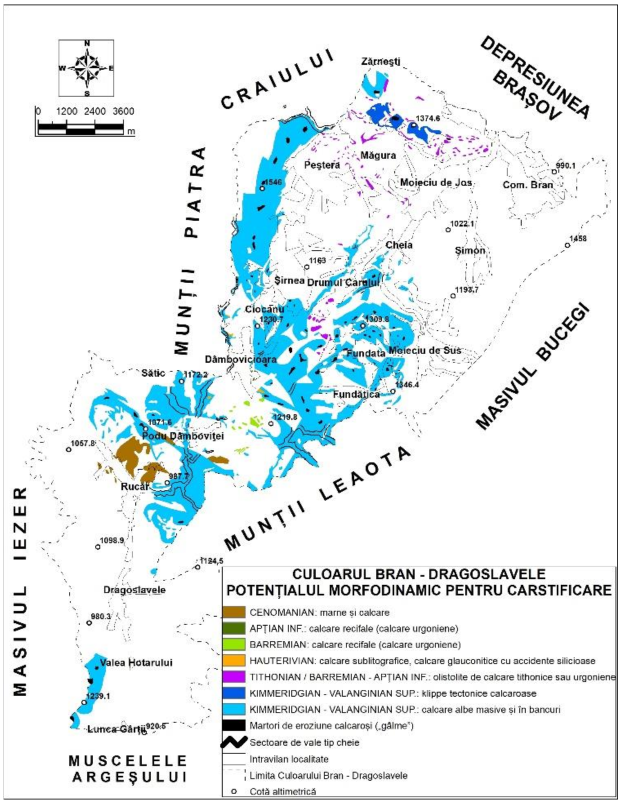


Figure 14. Morphodynamic potential for karstification

Conclusions. The information available and processed with the help of the geographic information system has outlined the final goal of the thematic approached, concretized by rendering the diversity of the processes of current landforms in the Bran - Dragoslavele Corridor. The 6 resulting maps show the spatiality of the potential for the production of processes common to the Carpathian mountain space, characteristic of a relief classified as low mountains, fully included in the fluvio-torrential morphodynamic fluvio-torrential stage. The processes generated by water runoff on the slopes are the most widespread. Organized runoff drives torrentiality intimately associated with runoff and gullying, while unorganized runoff generates surface erosion, analysed by means of the USLE model. At the opposite pole, the potential for landslides is insignificant due to the lithological conditioning (predominantly conglomeratic and calcareous) specific to the geographical area analysed. In conclusion, the variety of relief structural, lithologic, topoclimatic, topography and slope exposure, land cover and land use, all outline the complexity of the morphodynamic potential of this Transcarpathian corridor.

Morphohidric hazards and risks

Analysis of land susceptibility to surface erosion (USLE model)

The present study is part of the analysis of the morphodynamic potential of the transcarpathian corridor Bran - Dragoslavele, a low mountainous area in the Romanian Carpathians, which is highly favorable for erosional processes due to a high relief energy, diversified lithology, tectonic complexity, as well as the alternation and variation of atmospheric risk phenomena in the conditions of the affirmation of traditional activities related in particular to shepherding. In order to expand the agricultural pastoral areas and those intended for human settlements, deforestation over the last 3-4 centuries has deprived the slopes and soil of the protective forest cover over an area of 55.44%, favoring the amplification of the action of natural morphodynamic agents, which has led to the diversification of the range of current geomorphological processes and the relief forms they generate. In this context, the quantitative and spatial assessment of rainfall loss, expressed by the *average annual rate of surface soil erosion* (measurable in tons/hectare), was approached by applying the calculation model implemented in GIS environment using the universal soil loss equation (USLE). The results of the model implementation were concretized by the spatial delimitation of areas with different amounts of mineral and organic materials dislocated as a result of this process.

The continuous attraction of European structural funds for the development of agriculture in the Romanian Carpathian mountain area requires, among other things, the inventory of the land, especially those exposed to anthropogenic activities such as intensive grazing, deforestation, clear-cutting, as well as those related to infrastructure construction that inevitably lead to subsidence and destructuring of pedogenetic horizons. The identification of the precursor and triggering causes responsible for the physical degradation of soils (due to surface erosion, erosion by runoff, gullying, soil-slides or significant land masses, etc.) is of major practical importance in order to take appropriate decisions on how to prevent soil degradation losses and to implement the most effective measures to improve the quality of this valuable resource.

Among the many processes of land degradation, soil surface erosion is directly dependent on the intensive, sometimes inappropriate exploitation of the natural resources of the geographical environment (mainly natural vegetation and soil), a phenomenon that has increased with the increasing technological progress related to land use (Săvulescu et al., 2019), induced by the anthropogenic pressure on the natural environment, which is constantly increasing due to habitat expansion and the interests of society in order to meet increasingly diversified needs.

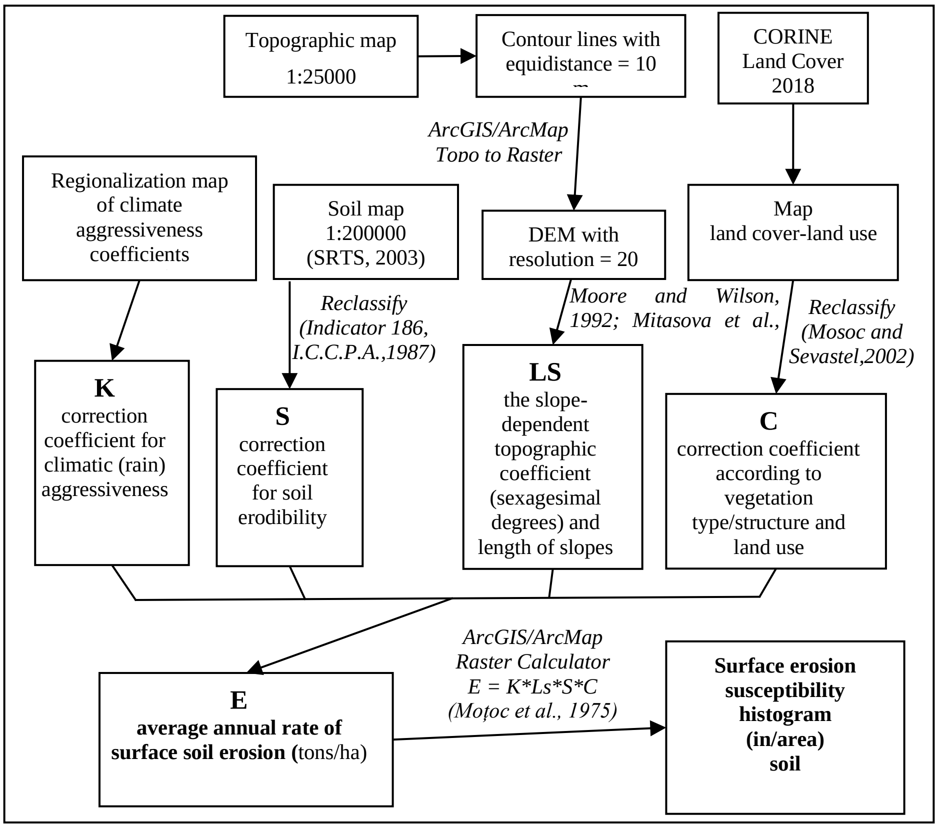


Figure 15. Methodological scheme of the implementation of the USLE model for the assessment of soil susceptibility to surface erosion in the Bran - Dragoslavele Corridor

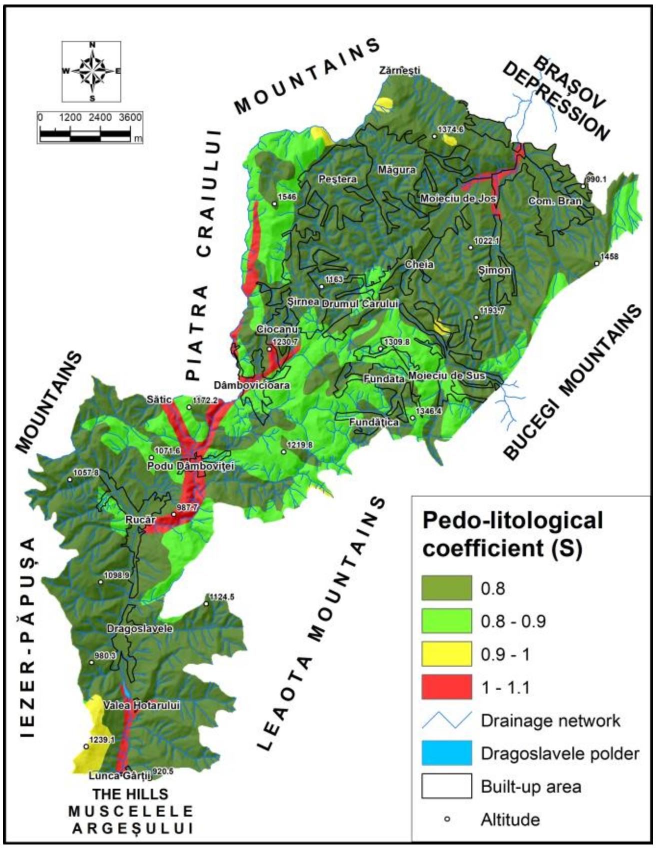


Figure 16. Correction coefficient (S) for soil erodibility
Correction coefficient (C) for vegetation type/structure and land use

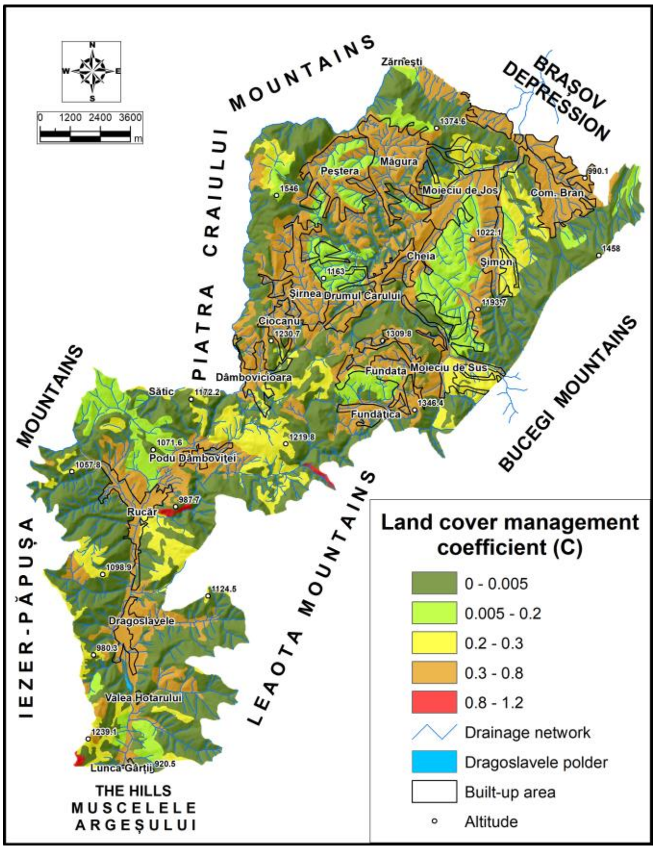


Figure 17. Correction coefficient (C) by vegetation type/structure and land use

For the mountainous area analyzed, *the correction coefficient (Cs) dependent on the influence of anti-erosion measures and works* was assigned the value 1, because in the area of the Bran - Dragoslavele corridor there were not or are not in practice such measures and works. Field observations or recent satellite images have made it possible to identify plots for annual or multiannual crops sown most of the time correctly, along the contour lines, on slopes with slope values usually ranging from 6° - 17° (in the villages of Șirnea, Ciocanu, Fundata and Fundățica) and 0° - 6° (in the villages of Bran, Moieciu de Jos, and those along the Carpathian valley of the Dâmbovița river within the Transcarpathian corridor studied).

Water hazard, flood risk and territorial vulnerability issues, case study: Turcu river

Study area . The hazard and flood risk analysis presented in the current research includes a section of the Turcu River in the Olt catchment (Romania) with a length of 20401 m out of a total of 29059.58 m, between the SH Tohanu Nou (45º33'8.679''' N, 25º23'0.314''' E) and the inrtavilanului inrtavilanului of Moieciu de Sus (45°25'23.386" N, 25°21'53.774" E) (Fig. 18). The implementation of the one-dimensional hydrological model revealed the 1% flooding band crossing from downstream to upstream the villages of Tohanu Nou (part of the town of Zărnești), located in the western part of the intramontane depression of Brasov, on the lower course of the Turcu river; Bran (Bran commune), Moieciu de Jos, Cheia and Moieciu de Sus (Moieciu commune), villages located in the area of the Bran - Dragoslavele corridor, on the middle course of the same river.

In the space of the mentioned intramontane corridor, the hazard and flood risk maps of the national project were made along the Dâmbovița river, between the center of the commune of Rucar and the village of Lunca Gârții (Stoenești commune). The other main fluvial axis of the intramontane corridor is the Turcu river valley, which gathers tributaries from the eastern flank of the Piatra Craiului syncline, the northern slope of the Leaota Mountains and the north-western slope of the Bucegi Massif. This mountain valley, with an obvious flooding potential, has not yet been included in the attention of the specialists who have drawn up flood risk maps on a national scale, considering only that "the fact that an area in our country is not covered does not lead to the conclusion that the area in question cannot be exposed to flood risk" (Source: https://rowater.ro/despre-noi/descrierea-activitatii/managementul-situatiilor-de-urgenta/directiva-inundatii-2007-60-ce/harti-de%20hazard-si-risc-la-inundatii/).

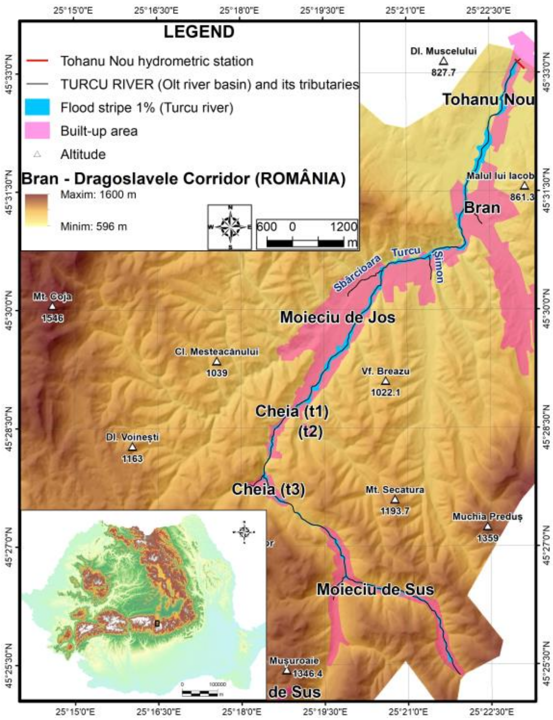


Figure 18. Location of the 1% inundability band on Turcu River (Olt basin)

The results obtained by solving Manning's equation based on field measurements are faithfully reproduced with Flow Calculator (h = 423.6 cm).

It also highlights the difference of 13.7 cm, which is considered to be small, resulting from calculations with *Hydraulic Toolbox 4.4* (h = 243.7 cm) and *HEC-RAS 5.0.7* (h = 230 cm), obtained from the numerical elevation terrain model.

It can be seen that the difference between the calculation based on field measurements (h = 423.6 cm) and the average of the measurements based on the numerical elevation model (h = 236.85 cm) is 186.75 cm (about 44% smaller).

Table 2. Turcu river level values at Tohanu Nou hydrometric station calculated with three free source hydraulic modeling software

No. crt.	**Flow value Q (m^3/s)**	**The significance values Q and h**	**Level value h (cm), c (m alt.), pt. n = 0,06 Flow Calculator**	**Level value h (cm), c (m alt.), pt. n = 0,06 Hydraulic Toolbox 4.4**	**Level value h (cm), c (m alt.), pt. n = 0,06 HEC-RAS 5.0.6**
1.	Q1% = 230	Q1% and h1%	423.6 cm / 691.125 m d M N	243.7 cm / 690,332 m on MNAT	230 cm / 690.19 m on MNAT
2.	Historical max. Q = 120	Q and h historical max. (July 2, 1975)	282.8 cm / / 689.717 m d M N	180.7 cm / 689,702 m on MNAT	171 cm / 689,6 m on MNAT

Note: *Values in blue have been calculated with the specified applications; Q1% - the flow corresponding to the 1% exceedance probability (statistical return period of 100 years); h - water depth in the calculation profile; c - elevation (expressed in m alt. abs.); n - Manning's roughness coefficient*

It can be seen that the difference between the calculation obtained from the field measurements (h = 423.6 cm) and the average of the measurements from the numerical elevation terrain model (h = 236.85 cm) is 186.75 cm (about 44% lower).

Methodology and database **.** The elaboration of flood hazard and risk maps should show some important elements of flood scenarios: flood magnitude, water surface elevation, water depth and discharge at different critical cross sections. In order to achieve the main purpose of the research, several methodological steps summarized (Fig. 19) have been followed.

The first stage consisted in the delineation of the 1% floodplain using the HEC-GeoRAS extension for Esri ArcGIS v.10.8 and HEC-RAS v.5.0.7.

The numerical terrain elevation model used to create the hydrographic database and finally the 1% floodplain was designed with a spatial resolution of 5 m and a discretization error correction coefficient of 0.5, by interpolating the elevation and drainage network taken from the 1:25000 scale topographic map, with contour equidistance equal to 10 m. The interpolation method was specifically designed for the creation of hydrologically correct digital elevation models (DEM), implemented in ArcGIS/ArcMap program, accessible through the Topo to Raster tool. It is based on the ANUDEM program developed by Michael Hutchinson (1988, 1989, 1996, 2000, 2011) (Source: https://pro.arcgis.com/en/pro-app/2.8/tool-reference/3d-analyst/how-topo-to-raster-works.htm).

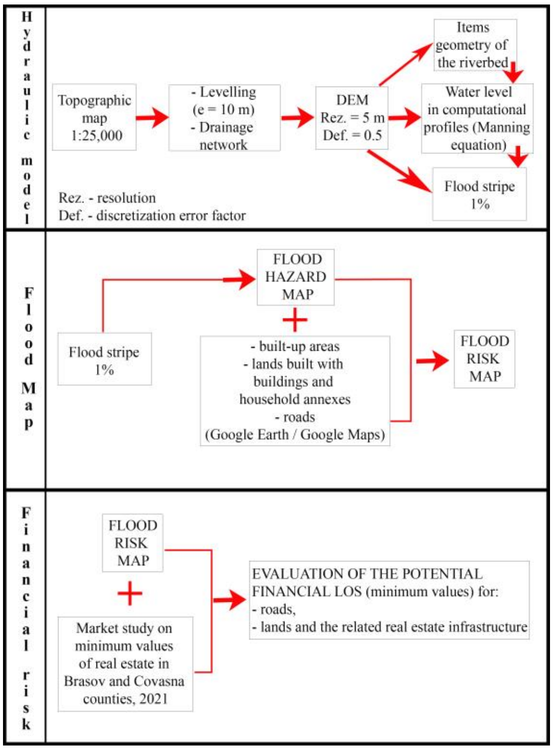


Figure 19. Methodological scheme of flood hazard and risk mapping

The first sub-stage consisted in the realization of the bed geometry elements, using the HEC-GeoRAS extension for Esri Arc GIS. The hydrographic database was obtained: Stream Centerline, Bank Lines, Flow Path Channel with a length of 20401 m, the maximum extension of the study area (Flow Paths Left and Right) and 139 cross-sectional profiles of the cross sections (XS Cut Lines). After the realization of the attribute database, specific to both the hydrographic network and the cross-sectional profiles, the databases were exported from the shapefile (.shp) format to the RAS data format, to be run and used in the HEC-RAS program.

The second sub-stage allowed to determine the water level in the calculation profiles based on the Manning equation ($Q = A/n * R^{2/3} * S^{1/2}$, where Q is the river flow, A - the runoff profile area, R - the hydraulic radius, S - the bed slope and n - Manning's roughness coefficient) implemented in the HEC-RAS program. In order to accomplish this task, the following operations were carried out: importing GIS databases (obtained in the first substage) related to the bed geometry through the Geometric Data module; filling in the tabular database with Manning's roughness coefficient (Bilașco et al, 2016, Manning, 1891), for each profile (for the riverbed, left and right banks/banks); carrying out the flow calculations and entering them in the table for each profile in the Steady Flow Data module; carrying out the calculations of the slope of the riverbed (downstream - downstream and upstream - upstream) for the 11 sectors of the network of talvegic channels, followed by entering the results in the Steady Flow Data module window. Water level results for each profile were obtained by running the hydraulic model in the Steady Flow Analysis module.

The third sub-stage allowed: visualization of the results of the hydraulic model (HEC-RAS); export of the databases from RAS format to GIS format (.shp) to be imported, run and used in the HEC-GeoRAS extension; modeling of the 1% floodplain, resulting in the vector and corresponding raster databases.

In the second stage, the flood hazard map of the Turcu River was made in the area of the 1% flood band, delimited previously. Within it, the hazard magnitude was established for three water depth ranges, according to the methodology implemented at national level: < 0.5 m, 0.5 - 1.5 m and > 1.5 m.

In the third stage, a flood risk map was made based on two water depth ranges (< 0.5 m and > 0.5 m) within the 1% flood band and the intersection of their areas with the mapped intravilan space for the 5 localities crossed by the Turcu River in the area of the band, in order to delimit the risk classes: high - corresponding to the 1% flooding band with water depth > 0.5 m in the intravillian space; medium - corresponding to the 1% flooding band with water depth < 0.5 m in the intravillian space; low - corresponding to the 1% flooding band on the extravillian land of the five localities. Residual risk means the overflow into the floodplain of the extravilan floodplain, without material damage. At the national level, in accordance with Directive 2007/60/EC, the degree of risk according to the magnitude of the hazard was taken into account for the flood risk maps, establishing three classes according to the water depth: < 0.5 m, low risk, with low impact on the human population, economic, socio-cultural activities and the geographical environment; 0.5 m - 1.5 m, medium risk, with medium to high impact; > 1.5 m, high risk, with very high impact.

In the fourth step, an assessment of the potential financial loss expressed in RON (Romanian Leu) and EURO (single European currency) was carried out for roads, land and related real estate infrastructure (mapped from recent satellite images), intersected by the 1% flood band area. The exchange rate communicated by the National Bank of Romania on November 15, 2022, 1 EURO = 4.9032 RON (RON) was used for the calculations.

As the analyses carried out in the last two steps (three and four) contain, in our opinion, also the most conclusive results on water hazards and risks, they will be presented in detail in chapter five.

Determination of the 1% flood band and hazard map. The 1% inundability band was concretized dimensionally and spatially by performing hydraulic calculations based on the flow corresponding to the probability of exceedance of 1% ($Q1\% = 230\ m^3/s$, recorded at SH Tohanu Nou), with a statistical return period of 100 years.

Topographic data used for the realization of the one-dimensional HEC-RAS model were concretized in a set of 139 cross-sectional profiles, 126 of which were drawn on the Turcu River, on the length of 20401 m (Fig. 20).

The use of specialized softwares allowed the realization of the defining elements of the bed geometry, the calculation of the water level in the transverse channels, as well as the visualization of the results of the one-dimensional hydraulic model, resulting in the vector and raster databases corresponding to the 1% flood band. The determination of the hazard magnitude over 3 water depth intervals within the 1% flood band was suggested by the methodology implemented at national level. By superimposing the thematic layers related to the intra-village areas and roads, the flood hazard map for the Turcu River was produced (Fig. 21, Fig. 22 and Fig. 23).

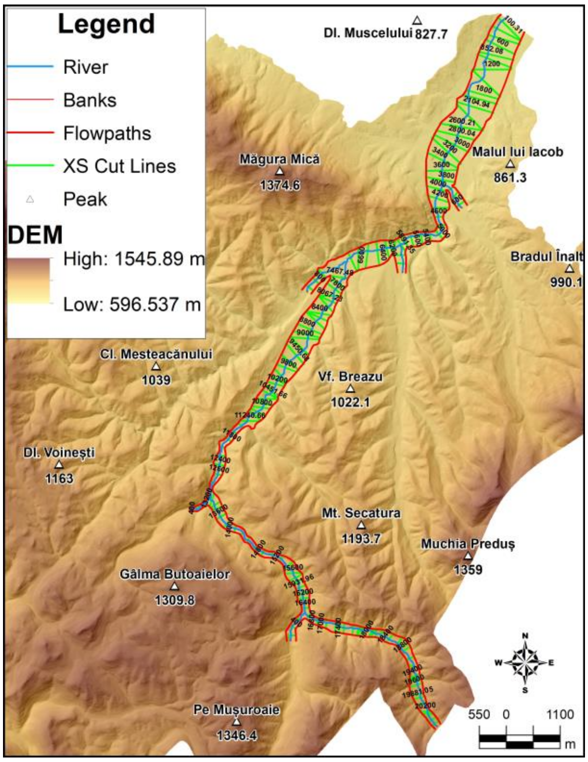


Figure 20. Geometric model of the studied river section, obtained using HEC-GeoRAS extension for Esri Arc GIS/ArcMap program

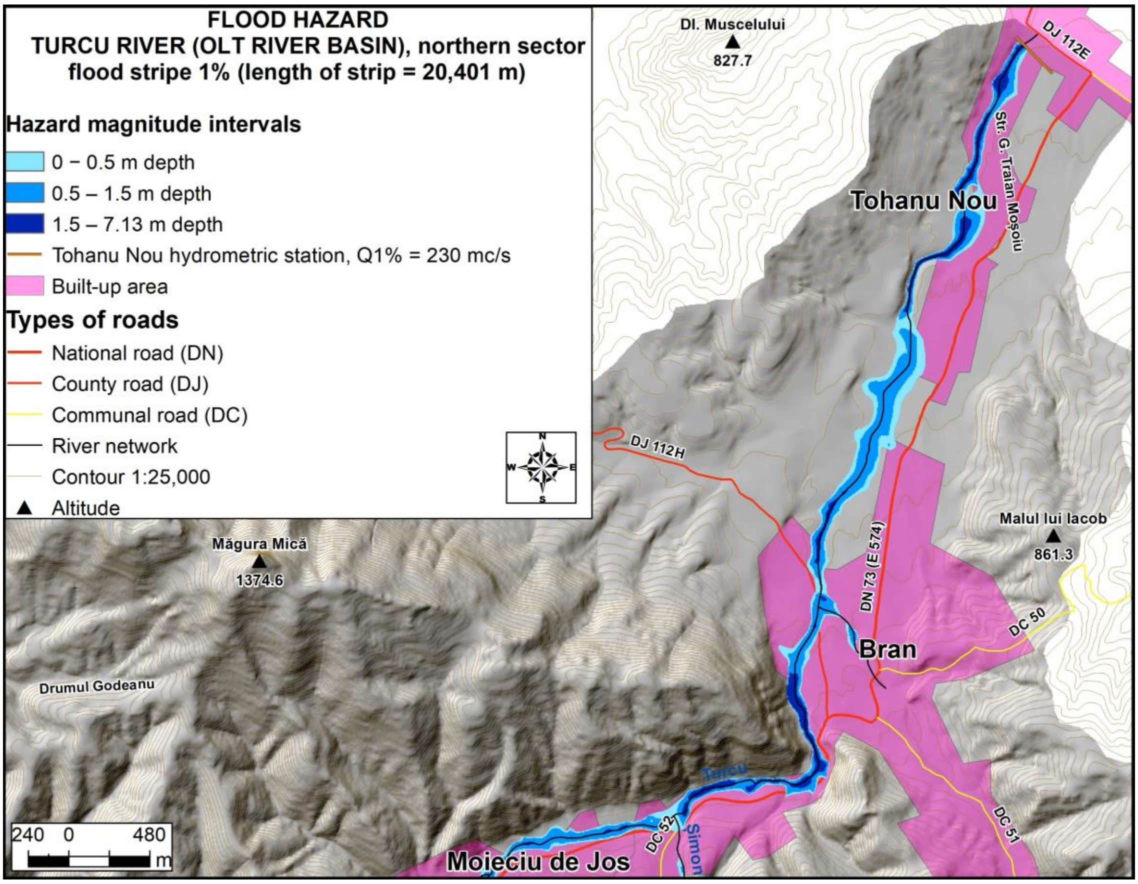


Figure 21. Flood hazard on Turcu river, northern sector

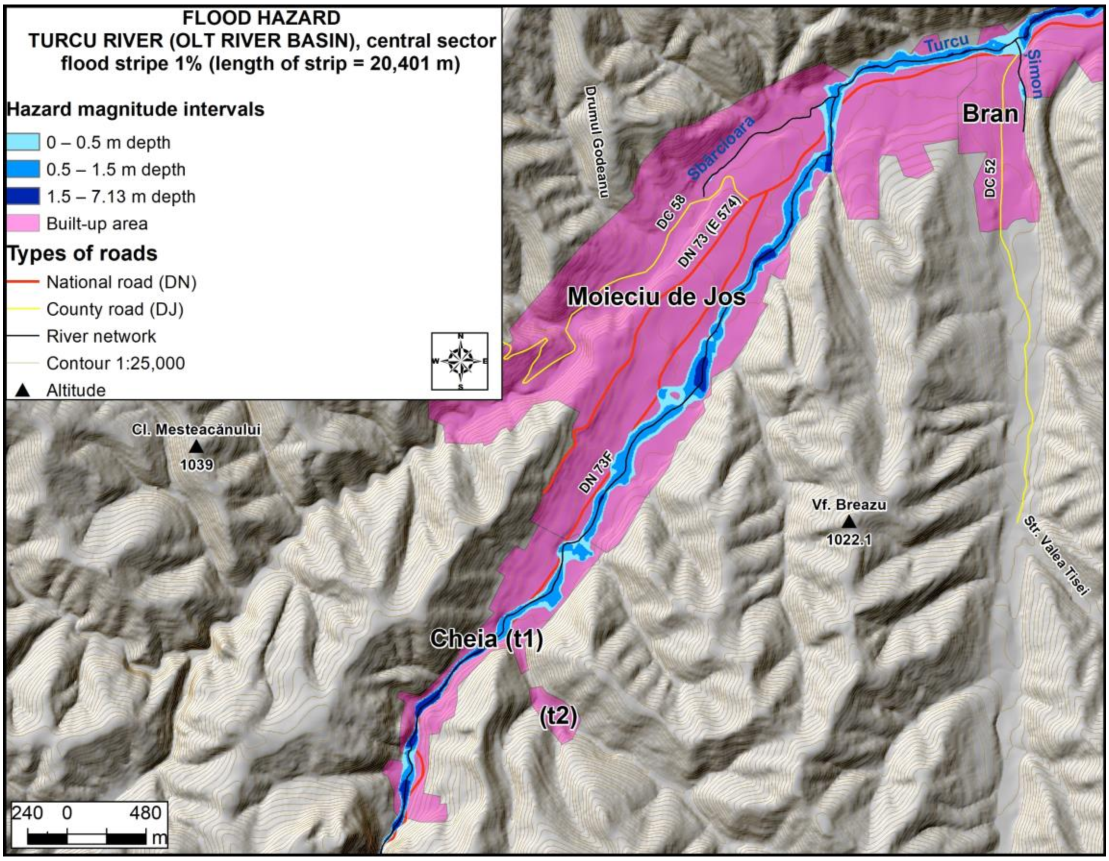


Figure 22. Flood hazard on the Turcu river, central sector

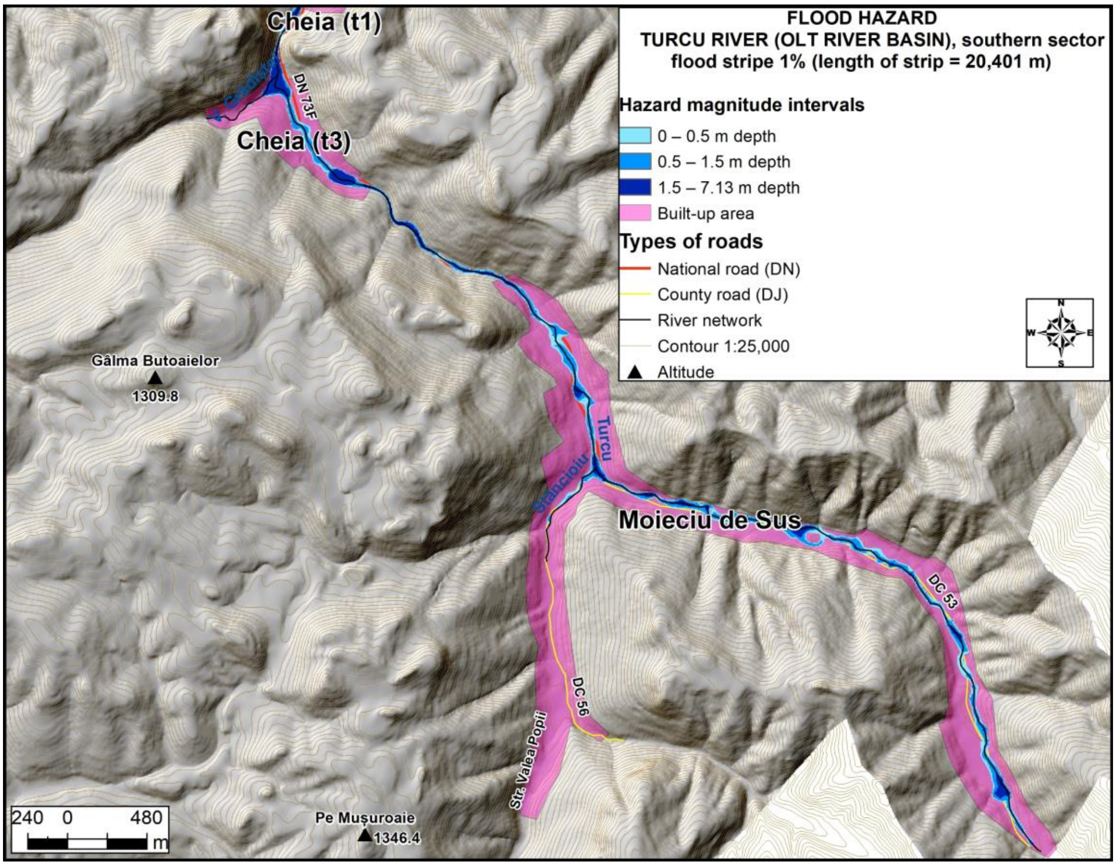


Figure 23. Flood hazard on the Turcu river, southern sector

RESULTS AND DISCUSSIONS

General considerations

The investigations carried out in the previous chapter have allowed us to highlight relevant data on the magnitude and location of the defining geomorphological processes within the tectonic corridor Bran-Rucăr-Dragoslavele, the morpho-hydric processes and the main values that give the relief the quality of useful resource in the development and land use planning of the analyzed unit, as well as certain restrictions induced by the latter.

In the following, we intend to bring to the foreground the most representative characteristics of the geomorphologic and morpho-hydric processes themselves, as well as their implications in the territorial functionality, taking into account, mainly, the vulnerabilities and opportunities operating in the Bran-Rucar-Dragoslavele corridor in relation to the threats and resources existing within it.

In this context, we proceeded to meticulous analysis based on field observations, bibliographical and cartographic sources and, above all, to GIS processing of the collected data categories in order to highlight novel results and useful truthful interpretations of the collected information. In this way, we prepared *morphographic and morphometric analyses of the factors and variables* involved in the structure and functionality of the geomorphologic complexes differentiated within the tectonic corridor and their specific morpho-denudational potential. Even if these analyses do not represent absolute novelties in terms of methodological approach, we emphasize, however, with natural modesty, that these factorial analyses at mesoscale and microscale were carried out for the first time at the level of the respective relief unit.

The approach continued, naturally, with the *assessment of the morphodynamic potential of geomorphologic processes and phenomena* likely to constitute hazards generating risks through the interference of socio-economic systems. It has resulted in the elaboration of six thematic maps showing the spatial potential of processes common to the Carpathian mountain space, characteristic of a relief classified as low mountains, fully included in the fluvio-torrential morphodynamic stage (specifically, torrentiality and runoff, snow and solifluction, disaggregation processes, landslides, landslides, accumulation of alluvium in streambeds and flooding, karstification). Details on the magnitude and spatial occurrence of these types of processes have been provided in the previous chapter.

The natural continuation of the analyses carried out to determine the morphodenododational and morphododynamic potential of the relief is concretized in the *approach carried out to quantify the risk induced by the geomorphological processes* referred to above.

We believe that this triptych of approach described above (morphology - morphodynamics - territorial functionality) has allowed us to bring through our *personal contribution a series of scientific data and significant information of a novel, original character*. We appreciate that the most important component of this approach is the one related to the risks induced by geomorphological processes and phenomena with special reference to the estimation of the degree of risk, to the localization of exposed areas, of course, in relation to the categories of processes and phenomena that generate them.

Considerations, results and discussions on risks induced by geomorphological processes and phenomena

The gradual population of the Bran - Dragoslavele corridor and the deforestation of forests over the last three to four centuries (in order to extend the areas of settlement and for agro-pastoral activities) have created external pressures on the geographical environment that have allowed the morphodynamic energy to manifest itself more intensively over larger areas. Morphodynamic energy, materialized in processes with hazard-generating potential, may become a source of economic (possibly also social) vulnerability under the conditions of increasing pressure from human activities (agro-pastoral, forest exploitation, quarrying, alteration of riverbeds and natural hydrological regime, etc.) in the Transcarpathian corridor analyzed.

In this context, the investigation of *geomorphologic risk* is conceived as an analysis by translating into the GIS environment the formula officially adopted by UNISDR (United Nations Office for Disaster Risk Reduction): Risk = Hazard * Vulnerability. For the quantitative assessment of geomorphological risk, *hazard* was defined by means of the morphodynamic potential (hazard-generating processes in the context of local environmental factors related to geodeclivity, land cover/land use and rock type) and *vulnerability* by spatial assessment of the economic damage that could be produced. Thus, the most representative anthropogenic features that could be represented on the geomorphological risk map produced and rendered at a scale of 1:120,000 (intra-village spaces and main roads) become some of the most vulnerable. At the same time, lands with different categories of use, with assigned economic value (productive and financial), represent the second class of vulnerable elements belonging to the geographical landscape, subject to complex interactions with the energies of morphodynamic agents.

The realization of a final raster with no discontinuities in the surface (no "no data") was based on the idea of the non-existence of zero risk areas. The thematic map was created using the Raster Dataset/Mosaic to New Raster tool of the ArcGIS/ArcMap program, according to the relation Rg = P + Ac/Ut + Pm + R (Mihai, 2005), where: Rg - geomorphologic risk, P - slope (geodeclivity), Ac/Ut - land cover/land use, Pm - morphodynamic potential (hazard-generating processes) and R - rock (lithology). By algebraic intersection of the pixels of the thematic layers under analysis, clusters of pixels were obtained, which were subsequently reclassified into three geomorphologic hazard classes. The final map was based on the idea of hierarchizing the geographic information extracted from the initial (original) sources, so numerical values of different orders of magnitude were assigned to each factor conditioning the geomorphological risk: thousands for slope, hundreds for land cover/land use, tens for the categories of morphodynamic potential and units for rock. In the final reclassification, the pixels integrating the different morphodynamic potential areas were assigned to the corresponding risk classes (Table 3). The intersection of the reclassified pixels is provisional, as it is necessary to discard those groupings that represent areas where the target conditions are not met. It is also judicious to validate in the field (and/or by aerial or satellite imagery) the results obtained from the general analysis carried out in the 'office' phase of the geomorphological risk investigation. As such, mapping followed by detailed mapping of the areas and vulnerable anthropogenic features becomes absolutely mandatory for the detailed characterization of this risk category.

In the thematic map as a whole, areas belonging to three risk classes have been defined:

1. *Areas at high and very high risk* - cover 1.84% (4.82 km²) of the area of the Bran - Dragoslavele Corridor (262 km²) and fulfill the corresponding conditions listed in Table 3. This risk class includes:

- four areas with landslides (three on Cenomanian marls in the central-southern compartment of the corridor and one on clays intercalated with Villafranchian sands and gravels of the Sohodol piedmont). The Rucăr landslide (left slope of the Râușorului) has been drained and seems stabilized as relatively recent constructions can be observed towards its base. A case study is needed to analyze the stability of the slope where the landslide could be reactivated, since its base has been cut by the layout of the Cimitirul Nou street, while immediately downstream there are numerous potentially vulnerable households and dwellings. The other two landslides on Cenomanian marls are located on the courses of torrential tributaries coming from the left slope of the Cheii Valley (Podu Dâmboviței village), with possible reactivation in the presence of a secondary vegetation of degraded grassland with isolated trees and shrubs, developed after deforestation. The vulnerability of the county road DJ 730A is evident since the materials that can block it can come from a distance of about 250 - 300 m on the torrential flow located to the west, with an outlet about 750 m upstream of the eastern end of the "In Pereți" gorge.

- steep slopes (with limited surfaces) belonging to some torrential tributaries of the Râușorului (Valea Lui Maldăr, V. lui Andreiaș, V. cu Țeapă, V. Preotului, etc.), as well as Valea lui Ecle, tributary of the Dâmbovița, made up of massive vracon sandstones. Landslide-rostogolitic collapse are occasional processes and do not represent a risk in the areas where they occur (Fig. 24), but all the valleys mentioned above develop alluvial cones at their mouths, which indicates the production of a substantial input of sandy alluvium from the greosoous area. The over alluviation of the sewers' beds increases the risk of overflow and flooding, which makes the Rucar locality very vulnerable. Under these conditions, the past works aimed at restoring the transport capacity of the bed of the Râușorului, as well as the flood defense infrastructure have proved useful and absolutely necessary.

- ste steep slopes (with relatively small areas) belonging to torrential tributaries of the Sbârârcioara-Valea Coacăzei basins (Strâmba Valley, V. Lungă, V. lui Nen, the basins of the Cale Valley, V. Pescarului, V. Ursului, V. Iezilor, etc.) and Turcu-Moieciu (Valea Lungă, V. Livezii, Șimon, etc.), composed of conglomerates with calcareous breccias (vraconian - cenomanian inf.). The situation is relatively similar to the one previously presented for the Dâmbovița basin, so that the over-alluviation of the collector beds (Turcu, Sbârârcioara, as well as of the Șimon valley) prefigures the risk of overflow and flooding, which makes the villages of Moieciu de Jos, Șimon and Bran more vulnerable. The risk of overflow and flooding on the Porții Stream also has a high potential to occur, due to the low slope of the lower stream sector (< 3°) which favors the accumulation and lateral torrential inflow of Villafranchian sands and gravels.

- limestone cliffs in key valley sectors, most of which evolved on fault paths. Out of the 22 key valley sections at risk of rockfall, 14 sections are crossed by municipal and county roads (Fig. 24) or by the national road DN 73F (Cheia de la Colțul Cheii). The risk of temporary blockage of these roads is high, due to the collapse of the slopes located mainly in the immediate vicinity of the roadway, as well as the input of coarse material transported in the floods by the lateral tributary torrential network.

- tectono-structural calcareous tectono-structural calcareous abruptnesses (south-west of the Pleașa hcst, north of the Podu Dâmboviței graben, the Giuvala Mountain hcst, the Urdea and Urdărița grabenes, south-west of the Vătarnița hcst). A particular situation of geomorphologic risk is encountered on the European national road DNE 73, in the "hairpin" curve crossing the cliff abruptness of the south-west of Mount Giuvala. The road segment is very vulnerable to landslides and rockfalls, so it is imperative to carry out works to strengthen the adjacent slope in order to ensure the protection of the Transcarpathian road traffic.

Table 3. Classification conditions of environmental factors determining the geomorphologic risk in the Bran - Dragoslavele corridor

GEOMORPHOLOGICAL RISK	PANTA (geodeclivity)	COVER / LAND USE	MORPHODYNAMIC POTENTIAL	ROCK (lithology)
SEA RISK and VERY BIG (M)	> 32°	8 and 9	Collapse and landslides Landslides	5, 8, 9, 10, 11, 12 and 16
MEDIUM RISK (med)	17° - 32°	3, 4, 6 and 7	Torrentiality and erosion (associated with areolar erosion) Unbundling	3, 4, 13, 14, 15, 17, 19, 20, 21, 22, 24, 25, 26, 28, 29, 30, 31, 32 and 33
RISC MIC (m)	0° - 17°	1, 2, 5 and 10	News and soliflux Silt accumulation in streambeds and flooding	1, 2, 6, 7, 18, 23, 27, 34, 35, 36, 37 and 38

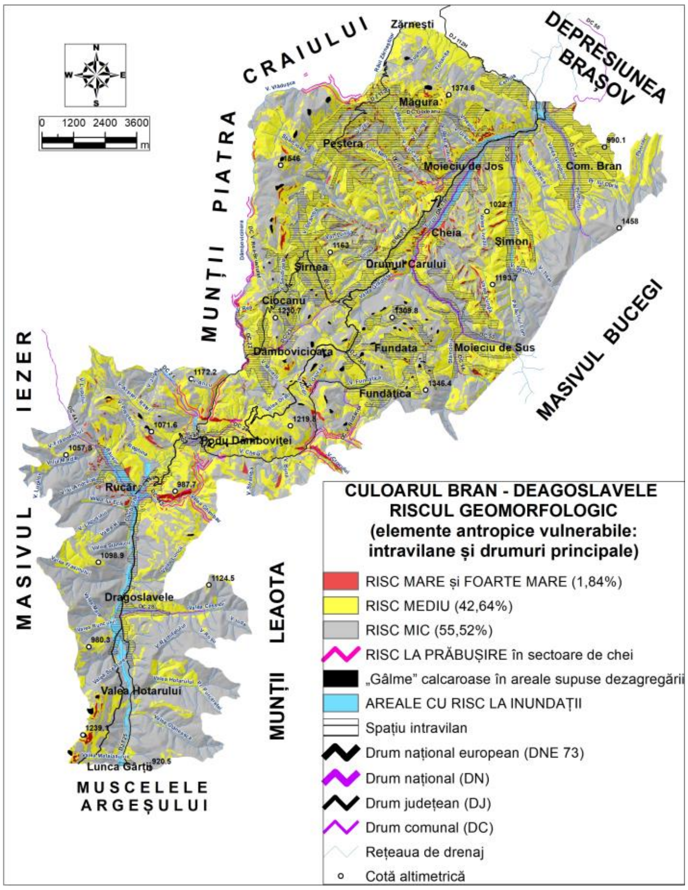


Figure 24. Geomorphologic risk in the Bran - Dragoslavele corridor

- calcareous abruptnesses of the tectonic klippelor tectonic klipp of the Culmea Măgurii (especially the one corresponding to the Gălbinarei Peak in the village of Măgura), of some olistolites in the northern sector of the corridor (for example, olistoliths of the Big and Small caves of the Church Hill in the territory of the village of Peștera) and of some erosion markers of the type of "gullies" of the high central sector in the area of the village of Fundata and the Coja Ridge (La Spărturi, Gâlma Pleșei, Muntele Coja, etc.a.). In these small and punctual areas there is no major geomorphological risk, but in certain situations (as in the case of the eastern ridge of the "La Spărturi" gully, located west of the village of Șirnea), the permeable, steep limestone slopes, without forest protection, are highly exposed to torrential erosion, surface washing away, karstification (lapiezation), disintegration and rolling of coarse materials that will contribute to the consolidation of the deluvio-colluvial cover, thus making it impossible to restore the useful edaphic volume, optimal for the development of meadows.

2. *Areas with medium risk* - they cover 42.64% of the area of the Bran - Dragoslavele Corridor (fig. 24) and fulfill the corresponding conditions listed in Table 3.

In this risk class are included land areas with medium geodeclivity that characterize most of the slopes of the Turc and Dâmbovița tributary torrential basins, under the conditions of natural vegetation cover predominantly herbaceous vegetation in different stages of evolution and / or exploitation during the calendar year. The differentiated exploitation of meadows through traditional pastoral activities (grazing and mowing) is visible by the mosaic appearance of color shades and parcel texture observable on satellite images, at the maximum of the vegetation cycle, especially in the area of scattered villages of the Branului Plateau.

On the overall background of the anthropized landscape, the manifestation of phenomena characterized by meteo-climatic parameters specific to complex topoclimates of order II (Teodoreanu E., 1980), especially atmospheric risk phenomena (Vrânceanu, 2011), contributes to the definition and perpetuation of the current geomorphological processes that shape it: torrentiality and runoff associated with areal erosion, the geomorphological processes with the most widespread potential today. These processes are associated with the disaggregation of gelliferous rocks (limestones and conglomerates), a process that is likely to occur between November and March, at altitudes usually above 1100 m, in the area of limestone "gullies" (Fundata - Fundățica - Ciocanu - Șirnea villages), on slopes not protected by forest vegetation or covered with spruce forests of low consistency.

In relation to the potentially vulnerable elements (land with different categories of use) observable in the landscape of the analyzed mountain area, the environmental risk does not generate critical situations under the conditions of rational (non-intensive) use of agricultural grazable and arable land. Moreover, the modeling performed by means of the USLE equation showed that in most of the territory of the Bran - Dragoslavele Corridor (98.76%), soil losses fall into the very low and low susceptibility classes, in areas covered not only by forest vegetation, but also by pastures, meadows and secondary mountain meadows, or meadows alternating with forest and shrub vegetation. Including the intravilane areas of scattered mountain villages with predominantly agro-pastoral activities (Șirnea, Ciocanu, Dâmbovicioara, Fundata, Fundățica, Șimon, Bran - Porții valley and Moieciu de Sus) are characterized by low potential soil erosion, with relatively rare punctual land degradation (especially on land intended for construction and road infrastructure).

The medium-risk class also included lands that were clear-cut within forest stands in the first decade of the 2000s, which are now being gradually revegetated with shrubs and young trees. Partially affected by dieback, these areas could be downgraded to low risk in the coming decades, once the continuity of the forest canopy is restored naturally (or by planting seedlings).

3. *Areas with low risk* - they cover 55,52% of the area of the Bran - Dragoslavele Corridor and fulfill the corresponding conditions listed in Table 3. In this risk class they can be grouped:

- areas of slopes and relatively thickly forested interfluves, located towards the periphery of the Transcarpathian corridor, at the contact with neighboring mountain units and in the central sector of the "gullies";

- areas corresponding to the Ciocanu erosion level, at altitudes between about 1100 and over 1250 m (in the area of Ciocanu - Șirnea - Peștera and Moieciu de Sus villages, Dealul Sasului, Plaiul Mare, the mouth of the Arșiței Valley, Căpitanului Mountain, Vârtoapele Mountain - Fundul Neagu), with pastoral lands (rarely cultivable) vulnerable to snow and solifluction processes;

- areas with major riverbeds (lunci) on the lower courses of the Dâmbovița (downstream of Rucăr, in the Podu Dâmboviței depression and upstream of Cheia Mică), Râușorul (downstream of the confluence with the Maldăr Valley), Roghina, Turcu-Moieciu (at Moieciu de Sus - Valea Băngăleasca, Cheia, Moieciu de Jos and Bran), Sbârârcioara (downstream of the confluence with Valea cu Cale), Șimon and Pârâul Porții. These areas with a geodeclivity of less than 3°, with a morphodynamic potential for the accumulation of alluvium in the riverbeds (and flooding), do not present a significant geomorphological risk, but they generate favorable conditions for the manifestation of hydrological hazards (overflow and flooding) that make the real estate and traffic-transport infrastructure of the crossed areas particularly vulnerable.

- The areas with river terraces (on the Dâmbovița - in the Podu Dâmbovița depression and in the south of the intramontane valley corridor, on the Turcu - at Moieciu de Jos, at the confluence with the Șimon river and at Bran, along the Șimon and Porții creek valleys) are protected from floods, being affected only by linear erosion whose energy is fed from the adjacent slopes.

- alluvial cones (proluvial deposits), some of which are large, developed at the confluences of tributaries with the broad beds of the main collectors: The Dâmbovița Valley - the agestru at Lunca Gârții, the terraced cone of the Caselor Valley at Dragoslavele, the agestru at the confluences with the Frasinului Valley and the Ecle Valley (both in the area of Rucar) and the terraced cone at the outlet of the Dâmbovița in the Rucar depression; the Sbârârcioara Valley in the vicinity of the confluence with the Turcu - significant being the alluvial cones at the outlets of the Ursului and Iezilor valleys (Bran);

- deluvial glacis of the Rucar and Podu Dâmboviței depressions.

The last two morphological types listed are protected from flooding, being affected only by linear erosion (with landslides on high banks), surface erosion and possible shallow landslides.

In conclusion, it can be noted that the geomorphological risk map essentially provides a picture of the morphodynamic potential of the Bran - Dragoslavele Corridor and shows to a large extent the existence of a relatively stable but vulnerable to extreme manifestation of agents that potentiate the current modeling processes. The limitations of the map drafted at 1:120,000 scale necessitate detailed risk analysis through case studies on restricted areas that require the realization of maps at large scales.

Like the entire Carpathian area affected by anthropic pressure, it remains imperative to regenerate and maintain the forest (as well as meadows, meadows and pastures through appropriate pastoral activities) that stop the erosive action of the current natural erosion agents, maintaining a slow evolution of the slopes in a relatively stable balance, but at the same time easily disturbed both naturally and by irrational anthropic interventions.

Results and discussion on the susceptibility of soils to surface erosion

The present research is part of a broader study entitled "Bran - Rucar - Dragoslavele corridor - applied geomorphology study", in which the potential of current landform modeling processes, among which surface and linear erosion play an important role, is also analyzed. In this context, the aim of the present study is to perform a quantitative argumentation of the modeling potential offered by surface soil erosion. The ultimate goal of the application of the

USLE model is intimately related to the choice of the best management policies to improve soil quality in order to reduce the mean annual erosion rate. At the same time, the mapping of areas with soil erodibility potential will be able to improve the knowledge about the vulnerability to rainfall and for other areas similar to the Carpathian mountain environment characterized by specific physico-geographical and economic-geographical conditions of the Bran - Dragoslavele corridor. .

The average annual rate of surface soil erosion in the Bran - Dragoslavele Corridor was calculated according to the formula: E = K*Ls*S*C, using the Raster Calculator function of the Spatial Analyst module of the ArcGIS/ArcMap program, the values obtained ranged from 0 to more than 4 t/ha/year. The average value calculated is 0.3 t/ha/year.

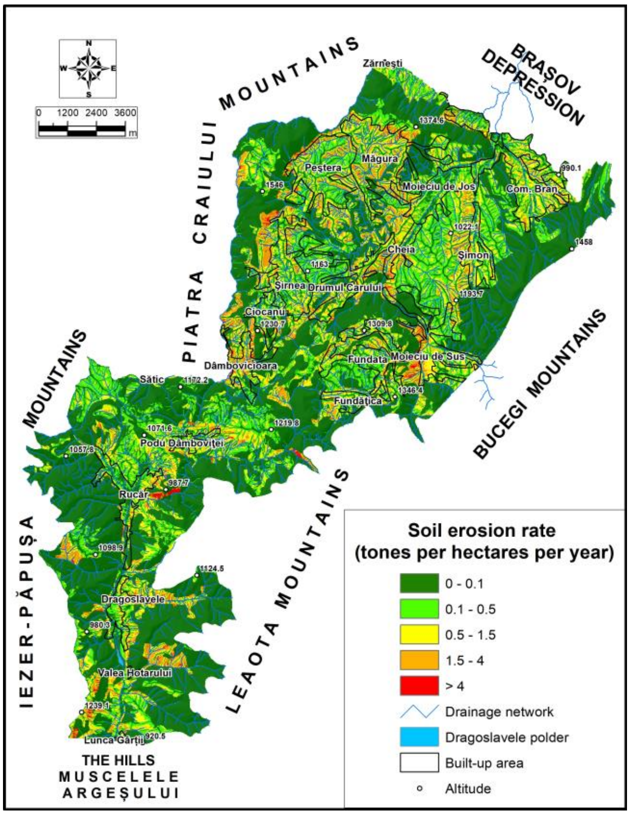


Figure 25. Spatial distribution of the mean annual surface soil erosion rate in the Bran - Dragoslavele Corridor (USLE model)

Table 4. Susceptibility to surface soil erosion in the Bran - Dragoslavele Corridor

Surface erosion (t/ha/year)	**Susceptibility classes**
0 - 0,1	Very low susceptibility (insignificant potential erosion)
0,1 - 0,5	
0,5 -1,5	
1,5 - 4	Low susceptibility (low potential erosion)
> 4	Medium susceptibility (moderate potential erosion)

The analysis of the resulting thematic map (Fig. 25) and the related histogram allows observations on the spatial distribution of the potential amount of material (both mineral and organic) displaced by surface erosion. The universally accepted threshold value for surface soil erosion is 3 t/ha/calendar year. According to the physico-geographical (pedoclimatic and relief) characteristics of the studied area (26200 ha), we consider that surface erosion values exceeding 1.5 t/ha/year (8.32%) represent areas at potential risk, quantified as follows (Table 4):

- 1,5 - 4 t/ha/year (7,08%), in areas with low potential erosion (low susceptibility), affected by clear-cutting from forest (with recently developed shrub vegetation, on slopes with slope of more than 17°), within discontinuous human settlements with complex croplands (on slopes with slope values usually between 6° - 17°, in the villages of Șirnea, Ciocanu, Dâmbovicioara, Fundata, Fundățica, Șimon, Bran - Porții valley and Moieciu de Sus);

- > 4 t/ha/year (1.24%), in areas with moderate potential erosion (medium susceptibility), mainly existing within the numerous sectors of quays, on limestone rocks with discontinuous vegetation, as well as in the limestone quarry of Mount Mateiaș, in areas with slopes with slopes with a gradient usually exceeding 32°.

At the same time, the histogram of the final thematic map shows that the largest area of the Bran - Dragoslavele Corridor (91.68%) presents tolerable, low values of the analyzed parameter, ranging between 0 and 1.5 t/ha/year, in areas covered with forest vegetation, pastures, meadows and secondary mountain meadows, as well as meadows alternating with forest and shrubland vegetation (on the slopes facing the neighboring mountain units, in the Coja Ridge, the Măgurii Ridge and in the "gully" area in the middle part of the Transcarpathian corridor), on slopes with slope values predominantly in the 17° - 32° range.

The USLE model has already been used in analyses for hilly and mountainous areas in Romania (Anghel and Bilasco, 2008, Colniță et al., 2016, Csiszér and Bilașco, 2018, Moldovan, 2019), but not in the Bran - Dragoslavele Corridor. Also, studies related to the analysis of the morphodynamic potential of the relief, with regard also to the surface washing of the soil (areal washing or pluviodenudation) have been carried out in mountain areas close to the Bran - Dragoslavele Corridor: the Ciucaș - Buzău Mountains (Ielenicz, 1984), the Curb Carpathians (Ielenicz, 1982) and in the mountains of the Timișului Basin (Mihai, 2005).

In the mountains of the Timișului Basin (Postăvaru, Piatra Mare, Predeal Cliffs and Timișu de Sus Depression), the areas with favorable potential for surface washing meet the following specific morphodynamic conditions: geodeclivity of 3° - 10°, lack of forest protection of the land (including in the built-up areas) and lower altitudes, usually 1300 - 1400 m (Mihai, 2005). Lands are protected by alteration barks with thicknesses frequently exceeding 0.5 m

(Ielenicz, 1982). At the same time, in the Ciucaș - Buzău Mountains, in terms of geodeclivity, surface scouring becomes active from slopes greater than 5° and frequently to more than 10° where there is no forest. The process also occurs on slopes above 20° below sparse forests (Ielenicz, 1984).

In order to analyze the surface soil erosion in the Bran - Dragoslavele Corridor, the classification of geodeclivity values on genetic basis was used (Surdeanu, 1998), so the following classes of values were defined: 0° - 3° - fluvial accumulation relief dominates; 3° - 6° - slight erosion processes and colluvio-prolluvio-deluvial accumulation processes; 6° - 17° - mass movement processes of landslide type dominate; 17° - 31°(32°) - landslides are accompanied by intense processes of diffuse erosion (surface scouring and washouts), subsidence and gullying, and torrential downbursting; > 32° - gravitational processes of sliding, rolling and slumping. These classes of geodeclivity values, characteristic for the manifestation of different geomorphological processes, were used to outline the conditions for classifying the factors of the morphodynamic potential in the Bran - Dragoslavele Corridor (within the framework of the above-mentioned more comprehensive study), among which is also soil surface erosion, frequently associated with scouring, gullying, ravine, torrentiality, snow avalanches and solifluction.

It is well known that the slope (geodeclivity) plays an essential role as a potential factor in triggering geomorphologic processes of slope and bed, well represented and evidenced in the mountain area under our research. According to the geodeclivity map, the majority of slopes in the Bran - Dragoslavele corridor fall within the range of 17°-32° (52.08%) and 6°-17° (27.21%), which allows us to state that there is a high potential, from this point of view, for the triggering and manifestation of surface soil erosion and the processes associated with it. Synthesizing information from previous research and integrating it with concrete field observations (carried out in different seasons from 2014 to 2023 in almost the entire region), we were able to conclude that the 6° - 17° geodetic-eclitic range is the most favorable for the initiation and manifestation of soil surface erosion in this mountainous area. To evaluate the same type of morphodynamic potential, we also used the interpretation of the morphometric indicator (related to geodeclivity) for each division of the relief of the Bran - Dragoslavele Corridor (three sectors), according to the geodeclivity map:

- for the northern sector, with a relatively uniform overall morphology, the most widespread values of geodeclivity (53.22%) are included in the range 17° - 32°, followed by those in the range 6° - 17° (27.64%);

- for the central sector, with an overall morphology fraught by numerous tectonic accidents, the most widespread values of geodeclivity (46.59%) are included in the range 17° - 32°, followed by those in the range 6° - 17° (30.15%), favorable to both surface and linear erosion, as well as to snow and solifluction (at altitudes above 1000 - 1100 m). The highest values of geodeclivity in the central sector characterize the steep (> 42°), very steep and overhanging slopes of the numerous key sectors, which represents the highest share of all three sectors of the Bran - Dragoslavele Corridor (3.57%);

- for the southern sector, characterized by the morphology of the Dâmbovița gorge, the most widespread values of geodeclivity (62.13%) are included in the range 17° - 32° (favorable to disaggregation on the Mateiaș limestones at altitudes above 1100 m, but also to torrential downpours), followed by those in the range 6° - 17° (19.06%).

In the Bran - Dragoslavele Corridor, under the conditions of an altitudinal range between 600 m and 1546 m, the other specific morphodynamic conditions (together with the geodeclivity) that outline the favorable potential for the production and manifestation of surface soil washing are: lithology (predominantly conglomerates, sandstones, marls, fluvio-lacustrine sands and gravels, but also extensive areas of calcareous rocks with rendzinic soils), land cover/land use (predominantly areas with pastures, meadows and grasslands in various stages of exploitation/degradation, areas with poorly completed forests, areas with clear felling and regenerating vegetation, but also areas of discontinuous human settlement) and the conditions of the mountainous climate with moderate nuance (Teodoreanu, 1980) characterized overall by relatively low average temperatures (average of 4.4°C in the period 1896 - 1970, at the Fundata meteorological station, 1384 m) and rich precipitation both in terms of quantity (average amounts of 1020.2 mm in the period 1921 - 1970, at the Fundata meteorological station) and number of days with rain.

The application of the USLE model for the Bran - Dragoslavele Corridor revealed the territories susceptible to surface soil erosion, depending on the morphological and climatic characteristics of this mountain subunit, the hydrological characteristics specific to the predominantly calcareous and conglomeratic areas, the physical properties of the soils (most types have a short profile), the degree of cover and the type of vegetation, as well as the agro-pastoral and forestry activities with local specificity. It was firstly found that in most of the analyzed territory, soil losses fall into the class of insignificant potential erosion, in areas relatively well covered by predominantly forested vegetation. The increased values, included in the range 1.5 - 4 t/ha/year, highlight a weak potential erosion that characterizes the overall intravilane areas of scattered mountain villages with predominantly pastoral activities. The highest values, above 4 t/ha/year, indicate a moderate potential erosion, on lands characterized by medium and high geodeclivity, as well as a low degree of cover, with discontinuity of the soil cover and of the protective vegetation cover. Under these conditions, the most affected territories correspond to the rugged limestone areas (22 sectors of quays), as well as the limestone mining area of the Mateiaș quarry.

The results of the modeling using the USLE equation can suggest local administrative authorities to apply different scenarios integrating mitigation or protection measures against land degradation that can aim at reducing the current level of surface soil erosion for different land use categories (Rosca, 2014). In order to prevent or reduce the soil losses that may occur due to surface erosion, as well as to achieve the highest possible economic efficiency with regard to the use of agricultural land (especially arable land), the following traditional agro-technical measures may be recommended for the studied area: Perseverance in the application of the cultivation system with ploughing and sowing arranged along the contour lines, on slopes up to 4° (7%) - 6° (10.5%), terracing of sloping land for agricultural crops (where possible), as well as conservation through revegetation with species of trees and shrubs that can halt further degradation of land susceptible to deep erosion (ravening) and landslides on the friable Cenomanian marls of the Rucar - Podu Dâmboviței area.

Results and discussions on flood risk and territorial vulnerability

The analytic approach was concretized in the *determination of the 1% flood band* and the *hazard maps* related to the flood areas in the Turcu river valley (between Tohanu Nou and Moieciu de Sus), results meant that, by correlating their contents with the socio-economic realities of the territory, we can extend the approach in the direction of water risk assessment and implicitly of territorial vulnerability. In order to estimate the vulnerability of the territory to flooding, the main tool used was the determination of the potential financial loss (minimum values) in case of flooding on the Turcu river for the land and related real estate infrastructure, mapped in the 1% flood band.

Assessment of the potential financial loss (minimum values) from flooding on the Turcu River for land and related real estate infrastructure mapped in the 1% flood band. The hazard and flood risk analysis along the Turcu River, upstream of the Tohanu Nou SH, was carried out in the 1% flood band which crosses from downstream to upstream the municipalities of Tohanu Nou (town of Zărnești), Bran (commune of Bran), Moieciu de Jos, Cheia and Moieciu de Sus (commune of Moieciu). For the vulnerable land and related real estate infrastructure, therefore subject to hydrological hazard (floods in floods and high waters), an assessment of the potential financial loss (minimum values) in floods was carried out. The analysis started from the inventory of the infrastructural categories represented polygonally (residential buildings, outbuildings, etc.) existing in the flood band, identified and mapped on recent satellite images. Thus, the area of the 1% flood band was superimposed on the surfaces of 555 infrastructures distributed within the administrative-territorial units, as follows. In the intra-village area of Tohanu Nou, the seat of Zărnești (Fig. 30), 70 infrastructures were identified, of which 68 residential buildings (houses, villas, hostels, etc.) and 2 household annexes. In the urban area of Bran, residence of the municipality of the same name (fig. 30 and fig. 31), 87 infrastructures were identified, of which 57 residential buildings, 23 household annexes, 6 public institutions (New Orthodox Church, "Inima Regina Maria" Chapel, "Sextil Pușcariu" High School Bran - partially in the area of the band, SRI headquarters in Bran - partially in the area of the band, Bran Police Station, "Aurel Stoian" public parking lot - partially in the area of the band) and one private commercial establishment ("La Doi Pași" shop). In the intravilan area of Moieciu de Jos, the residence of Moieciu commune, 145 infrastructures were identified, of which 130 residential buildings and 15 household annexes. In the intravillage area of Cheia, a village in the commune of Moieciu (fig. 32), 89 infrastructures were identified (57 in t1 and 32 in t3), including 75 residential buildings, 13 household annexes and a private industrial bottled mineral water production unit, 'Izvorul Moieciu'. In the intravillage area of Moieciu de Sus, a village in Moieciu commune (fig. 33), 139 infrastructures were identified, of which 112 residential buildings, 25 household annexes and 2 public institutions (the cultural center and the secondary school Moieciu de Sus). In the exravilan area of Tohanu Nou and Bran (fig. 30), 25 infrastructures were identified, including 10 residential buildings, 13 household annexes and 2 commercial establishments (restaurants "Taverna Lupilors" and "La Lupi"). It is illegal to build housing and economic infrastructure on land outside the urban area. In the case of the extravilan area of Tohanu Nou and Bran we can admit that the buildings have a building permit that would prove their allocation to the adjacent intravilan area for the purpose of calculating the potential financial loss (minimum values) in case of flooding.

The distribution of the mapped infrastructure within the 1% flood band, reclassified by water depth ranges, is as follows: 433 infrastructures were identified in the flood band with water depth > 0.5 m (195 fully included), and 360 infrastructures were identified in the flood band with water depth < 0.5 m (122 fully included).

It was found that 238 infrastructures intersect the bands with both depth values, and 75 infrastructures fall partially or entirely within the flood band with water depth > 1.5 m.

The Turcu River, in the sector for which the 1% flood band was realized, has an average width of less than 10 m (10.13 m width of the minor riverbed in the profile drawn at SH Tohanu Nou). According to the Water Law 107/1996 (Annex no. 2) (Source: https://legislatie.just.ro/Public/DetaliiDocument/8565), concerning the width of protection zones along watercourses, for watercourses with a width of less than 10 m, starting from the minor riverbed boundary, the width of the protection zone is 5 m. By realizing the buffer of 10 m width from the centerline of the Turcu River, 44 infrastructures partially located in the area of maximum imminent flood risk were identified, found in the following intra-village areas: 32 in Moieciu de Sus, 6 in Cheia, 2 in Moieciu de Jos, 3 in Bran and one in Tohanu Nou.

Following this approach, minimum values expressed in Romanian lei (RON) were assigned for land, courtyards, residential buildings and household annexes, as well as for commercial, industrial, social-cultural infrastructure, or infrastructure with other than economic use. The most recent minimum values are valid for 2020, taken from the "Market study on the minimum values of real estate properties in Brasov and Covasna counties, 2021", Chamber of Notaries Publics Brasov (Source: http://www.unnpr.ro/files/expertize2021/CNPBrasov/bv_si_cv_2021.pdf).

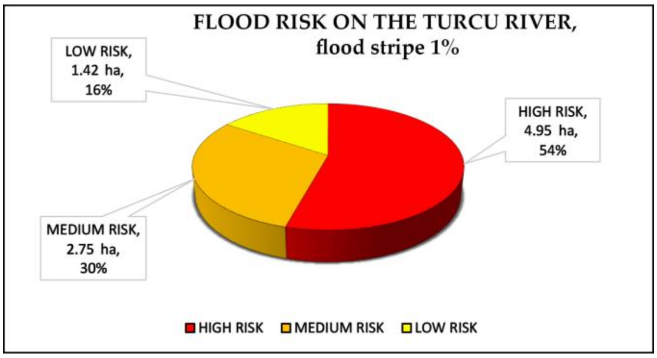


Figure 26. Turcu River - flood risk of land with related real estate infrastructure, mapped in the 1% flood band

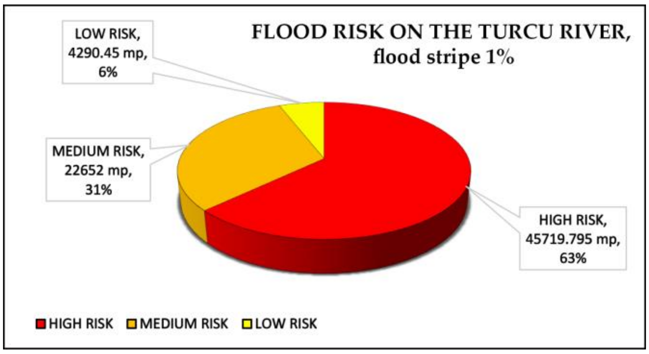


Figure 27. Turcu River - flood risk of land with residential buildings, buildings with economic, social-cultural, etc. use, mapped in the 1% flood band

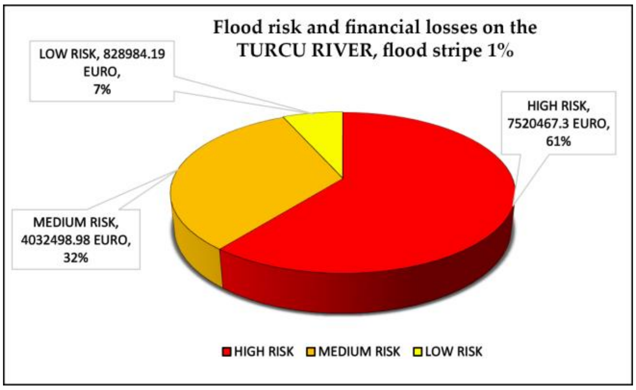


Figure 28. Turcu River - potential financial loss (minimum values) for land and related residential buildings, mapped in the 1% flood band

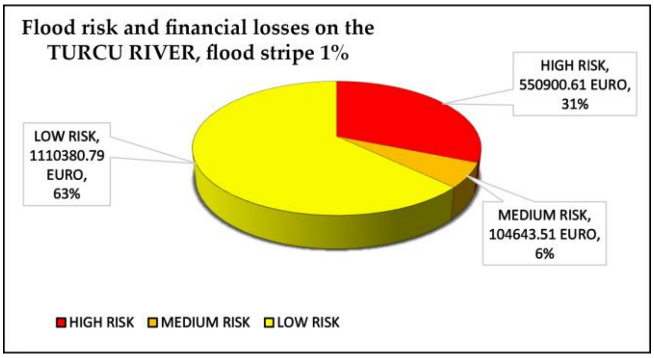


Figure 29. Turcu River - potential financial loss (minimum values) for land and related real estate infrastructure for economic, social-cultural, etc. use, mapped in the 1% flood band

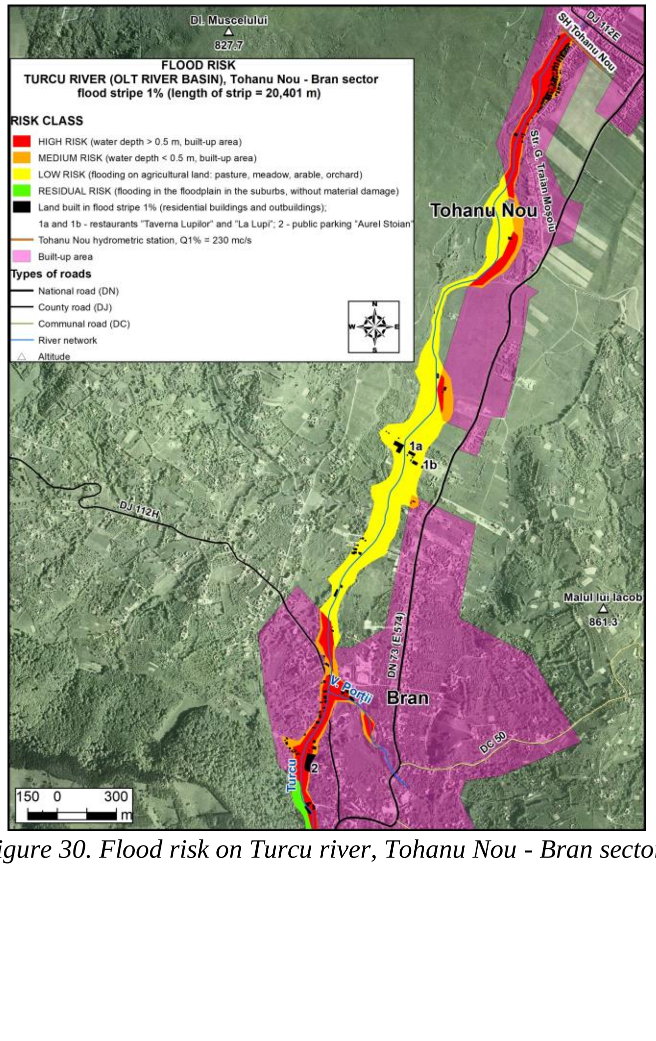


Figure 30. Flood risk on Turcu river, Tohanu Nou - Bran sector

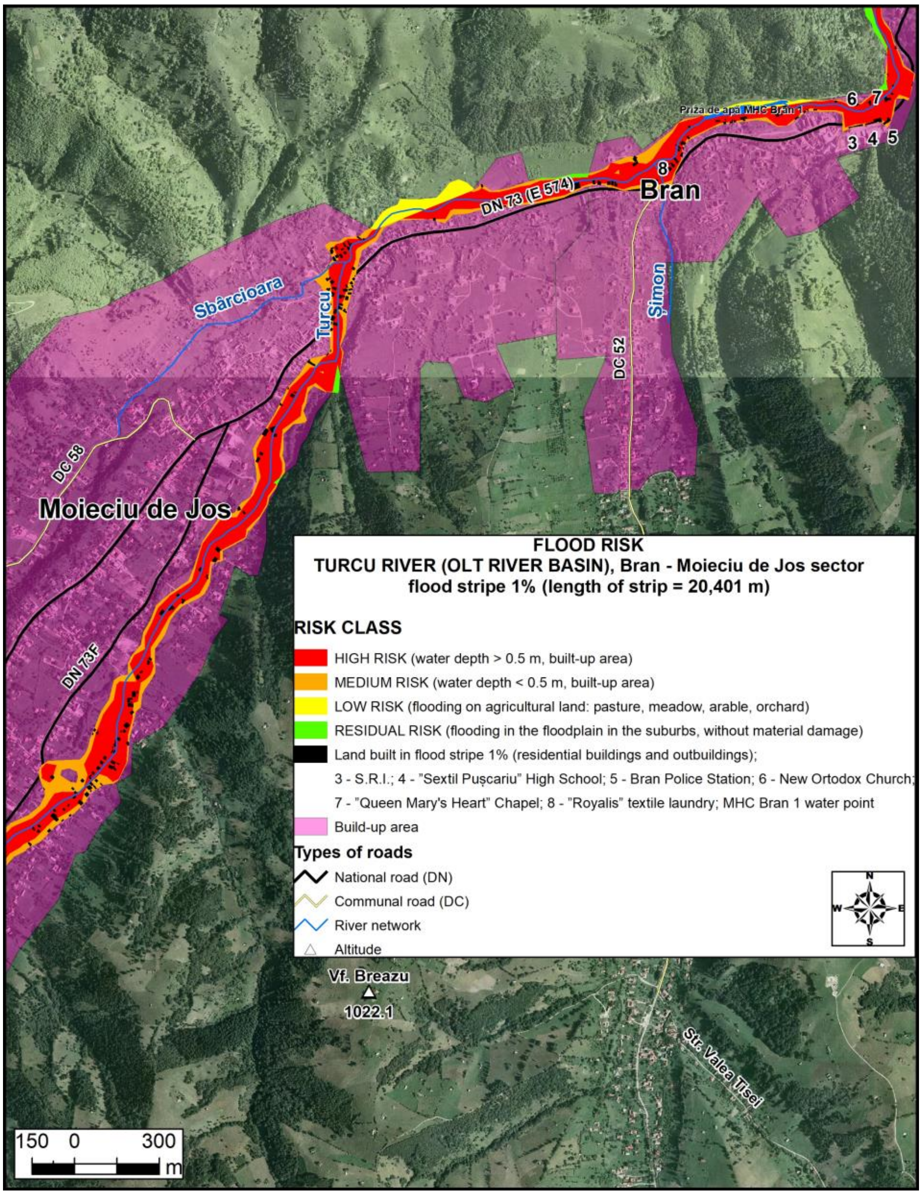


Figure 31. Flood risk on Turcu river, Bran - Moieciu de Jos sector

The high risk class corresponding to the 1% inundability band with water depth > 0.5 m of the five localities' intravilan space (78.784119 ha), of which 4.957727 ha are built-up land areas, predominantly with residential buildings and household annexes, public institutions and infrastructure with economic use (two). The difference of 73.826392 ha is the area of agricultural land with use categories: pasture, meadow, arable, fruit trees/shrub plantation.

The medium risk class corresponding to the 1% inundability band with water depth < 0.5 m of the five localities' intravilan space (33.329536 ha), of which 2.75053 ha are built-up land areas, predominantly with residential buildings and household annexes, plus some public institutions; The difference of 30.579006 ha is the area of agricultural intravilan agricultural land with the categories of use: pasture, meadow, arable, fruit trees/shrub plantation.

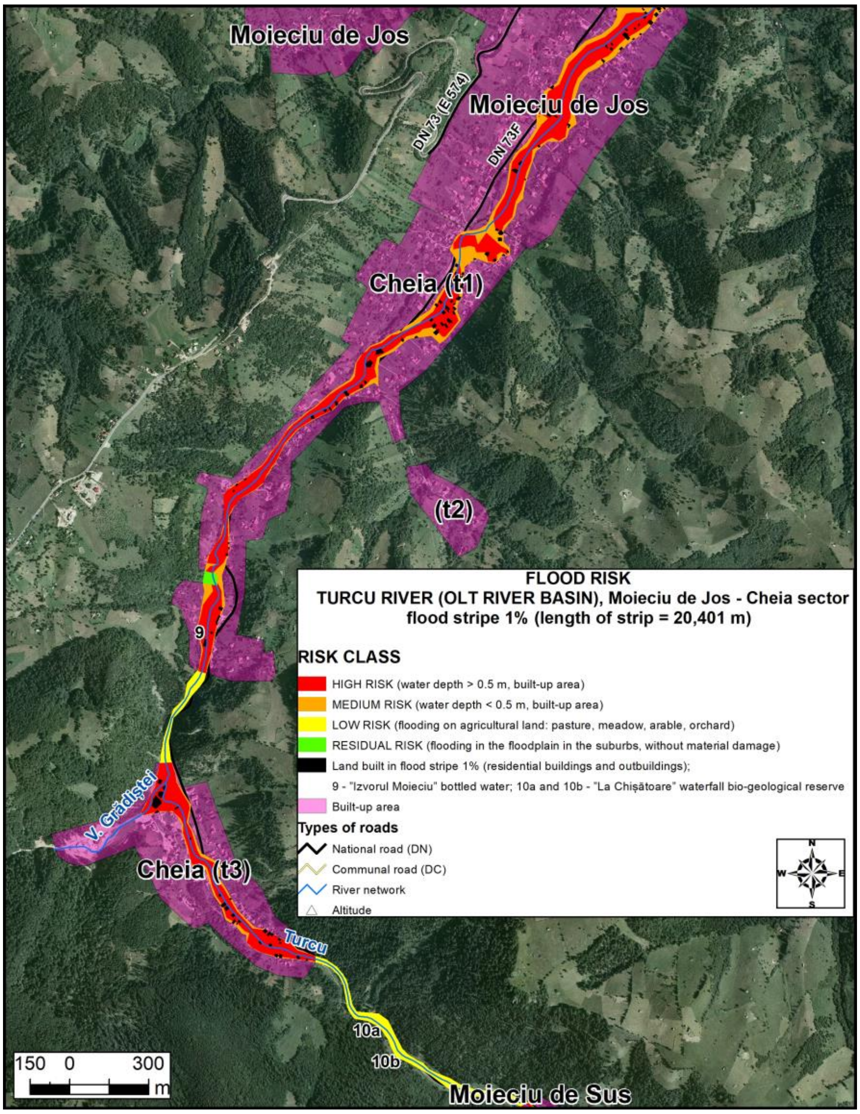


Figure 32. Flood risk on river Turcu, sector Moieciu de Jos - Cheia body 3

The potential financial loss (minimum values) for land and related real estate infrastructure in the area of high and medium risk classes is as follows: residential buildings, 56646504,28 lei (11552966,28 euro); household annexes, 1196851,22 lei (244095,94 euro); public institutions, 2901428,86 lei (591741,89 euro). The potential financial loss (minimum values) for infrastructure with economic use in the area of high risk class is 312835,13 lei (63802,23 euro). Therefore, the total amount of the potential financial loss (minimum values) for the land, yards, buildings and related real estate infrastructure, mapped in the area of the high and medium risk classes is 61057619,49 lei (12452606,35 euro).

The low risk class corresponding to the 1% flood band on the land outside the five municipalities (35.539844 ha). It was calculated by subtracting the residual risk areas from the sum of 10.663825 ha (agricultural non-urban agricultural land in the floodplain with depth < 0.5 m) + 24.858542 ha (agricultural non-urban agricultural land in the floodplain with depth >

0.5 m). Within the flood band 16 areas were identified in the floodplain, of which 5 areas were classified as low risk, the other 11 areas were classified as residual risk.

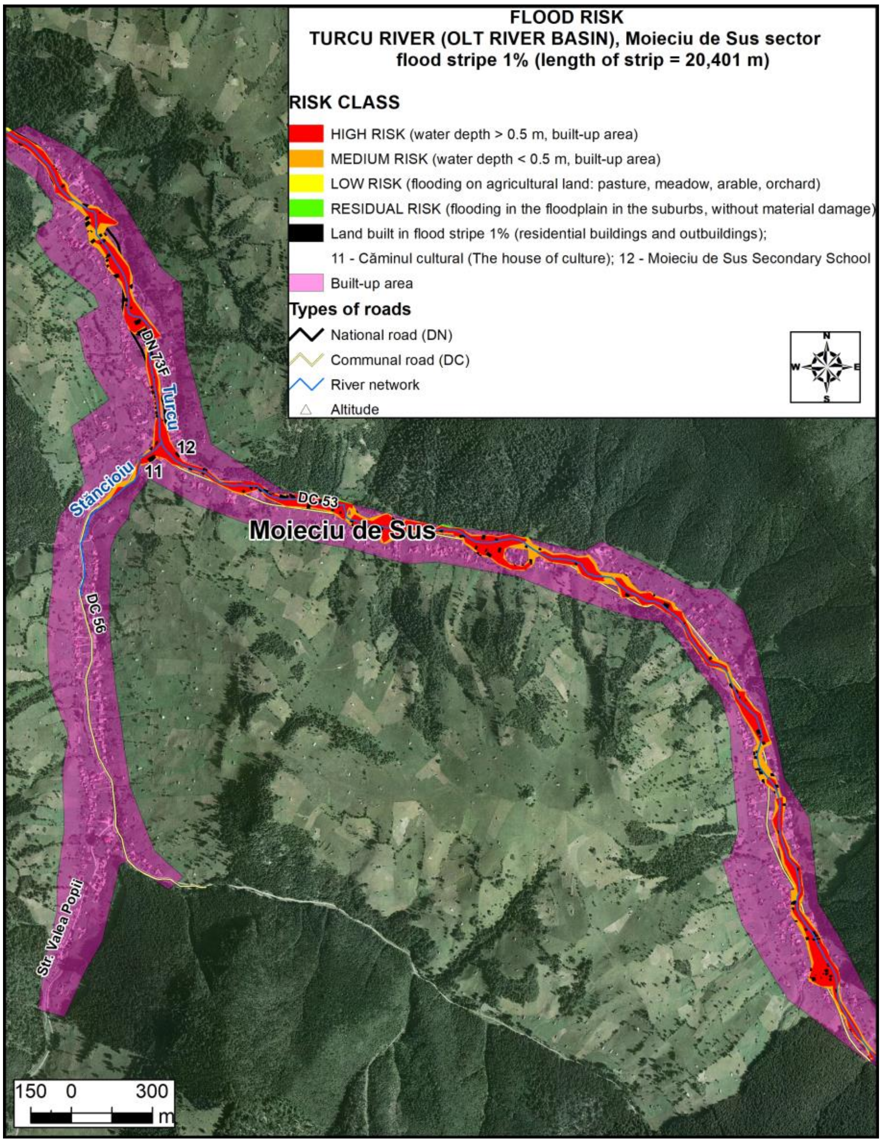


Figure 33. Flood risk on the Turcu river, Moieciu de Sus sector

The low risk class included: Agricultural extravilan agricultural land, two areas (pasture, meadow, arable, fruit trees/shrub plantation); area corresponding to the water intake (water surface) of the Bran 1 micro-hydropower plant (in conservation); areas (two) including segments of the DN 73F along the Turcu river gorge (between the settlements Cheia trup 1 - Cheia trup 3 and Cheia trup 3 - Moieciu de Sus); residential buildings (ten); economic infrastructure (two restaurants) and household annexes (thirteen). The 25 buildings in the extravilan area of Tohanu Nou and Bran could be illegal only if they are not registered with a building permit attesting their allocation to the adjacent intravilan area. They are found in the band with water depth > 0.5 m (0.454075 ha) and in the band with water depth < 0.5 m (0.975849 ha).

The potential financial loss (minimum values) for the land, courtyard, buildings and related real estate infrastructure, categorized in the area of the low risk class is 10180798.07 lei (2076357.9 euro);

The residual risk is the overflow into the floodplain of the floodplain, without material damage. The potentially affected area measures 1.982523 ha, which is the sum of the areas of the 11 areas (meadow, small wooded areas) classified with this risk category in the 1% flood band.

The pressure on land, related to economic activities in the intravilane spaces of the developed settlements along the Turcu valley, has increased considerably over the last three to four decades, in the absence of administrative restrictions.

The flood risk for the land and related real estate infrastructure located in the intravilane or extravilane areas of the localities crossed by the Turcu River, mapped in the 1% flood

band, can be perceived by understanding the concept of vulnerability of the identified real estate categories. They could come into contact with the erosional force of the liquid and solid flow or with the impact force generated by projected objects. The mentioned forces are conditioned by the morphology of the drainage bed, the arrangement of the obstacles built in the forward flow direction, the flow size, the depth (Fig. 21, Fig. 22 and Fig. 23) and the velocity generated by the overflowing stream during floods (the velocity of water movement in the floodplain has been calculated but not used in the present analysis).

The total value of the potential financial loss (minimum values) for the land and related real estate infrastructure, mapped in the 1% flood band area of the Turcu river is the sum of the values obtained for the calculation of the potential financial loss in the areas of the three risk classes: 61057619,49 lei (value in the high risk class + value in the medium risk class) + 10180798,07 lei (value in the low risk class) = 71238417,56 lei, equivalent to 14528964,26 euro. The financial value obtained has been reduced by the value attributed to the household annexes (1864554,86 lei) that are not insured by the compulsory insurance policy against natural disasters (Source: https://www.paidromania.ro/ce-este-pad/). The resulting amount is set aside as a reserve fund in the state and/or local budgets for the compensation of owners insured by the PAD. Therefore, the total amount of potential financial loss (71238417,56 lei) - the amount of potential financial loss attributed to the household annexes (1864554,86 lei) = the PAD insurance fund (69373862,7 lei, equivalent to 14148691,2 euro). The fund can be set up as a financial reserve in the state and/or local budgets for the compensation of owners insured under the PAD for flood damage.

Insurance against natural disasters is compulsory in Romania under Law 260/2008 (Source: https://legislatie.just.ro/Public/DetaliiDocumentAfis/126184). However, compulsory insurance covers only partial compensation, which is decided by the insurer following an analysis carried out by the damage assessment commission. The amount of the compensation will be calculated at the minimum market value of the land and related real estate infrastructure (dwellings registered with the tax authorities), which are located in the 1% flood band and are likely to be affected by severe flooding.

We believe that the usefulness of the thematic maps and layers produced in the current research also lies in the support it can provide to insurance firms in making decisions to engage or not to engage in offering optional insurance policies (Bilașco et al., 2021, Costea et al., 2022). These decisions can be based on the hazard magnitude criterion (water depth) and the position in the flood band of the real estate to be assessed. Also, the developed maps can become useful tools in making decisions for voluntary insurance of land and real estate infrastructure subject to flood risk, for the population owning properties located in the risk areas (Sestras et al., 2022).

Assessment of the potential financial loss from flooding on the Turcu River for road segments intersected by the 1% flood band and water depth > 0.5 m. Roads along the Turcu Valley partially intersect with the 1% flood band area. Those road segments are susceptible to erosional degradation triggered by floods and high waters on the Turcu River under the overflow conditions dictated by Q1% = 230 m^3/s (SH Tohanu Nou).

In Table 5, the works cost value (2722974,1 lei/km) for a rehabilitated/modernized county road has been taken from the above-mentioned source, and the similar works cost values for the potentially risky segments of DNE, DN and DC have been expressed by percentage approximation based on the dimensional criteria of the road type, starting from the works cost value for 1 km of DJ, according to argument (1) expressed above, taking into account also the arguments numbered (2) and (3). The percentage approximation is given in the fifth column of Table 5. Thus, the potential financial loss was calculated as the product of the length of road potentially affected (km) and the cost of the rehabilitation works (RON/km).

Table 5. Assessment of the potential financial flood loss on the Turcu River for in-flooded road segments with 1% flood band and water depth > 0.5 m

Potential financial loss from flooding on the Turcu river for road segments intersected by the 1% flood band and water depth > 0.5 m					
1	**2**	**3**	**4**	**5**	**6**
Type and road sign	**Width platforms = pc + a (m)**	**Length of road potentially affected (km)**	**Road surface potentially affected (m^2) (2 x 3)**	**Cost of rehabilitation works (lei/km)**	**Loss financial potential (Lei and Euro) (3 x 5)**
DNE 73	8,3 + 2,2 = 10,5	0,42571	4469,955	2722974,1 + 40% **	1 622 876,22 Lei
DN 73F ²	7 + 2 = 9	3,44538	31008,42	2722974,1 + 20% **	11 258 016,6 Lei
DN 73F ¹	6,5 + 2 = 8,5	0,27437	2332,145	2722974,1 + 10% *	821 812,64 Lei
DJ 112H	6 + 2 = 8	0,23005	1840,4	2722974,1 *	626 420,19 Lei
DC 53	4,35 + 2,15 = 6,5	1,23543	8030,295	2722974,1 - 30% **	2 354 830,72 Lei
TOTAL		5,61094	47681,215	-	16 683 956,37 Law = 3 402 666,90 Euro

*pc - carriageway; a - verge; ¹ - Moieciu de Sus and Cheia; ² - Moieciu de Jos; * - cost value of rehabilitation/modernization works taken from http://litera9.com, valid for DJ 112H; ** - cost value of rehabilitation/modernization works approximated as a percentage based on the dimensional criteria of the type of road .*

The road segments subject to the major risk of degradation by the mechanical action of water laden with silt when the river overflows are those resulting from the intersection of the above-mentioned traffic arteries with the 1% flood band whose depth exceeds 0.5 m. Thus, on the flood risk map, from upstream to downstream, on the course of the river and the Turcu valley, the vulnerable segments are distinguished. In the municipality of Moieciu de Sus (the "uluc de vale" sector), the DC 53 crosses the Turcu river twice (two bridges) and is in the flood band for a length of 1235.43 m (29.53% of the total length of the municipal road). In its extension, in the same municipality, the DN 73 F crosses the Turcu river three times (three bridges) and is in the flood band for a length of 758.6 m. In the extraurban area between Moieciu de Sus and Cheia trup 3 (narrow gorge-type valley sector), DN 73F crosses the flood band for 928.7 m, and in the intraurban area of Cheia trup 3, located in a small basin where the Grădiștei and Turcu valleys meet, the same road crosses the flood band for 468.76 m. In the extravilan area of Cheia between bodies t3 and t1 there is a narrow sector of a key-type valley (Cheile Grădiștei gorges in the right of Colțului Cheii) where the DN 73F road follows almost parallel to the river course, the length of the intersection with the floodplain is 112.45 m. Further on, the road crosses the territory of Cheia, body 1, where it closely follows the course of the river, as the valley continues to be relatively narrow in the southern half of the crossed administrative-territorial entity, so that the length of the intersection with the floodplain is 1176.87 m. Downstream, in the municipality of Moieciu de Jos, the wide valley sector allowed the construction of the DN 73F infrastructure at a safe distance from the course of the Turcu river and its possible overflow areas, so that the road section intersected with the flood strip is only 274.37 m. It can be seen that out of the total length of 8445.05 m of DN 73 F, the flood risk map for a flow Q1% = 230 m^3/s indicates road segments with a high potential risk for this hazard, measuring a total length of 3719.75 m (44.04% of the length of this road).

The risk map also reveals the high vulnerability of the DN 73 (E 574) road on the segment between the junction with DJ 112H and the junction with DN 73F. Several particular aspects stand out. In the urban area of Moieciu de Jos (northeastern third), immediately upstream of the confluence with the Sbârârcioara River, where the Turcu River and its floodplain cross the DNE 73 for a length of 113.89 m, there is a road segment with very high vulnerability under the hazard conditions studied. Consequences with major damaging potential could be materialized by the temporary blocking of the only communication (transport and supply) with and between the localities of Moieciu de Jos (2222 loc./year 2011), Cheia (488 loc./year 2011) and Moieciu de Sus (1001 loc./year 2011) (Source: http://www.recensamantromania.ro/resultate-2/), which are located on the upper course of the Turcu valley, could cause serious disruption to the transportation-supply activities, as well as to the tourist flow on this traditional tourist axis of local and national importance, which is intensively frequented and is part of the Bran - Dragoslavele Corridor.

The potential financial loss was calculated as the product of the length of the potentially affected road segments (km) and the cost of rehabilitation works (lei/km). The total amount calculated (indicative and expressed at the value of the Romanian Leu on the market on November 15, 2022) for the road segments potentially degraded (5.61094 km) by the erosion exerted by the Turcu River at the Q1% (230 m^3/s at SH Tohanu Nou) overflow is 16683956.37 lei, equivalent to 3402666.90 euro. This financial value is only a part of the total amount that could be approved by Brasov County Council as an insurance fund for the restoration of public roads possibly damaged in the flood area of the Turcu River.

The localities of Bran, Moieciu de Jos, Cheia and Moieciu de Sus are part of an axis of intense traffic along the river and the Turcu valley, to and from places with tourist attractiveness and activity, belonging to the mountain subunit of the Bran - Dragoslavele corridor. The only traffic route along the mentioned localities is the public roads DNE 73, DN 73F and DC 53, and the present study shows that the last two arteries have a major flood risk potential, materialized by 4.955518 km of road segments that could be degraded by the mechanical action of sediment-laden water when the Turcu river overflows.

Conclusions. The current research is an in-depth local study of the floodplain of the Turcu River, a tributary of the third order in relation to the Danube River, partially included in the area of the Transcarpathian corridor Bran - Dragoslavele. The present study contributes, on the one hand, by completing the national hydrological database held by A.N.A.R.A. and I.N.H.H.G.A. On the other hand, through the realization of flood hazard and risk maps, it has been possible to cover an area along an axis of particular tourist relevance. At the same time, the research area approached in the present study was not included in the maps published at national level, accessible and visualizable in the portal presented online by A.N.A.R.A. However, we anticipate that the overflow of the Turcu River at a Q1% flow of 230 m^3/s, almost double the historical maximum of 1975 (120 m^3/s), may cause significant material damage under the increasing anthropogenic pressure, visible by the increasing concentration of buildings built in the area of the 1% flooding band in the last 30-40 years. We note that climate change effects have not been taken into account for the hydraulic modeling in the present research.

The realization of the natural flood hazard map, which was concretized by delimiting the ranges of water depth values in the 1% flood band, led, in a subsequent stage, to the creation of the flood risk map, which was then divided into three risk classes (high, medium and low), to which the residual risk was added. Within the three classes, the potential financial loss (minimum values) from flooding was calculated for land and related real estate infrastructure (more than 555 infrastructures identified on recent satellite images), located in the intravilane or extravilane areas of the localities crossed by the Turcu River, mapped in the 1% flood band. The risk was perceived, therefore, by understanding the concept of vulnerability of the backyard land and the real estate infrastructure on their surface.

Regarding the vulnerability of the road infrastructure, we emphasize the fact that the only road along the localities of Bran, Moieciu de Jos, Cheia and Moieciu de Sus are the public roads DNE 73, DN 73F and DC 53. The present study emphasizes that the last two arteries have a major flood risk potential, concretized by 4.955518 km of road segments that could be degraded by the mechanical action of sediment-laden water, in case of overflow of the Turcu river. The observations made on the flood risk map clearly highlight the segments vulnerable to hydrological hazard, marked on the heavily traveled tourist axis, with a particular tourist attraction, which runs between the mentioned localities along the Turcu valley. Brasov County Council and Local Councils could make use of the useful information from the current research, especially that contained in the cartographic material, in order to draw up more precise intervention plans, useful to the County Inspectorate of Gendarmerie "Nicolae Titulescu"

Brasov, Brasov County Committee and Local Committees organized for emergency situations. We are of the opinion that the intervention plans should be carried out thoroughly and rigorously, because the observations from the current research show that in the event of a severe flood disaster in the Turcu valley bed, the major problem of the imminent temporary blocking of the only road (DN 73F - for transport and supply) that allows the connection between the localities of Moieciu de Jos, Cheia and Moieciu de Sus, which are located on the upper course of the valley studied, should be analyzed and solved.

The risk maps elaborated in the present study can also support the planning-management activity for the realization of investment works in order to prevent and combat the effects of floods, which are the responsibility of Brasov County Council. At the same time, these maps can be an important working tool for the realization of various local plans and strategies in areas such as: land use planning, urban planning, flood risk management, flood risk management, public information, etc.

In the future, the increase of the working spatial resolution, the accuracy of the extent of the 1% inundation band, as well as the quality of detail of the hazard and risk maps, could be improved by using DEMs obtained from the leveling and network of talvegauges extracted from 1:5000 scale topographic plans, or DEMs obtained from the scanning of the target land surface by means of a drone-mounted LIDAR sensor.

The associated risks indicate, for the floodplains included in the risk maps, calculated at different probabilities of exceedance of the maximum flow, the potential damage to property and human casualties, in accordance with the requirements of Directive 2007/60/EC. According to the Flood Risk Management Plan, National Synthesis, p. 24, the main element exposed to hazard is the population. The calculation of the number of potentially affected inhabitants has been recalculated on the basis of the final official data provided by the National Institute of Statistics, valid for the 2011 census. The calculation may be recalculated whenever new demographic information provided by the NSI becomes available.

Results and discussions on relief as a tourist resource of the Bran - Rucar - Dragoslavele Corridor

Geomorphosites. Evaluation method, diagnostic sheet, hierarchical value and their distribution in the area of the Bran - Rucar - Dragoslavele Corridor

Some of the most widely used assessment methods for geomorphosites are those of traditional members of the International Association of Geomorphologists (IAG) working group on geomorphological sites, representatives of the University of Modena and Reggio Emilia (Mario Panizza, Coratza Paola and Giusti Cecilia, 2005), Univ. of Lausanne (Reynard E., 2009), Univ. of Valladolid (Serrano E. and Gonzalez Trueba J.J., 2005), Univ. of Cantabria (Bruschi V.M. and Cendrero A., 2005) and Univ. of Minho (Pereira P. et al., 2007). In addition to the listed authors, Jean-Pierre Pralong, former researcher and professor at the Univ. of Lausanne, has proposed an evaluation method that focuses on the touristic value of geomorphosites (Pralong, 2005). The evaluation methods, originating at least from authors representing the geomorphological schools listed above, pursue different goals, but all of them include the following evaluation criteria: rarity, integrity and scientific representativeness (Comănescu L. et al., 2012).

Outstanding Romanian contributions in terms of geomorphosite studies have been made by representatives of the geographic schools of Oradea (Ilieș Dorina and Josan N., 2009), Cluj (Irimuș I.A., 2009, 2010, 2011, 2012, 2014 and others; Cocean (Munteanu) Gabriela, 2011, 2012, 2015, 2017, 2021 and others; Toma Bianca, 2010, 2012, 2013 and others; Petrea D., 2009 and collaborations), from Bucharest (Comănescu Laura, 2009a, 2009b 2010, 2012 and others, in collaboration with Nedelea A., Dobre R., Ielenicz M.) and Oradea (Ilieș Dorina and Josan N., 2009).

The evaluation, preceded by the rigorous selection and followed by the hierarchical ranking of the geomorphosites from the Bran - Dragoslavele corridor is possible by using criteria (partially taken, modified and adapted) inspired by the method conceived and proposed by Cocean G. and Surdeanu (2011), applied to the analysis of geomorphosites from the Trascău Mountains (Cocean G., 2011). We justify the approach of this method (following an in-depth analysis of the methods proposed by the mentioned international authors) by the relative similarity between the relief developed on the Mesozoic limestones of the two Carpathian geographical areas, namely the relief of the numerous key-type valley sectors, the majority of caves developed in their slopes, as well as the relief of isolated massifs of the klippites and olistolites category, taking into account the genetic peculiarities characteristic of each relief unit and also the particular characteristics resulting from the comparison of the same genetic types of relief.

Within the method approached, the intrinsic or structural values (geomorphological, aesthetic and ecological) of the geomorphosites will be detached from the functional

values derived from the former, attributed by man (cultural, scientific and economic). 38 proposed criteria will be applied to the geomorphosites, based on which the most appropriate score will be given, as objectively as possible, among the 5 fractions scaled equidistantly in the range 0.00 - 1.00 point. The application of the method will be tested for the study area, and the 16 most representative geomorphosites resulting from the rigorous selection stage will be evaluated (Fig. 34).

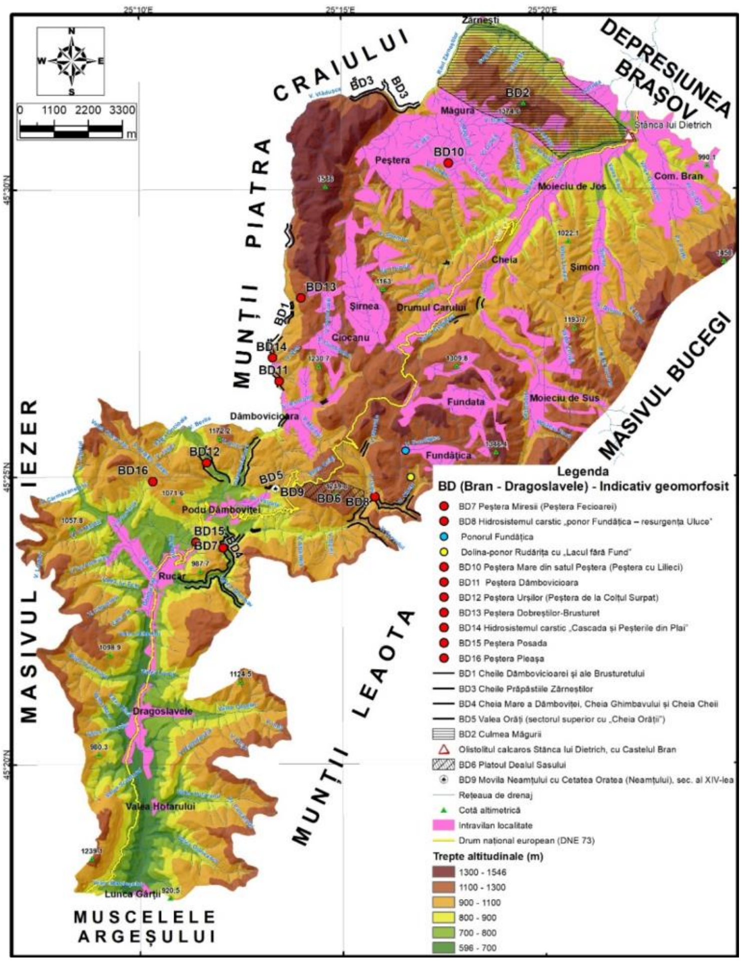


Figure 34. Bran - Rucar - Dragoslavele corridor, spread of proposed geomorphosites

For reasons of space, the rigorously selected diagnostic sheets (Table 7), ordered according to the hierarchical values, realized for the 16 geomorphosites of the Bran - Dragoslavele Corridor (Table 6), have been reproduced at the end of the paper (Appendix II).

Table 6. Geomorphosites of the Bran - Rucar - Dragoslavele Corridor

Nr. crt.	**GEOMORFOSIT / protected natural area status**: SPA - strict protection zone of Piatra Craiului National Park (IUCN category Ib); RNGG1 - Geological and geomorphological nature reserve "Karst area Cheile Dâmbovița - Dâmbovicioara - Brusturet", included in SPA; RNGG2 - Nature Reserve (proposed) "Moieciu - Fundata - Dâmbovicioara - Rucar - Moieciu Geological and Geomorphological Complex" (IUCN category IV); RNCZ - Nature Reserve "Zărneștilor Gorges", included in SPA; ROSCI 0194 Natura 2000 site ROSPA 0165 Natura 2000 site	**TYPES**	**RELEVANCE for fields of study (other than geomorphology) and applicability**
1	**MIRESII CAVE (P. Fecioarei)** / RNGG1 included in SPA (IUCN category Ib); proposed as a natural monument (IUCN category III)	speologic geomorphosite	- zoospeological (bat colony) - environmentally friendly (isolated biotop) - physical caving (diversified caving) - landscaping (new portal) - paleontological (fossils of Mesozoic marine invertebrates)
2	**DOBREȘTILOR-BRUSTURET CAVE** / RNGG1 included in SPA (IUCN category Ib); nature monument (IUCN category III)	speologic geomorphosite	- zoospeological (one locally endemic invertebrate, one for the Southern Carpathians and chiroptera) - environmentally friendly (isolated biotop) - physical caving (diversified caving)
3	**THE BIG CAVE IN THE VILLAGE OF PEȘTERA (P. with Bats)** / RNGG2; nature monument (IUCN category III) included in the Integral Protection Area (IUCN category II) of the PNPC and ROSCI 0194 (1 ha)	speleological geoarcheosite with paleolithic remains	- zoospeological (invertebrates and chiroptera in periodically established gestation colonies) - archaeological (Paleolithic geoarcheospeosite) - Tourist (cave open to the public, even if it has habitat code: 8310, Caves closed to the public)
4	**BEAR CAVE (P. de la Colțul Surpat)** / RNGG1 included in SPA (IUCN category Ib); nature monument (IUCN category III)	speologic geomorphosite	- zoospeological (a locally endemic invertebrate and bat colonies) - speogenetics (former resurgence) - paleontological (fossils of Quaternary vertebrates) - Tourism (until 2007) - cultural (until the 1980s)
5	**PLEAȘA CAVE** / RNGG2; proposed nature reserve (IUCN category IV)	speologic geomorphosite	- Zoospeological (a locally endemic invertebrate)
6	**POSADA CAVE** / RNGG2 and ROSCI 0194	speologic geomorphosite	- physical speleology - zoospeological (chiroptera)
7	**DÂMBOBOVICIOARA CAVE** / RNGG1 included in SPA (IUCN category Ib); nature reserve (IUCN category IV)	speologic geomorphosite	- zoospepeological (a Carpathian endemic invertebrate) - paleontological (fossils of Quaternary vertebrates) - economic (geoturistic mass tourism)

8	**KARST HYDROSYSTEM "PONOR ASS - THE RESURRECTION OF ULUCE" /** RNGG2; Uluce Cave - nature reserve (IUCN category IV) included in ROSCI 0194	karst hydrogeomorphosite which includes Uluce Cave (speological geomorphosite)	- hydrogeological - zoospeological (a locally endemic invertebrate and chiroptera in Uluce Cave) - paleontological (fossils of Quaternary vertebrates) - economic (partial water abstraction for domestic use)
9	**KARST HYDROSYSTEM "WATERFALL AND CAVES DIN PLAI" (Upper Cave of Valea Rea and Lower Cave of Valea Rea)** / RNGG1 included in SPA (IUCN category Ib)	karst hydrogeomorphosite	- hydrogeologic - zoospeological (a Carpathian endemic invertebrate and chiroptera in the Upper Cave of the Rea Valley)
10	**ORĂȚI VALLEY (UPPER SECTOR with "ORĂȚII KEY") /** RNGG2; geomorphosite included in ROSCI 0194 and ROSPA 0165	singular geomorphosite - deep limestone torrent on a cliff face ("Key to the City")	- geologic/geomorphologic (calcareous torrent cut into the cliff) - paleontological (fossils of Mesozoic marine invertebrates) - Tourism (geotourism and recreational tourism - canyoning)
11	**SUMMIT /** RNGG2; geomorphosite included in the PNPC Sustainable Conservation Area, ROSCI 0194 and ROSPA 0165	complex geomorphosite - isolated klippite- and of calcareous olistolites	- geological (klippe and olistolite) - paleontological (fossils of Mesozoic marine invertebrates) - cultural-historical (Bran Castle on Dietrich's Rock - calcareous olistolite) - archaeological (Neolithic) - landscaping (tamatic belvedere)
12	**THE MOUND OF NEAMT WITH CITADEL ORATEA /** RNGG2; geomorphosite included in ROSCI 0194 and ROSPA 0165	complex geomorphosite - geoarcheosite with ancient and medieval remains on the surface of a limestone plateau with marginal fault scarps	- archaeological (ancient and medieval history) - geological (horst-type ruptured structure) - paleontological (fossils of Mesozoic marine invertebrates) - cultural-historical (medieval Oratea Fortress)
13	**SASULUI DEAL** / RNGG2 **plateau**; geomorphosite included in ROSCI 0194 and ROSPA 0165	geomorphosite system - partially karstified plateau including the paleontological geomorphosite of "Sălătruc" (1184 m)	- palaeogeographic (Barremian 'reef nest' erosion markers) - paleontological (fossils of Mesozoic marine invertebrates) - cultural-historical / archaeological (ruins of a tactical military device from the First World War) - landscaping (panoramic belvedere)
14	**THE BIG KEY TO DÂÂMBOBOVIȚEI, THE KEY TO GHIMBAV and KEY KEY /** RNGG1 included in SPA (IUCN category Ib), ROSCI 0194 and ROSPA 0165	geomorphosit system - 3 key valley sectors (total length = 7,7 km, of which Ch. Mare a Dâmbovița = 4.05 km)	- geologic - morphogenetic - paleohydrographic (speleoepigenetic sector) - biogeographical (Carpathian endemic plants; one invertebrate and one vertebrate, both glacial relicts) - paleontological (fossils of Mesozoic marine invertebrates) - historical (early medieval - Battle of Posada?, 1330) - economic ("wild boating" until 1962) - tourism (eco-tourism, geo-tourism and recreational tourism: mountain hiking, classic mountaineering and kayak-canoeing in the 1970s)

15	**THE KEYS OF DÂMBOVICIOAREI and THE BRUST /** RNGG1 included in SPA (IUCN category Ib), ROSCI 0194 and ROSPA 0165	geomorphosit system - 6 key valley sectors (total length = 4.52 km, of which the Dâmbovicioarei Key = 1.82 km)	- geologic - morphogenetic - paleohydrographic (speleoepigenetic sectors) - biogeographical (Carpathian endemic plants; endemic invertebrates in caves: Dâmbovicioara, Upper Cave of Valea Rea and Dobreștilor) - paleontological (fossils of Mesozoic marine invertebrates) - economic (still water from the springs of Gâlgoaie and trade in traditional culinary products) - tourism (ecotourism, geotourism and recreational tourism: mountain hiking, classic mountaineering and climbing) - cultural (houses with traditional Muscovite architecture, Traditional Museum, etc.)
16	**THE KEYS TO THE ZĂRNEȘTILOR /** RNCZ included in SPA (IUCN category Ib), ROSCI 0194 and ROSPA 0165	complex geomorphosite - 6 key valley sectors (total length = 3.9 km, of which the Key to the Valley of the Cliffs = 1.7 km)	- geologic - morphogenetic - paleohydrographic (speleoepigenetic sectors) - biogeographical (Carpathian endemic plants; invertebrates - a local endemic in the Big Cave and the Small Cave of Prepeleac) - paleontological (fossils of Mesozoic marine invertebrates) - tourism (ecotourism, geotourism and recreational tourism: mountain hiking, classic mountaineering and climbing)

Table 7. Hierarchy of geomorphosites in the Bran - Dragoslavele corridor

NR. CRT.	GEOMORFOSIT (BD - callsign geomorphosit)	Structural Values			Functional Values			AR	TOTAL
		VS1	VS2	VS3	VF1	VF2	VF3		
1	**BD1** Dâmbovicioarei and Brusturetului Gorges	5	3,25	3	2,75	5	8,25	0,75	**26,5**
2	**BD2 The Butte**'s Ridge	5,50	3	2,50	3,25	4,50	8	1	**25,75**
3	**BD3** Zarnesti Gorges	5,25	3	3	1	4,75	7,75	0,75	**24**
4	**BD4 The** Great Key of the Dâmbovița, the Ghimbavului Key and the Key of the Key ("Cheița")	5	3,25	3	1,25	4,75	5,75	0,50	**22,5**
5	**BD5** Orăți Valley (upper section with "Key to the City")	4,25	2,50	2	2,50	4	5,75	1,25	**19,75**
6	**BD6** Dealul Sasului Plateau	3,75	3,50	2,25	1,25	4,75	4,75	0,75	**19,5**
7	**BD7** Miresii Cave (P. Fecioarei)	5,25	2,50	2,25	1,25	4	4,50	0,25	**19,5**
8	**BD8** Karst hydrosystem "ponor Fundățica - Uluce resurgence"	5,50	1,75	2	1,25	3,50	5,50	1,50	**18**
9	**BD9** Movila Neamțului with Oratea Fortress	2,25	2,50	2	2	3,75	6	0,75	**17,75**
10	**BD10** Big Cave in the village of Cave	3,75	1,75	2	2	4,25	5	1,25	**17,5**
11	**BD11** Dâmbovicioara Cave	3	1,50	1,75	1,75	3,25	7,25	1,25	**17,25**
12	**BD12** Bear Cave (P. Surpat Corner)	3,75	1,75	2	2	3,50	5,25	1,25	**17**
13	**BD13** Dobreștilor-Brusturet Cave	4,75	2	2	0,75	3,25	3,75	1	**15,5**
14	**BD14** Karst hydrosystem "Waterfalls and Caves in Plai"	3,50	1,75	1,50	0,25	3,25	5,50	1,25	**14,5**
15	**BD15** Posada Cave	4	1,50	1,50	1,25	2,50	5	1,50	**14,25**
16	**BD16** Pleașa Cave	4	1,50	1,25	0,25	1,50	4,50	0,75	**12,25**

We appreciate that the 16 proposed geomorphosites could be the most valuable in the area of the Dragoslavele Bran Dragoslavele Corridor, because in a first stage, following the exhaustive analysis, the first 36 objectives with certain morphotouristic value were selected. Therefore, we consider that the geotouristic promotion and planning measures in the studied area should start from them. There are no objective hierarchies, but only those that tend as much as possible towards the ideal of objectivity, but we believe that the reasoning based on the criteria used to establish the hierarchy has succeeded in propelling each proposed geomorphosite to the position it deserves.

Geomorphosites diagnostic sheet (example)

Name	the keys of the dambovicea and the bustsuret	
Call sign	BD1	
Location	In the north-central part of the Bran - Dragoslavele Corridor, on the border with Piatra Craiului Massif	
ATU	Village of Dâmbovicioara (commune Dâmbovicioara)	
Types	Geomorphosit system - key valley sectors	
Extension	Linear	
Total value	**26,50 p**	
V. Structural	11,25 p	
V. Functional	16 p	
Restrictive attribute	0,75 p	

STRUCTURAL VALUE		
TIP	PCT	JUSTIFY
Geomorphologic	5	- complex genesis, involving several morphogenetic factors: tectonic conditioning (longitudinal faults and transverse faults), lithologic conditioning (alternation between limestones and conglomerates along the Brusturetului - Dâmbovicioara Valley), classical epigeny and speleoepigeny (1,00 p.) - slow dynamic, deductible (0.50 p.) - five elements of geomorphologic interest: large limestone cliffs; residual relief on the slopes (towers, buttresses and arches) and secondary ridges; caves in the slopes, including the geomorphosite P. Dâmbovicioarei; karst springs (some of them captured) and speleoepigenetic sectors (1.00 p.) - slightly affected geomorphosite (0.75 p.) - geomorphosite unique system at regional level, due to tectonic conditioning in genesis (0.50 p.) - stratified, but also massive limestones, predominantly monoclinal (shallowly dipping), diaclaciated and phallic (0.75 p.) - the greatest differences in level between the upper slopes and the Dâmbovicioara valley are between 100 and 200 m, in the lower part of the Dâmbovicioara valley (0.50 p.)

Aesthetics	3,25	- geomorphosite system with a unique physiognomy, due to the geomorphologic features mentioned above, especially the numerous speleoepigenetic sectors (0.75 p.) - the chromatic mosaic is created by associating the gray tones of carbonate rocks with the chromatic palette of chlorophyll vegetation and the reflections of the water of the Dâmbovicioara river (0,75 p.) - being geomorphosed system, linear type, can be partially received from numerous vantage points (0.75 p.) - The geomorphosite is an essential landscape component in the big picture and is also protected for its landscape content. It belongs to RNGG1 (IUCN category IV) of the SPA (IUCN category Ib) of the PNPC, being also included in the protected natural areas of community interest ROSCI 0194 and ROSPA 0165 Piatra Craiului (1,00 p.)
Environment	3	- characteristic biotope for habitats of community/national interest, such as calcareous rocky slopes with casmophytic vegetation, etc., but also for endemic Carpathian plant species: *Campanula carpatica* (Carpathian bellflower), *Aconitum moldavicum* (omag) and *Dianthus spiculifolius* (Hungarian beard); the postglacial relict *Ligularia sibirica* (marigold or mountain cucumber) is present in the valley between the narrow Brusturet gorge and the Brusturet hut (1,00 p.) - Characteristic biotope for fish (*Barbus meridionalis* or moorhag) and amphibian species (*Triturus montandoni* or Carpathian newt and *Bombina variegata* or yellow-bellied puffbill) of community/national interest in the ROSCI 0194 protected natural area. The local endemic *Duvalius duebelianus* and the Southern Carpathian endemic *Dermestes latissima* live in the Dobreștilor-Brusturet cave, and the Carpathian endemic invertebrate *Plutomurus carpaticus lives in the* Dâmbovicioara and P. de Sus caves in Valea Rea (1,00 p.) - the geomorphosite is fully protected, as it belongs to RNGG1 included in the PNPC SPA, ROSCI 0194 and ROSPA 0165 (1,00 p.)

FUNCTIONAL VALUE		
TIP	PCT	JUSTIFY
Cultural	2,75	- appears in more than 50 graphic representations and photographs in tourist information/popularization articles, as well as in photo albums or videos presented on the internet. The painter Nicolae Grigorescu realized the famous painting entitled "Cheile Dâmbovicioarei", exhibited at the National Art Museum of Romania in Bucharest (1,00 p.) - on October 26, on St. Dumitru's Day, local ritualistic bonfires called "sumedre fires" were lit. One of the fires was organized under the Urzicarilor cliff, at the entrance to the Key of the Cave from the village of Dâmbovicioara; the annual events perpetuated and also current are linked to the day of the Commune of Dâmbovicioara (31 May) and the day of the feast of Sânzienelor (24 June), in conjunction with the 'Universal Day of Jai' (1.00 p.) - the village of Dâmbovicioara (with the hamlet "Valea Rea" and some households inserted among the sectors of quays) still preserves elements of traditional Muscelene architecture related to the construction of dwellings, households, or scattered structures of habitat with stables and outbuildings (0.75 p.)
Scientific	5	- Brief references to this geomorphosite system are found in occasional publications and in articles dedicated to tourism promotion. The scientific references appear in several articles in national paleontological and geomorphological journals, as well as in an international journal article on the genesis of keys by speleoepigenesis (0,75 p.) - a scientific resource with polyvalent addressability, due to its geological/geomorphological, paleohydrographical, paleontological, biogeographical, economic (still water - the Gâlgoaie springs) and tourism (ecotourism, geoturism and forms of recreational tourism) interest (1,00 p.) - model with maximum expressiveness (1.00 p.) - geomorphosit system with regional representativeness (0.50 p.) - geomorphosite of high paleogeographic (paleohydrographic) interest, useful for deciphering the genesis and evolution of the relief to the present state with key valley sections (0.75 p.) - complex paleontological remains, with Mesozoic marine invertebrates and Quaternary vertebrates (1,00 p.)

Economic	8,25	- *biospeleological and paleontological research* (based on special permits), *geoturism, ecotourism, mountain hiking, mountaineering and climbing, mass caving with geoturistic character* (Dâmbovicioara Cave), *cycle tourism*, as well as *cultural-rural tourism with ethnographic character* (houses with traditional Muscovite architecture, Traditional Museum of the Wallachian Country, varnițe and annual cultural-artistic / ethno-folcloric events) *(*1,00 p.) - potential for tourist development of national interest, recognized for the forms of tourism mentioned, with direct access on the road DC 22, from the village of Dâmbovicioara (1,00 p.) - access by car on DJ 730 (from Podu Dâmboboviței) and DC 22 (from Dâmbovicioara) along the quays (1.00 p.) - numerous hostels along the Dâmbovicioara Valley (Dâmbovicioara village) (1.00 p.) - the key-type valley sectors are crossed by several approved and maintained tourist trails; most climbing trails are properly equipped; the perimeter of the geomorphosite has the Argeș Public Mountain Rescue Service (Dâmbovicioara village) (1,00 p.) - distance to Rucar, nearest town with complex services < 10 km (0.75 p.) - the nearest urban centers to the S.P. Salvamont Argeș (village Dâmbovicioara) are Câmpulung (27574 loc./2021), 32.1 km away and Zărnești (21624 loc./2021), 31.4 km away (0.50 p.) - complex, permanent valorization (mainly during the summer season) (1,00 p.) - tourism promotion on websites (Dâmbovicioara Tourist Information and Promotion Center, etc.) and on YouTube, with a maximum of national reach (0.75 p.) - the sport climbing competition "Memorial Bebe Nistorescu" organized by the Argeș County Mountain Rescue Public Service in the walls of the gorges at the confluence of the Dâmbovicioara Valley with the Muierii Valley, which reached its 7th edition in 2019, a competition held to celebrate the 5th anniversary of the first Romanian mountain rescue team, in Câmpulung, in 1969 (0.25 p.)

RESTRICTIVE ATTRIBUTE	
PCT	JUSTIFY
0,75	- key sectors are vulnerable to processes such as karstification, disaggregation, landslides, subsidence, subsidence and torrentiality, but may be affected to a lesser extent (0.25 p.) - intensive tourist operation with heavy road traffic on weekends during the summer season (0.25 p.) - minor and temporary unsightly elements, due to the high flow of tourists, by foot and by road (air polluted with noxious pollutants), during the summer season; rare unsightly elements of improvised and abandoned infrastructure in some households along the communal road (0.25 p.)

Personal contributions related to the morphogenesis, inventorying and capitalization of some unpublished speleological geomorphosites from the Bran - Rucar - Dragoslavele corridor

The results recorded in this section are the fruit of an old passion for cave exploration, and in this case the term is not an exaggeration as we proceeded to investigate two caves that are difficult to access and scientifically unstudied in order to map their morphology and to decipher other relevant aspects regarding their genesis, characteristics and intrinsic value: the *Dobreștilor-Brusturet cave* and the *Miresii cave*.

CONCLUSIONS

The Bran - Rucar - Dragoslavele corridor has aroused the interest of a considerable number of researchers, geologists and geographers in particular who, since the beginning of the last century, have elaborated more concise or more extensive works, but, undoubtedly, extremely important for the knowledge of this emblematic unit of the Romanian Carpathian space. Our passion for geomorphology and our personal attachment to this area led us to try to overcome this apparent impediment, induced by the assumption that it would be difficult to obtain unprecedented, truthful and useful results at the same time. As a result, we aimed to give the present study a clearly applicative character, making it possible, on the one hand, to capitalize on the conclusive results existing in the studies of illustrious predecessors and, on the other hand, to approach the relief of the corridor from a different perspective, by delving into issues that have not been investigated in detail so far.

The issues to which we refer, analyzed mainly at the microscale in order to ensure a satisfactory resolution of applied approaches that are intended to be equally applicable, are mainly three: first, it aims to assess the functional role of the relief in the territorial ensemble of the Bran - Rucar - Dragoslavele corridor, manifested particularly through the morphodynamic processes and phenomena that relate and even interfere with elements of the built habitat and with various economic activities that the population carries out in that area.

The second concerns the assessment of territorial threats, i.e. geomorphologic, morpho-hydric and hydric hazards. Obviously, the results obtained would have been of purely theoretical or statistical relevance if the approach had not taken into account the way in which the hazard identified (in terms of magnitude and localization) affects the population and a number of elements exposed to risk (buildings, communication routes, etc.), thus determining different degrees of exposure to risk according to territorial vulnerability.

Finally, the third main issue is related to an aspect, at least equal in importance and territorial impact, which derives from the resource potential of the relief with certain openings for tourism, educational, scientific and other purposes.

Subsidiarily, through the analysis and explanatory description of the three aspects mentioned, we aimed to decipher their interactions in the territorial context, emphasizing the degree of risk and vulnerabilities, respectively the opportunities they could bring. At the same time, depending on their nature, we have constantly sought to formulate warnings, recommendations and concrete proposals to mitigate hazards or, on the contrary, to emphasize the useful values associated with the physical-geographical factors, first of all the relief, which could be extremely useful to decision-makers involved in local and regional development and planning strategies and in the implementation of concrete spatial planning measures.

In order to meet the above-mentioned main objectives, we first proceeded to outline a generalized synthetic framework of the Bran - Rucar - Dragoslavele corridor, inspired of course by the most well-known and relevant monographic works that focus particularly on geological and geomorphological factors and processes, from the classical to the most recent. We started from the premise that no applied study is possible without the knowledge provided by fundamental research.

From a methodological point of view, the research was based on a natural and absolutely necessary balance between indirect induction, through the consultation of bibliographies, cartographic resources, exploration of spatial databases and spatial analysis in GIS environment, respectively direct observation in the field to validate the results, to complete the explanatory syntax or to explore unusual forms (speosituri).

We appreciate that, in our opinion, the accumulated data and results, in particular those contained in chapters four and five, bring a series of original personal contributions on previously unelaborated directions, at least for the relief unit under investigation.

Thus, the morphographic and morphometric analyses presented in chapter three, in addition to their usefulness in defining the denudation potential, have provided us with additional arguments in the adoption of morphological regionalization.

The most conclusive result obtained in order to determine the morphodynamic potential of the relief are the six maps showing the spatial potential of the production of processes common to the Carpathian mountain space, characteristic of a relief classified as low mountains, included in the fluvio-torrential morphodynamic stage: slumps/rostoughing; torrential-sloughing (associated with areal erosion and shallow landslides); snow-sloughing; deaggradation; accumulation of alluvium in streambeds and flooding, respectively karstification. The modeling of the processes and their areal distribution was achieved by converting vector data into raster format with 10 m spatial resolution and realizing the following thematic layers: slope (geodeclivity), rock (lithology), land cover/use (land use), elevation (hypsometric step) and "spatial distribution of snow cover". In order to spatially outline the potential manifestation of each geomorphological process (or intimately associated processes), the thematic layers used were selected, prioritized and integrated into the analysis according to their morphodynamic significance. The slope (geodeclivity) was, in all the analyses (except the potential for karstification), the most highly rated, as it plays an essential role in triggering slope and bed geomorphologic processes, which are very well represented and emphasized in the mountain space.

The maps of morphodynamic potential faithfully reflect the rendering of the diversity of the current landform processes in the Bran - Dragoslavele Corridor. The analysis of the resulting maps led us to the conclusion that the processes generated by water runoff on the slopes are the most widespread. Organized runoff drives torrentiality intimately associated with runoff and gullying, while unorganized runoff generates surface erosion, analyzed by means of the USLE model. On the opposite pole, the potential for landslides is insignificant due to the lithological conditioning (predominantly conglomeratic and calcareous) specific to the geographical area analyzed.

The water hazards and associated risks were investigated through a case study of the Turcu river basin located upstream of SH Tohanu Nou, not by chance chosen as it is strongly affected by anthropogenic pressure generated in the last three to four decades due to the concentration of numerous constructions in the 1% floodplain. The hydraulic modeling was carried out using the HEC-RAS (Hydrologic Engeneering Center River Analysis System) application, thus obtaining the flood hazard and risk maps. The flood risk maps were elaborated based on two water depth ranges (< 0.5 m and > 0.5 m) within the 1% flood band and the intersection of their areas with the mapped intravilan space for the 5 localities crossed by the Turcu River in the band area, in order to delimit the risk classes: high - corresponding to the 1% flooding band with water depth > 0.5 m in the intravillian space; medium - corresponding to the 1% flooding band with water depth < 0.5 m in the intravillian space; low - corresponding to the 1% flooding band on the extravillian land of the five localities. A personal contribution that required a considerable effort was the estimation of the risk according to the territorial vulnerability determined by the size of the total financial losses that could occur in floods taking into account the market value of land (according to the "Market study on the minimum values of real estate properties in Brasov and Covasna counties, 2021", prepared by the Chamber of Notaries Publics Brasov), buildings and road infrastructure elements.

As a result of the implementation of the study, the national hydrological database held by A.N.A.R.A. and I.N.H.H.G.A. was completed with the information resulting from the present research. Also, the flood hazard and risk maps for the Turcu River will be useful for the local authorities involved in the elaboration of intervention plans, as well as in the planning-management of local strategies for the realization of investment works for the prevention and combating of floods.

The touristic potential of the relief of the Bran - Rucar - Dragoslavele Corridor is quite remarkable and is largely due to the structural and lithological characteristics of the strongly tectonized substratum, which is subject to a highly diversified active morphodynamics through specific mechanisms and processes. In particular, the presence of eojurassic-neocretaceous limestones (strongly tectonized) over which Cretaceous deposits, mainly represented by vracon sandstones, marls (Cenomanian, Neocomian, Barremian and Lower Aptian) are transgressively rebuilt, and the complexity of the genetic conditioning of a structural tectonic nature explain the multitude, variety and spectacularity of the forms of great tourist attraction and, not rarely, of scientific significance. Cele mai reprezentative forme, cu largă răspândire și diversitate morfologică, sunt masivele izolate și martorii de eroziune din categoria klippelor tectonice calcaroase și a olistolitelor calcaroase, flancurile de sinclinal suspendat (Muntele Coja, Muntele Mateiaș ș.a.), horsturile, grabenele, tectono-erozive basins and depressions, tectono-carstic basins, tectonic abruptnesses, gorges, valley sectors in gorges, karst valleys, caves (hundreds of them, in the slopes of gorges) etc., their typology is actually much broader. Inventorying and describing them is therefore a real scientific challenge.

However, unfortunately, we note that geotourism, as the main way to capitalize on the values of the relief through the practice and promotion of tourism, is almost non-existent in this area. Under these circumstances, we set out to carry out a comprehensive assessment of the relief, taking into account the components with exceptional potential, the geomorphosites, both from a scientific and practical perspective, through ideas and contributions that could be taken into account by the bodies responsible for stimulating the diversification of the tourist offer in the region, followed naturally by the promotion and valorization of geomorphosites, which would increase the number of tourists and, consequently, the income from tourism activities.

As a result, our approach was oriented towards making an exhaustive inventory (as much as possible) of the landforms carrying valuable tourism potential, identifying their place and function (as geosites, geomorphosites, archaeospeosites, etc.) in the local and regional geographic landscape and, finally, exploring the appropriate ways to prioritize them and to put them in the right place in order to increase their attractiveness and tourist satisfaction, and thus the prosperity of the local economy.

In the context outlined above, we have achieved a number of results which we believe, with all due modesty, could be considered meritorious. We consider the following aspects:

- initial, preliminary assessment, which allowed the analysis of 36 geosites and geomorphosites from which 16 geomorphosites were selected as the most representative;

- The complex evaluation of the geomorphosites in the area of the Bran - Dragoslavele Corridor was based on 38 criteria, some of which are not found in the cited sources, these being designed and argued for the first time (for reasons of space the evaluation sheets have been included in the Appendices);

- The final ranking of the geomorphosites (16 in number) has become the aspect that highlights the main objectives towards which priority should be given to promotion/valorization measures for tourism purposes, the first 7 geomorphosites with the highest score being: Dâmbovicioarei and Brusturetului Gorges (BD1), Măgurii Ridge (BD2), Zărneștilor Gorges (BD3), Dâmbovița Great Dâmbovița Gorges, Ghimbavavului and "Cheița" Gorges (BD4), Orăți Valley - upper sector with "Orății Gorges" (BD5), Dealul Sasului Plateau (BD6) and Miresii Cave (BD7);

- research by exploration and direct observations of two caves very rarely visited and unstudied so far from a speophysical and speleogenetic point of view (Miresii Cave and Dobreștilor-Brusturet Cave) for which topographic measurements were made, floor plans and a longitudinal profile (of Miresii Cave), with observations on morphology, morphogenesis and speleofauna;

- proposals for the promotion of geotourism and ecotourism in the Bran - Rucar - Dragoslavele Corridor, including the one related to the promotion and development of the routes of four thematic geotouristic circuits in the territory, which we consider of certain tourist attractiveness, scientific and educational relevance. It should be noted that the four proposed thematic circuits, through appropriate suggestive names and cartographically designed, include not only geomorphosites but also numerous other valuable components of cultural heritage (historical relics, elements of popular architecture, cultural buildings, etc.) that considerably enhance the potential of the proposed circuits. Specifically, these are the following thematic geocourses:

1. "The road of the gorges and caves in the upper basin of the Dâmbovițean",
2. "The road of the gorges and caves in the upper basin of the Valley of the precipices",
3. "The fossil nests of the Tethys Sea in the Moieciu - Dâmbovicioara - Rucar area",
4. "The caves of the Paleolithic ancestors";

- the reasoned proposal on the establishment of a new geological and geomorphological nature reserve with the name "Moieciu - Fundata - Dâmbovicioara - Rucar - Moieciu Geological and Geomorphological Complex", IUCN category IV;

- last, but not least, the identification and proposals for the development of thematic somatic thematic belvederes (3 in number).

We believe that the novelties introduced in this paper also have a number of useful elements that could be taken into account by decision-makers involved in local and regional development management. We therefore intend to make available to them, after the public defense of the thesis, a less technical version emphasizing the concrete practical aspects and proposals for measures that could be beneficial for the promotion and capitalization of the useful resources of the relief and those aimed at reducing the risks induced by the hazards specific to the area studied.

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