INFLUENCE OF THE MORPHODYNAMIC FACTORS ON THE TERRITORY OF ALBANIA

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Abstract: In terms of landforms, Albania shows a great variability, ranging from sand and rock coasts (some corresponding to a dalmat coast), karst mountainous ranges and ridges, large (intra-montane) poljes, high mountains holding a periglacial imprint, canyons, gorges etc and all of it comprised in only 28.748 km² and within an elevation range of 2751 m. occurring karst-glacial interactions. The object of the paper is geomorphological features and the use of physical-geographical and morphological elements in order to organize and regulate rural space. It aims to fully understand the morphological phenomena and to explain the causes and consequences of some human factors in the development of external relief modeling processes. Morphogenetic factors, which differentiate regionally the morphodynamics of Albania, are numerous, but some of them have a specific meaning. Lithologic content influences the present dynamic due to rocks diversity. They appear a various resistance to the attack of external processes and generate or restrict the development forms on various rocks. The differences in the geologic structures lead to layes processes along schist plans, faults etc, that means to a selective modeling. Climatic, hydrographic, pedogenetic and vegetation conditions have played an important role in modeling the relief of the mountainous ranges. Thanks to these elements and the mutual interaction between them, significant changes have appeared, being reflected in morphogenesis, where a good part of the relief shapes have a polygenetic character. Relief of Albania influences through its morphomeytric elements, general ones are very high altitude, landforms and processes, that taking place in alpin forms, hilly and plains. Differentiation of the stages of relief evolution is another goal, through which the various forms of genetic complexes are analyzed. The determination of the age of the relief is based on the morphological evolution of the tectonic cliffs and on the deposition of particulate materials along their base. Genetic complexes of the relief have been analyzed in close relation to intensive tectonic activity up to the new Quaternary, lithological content, and climate change. Based on Quaternary deposits, the complex dynamic equilibrium between the values of new tectonic differentiation, climate change and the use of relief for human purposes has been determined. Through the dynamics of current relief modeling processes, assessments have been carried out in the framework of land regulation, influencing the determination of investments in rural infrastructure, especially agricultural and road infrastructure, in preventing and curbing some of the main geomorphological, climatic and seismic hazards. Great perspectives are the parameters of the coastline configuration, ecosystems and diversity of relief for the development of tourism, which has created conditions for the expansion of tourist accommodation infrastructure and the formation of narrow belts of artificial beaches along the rocky coasts.
Keywords: morphodynamics, relief, coast, ecosystem, turism,.

1. MATERIALS AND METHODS

The first phase of the article preparation work is the collection and research of the necessary scientific literature and the use and collection of the nearest geographical information. The method of comparison has been used in the analysis of all natural and human components. Although many social scientists place the physical event into a black box and focus on the societal aspects of hazards, geomorphologists will wish to define their field precisely to emphasize their contribution.

From a strict geomorphological point of view, geomorphic hazards must be regarded as the suite of threats to human resources arising from instability of the surface features of the earth. The threat arises from landform response to superficial processes, although the initiating processes may originate at great distances from the surface. Thus, this definition excludes earthquakes, but not the landform response, e.g. slope failure, to earthquakes. Similarly, sea level rise is not a geomorphic hazard, but enhanced coastal erosion as a result of sea level rise is. According to this definition, processes such as wind, floods, and tsunami are not geomorphic hazards because they are not geomorphic processes until they change the landscape.[1]

2. ROLE OF GEOLOGIC CONTENT IN THE MORPHODYNAMICS OF RELIEF

Lithologic content influencs the present dynamic due to rocks diversity, with mineralogic formations, different physical and chemical proprieties, and the way of disposal in strates, as thin, thick and alternance. The differences in

[1] Garesa.P. Douglas J. Shermanb. K. Nordstrom.F. Geomorphology 10. (1994)

the lithology, lead to modeling processes of the relief, alongs carbonatic, magmatic, molasses and flysches, that means to a selective erosion. The dynamic morphological development of the relief during the Holocene period is closely related to the lithological diversity, the high degree of tectonization, the intense tectonic uplifts and the conditions of cold and generally humid climate. Regressive erosion of the river network, influenced by current tectonic uplifts, has increased the size of the Drin, Mat, Shkumbin and Vjosa valleys. Uplift tectonic movements have led to a continuous decrease in the groundwater level in the limestone rocks. Physical properties of bare carbonate rocks and vegetation which is poor in some sectors, affecting the values of temperature amplitude and air humidity. Complex relationships between landforms and the external environment were indicated. Geomorphic systems are often affected by episodic large events such as volcanic eruptions, glaciation, and megafloods which lead to a disturbance of system adjustment, sometimes in a catastrophic way. Also, responses of geomorphic systems to external changes tend to be nonlinear, including lag time, relaxation time, and thresholds.[2]

Regarding the development of periglacial phenomena, we emphasize that they are quite developed, where the clear evidence is the presence of colluvo-proluvial cones at the foot of the slopes of Alps, Korab, Dajt, Jabllanica, Tomor and Kurvelesh.. Climate change during and after the glaciation influenced the modeling of the relief of the mountain range, through circuses, glacial valleys and moraine deposits on the ridges of Polis, Jezerca, Valamara etc. Periglacial and glacial processes led to the formation of particulate matter in the ultrabasic and limestone sectors, closely related to intensive tectonic destruction. In the Holocene the bed of the rivers Drin, Mat, Shkumbin and Vjosa was completely differentiated from the gravel. Alteration of flyschs and molasses by selective erosion of streams, brought instability of ultrabasics on them, leading to massive displacement in the form of blocks along different segments of the slopes of mountainous ranges. The placement of Holocene deposits on the glaciers and in the sandstones and magmatic of Drin, Mat and Vjosa river-basins and testifies to their active transport, influencing the morphological evolution of the lower sectors of the valleys. The mass movement types, distribution and shapes are strongly controlled by both the lithological characteristics and the multi history structural setting. Active slow-moving landslides, commonly characterized by multiple and superimposed landslide bodies, confirming that the spatial distribution of the recent landslides is frequently influenced by the presence of older landslides. New mass movement of the river catchment represents a useful tool for territorial planning, and engineering-geological and environmental purposes in the study area. It is, also, the starting point for both quantitative landslide risk analyses and the design of the most appropriate risk mitigation measures.[3]

The intensity of earthquakes is also affected by the depth of groundwater, the characteristics of the relief, the conditions of the laying of the layers and the interweaving of the rocks. In flysch and molasses territories, with high landslide intensity and in sectors along active tectonic faults, constructions are not recommended, due to limited bearing capacity.[4] Currently, there have been several high intensity earthquakes with epicenter near Thumana, Durrës and Shijak, which were also felt in the villages of central part of territory of Albania. Seismic tremors have brought about reactivation of landslides, landslides, falls and avalanches in the eastern and northern parts of territory of Albania. Civil protection units and staffs should be engaged in seismic tremor situations, determining the appropriate routes for evacuation of the affected population and providing emergency services, while groups of specialists in the fields of geology and geomorphology should determine the location of some of the areas affected.

3. ROLE OF THE CLIMATIC FACTORS IN THE MORPHODYNAMICS OF RELIEF

The mountain ranges is part of the Mediterranean climate zone, with cold and wet winters and hot and generally dry summers, being reflected in the daily, monthly and annual performance of various climatic elements. Climatic conditions are important for the development of active morphogenesis, being reflected in the continuous modeling of current relief forms. Among the main factors influencing the formation of climate are cyclonic and anticyclonic activity, position, height, shape, size and degree of fragmentation of the relief.

The position of these ranges as a connecting sector between the central and southeastern part of the country, near the passage of some air masses, has conditioned lower temperature values, with frequent inversions and relatively long periods of frost. The climatic conditions of these ranges have been influenced by local factors, such as hypsometric values, exposure and slope of the slopes, the direction of the mountain ridges and river valleys, etc. The mountainous ranges, with the direction mainly northwest-southeast, affects the circulation of air masses, emphasizing the fluctuations of the climatic elements. The high values of the absolute height of the central

[2] Oguchi.T. Butler.D. The International Encyclopedia of Geography. Chapter Geomorphic systems. John Wiley & Sons, Ltd. Published. (2017).

[3] Borrelli.L. Muto.F. Geology and mass movements of the Licetto River catchment (Calabrian Coastal Range, Southern Italy) Journal of Maps. Volume 13, - Issue 2. (2016).

[4] Collective of authors. Geological map of the Republic of Albania. Tirana Albania. (2017)

mountainous ridges partially prevent the entry to the east of warm and humid winds coming from the west. While from the northern sector, the Drin valley allows the penetration of warm and humid winds. High necks, gorges and other valleys, enable their penetration, inside the ranges. Cold air masses penetrate through the upper Shkumbin valley into the central part of the territory. The northwest-southeast direction, in most of the Mat, Erzen, Shkumbin, Devoll, Osum and Vjosa valleys, creates conditions for a meridional circulation of winds, complicating the regime of climatic elements in the interior of the mountain range.[5]

Regarding its subject, e.g. it includes the research into agricultural or urban ecosystems, in terms of aims, e.g. it intends to increase the quality of human life and among its methods, the tools of social research, e.g. historical ecology, are also applied. Anthropogenic geomorphology, consequently, easily fits among the various fields of landscape ecology, and the knowledge of ecological approached landscape research bulked during the last few decades would provide a useful theoretical background to anthropogenic geomorphology, too.[6]

4. IMPACT OF THE CLIMATIC ELEMENTS ON THE AGRICULTURAL ECONOMY

The biological requirements of agricultural crops are closely related to the climatic conditions of the mountain range. The assessment of climate assets will increase the productive agricultural and livestock potential, while limiting the damage to rural settlements and especially to the agro-tourism sector. In the economic structure of the mountain range, the local population had to face the difficult conditions of fragmented relief, harsh mountain climate and partial lack of surface water. Changes in crop cycle conditions in specific sectors have affected the way agricultural production is organized, because the climatic elements especially in the interior of the mountain range show pronounced continental nuances damaging crops through frosts and harmful winds in periods of certain year. Although agricultural production has increased slightly during the period of the transition, oscillations of their are emerging due to climatic conditions and low investment by state and non-governmental institutions. Micro-climatic conditions have affected the development of the incomplete cycle of cereals and other agricultural crops, while agro-climatic practices and protection measures are lacking. Plenty of crops should be planted in short cycle because late spring frosts pose a worrying problem for some orchards, as they interrupt the vegetation cycle. Wheat crop is planted up to quotas 1000 meters, while barley and oats rye grow in deep mountainous areas adapting to harsh weather conditions especially in the winter season. Cereals are usually planted in the fall and the industrial tobacco plant in the spring. In the framework of agricultural development, the sectors most affected by negative meteorological phenomena should be identified, providing detailed information accompanied by agrometeorological field studies, limiting plantings along the bottom of valleys in the interior of the mountain range. A good part of the economic units due to the unexpected meteorological changes have been forced to apply the circulation of agricultural crops where we can mention the villages of Gradisht, Bushat, Hoçisht, Sovjan, Fushe-Kuqe etc in which the vineyards are quite well adapted. On the slopes with western and southern exposure, with higher values of heat and lighting, with a dense surface water network on the ridges there are premises for increasing the yield of corn, tobacco and high quality vineyards. On this ridgs, which is protected from the winds of the northern, eastern and southeastern quadrants, favorable conditions are created for the construction of solar greenhouses for quality vegetables. Cold winds of seasonal character, east and west, constantly threaten agricultural production, while the pronounced lack of surface water, mainly in the eastern part of the mountain range, significantly affects the yield of corn and industrial plants. In the several climatic stations should be set up for the development of weather elements in order to guarantee the sustainable vegetative development of orchards, vineyards and vegetables.

5. ROLE OF THE HYDROGRAPHIC NETWORK IN THE MORPHODYNAMICS OF RELIEF

The mountain range is characterized by a irregular rainfall regime with inflows several times higher than the average perennial rate, especially during the winter and spring season, forcing the Drin, Buna, Mat, Shkumbin, Seman, Vjosa and Pavlla rivers during the lower sector to deviate from the existing bed. Floods usually occur a few days after the rains, accompanied by the melting of snow, where the erosive intensity is closely related to the considerable slope of the bed, along the middle and upper sector of the Buna and Seman rivers. As a frequent occurrence, floods are included in the group of natural hazards with serious consequences for many settlements, along the main valleys. Their evolution is related to climatic rather than geomorphological causes, while the construction of irrigation canals and drainage network without scientific criteria has led to the increase of flooded areas. The expansion of the planted area and settlements towards the terrace levels up to the rivers of Drin, Buna, Seman and Vjosa, has led to the continuous occurrence of local floods, damaging the productive soil layer, road network and irrigation. The meandering of the Buna, Drin, Seman and Vjosa rivers have led to significant changes in the direction of the current

[5] Collective of authors. Climatic Buletin of the Republic of Albania. Tirana Albania.(1988)
[6] Lóczy.D. Predictable trends for geomorphological and landscape research. Földrajzi Közlemények 132: 1. (2007)

riverbed. Interference in some of the embankment works has led to the disruption of the water and rigid river flow regime along the lower sector of the Drin and Buna rivers. The Shkodra, Myzeqe and Delvina plains has generally formed a new longitudinal profile, accompanied by intense lateral erosion along the boundary segments. The riverbeds, along the above-mentioned sector, has a slope of 1-2o, being partially endangered by floods. In relation to hydro-technical works, a part of the network of canals and embankments should be revised and adapted more correctly to the current morphographic conditions. The construction of canals and mountains dams, along the rivers, will avoid the massive discharge of solid stream, significantly facilitating the flow of the river of Drin, Mat, Shkumbin, Seman and Vjosa. Rehabilitation of the hydrological regime requires the expansion of the Buna, Drin and Vjosa river-beds and the continuous cleaning many of sectors, accompanied by the creation of corridors through the gravel. Works were carried out on several embankments and river dams. During the upper sector of the terraced levels, gutters should be built to remove excess surface water. In the most of villages must to install some meters of the maximum flow level, in order to take precautionary measures to withstand the risks up to possible flood disasters. Near northwestern part of Albania, such as in Obot, Shirgj and Pentar, works should be carried out mainly in the deepening of the Buna river bed as well as to regulate the flows through the construction of several dams. Deviate the existing bed of some of the torrential streams and the Holta river in Devoll river-basin in some short segments and cover with concrete the sectors near the estuaries of the torrential streams towards the rivers, while the storage cones are accompanied by culverts. During the winter, heavy snowfalls, sudden temperature fluctuations, winds and morphological elements of the relief, in limited sectors, have led to frequent avalanche cases. From the slopes of the mountains, avalanches are activated, which take from the beds where they pass, large quantities of stone blocks, transporting them to planted areas, pastures and residential centers. In this period, when the local winter winds do not act, this large amount of snow, gradually descends downwards through paths and narrowings, in the form of gutters and ravines, as in Jezerca, Gjalica, Korab, Martanesh, Lura, Jabllanica, Belica, Valamara, Tomor, Kurvelesh etc. In the Bukanik mountain ridge, sectors of Bukanik and Zavalina, are modeled on slopes, which favors avalanches, while their most destructive traces are observed in the western part of ridge, from the bends of pine, fir and beech trees. In the external relief modeling processes, the activity of the water network, presents a special morphological importance. The largest water resources belong to the eastern and central part of the mountain ranges with mainly ultrabasic and effusive construction slightly permeable. The dense surface network in these sectors is related to the greater amount of rain and snowfall that falls on the mountain slopes of the eastern sectors. of the southeast. The mountain range is crossed by streams and streams, which belong to the catchment area of Shkumbin and Devoll. One of the factors that has determined the karst features of the river network is the lithology, which is represented in a good part by limestones. In the territories where limestones with very active karst processes are widespread, the degree of density of the river network is small. The low permeability of ultrabasics and flysch as well as the large slope of the fall of the latter, is reflected in the values of the river network coefficient, where most of the precipitation ends up in the water flow. Among the factors that condition the regime of the hydrographic network of branches in the Shkumbin and Devoll basins are the climatic conditions with main representatives rainfall and air temperature. Rivers are characterized by a rich water flow during most of the year, where their network of upper tributaries is distinguished for a torrential regime. An important indicator of the development of underground karst in the mountain ridges with limestone construction is the presence of karst springs which emerge during the tectonic contact of limestone rocks with those of impenetrable flysch and ultrabasic. There is a close relationship between the monthly and annual performance of the flow regime and that of the climatic elements with the monthly seasonal and annual performance and geological factors. The seasonal regime of water flows is closely related to the climatic regime, where the lowest values are recorded in the eastern peripheral sectors of the range such as Alpes, Korabi, Tomor, Lura, Gramos, Kurvelesh etc, where there are significant fluctuations in flow levels. During the winter with high intensity rain, often in the form of showers, streams and rivers are distinguished for immediate increase of the flow where as such are the rivers of Drin, Mat, Shkumbin, Devoll, Osum, Vjosa, Bistrica etc. The morphological activity of watercourses is quite active especially in the full period, when they deepen their bed and transport large quantities of solid materials. The main rivers differ due to the morphological characteristics of the relief and by the different level between the local erosion base and the food sector. The highest density of the hydrographic network is in the upper sector of the Drin and Vjosa basins. The hydrographic network of the Albania extends along a predominantly magmatic territory and is characterized by a relatively more regular flow regime. Regarding the distribution of surface water, the main place is played by the Drin river, which flows into the Adriatic Sea. Other tributaries of the Drin basin are the river Valbona, Radika, Curraj, Shala, etc.

6. ROLE OF PEDOGENESE IN MORPHODYNAMICS OF RELIEF

In physical-geographical terms, soils are formed thanks to the close relationship with the morphological evolution of the relief. The formation and development of pedogenesis, as an element of morphotectonic and morphoclimatic evolution is mainly related to the diversity of rocks, relief conditions and climate. The main role in soil formation is played by the composition of rocks, influencing the development of vegetation, microorganisms and physico-chemical processes within it. In the process of soil formation, the morphological features of the relief, such as the slope and the exposure of the slopes have played an impact on the amount of heat, humidity and water regime by rinsing the humus nutrients. The slope of the slope has led to the reactivation of soil-forming processes, while the best quality soils lie at the foot of slopes and river valleys above the colluvial-proluvial deposits. The high value of the depth of fragmentation and its direction, have created a variety of slope exposure, especially in the limestone territories, influencing the process of humus formation. On slopes with northern and northeastern exposure, which are colder and wetter, this process appears more advanced. In some sectors, where the slopes are presented with high slope and poor vegetation cover along the limestone rocks the process of pedogenesis is missing. In the low slope and rich vegetation sectors, especially in the forestry sectors, in the Drin and Devoll valleys, the soils are fertile with thicker horizons and more limited leaching. Soils have determined the development of vegetation, especially woody, influencing slope processes especially in flysch and molasses sectors. Vegetation in close connection with relief and climate features have determined the changes in soil types, in their geographical distribution, their vertical stratification and in the percentage of nutrient content. Human activity has led to the acceleration of their development and transformation where as a result the negative effects reflected in their current state have increased. The protection and rational use of the pedogenetic fund in the ultrabasic and flysch sectors is reflected in the limited development of morphogenic phenomena, especially of the sword processes. The analysis of soil types is important to determine the size and duration of external modeling processes of the current relief. Determining the categorization and cadastre of agricultural lands should be one of the main objectives of the central and local government, in order to better adapt agricultural crops.

7. GEOMORPHOLOGIC HAZARDS

Gravity, flowing water, and temperature changes are the main forces behind hillslope processes, with the action of animals and plants being important in some situations. In some parts of the world,similar features have been built to protect infrastructure from other types of mass wasting. Weathering on hillslopes, as elsewhere, includes the in situ conversion of bedrock into regolith and the subsequent chemical and mechanical transformation of regolith. Several hillslope processes serve to transport regolith and other weathering products. They range from slow and continual processes to rapid and intermittent processes. Splash processes into three categories: leaching, soil creep, and rainsplash and sheet wash. Rocks are subject to stress and gravitation.[7] When the subject, aim and methods of landscape ecology are analysed in more details, it is seen that the anthropogenic aspect is central. Regarding its subject, e.g. it includes the research into agricultural or urban ecosystems, in terms of aims, e.g. it intends to increase the quality of human life and among its methods, the tools of social research, e.g. historical ecology, are also applied. Anthropogenic geomorphology, consequently, easily fits among the various fields of landscape ecology, and the knowledge of ecological approached landscape research
bulked during the last few decades would provide a useful theoretical background to anthropogenic geomorphology, too.[8]

When assessing hemeroby, estimations are made for the degree of human geomorphic impact based on the rate of soil erosion, surface dissection or the abundance of terraces, escarpments and artificial excavational features. At the highest level of human impact, in urban-industrial or urban-technical ecosystems, even remnant patches of semi-natural ecosystems seldom occur wedged into built-up areas and into linear infrastructural elements.[9]

The main environmental challenges and actions needed for this purpose are, informal development and non-implementation of law associated with socio-economic problems need to formalize the tourism sector and find ways to finance local infrastructure and generate assets as part of the process land development, development of tourist infrastructure with public and private funds. Globally non-competitive economic activities with a low quality and seasonal tourism product need to develop a competitive and sustainable model of tourism development, which will boost the tourism sector and local economies as well as expand the range of services offered related to it.

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Construction on the coast, in the hills around the city of Saranda with poor quality and cultural heritage which requires restoration and protection need to increase the quality of design by supporting
environmentally friendly methods, reducing energy consumption and the use of renewable energy in new construction developments. Damage to natural resources needs to protect and improve biodiversity areas, protect green spaces, species and habitats. Noise pollution, caused mainly by vehicle traffic on the main streets of the city of Saranda as well as by nightclubs, need to control the noise level to which the population and tourists are exposed. Lack of environmental awareness by the population, business and visitors needs demonstration actions and public sector initiatives.[10]

8. RECOMMENDATIONS

Based on the relatively wide spread of erosion hotspots, as a good part of the mountain range consists of flysch and molasses deposits, we think that measures should be designed to prevent active slope processes.
Prior to the development of construction infrastructure, geomorphological and geological-engineering studies should be undertaken.
In order to avoid floods, protective canals and embankments should be built, accompanied by the prohibition of the use of inert materials from the Drin, Mat, Shkumbin, Devoll, Osum, Seman and Vjosa rivers.
To determine the geographical distribution of avalanches, especially the routes and their respective dimensions, accompanied by the construction of several barriers and the planting of several forest belts.
In the sectors with high seismicity, detailed studies should be carried out regarding the construction of road and tourist infrastructure.
All physical-geographical elements should be evaluated and adapted to the rural environment in order to develop tourism.
Harmonization of modern practices of tillage, agricultural circulation, fertilization and protection of the natural ecosystem will guarantee a sustainable rural development.

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