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# A Community-Based Approach to Flood Vulnerability Assessment: The Case of El Cardón Sector

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**Abstract:**

Floods pose a recurrent threat to the population of Venezuela, primarily due to the characteristics of its basins and human activities in alluvial zones. While hydrometeorological phenomena contribute to flooding, human decisions regarding land use intensify the impact. This research project aims to provide comprehensive information and tools to empower the inhabitants of the Cardón Sector to mitigate flood risks effectively. Through a structured approach comprising four chapters, the project seeks to establish a precedent for addressing flood-related challenges at both the research and community levels.

Keywords: Flood, Venezuela, alluvial zones, land use, hydrometeorological phenomena, disaster management, community empowerment, research project, flood risk mitigation.

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## Introduction:

Floods are the type of threat that most frequently impacts the population of Venezuela, due to the number of existing basins, their physical and climatic characteristics and the recurrence of overflows. But the problems that arise, in the form of disasters, occur because of the use that settlers make of the soil in the alluvial zones, their fertility, the availability of water and their scenic conditions, make them extremely attractive for agriculture, housing and the allocation of services. Hydro meteorological phenomena are conducive to flooding, but disasters are caused by human decisions in relation to the exploitation of the

environment, so that the change in land use, with productive activities such as agriculture and livestock (opening of marginal agricultural frontiers in mountainous border areas), as well as the effect of intensive agricultural practices and technologies (in rupture with tropical forest ecosystems) that have Deforestation, soil erosion and direct runoff into the main basins of Venezuela are, among others, the cause of the multiple problems that the inhabitants of the areas near the rivers experience.These effects, in turn, are influenced by other natural phenomena such as the loss of forest cover due to landslides in the high-slope areas of the basins.That is why it is necessary to carry out this project to provide all the useful and irrelevant information to all the inhabitants of the Cardón Sector in general, at the same time providing them with the tools that motivate them to participate in the well-being of their community, since in this way the objective set in the development of this research work can be achieved effectively and efficiently. In addition, not only the members that make up the community of the El Cardón Sector would benefit, but also the surrounding towns.This research aims to set a precedent in relation to the subject and studies of this nature in the region, achieving contributions both for the research area and at the community level.

## Problem statement:

Floods in South America killed hundreds of people and destroyed crops in several countries. The El Niño climate phenomenon, caused by a low pressure center in the South Pacific Ocean, is capable of generating floods and droughts with devastating social and economic effects. The situation in the north of the country is alarming as it is a vulnerable area. According to Arévalo E., (1998).In the same way as the disaster that occurred in December (1999), Venezuela suffered the greatest catastrophe in its history, which was also one of the worst disasters in Latin America in a century. After heavy rains with above-average rainfall, Venezuela was inundated by ten days of torrential rains that caused massive landslides, unprecedented damage to ecology and infrastructure, and enormous human losses (there is no exact figure but it is estimated that several thousand deaths occurred and more than 400,000 people were affected. officially , more than 27,000 homes were destroyed and 40,000 damaged, as well as countless drinking water services, schools, hospitals, and other critical social services. Many people still remain in shelters, both military and civilian, and many continue to live in areas of extreme risk. The affected areas were the states of Miranda, Falcón, and the Capital District, but the most affected by the disaster was the state of Vargas. According to data provided by the Caracas Fire Department.On the other hand, in the state of Falcón, (2005) in the carnival seasons was overshadowed by the heavy rains that from the early hours of Sunday began to fall in different regions of the country, since Falcón was the first entity

affected by the passage of a trough, the rains began to spread to the entire northern coastal region of Venezuela passing through the central states of Aragua and Carabobo, and strongly affecting the Capital District, the heavy rainfall is due to a meteorological phenomenon called "trough" is both a geomorphological and meteorological phenomenon. that moves from the northern hemisphere, passing through the Atlantic Ocean, entering the Caribbean basin, destabilizing the atmosphere, which causes some nuclei of cloudiness and in turn precipitation, as he explains: (Torres, R, meteorological forecast of the Cagigal Naval Observatory in Venezuela). According to figures provided by the Minister of the Interior and Justice, Jesse Chacón, during the month of February (2005), 33 people died due to the rains throughout Venezuela. Chacón offered a balance with the data provided, which accounted for 4,947 people affected, 16,140 affected, 42 injured and 43 missing. As for families, it reported 5,057 families affected and 3,659 families affected. Regarding the figures referring to the damage to homes, the minister indicated that 5,703 homes were affected and 2,951 homes were destroyed. The balance by region was led by the state of Mérida, with 5,000 affected, 36 injured, 39 missing and 13 dead. Regarding Vargas, he said that the supply of drinking water in the sectors of Macuto, Los Corales and Caraballeda was normalized. Regarding the scope of this work, it was evidenced that last October, (2008), from the 12th to the 24th, the Cardón Sector of the Colina Municipality of the Las Calderas Parish of the State of Falcón, was affected by heavy rainfall and gusts of winds, which created an environment of chaos in the sector. affecting 165 families, 660 people affected, 11 affected families, 33 affected people, 85 affected infants, 145 affected children, 82 adolescents, 285 adults, 63 older adults, 136 total homes affected. According to information provided by (Regional Civil Protection, Coro) In this sense, it is necessary to induce the community with respect to the risks it presents As has been shown, there is an organizational strategy by various entities and through the implementation of new laws (Law on Citizen Security, Fire Brigades and Civil Emergency Administration, Civil Protection and Disaster Management Organization) in order to promote integration and joint work. where activities identified in the Prevention strategies are included. Mitigation, preparedness, alerting, response, reconstruction and rehabilitation, creating the necessary spaces for organization, and the broad participation and integration of all social actors, not only in doing but also in thinking, that is, decision-making on the activities that are their responsibility.The El Cardón Sector, as it could be evidenced, the locality is at constant risk since it is in the areas surrounding the Coro River, according to the versions of the inhabitants, they have lost their goods and the infrastructure of their homes have suffered destabilization in rainy seasons, due to the flooding of the river, at the same time the members of this Sector are affected by garbage. debris, among others, which is located in the western part of the Community, which also spreads diseases that directly

affect individuals, especially the elderly and children. In accordance with the above, the following questions arise:

1. What will be the most vulnerable areas due to flood risks in the El Cardón Sector?
2. What vulnerable elements of flood risks are present in the Sector?
3. What results will be obtained from a vulnerability analysis in terms of flood risk in the El Cardón Sector?

## Objectives of the research:

**General objective**

1. Analyse the vulnerability in the flood areas (Stages I and II) of the Cardón Sector, Colina Municipality, Las Calderas Parish Edo Falcón.

**Specific objectives**

1. Diagnose the vulnerable flood risk areas present in the El Cardón Sector, Colina Municipality, Las Calderas Parish Edo Falcón.
2. Identify the elements of vulnerability that directly affect the El Cardón Sector, Colina Municipality, Las Calderas Parish Edo Falcón.
3. Perform a vulnerability analysis in the flood areas (Stages I and II) of the El Cardón Sector, Colina Municipality, Las Calderas Edo Falcón Parish.

## Justification of the Investigation:

First of all, it is necessary to highlight that this research is of great interest and is for the benefit of the entire population of the El Cardón Sector in general or other localities in particular, since it is intended to contribute with the help to obtain clear and precise knowledge in relation to the most vulnerable areas in terms of flooding in terms of the risks present in the different areas. Communities and in turn motivate them to search for possible solutions, taking into account their opinions and experiences as true authors of the research.

It is worth considering that all research has its direct focus and its particular reason fixed on a specific portion of the population of a region. For this reason, the Cardón Sector is taken into account for the study in particular of its vulnerability in terms of flood areas, specifically of Stages I and II, since in rainy seasons the overflow of the Coro River affects its inhabitants, especially those who live in the

vicinity of said River. Particularly those that are located to the west of these two stages and this is the lower part of the locality since the Sector has a slope (according to the versions of the Communal Councils), which are those who reside in the vulnerable zone.

The El Cardón Sector, being located in the vicinity of the Coro River, has always presented problems in the rainy seasons, since in both stages the streets have collapsed and flooded the houses, causing great material losses, causing victims. According to the versions of the inhabitants, the most affected houses have been flooded to 75%, in this sense, it is necessary to carry out a previous investigation using the necessary tools in order to carry out the vulnerability analysis in flood areas of that community.

It could be summarized below that this research is a contribution as far as the area of research is concerned in the State of Falcón, since there are no similar projects carried out in the region where a problem of this nature is reflected in the form of research, it is expected that with the graduation of the first professionals in disaster management the rate of work will increase, Proposals and projects on the problems that affect the communities of the region from the preventive point of view of what can be considered a disaster, whether natural or man-made.

It should be noted That to the extent that these natural disasters produce greater devastation, due to the lack of prevention, the neglect of infrastructure, services, the precariousness of housing and construction in high-risk areas, the greater the costs involved in the reconstruction of the affected areas (when this is technically possible) and the lower the possibilities of governments to be able to cover them in a context of crisis.

## Theoretical framework:

In this project, a previous report will be developed about the most vulnerable areas with respect to the floods that affect the El Cardón Sector, which is located in the State of Falcón, Colina Municipality, Las Calderas Parish, bordered on the north by the San Luis Sector, on the south by the Las Calderas Village, to the east by Las Calderas Avenue, to the west by the Coro River; This is a low topographic area, the landscape is xerophytic, the climate is very hot and the soil is arid. Population of 2,800 inhabitants (information provided by the Communal Councils of the Sector) for a total of 746 dwellings.

## Background:

Throughout history, researchers have taken on the task of proposing and studying the topics related to this study. Parra M. (2004) has developed a research topic entitled

"Delineation of flood plans in the La Llave River" (Vinto-Cochabamba). The General Objective was; Determine the floodplains affected by the overflow of the river for the causes of different return periods. The investigation was La Llaveprojective according to its purpose, according to its knowledge it was descriptive with a basic field design. The sample population was the inhabitants of the Cochabamba-Oruro highway with the inhabitants who are in the adjacent areas of the Rocha River.

The instrument used was the creation of a file by means of the Hec Georas extension and the digital elevation model in the form of a T.I.N. (Trianguled Irregular Network), in which the geometry of the channel was determined, at the same time a semi-structural interview was used with the inhabitants of the affected areas; Results: In conclusion, the study determined the critical areas or areas of greatest risk to the occurrence of an event, the expected water levels due to the different design causes and the possible affected areas adjacent to the La Llave River.Based on the above, it is important to highlight the importance of education and training to the Communities in terms of risk, especially to the inhabitants of areas surrounding the Rivers, which is why individuals must become aware of the construction of houses, preservation of the environment, etc. in order to minimize the possible consequences that adverse events can cause.In this sense, Alfaro G. among others, (2005) He carried out a degree project entitled: Vulnerability analysis in the main hydrological basins of Venezuela. The General Objective was to analyze the main vulnerable hydrological basins of Venezuela; The research was projective, also called "feasible project" according to its purpose, according to its knowledge it was documentary (consultation, review and analysis of secondary sources - documents and books or theses.), with a field design. Population - sample It was made up of people who live in the areas surrounding the banks of Venezuela's rivers. The instrument used was semi-structured "interviews". The result obtained was a process of feedback and introduction of elements from different perspectives that were combined in trying to understand and explain the phenomenon, location of care alternatives and future work. In view of the above-mentioned problems, it can be considered that the acculturation of the Communities in

terms of natural and man-made hazards is of the utmost importance, since it will allow the minimization of the consequences that they entail. It should be noted that Venezuela is a country that lives in constant risks in rainy seasons since it is limited to the North with the Caribbean Sea, considering that the most vulnerable areas are the cities closest to it, in turn the lack of training to the inhabitants, lack of awareness and few economic resources which lead to the need to build in areas without acts. That is why knowledge and preparation must be instilled in localities to achieve rapid and effective responses in the event of events of great magnitude, but mainly this will corroborate with the minimization of both material and human losses.At the same time, Rodríguez J & Villasmil D., (2007) They carried out a research paper entitled: "Planning Urban Vulnerability of the Caracas Metropolitan AreaThe General Objective was to plan the reduction of environmental risks in the vulnerable metropolitan areas of Caracas. The research was documentary with a field design The population- shows the inhabitants of the Metropolitan areas of Caracas. The instrument used was the "survey", with two alternatives Yes and No. The results showed that all the main access roads to the city are exposed to landslides and have no possibility of expansion because in some sections they have been invaded by neighborhoods; Tunnels and viaducts are highly susceptible and as for fossil fuel supply, it depends on two supply systems whose fuel receiving areas have been surrounded by formal and informal urban developments.Likewise, the research allowed to highlight that environmental planning allows the reduction of risks that may occur in any locality in this case in the City of Caracas, that is why the environment must be taken care of, not damaging the ecosystem, keeping green areas in good condition, cultivating and periodically cleaning the streams and recreation areas, In order to minimize the possible consequences of natural or man-made events, at the same time this would provide a significant benefit for all Venezuelans since it will allow the reduction of costs in reconstruction and rehabilitation, therefore emphasis should be placed on the preparation and training of the inhabitants of each City, Region or Community to guarantee the reduction of economic, material and human losses.

## Theoretical bases:

This research is oriented to the theoretical foundation of the needs since there are currently diversities of both anthropic and natural events that merit that the communities have knowledge of the areas vulnerable to flooding of these localities. In this sense, Maslow A., (1943) argues that: "They are all those needs that an individual presents after having satisfied the physiological ones", that is why he needs to feel sure of himself and protected in terms of the environment that surrounds him; even develop certain limits of order. These include: Physical Security, Health Security, Employment Security, Income and Resource Security, Moral Security, Family Security, Private Property Security.**According to Walker, G., (**1991) Vulnerability "is a function of inherent factors and external factors, linked to it, which together make some individuals better able to adapt than others, according to each type of threat". (p. 26).On the other hand, the Colombian Institute of Geology and Mining **(Ingeominas), (**2001) defines susceptibility or vulnerability, as the potential for structural and functional change that a system has in the face of a threat, is specific to each system; A very susceptible system is one that has the most physical conditions to change. For this reason, susceptibility is associated with a larger surface area, a greater number of structural and organic elements, and greater energy exchange. (p. 19).

Continuing with the previous reference, he also explains that external conditions, two typologies have also been identified with which it is proposed to analyze the system: permanent external conditions and conjunctural external conditions: a) Permanent external conditions make a system more vulnerable than another similar or equally susceptible due to the spatial arrangement that it has in relation to the threatening factor. It is a concept that has already been defined as a factor or degree of exposure, in which the relative spatial situation of the individual is what produces his or her condition of vulnerability.

(b) With regard to conjunctural external conditions, these are temporary situations, which link the system to a threatening factor at a given moment or moments and thus make it more vulnerable than other similar or equally susceptible systems, especially if it is at its critical moments or with greater energy consumption. The concept of temporality factor is proposed to refer to these transient conditions.

Both factors that of exposure linked to space and that of temporality can be integrated into a single concept: exposure, which is defined as the spatiotemporal situation of an individual in the face of a threat or factor that may induce change.

As can be seen, structure-functioning, energy and space-time are factors to be taken into account in a vulnerability analysis, it must be shown that it is a function in which susceptibility and exposure are directly proportional factors: the greater the susceptibility and exposure, the greater the vulnerability. The same is expressed by **Ingeominas (**2001: 20).

However, there is another factor that must be taken into account if vulnerability is to be assessed systemically. This concept is intended to express what is understood in psychology and in the environment as resilience, or "the ability of the individual to react and recover in the face of adversity, which implies a set of qualities that promote a process of successful adaptation and transformation, despite the risks and adversity itself" (Bernard, 1996, n.d.).

In the same way, Capra F., (1998) citing Maturana and Prigogine, have shown that systems have a capacity for self-organization that operates in the opposite direction to entropy, that is, that they tend to enable the system to adapt to factors of change or environmental threats. (p. 359).

According to Peiró, S. (2005) "Vulnerable zones are all those that are exposed to natural or androgenic events, which can affect the various uses of the area, in a strict sense, all areas of the planet are vulnerable, it is therefore necessary to establish a gradation, associated with the probability that a certain event, that puts a certain area at risk to actually occur."

Within this framework of ideas , "environmental vulnerability" is the condition by virtue of which a population is or is exposed or in danger of being affected by a phenomenon of human or natural origin, called a threat; In accordance with the above, vulnerability is defined as an internal factor, which contains the conditions that a region has to face the threat, it is a relative concept that must be analyzed against the particular conditions of each community, Environmental vulnerability is a concept that is related to the susceptibility or intrinsic predisposition of the site and natural resources to suffer damage or loss. These elements can be physical or biological. Understanding the

environmental vulnerability of a given region involves accurately understanding the susceptibility or resilience of that area to natural disasters. (ccad/sica-dgma - undp/unep/eclac and world bank, (1999), (p.4)

From this point of view Llavell A., (2003), states that the Identification of natural and man-made phenomena that may affect a vulnerable area It depends on the specific conditions of a site under study, according to its location, and on the phenomena that can manifest themselves with greater or lesser intensity. In addition, the vulnerability of exposed systems in a region determines the levels of risk to which it is subjected. Therefore, the first step in the construction of a risk atlas is the identification of the phenomena that have affected and therefore may affect a geographical area.According to Fernández E. (2005), the types of vulnerability are general terms: physical vulnerability and social vulnerability. The first is more feasible to quantify in physical terms, a city whose buildings were designed and built respecting a building regulation that has strict requirements to provide safety against seismic effects, is much less vulnerable to the occurrence of an earthquake, than another in which its buildings are not prepared to withstand such a phenomenon.

Physical vulnerability is expressed as a probability of damage to an exposed system and is normally expressed through a mathematical function or vulnerability matrix with values between zero and one. Zero implies that the damage suffered in the event of a certain intensity is zero, and one implies that this damage is equal to the value of the exposed good.

## Methodological Framework

**Type of research:**

Based on the objectives formulated in this research with respect to the Analysis of vulnerability in the flood areas of the El Cardón Sector, Colina Municipality, Falcón State as a key factor to minimize the most relevant risks and seek the well-being of the locality in general, it is necessary that the type of research that corresponds to it, It is a descriptive and documentary field in terms of obtaining information, which is defined by the Universidad Pedagógica Libertador, (2006) as follows:

> Field research is understood as the systematic analysis of problems in reality, with the purpose of either describing them, interpreting them, understanding their nature and constituent factors, explaining their causes and effects or predicting their occurrence, making use of methods characteristic of any of the known or developing research paradigms or approaches (p. 18).

According to Balestrini, (2001) "the research designs of exploratory, descriptive, diagnostic, evaluative studies, formulation of causal or experimental hypotheses and feasible projects, will always be field-based.

In the case of this research, it will be treated according to the above, as a descriptive research, with a basic field design.

Based on the above, the research was developed in order to describe the causes, effects and nature of the problem in order to provide possible solutions to what has been raised as a problem in the Cardón sector, taking into account all the factors that in one way or another derive from this situation.

## Research Design:

The projection of this research is based on the application of Documentary Design and Field Design. The first consists of the study of problems with the purpose of broadening and deepening the knowledge of their nature, with the support, mainly, of previous works, information and data disseminated by printed, audiovisual or electronic media, according to the Universidad Pedagógica Libertador (2006:20).

Regarding the Field Design: The data of interest are collected directly in reality; In this sense, it is an investigation based on the original or primary data, (p. 18)

**Población and Simple:**

**Población:**

According to Hernandez et al., (1998); Population refers to: "A universe of individuals or elements that have the same possibility of being measured" (p.212). In this sense, the population of the present study is made up of 2800 inhabitants of the El Cardón Sector of the Municipality of Colina Parroquia Las Calderas Edo Falcón (according to the Communal Councils of said Sector), that is, it is the subset of the universe. It is evident that the concept of population refers to a general whole where a sample or subset of a system will be taken for an object of study.

**Simple:**

In the case of this research, the sample will be limited to 247 people who are members of the El Cardón Sector, located in the Las Calderas Parish, Colina Municipality

According to Hernandez et al. (1998), the sample refers to a subset of the population to be measured (p. 12).

It could be summarized below that the sample is a small portion of the population under study, which will be studied in order to find a possible solution to a problem.

$$n = \frac{k^2 Npq}{Ne^2 + k^2 pq}$$

***k* = 1.644854 $k^2$ = 2.705543**

***e* = 5.0% $e^2$ = 0.0025**

***p* = 0.5 *p x q* = 0.25**

***q* = 0.5**

***N* = 2,800 *n* = 247**

**Data:**

**Pr =** Resultant Probability

**k =** Sample selection interval coefficient

**e** = Margin of error

**p** = Probability of Success

**q** = Probability of Failure

**N** = Population

$k^2$ = Squared sample selection interval coefficient

$e^2$ = Margin of error squared

**Data collection techniques and instruments:**

The data collection techniques applied in the research will be direct observation and it is participant-type since the researcher interacts with the observed subjects, as a complement in the application of this technique, a checklist was used as an instrument, in which all the collected data were captured. The observation applied in this study will allow the search for the necessary data that led to the resolution of the situation posed. (See Annex I) According to Hernandez et al. (1991), observation consists of the systematic, valid, and reliable recording of behavior or overt conduct. It can be used as a measuring instrument in a wide variety of circumstances. (p.216). At the same time, the "survey" technique was applied, "a technique that consists of obtaining information about a group of individuals, it can be oral or written according to the need (Arias, F, 1997), whose purpose is to interact directly with the human resources of the Sector, to obtain important opinions, the use of this technique will be materialized through the instrument "questionnaire". Prepared in order to collect the information for the presentation of the research in this case, a questionnaire will be used, from which through this instrument it is intended to demonstrate the validity and reality of the situation raised; the first of these is made up of fifteen (15) closed questions with two alternative answers (Yes and No) (See Annex II).

According to Kerlinger (1990) the questionnaire: "It is a structured script of items referring to indicators, which has levels of action and reaction responses, about a concept, designed by the person who performs the instrument" (p. 94).

**Validity and reliability:**

**Validity:**

To establish the validity of the questionnaire, the expert judgment test technique was used, which according to Chávez A. (1994:194) is defined as follows, "consists of the analysis of the correspondence of the instrument with its context". In relation to the previous quotation, it must be submitted to the

review by three (3) professionals for the purpose of this study, in order to establish the validity of the questionnaire: Sánchez Luís R, C.I Nº 10.477.427, specialist in Industrial Engineering and research methodology, criterion to be evaluated research methodology, Francisco A. Moreno A. C.I Nº 11.138.529, the criterion to be evaluated in the instrument is the content, Prof. José Laurencio C.I Nº 2.740.589 MSC Finance and Marketing, criterion to be evaluated in the instrument is wording (See annex III).

The experts, after having carefully reviewed both the instrument and the items, certify that the items are congruent, and that they are related to the context and theoretical concepts developed in the study.

**Reliability:**

In order to determine the degree of reliability of the instrument used in this study, i.e. a questionnaire, a "pilot test" was carried out, which consists of administering the questionnaire to a small group of people in order to calculate its duration, learn about their difficulties and correct their defects, before applying it to the entire sample. (Sabino, C 1992:107). In this test, the instrument was applied to ten (10) of the subjects of the study population (See Appendix IV). The results were processed by the Kuder-Richardson method (KR-20), (1984): Which is a procedure that aims to detect the extent to which an instrument can evaluate or diagnose a certain reality as reliable inserted in the Ms Excel program, according to the following formula:

$$KR20 = \left(\frac{n}{n-1}\right)\frac{\sigma_t^2 - \sum p_i q_i}{\sigma_t^2}$$

Data:

N: is the number of items.

RC: Correct Answers

RI: Incorrect Answers

Pi: Proportion of correct answers to the item

qi: Proportion of incorrect answers to item i

$\sum p_i q_i$: Sum of pi * qi

Seen in this way , the instrument of a questionnaire is considered valid when the KR-20 exceeds 0.61,

with the KR20 being an indicator of fidelity (internal consistency). Methods based (Rulon, Cronbach's Alpha, Spearman, Brown) on division into two portions (See Appendix V)

The reliability of a measuring instrument refers to the degree to which the application repeats the same subject or object produces the same results, while validity in general refers to the degree to which an instrument actually measures the variable it purports to measure (Hernandez et al. 1998, p. 236).

**Analysis Techniques:**

The analysis of the results involves the presentation of a detailed summary of the data collected and the statistical treatment of the same, which, once collected, proceeds to interpret its results, that is, they are explained and the information that has been obtained is given meaning.

After having interpreted the results obtained through the Kuder-Richardson method (KR-20), in which the result was obtained as 0.97, which is interpreted in the same way as Cronbach's Alpha, we proceed to the elaboration of graphs which visually represent the information collected and tabulated through the instruments applied to the sample under study in the research.

**Analysis and discussion of the results:**

**Analysis:**

After the information was collected, the data were analyzed using descriptive statistics defined by Hernández et al. (1998) as: "Critical determination method, in relation to quantitative proportions resulting from a distributive measurement".According to the above, the author refers to the application of descriptive statistics, the data are ordered by frequency distribution and then analyzed under the criteria of the research, in this way the needs will be detected and in the same way the statistics will be applied. This view of the information will allow the researcher to obtain an accurate assessment in order to elaborate the conclusions and recommendations of the project.

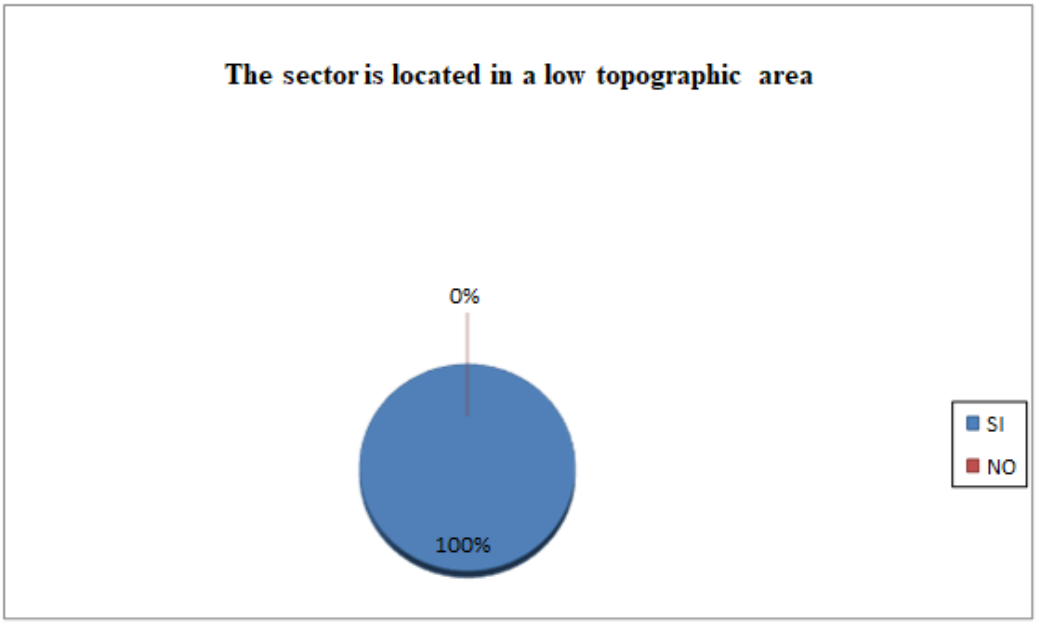
**Table No: II**

**General frequency table:**

| Items | Alternative | | Observation | Absolute Frequency | | (%) Relative Frequency | |
|---|---|---|---|---|---|---|---|
| 01 | YES | NO | Low Topographic Location | 1 | 0 | 100% | 00% |
| 02 | YES | NO | Proximity to | 1 | 0 | 100% | 00% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | the Coro River | | | | |
| 03 | YES | NO | In the river there are pieces of blocks | 1 | 0 | 100% | 00% |
| 04 | YES | NO | Trash in the vicinity of the River Lack of cleanliness. | 1 | 0 | 100% | 00% |
| 05 | YES | NO | Earth displacement | 0 | 1 | 00% | 100% |
| 06 | YES | NO | Dead Animals | 1 | 0 | 100% | 00% |
| 07 | YES | NO | Materials, Not Acts | 0 | 1 | 00% | 100% |
| 08 | YES | NO | Parks and green areas | 1 | 0 | 100% | 00% |
| 09 | YES | NO | Rodents | 1 | 0 | 100% | 00% |
| 10 | YES | NO | The inhabitants are attentive and alert | 1 | 0 | 100% | 00% |
| 11 | YES | NO | Residents fear being affected during the rainy season | 1 | 0 | 100% | 00% |
| 12 | YES | NO | Residents have been psychologically affected by the floods | 1 | 0 | 100% | 00% |

| Item | Alternative | | Observation | Frequency | | (%) Frequency Relative | |
|---|---|---|---|---|---|---|---|
| 1 | YES | NO | Low topographic location. | 1 | 0 | 100% | 00% |

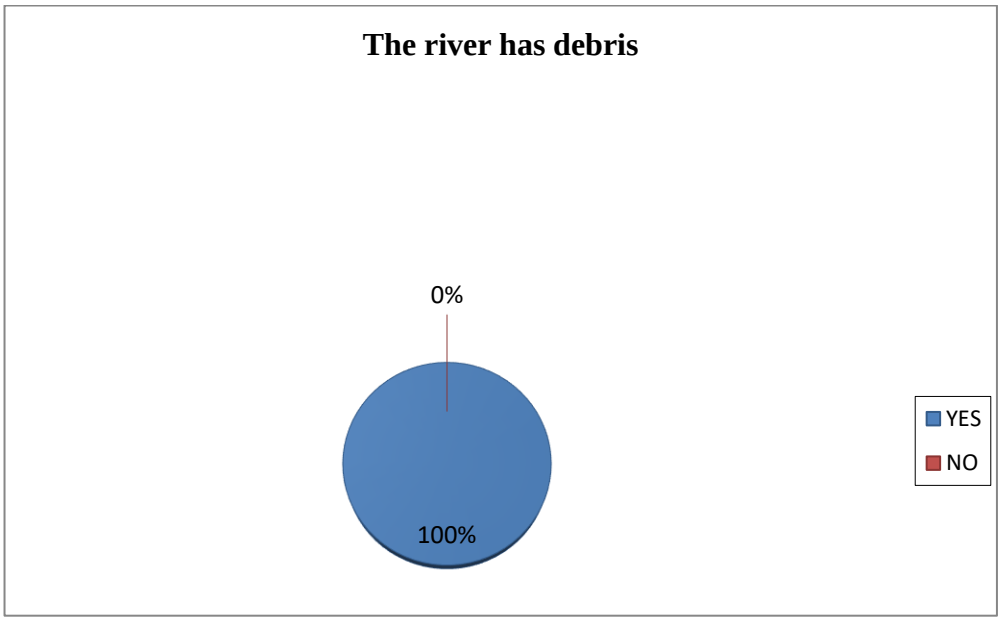



**Analysis:**

It was possible to visualize that the Community is located in a low zone since its concavity slopes in the western part and the houses are directly affected at the time of overflows of the Coro River, therefore those that suffered the greatest consequences are those closest to it

**Graph No.: III**

| Item | Alternative | | Observation | Frequency | | (%) Frequency Relative | |
|---|---|---|---|---|---|---|---|
| 3 | YES | NO | Pieces of blocks. | 1 | 0 | 100% | 00% |

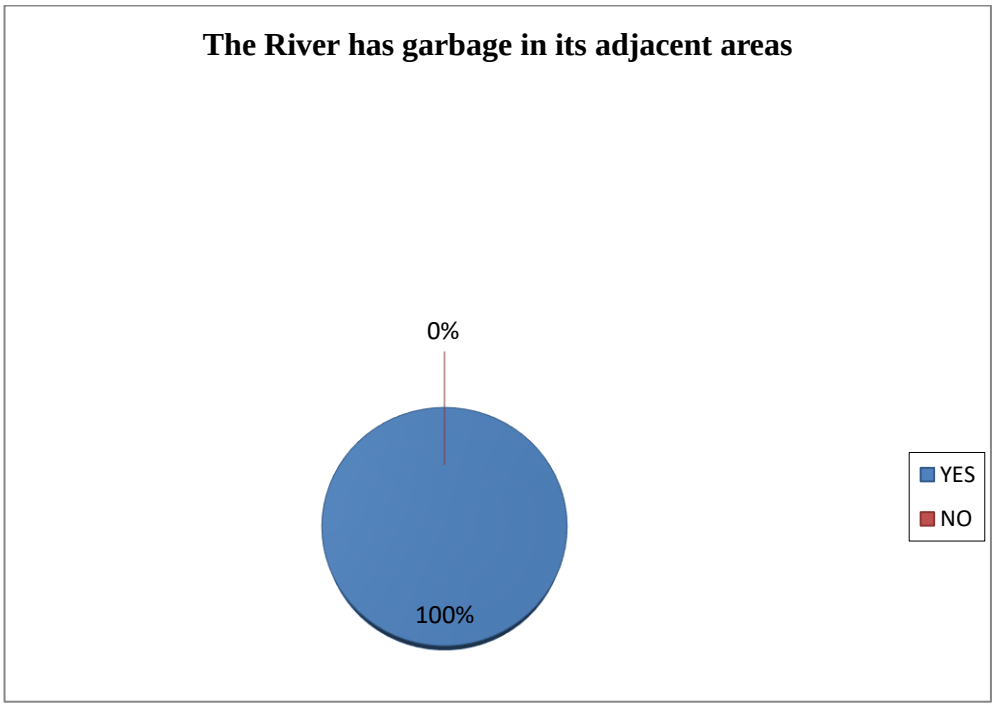



**Analysis:**

It can be observed both in the river and in its surroundings the remains of blocks, which hinder the flow of water, in the same way these carry greater consequences at the time of the rainy seasons.

**Graph No.: IV**

| Item | Alternative | | Observation | Frequency | | (%) Frequency Relative. | |
|---|---|---|---|---|---|---|---|
| 4 | YES | NO | Lack of cleanliness | 1 | 0 | 100% | 00% |

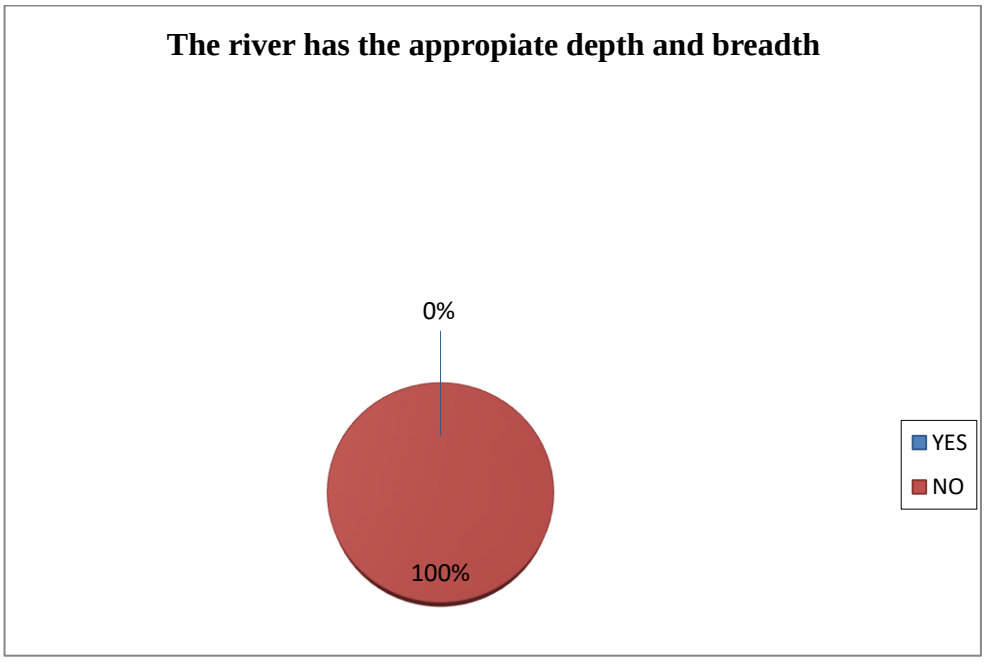



Analysis:

On the banks of the Coro River, solid waste is visualized, which leads to the reproduction and experience of rodents that spread diseases, this is one of the many weaknesses that the El Cardón Sector has and therefore it is necessary to have a periodic cleaning day and at the same time the inhabitants must become aware of the problem that this represents.

**Graph No.: V**

| Item | Alternative | | Observation | Frequency | | (%) Frequency Relative | |
|---|---|---|---|---|---|---|---|
| 5 | YES | NO | Landslides in rainy seasons | 0 | 1 | 00% | 100% |

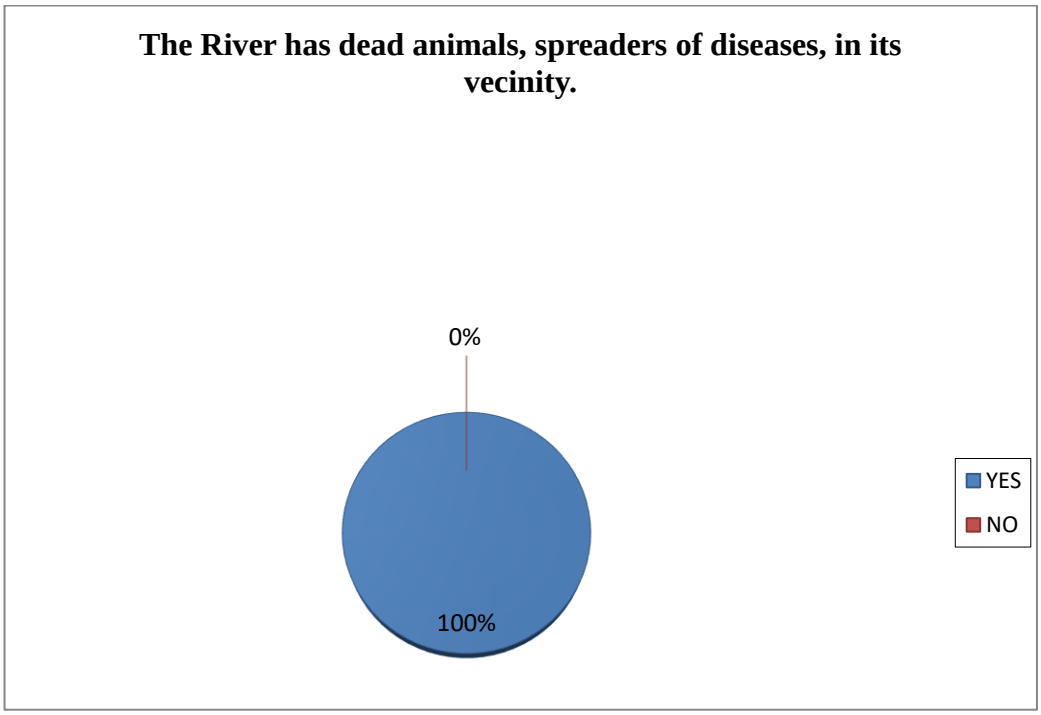



Analysis:

Due to the heavy rainfall and flooding of the Coro River, the land has shifted and the depth of the river is not the most adequate.

**Graph Nº: VI**

| Item | Alternative | | Observation | Frequency | | (%) Frequency Relative | |
|---|---|---|---|---|---|---|---|
| 6 | YES | NO | Two (2) dead dogs. | 1 | 0 | 100% | 00% |

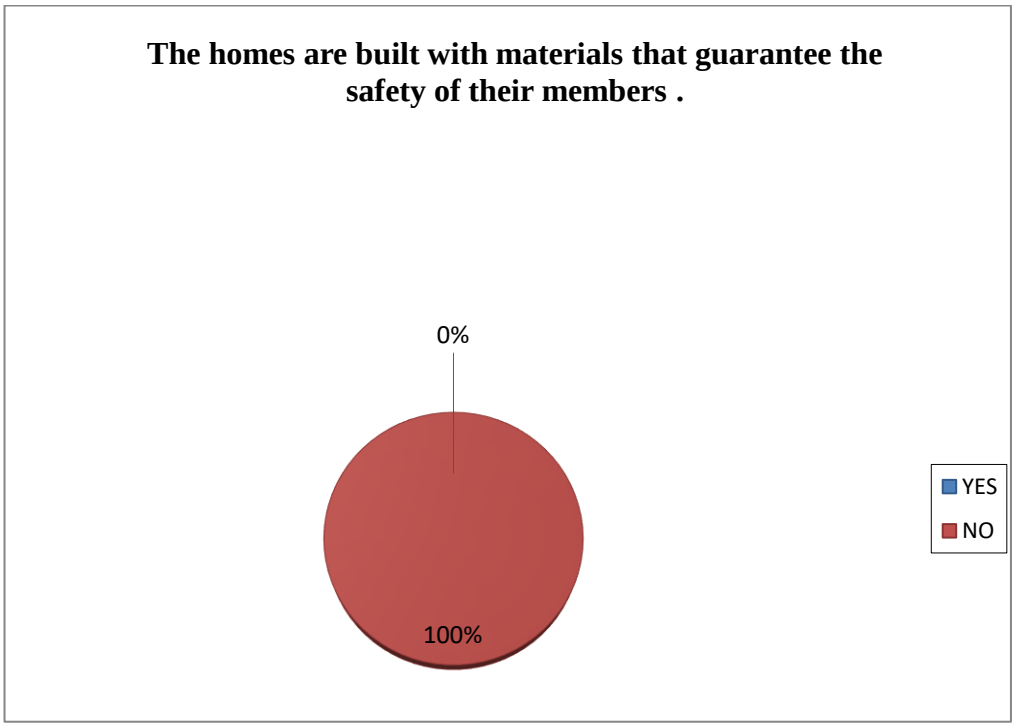



Analysis:

At the time of making the respective observation in the vicinity of the River, two (2) dogs were visualized, in a state of decomposition, this leads to the spread of diseases in the locality, which would affect all the members of said Sector, especially children and the elderly.

**Graph No: VII**

| Item | Alternative | | Observation | Frequency | | (%) Frequency Relative | |
|---|---|---|---|---|---|---|---|
| 7 | YES | NO | Materials, not acts. | 0 | 1 | 00% | 100% |

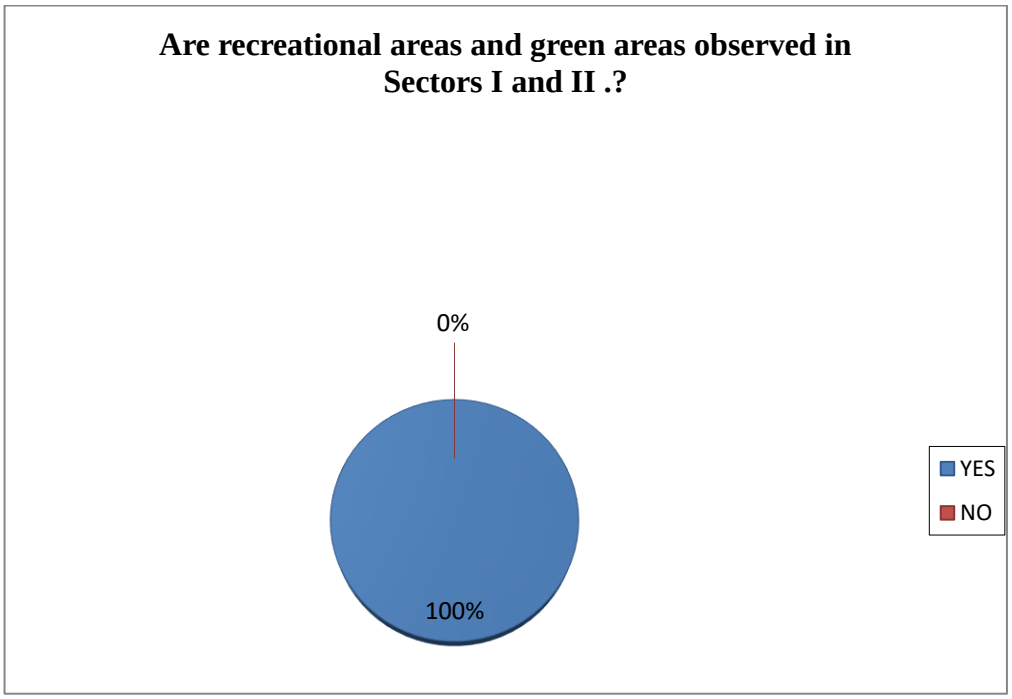



Analysis:

Houses need to be reinforced with higher quality materials, since they have suffered structural damage due to continuous flooding and consequently the foundations of the residences are debited, this can cause detrimental damage to those who inhabit them (death).

**Graph No.: VIII**

| Item | Alternative | | Observation | Frequency | | (%) Frequency Relative | |
|---|---|---|---|---|---|---|---|
| 8 | YES | NO | Parks and green areas | 1 | 0 | 100% | 00% |

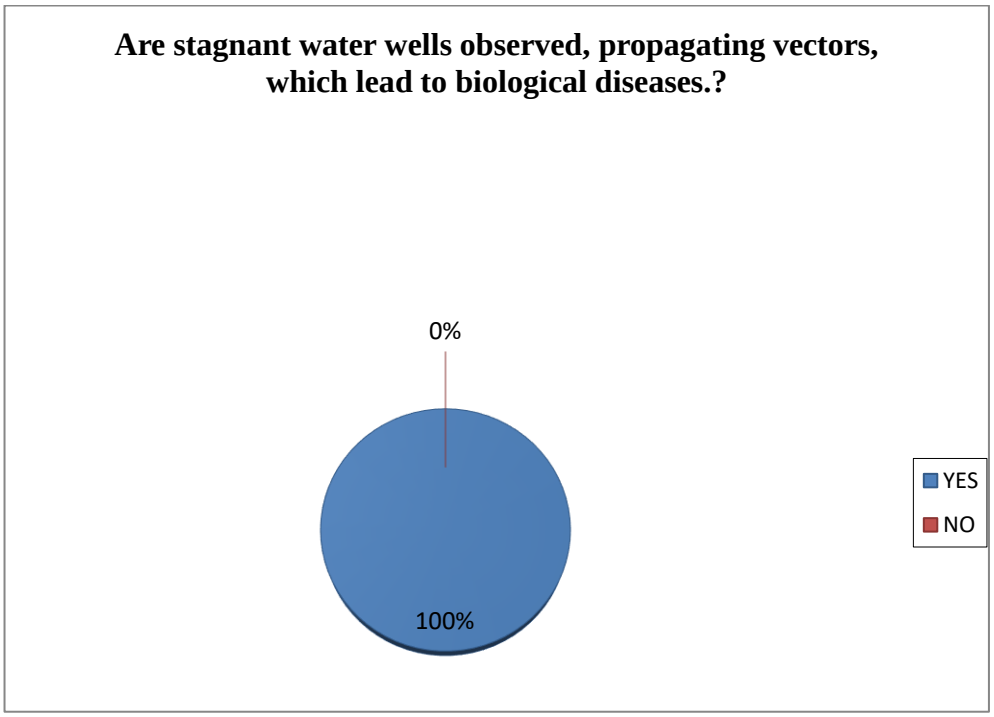



Analysis:

This Sector has trees and a recreation park that allows the physical and mental development of the inhabitants of the Community, through the realization of certain activities, it can be said that it will help the emotional development of children and consequently of adults and elderly people who have been affected by the floods.

**Graph Nº: IX**

| Item | Alternative | | Observation | Frequency | | (%) Frequency Relative | |
|---|---|---|---|---|---|---|---|
| 9 | YES | NO | Rodents | 1 | 0 | 100% | 00% |

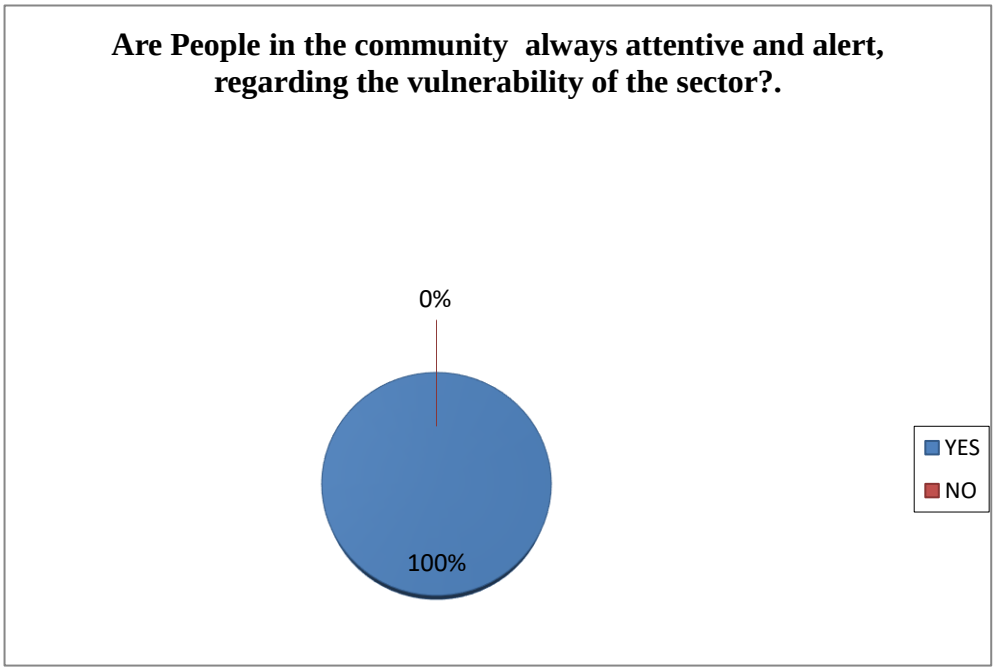



Analysis:

In the vicinity of the river, in addition to solid waste, debris is also observed two water wells, which contain green lava and rodents are observed in them, these are harmful to the inhabitants at the time of heavy rainfall since they lead to the spread of diseases.

**Graph Nº: X**

| **Item** | **Alternative** | | **Observation** | **Frequency** | | **(%) Frequency Relative** | |
|---|---|---|---|---|---|---|---|
| **10** | **YES** | **NO** | **The inhabitants are attentive and alert.** | **1** | **0** | **100%** | **00%** |

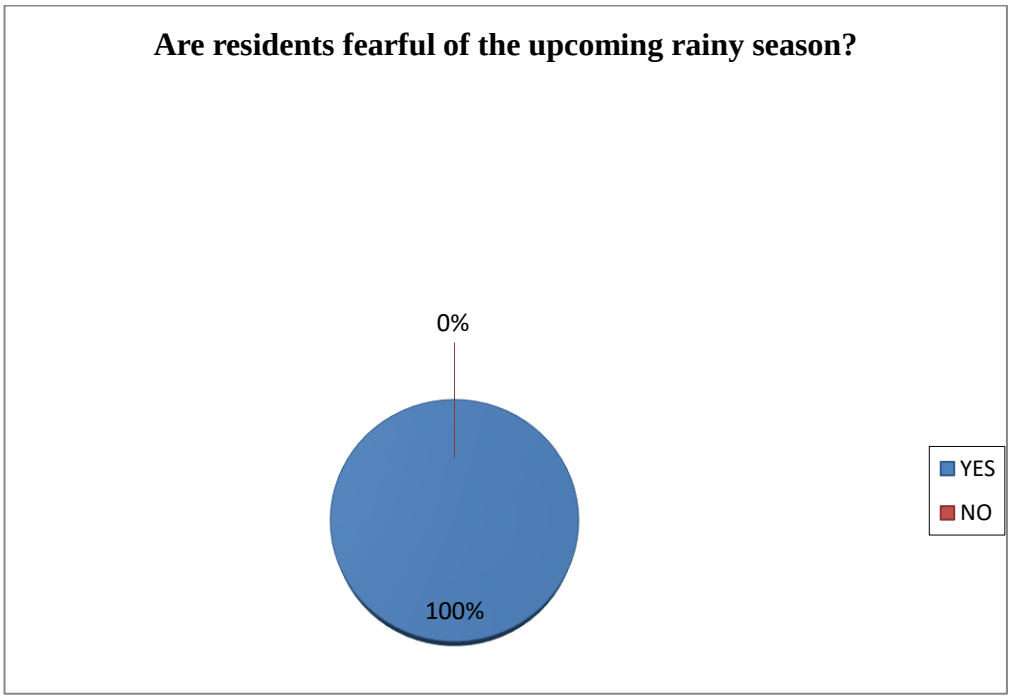



Analysis:

It was observed that the study sample subjects at the time of carrying out the respective items of the survey were attentive and alert with respect to the subject, since in the rainy seasons they have suffered many material losses and deterioration of the infrastructures of the houses, which leads to a high risk for their inhabitants.

**Chart No: XI**

| **Item** | **Alternative** | | **Observation** | **Frequency** | | **(%) Frequency Relative** | |
|---|---|---|---|---|---|---|---|
| **11** | **YES** | **NO** | Residents fear being affected during the rainy season | **1** | **0** | **100%** | **00%** |

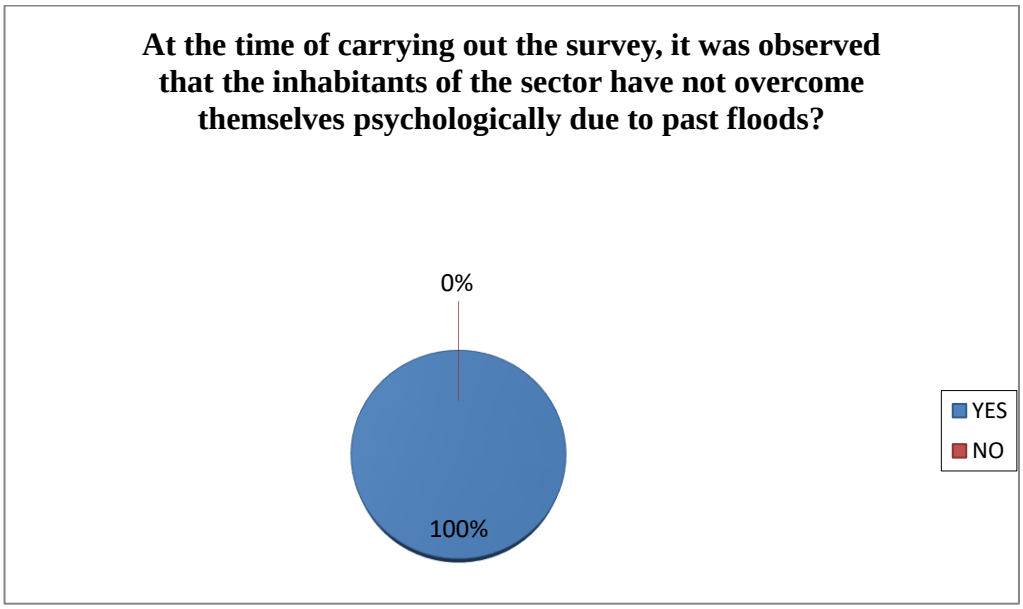



Analysis:

The inhabitants of the El Cardón Sector can be observed that they fear being affected in the rainy season, due to the consequences that they have produced, their attitude is notorious when it comes to the issue in question, Consequently, the necessary measures must be taken to solve the problems presented by the Community.

**Graph No.: XII**

| **Item** | **Alternative** | | **Observation** | **Frequency** | | **(%) Frequency Relative** | |
|---|---|---|---|---|---|---|---|
| **12** | **YES** | **NO** | **The inhabitants have been psychologically affected by the floods.** | **1** | **0** | **100%** | **00%** |




Analysis:

It was visualized that at the time of conducting the survey to the subjects under study, it could be perceived that they have not recovered psychologically from the damage caused by the floods in the Sector, they fear of suffering greater losses and even their lives

**Questionnaire:**

**Table No.: XIII**

**General frequency table:**

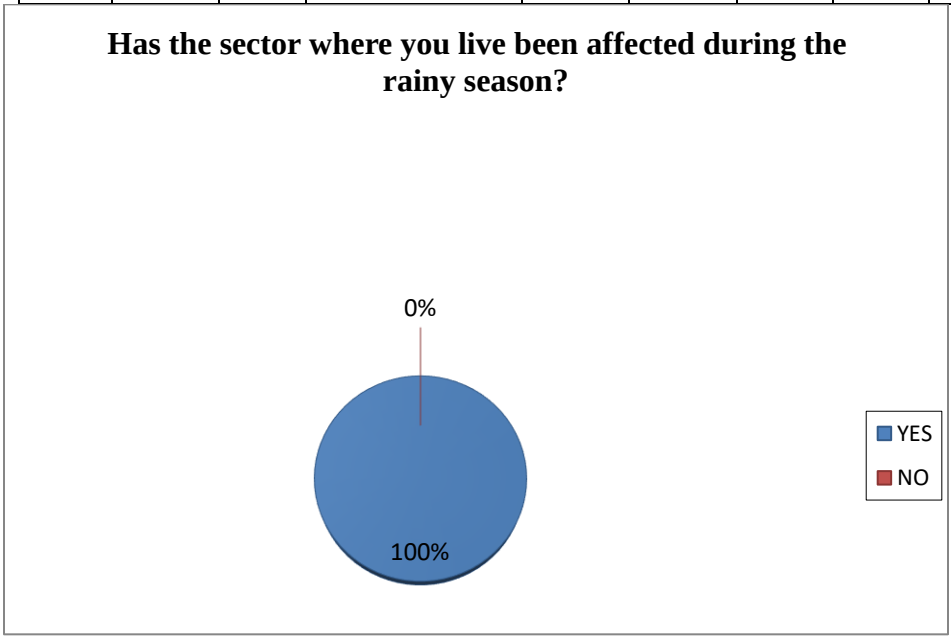
| Items | Alternative | | Codes | | Absolute Frequency | | (%) Relative Frequency | |
|---|---|---|---|---|---|---|---|---|
| 01 | YES | NO | 1 | 0 | 247 | 00 | 100% | 00% |
| 02 | YES | NO | 1 | 0 | 199 | 48 | 81% | 19% |
| 03 | YES | NO | 1 | 0 | 247 | 00 | 100% | 00% |
| 04 | YES | NO | 1 | 0 | 127 | 120 | 51% | 49% |
| 05 | YES | NO | 1 | 0 | 247 | 00 | 100% | 00% |
| 06 | YES | NO | 1 | | 247 | 00 | 100% | 00% |
| 07 | YES | NO | 1 | 0 | 214 | 33 | 87% | 13% |
| 08 | YES | NO | 1 | 0 | 247 | 00 | 100% | 00% |
| 09 | YES | NO | 1 | 0 | 247 | 00 | 100% | 00% |
| 10 | YES | NO | 1 | 0 | 201 | 46 | 81% | 19% |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 11 | YES | NO | 1 | 0 | 247 | 00 | 100% | 00% |
| 12 | YES | NO | 1 | 0 | 100 | 147 | 40% | 60% |
| 13 | YES | NO | 1 | 0 | 247 | 00 | 100% | 00% |
| 14 | YES | NO | 1 | 0 | 247 | 00 | 100% | 00% |
| 15 | YES | NO | 1 | 0 | 247 | 00 | 100% | 00% |

Sources: Penso A. Carlos N., (2009)

**Graph Nº: XIV**

| Item | Alternative | | | Code | | Frequency | | (%) Frequency Relative | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Yes | No | | | | |
| 1 | YES | NO | | 1 | 0 | 247 | 00 | 100% | 00% |

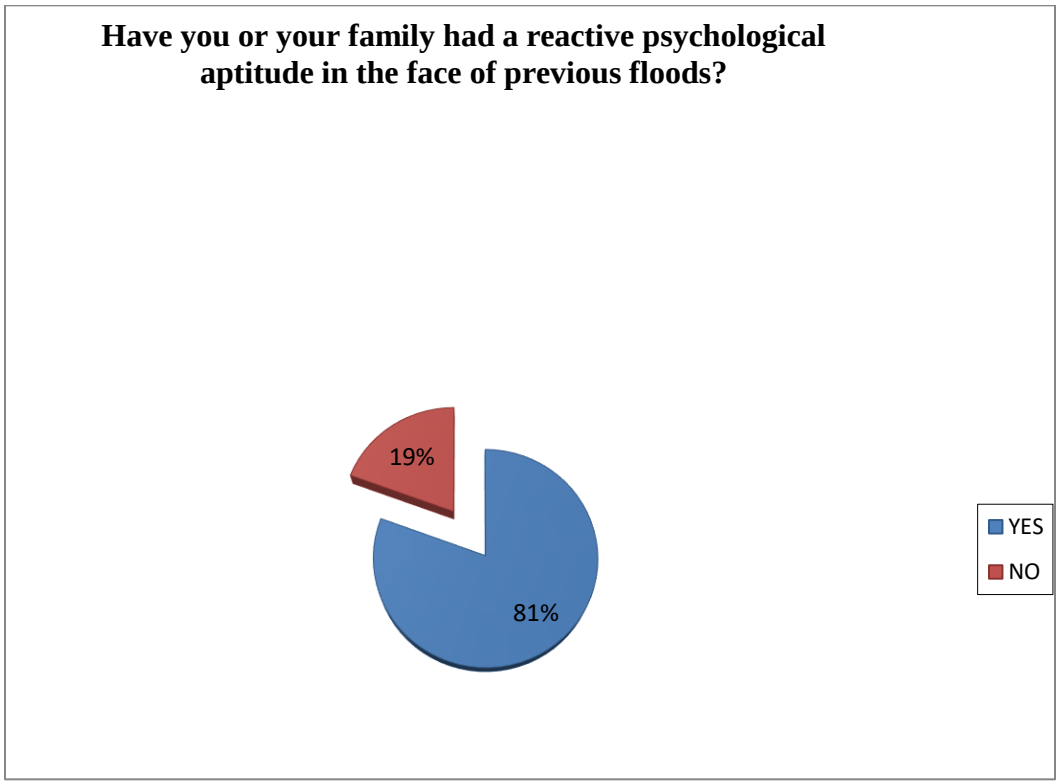



Analysis:

According to the data, that is, 100% of the inhabitants of the El Cardón Sector state that the town has been affected in the rainy seasons.

**Graph Nº: XV**

| Item | Alternative | | Code | | Frequency | | (%) Frequency Relative | |
|---|---|---|---|---|---|---|---|---|
| | | | Yes | No | | | | |
| 2 | YES | NO | 1 | 0 | 199 | 48 | 81% | 19% |

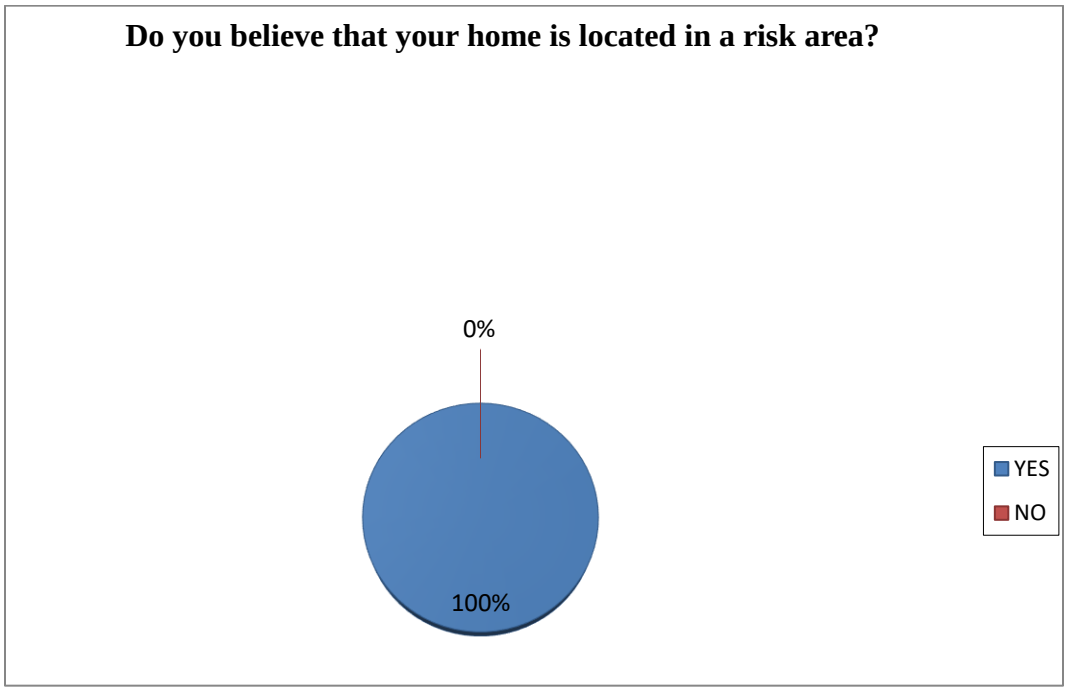



Analysis:

According to the data provided in the tabulation, it was announced that 81% of the subjects under study have had a quick and active reaction to face the consequences of rainy periods, since the houses have suffered structural damage and fear of losing not only their property but also their lives, while 19% indicated that they have not had such an impulsive reaction. On the contrary, they have behaved with a calm and unhurried attitude.

**Graph Nº: XVI**

| **Item** | **Alternative** | | **Code** | | **Frequency** | | **(%) Frequency Relative** | |
|---|---|---|---|---|---|---|---|---|
| | | | **Yes** | **No** | | | | |
| **3** | **YES** | **NO** | **1** | **0** | **247** | **00** | **100%** | **00%** |

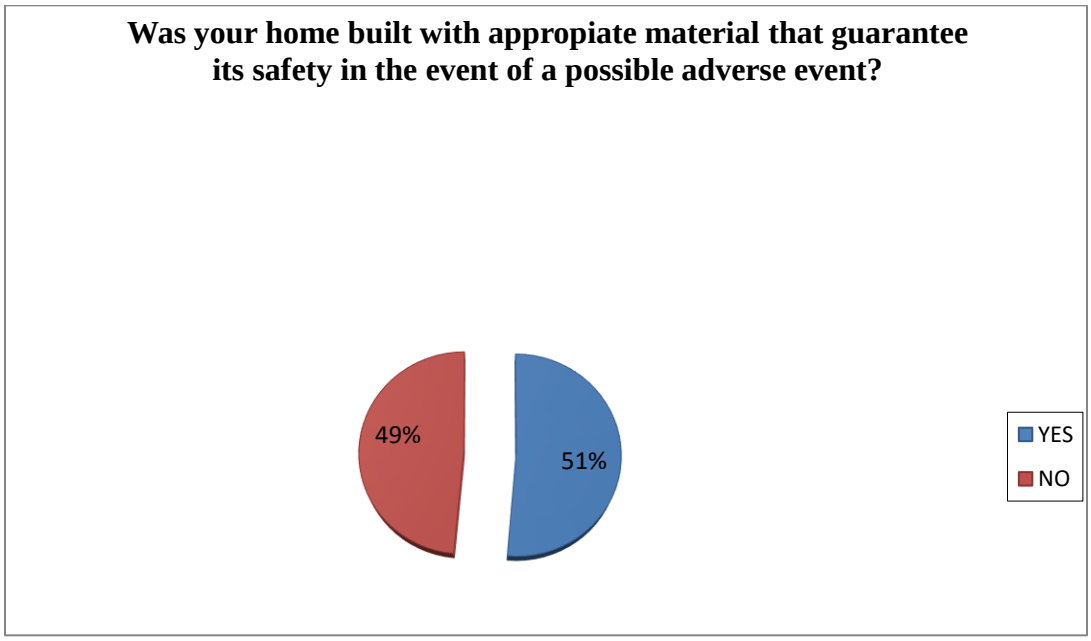



Analysis:

The results projected in the applied item showed that 100% of the study sample subjects indicated that the Community is located in a risk area. It is therefore clear that it has suffered the consequences of past floods. It is highly vulnerable due to its presence in the vicinity of the Coro River.

**Graph Nº: XVII**

| Item | Alternative | | Code | | Frequency | | (%) Frequency Relative | |
|---|---|---|---|---|---|---|---|---|
| | | | Yes | No | | | | |
| 4 | YES | NO | 1 | 0 | 127 | 120 | 51% | 49% |

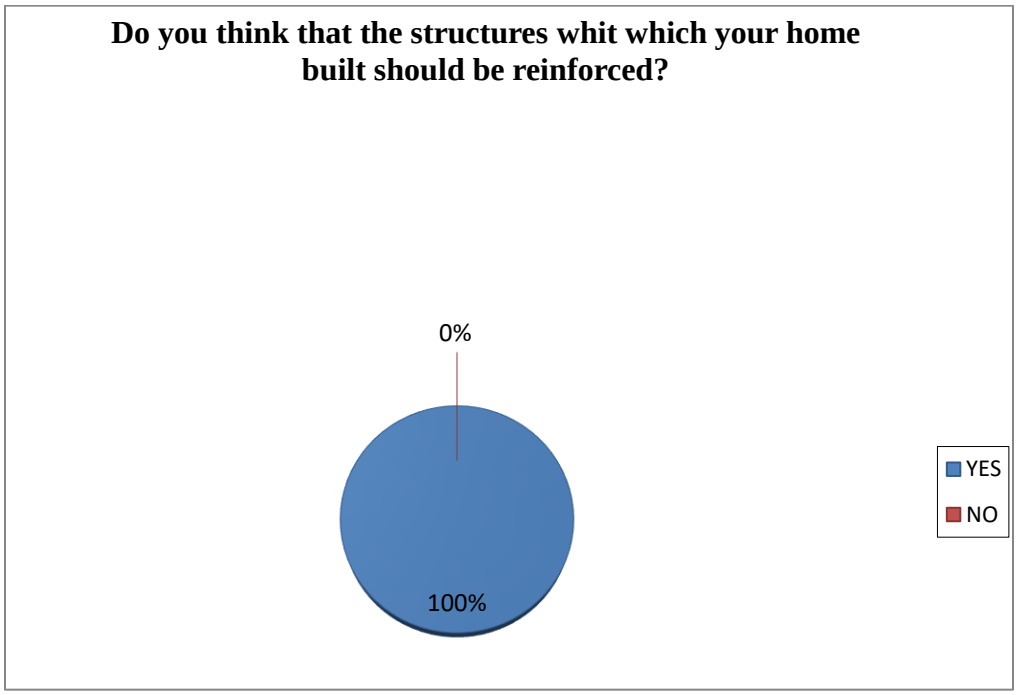



Analysis:

According to the results projected in the graph, it can be evidenced that 51% of the respondents said that the construction of their home was carried out with quality materials guaranteeing their safety and that of their loved ones in the face of flood threats or other adverse events, while 49% indicated that their homes are not built with highly qualified materials because they suffered notable deterioration in their structures after the heavy rains that affected the sector.

**Graph Nº: XVIII**

| **Item** | **Alternative** | | **Code** | | **Frequency** | | **(%) Frequency Relative** | |
|---|---|---|---|---|---|---|---|---|
| | | | **Yes** | **No** | | | | |
| **5** | **YES** | **NO** | **1** | **0** | **247** | **00** | **100%** | **00%** |

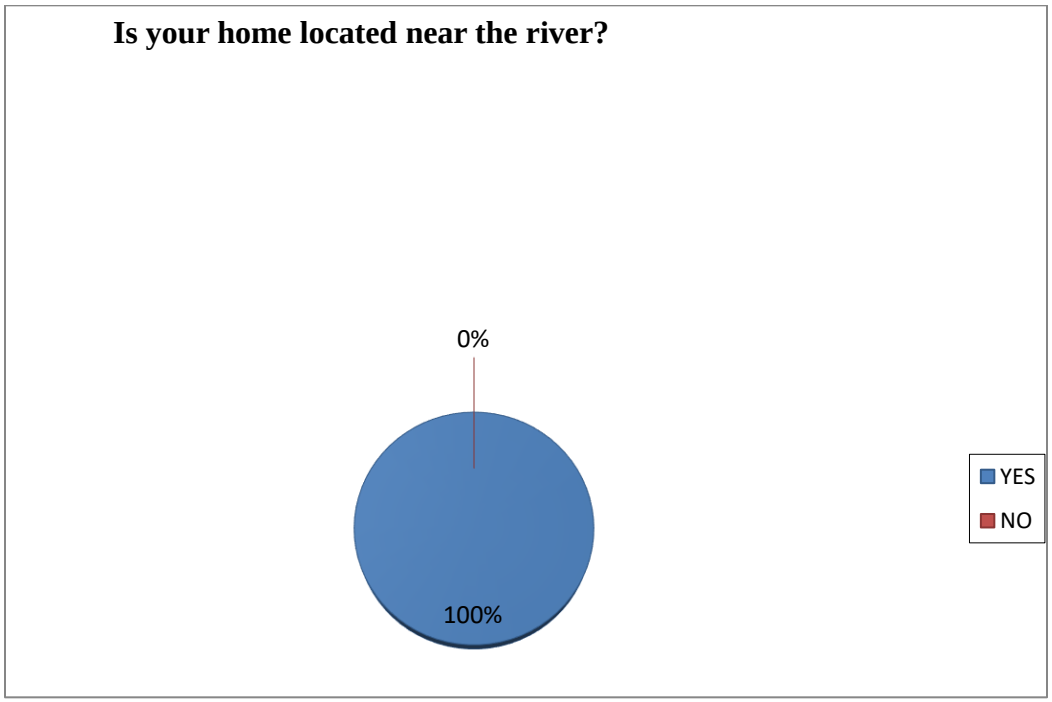



Analysis:

The entire sample under study pointed out that during the floods they have suffered material losses, because the type of construction is not the most appropriate, since it has weak foundations, which should be reinforced, in order to withstand the onslaught of a hydrometeorological event.

**Graph Nº: XIX**

| Item | Alternative | | Code | | Frequency | | (%) Frequency Relative | |
|---|---|---|---|---|---|---|---|---|
| | | | Yes | No | | | | |
| 6 | YES | NO | 1 | 0 | 247 | 00 | 100% | 00% |

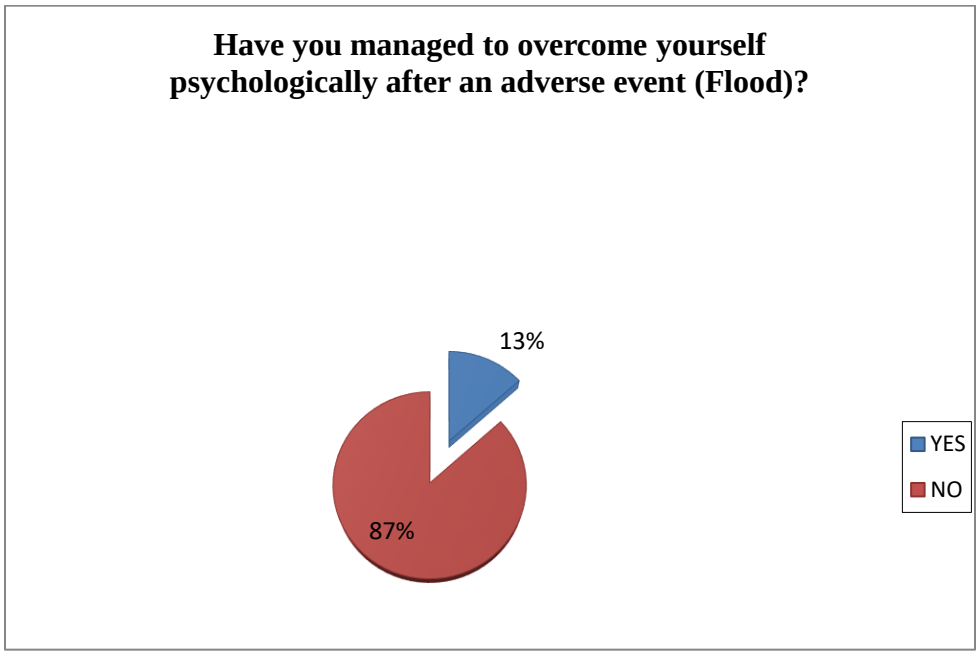



Analysis:

Regarding the location of the houses, 100% of the objects of study indicated that their homes are located in the vicinity of the Coro River. Well, these homes are certainly located in a highly vulnerable area, due to their proximity to the river.

**Graph Nº: XX**

| **Item** | **Alternative** | | **Code** | | **Frequency** | | **(%) Frequency Relative** | |
|---|---|---|---|---|---|---|---|---|
| | | | **Yes** | **No** | | | | |
| **7** | **YES** | **NO** | **1** | **0** | **214** | **33** | **87%** | **13%** |

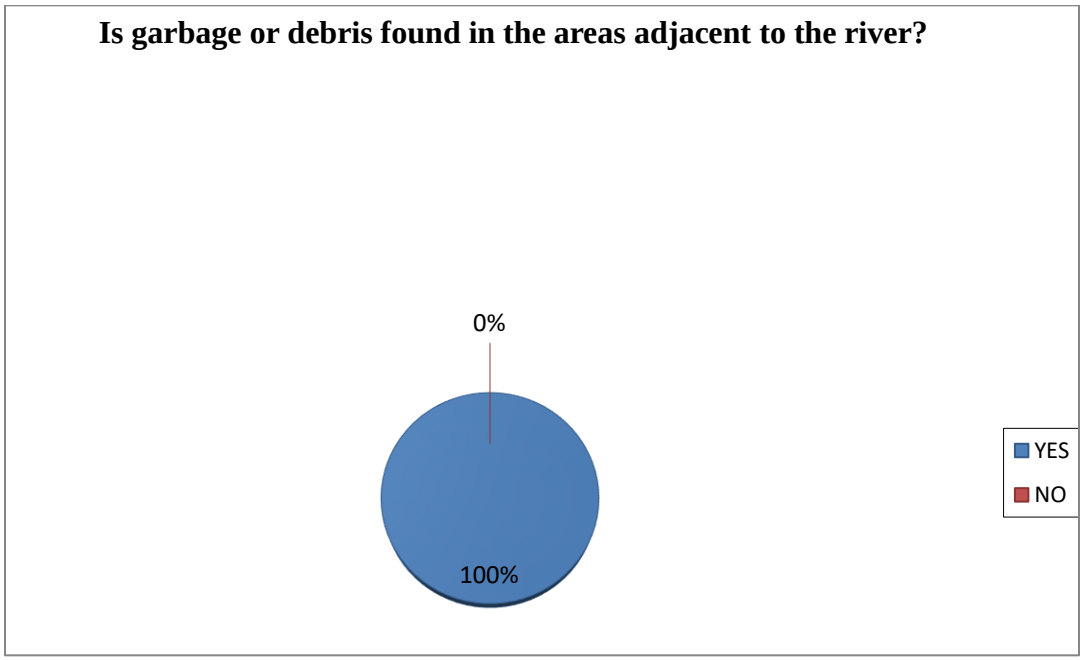



Analysis:

The results obtained by the instrument applied showed that 87% of the inhabitants indicated that the Community has been affected in its entirety by the floods, it has not been able to recover psychologically after the floods that have occurred in the Cardón sector, while 13% expressed that they have recovered satisfactorily after the event.

**Graph Nº: XXI**

| Item | Alternative | | Code | | Frequency | | (%) Frequency Relative | |
|---|---|---|---|---|---|---|---|---|
| | | | Yes | No | | | | |
| 8 | YES | NO | 1 | 0 | 247 | 00 | 100% | 00% |

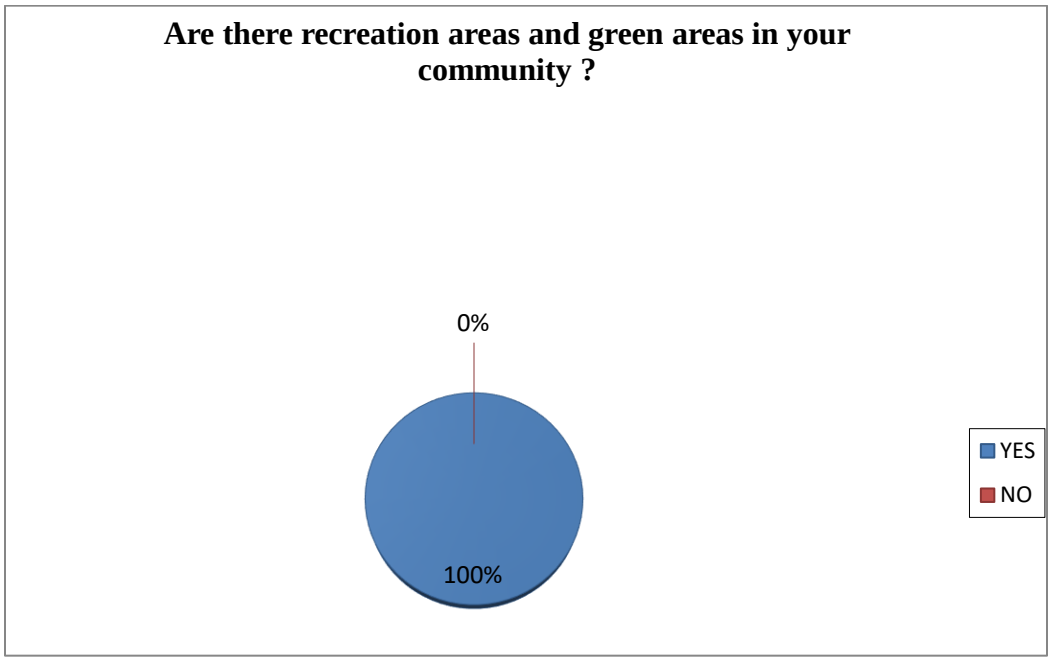



Analysis:

The graph shows that 100% of the respondents said that in the areas adjacent to the Coro River there is garbage and debris, which has greater consequences when the rainy seasons occur, since it hinders the normal flow of water, when the river is at its maximum flow, overflowing and causing flooding in the homes in the sector.

**Graph No.: XXII**

| Item | Alternative | | Code | | Frequency | | (%) Frequency Relative | |
|---|---|---|---|---|---|---|---|---|
| | | | Yes | No | | | | |
| 9 | YES | NO | 1 | 0 | 247 | 00 | 100% | 00% |

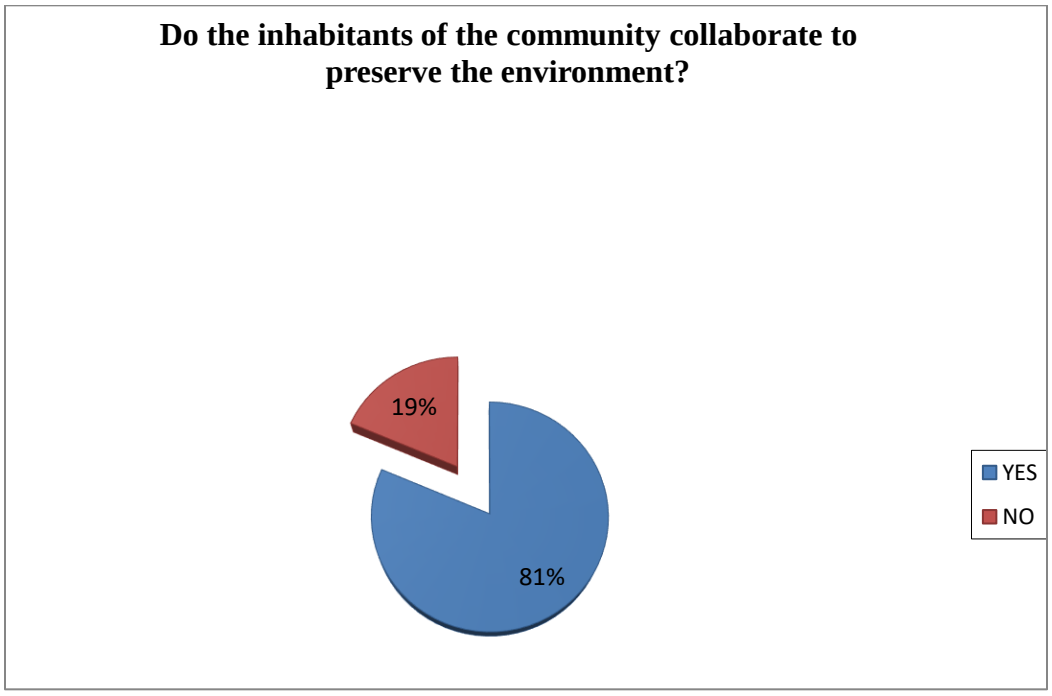



Analysis:

In relation to the percentage reflected in the graph, the sample under study, I point out that there are recreation areas and green areas within the El Cardón Sector, which serve for the recreation of the inhabitants of the sector.

**Graph Nº: XXIII**

| Item | Alternative | | Code | | Frequency | | (%) Frequency Relative | |
|---|---|---|---|---|---|---|---|---|
| | | | Yes | No | | | | |
| 10 | YES | NO | 1 | 0 | 201 | 46 | 81% | 19% |

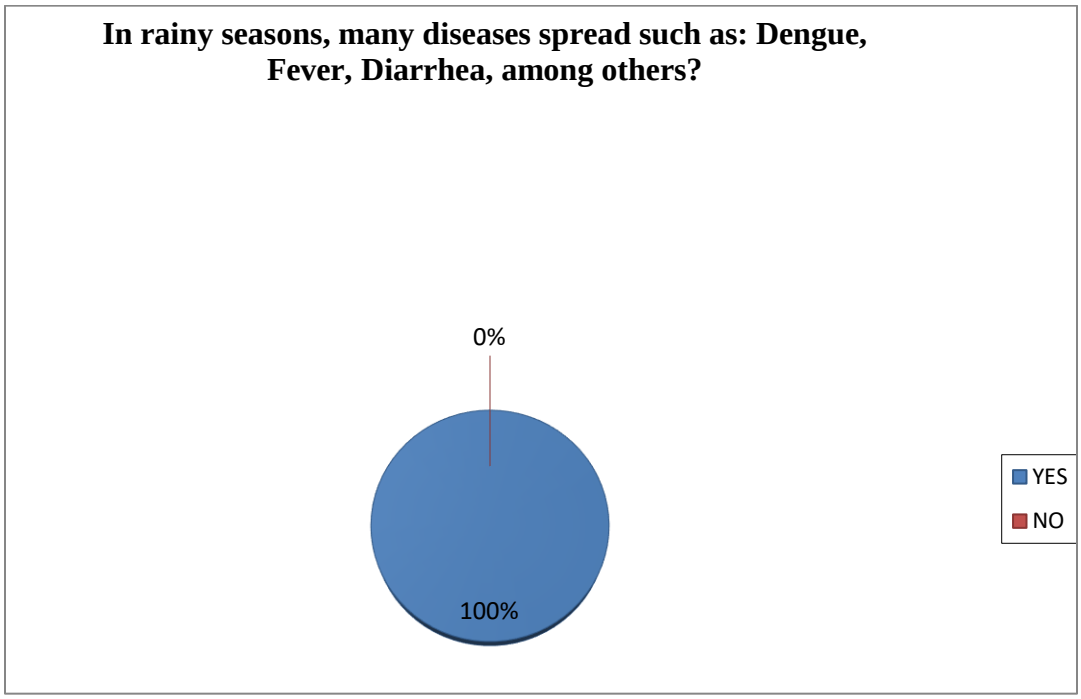



Analysis:

According to the graphic project, 81% of the inhabitants collaborate for the preservation of the environment, as they have participated in the tree planting and debris collection days that have been carried out in the sector and 19% indicated that they have not contributed any common good for their maintenance and are apathetic to the community work of environmental protection.

**Graph No.: XXIV**

| Item | Alternative | | Code | | Frequency | | (%) Frequency Relative | |
|---|---|---|---|---|---|---|---|---|
| | | | Yes | No | | | | |
| 11 | YES | NO | 1 | 0 | 247 | 00 | 100% | 00% |

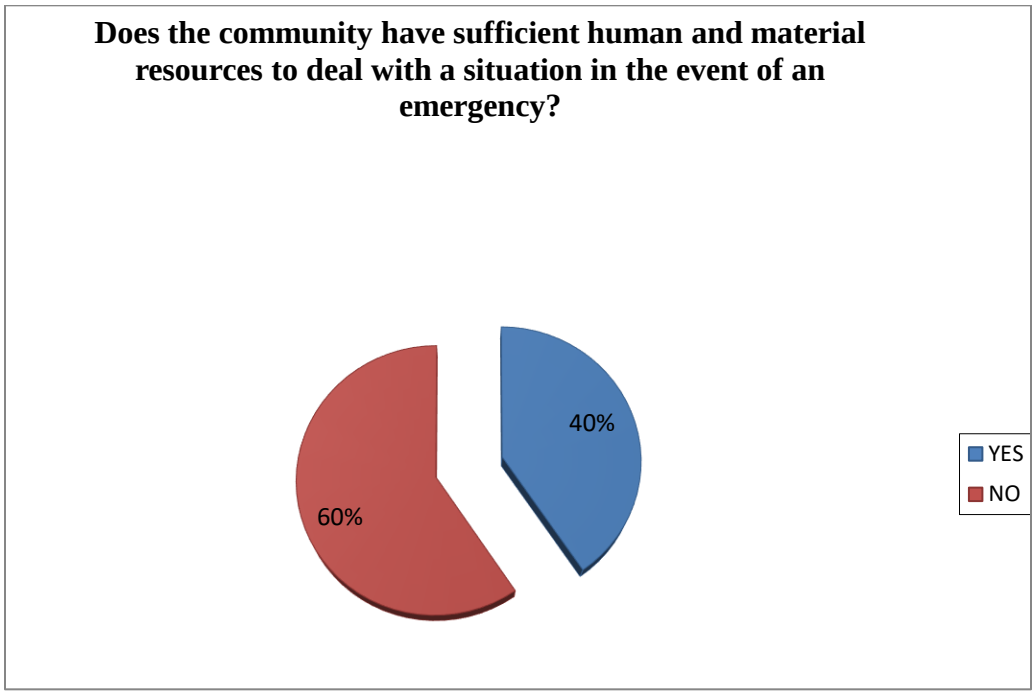



Analysis:

The inhabitants subject to study stated that in the rainy seasons many diseases are spread such as: dengue, diarrhea, fever among others, due to the stagnation of the water, garbage on the banks of the river...

**Graph No.: XXV**

| Item | Alternative | | Code | | Frequency | | (%) Frequency Relative | |
|---|---|---|---|---|---|---|---|---|
| | | | Yes | No | | | | |
| 12 | YES | NO | 1 | 0 | 100 | 147 | 40% | 60% |

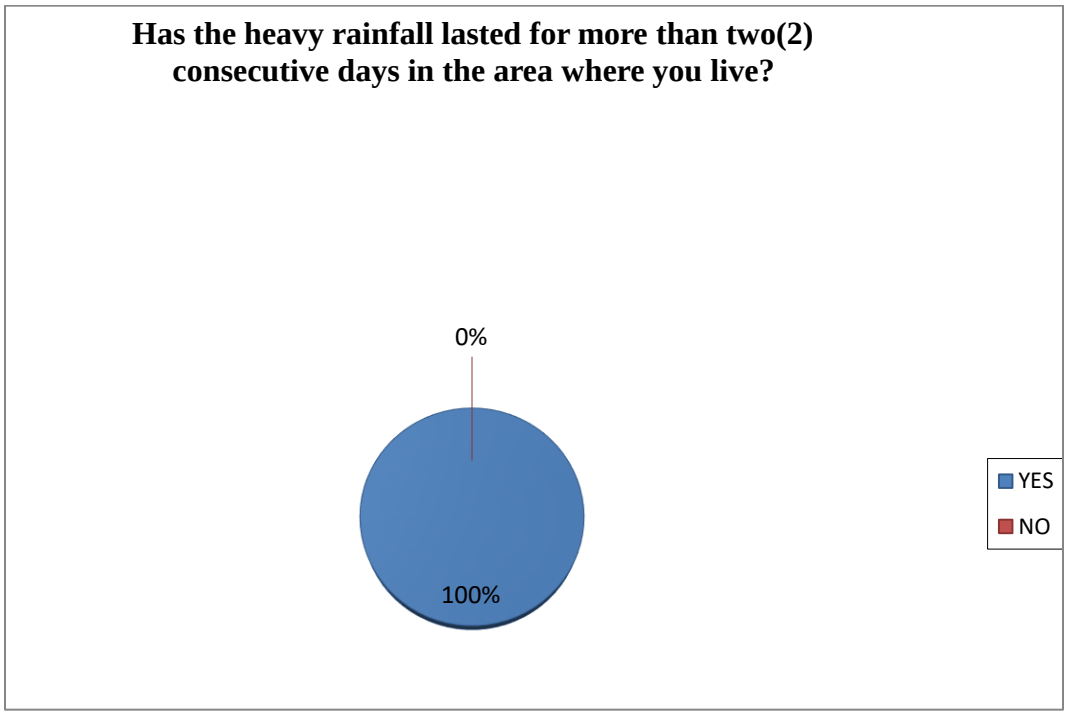



Analysis:

The result of this item shows that 40% of the community (according to information from the members of the Communal Councils) have both material and human resources to deal with an emergency situation, while 60% did not agree, indicating that in past seasons there have been no immediate responses when it comes to attending to the affected people.

**Graph No.: XXVI**

| Item | Alternative | | Code | | Frequency | | (%) Frequency Relative | |
|---|---|---|---|---|---|---|---|---|
| | | | Yes | No | | | | |
| 13 | YES | NO | 1 | 0 | 247 | 00 | 100% | 00% |

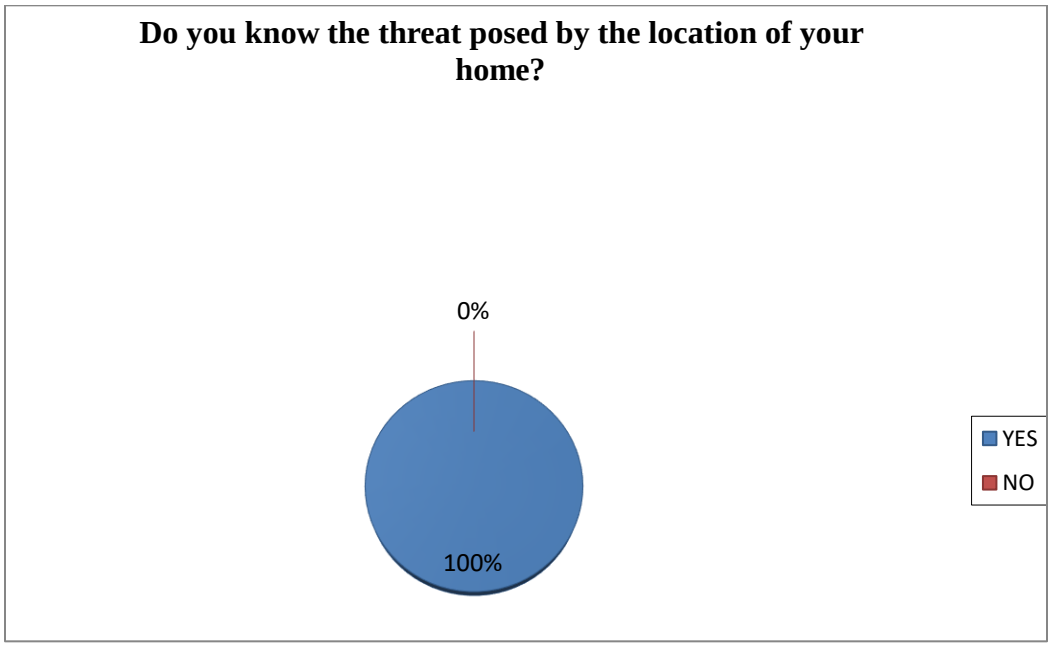



Analysis:

100% of the objects sampled under study have witnessed prolonged rains in past events, which, due to the copiousness of the rainfall, have generated floods, which have had consequences such as loss of material resources to the inhabitants of the sector

**Graph No.: XXVII**

| Item | Alternative | | Code | | Frequency | | (%) Frequency Relative | |
|---|---|---|---|---|---|---|---|---|
| | | | Yes | No | | | | |
| 14 | YES | NO | 1 | 0 | 247 | 00 | 100% | 00% |

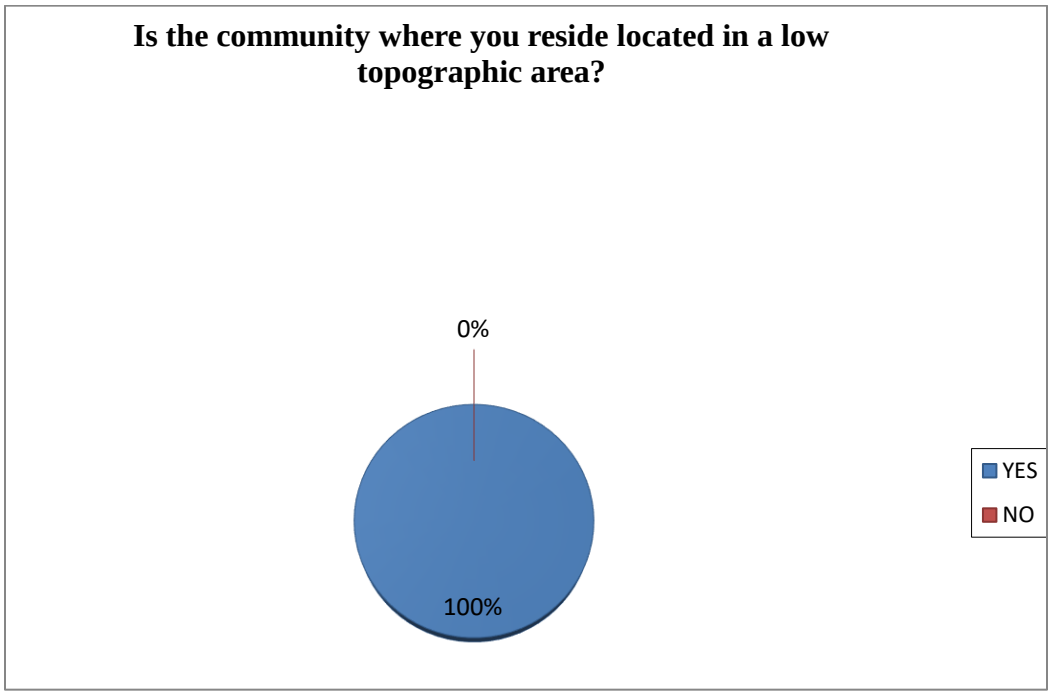



Analysis:

In relation to the results obtained in a certain item, 100% of the respondents expressed that they are aware of the threat posed by the location of their home, since they are located in the western part of the parish of Las Calderas in the vicinity of the Coro River. But despite knowing the vulnerability of the house built on the banks of the river, he refuses to move to an area that offers greater security for its occupants.

**Graph Nº: XXVIII**

| **Item** | **Alternative** | | **Code** | | **Frequency** | | **(%) Frequency Relative** | |
|---|---|---|---|---|---|---|---|---|
| | | | **Yes** | **No** | | | | |
| **15** | **YES** | **NO** | **1** | **0** | **247** | **00** | **100%** | **00%** |




Analysis:

The graph showed that 100% of the sample under study stated that they know that the El Cardón Sector is located in a low topographic area and vulnerable to floods such as those that occurred in previous events.

## Discussion of Results:

In the analysis carried out, it should be noted that the results obtained in the graphs showed that the study sample subjects indicated that the El Cardón Sector is located in a high-risk area, since it is located in a low topographic area and on the banks of the River. Similarly, 40% of the sample subjects under study indicated that the community has human and material resources to deal with an emergency situation, but 60% expressed that they do not have enough resources to solve such events since in past seasons there have been no immediate responses when it comes to attending to the affected people. At the same time, 100% said that garbage and debris are found on the banks of the river, which hinder the free flow when the flow increases as a result of the copious rainfall that eventually occurs.

This research made it possible to publicize the most vulnerable areas due to flood risks in the El Cardón Sector (Stages I and II), right bank of the Coro River, geographically located to the west of the Sector, in terms of the elements that represent risks in the locality are: Accumulation of water, solid waste, debris and dead animals; This has greater consequences in the event of floods, due to the spread of vectors, which affect the community, with children and the elderly being more vulnerable.

## Conclusion:

This research work shows the fulfillment of the proposed objectives, in this sense It is important to know the Risks, which occur both naturally and anthropically in the community where you live, and to know the most vulnerable areas, since this lack of knowledge is the cause of damage, which in many cases can be incalculable, which in turn can be irrecoverable, it is also necessary to know that it is mandatory to have a preventive culture and become aware in order to collaborate in the minimization of the risks raised above.

In the perspective adopted from the analysis carried out on each item, it was determined that the subjects under study consider that their homes are located in a vulnerable and high-risk area, since they are located in a low topographic zone, with little or little filling that allows leveling with the main level "Las Calderas" and therefore acting as a wall and preventing the passage of water from the Coro River to the sector. in order to prevent a flood in its entirety. la Avenida

It can also be evidenced that the structures of some of the houses built are corroded as a result of the continuous floods and can collapse, it is worth noting that when the flood occurs, there is a collapse of the sewage system, which mixes with the water product of the event, contaminating them, increasing the vulnerability to infections. On the other hand, it is possible to visualize the debris, garbage and dead animals that are in the vicinity of said river, therefore in case of heavy rainfall, the sector would flood more easily, since it hinders the normal circulation of the river and this would lead to multiple damages, also, as these are floodable areas, they are susceptible to stagnant waters, leading to the proliferation of vectors that affect the spread of infections in the inhabitants of the El Cardón Sector.

It is important to highlight the psychological condition resulting from the events that have arisen, therefore, many of the respondents feel distressed and on alert, since when it rains for more than two continuous hours, they fear that the place could be flooded, as has happened on other occasions, as was recorded in 2008. where many families

were affected, who lost part of their property and suffered structural damage to their homes (information provided by Regional Civil Protection, City of Coro) It is observed that there is a need to apply strategies that help the community in the face of the events that it is exposed.

History has therefore shown that the protection of persons and property in situations of collective risk is necessary. Through laws, provisions, protection standards, security policies. Citizens have the right to have all human and material resources articulated to safeguard the life and values of the community. To contribute to the achievement of this goal, the joint effort of the whole Community is necessary.

It should be noted that the legal regulations on Civil Protection highlight the need to develop activities in the different sectors in the Communities on: information, prevention, dissemination in the field of Civil Protection. Health education is one of the areas of knowledge in which its contents serve as a fundamental instrument for promoting human and environmental well-being. This is a political and social strategy that must enable the participation of the population in order to achieve positive health.

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