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Risk Perception in the Nigua River Basin: Key Determinants and Policy Implications

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Abstract: The Nigua River basin in the Dominican Republic is a critical hydrographic area facing significant environmental challenges, including deforestation, soil erosion and pollution from mining and agricultural activities. This study explores the role of risk perception among local residents in shaping policies for the basin's sustainable management. The research aims to identify the factors influencing risk perception and propose actionable strategies to improve environmental governance in the region. A "perceived risk profile" methodology was applied, using survey data from 1223 basin residents. The analysis identified key variables that influence risk perception, including demographic factors such as education, gender, and place of residence. The findings reveal that risk underestimation correlates with low awareness of risks, uncertainty about the origins of disasters, fatalism toward natural events, and low trust in institutions. In contrast, risk over-estimation is linked to infrequent risk communication, heightened catastrophism and a strong emphasis on the benefits of environmental protection. The study also highlights significant regional differences in risk perception, with residents of the lower basin exhibiting higher perceptions of risk due to cumulative pollution and frequent disaster impacts. Based on these insights, the study recommends targeted strategies to bridge risk perception gaps, including tailored risk communication, community-based environmental education and stronger institutional trust-building initiatives, all aimed at fostering more effective and inclusive environmental governance in the Nigua basin.

Keywords: basin; impact; sustainable development; resilience; objective risk; risk perception

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1. Introduction

A hydrographic basin represents a dynamic physiography where the soil, the river, the vegetation, the fauna and the population that live in its area interact. River basin management is a topic of global importance. At the international, regional, and national levels, the issue of hydrographic basins and the use of this territorial space as a unit for planning, management, and administration of natural resources is highly relevant. This is due not only to the interest and concern of the actors and directly interested groups, such as communities, local organizations, municipalities and national institutions, among others, but also to international cooperation [1]. It is also a constantly evolving practice that involves the management of land, water, biota and other resources in a defined area for ecological, social and economic purposes [2–4].

The implementation of public policies for the management of natural areas, especially in river basins, is vital for ecosystem services and territorial development [5–7]. The implementation of public policies for the management of natural areas, especially in river basins, is vital for ecosystem services and territorial development. Water, as an essential resource for life and progress, must be managed for the benefit of all living beings. This entails responsibilities in its conservation and use, under an integrated and participatory approach, recognizing it as a fundamental human right. The interaction between humans and hydrographic basins varies throughout their physiography. In areas with a larger population, lower impact from agricultural activities, or less use of forested areas, the quantity and quality of water in the ecosystem are likely to differ [8].

Deforestation and selective logging within a river basin can also alter local microclimate and fire regimes, causing widespread collateral damage to ecosystem balance and sustainability. Changes in land use contribute significantly to environmental degradation, exacerbating the negative impacts of climate change—expressed through deforestation, erosion, pollution, soil degradation and reduced water availability [9–11]. Water management infrastructure and practices fundamentally alter key hydrological processes that maintain river habitat diversity and good water quality. Hydrographic basins are fragile ecosystems with complex management needs [12]. Therefore, adapting to the particularities of each basin requires carrying out detailed research on the various factors contributing to water quality degradation [13].

The capacity of rivers and their biota to respond to altered flow regimes is not unlimited. However, changes caused by urbanization, excessive water abstraction, or rapid climate shifts leading to flows outside the natural range of variability have significant consequences for river ecosystems and the people who depend on them [14].

According to the United Nations, the existing water crisis in Latin America and the Caribbean stems more from institutional issues than from the physical unavailability of the resource [15]. Integrated water management models have proven difficult to implement due to institutional problems, including lack of government support inadequate financial resources, poor coordination, insufficient legal frameworks, unclear roles, administrative and financial dependency and political misuse—factors that collectively undermine their sustainability.

In the Dominican Republic (DR), several river basins and sub-basins have been prioritized on technical and economic criteria to ensure comprehensive management of natural and environmental resources, thereby guaranteeing socioeconomic and environmental sustainability [16].

Among these is the Nigua basin, covering 208 square kilometers in San Cristóbal province, southwest of the Dominican capital. This river basin is highly vulnerable to water erosion due to the steep slopes of its terrain (61% of its territory has slopes greater than 32%) and the use of these slopes for subsistence agriculture, without Conservation works or practices. Another critical concern is its mineral wealth, mainly construction materials, which have been exploited indiscriminately and disorderly [17].

Mining exploitation in the area has caused various impacts on the waters of the Nigua basin, which serves as both an aqueduct and a vital water source for several river communities within the province of San Cristóbal. Furthermore, the demand for competitive agricultural products has chronologically displaced traditional crop types and agroforestry practices in the region, leading to increased erosion on the mountain slopes and aggravating the environmental challenges of the basin, including the effects on flora and fauna [18].

Among the environmental problems of greatest concern in the Nigua basin over the last 10 years has been soil degradation. The environmental risk is heightened by the presence of extreme natural phenomena, especially heavy rainfall, and the anthropogenic actions such as deforestation of native and endemic flora to develop subsistence agriculture in areas with steep slopes and a history of landslides. These issues are exacerbated by surface erosion of the geological substrate and limited sustainability practices that threaten the balance of the socio-ecological system.

The evidence outlined for the Nigua basin reflects contradictions that must be resolved to achieve sustainable development in the near future. This ecosystem highlights the need for integrated sustainability studies. Actions aimed at improving productivity, implemented without local authorities having a plan for the rational use of natural resources or comprehensive disaster risk management policies, have led to new patterns of land and water use, resulting in increased vulnerability in the Nigua basin. However, despite the existing risks, strong emotional and attachment bonds influence how people act and perceive environmental risks in the environment where they live [19].

Numerous studies indicate that the perception of environmental risks is a social construct, based on interactions between individuals and groups. It is shaped by direct past experiences in those locations, existing social and cultural relationships and physical properties of the environment that enable individuals to define, understand and confront threatening events [20,21]. Hence, understanding risk perception and the variables influencing it is critical when making political decisions for environmental management [21].

Addressing this situation requires urgent collaborative efforts involving agricultural producers, local communities, academic researchers and government institutions at municipal and state [22]. Identifying and addressing the key factors that hinder soil conservation is essential to developing strategies that mitigate the impacts of climate change, thereby alleviating water stress caused by excessive or insufficient rainfall.

Sustainable development has been the focus of numerous investigations, particularly in the context of global climate change [22,23]. In this sense, one of the clearest approaches to this challenge is addressing it as a trilemma involving economic growth, social equity and environmental sustainability [24].

Society's interactions with the environment and with governance systems have led to normative contradictions, especially in legislative design. This has essentially happened with environmental protection standards and those promoting economic and social development. Balancing these interests is a challenge for governments and society [25].

Risk studies have emerged as a valuable tool for evaluating sustainability, demonstrating their ability to address both objective and subjective dimensions of analysis [26]. Risk assessments of hydrographic basins have been used to guide decisions regarding sustainable management [27–30].

However, one of the most challenging aspects to study is risk perception, or subjective risk. This is because it is at a relative disadvantage with respect to the objective risk, for which there are event statistics, production records, or imaging systems. [31]. These tools enable even reactive evaluations of impacts on the objects of study [32]. Prospective approaches, such as risk matrices or failure modes and effects analyses, have been increasingly utilized [33].

Risk perception measures the thought processes or awareness of individuals or social groups regarding specific dangers that generally accompany societal activities. Risk behavior is derived from these thought processes. For this reason, studies of these aspects have advanced towards the perceptual or behavioral measurement of themes forming the basis for subjective risk assessments [26,34–37].

One of the most successful methodologies in recent years has been the use of perceived risk profiles [26,34–38]. While profiles can be directly constructed from survey results, variable-based profiles have gained popularity due to their comprehensiveness. Each variable, representing the aggregated results of several questions, provides a clearer perspective on the risk perceptions of the studied groups, serving as a tool for grouping and averaging opinions.

A large number of authors have addressed the issue of risk perception and sustainable management of basins [39–45]. These studies, while employing varied methodological approaches, have consistently focused on establishing effective governance, management and risk communication policies. These efforts are largely informed by the application and measurement of criteria through surveys. Identifying commonalities among these studies provides a foundation for the present research.

This study analyzes how the perceptions of risks associated with natural phenomena, especially water, landslides, floods and droughts, differ among basin residents based on their socioeconomic and cultural characteristics, including age, education, land ownership and land use. The objective is to determine the key factors influencing environmental risk perception in the region to guide preventive measures and policies for the efficient planning and management of water resources.

2. Methods

2.1. Case Study Area

The Nigua River basin (Figure 1) is located in the south-central region of the Dominican Republic and forms part of the hydrographic system of the island of Hispaniola. This river holds significant historical, cultural and ecological importance for the country, with its waters flowing through various communities before emptying into the Caribbean Sea near the city of San Cristóbal. The basin spans approximately 307 square kilometers, primarily within the province of San Cristóbal. The Nigua River originates in the foothills of the Cordillera Central, specifically in the Los Cacaos area, at an altitude exceeding 1200 m above sea level. It completes its course on the Caribbean coast, near San Cristóbal's main municipality [17].

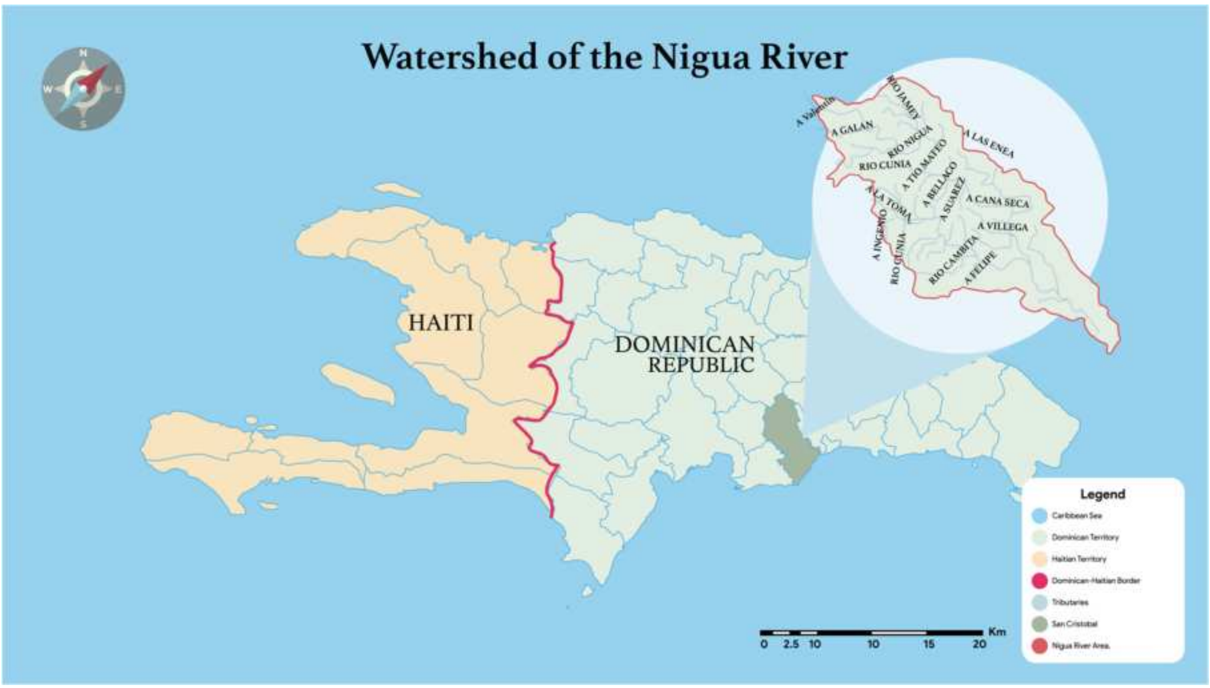

Figure 1. Geographic location of the Nigua hydrographic basin, Dominican Republic.

The Nigua River exhibits a tropical hydrological regime, characterized by variable flows dependent on seasonal rainfall. During the rainy season, its flow increases significantly, often causing flooding in low-lying areas. Conversely, in the dry season, the flow decreases substantially. This basin is one of the most vital in the Dominican Republic, as the surrounding communities rely on the river for domestic, agricultural and industrial use. The basin's lands are primarily used for cultivating crops such as coffee, cocoa and bananas, particularly in its upper and middle regions. Historically, the river supported industrial processes, especially in San Cristóbal, where sugar mills operated during the colonial era. Additionally, parts of the river are utilized for recreational activities, including ecotourism and bathing [46].

However, the Nigua River basin faces several environmental challenges. Agricultural activities and urban expansion have led to a loss of vegetation cover in the upper areas of the basin. Furthermore, untreated domestic and industrial wastewater discharges have compromised water quality, particularly in the lower section of the river. Soil degradation in sloped areas has also intensified sedimentation within the riverbed. Given these challenges, this study aims to address the critical issues affecting the Nigua River basin and propose solutions for its sustainable management [17,47].

2.2. General Strategy for Risk Perception Analysis

The methodology used in this study was the perceived risk profile, which is based on the use of variables and surveys. An important aspect of this methodology is the availability of specialized software for these types of study. The RISKPERCEP code, developed by an interdisciplinary group from the University of Havana, Cuba, has been applied in multiple studies on occupational risk perception and public perception of risk [26,36,37,48,49]. Within the area of occupational risks, studies have included personnel from clinical laboratories, veterinarians, vaccine production facilities, dental clinics, telephone linemen, and others [26,48].

In the public sector, risk perception studies have been conducted on climate change among teachers at UNESCO-associated schools in Cuba and among university professors in Honduras [50,51]. Also, studies on risk perception associated with the labor impact of the COVID-19 pandemic, which had international scope, have been carried out [52]. More recently, a subjective risk project related to sargassum flooding on beaches in the Dominican Republic was completed [37].

For this study, the following algorithm (Figure 2) was used. The key element of the algorithm illustrated in Figure 2 is the "fragmentation" of thought. To achieve this, variables are employed to represent the areas of risk perception under investigation. These variables are explored through responses to a survey, specifically designed for the studied environment. Each question has a qualitative-quantitative relationship with the associated variable. The administration of the surveys and the compilation of responses are supported by online tools. The evaluation includes tables and graphs of the mean values of the variables at both group and individual levels, as well as their corresponding dispersion analysis. Finally, the variables with the greatest impact are identified, and training actions or other corrective measures are implemented based on the interpretation of the results (Figure 2).

2.3. Selection of Variables and Survey Design

The design of risk perception variables depends on the objectives of the study [34,35,38]. Other studies on risk perception in basins have used variables similar to those provided in this study [30]. The deduction of the body of variables used in these cases can be deduced either by interpreting the questions in their surveys or by direct mention. For example, although using the method of structural equations, Santoro et al. [40] referenced variables such as familiarity with risk, past history of disasters, catastrophism, control and knowledge of risk. Spett [40] used familiarity with risk, catastrophism, risk control and trust in institutions. Segura et al. [41] included variables like familiarity with risk, past history of disasters, understanding of risk, risk control, trust in institutions and role of the press. Svahn [42], who directly applied the psychometric paradigm (as in this study), used variables such as voluntariness, immediacy of the effect, knowledge of the risk, uncertainty, risk control, familiarity with the risk, catastrophism, fear, trust in institutions and the role of the press [53].

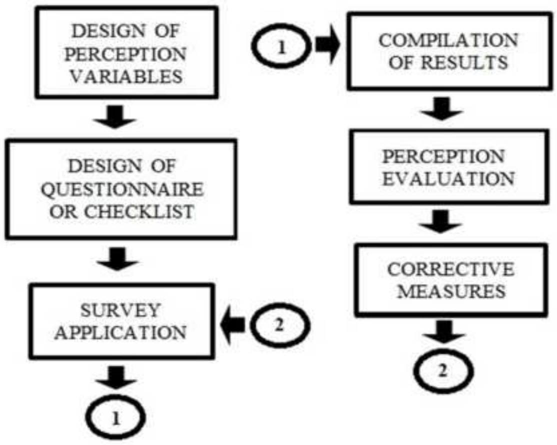

Figure 2. Algorithm for risk perception study.

Anilan et al. [43] worked with variables such as familiarity with risk, fear, history of disasters, trust in institutions and understanding of risk. Similarly, other research groups used familiarity with risk, past history of disasters, trust in institutions, understanding of risk, catastrophism and the role of the press. In the same way, the questions used in the aforementioned research have served as the basis for those formulated in this study [44,45]. Based on our previous experience [43] and following the practices of the cited authors, Table 1 presents the variables evaluated on this study. For the analysis of psychosocial risks, three types of variables are used: those related to the individual, those related to the nature of the risk or physical risk and those associated with risk management (managed risk). To evaluate each variable, a survey was designed (Table A1 in the Appendix A). Table 1 also illustrates the correspondence between the variables and the questions included in the survey.

Table 1. Variables from the risk perception study, their classification and correspondence with the survey questions (Table A1 in the Appendix A).

No.	Variable	Code	Component	Cluster	Questions in the Survey
1	Familiarity of the subject with the risk situation	FAMI	Reverse	Individual	1, 2
2	Understanding risk	UNDER	Extremes	Individual	20, 21
3	Uncertainty	UNCE	Straight	Individual	3
4	Willfulness	WILL	Reverse	Individual	4, 5
5	Personal involvement	INVO	Straight	Individual	6
6	Controllability	CONT	Reverse	Individual	13
7	Catastrophic potential	CATA	Straight	Nature	8
8	Past history of disasters or dangers	HIST	Straight	Nature	9
9	Immediacy of consequences	IMME	Straight	Nature	10
10	Reversibility of consequences	REVE	Reverse	Nature	11, 12

Table 1. *Cont.*

No.	Variable	Code	Component	Cluster	Questions in the Survey
11	Panic	PANI	Straight	Nature	14, 15
12	Risk-benefit inequality	R-BI	Straight	Management	16
13	Benefits of exposure	BENE	Reverse	Management	16, 17
14	Trust in institutions	INST	Straight	Management	22, 23
15	Role of the press or broadcast media	PRES	Straight	Management	18, 19

Another important aspect regarding the selection of variables is the analysis of their relationship with the perception of risk associated with each one. It was observed that some variables behave in a directly proportional manner (Direct behavior), such as catastrophic potential, generated panic, and the immediacy of consequences, while others behave inversely, such as familiarity with the risk, the ability to control it, and the reversibility of its consequences (Inverse behavior). The risk compression variable has the particularity that its behavior with respect to the associated risk perception is extreme, which means that experts and non-specialists in the subject underestimate it equally (Extreme behavior). As a necessary simplification, to avoid adding subjectivities to the study, the variables considered are independent of each other, with each one contributing similarly to the quantification.

For the design of the survey, rules proposed by experts have been followed [48,53]. The questionnaire must be adapted to the types of dangers and the study groups; it must generate empathy, move from the known to the uncertain, from the general to the particular and from the institutional to the individual [53]. To facilitate the evaluation, closed questions were used, with answers are ordered unidirectionally in three gradations to achieve a correlation with the associated risk perception scale. This scale has three levels: 1 indicates underestimation of the risk (low risk perception) and 3 indicates overestimation (high risk perception), and 2 represents an adequate perception of the risk [48,54].

This scale corresponds to questions where the variables evolve directly with respect to the associated perception. When the variables evolve inversely or in an extreme manner, the computer tool makes adjustments during the evaluation. The survey applied in the study appears in Table A1 in the Appendix A. It reflects the relationship of each question with the investigated variable. The survey was conducted individually through templates designed specifically for this purpose.

2.4. Evaluation of Risk Perception

The compilation of results has been carried out by transferring the records obtained during the application into Excel tables, enabling their automated introduction into the RISKPERCEP code. The evaluation of risk perception was based on the application of quantification indicators in the form of simple schemes, which allowed average assessments to be made at the levels of variables, respondents and study groups [54,55]. The results can be displayed in analytical form (charts) and graphically (histograms and broken lines).

Given that the system uses ordinal qualitative values to describe the survey's results (assigned numerical values) and the subsequent processing is based on the average of these values, which is mathematically and statistically correct, an instrumental license was adopted. This involves defining a new non-statistical estimator, referred to as the Weighted Perception Score (hereinafter "Score"). Based on these Scores, risk underestimation (values below 2 or low risk perception) and risk overestimation (values above 2 or high risk perception) are established. A Score value of 2 corresponds to an adequate risk estimation or perception. From this point on, the terms underestimation, overestimation and adequate risk estimation are used in the text of the article in the sense described. As part of this calculation, the specific dispersions of each variable with respect to its score value were also determined, illustrating the group's unanimity and representing the collective tendency toward a common opinion. Corrective measures are the corollary of the interpretation of the results, where the application of the Pareto principle is the key to identifying the most significant contributors (variables, respondents and study groups), and preparing the tasks with the greatest impact on their resolution [56]. The state of risk perception must be reevaluated, after a period of implementing the measures deduced from the study to verify their effectiveness [54,57].

2.5. Sample Size

To calculate the sample size, expression 1 is used [58]

$$n = \frac{N\,Z^2 p\,q}{e^2(N = 1) + Z^2 p\,q} \quad (1)$$

where:

n—sample size
p—probability of the event occurring or the expected proportion
q—probability that the event does not occur
e—precision (maximum allowable error in terms of proportion)
Z—probabilistic factor; Z = f (confidence level)
N—starting population.

In this article it has been used $p = 0.5$ and q = 0.5 for a confidence level of 95% and a precision of 5%, determining a minimum sample size of 1051 people to be surveyed. To exceed that figure, 1123 people in the study area have been surveyed.

2.6. Manuscript Correction Using Artificial Intelligence

ChatGPT was employed to check and correct the English in the manuscript. The command used was: "Check the English in the following document".

3. Results

3.1. Characterization of the Study Sample

Out of a total of 1123 respondents surveyed, 46.9% were women and 53.1% were men. Regarding age distribution, 38% were between 18 and 35 years old, 29.6% were between 36 and 50 years old, and 32.4% were between 51 and 60 years old. No respondents were over 60 years old. Of the sample, 98.8% were Dominicans, while the remaining 1.2% were foreigners residing in the country. Additionally, 86.3 had been living in the area for more than 10 years; 2.4% had been living in the area for less than a year, and 11.6% had lived there between 1 and 10 years. Finally, in terms of education, 27.4% had primary education, 57.9% secondary education or technical training and 14.7% had university education. For the study the basin was divided into upper, middle and lower basin. Figure 3 shows the map of the basin divided into these three sectors and indicates the cities and towns in which the surveys were conducted.

All respondents live and work in the Nigua basin. Figure 4 shows how respondents are divided according to the part of the river basin where they live and work. More than half of the inhabitants reside and work in the middle hydrographic basin, even though the city of San Cristóbal, the main population settlement in the area, is located in the lower basin (Figure 4).

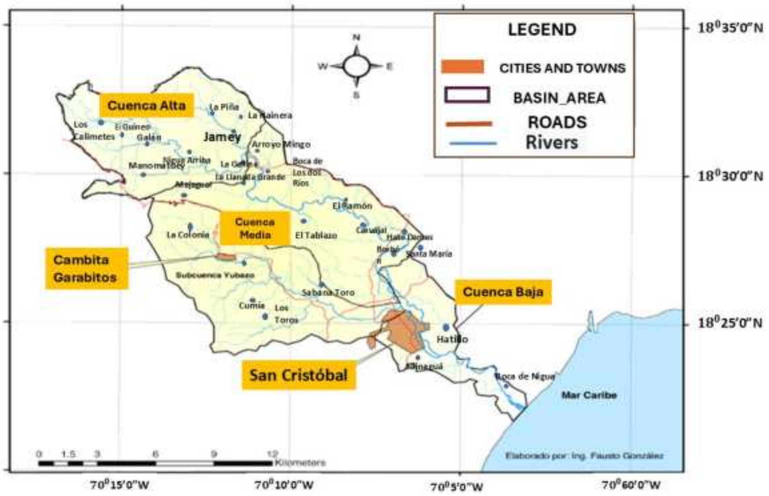

Figure 3. Locations where the surveys were carried out (See Table A2 in the Appendix A).

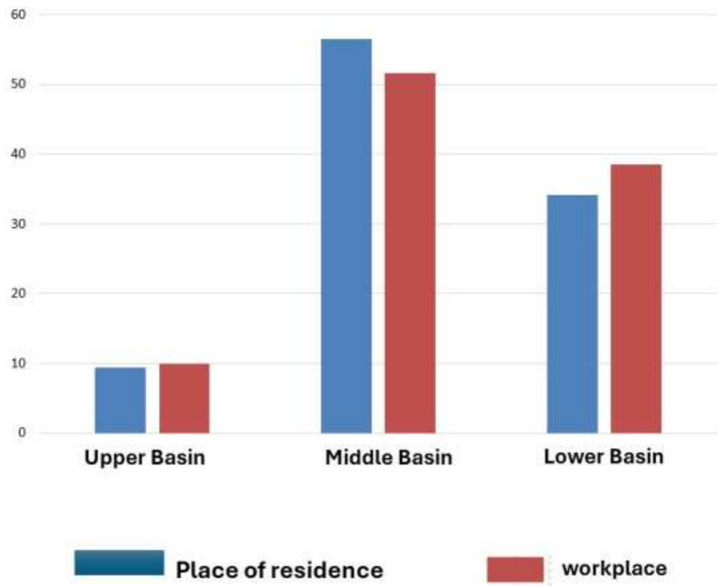

Figure 4. Distribution of respondents according to place of residence and work in the Nigua basin.

3.2. Risk Perception Analysis

As stated before, the study covered 1123 individuals residing in the three areas of the Nigua basin (upper, middle and lower), corresponding to the total population sample of heads of households inhabiting the micro-basin (69,562 households), according to the national census. These are validated under the judgment of experts. The size of the surveyed population makes the study reliable from the perspective of sample size. The results in average responses per question can be seen in Table A3 in the Appendix A. For this stage of the analysis, cases of ambiguous answers or unanswered questions (154 cases) within the matrix of 25,829 answers (23 questions answered by 1123 respondents) were assigned a value of 1, interpreted as underestimation of the risk in such cases.

Table A4 (in the Appendix A) shows the average values for the variables, highlighting notable cases of the variables INVO, CATA, BENE and PRES, which exhibit significant dispersion from the central perception value. This shows some disagreement in the group regarding the answers to the questions corresponding to these variables. Addressing this issue would involve redoing detailed studies with new questions incorporated into the assessment of these variables. However, for this stage of the analysis, the values obtained are considered valid.

The perceived risk profile graph derived from the subjective risk study of the Nigua basin is shown in Figure 5. This figure allows for e visual assessment of which variables deviate the most from the central value (2), enabling the application of the Pareto principle to identify the "vital few" of the study [56]. These variables have been the focus of this research. The fact that the group shows an average perception value of 2.08 (where value 2 is considered adequate) should not be regarded as a definitive conclusion.

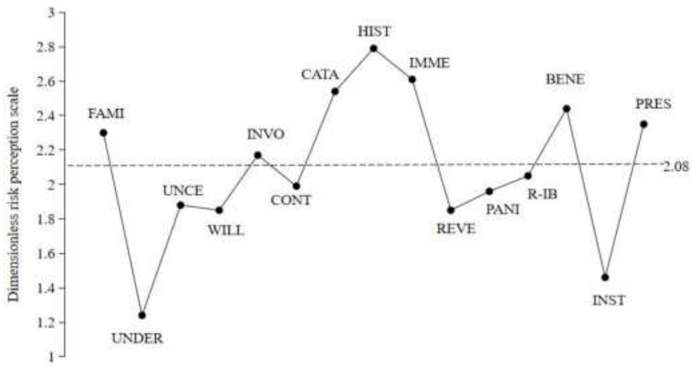

Figure 5. Perceived risk profile. (FAMI—Familiarity of the subject with the risk situation, UNDER—Risk understanding, UNCE—Uncertainty, WILL—Willfulness, INVO—Personal Involvement, CONT—Controllability, CATA—Catastrophic potential, HIST—Past history of disasters or dangers, IMME—Immediacy of consequences, REVE—Reversibility of consequences, PANI—Panic, R-IB—Risk-inequality benefit, BENE—Expected benefits of exposure, INST—Trust in institutions, PRES—Role of the press or broadcast media). The dimensionless risk perception scale (Y axis) indicates: 1–risk underestimation; 2–adequate estimation of the risk; 3–risk overestimation.

The imbalances observed between variables constitute an alert to investigate the specific values of each one. The values of each indicator are the direct result of the quantification of the answers preferred by the respondents, among those suggested. By approximations of the method, each variable is independent; however, in this analysis, some obvious interactions have been examined. The interpretation of the most important values obtained in the study allows us to determine the following:

The survey shows a tendency to underestimate the risk for the following variables:

Understanding of the risk (UNDER): This is essentially due to the response to question 23, which highlights the weak link between the university's scientific activity and the communities when addressing activities and work related to the development of the basin under study. Additionally, a direct relationship can be observed with the uncertainty variable, where the belief in the purely natural origin of disasters is manifested.

Uncertainty (UNCE): There is a certain underestimation associated with the uncertainty about the origin of disasters (question 3) in the basin, as about 25% of those surveyed believe that disasters are solely due to natural factors. This, in turn, reflects a low understanding of risk.

Voluntariness (WILL): Underestimation is mainly due to the voluntary acceptance of natural disasters as inevitable, as indicated by the 50% response rate to question 5. This reflects high voluntariness within the group investigated.

Trust in institutions (INST): Very low credibility is observed regarding the role of government institutions and non-governmental organizations (NGOs) in the development of the basin. Approximately 65% of respondents agree on their inadequate role in this regard (see question 22).

On the other hand, the group shows a tendency to overestimate the risk for the following variables:

Familiarity with risk (FAMI): The infrequency of news about disasters in the basin tends to increase the perception disaster-related risks. This is particularly related to the response to this phenomenon in question 1, which is manifested with an agreement of more than 70% in the group investigated. This aligns with the insufficient role of the press in informing the public about the risky situation of the basin (see results of questions 18 and 19).

Catastrophism (CATA): With an agreement of 50 and close to 85%, the respective answers to the questions 7 and 8, which evaluate the catastrophism of disasters, show the denoted impact on families and the natural resources on which the community depends. Notably, the panic variable (PANI) does not correlate with these results of catastrophism (CATA). This discrepancy is attributable to the living context of the respondents, who, due to their social circumstances, are forced to live in poverty and coexist with the realities of the river basin. For this reason, responses to questions 14 and 15 tend to reflect concern about the situation rather than fear. The CATA variable shows a high dispersion with respect to its mean value (see Table A4 in the Appendix A). This is essentially due to demographic factors and regional effects of the consequences. This aspect is analyzed in later sections of this paper.

Immediacy of consequences (IMME): The preferred response to the Yes option in question 10 indicates a rapidly evolving memory of disasters and their negative consequences.

Benefits of risk exposure (BENE): A general response trend (question 17) addresses the relevance of environmental protection (which basin exploitation strategies should have), which constitutes a measure of risk overestimation. This preference contrasts with other responses, such as a balanced risk–benefit policy or the acceptance of benefits at any environmental cost. The BENE variable shows a very marked dispersion. This situation also seems to have its reasons in the preferred demographic distribution of the areas of residence of the respondents (middle and lower basin), in which the areas of greatest impact due to disasters and poor management of the basin are concentrated.

Role of the press (PRES): The prevailing opinion regarding the insufficient communication provided by the media about the state of the basin generates a perception of risk overestimation. This aligns with the preferred response on this topic (question 19), where nearly 60% of respondents agreed. The PRES variable also shows a high dispersion with respect to its mean value (Table A4). Again, demographic reasons seem to affect this situation. The majority of inhabitants, belonging to the middle and lower basins, perceive situations affecting the basin that are not well treated or communicated by the media.

The INVO variable also shows a marked dispersion (see Table A4), but it is not one of the most important contributors to the overestimation of risk. Issues related to demographic dispersion in the basin may also explain this situation.

To summarize, a multicausal issue related to the score values of the variables in the study is the significant dispersion concerning their averages (see Table A4 in the Appendix A). This dispersion is essentially driven by demographic factors, including combinations of criteria such as age, sex, place of residence and educational level. It also involves interrelationships between the variables that establish perceptual patterns, which cannot be fully analyzed due to the independent nature of the variables as assumed methodologically. The study reveals both overestimation and underestimation of risk.

The overestimation is attributed to:

- The low frequency of news dissemination about the state of the basin (low familiarity with the risk).
- The non-acceptance of risk exposure (low voluntariness).
- Knowledge of the severity of certain disaster impacts on the basin (high catastrophism).
- Recognition of recent memories of disasters (disaster history).
- Rapidly developing memory of consequences (high immediacy).

Conversely, the following aspects contribute to underestimation:

- Limited connection between scientific institutions and the issues of the basin (low understanding of risk)—this study is demonstrating a reestablishment of that link.
- Lack of awareness regarding the anthropogenic influence on the basin's environmental problems (uncertainty).
- Insufficient communication from the media about the state of the basin.
- The limited role of institutions in managing basin's problems (low institutional climate).

3.3. Influence of Demographic Variables on Risk Perception

Figure 6 shows the result of risk perception by sex. The overall average indicates that both men and women have an adequate perception (2.09 for women and 2.1 for men), with no significant differences between the perception of these two groups for any of the variables under study. The tendency to underestimate and overestimate risk is similar for both. Interestingly, other studies have shown that women tend to have a better perception of risk than men [59]; however, in this case, no differences were observed, which could be explained by the large sample size analyzed.

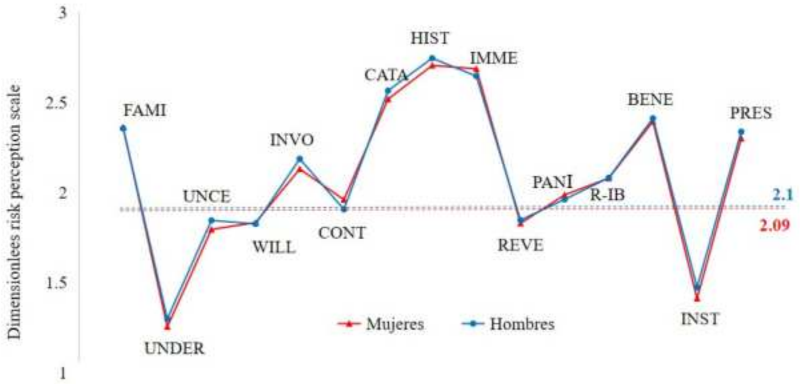

Figure 6. Comparison of risk perception by sex. (FAMI—Familiarity of the subject with the risk situation, UNDER—Risk understanding, UNCE—Uncertainty, WILL—Willfulness, INVO-Personal Involvement, CONT—Controllability, CATA—Catastrophic potential, HIST—Past history of disasters or dangers, IMME—Immediacy of consequences, REVE-Reversibility of consequences, PANI—Panic, R-IB—Risk-inequality benefit, BENE—Expected benefits of exposure, INST—Trust in institutions, PRES—Role of the press or broadcast media). The dimensionless risk perception scale (Y axis) indicates: 1–risk underestimation; 2–adequate estimation of the risk; 3–risk overestimation.

There is no appreciable difference in risk perception among different age groups, nor are there significant differences in the perceived risk profile by variables (Figure 7). Nolte and Hanoch [60] report that older adults report less favorable attitudes toward risks and risk taking in many contexts studied, however, age differences in behavioral risk taking vary by task characteristics (e.g., information provided, option framing). The context of similar tasks and life situations of the different age groups considered in our study seems to be the justification for a similar risk perception regardless of the age group studied.

Regarding the place of residence, this is where the most significant differences are observed (Figure 8). The average risk perception increases from the upper range (2.01) to the middle range (2.07) and the lower range (2.14), showing a tendency to overestimate. A possible explanation for this phenomenon lies in the variation in water quality along the course of the river, from its source to its mouth. As water flows, it may be exposed to various contaminants and environmental factors that affect its purity, influencing residents' perceptions of the risks they face. This relationship suggests that risk perception is not only linked to individual experience but also to environmental conditions.

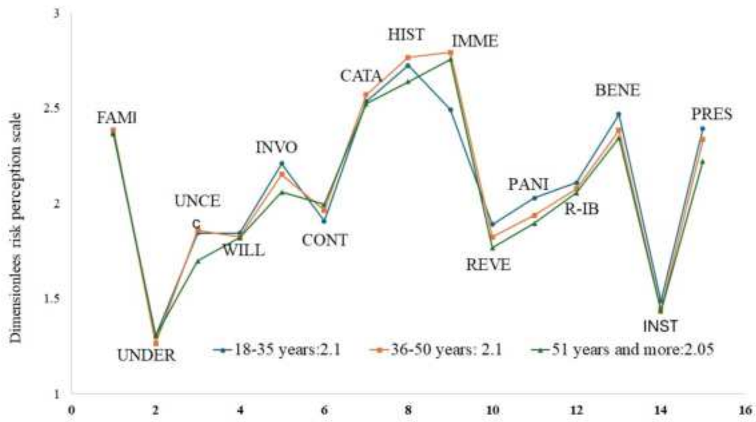

Figure 7. Comparison of risk perception by age. (FAMI—Familiarity of the subject with the risk situation, UNDER—Risk understanding, UNCE—Uncertainty, WILL—Willfulness, INVO—Personal Involvement, CONT—Controllability, CATA—Catastrophic potential, HIST—- Past history of disasters or dangers, IMME—Immediacy of consequences, REVE—Reversibility of consequences, PANI—Panic, R-IB—Risk-inequality benefit, BENE—Expected benefits of exposure, INST—Trust in institutions, PRES—Role of the press or broadcast media). The dimensionless risk perception scale (Y axis) indicates: 1–risk underestimation; 2–adequate estimation of the risk; 3–risk overestimation.

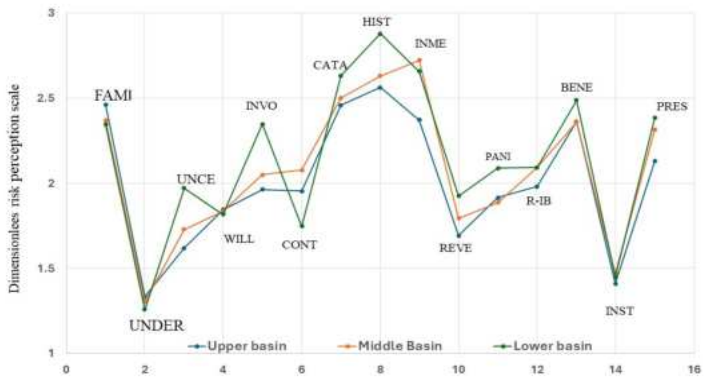

Figure 8. Comparison of risk perception by place of residence. (FAMI—Familiarity of the subject with the risk situation, UNDER—Risk understanding, UNCE—Uncertainty, WILL—Willfulness, INVO—Personal Involvement, CONT—Controllability, CATA—Catastrophic potential, HIST—Past history of disasters or dangers, IMME—Immediacy of consequences, REVE—Reversibility of consequences, PANI—Panic, R-IB—Risk-inequality benefit, BENE—Expected benefits of exposure, INST—Trust in institutions, PRES—Role of the press or broadcast media). The dimensionless risk perception scale (Y axis) indicates: 1–risk underestimation; 2–adequate estimation of the risk; 3–risk overestimation.

In this sense, the greatest differences are observed in the UNCE variable, where the inhabitants of the upper basin tend to significantly underestimate the risk (1.41) compared to the perceptions of the inhabitants of the middle (1.8) and lower basins (1.9). For the INVO variable, the inhabitants of the lower basin overestimate the risk (2.28) compared to an adequate perception among those in the middle (2.07) and upper basins (1.98). Regarding the HIST variable, there is a high tendency to overestimation in ascending order: the upper basin (2.46), the middle (2.65) and the lower (2.85). Finally, for the PANI variable, while residents of the upper and middle basins show, on average, a slight tendency to underestimate the risk (1.88), those in the lower basin demonstrate an adequate perception (2.08).

The greater perception of risk among the inhabitants of the lower basin compared to those of the middle and upper basins seems to be linked to the natural flow of water toward the lowest part of the ecosystem, which also carries pollution and the effects of disasters. This is confirmed by the values observed in the INVO, HIST and PANI variables.

This observed behavior might be explained by the urbanization of the middle and lower parts of the Nigua basin, where the city of San Cristobal is located. This has an impact on the physical state of the basin. As stated by [55], urbanization affects ecosystem functions and services by fundamentally altering the balance between precipitation, water yield, and evapotranspiration in river basins. Accurate quantification of future hydrologic impacts is essential for national urban planning and river basin management decision-making [60,61].

When evaluating the role of educational level on risk perception (Figure 9), there is a slight tendency to overestimate the risk across all groups. (Primary: 2.04, Secondary and Technical level: 2.11, Academic: 2.09), however, there are no appreciable differences between these groups. According to our study, the group score based on the variables considered, when coupled by educational level, is showing that the influence of this demographic characteristic on risk perception may be insignificant. A reflection of this situation, in a simplified way (only two variables: UNDER and R-IB), is proposed by Nolte and Hanoch [60] who report that cognitive changes (e.g., in learning, risk/reward processing) may impede the ability to engage in beneficial risk taking.

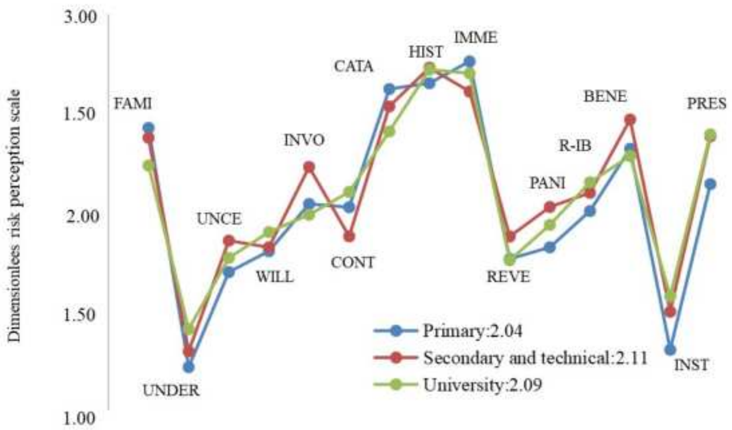

Figure 9. Comparison of risk perception by education. (FAMI—Familiarity of the subject with the risk situation, UNDER—Risk understanding, UNCE—Uncertainty, WILL—Willfulness, INVO—Personal Involvement, CONT—Controllability, CATA—Catastrophic potential, HIST—Past history of disasters or dangers, IMME—Immediacy of consequences, REVE—Reversibility of consequences, PANI—Panic, R-IB—Risk-inequality benefit, BENE—Expected benefits of exposure, INST—Trust in institutions, PRES—Role of the press or broadcast media). The dimensionless risk perception scale (Y axis) indicates: 1–risk underestimation; 2–adequate estimation of the risk; 3–risk overestimation.

3.4. Discussion

An analysis of the results, through their comparison with other similar studies, shows that the study conducted on risk perception regarding climate change in schools associated with UNESCO in Cuba could serve as a reference [32]. A notable characteristic of this study is its focus on revealing the risk perception of a human group facing a global phenomenon, which is somewhat similar in magnitude to the impact of the basin. Therefore, it is relevant to note that, in this study, the variables UNDER, UNCE and INST demonstrated an underestimation of risk, driven by reasons similar to those found in this analysis. The results for the INVO, IMME and CATA variables are also comparable. For instance, the INVO variable is overestimated in the climate change study because the population surveyed feels directly affected by the phenomenon, including its impact on health and comfort conditions, which aligns with the findings of this research. Regarding catastrophism and immediacy, these factors are more pronounced in this research due to a focus on a localized phenomenon, where disaster effects are experienced more directly by residents.

Another comparable study is the one conducted in universities in Honduras regarding climate change and natural disasters [51]. In that case, a comparison of the variables responsible for underestimation reveals that, as reported by [51], there are similarities in the COMP, UNCE and INST variables. Honduran teachers reported gaps in their understanding of climate change, uncertainty in scientific knowledge about certain aspects of the phenomenon, and deficiencies in the role of institutions in managing it. These findings again align with the observations in this research. In the reference study, teachers exhibited low voluntariness to expose themselves to climate change, leading them to overestimate the risk associated with this variable. They also felt personally involved in the potential damage the phenomenon could cause to themselves and their families, further contributing to risk overestimation. These results coincide with the findings of this research.

In its conclusions regarding climate change, and in response to similar risk underestimation variables, the IPCC in its Fifth Assessment Report emphasizes the need for education, dissemination of scientific advancements on the phenomenon, and an active role for institutions in managing climate-related risks by leading adaptation actions and mitigation strategies [22,23,32]. In this regard, and concerning these variables, it is advisable to adopt measures similar to those recommended in the referenced report [22,23].

On the other hand, reviewing information related to similar studies reveals comparable behaviors in risk perception studies of other basins [39]. For instance, Santoro et al. [39,58] note that familiarity with a situation decreases as more years pass after major events, a trend that aligns with the findings of this study. In [62], it is demonstrated that familiarity and past experiences are interconnected and that perspectives on future events are correlated with them—patterns also observed in this research. Additionally, Spett's study highlights issues of catastrophism among respondents, with estimated losses ranging from USD 1000 to USD 100,000 in 40% of cases [44]. Segura et al. [41] report that respondents recall significant flood events; however, the perceived likelihood of being affected diminishes due to the long return period of such events, which is consistent with the present study. Similarly, there is minimal direct involvement reported, a finding that also parallels our results. Svahn [42] indicates that the low (annual) frequency of floods corresponds to reduced familiarity with them. Risks are considered moderate to high, with losses primarily involving economic and property damage. Furthermore, collective preparation measures are viewed as highly important. These observations align with our study regarding familiarity, catastrophism, and the expected role of institutions [45]. Mastrandrea [45], in his historical overview of social perception, emphasizes the high level of catastrophism associated with floods compared to events like droughts. He also highlights the immediacy of flood events as a significant concern. His study reveals limited institutional impact on urban planning and a lack of intervention policies, resulting in greater vulnerabilities. Likewise, Moretto and Gentili [44] report low public knowledge of flood-related terms, vague memories of past flood events, and a perception of weak governance characterized by inadequate planning, absent drainage systems, and poor infrastructure. Variables such as knowledge, familiarity, historical experience, and trust in institutions play a similar role in their studies, and the current research [43] shows respondents' concerns about damage to homes and property, as well as the need for control measures to mitigate risks. Once again, this aligns with our findings regarding catastrophism and the role of institutions.

3.5. The Sustainable Management of the Nigua Basin: Actions and Policies to Address the Perception of Risk

The study's results on actions and policies for the sustainable management of the Nigua basin can be summarized as follows:

- The low level of knowledge about the basin's environmental risks must be addressed through systematic studies conducted by the scientific and academic community. These studies should link flood hazards and other climatic phenomena in the basin with the vulnerabilities of the communities living there.
- Uncertainty regarding the natural origins of disasters—where the vulnerabilities of communities are overlooked—is a crucial factor in understanding risk. This knowledge should be strengthened within communities through focus groups and leaders who can disseminate information about the mechanisms by which disasters evolve. Institutional measures, such as community relocation where necessary and regulations to prevent harmful exploitation of the basin, must accompany these efforts.
- The perception of high voluntariness or full acceptability of exposure to inevitable disasters must be altered through community-oriented messaging that is both clear and comprehensible. This should be supported by institutional measures. (See previous point).
- Credibility of institutions must be improved through concrete actions that demonstrate governmental concern for the vulnerabilities of basin residents. Policies should aim to strengthen the relationship between governance and the community.
- From the perspective of familiarity with risk, a robust information system is required. This system should leverage networks and media outlets to maintain alerts about dangers and vulnerabilities in the basin. These efforts can be reinforced by community leaders and focus groups.
- Issues of catastrophism related to disasters must be addressed on a localized basis through risk inventories for different areas of the basin. Similarly, the immediacy of consequences should be analyzed with a localized approach. Both aspects should be tackled through enhanced disaster preparedness training.
- The findings regarding the benefit variable present an opportunity to shape policies that promote environmental conservation.
- The minimal role of the press in disseminating information about the basin must be counteracted. Networks and media outlets should share scientifically validated information tailored to the average educational level of basin communities. Leaders and focus groups must also actively contribute to this effort.

Based on the results of the study, several actions and strategies are suggested to ensure the sustainable management of the Nigua hydrographic basin in the Dominican Republic:

- Develop a comprehensive management plan that integrates land, water, biota, and human activities within the Nigua basin. It is essential to establish a multi-stakeholder river basin management committee that includes government agencies, local communities, NGOs, and academic institutions.
- Promote collaboration among the Civil Defense and other institutions, such as the Ministry of the Environment, the Ministry of Agriculture, and the National Institute of Water Resources of the Dominican Republic, to develop plans for confronting, mitigating, and adapting to natural phenomena such as fires, erosion, pollution, and landslides in the Nigua basin.
- Ensure sustainable use and quality of water resources in the Nigua River, particularly in the middle and lower basin, specifically in the San Cristóbal area. Actions include establishing water quality monitoring stations and enforcing regulations to control pollution from industrial and agricultural sources; implementing effective systems for the collection, management, and disposal of solid waste in San Cristóbal and riverside settlements of the Nigua basin to prevent pollution from solid waste and leachate entering the river.
- Engage and educate the community by raising awareness and involving local communities in sustainable river basin management. Proposed actions include conducting

educational programs and workshops on environmental conservation and sustainable practices, aligned with the San Cristóbal province strategic plan; engaging local communities in reforestation and conservation projects; and promoting community-based monitoring and reporting of environmental issues.

- Develop a communication system through social networks and the press to increase visibility of the problems in the Nigua basin. This system should ensure effective communication routes and facilitate feedback between the central and local governments of San Cristóbal province and the inhabitants of the basin.

Institutional strengthening and improvement of the governance of institutions involved in the management of the Nigua basin can be achieved by enhancing coordination among government agencies responsible for environmental protection, agriculture, and water resources. It also requires ensuring adequate funding and resources for implementing sustainable management practices, as well as developing clear legal frameworks and policies to support sustainable river basin management and enforce compliance.

Monitoring and evaluation efforts must be strengthened by tracking the effectiveness of management policies and making adjustments as necessary. This involves establishing a robust monitoring and evaluation framework to assess the impact of implemented policies, using data from risk perception studies and environmental assessments to guide policy adjustments, and involving local communities and stakeholders of the Nigua basin in the evaluation process to ensure transparency and accountability.

The implementation of these strategies can help ensure the sustainable management of the Nigua hydrographic basin, preserving its ecological integrity and promoting the well-being of the communities that depend on it.

3.6. Limitations of the Study

This study is not exempt from the limitations that generally accompany risk perception research. From a methodological perspective, the assumption of independence between variables, as part of the perceived risk algorithm, places it at a disadvantage when exploring relationships between variables. The fragmentation of thought into individual variables is an approach that has drawbacks for making deductions, which increases the subjectivity of interpretations. Additionally, the variables used for fragmentation could be further subdivided or expanded; however, this would undermine the pragmatism of the survey and introduce additional complexities to the study.

Another limitation relates to the number and type of questions used to investigate each variable. For practical reasons, and considering the target population, the number of questions is limited. It is well understood that fewer questions associated with each variable lead to a less comprehensive investigation of its behavior. This is another factor contributing to the subjectivity of the results.

The closed-ended format of the questionnaire facilitates mathematical processing, yet this approach limits the possibility of incorporating new insights derived from the creativity and knowledge of the surveyed population. Processing open-ended responses presents a challenge for analysis, though artificial intelligence algorithms could offer new approaches that are not included in this research.

Although efforts were made to ensure the population sample was representative of various demographic factors, material and time constraints may have affected this goal, introducing a bias into the results that has not been thoroughly analyzed.

Finally, the extrapolation of results to practical applications for risk management and communication policies is an aspect that cannot be overlooked. To achieve effective implementation, several elements are crucial: credibility stemming from the competence of the study's executors; alignment with the social context, including clear communication and an understanding of community needs; relevant content compatible with societal values; clarity in messaging for both the public and risk managers; continuity and consistency achieved through repetition; and accessible, reliable communication channels tailored to the audience's comprehension capabilities. A knowledge system derived from the study that supports these diverse capabilities is essential for the successful extrapolation of results. However, the completeness of such an achievement remains a point of contention, regardless of the efforts made in studies of this nature.

4. Conclusions

The analysis of risk perception in the Nigua River basin reveals a complex relationship between the underestimation and overestimation of risk among local residents. This study, based on a large and representative sample, provides valuable insights into the factors shaping risk perception in the region. Key findings indicate that risk underestimation is influenced by factors such as limited understanding of risks, uncertainty regarding the causes of disasters, acceptance of natural disasters as inevitable, and a lack of trust in institutions. These findings highlight a critical need for targeted interventions aimed at improving education, fostering clearer risk communication, and strengthening community engagement with local institutions. Addressing these issues will be essential for reducing the underestimation of risks and promoting proactive environmental governance.

Conversely, risk overestimation is associated with limited exposure to risk information, a tendency toward catastrophism, and an overemphasis on the perceived benefits of environmental protection. This suggests that inadequate media coverage and heightened disaster awareness may contribute to exaggerated perceptions of risk. To address this, it is crucial to improve the frequency and accuracy of risk communication efforts, ensuring that residents have access to reliable information that contextualizes risks without causing unnecessary alarm.

Demographic analysis further reveals significant variations in risk perception. While gender does not have a significant impact on perceptions, education level and place of residence play key roles. Higher education levels correlate with a slightly greater tendency to overestimate risks, likely due to a more informed understanding of potential hazards. Additionally, residents of the lower basin exhibit higher risk perceptions, likely influenced by cumulative pollution and recurring environmental disasters. This underscores the importance of addressing regional disparities in risk perception.

To bridge these gaps in risk perception and enhance the management of environmental challenges in the Nigua basin, several concrete actions are recommended:

1. Enhanced Risk Communication: Implement a robust, ongoing program of risk communication that provides clear, accessible information about environmental risks, disaster preparedness, and the role of local institutions.
2. Community Education Programs: Develop educational initiatives aimed at increasing environmental awareness, focusing on both the causes and potential solutions to local environmental problems.
3. Institutional Engagement: Strengthen relationships between local communities and institutions by building trust through transparent communication, responsiveness to concerns, and active participation in decision-making processes.
4. Targeted Policy Interventions: Design policies that address the specific risk perceptions of residents in different areas of the basin, with particular focus on the lower basin, where perceptions of risk are most acute.

By adopting these strategies, it will be possible to address both the underestimation and overestimation of risks, contributing to the sustainable management of the Nigua River basin. These efforts will help preserve the ecological integrity of the region while ensuring the safety and well-being of its residents.

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Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

Table A1. Survey applied to the risk perception study of the Nigua basin.

No.	Question (Suggested Answer Variants)	Related Variables
1	R1—How often do you hear news about impacts on the basin under study and their consequences? (1–Annual, 2–Monthly, 3–Weekly)	FAMI
2	R2—How often is your area of residence affected by disasters?: (1–Never, 2–Sometimes, 3–Frequently)	FAMI
3	R3—The disasters in the basin under study are due to: (1–Natural factors, 2–Natural and human factors, 3–It is not possible to accurately determine their origin)	INCE
4	R4—Are the disasters in the basin under study due to human activities? (1–Yes, 2–Moderately, 3–No)	WILL
5	R5—Do you accept the exposure of your family group to natural disasters as normal and inevitable? (1–No, 2–Moderately, 3–Yes)	WILL
6	A6—Sometimes the appearance of new or increased diseases is attributed to natural disasters. Has your or your family's health been affected by these disasters? (1–No, 2–Moderately, 3–Yes)	INVO
7	R7—Is your or your family's standard of living affected by the state of the basin? (1–No, 2–Moderately, 3–Yes)	CATA
8	R8—Are you aware of any of the following impacts of disasters in the basin under study: reduction in available water, extinction of species, reduction in crop productivity, appearance of new diseases, flooding of homes, loss or contamination of food, death by drowning, loss of animals, or accumulation of garbage? (1–No, 2–Moderately, 3–Yes)	CATA
9	R9—Do you consider that natural disasters, such as hurricanes, floods and/or droughts, that occurred recently are related to the effects on the basin under study? (1–No, 2–Moderately, 3–Yes)	HIST
10	R10—Do you specifically remember any impact on the basin due to its level of severity? (1–No, 2–Moderately, 3–Yes)	IMME
11	R11—Do you consider that the problems of the basin can be reversible if community positions and appropriate policies are followed? (1–No, 2–Moderately, 3–Yes)	REVE
12	R12—For the basin to recover its attributes after being affected: (1–Additional actions by human systems are essential, 2–Additional actions by human systems are sometimes necessary, 3–The natural mechanism is sufficient)	REVE
13	R13—According to the role currently played by the State and its policies: (1–The deterioration of the basin is inevitable, 2–A consensus between the state and society will delay the deterioration of the basin, 3–The application of policies will allow control successful over deterioration)	CONT
14	R14—The feeling that possible disasters produce in the basin under study can be described as: (1–Simple wake-up call, 2–Concern, 3–Fear)	PANI
15	R15—The effects of disasters in the basin under study for the survival of their social and/or family environment can be classified as (1–Insignificant. 2–Worrying, 3–Frightening)	PANI

Table A1. *Cont.*

No.	Question (Suggested Answer Variants)	Related Variables
16	R16—What is more important to conserve the basin, the benefits derived from technological development or the effects on the environment that it may cause? (1–Greater weight of the benefits than the effects, 2–Benefit-effects balance, 3–More important the effects than the benefits)	RB-I
17	R17—In the case of the basin under study, there are strategies for exploiting natural resources that can affect the environment. In your opinion, what is more important? (1–Environmental protection, 2–A balance between the development of exploitation strategies and environmental protection, 3–The economic benefits derived from exploitation strategies)	BENE
18	R18—Does the mass media play a positive role in terms of credibility, relevance and scope of information about disasters in the basin under study and their consequences? (1–No, 2–To some extent, 3–No)	PRES
19	R19—What role does the media play regarding information about the state of the basin? (1–Alarmist or excessive communication, 2–Adequate communication, 3–Little or insufficient communication)	PRES
20	R20—In your opinion, your level of preparation and knowledge about disasters in the basin is: (1–Low, 2–Adequate, 3–High)	UNDER
21	R21—Your level of preparation and knowledge of methodologies and organizational aspects to take into account the development of the basin under study and adaptation to the problems associated with its environment is: (1–Insufficient, 2–Adequate or sufficient, 3–Excessive)	INST
22	R22—The participation of governmental and non-governmental organizations in activities and work related to the development of the basin under study is: (1–Insufficient, 2–Adequate or sufficient, 3–Excessive)	INST
23	R23—The link between the university and its scientific activity with the communities when addressing activities and work related to the development of the basin under study is: (1–Insufficient, 2–Adequate or sufficient, 3–Excessive)	UNDER

Table A2. Geolocation of the points where the surveys were applied.

PROVINCES	Location	UTM-E	UTM-N
San Cristobal	(1)-The Calimetes	627,410.5846855	2,050,664.9658157
	(2)-El Guineao	632,362.4994234	2,046,948.3522691
	(3)-Galan	627,536.7291025	2,049,343.9550171
	(4)-Chigger Above	626,043.9430443	2,048,934.3780058
	(5)-Manomatuey	628,943.5943698	2,045,111.1911268
	(6)-Majagual	627,308.3591647	2,044,024.2798557
	(7)-The pineapple	629,026.5384932	2,050,184.0074779
	(8)-La Hainera	624,512.1201763	2,050,000.2113245
	(9)-Jamey	624,750.7200916	2,049,386.9640012
	(10)-Mingo Stream	623,787.8959036	2,048,642.9046969
	(11)-La Llanada Grande	624,680.2670226	2,046,712.0796937
	(12)-The chicken	623,770.9601576	2,046,736.8908712
	(13)-Boca de los dos Ríos	623,448.3748074	2,046,734.7978367
	(14)-The Colony	605,866.9987359	1,990,471.0523763
	(15)-Change Doodles	626,215.1365539	2,040,789.265691
	(16)-El Ramón	620,960.3623201	2,045,981.0771521
	(17)-San Francisco	619,116.8078809	2,045,323.9289841
	(18)-Herd Ladies	616,985.3169255	2,043,773.7508426
	(19)-The Pomier	620,197.3848483	2,041,396.00572
	(20)-Santa María	616,647.4424703	2,041,466.2191706
	(21)-Savanna Toro	620,541.5644732	2,037,986.055368
	(22)-Hatillo	615,257.0430803	2,038,537.5469995
	(23)-San Cristobal	617,116.8010335	2,036,673.7369179
	(24)-Chigger	612,891.5331968	2,031,699.4029077

Table A3. Distribution of answers (1, 2 or 3) for each question.

Question No.	% 1	% 2	% 3
1	72.7	17.1	9.51
2	16.8	77.7	5.87
3	23.3	72.3	3.85
4	16.3	67.2	16.5
5	18.8	30.4	51.7
6	33.3	18.3	47.4
7	27.0	20.3	52.7
8	41.8	8.58	87.9
9	85.8	12.5	79.2
10	11.3	10.2	77.5
11	5.32	31.0	63.5
12	27.8	67.5	4.18
13	12.9	70.7	17.3
14	16.7	79.2	4.24
15	12.9	71.4	16.6
16	5.27	81.4	13.5
17	43.8	53.4	2.98
18	9.99	49.6	40.4
19	3.21	59.6	36.2
20	46.6	50.0	3.85
21	47.0	50.8	2.01
22	65.5	32.3	2.01
23	90.1	8.15	1.57

Table A4. Mean values of the perception variables for the study.

No.	Variable	Mean Value (Dispersion)
1	FAMI	2.30 (318,648,157)
2	UNDER	1.24 (535,521,67)
3	UNCE	1.88 (267,813,43)
4	WILL	1.85 (518,430,175)
5	INVO	2.17 (376,211,536)
6	CONT	1.99 (194,789,140)
7	CATA	2.54 (377,208,538)
8	HIST	2.79 (232,0,891)
9	IMME	2.61 (248,0,875)
10	REVE	1.85 (610,277,236)
11	PANI	1.96 (222,698,203)
12	RB-I	2.05 (59,914,150)
13	BENE	2.44 (639,0,484)
14	INST	1.46 (345,571,207)
15	PRES	2.35 (583,228,312)
16	Survey’s average	2.08 (99,891,133)

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