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Magda Francisca Cejas Martinez
Department of Business Administration, Universidad Nacional del Chimborazo

Edith Josefina Liccioni
Department of Communication, Universidad Nacional del Chimborazo

Juan Pablo Morales Corozo
Universidad Experimental de los Llanos Ezequiel Zamora

Derling Jose Mendoza Velazco
Faculty of Humanistic and Social Sciences, Universidad Tecnica de Manabi

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https://doi.org/10.5109/7183317

出版情報：Evergreen. 11 (2), pp.602-611, 2024-06. 九州大学グリーンテクノロジー研究教育センター
バージョン：

EVERGREEN Joint Journal of Novel Carbon Resource Sciences & Green Asia Strategy, Vol. 11, Issue 02, pp602-611, June, 2024

Social Dynamics and Public Policies in Peripheral Degraded Areas in the Northern Zone of Ecuador

Magda Francisca Cejas Martinez[1,2,*], Edith Josefina Liccioni[3], Juan Pablo Morales Corozo[4], Derling Jose Mendoza Velazco[5], Mercedes Carolina Navarro Cejas[5]

[1]Department of Business Administration, Universidad Nacional del Chimborazo, Riobamba, Ecuador

[2]Department of Economic, Administrative and Trade Sciences, Universidad de las Fuerzas Armadas ESPE, Quito, Ecuador

[3]Department of Communication, Universidad Nacional del Chimborazo, Riobamba, Ecuador

[4]Universidad Experimental de los Llanos Ezequiel Zamora, Barinas, Venezuela

[5]Faculty of Humanistic and Social Sciences, Universidad Tecnica de Manabi, Portoviejo, Ecuador

*Author to whom correspondence should be addressed:
E-mail: martinezmagda661@gmail.com

(Received March 14, 2024; Revised May 14, 2024; Accepted June 2, 2024).

Abstract: This study is aimed at defining the areas of the national policy in relation to vulnerable zones. The leading approach to this problem is the method of considering risk factors for assessing the danger of mudflows, which allows evaluating the degree of water erosion at sampling points. The following methods were also used: accounting for universal soil losses, geotechnical studies, assessment of soil losses as a result of water erosion, photogrammetry, orthorectification of images using ground control points, orthophotomosaics, comparative, systematic, logical analyses, synthesis, deduction. The paper presents the results of the study of: international initiatives aimed at reducing the impact of natural disasters and risk management are described, the negative impact of natural disasters on social dynamics is substantiated, a territorial planning tool is considered in detail, a digital model of the Mirador district of the city of Lumbaki is created, parameters are specified, the totality of which can help determine the threat of soil movements.

Keywords: risk management; natural disaster; development planning; soil erosion; soil condition assessment

1. Introduction

Currently, in the context of globalisation, the technologisation of processes in systems of various areas and levels, the search for new modern tools to solve problems arising in the course of the activities of society and the state, it is becoming increasingly difficult to ignore the issues of studying the frequency and intensity of natural disasters, as well as their impact on environmental, economic, social, and other spheres of public life. During the period 1981-2019, 12,561 natural disasters were recorded in the world, of which 23.9% occurred in Latin America and the Caribbean[1)]. Ecuador can be considered one of the most vulnerable regions of the world to natural disasters. During the period 2000-2016, 17 natural disasters were registered in this republic, as a result of which 927 people died, 11,914,636 people were injured[2)].

From the standpoint of risk management, poorly developed policy at the local level exacerbates the identified problem and leads to significant resource costs for the state. At the current stage of society's development, there is no possibility of accurately determining the time and place where a natural disaster will occur, but there is a possibility of analysing the area in which it occurred. In the field of disaster risk management, the most urgent problem today is the designation and control at the state level of areas that are more prone to natural disasters (flood, earthquakes)[3)]. Consequently, the study of vulnerable areas around the perimeter of the city is a constant task within the framework of territorial planning.

According to the analysis conducted by G. Grijalva et al.[4)], the main tool of municipal authorities in land management can be the resettlement of residents from various risk sectors, for which it is necessary to obtain accurate data on vulnerable populations. J. Guayasamin et al.[5)] consider the impact of the application of the concept of "nature rights" on the conservation of biodiversity in Ecuador and on a global scale. This concept became the basis for the adoption of legislative acts in Ecuador that recognise ecosystems and living organisms as holders of rights. The paper describes how the application of "nature rights" in Ecuador has led to the conservation of many unique ecosystems and biodiversity, as well as how this affects the global level of nature conservation and can help achieve the UN Sustainable Development Goals. I. Yassin et al.[6] discuss various methods and approaches to modelling seismic activity, and possible consequences of earthquakes for urban infrastructure and urban populations.

Research by D. Maruri and G. Vega[7] describes the development of the urban green zone network project for Milagro, Ecuador. The authors propose a plan for the development of an urban network of green zones, which can contribute to improving the quality of life of citizens, preserving biodiversity and protecting the environment in Milagro. The paper also presents examples of other cities where the creation of an urban network of green zones has led to an improvement in the lives of citizens and a reduction in the negative impact on the environment. P. Poma et al.[8] investigated the issue of environmental consequences associated with the management of municipal solid waste in an open landfill in Loreto, Eastern Ecuador. J. Zambrano et al.[9] studied the sustainability of the urban environment in the Pasage canton in Ecuador. The study examines various indicators of urban sustainability, such as water quality, waste management, green areas, which allows identifying the most critical problems related to the sustainability of the urban environment in the canton and provide recommendations for improving the situation[10].

The disaster risk management studies presented to date are mostly limited, are of a fairly general nature and are devoted to the role of zoning of urban and rural areas, however, the study of disaster risk management using microzoning in degraded peripheral areas remains open.

The study's relevance lies in its revelation of the intricate interplay between social dynamics and environmental hazards in the Mirador district of Lumbaki, highlighting the urgent need for informed risk management strategies. The purpose of this study was to determine the directions of state policy regarding social dynamics in the processes of urban microzoning in degraded peripheral areas in the Mirador district of the city of Lumbaki. The study objectives are to analyse the social dynamics causing soil erosion in Lumbaki's Mirador district, assess geotechnical threats, advocate for informed risk management, and propose strategies for preserving the region's socio-economic and environmental aspects. Its significance is underscored by the call for proactive measures to address the vulnerability of communities, emphasizing the pivotal role of innovative practices in fostering socio-economic resilience and sustainable development.

2. Materials and Methods

Knowing the processes of external geodynamics in the Lumbaki district, which occur as a result of tectonic processes or under the influence of climatic factors considered as the main trigger factors, the following research methods were used: the method of accounting for risk factors to assess the danger of mudflows, the method of accounting for universal soil losses, geotechnical studies (GTI), the method of assessing soil losses in as a result of water erosion, photogrammetry, orthorectification of images using ground control points, orthophotomosaics, comparative analysis, system analysis, logical analysis, synthesis and deduction methods.

The application of the risk factor accounting method for assessing the danger of mudflows is aimed at determining the threat level conditioned by mass movements present in the El Mirador district, considering such variables as: slope coefficient, soil permeability, lithology, precipitation, and vegetation cover. Due to the constancy of these variables, they are decisive for the occurrence of mass removal processes, whether they are landslides (translational and/or rotational), falling stones, flows, creep.

The equation used to create a map of mass movements in the El Mirador district is based on an assessment of the weight of variables. The main variables were identified, which, due to their thematic correspondence and characteristics, allow adequately determining the threat of mass soil movements and are directly related to terrain morphometry, soil permeability, lithology, land use and soil cover, as well as precipitation. Thus, the risk levels of mass movements are determined by the interaction of variables in accordance with the following equation (1):

$$\mathrm{A_t} = 0.52 \times [\mathrm{LS_{factor}}] + 0.20 \times \mathrm{L} + 0.10 \times \mathrm{P} + 0.10\mathrm{C_v} + 0.08 \times \mathrm{Pr}, (1)$$

where $\mathrm{LS_{factor}}$ – slope coefficient; L – litology; P – permeability; $\mathrm{C_v}$ – vegetation cover; Pr – precipitation.

The universal soil loss method was used to determine the degree of erosion. This equation predicts soil loss due to seepage on certain slopes and surfaces (2):

$$\mathrm{A} = \mathrm{R} \times \mathrm{K} \times \mathrm{LS} \times \mathrm{C} \times \mathrm{P}, (2)$$

where R – precipitation erosivity index; K – soil erosivity; LS – coefficient of the relief; C – factor of cover; P – factor of soil protection practices.

The geological and engineering survey method was used to determine the geotechnical characteristics of the soil at the sampling sites. In the course of the study, various tests were performed, such as determination of the degree of slope of the surface, assessment of the slope, assessment of lithology, determination of the composition of the soil, assessment of vegetation cover. The method of assessing soil losses as a result of water erosion was used to identify two points with moderate erosion and three with a high degree of erosion.

The photogrammetry method was applied to create a digital surface model (DSM), which allowed estimating the height of the relief and surface objects. For a more detailed study of the terrain, the method of orthorectification of images using ground control points was also used. The use of the orthophotomosaic method provided a detailed model of the study area.

The use of system analysis allowed considering all the identified characteristics of soil samples from the standpoint of the system, the integrity and safety of which has a direct impact on the life and health of local residents. Logical analysis was used to define terms and concepts. The description of the results and conclusions of the study required the use of synthesis and deduction, which allowed combining the results of all the methods used and drawing logical conclusions from the available data.

3. Results

In the 1960s, natural phenomena were considered by the scientific community as catastrophes, and their study was implemented within the framework of physical sciences. These studies reinforced the position that the events of natural phenomena are equal to catastrophes, completely separating them from social components[11]. At that time, governments focused their actions on reactive measures in the event of disasters. Over time, significant progress has been made in disaster risk management, and concepts have emerged that focus on methodologies for calculating damage and losses, while taking into account the environment, economy, and social component as parameters for accounting. In the 1970s, the UN adopted several resolutions on planning as a tool for disaster risk reduction. Although much progress has been made, the social component has not been considered in risk forecasting. In the 1990s, the UN declared October 13 the International Day of Risk Reduction, expressing a basic concept in which disasters are considered as a problem that must be taken into account in development planning, especially in sectors where there is no territorial planning and there is significant demographic growth, which emphasises the social component of risk[12].

Further actions of the world scientific and expert community were aimed at reducing the risk of natural disasters in developing countries to prevent material damage and loss of life. During this time, disasters have been thoroughly investigated from the standpoint of various disciplines that define risk as the probability with which a threat is detected in a system where vulnerability is taken into account, threat is considered as the probability with which an event occurs that can cause significant damage to a social group, and vulnerability is defined as the willingness of a social group to suffer damage and recovery time after the event that happened[13].

By the year 2000, the UN intended to provide social groups with the opportunity to take measures to counter natural and man-made disasters. Much attention was paid to raising public awareness of events and their level of impact on the environment and society. It was taken into account that disasters are not natural and are partly conditioned by social dynamics depending on natural, biological, technological, and other threats. By 2005, the UN had developed the Hyogo Framework for Action as a tool for implementing disaster risk reduction measures, the goal of which until 2015 was to reduce damage from natural disasters and increase resilience[14]. Various efforts have been made at the global level, especially in working with developing countries. Strategic monitoring and implementation points have been established in Latin America and the Caribbean. A number of countries have made political commitments to promote disaster risk management.

The Third UN World Conference on Disaster Risk Reduction in 2015 assessed the implementation of the Hyogo Framework, in particular, its strategies, national and regional plans, various forms of cooperation, with regard to commitments made by the participating countries. By that time, several countries had made progress in disaster prevention and mitigation, seeing it as a profitable investment that significantly improves their potential[15),16]. The Sendai Framework is an enhanced version of the Hyogo Framework, which prioritises disaster risk understanding, strengthening disaster risk management, and government investment in disaster risk reduction and effective response to resilience building. By 2015, the UN had put into effect the Sendai Framework, which includes an update of the Hyogo Framework: this document reflects the experience gained in relation to disasters and disaster risks since 1989, in addition, it aims to address the shortcomings identified in the years since the Hyogo Framework 2005[17].

The Constitution of the Republic of Ecuador emphasises that disaster risk management is the competence of all levels of Government[18]. Insufficient understanding of the scope of competence remains a problem of the applicability of disaster risk management, therefore, it was not implemented in a number of cantons and provinces, which led to large economic costs in 2016 due to the earthquake[19]. The system of rapid response to a natural disaster has demonstrated the weakness of management. The analysis of social dynamics in the processes of urban microzoning in degraded peripheral areas should be studied in two aspects: the impact of natural disasters on the social dynamics of the degraded area, as well as the impact of social dynamics on soil degradation in the context of disaster risk management[20].

Regarding the first aspect, the following negative consequences can be identified that affect the social dynamics of a degraded peripheral area: deterioration of the health of the local population due to diseases associated with environmental pollution[21], increased mortality, deterioration of the socio-psychological state of the population, migration. Many of these problems are caused by anthropogenic factors, such as deforestation, man-made pollution, overgrazing, excessive irrigation of soils to increase their productivity, and other destructive actions that affect the full functionality of the soil (water filtration, nutrient balance) and provoke the occurrence of natural disasters[22].

Territorial planning is a regulatory and technical tool that combines a complex of administrative, state, political, and planning measures that guide the development of the territory and regulate the use, occupation, and transformation of urban and rural space[23]. The development and land use plan of the canton of Gonzalo Pizarro is a tool that allows organising the territory based on technical analysis, consensus of citizens, and political commitments. The territory of Gonzalo Pizarro contains zones of informal settlements that have been created in various sectors (Fig. 1). One of these has recently appeared in the El Mirador area of Lumbaki, located on the periphery of a consolidated urban area that is classified as a conservation area, and has caused irreversible changes in the geoforms through anthropogenic phenomena, provoking erosion processes. The problem of erosion in this area is high and can lead to the movement of the soil to the areas below, which can cause dangerous phenomena

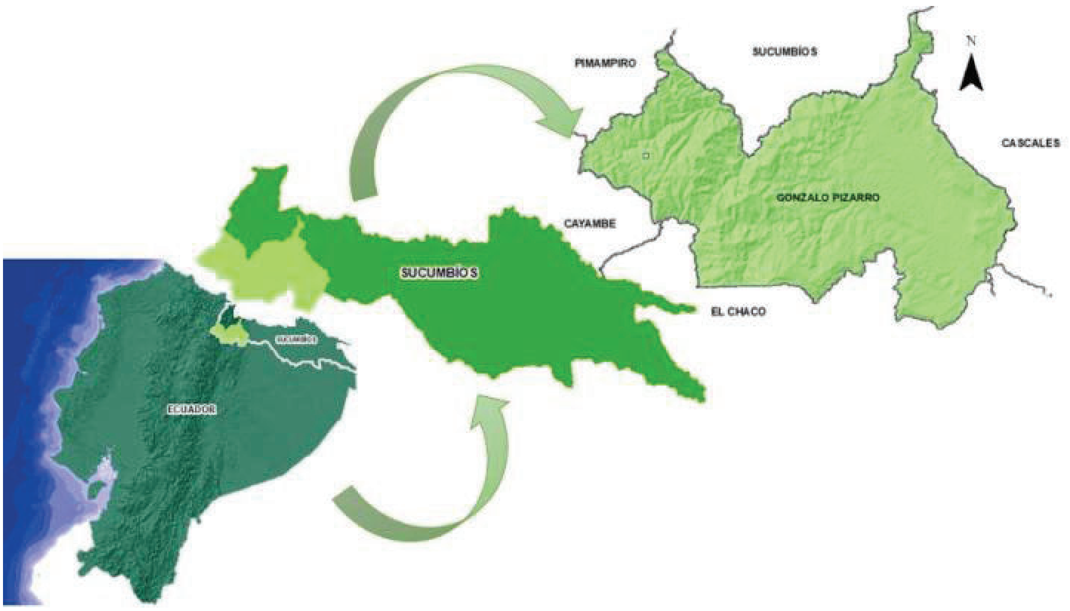

Fig. 1: Location of the Gonzalo Pizarro canton.
Source: compiled by the authors based on the data of C. Alvear[24].

To date, there is no scientific literature in which there would be reliable data on how the social dynamics that have developed in the sector can provoke dangerous events. No studies have been conducted to characterise the current soil conditions and possible geotechnical hazards present in the area, so it is not known what impact will be had on the buildings and what consequences may arise in the near future.

In 2013, as a result of anthropogenic activities in other sectors, landslides occurred, which led to a state of anxiety among the residents of the sector, most of whom had improvised houses built without technical criteria in places where vulnerability conditions exist[25]. As a result, this criterion allowed limiting the construction of houses in the sector, which caused concern among the residents of the sector, who demanded scientific and technical research to identify places of increased vulnerability in order to be able to make decisions and develop local legal acts.

The lack of information on the aspects of soil geotechnical characteristics and sustainability does not allow territorial entities responsible for assessing risks and natural disasters to apply strategies to minimise the consequences. Citizens in general are in a state of increased vulnerability due to lack of knowledge, which can lead to a catastrophe (Fig. 2).

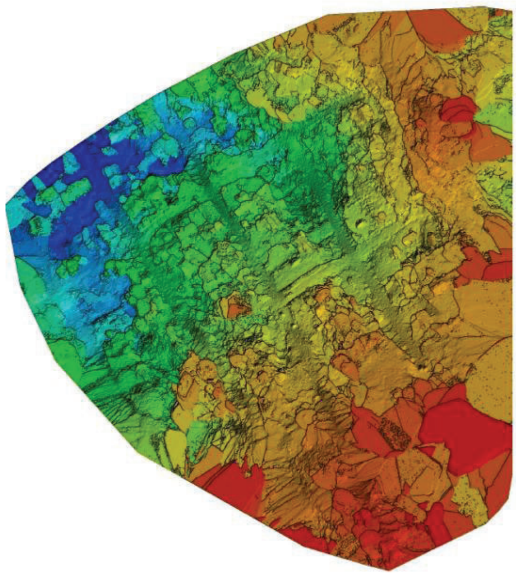

Fig. 2: Digital surface model.
Source: compiled by the authors.

In Figure. 2, based on the structure of the point cloud, a digital model was created and digital surface models (DSM) were generated, which correspond to a continuous numerical model representing the heights of the relief and surface objects (buildings, vegetation). The red colour indicates the smallest number of overlapping images, and the green colour corresponds to the largest number of images taken in a given area. Based on a set of calibrated images, the process of orthorectification of images was carried out using ground control points (5 GCP) (Fig. 3).

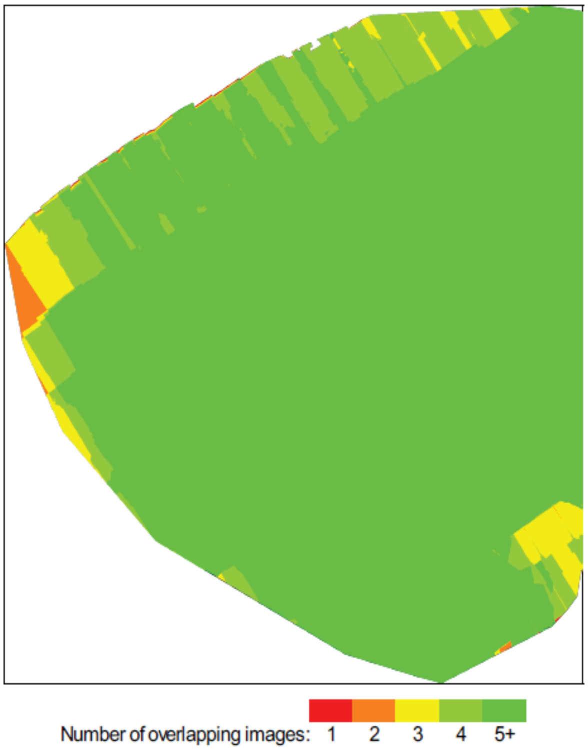

Fig. 3: Number of overlapping images.
Source: compiled by the authors.

The comparison of images was carried out based on control points and the number of photos overlapping objects. After checking the GCP, orthorectification was carried out and, consequently, the final comparison of images to create orthophotomosaics (Fig. 4).

Fig. 4: Orthophotomosaics of the area of interest (AOI).
Source: compiled by the authors.

The quality report reflects an average square error of 0.002 m for geo-linking. The development of an effective strategy for disaster risk management is possible with an appropriate analysis of the soil condition in the controlled region. Conducting a comprehensive study will allow, through microzoning in degraded peripheral areas, to determine the territories most exposed to the risks of natural hazards, and to minimise their consequences. As part of this study, soil samplings were conducted at five points in Lumbaki to assess the soil according to the following criteria: the degree of slope of the surface, slope assessment, lithology assessment, soil composition, and vegetation cover. Table 1 provides data on the analysis criteria.

Table 1. Analysis of geotechnical characteristics of the soil.

Exact coordinates of WGS 84 (zone 18 S)		**Degree of surface slop**	**Slope estimation**	**Assessment of lithology**	**Soil composition**	**Vegetation cover**
X	Y					
241,237	10,004,898	25-40	4	4	5	4
241,229	10,004,845	>40	5	4	5	4
241,146	10,004,867	25-40	4	4	5	4
241,186	10,005,070	25-40	4	4	5	4
241,115	10,004,778	>40	5	4	5	4

Source: compiled by the authors.

When analysing soil samples, it was revealed that there are slopes in the area that are at an angle in the range from 25% to 40% and above 40%, which respectively have grades 4 and 5; when analysing lithology, it was noted that alluvial deposits are present; the soil is mostly clay, this is an urban area. The annual precipitation exceeds 3,600 mm. Table 2 shows the values obtained as a result of sampling in July and August. Rainy days and their duration were marked in the table, and rain intensity (I), rain energy (E) and rain erosivity (R) were calculated.

Table 2. Indicators of the potential of precipitation causing erosion.

Date of application	P	t	I	e	E	R
	mm	min	mm/h	MJ/ha*h	MJ*mm/ha*h	MJ*mm/ha*h
07/03/2022	45	35	77,143	2,893	130,171	50,622
07/02/2022	48	40	72,000	2,866	137,569	57,321
07/08/2022	51	90	34,000	2,576	131,377	115,921
07/10/2022	48	85	33,882	2,575	123,584	109,424
07/14/2022	35	45	46,667	2,698	94,445	60,714
08/18/2022	25	60	25,000	2,457	61,429	73,715
07/19/2022	31	45	41,333	2,652	82,197	59,659
07/23/2022	31	60	31,000	2,540	78,750	76,209
07/27/2022	38	75	30,400	2,533	96,245	94,978
08/01/2022	34	80	25,500	2,465	83,804	98,593
08/03/2022	36	95	22,737	2,420	87,138	114,973
08/28/2022	35	71	29,577	2,522	88,275	89,537
08/29/2022	39	60	39,000	2,629	102,533	78,871
Average value	38	65	39,095	2,602	99,809	83,118

Source: compiled by the authors.

Table 3 shows the degree of water erosion at the sampling sites: two points with moderate erosion and three with a high degree of erosion in places with steep slopes and improvised dwellings, where land use was restructured, as a result of which the soil was completely exposed.

Table 3. Degree of water erosion at the sampling sites.

Coordinates of the Reference Point WGS 84 Zone 18 S		Ground cover	Factor R	Factor K	Factor LS	Factor C	Degree of water erosion	Condition
X	Y		[MJ*mm/ ha*h]	[t*ha*h/(ha*MJ* mm)]				
241,237	10,004,898	Bare ground	83,118	1,930	0.441	1	70.66	High
241,229	10,004,845	Thin vegetation	83,118	1,939	0.443	0.6	42.82	Moderate
241,146	10,004,867	Thin vegetation	83,118	1,957	0.447	0.6	43.60	Moderate
241,186	10,005,070	Bare ground	83,118	1,930	0.463	1	74.20	High
241,115	10,004,778	Bare ground	83,118	1,939	0.445	1	71.66	High

Source: compiled by the authors.

Mass removal processes occur as a result of an increase in destabilising forces and/or a decrease in the resistance of the materials involved. The factors that control the movement of slopes, in general, are factors that can change the internal and external forces acting on the ground. For an adequate analysis to determine the danger of mass movement, it is necessary to determine the causative and provoking factors of these natural phenomena, therefore, it is important to have a clear distinction between them. In the Mirador district of Lumbaki, the most important points were selected in accordance with the history of dangerous events. At the same time, the stories of the residents of the sector were very useful when collecting data in the field, especially when determining the points and the best access to them for greater accuracy.

It is advisable to manage the risks of natural hazards in the field of public policy, considering the factors of social and natural interaction, through territorial zoning and with the inclusion of mandatory stages of analysis, planning, forecasting, and decision-making design. The lack of territorial planning and poor-quality forecast of territorial expansion lead to the fact that residents with limited resources find themselves in high-risk sectors. Zoning should be carried out on the basis of diagnostics of economic, biophysical, and social components, which should be taken as a basis for the development of a plan for the territorial risk management of natural disasters in land use and settlement of unoccupied lands. Incorporating community-based early warning systems, such as training local residents to recognize precursors of disasters and establishing communication networks, can enhance preparedness and response efforts. Additionally, investing in resilient infrastructure, such as flood-resistant buildings and decentralized water and energy systems, can mitigate the impact of natural disasters on vulnerable urban populations. Coupled with comprehensive urban planning that prioritizes equitable access to resources and services, these practices can build resilience and reduce the vulnerability of urban areas to natural disasters.

Natural disasters pose a serious threat to vulnerable urban areas, often characterised by poor housing conditions, overcrowding and lack of basic infrastructure. Effective risk management in such areas requires an integrated approach that takes into account social, economic and environmental factors. In vulnerable urban areas, social factors such as poverty levels and access to healthcare greatly influence communities' resilience to natural disasters. Economic factors, including income inequality and employment opportunities, impact individuals' ability to prepare for and recover from such events. Moreover, environmental factors like deforestation and urbanization patterns can exacerbate the severity of natural disasters, amplifying their destructive impact on already vulnerable populations. Thus, addressing these interconnected social, economic, and environmental factors is crucial for implementing effective risk management strategies in urban areas prone to natural disasters.

4. Discussion

According to the analysis by C. Padrón Chacón[26)], disaster risk management is an integral part of spatial planning. Improper land use due to various factors can generate and create dangerous events and disasters. The lack of land use planning and poor forecasting of territory expansion leads to the fact that low-income residents find themselves in high-risk sectors[27)]. Probably, the author of the study sees the main reason for improper land use not in communities or their organisational forms, but at the governmental and institutional levels, which may indicate their disinterest in raising awareness about disaster risk management. These conclusions correlate with the results of the study, since no government programmes aimed at improving land use practices have been implemented in the El Mirador area under study.

A study by M. Martínez et al.[28)] suggests that it is necessary to include disaster risk management in development and land use plans based on the diagnosis of economic, biophysical, and social components, considering it as a fundamental basis for the use and occupation of land. The authors argue that risk management is one of the fundamental principles within the framework of protecting the local economy, which requires the search for alternatives based on best practices to improve social, economic, and environmental components. Thus, the study confirms the need to promote rural practice through collective decision-making, the use of preventive measures, and the preparation of an early response system to fundamental risk situations.

R. Beilin and J.-A. Paschen[29)] devoted their work to the topic of risk, sustainability and responsible practices in connection with landscape change and wildfires in Australia. The paper discusses various approaches to risk management related to forest fires, including the principles of sustainability, adaptation, and responsibility. The authors also describe examples of practices that help improve the ability of communities and individuals to respond to forest fires and reduce their impact on the environment. The study points out that the key factor in ensuring effective forest fire control is the ability for collective action and cooperation between state and non-government organisations and communities. This fact confirms that the practice of effective public administration and land control can reduce the risk of forest fires and other natural disasters.

C. Huyck et al.[30)] draw attention to the fact that the accuracy of building exposure data (i.e., information about buildings that may be at risk of natural disasters) plays an important role in the accuracy of risk modelling. The study discusses various data uncertainty factors, such as insufficient accuracy of geospatial data, various methods of classifying buildings and their use in risk modelling, and restrictions on access to information. By improving the quality of disaster risk modelling by considering the uncertainty of data on the exposure of buildings, it is possible to predict and reduce the level of negative consequences of natural disasters for the population and urban infrastructure[31)]. The study did not consider information about buildings, but this approach can be useful in the context of preserving residential buildings and urban infrastructure in conditions of increased risk of natural disasters.

M. Vicuña et al.[32)] studied 12 cities on the coast of Chile and analysed their urban planning form, taking into account factors such as the location of buildings, the type of land, and the height of buildings in order to assess their vulnerability to tsunamis. The researchers also considered historical data on the tsunami in each of the cities and assessed the degree of vulnerability of each city based on its urban planning form. The results of the study showed that urban planning is of great importance for reducing the vulnerability of cities to tsunamis. The data of the reviewed study indicate that it is necessary to assess the risks of a tsunami when planning settlements on the coast and take measures to reduce the vulnerability of buildings and the population. Thus, the main idea of this study about the urgent need for planning and risk accounting in the process of urban development construction is confirmed.

A. Acevedo et al.[33)] assessed seismic risks for residential buildings in three of Colombia's largest cities: Bogota, Medellin, and Cali. The authors used seismic maps, data on buildings, including the year of construction, construction and use of the building, and statistical methods to determine the level of seismic risk in each of the cities. The results of the study showed that most of the buildings in these cities were built before the introduction of modern safety standards and require strengthening of structures or rebuilding to reduce the risk of damage or destruction in the event of a seismic event. In the context of seismic activity or the threat of landslides due to soil degradation, it is also necessary to strengthen public awareness of seismic risks and the need to take measures to protect residential buildings from natural disasters, develop strict building codes and regulations to minimise risks during the construction of new buildings[34].

J. Wesley[35] examined the factors that create a favourable environment for good disaster risk management practices in the city of Manizales in Colombia. The author analysed several critical moments in the history of the city associated with major natural disasters, and revealed how the city adapted and strengthened its risk management systems in response to these events. The work also demonstrates the role of various state and non-state organisations in risk management and highlights factors that contribute to effective disaster risk management in the city. Since the problems of risks and their management can be particularly acute in degraded peripheral areas, the work considered can expand the current database on the practices of risk management of natural disasters and other types of risks. The most important element of risk management, in this case, may be the creation of mechanisms for coordination between different levels of government, as well as between public organisations and the private sector.

The study by M. Hope et al.[36] describes an approach to disaster risk management based on close cooperation between various stakeholders. The authors investigated how different people and organisations with different roles and responsibilities in disaster risk management can collaborate to create an effective disaster risk management system. Disaster risk management should not be the task of experts alone, but should be a process in which all stakeholders participate and cooperate with each other. This approach confirms the need to create better conditions for cooperation between stakeholders, information exchange and problem solving, which can contribute to more sustainable and progressive solutions in the long term.

Article by P. McGowran and A. Donovan[37] argues that disaster risk management cannot be effective if it is based only on expert knowledge and ignores the experience and involvement of the community. Researchers suggest using assemblage theory to create collaborative practices in which experts and communities work together to understand and manage disaster risks. The study discusses how assemblage theory can help create a more flexible and adaptive disaster risk management system that can better respond to changes in the social and natural environment. Thus, disaster risk management should be based on joint participation and cooperation between experts and communities, and not only on expert knowledge. Using assemblage can help create a more flexible and adaptive disaster risk management system[38]. The application of assemblage theory can complement the applied part of this study and help in the implementation of risk management programmes in practice.

The reviewed studies show that zones with degraded soil as a result of natural, climatic, and anthropogenic factors require special attention from the scientific community and national policy. In addition, researchers agree that the joint work of experts (public or private) and the local community is more productive in the context of risk management.

5. Conclusions

The results of the study demonstrate evidence of how the social dynamics that have developed in the El Mirador district of the city of Lumbaki can provoke dangerous events, namely, changes in soil conditions due to illegal buildings, which can lead to soil erosion. The study allowed describing the current state of the soil and possible geotechnical threats existing in the area. After studying the scientific data available to date, no reliable evidence has been found of a connection between the problems of flooding in the lower areas of the Mirador district and the problem of erosion arising on the site as a result of land conversion and anthropogenic activities caused by the social dynamics of the sector.

The study revealed that in the absence of detailed information on aspects of geotechnical characteristics of the soil and stability, the population may be in a dangerous situation. Such a situation may arise due to the fact that the territorial authorities responsible for assessing risks and disasters cannot apply strategies aimed at minimising the consequences that may be caused by the above-mentioned events. The high degree of vulnerability of the population due to ignorance, which would lead to a disaster, requires government agencies to initiate programmes to inform local residents living in potentially dangerous locations of basic risk management methods.

The risk management concept considered in the paper is one of the main factors that can contribute to the preservation of quantitative and qualitative indicators of the social aspect of the territory within the framework of protecting the local economy. Competent disaster risk management requires the introduction of innovations based on best practices, which will improve the social, economic, and environmental components of degraded peripheral areas. Although the study focused on microzoning of the degraded areas of Lumbaki, further research should focus on conducting a risk analysis, which would allow a final assessment of the prospect of capital construction of housing and commercial real estate in the upper El Mirador district of Lumbaki.

The study highlights the urgent need for further research into the geotechnical characteristics of the soil and stability in the El Mirador district of Lumbaki. Future studies should prioritize conducting a comprehensive risk analysis to assess the potential dangers posed by illegal construction and soil erosion, particularly in relation to the vulnerability of the local population. Additionally, there is a crucial opportunity for governmental agencies to implement informed risk management programs aimed at safeguarding residents and preserving the social, economic, and environmental integrity of the area.

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