



RESEARCH PAPER

BRIDGING THE GAP: INVESTIGATING BARRIERS AND ENHANCING RESILIENCE IN LAST-MILE COMMUNITIES THROUGH INCLUSIVE EARLY WARNING STRATEGIES IN RURAL LEZHA, ALBANIA



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Acronyms

UNDRR	United Nations Office for Disaster Risk Reduction
ASIG	Albanian State Authority for Geospatial Information
IFRC	International Federation of Red Cross and Red Crescent Societies
INSTAT	National Institute of Statistics
DRR	National Disaster Risk Reduction
MHEWS	Multi-Hazard Early Warning System
PSU	Primary Sampling Units
SSU	Secondary Sampling Units
USU	Ultimate Sampling Units

Abstract

Last-mile communities often face increased vulnerability to disasters, potentially due to challenges in accessing early warning information and building resilience. This situation may exacerbate their susceptibility to hazards and could lead to a downward spiral of increased risk, impact, and vulnerability. This research aims to investigate whether barriers exist that hinder last-mile communities in rural Lezha, Albania, from effectively accessing, comprehending, and acting on early warning information.

A mixed-method approach has been used in this research, combining quantitative and qualitative methods and using multi-stage stratified sampling. Data is collected through secondary and primary methods and then validated for reliability and credibility. Finally, data is analysed using thematic and statistical methods, with ethical considerations such as anonymity being prioritized throughout the entire research.

The research reveals that the majority of respondents lack access to timely and comprehensible early warning information, with only 11% finding such information easily accessible. When such information is received, 69% of respondents struggle to understand it. Despite receiving some early warning information, 94% of respondents have not taken any preparedness measures, and only 8% feel adequately prepared for emergencies. Regarding their resilience, 84% of respondents report feeling between neutral to not resilient.

Last-mile communities in Lezha County face significant challenges in accessing and understanding early warning information, leading to increased vulnerability and a lack of preparedness for emergencies. This research's findings underline the need for improved communication, increased participation in training exercises and awareness activities, and better access to humanitarian assistance. Collaboration between various stakeholders is crucial for developing inclusive and targeted strategies.

Keywords: Natural disaster, last-mile communities, Lezha County, early warning information, barriers, humanitarian assistance, resilience.

1. Introduction

Natural disasters and climate-related events pose significant threats to last-mile communities in rural areas, highlighting the vital need for timely and accessible early warning information and effective early action measures to enhance resilience. These communities are often the most affected by natural hazards whilst being the least resilient, struggling to recover from their impacts. Limited ability to access, comprehend, and act on early warning information exacerbates their vulnerability. This creates a downward spiral where already vulnerable communities that are the least prepared suffer the most significant losses, making them even more vulnerable.

In recent years, Lezha County has been disproportionately affected by natural hazards. The literature (see Section 3) reveals that while there is considerable data on hazard exposure and vulnerability, there is less emphasis on how local populations, especially in rural areas, interact with early warning systems. This study aims to address this gap by exploring which are the specific barriers that prevent rural communities in Lezha from fully benefiting from Multi-Hazard Early Warning System (MHEWS). By examining these barriers, the study seeks to contribute to the broader understanding of how to improve the dissemination and effectiveness of early warning systems in rural, last-mile settings.

This research aims to investigate the barriers that prevent last-mile communities in rural Lezha, Albania, from accessing, comprehending, and acting on early warning information. The main research question is: *“What are the barriers preventing last-mile communities in rural Lezha, Albania, from accessing, comprehending, and acting on early warning information, and how can these barriers be mitigated to enhance community resilience and disaster preparedness?”*

The specific research objectives are to identify the challenges that rural communities in rural Lezha County, Albania, face when accessing, comprehending, and acting on early warning information. By understanding these challenges, this study aims to create a baseline to further address how these communities can better prepare for disasters through improved access and understanding of early warning information, as well as acting on it.

Furthermore, this research is significant in helping understand how to make early warning systems more inclusive and accessible, helping last-mile vulnerable communities be safer in emergencies. Insights from this research will help better plan for emergencies, helping vulnerable rural communities, by adapting policies and strategies, as well as community work, at the local, regional, and national levels.

In the short term, the results of this research give a basis for creating positive, lasting changes in disaster preparedness for communities in rural areas in Lezha District, Albania, with the potential for a wider implementation. In the long term, this approach could be applied to other regions across Albania, fostering a positive and lasting impact on the well-being of rural communities nationwide.

2. Literature Review

2.1. Review Process

2.1.1. Inclusion and exclusion criteria

The literature selection process was guided by pre-defined inclusion and exclusion criteria to ensure relevance and quality. To be included in the review, resources needed to focus on peer-reviewed articles, reports, and publications related to the early warning system, disaster preparedness, and extreme natural events in Albania (Figure 1). Priority was given to studies specifically targeting information regarding Albania, and not the broader Balkan region. Additionally, only studies published in 2020 and 2024 were considered, unless a seminal work was deemed highly relevant, or the same information provided had not been updated after 2020. Trusted sources such as UN agencies, the International Committee of the Red Cross (ICRC), Elsevier, and Springer were prioritized to ensure credibility.

Exclusion criteria were applied to maintain a focused and high-quality selection. Resources with outdated data or findings not applicable to the current context were excluded, as were those with no specific focus on early warning systems or extreme events in Albania. Duplicates, irrelevant topics, and resources of poor methodological quality were similarly excluded from the final selection.

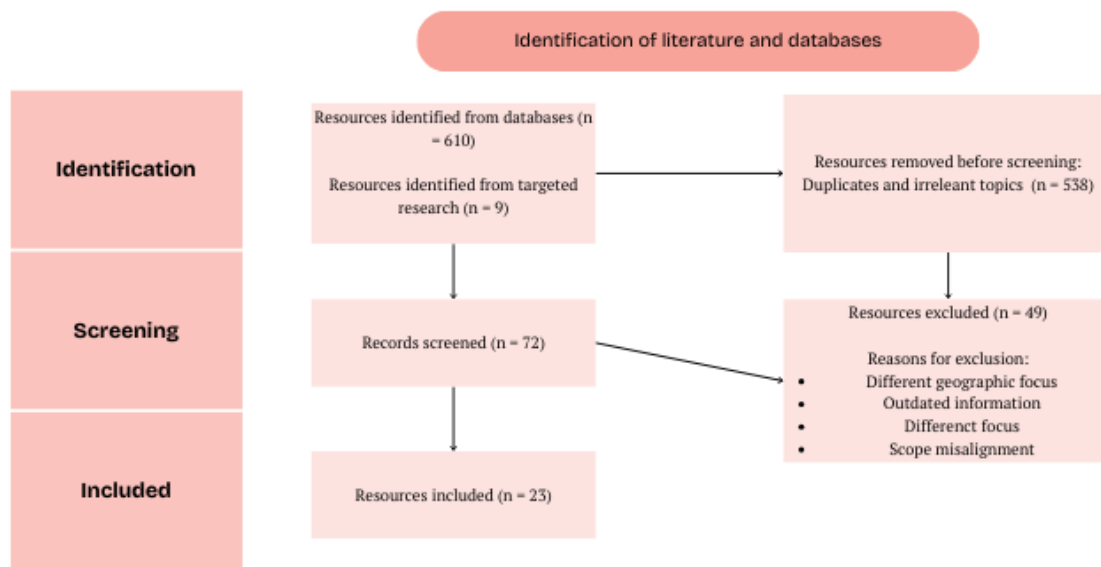


Figure 1. Literature review process

2.1.2. Information sources and search

A comprehensive search strategy was employed across multiple databases and specialized resources to gather a wide range of literature. These sources included Google Scholar, Springer, the UN Library, ICRC resources, Elsevier, and targeted Albanian government databases. Google Scholar yielded 148 results, from which 5 relevant resources were selected. Springer returned 171 results, with 3 being included. The UN Library provided 57 results, with 3 included in this review. The ICRC database returned 33 results, 2 of which were selected for their relevance to localized impacts. Elsevier contributed 1 key article out of 201 screened. Lastly, 9 targeted resources from Albanian national strategies, regional plans, online databases, as well as other international online databases were included to provide crucial insights and local context. The selected literature addressed mainly key aspects of natural disasters in Albania, information on early warning and disaster preparedness, disaster management and impact, offering important information in this context.

2.1.3. Screening and selection process

The screening and selection process ensured that only the most relevant and high-quality resources were included. Initially, a total of 610 resources were identified across the various databases and targeted sources. After an initial screening process to remove duplicates and irrelevant topics, 538 articles were excluded. This left 72 articles, which

were subjected to a more detailed review. The remaining records were assessed based on their alignment with the research question, methodology, and focus on disaster preparedness, early warning systems, and rural communities. During this phase, an additional 49 resources were excluded due to geographic mismatch, outdated information, a different focus, or scope misalignment. Ultimately, 23 resources were selected for inclusion in the literature review. These selected resources represented a diverse mix of international, national, and regional perspectives, all of which were deemed crucial to provide an informed background for the research question.

2.1.4. Analysis

The final 23 resources were analyzed thematically to draw out key information related to Albania in general and Lezha in particular exposure to extreme natural events, past events, general impacts, and specific impacts on rural communities. This thematic analysis allowed for a synthesis of national and regional strategies, local policies, and international organizations' reports, forming a holistic understanding of extreme natural events impacts in Albania in general and Lezha in particular.

2.2. Literature Review Summary

Albania, a country in South-Eastern Europe with a population of 2,793,592 (National Institute of Statistics, 2022), is primarily characterized by a Mediterranean climate (Qiriazhi et al., 2000) due to its proximity to the Mediterranean Sea (Figure 2) (Google Earth, 2024). However, climate change projections indicate that the country will face significant challenges due to changes in precipitation patterns, rising temperatures, and sea-level rise (Fida et al., 2009), all of which pose substantial risks. These factors are expected to increase the frequency, duration, and severity of extreme natural events such as floods, flash floods, fires, landslides, and other hazards.

According to the “World Risk Report 2023,” Albania is ranked with a “high” World Risk Index, indicating both a high level of exposure to disasters and significant vulnerability to extreme natural events (Bündnis Entwicklung Hilft / IFHV, 2023). Vulnerability, in this context, is defined by susceptibility, lack of coping capabilities, and a lack of adaptive capacities. This combination of high disaster risk and climate change impacts, coupled with a population highly exposed to these events, underscores the urgency for improved disaster preparedness and risk reduction mechanisms in the country.

Between 2008 and 2021, Albania was among the top 20 countries in Europe and Central Asia with the highest number of internal displacements triggered by disasters (United Nations Office for Disaster Risk Reduction, 2023). For example, in July–August 2021

alone, wildfires affected 20,000 people, displacing 1,000 (International Federation of Red Cross and Red Crescent Societies, 2021). However, there remains a significant data gap concerning the economic impacts of such disasters. The World Bank estimates that earthquakes between 2014 and 2024 caused financial losses amounting to USD 1,150,100, affecting 1,400 people and causing 51 fatalities. This lack of comprehensive data highlights the need for improved disaster risk assessment and early warning systems, which are critical components of Albania's National Disaster Risk Reduction (DRR) strategy (National Disaster Risk Reduction Strategy 2023 – 2030, 2023). Although Albania has a Multi-Hazard Early Warning System (MHEWS) in place, the effectiveness of this system, especially in last-mile rural communities, remains under-researched (UNDRR and WMO, 2022).

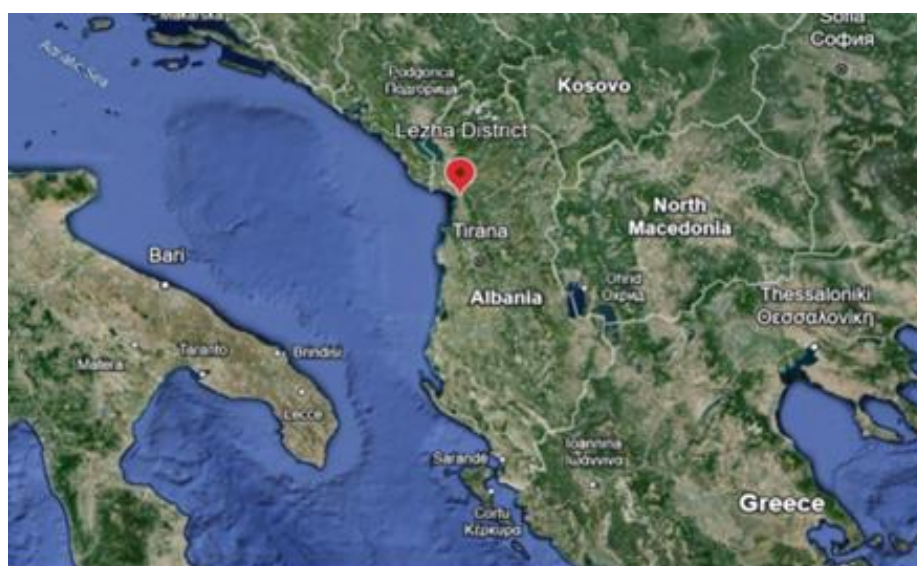


Figure 2. Map of Albania

Between 2008 and 2021, Albania was among the top 20 countries in Europe and Central Asia with the highest number of internal displacements triggered by disasters (United Nations Office for Disaster Risk Reduction, 2023). For example, in July–August 2021 alone, wildfires affected 20,000 people, displacing 1,000 (International Federation of Red Cross and Red Crescent Societies, 2021). However, there remains a significant data gap concerning the economic impacts of such disasters. The World Bank estimates that earthquakes between 2014 and 2024 caused financial losses amounting to USD 1,150,100, affecting 1,400 people and causing 51 fatalities. This lack of comprehensive data highlights the need for improved disaster risk assessment and early warning systems, which are critical components of Albania's National Disaster Risk Reduction (DRR) strategy (National Disaster Risk Reduction Strategy 2023 – 2030, 2023). Although Albania has a Multi-Hazard Early Warning System (MHEWS) in place, the effectiveness

of this system, especially in last-mile rural communities, remains under-researched (UNDRR and WMO, 2022).

Lezha County, located in Central Albania on the Adriatic coast, was selected as the focus of this study due to its unique geographic and environmental vulnerabilities. Historically, the region was a wetland, which was reclaimed during the communist regime to accommodate residential infrastructure. This transformation has left the area susceptible to a variety of natural hazards, which often overlap in terms of timing and location.

The Albanian Red Cross, under the ZAFRA program work (2018 - 2023), confirms that inadequate infrastructure increases the severity of floods every few years in Lezha, among others, and landslides affect villages situated in sloping areas (Albania Red Cross, 2020). Moreover, the natural disasters in Lezha have been so severe that military intervention has been repeatedly required to support emergency services and assist with coping and recovery efforts (Bonner et al., 2023).

Lezha has experienced significant seismic activity, with two of Albania's strongest earthquakes in the last 40 years occurring in this region (Marku et al., 2022). In addition, the county has seen an increase in the frequency and intensity of extreme natural events such as floods, fires, and landslides, exacerbated by climate change and inadequate infrastructure. These overlapping risks make Lezha an ideal case study for investigating the barriers to effective disaster preparedness, particularly in rural, last-mile communities.

Lezha County (Figure 3) is highly exposed to multiple natural hazards, as documented in various reports and databases. According to the UNDRR DesInventar Sendai database, 20% of deaths in the region between 2022 and 2024 were caused by flash floods, while 16% were attributed to snowstorms (DesInventar, 2024). Furthermore, 86% of homes were either damaged or destroyed by flash floods, highlighting the vulnerability of local infrastructure to water-related disasters (Figure 4) (State Authority for Geospatial Information, 2024). The area is also highly prone to fires, with specific administrative units identified as high-risk zones (Figure 5). Wind hazards, while less frequent, pose additional risks to both agriculture and infrastructure, particularly in the municipalities of Lezhë and Kurbin (Figure 6). These maps provide valuable spatial representations of the region's hazard exposure, helping in the identification of vulnerable areas and supporting efforts to develop targeted mitigation strategies.



Figure 3. Map of Lezha District

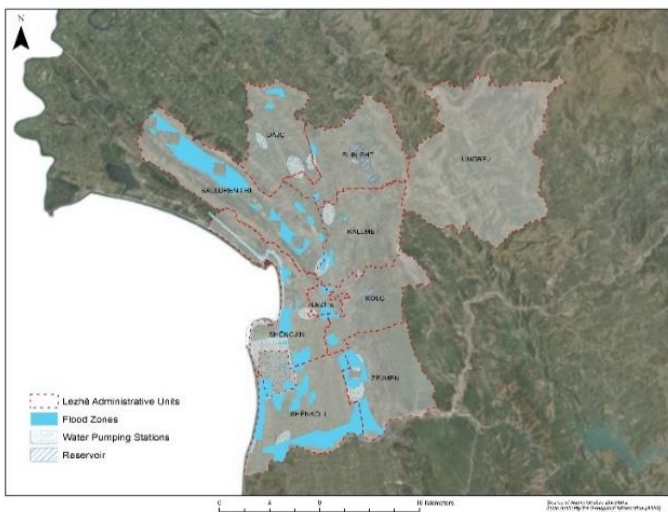


Figure 4. Flood zones in Lezha (2022 - 2024)

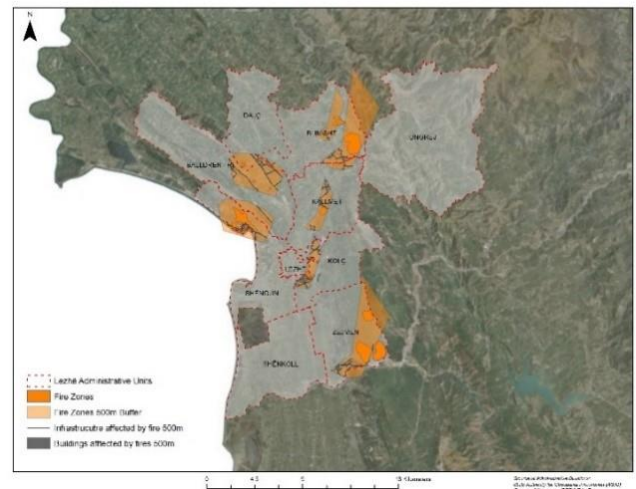


Figure 5. Fire zones in Lezha (2022 - 2024)

While Albania's MHEWS is a crucial component of the national DRR strategy, and more locally in "The Strategy for Reducing the Risk of Disasters in Lezha Municipality" (Disaster Risk Reduction Strategy in Lezha Municipality, 2020), and "Lezha Municipality – Civil Emergency Plan" (Disaster Risk Reduction Plan for the Municipality of Lezha, 2020), there is limited research on how these systems operate at the local level, especially in rural communities like those in Lezha County. The existing literature on MHEWS in Albania often focuses on the impacts and projections of hazards. However, less attention has been paid to the social dimensions, particularly how last-mile communities' access, comprehend, and act on early warning messages. The mechanisms through which these warnings are communicated are insufficiently explored in terms of their reach and effectiveness in rural areas.

Lezha embodies the challenges faced by many rural Albanian regions, including infrastructural limitations and socio-economic vulnerabilities. The county's susceptibility to various overlapping natural hazards makes it an ideal case study for comprehensive disaster preparedness research. This study aims to fill critical gaps in the current understanding of MHEWS effectiveness in rural, last-mile settings by exploring specific barriers that prevent rural communities from fully benefiting from MHEWS. Insights gained from this research will not only be specific to Lezha but also applicable to other rural areas facing similar challenges in disaster preparedness and resilience. By addressing these gaps, this study seeks to contribute to the broader understanding of how to improve the dissemination and effectiveness of early warning systems in rural, last-mile areas, ultimately enhancing community resilience and disaster preparedness.

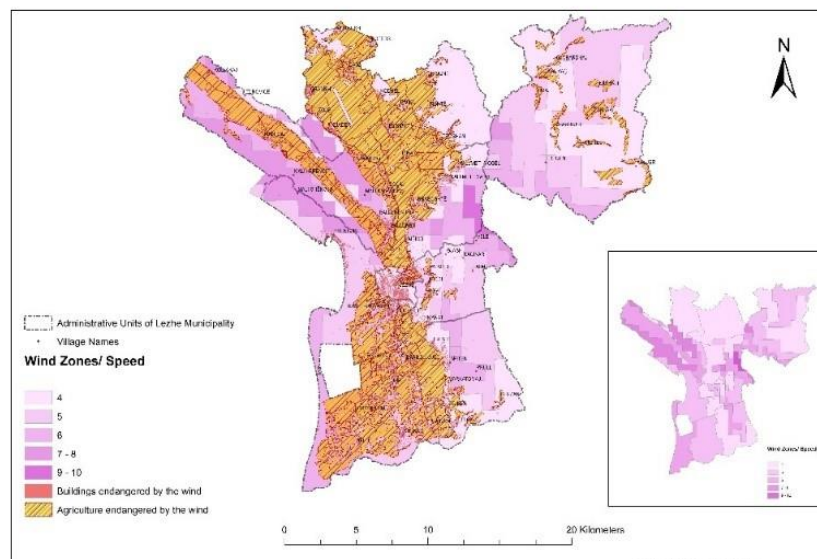


Figure 6. Map of wind zones and speeds

3. Methodology

3.1. Methodological Approach

In developing the research methodology, a combined approach was taken, including quantitative and qualitative methods, to determine the most realistic situation. Ethical considerations were planned, designed, and adopted throughout this research to minimize potential risk and harm to participants (Figure 7). This research was conducted during the period January to August 2024.

The quantitative method consisted of the design and implementation of one face-to-face survey questionnaire for local residents in the three identified administrative units in

Lezha County. The survey questionnaire was translated into Albanian language and implemented from 10th March to 29th May 2024. The qualitative method involved a stakeholders' meeting to discuss preliminary data received by the questionnaire. The meeting was organized on 17th April 2024. The survey was implemented on a representative sample as described in Section 4.3, providing a confidence interval of 90% and a margin of error $\pm 5\%$.

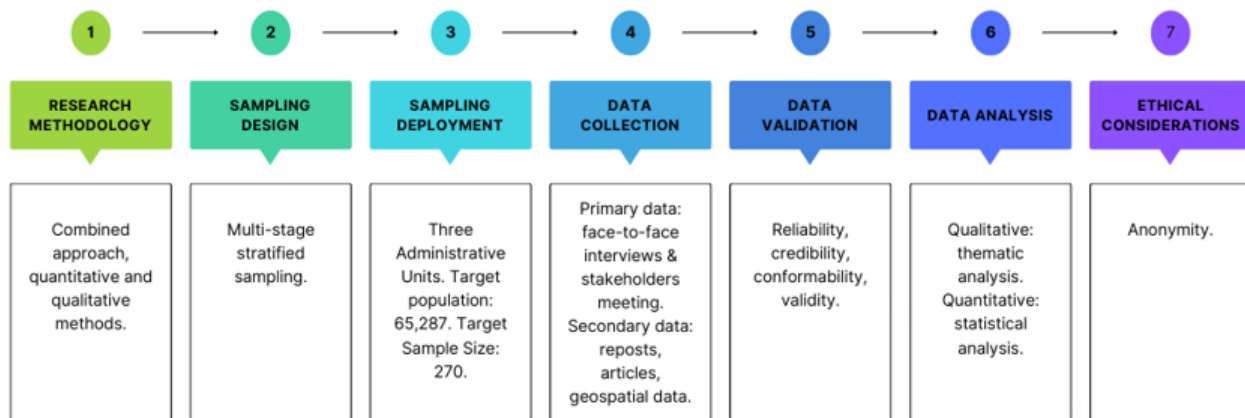


Figure 7. Methodology framework

In designing this research, the focus was intentionally placed on multiple hazards rather than a single one. The primary goal was to evaluate whether the target population could access, understand, and respond to early warning information. A limitation of this approach is that different areas are not equally exposed to natural hazards, leading to varying perceptions and experiences among respondents. However, since this is the first study of its kind and scope, this broader approach is considered valuable for providing a general understanding of the situation, laying the foundation for future research that can explore how the population engages with specific hazards.

3.2. Data collection

Two types of data sources have been used in this research, secondary (literature review, see Section 3) and primary.

Secondary Data Source:

- External document analysis. This group of documents includes information collected from reports or publicly available studies related to these topics from other organizations such as the UNDRR and IFRC.
- Information published by public institutions. These documents include studies, reports, or data published by institutions or governmental agencies such as the

National Institute for Statistics (INSTAT), Ministry of Tourism and Environment, etc.

- Geospatial data. Data provided by open-source platforms such as DesInventar, Google Earth, and the Albanian State Authority for Geospatial Information (ASIG).
- Research works. These materials include studies conducted by academic institutions and research organizations.

Primary Data Sources:

Following the desk review and data extraction from secondary data sources, a face-to-face survey questionnaire and one stakeholder meeting were implemented and used as sources of primary data.

Data collection through direct interviews and the stakeholder meeting allowed for the collection of reliable and useful information in investigating the barriers preventing last-mile communities in rural Lezha, from accessing, comprehending, and acting on early warning information. This information provides the fundamental understanding that helps better plan for strategies and actions on how these barriers can be mitigated or overcome, helping to enhance community resilience and disaster preparedness.

3.3. Survey Sampling

Considering the aim of the research to investigate the barriers that prevent last-mile communities in rural areas of the Lezha District in Albania, from accessing, comprehending, and acting on early warning information, the multistage sampling with stratification method was used. In the context of this research, “last-mile communities” are identified as communities living in rural and semi-rural areas, which are also the final segment of service delivery, whether in logistics (Maša, 2015), telecommunications, or broadband (Dennis, 2000).

75 villages from nine administrative units located away from the main urban centres of each of the municipalities were selected on the basis of the most exposed to natural disasters and have been further grouped into three main groups depending on the frequency and impact of disasters during the last three years 2020 – 2023. The Primary Sampling Units (PSU) were identified as follows:

1. 1st Group –Administrative Units with the villages most affected by a combination of natural disasters (floods, fires, landslides, etc.) in the last three years, 2020 – 2023. This group has the highest weight of 50% of the total.

2. 2nd Group – Administrative Units with villages most affected by fires during the period 2020 – 2023. This included a total weight of 25%.
3. 3rd Group – Includes Administrative units with villages most affected by floods during 2020 – 2023, with a total weight of 25%.

In the second stage, four main criteria were used to select the most representative administrative units based on the Primary Sampling Units identified in the first stage, namely:

1. Economic criteria – Investment in the civil protection system.
2. Environmental criteria – Presence or proximity to a natural protected area.
3. Geographic representation – Geographic position of the administrative units.
4. Population size – Population size at the administrative unit level.

A scoring system was established for the identified indicators, assigning scores based on each indicator's relevance to the research's objective. Additionally, a weighting factor was introduced for each indicator. This weighting factor reflects the importance of each indicator and ensures that the population of inferences is accurately represented. The score of indicators has been multiplied by the respective weighting factor for that indicator. After this, the sum of each indicator–weighting factor was calculated to achieve an overall score, followed by a multiplication by 25 to standardize in a 100-point system. This approach led to a score scale of 1-100, where 1 is the minimum and 100 is the maximum, and resulted in the identification of the Secondary Sampling Units (SSU).

Administrative Unit (A.U)	Population Number	Sampling no. per Administrative Unit
Balltren	17,087	70
Shëngjin	21,423	89
Shënkoll	26,777	111
Total	65,287	270

Table 1. Total sample size

The Ultimate Sampling Units (USU) were identified in the third stage. In line with the research ethical considerations, sampling has been conducted only for individuals over the age of 18 years. Due to the grouping of age groups in the range of 15 to 19 years by the Albanian National Institute for Statistics (INSTAT), as a reference for the total population, the calculations are based on the list of voters for the 2021 election published by the Central Election Commission (which is based on data from the Civil Status Office) at the municipality and district level (Komisioni Qendror i Zgjedhjeve, 2021). Ultimately, the three administrative units with the highest scores were selected

and stratified respecting the proportion for each of them (Tab. 1). Figure 8 shows administrative units in Lezha.



Figure 8. Administrative Units in Lezha

The research aim is to investigate the barriers that prevent last-mile communities in rural Lezha, Albania, from accessing, comprehending, and acting on early warning information. In line with this aim, time, and resources, the non-probability sampling method was employed.

Non-probability sampling is a sampling technique that does not rely on random selection, often leading to cost-effective and less stringent sampling processes. As Brislin & Baumgardner have described “...Non-probability sampling is flexible, allowing researchers to select participants based on specific criteria relevant to the study... Non-probability sampling can provide rich qualitative data, especially in exploratory research where understanding context and depth is crucial.” (Richard, 1971)

The non-probability sampling technique has been selected for this research because it offers advantages, without affecting the quality of results. This method is faster and cost-effective, while also allowing to find respondents that have a high motivation to take part in the research.

While this method offers practical advantages, it is important to point out that it can introduce biases and limit the generalizability of findings, as discussed in Section 6 – Discussion, Implications, and Potential Limitations.

Selection of respondents

Considering that the method used is non-probabilistic, the selection of respondents was based on systematic sampling on the spot. Based on their local knowledge, the

interviewers picked “representative” locations or units to conduct the interviews. When the location was identified, respondents were recruited falling in the criteria of being local residents, over eighteen years old, posing attention to inclusion of a diversity of genders and age ranges. The fieldwork began on 10th March 2024 and was completed on 29th May 2024.

3.4. Electronic data collection

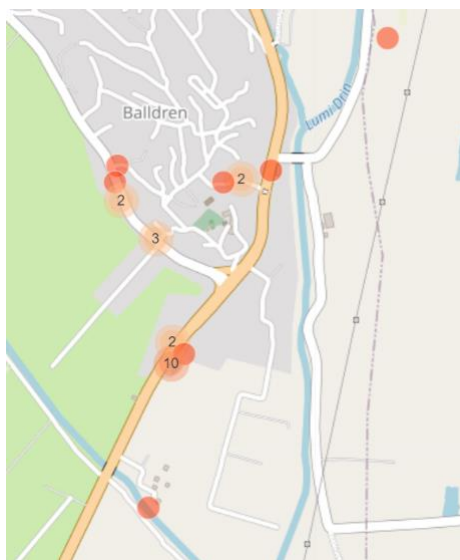


Figure 9. Geolocation of interviews in one area in Balldren (KoboToolbox)

Face-to-face interviews were conducted by three enumerators using Computer-Assisted Personal Interviewing (CAPI) approach. The software used is KoboToolbox allowing use from smart devices on the ground, real-time upload of answers to the server, geolocation pinning, and geolocation visualization (Figure 9). The software allowed each questionnaire completed by the enumerator to be uploaded immediately and subsequently reviewed by the researcher. Data were then validated, closed-ended questions coded accordingly, and open-ended questions reviewed for a logic check.

4. Results and Findings

4.1. Demographic data

This section provides demographic data on respondents, aiming to create a clearer understanding of the sample. The majority of respondents in this research are male, representing 56% of the sample, while females make up 44% (Figure 10). Respondents' age was grouped by incrementing ten years, starting at eighteen years old. The most represented age groups are 38 to 46 years old (22%), and 58 to 67 years old (21%), followed by the 48 to 57 age group (20%). The youngest group aged 18 to 27 is represented by 14% of the total (Figure 11).

This distribution provides a comprehensive representation of the research sample, helping us understand the diverse experiences, perspectives, and perceptions based on diverse knowledge and understanding.

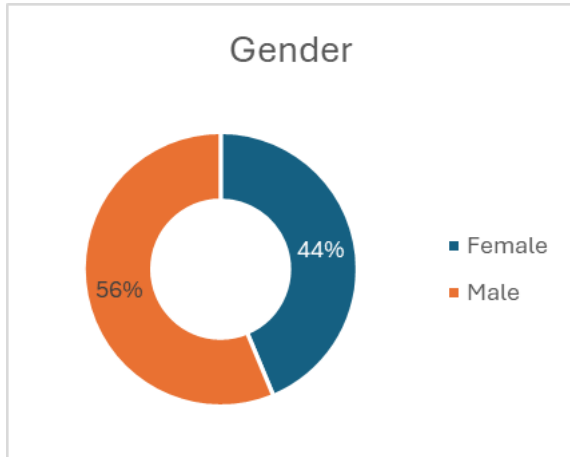


Figure 10. Gender of respondents

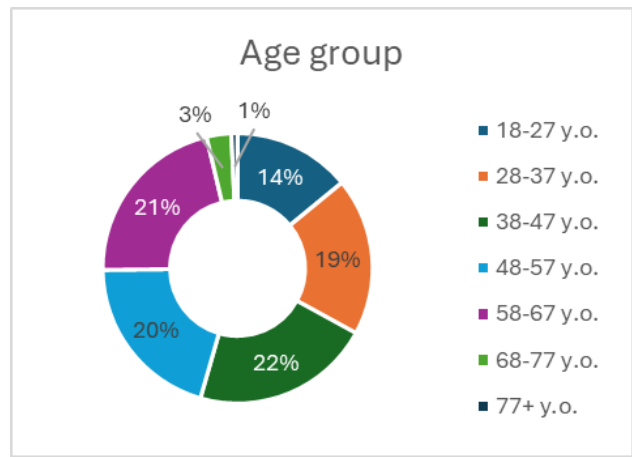


Figure 11. Age group of respondents

Regarding education, this study offers a good representation of various educational backgrounds. Thirty percent of respondents have completed secondary school, and 27% have completed university studies (Figure 12). Additionally, 23% of respondents have completed high school. The sample also includes individuals whose highest educational level ranges from primary school to professional studies, as well as respondents who have obtained education beyond undergraduate or graduate degrees.

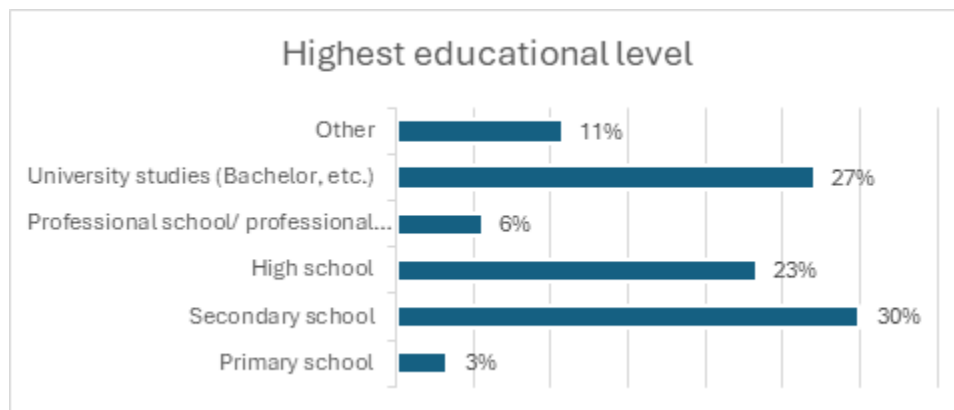


Figure 12. Highest education level achieved

The study also provides a diverse representation of employment statuses. Nearly half of the respondents are employed full-time (49%) (Figure 13), 7% of respondents are students, 14% are self-employed, 10% are retired, and the lowest representation

includes seasonal workers at 3%, and persons who do not have stable employment at 1%.

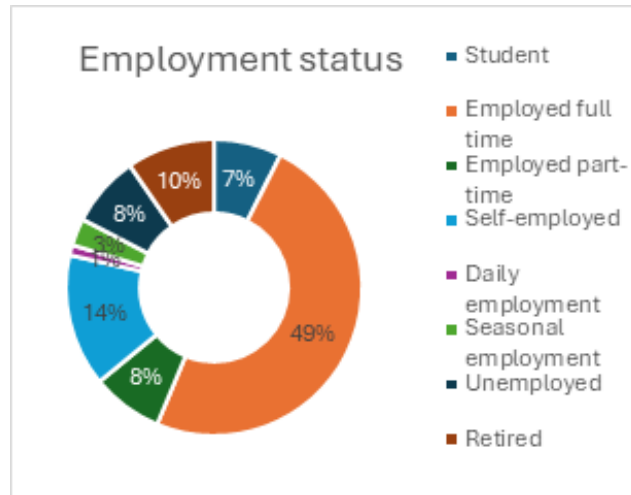


Figure 13. Employment status

The employment data gathered matches 2023 official data provided by the Albanian government, ranking Lezha as one of prefectures with the lowest employment rate with 45,8% (National Institute of Statistics, 2024).

4.2. Access to early warning information

Access to early warning information is vital for individuals and communities, allowing them to take timely and appropriate actions in response to potential emergencies. For this reason, respondents were asked about their access to early warning information.

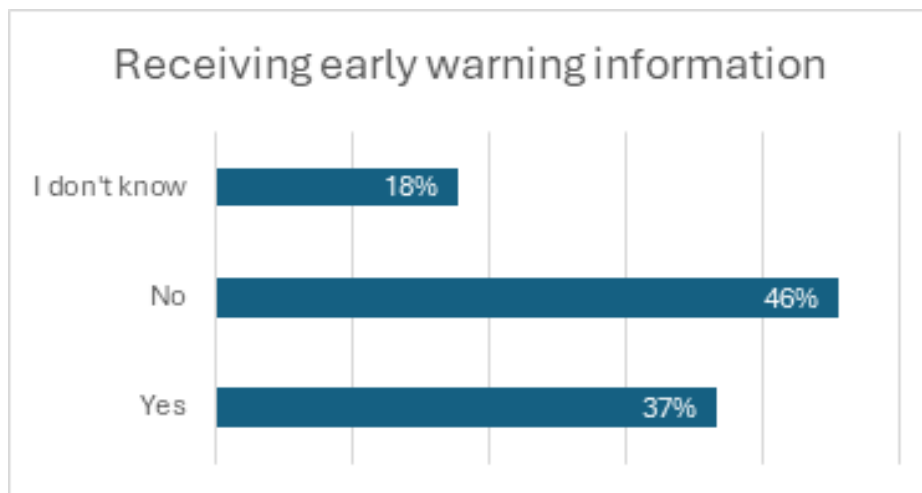


Figure 14. Receiving early warning information about potential natural disasters or emergencies

When asked if they receive early warning information about potential natural disasters without actively searching for it, 46% said they do not, 37% said they do, and 18% were unsure whether they receive such information (Figure 14). Based on this data, it is understood that there is a need for greater efforts in ensuring last-mile communities are informed about potential disasters and teaching them how to access early warning information.

As shown in Figure 15, Shënkoll is the administrative unit facing the most challenges in accessing early warning information about potential natural disasters. Balldren and Shëngjin follow, with a notable portion of Shëngjin respondents indicating that they are unsure about their access to this information.

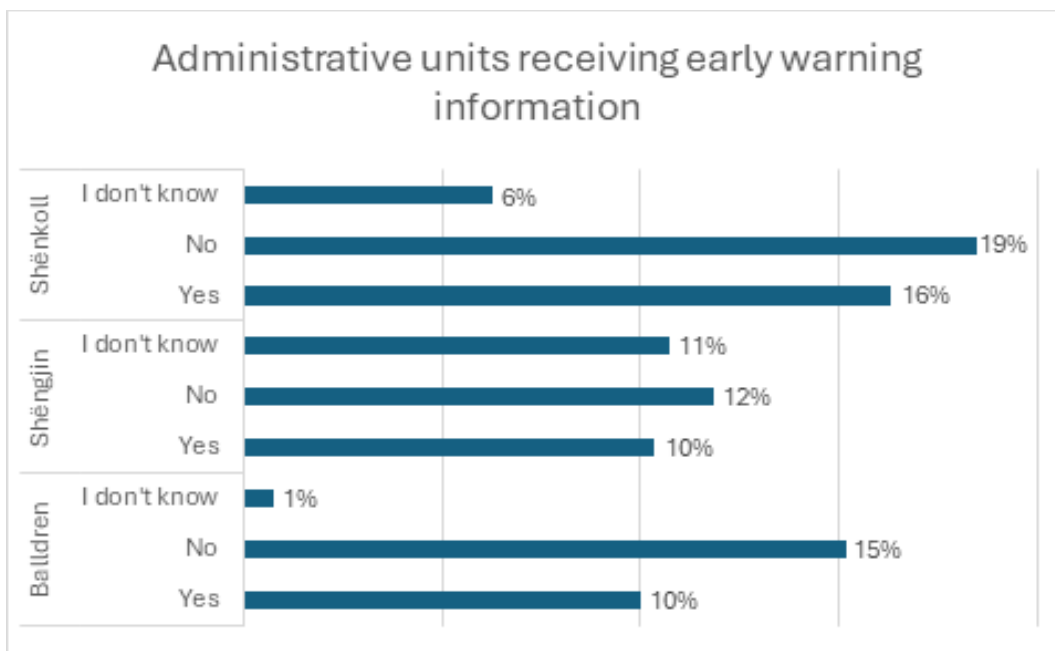


Figure 15. Receiving early warning information about potential natural disasters or emergencies in each administrative unit

It is important to understand whether individuals from these communities know where to proactively look for early warning information. For this reason, this research has also explored the potential correlation between education level and awareness of sources for early warning information. As seen in Figure 16, most respondents who confirmed they know where to proactively seek this information have completed university studies (20%). On the other hand, those less aware of where to look for this information tend to have completed primary school (1%). This difference may be due to the improved research skills of university graduates, as well as efforts to incorporate civil emergency-related topics into earlier stages of education in Albania.

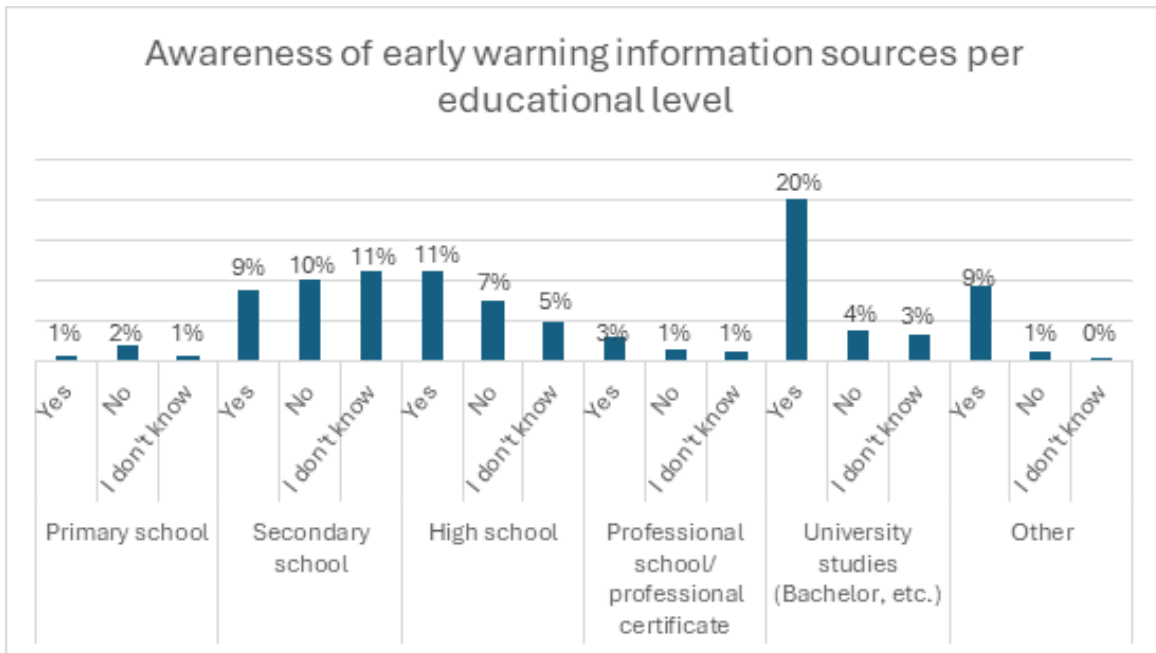


Figure 16. Awareness of sources from which respondents can search for early warning information as per their educational level

Respondents were asked to rate on a scale of 1 to 5 how easy it is for them to access early warning information. Only 11% rated the information as very accessible, while 89% rated it as somewhat accessible to not accessible at all (Figure 17). This data points to significant challenges these communities face in accessing this information while underlining the urgent need to ensure that last-mile communities have adequate access to early warning resources.

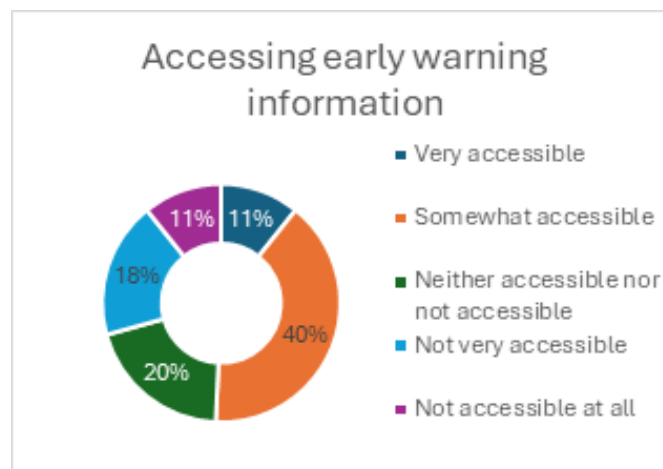


Figure 17. Accessing early warning information

The data displayed in Figure 18 provides a comparison of male and female respondents' perceptions of their ability to access early warning information in rural. A noticeable trend is that both genders predominantly report limited accessibility to such information,

with the majority of responses concentrated in the “Not very accessible” and “Somewhat accessible” categories (Figure 18). For males, 18% indicated that early warning information is “Not very accessible,” and 14% rated it as “Somewhat accessible.” Similarly, 9% of female respondents reported it being “Not very accessible,” while 15% considered it “Somewhat accessible.” However, more males (11%) than females (9%) noted that information is “Not accessible at all.” This indicates a slight gender disparity in perceived access challenges, with males facing slightly more pronounced barriers overall.

On the higher end of the accessibility spectrum, the percentage of respondents who rated early warning information as “Very accessible” remains minimal across both genders, with only 2% of both males and females selecting this option. This suggests that regardless of gender, early warning information is perceived as largely difficult to access in rural Lezha. The data points to significant room for improvement in making early warning information more widely accessible and comprehensible. Addressing this gap through more inclusive and effective communication strategies could enhance disaster preparedness and resilience, particularly in these last-mile communities that are disproportionately vulnerable due to limited information accessibility.

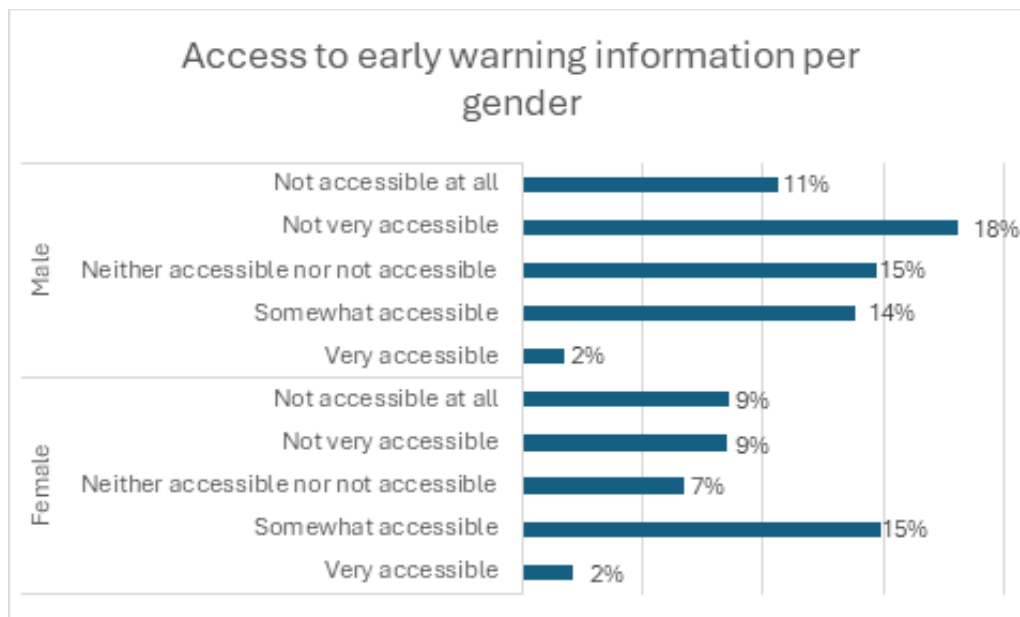


Figure 18. Accessibility to early warning information per gender

To better understand how to reach last-mile communities, the research further explored how respondents typically seek to receive early warning information about approaching emergencies. The most commonly used source is television broadcasts, relied upon by 89% of respondents (Figure 19). Social media platforms are the second most popular source, used by 58% of respondents, followed by phone calls from friends or family,

which rank third with 40%. The least used method is text messages, with only 5% of respondents reporting that they receive early warning information this way.

As also described in the question below, respondents face several challenges when receiving early warning information, ranging from they don't know where to look, they receive information late, and they get uncertain or conflicting information from many sources.

People tend to share what they know, which may not always be timely or verified in cases when information is provided by friends or family. Official agencies might not be as visible or active on social media platforms compared to other unofficial sources (bloggers, community groups, etc.) which can explain why respondents aren't consistently receiving updates directly from verified or official channels. These challenges suggest that the respondents may be getting information from both informal and official channels, which leads to inconsistent quality of information.

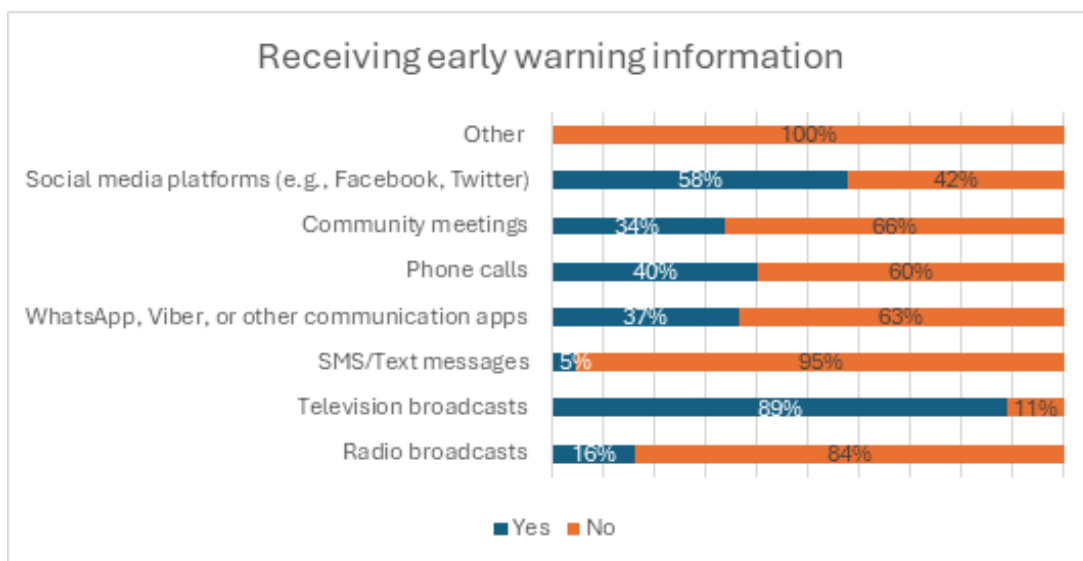


Figure 19. Receiving early warning information

In response to an open-ended question posed about the challenges they face in accessing early warning information in their communities, most respondents identified internet access as the main challenge. This ranges from a complete lack of internet access to issues with weak or unreliable connections. Many respondents also pointed out problems with the telecommunication network, such as poor mobile phone signals, as significant barriers.

Additionally, respondents pointed to a lack of reliable information sources and delays in receiving timely information as significant challenges. Infrastructure reliability was

another challenge mentioned, with issues like frequent power outages and a general lack of electricity making it difficult to access early warning information.

This open question allowed respondents to express their perspectives. Below are some of their quotes:

“We do not receive information from anyone” - says ES from Balldren.

“Lack of quality in the information I’m looking for, reliability” - says VB from Shëngjin.

Infrastructure appears to be another significant problem, as also described during the stakeholders' meeting. Participants mentioned that extreme weather events often affect electricity. Without electricity, accessing internet for information, watching TV broadcasts, or even contacting each other becomes problematic. Additionally, physically moving from one location to another becomes challenging as road infrastructure is often not accessible or safe to use.

4.3. Comprehending early warning information

The research further explores respondents' comprehension of early warning information. When asked how well they understand the information they receive, only 6% reported having an excellent understanding, while 46% of respondents indicated that their understanding ranges from neutral to poor (Figure 20). This points to a significant gap that even when communities receive early warning information, their ability to comprehend it is often limited.

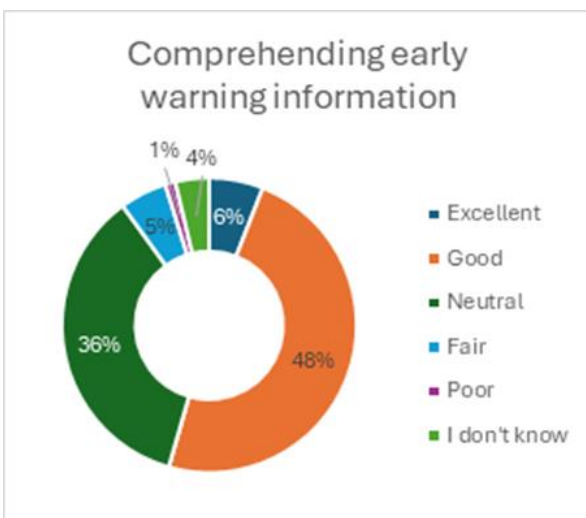


Figure 20. How well do respondents understand early warning information received

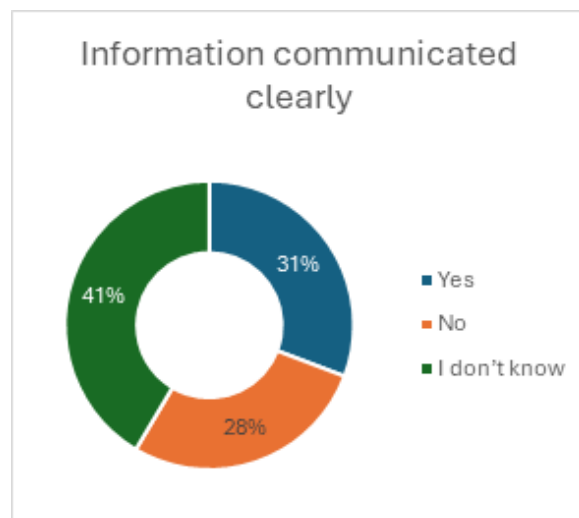


Figure 21. Early warning information is communicated in a clear and easily understandable manner

The situation is further confirmed by data received when asking if early warning information they receive is communicated in a clear and easily understandable way. Only 31% answered “Yes” while respondents that answered “No” and “I don't know” amount to 69% (Figure 21).

If we consider this data in conjunction with the data received when asking about accessing early warning information, we understand that not only there is a problem in accessing such information but also when such information is available to these communities it is not easily understood.

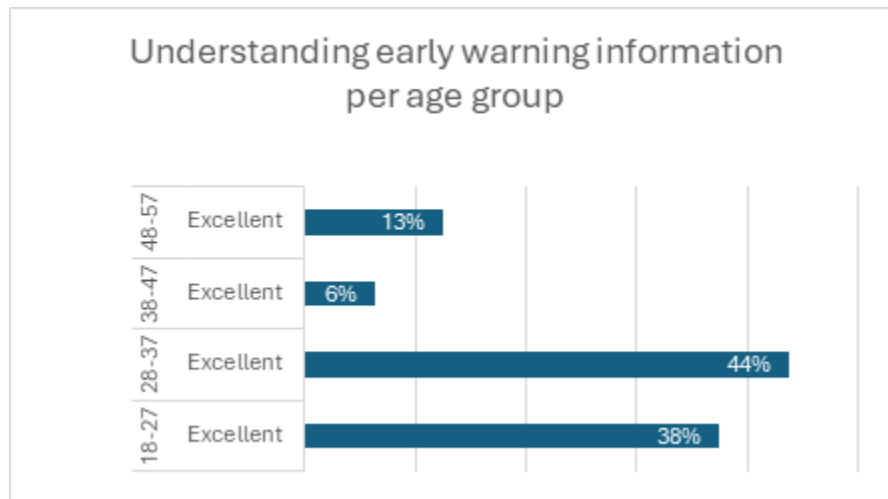


Figure 22. Excellent comprehension of early warning information per age group

The data in Figure 22 reveals notable disparities in the comprehension of early warning information across different age groups in rural Lezha, Albania. It is particularly striking that only 6% of respondents across all age groups rated their understanding as “Excellent.” The age group of 28-37 stands out, with 44% of respondents within this range reporting an excellent level of comprehension, followed by the 18-27 group at 38%. Conversely, the older age groups, 48-57 and 38-47, report significantly lower levels of excellent comprehension at 13% and 6%, respectively. These figures suggest that younger adults in rural Lezha are far more likely to perceive themselves as highly capable of understanding early warning information compared to their older counterparts.

These age-based discrepancies may be influenced by several social factors, particularly access to education, technology, and digital literacy. Younger generations in rural Albania, particularly those between 18-37, are more likely to have been exposed to formal education in a period where access to technology and modern communication tools had improved. This could enhance their ability to interpret complex information such as early warnings. In contrast, older individuals in rural communities, who may have

had more limited access to formal education and digital tools, might struggle with understanding such information. Additionally, cultural factors such as traditional communication methods and trust in informal networks among older age groups may further contribute to their lower levels of comprehension. These findings underscore the need for tailored communication strategies that address the specific needs of different age groups to ensure that early warning information is comprehensible to all community members, especially the older population.

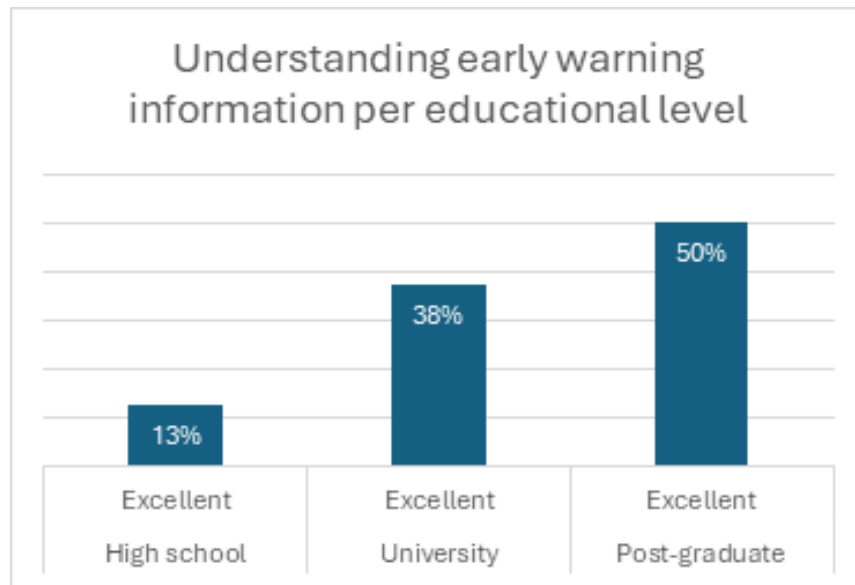


Figure 23. Educational level of respondents who have expressed an excellent comprehension of early warning information

The data presented in Figure 23 highlights a strong correlation between the level of education and the ability to comprehend early warning information in rural Lezha, Albania. Respondents with higher levels of education, such as post-graduate studies, demonstrate the highest rate of excellent comprehension, with 50% reporting this level of understanding. Similarly, 38% of individuals with university-level education also indicated an excellent grasp of early warning information. In contrast, only 13% of those with a high school education reported excellent comprehension, and no respondents with primary school, secondary school, or professional certificates rated their understanding as excellent. These results suggest that education significantly enhances individuals' ability to process and fully understand early warning information.

Several social factors likely contribute to these disparities. Individuals with higher education levels are generally more exposed to critical thinking, analysis, and digital literacy skills, which may enhance their ability to interpret complex or technical information. Additionally, those with more advanced education may have broader access to diverse information sources and communication channels, including digital platforms

where early warnings are often disseminated. In contrast, those with lower educational levels, particularly in rural areas, may have limited exposure to formal education or be reliant on traditional, non-digital forms of communication, making it harder for them to engage with and understand early warnings. These findings highlight the need for targeted educational and communication strategies that cater to all educational levels to ensure that early warning messages are understood and acted upon by all members of the community.

The research also tried to identify the root causes of difficulties in understanding early warning information. Respondents were asked which factors contribute to these challenges. Similarities with the issues in accessing early warning information can be drawn.

The main factor affecting comprehension is limited access to the internet or media, with 50% of respondents pointing to this as the key issue (Figure 24). While this may appear to be an issue of access, it also reflects a comprehension problem, as individuals who rely on limited or intermittent media access often miss important contextual information that aids understanding. Without consistent exposure to information platforms, communities may receive incomplete or fragmented messages, reducing their ability to fully understand the scope, urgency, or necessary actions associated with early warnings. Additionally, 32% of respondents pointed to the difficulty in finding reliable information sources as a barrier to understanding, while 17% expressed that the large amount of information also hinders their ability to comprehend the warnings. When communities cannot easily identify trusted sources, they may be exposed to conflicting or unclear messages, making it harder for them to interpret warnings correctly. The difficulty in navigating the information landscape not only causes delays but also contributes to misunderstandings of crucial details, diminishing the effectiveness of the warnings themselves.

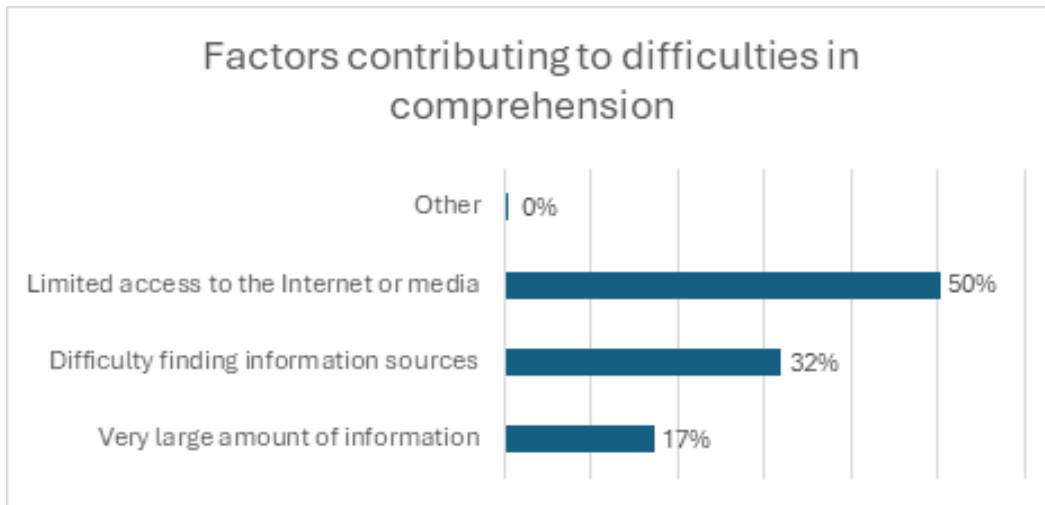


Figure 24. Factors contributing to difficulties in comprehending information

Respondents were further asked if they use additional resources or support to improve their understanding. Ninety-one percent of respondents answered that they do not utilize additional resources for this purpose (Figure 25). Disaggregated data demonstrates that this lack of additional resources use is not related to specific age groups or gender. This, instead, highlights a broader issue where there is a widespread absence of additional support to help these communities better understand the information.

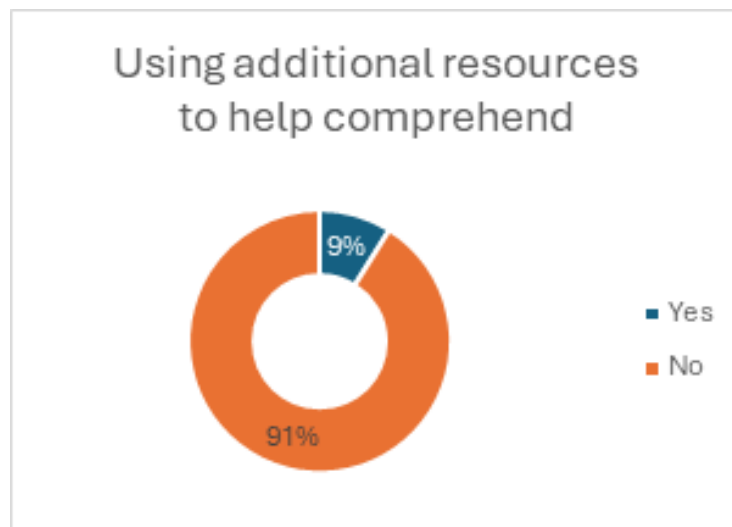


Figure 25. Utilizing additional resources or support to enhance understanding of early warning information

To determine how to better support these communities in understanding early warning information, respondents were asked an open-ended question about the types of resources or support they would find helpful. The most common suggestions involved internet and social media resources, such as mobile applications and online platforms that provide real-time reliable information, as well as social media channels that offer

such updates. Additionally, respondents suggested that attending training sessions, workshops, and awareness-raising activities would improve their comprehension. In addition to virtual channels and virtual materials, printed informational materials were also suggested as tools to improve their understanding.

“Online applications in Albanian language” - has been suggested by AT in Shënkoll.

“Organizing awareness campaigns at the community level to promote awareness and preparedness for emergencies” - suggested AV in Shëngjin.

4.4. Acting on early warning information

Once information has been received and understood it is also important for communities to know how to act on it. Respondents have been asked if they have taken any measures to prepare for potential emergencies. Answers show that the vast majority of respondents are not prepared to act in emergencies. Disaggregated data shows that this lack of preparedness is not related to gender or age group, rather it is a general situation within these communities. Ninety-four percent of respondents say they have not taken any measures to prepare for potential emergencies, while only 6% have done so (Figure 26).

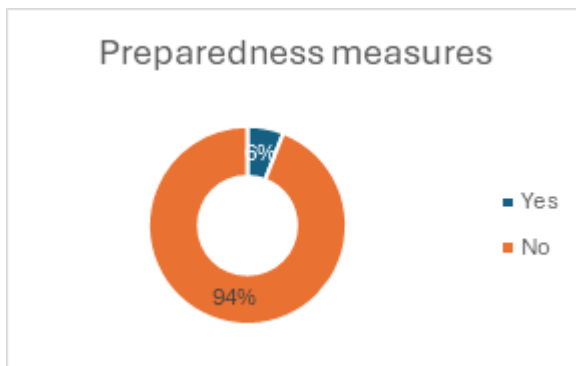


Figure 26. Any measures taken to prepare for potential emergencies or disasters upon receiving early warning information

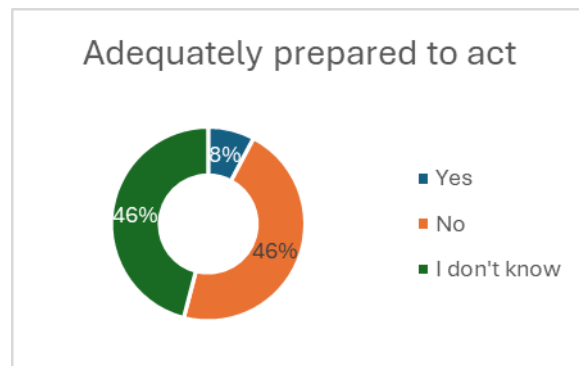


Figure 27. The feeling of being adequately prepared to react in various circumstances based on the information received

Aiming at understanding the ability to act on early warning information respondents have been asked if they feel adequately prepared to react in various circumstances based on information they receive. It is no surprise that only 8% say they feel adequately prepared (Figure 27) while 46% declare that they are not prepared, and another 46% answer that they do not know. It is understood from this data that even if early warning information has been received and understood there is still an enormous lack of preparedness and ability to act in cases of emergencies.

These results in conjunction with data regarding respondents' participation in exercises can make us argue that the lack of preparedness to act on early warning information appears to originate from both insufficient actionable instructions within the information provided and a broader general lack of preparedness in the community.

The fact that only 8% of respondents feel adequately prepared suggests that even when information is received and understood, it may not be sufficiently instructive or clear about the steps to take in emergencies creating a gap in the practical, action-oriented content of the warnings, leaving individuals uncertain about how to respond effectively in critical situations.

At the same time, the large proportion of respondents (46%) who either feel unprepared or do not know if they are prepared suggests a deeper issue of general preparedness. This could be due to a lack of knowledge, training exercises, or experience in responding to emergencies, meaning that even if the information provided does include instructions, the community may not feel confident or equipped to follow through on them.

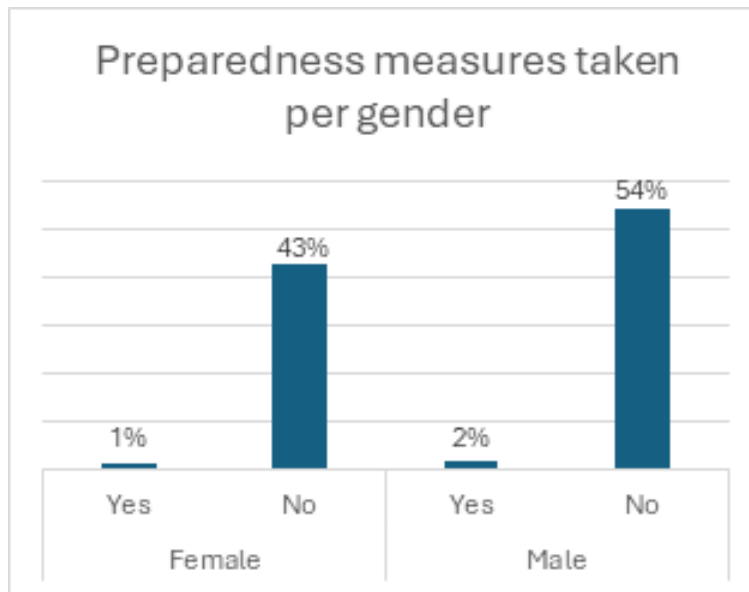


Figure 28. Percentage of males and females that have taken preparedness measures

The data in Figure 28 reveals a gender disparity in emergency preparedness actions, with both males and females showing very low rates of proactive measures in response to early warnings. Only 1% of female respondents and 2% of male respondents reported taking preparedness measures, while the vast majority (43% of females and 54% of males) indicated no action taken. This inaction across genders suggests systemic barriers that transcend gender lines, potentially rooted in broader community-wide challenges.

However, the marginally higher rate of inaction among male respondents (54% compared to 43% for females) warrants careful examination within the context of rural society. Traditional gender roles in rural Albania often assign different responsibilities to men and women in household management and community life. The slightly lower rate of inaction among women might reflect their traditional roles as primary caregivers and household managers, potentially making them more attuned to safety concerns. Economic factors may also play a role, as limited financial resources in rural areas could constrain both genders' ability to invest in preparedness measures, regardless of their awareness or desire to act on warnings.

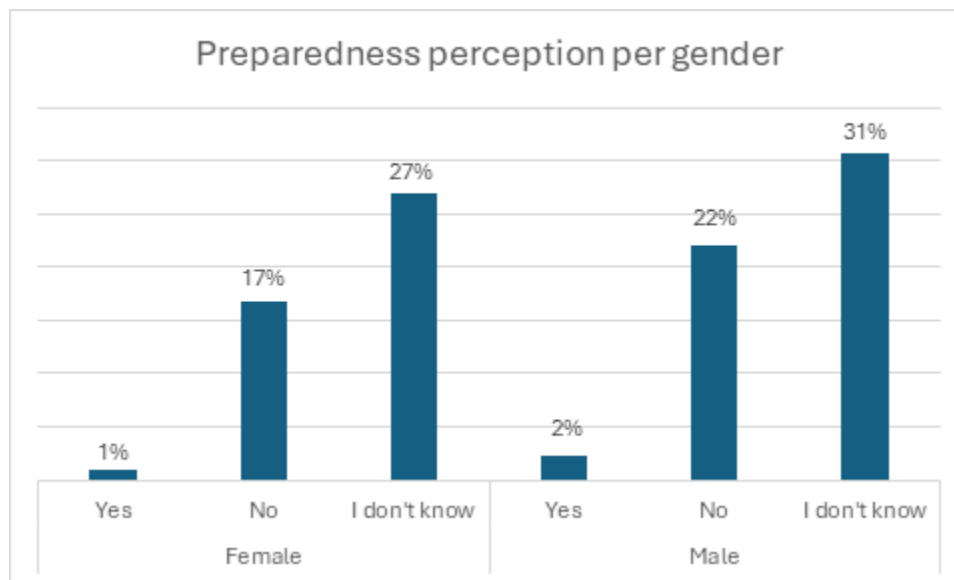


Figure 29. Gender-based perceptions of emergency preparedness

Analysis of perceived preparedness levels reveals gender disparities in how rural Lezha residents evaluate their readiness to respond to emergencies (Figure 29). The data indicates extremely low levels of perceived preparedness across both genders, with only 1% of female respondents and 2% of male respondents feeling adequately prepared to react to various circumstances based on received information. This negligible difference between genders in positive responses suggests that the overall emergency preparedness system is failing to instil confidence in residents regardless of gender, pointing to issues in information dissemination and preparedness training.

The distribution of negative responses and uncertainty provides further insights into gender-specific perceptions. While 17% of females and 22% of males definitively state they are not prepared, an even larger proportion of 27% of females and 31% of males express uncertainty about their preparedness level. These findings suggest that gender roles in rural Albanian society may be less influential in shaping preparedness perceptions than other factors. The data underscores a need for more effective, gender-

inclusive preparedness initiatives that can transform uncertainty and negative perceptions into confident readiness across all demographic groups.

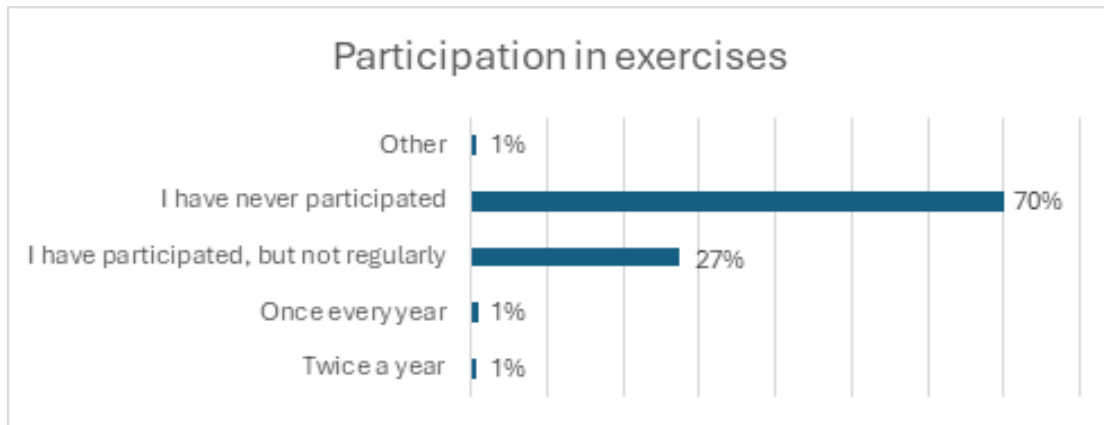


Figure 30. Participation in exercises to practice responding to early warning information

Regular training exercises can play an important role in improving the ability to respond to early warning information. However, when respondents were asked about their participation in such exercises, 70% reported that they had never taken part in them (Figure 30). Another 27% said that they had participated but not on a regular basis, and only 2% said they participate once or twice a year. The ability to respond promptly and effectively to early warning information is closely linked to regular training and practice. A lack of access to or participation in these exercises can significantly hinder the ability to act on early warning information. It appears that respondents in our target area largely lack opportunities to access such exercises.

When analysing disaggregated data, it becomes evident that the lack of training exercises to prepare for acting once this information has been received is not connected to age group, gender, or location. It is rather a general situation faced by these communities who are considerably lacking regular training opportunities to enable them to act once information has been received.

Using an open-ended question, respondents were asked to describe factors that contribute to delays or an inability to take necessary actions when they understand that a potential emergency or disaster is approaching. A significant number of respondents identified lack of awareness and education as the main factor. This was followed by issues related to insufficient or unreliable information.

Another major challenge faced by these communities is a lack of financial resources and their distance from urban centres. As described in Section 5.5, a safe environment (aid, shelter, and other types of support) is concentrated in urban centres, and traveling to urban centres requires specific vehicles which are not available to many residents in these areas while taking such a trip is also costly. This, when combined with inadequate

infrastructure and technology as expressed by respondents, creates a situation where communities struggle to prepare for and act on early warning information. The combination of these factors, lack of awareness, insufficient information, limited access to technology, limited financial resources, and poor infrastructure, prevents these communities from taking the necessary actions in a timely manner.

Respondents have described factors as follows:

“Lack of financial means, shelter for the family and livestock” - says RV from Balldren.

“As a teacher, we receive information from the General Directorate. Gaps in education, awareness, and exercise are our main challenges in acting on the information we receive” - says AH, teacher in a local public school, during the stakeholders meeting.

“Lack of internet access and phone network” - says PS from Shëngjin.

4.5. Humanitarian aspect

Humanitarian support is extremely important before, during, and after emergencies. This humanitarian support can come from public organizations, non-profit and humanitarian organizations, private businesses, as well as other sources. Because of its importance, this research has dedicated an entire section of the survey, and consequently report, to the humanitarian aspect.

Respondents were asked if they are able to access timely and adequate humanitarian aid and assistance during and after natural disasters or emergencies, such as alternative shelter, food aid, medicine, etc. Only 15% of respondents answered that they are able to access adequate humanitarian aid and assistance (Figure 31) while 33% answered they are not able to access such aid and support, and 52% said that they are not sure about having access to this type of support.

To gain a better understanding of the local situation, respondents were asked to describe the challenges they face in accessing support. In this open-ended question, they had the possibility to describe any barriers they may have encountered. The majority of respondents reported that they do not receive information about available humanitarian support, and many noted that the infrastructure in their area is not favourable for them to reach sites where such support or aid is being provided. They explained that most aid is concentrated in urban centres, making it difficult for them to travel to these locations and access the assistance. A lack of information coupled with inadequate infrastructure, prevents these communities from accessing the humanitarian support they need.

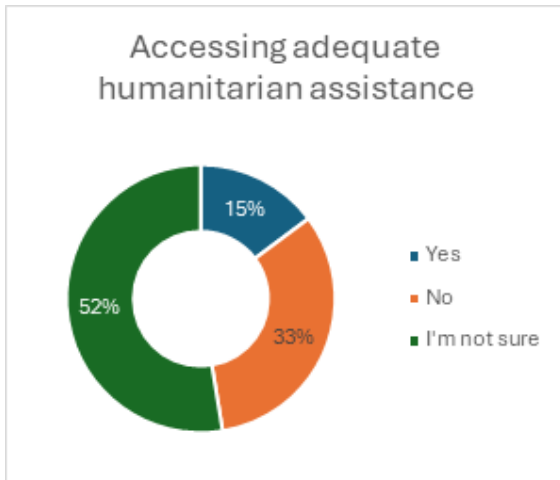


Figure 31. Ability to access timely and adequate humanitarian aid and assistance during and after natural disasters or emergencies



Figure 32. Resilience in coping with the aftermath of extreme events

In a general situation where communities in Lezha are experiencing an increased frequency and duration of extreme events and emergencies, building resilience, especially within last-mile communities is of utmost importance. Target communities have been asked how resilient they feel they are in coping with the aftermath of extreme events. As seen in Figure 32, only 16% say that they feel somewhat resilient while 84% say that they are between neutral to not resilient, with the higher response rates of 34% expressing themselves as not resilient.

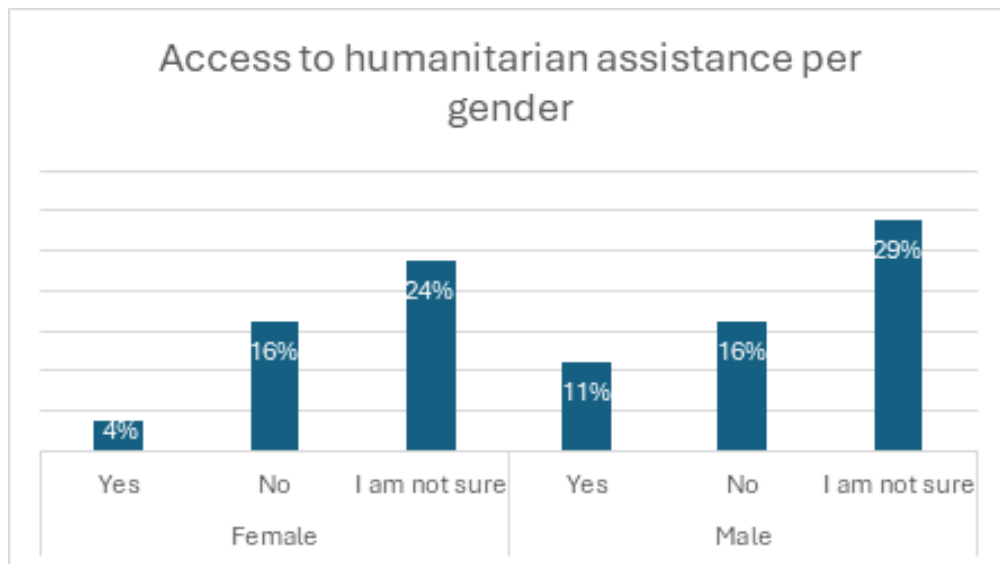


Figure 33. Access to humanitarian aid per gender

Analysis of humanitarian assistance accessibility reveals significant gender-based disparities and a concerning level of uncertainty across both male and female

populations in rural Lezha (Figure 33). The data shows that only 4% of female respondents and 11% of male respondents definitively confirm their ability to access timely and adequate humanitarian aid during and after disasters. This gender gap in assured access to critical resources such as shelter, food aid, and medicine points to potential systemic inequalities in aid distribution mechanisms or gender-specific barriers that disproportionately affect women's ability to receive assistance.

Perhaps most striking is the high level of uncertainty regarding aid access, with 24% of female respondents and an even higher 29% of male respondents indicating they are “not sure” about their ability to access humanitarian assistance. This widespread uncertainty, coupled with the substantial proportions who definitively state they cannot access aid (16% for both genders), suggests a critical lack of clarity and confidence in humanitarian response systems.

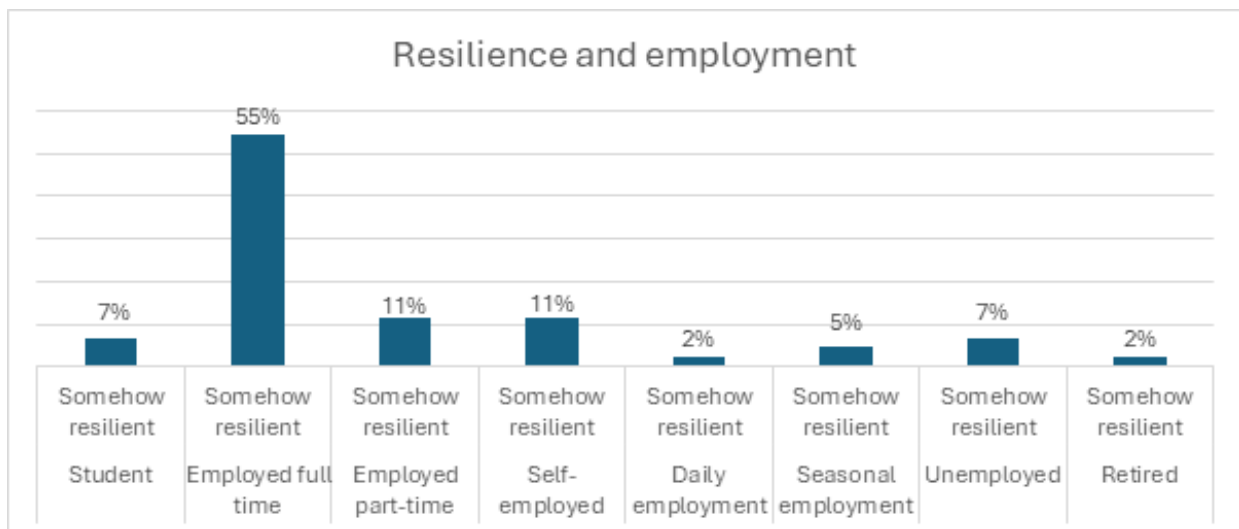


Figure 34. Employment status of respondents that feel “somewhat resilient”

The data presented in Figure 34 shows correlation between employment status and perceived resilience in the face of extreme events. Full-time employed individuals represent the highest proportion of those feeling somewhat resilient at 55%, significantly outweighing all other employment categories. This substantial disparity suggests that stable, consistent employment serves as a crucial foundation for building resilience against disasters in rural Lezha. The security of regular income likely translates into better access to resources, information, and the financial flexibility to prepare for and recover from extreme events, thereby enhancing overall resilience.

Self-employed and part-time employed individuals show identical resilience levels at 11% each, markedly lower than their full-time employed counterparts but higher than other categories. This middle-ground position potentially reflects the double-edged

nature of these employment types in rural contexts, offering some financial stability but with greater vulnerability to disruption during disasters. The notably low resilience levels among the unemployed (7%), seasonal workers (5%), and daily workers (2%) underscore the critical role of stable employment in building disaster resilience. These findings suggest that economic precarity significantly undermines individuals' capacity to cope with extreme events, highlighting the inextricable link between financial security and disaster preparedness in these communities.

Based on disaggregated data, males appear to be the least resilient, while women are the most uncertain about their level of resilience. Among respondents who described themselves as somewhat resilient, men tend to express more confidence in their resilience compared to women. However, the difference is minimal, so it is not possible to attribute the feeling of self-resilience or the lack thereof to belonging to a certain gender. When considering the resilience of these communities, it is important to address their needs collectively, as the requirements are consistent across different age groups and genders.

In high-income economies, non-profit and humanitarian organizations play a crucial role in community preparedness and support before and after extreme natural events. This research aimed to determine if the same applies to organizations in Albania, particularly in Lezha. Respondents were asked whether they or anyone in their community had received training or support from humanitarian organizations on disaster preparedness or response.



Figure 35. Received training from humanitarian organizations on disaster preparedness or response

The results show a significant gap with 81% of respondents answering they have not, 16% unsure, and only 3% confirming that they had received such training or support (Figure 35). This indicates an opportunity for non-profit and humanitarian organizations,

local, national, and international to address this gap and provide training for local communities in enhancing disaster preparedness and response efforts in the area.

To understand the types of support that these communities need, an open-ended question was posed asking which aspects of the support they have received are helpful or otherwise lacking. Most respondents indicated that they had not received any support. However, some noted that financial assistance is crucial when dealing with extreme natural events. One respondent highlighted the important role of the military in providing support during and after such events, proving that there is military involvement not only in the different stages of emergency management but also in supplying humanitarian aid. Additionally, another respondent suggested that establishing a designated meeting point for people to bring their livestock and collect food parcels would be beneficial.

Here are some answers provided by respondents:

“At local levels, lack of cooperation and coordination between institutions and poor awareness of the importance of cooperation” - says FT from Shënkoll.

“The fact that the military is the first to support us is helpful” - says EH from Balldren.

“We need cash and material help” - says FG from Shëngjin.

4.6. General feedback from last-mile communities in rural Lezha

The last section of the survey questionnaire contained only open-ended questions aimed at gathering any recommendations coming directly from these communities.

Respondents were asked for suggestions on what could be done to overcome barriers to accessing, understanding, and acting on early warning information. The main recommendation from these communities is to focus on awareness and education campaigns. They believe organizing local information and awareness campaigns is important in helping each community member learn how to access such information, better comprehend it, and what actions are needed in specific circumstances. Additionally, the development and distribution of educational materials containing information about risks and appropriate actions are seen as important measures to help address these barriers.

Organizing regular, targeted training sessions for the community at least once a year can significantly help local residents overcome these barriers. Such training has multifaced

benefits. They would not only improve communities' ability to deal with early warning information but also improve interactions between communities, local authorities, and non-profit organizations. Regular training improves communication, strengthens community relationships, and ensures that everyone is better prepared for potential emergencies.

Infrastructure and information technology have an important place in the recommendations from local communities. Specifically, improving mobile phone networks and internet access is crucial for real-time information access. Additionally, developing mobile applications in Albanian language or other resources that provide quick access to information, as well as using social media networks, can significantly improve their ability to access, understand, and act on early warning information.

Community involvement is also seen as an important factor for improving engagement with early warning information. Encouraging local communities to participate in meetings focused on risk and prevention, as well as raising awareness on these topics, can significantly benefit these communities. Additionally, some respondents suggested forming and training local volunteer groups that could be activated during emergencies. These groups could play a vital role in supporting agencies and organizations in implementing security measures and providing support before, during, and after emergencies.

Further, respondents from the targeted areas were asked what resources or support they thought would improve their community's participation and engagement in the early warning system.

It is evident that a face-to-face approach remains extremely important for these communities. Most respondents suggest organizing regular meetings with and within the community to discuss various topics related to extreme natural events, with topics ranging from risks and prevention, to sharing experiences and lessons learned. These meetings can be coupled with occasional training for the community to help them access, comprehend, and act on information received.

Technology and social media remain crucial means of communication with these communities. The use of social media and the creation and use of mobile applications in Albanian language to disseminate early warning information have been suggested to increase access and use by the community. This nevertheless needs to be addressed with clear and reliable information. Regular, clear, and straightforward communication from local, regional, and national authorities directed to share information about

potential risks, prevention measures, and warnings is seen as very important by these communities.

Among respondents, engagement of local organizations and community members has a significant importance. Many suggest that local organizations, schools, businesses, and local leaders (in Albanian called the “*village elderly*”) should be involved in organizing regular meetings, distributing, promoting, and implementing early warning information.

DK from Shëngjin suggests: “*Closer communication with local residents.*”

SL from Shënkoll says: “*Strengthening cooperation and coordination between different institutions, including local authorities, emergency response agencies, public health, and the local community.*”

NG from Balldren says: “*Information sources, financial means, and communication channels for real-time information.*”

AK confirms this during the stakeholders meeting by saying: “*The most important thing is to provide clear, concise, and reliable information, which can be understood by everyone. Providing clear and understandable information leads to trust in the community. This will make community members themselves interested in attending workshops and trainings regarding this topic.*”

KS and SG from Balldren suggested: “*Clearer and more structured information*” and “*More cooperation with public institutions, such as the Municipality of Prefecture.*”

Lastly, respondents have been asked to suggest improvements for humanitarian organizations or government agencies to better support them and their communities during emergencies or disasters. Increasing the number of volunteers is the most suggested matter. Whether it is to help distribute aid, organise training programs, or be more present at the local level, involving more volunteers is seen as an effective way to better reach communities.

More awareness-raising and training activities take a large portion of respondents’ suggestions. The perception of these activities is that they will strengthen cooperation and communication between these organizations and local communities. In addition, these initiatives will involve the local community in a more direct way.

The role of public agencies and humanitarian organizations has also been emphasized as important in involving local communities during the planning phase of emergency management. In addition, they can support the creation of local security committees that

at the same time will help community involvement, better and quicker communication within communities, and more direct and clear communication between communities and public authorities.

Organizations and institutions should create close partnerships with the local community” - says FG from Shënkoll.

“Involving more volunteers”, and “Having more volunteers in the distribution of humanitarian aid” - say MD and from Balldren.

“Raising awareness among residents for the importance of protection from natural disasters” - says BB from Shëngjin.

“They can take steps to encourage active community participation in the development of emergency plans, including the creation of a local security committee” - says AQ from Balldren.

“To create safe places for community evacuation when natural disasters occur” - says KC from Shëngjin.

5. Discussion, Implications, and Potential Limitations

Effective dissemination of early warning information is essential for everyone exposed, and vital for last-mile communities which often have a lower level of resilience and a high level of exposure. Early warning systems are particularly crucial for last-mile communities, as they are often the most vulnerable to natural hazards and can benefit immensely from timely and accurate information tailored to their specific contexts and needs (Briceno, 2008).

Almost half of respondents say that they do not receive early warning information (46%), while the vast majority (89%) rate access to this information as only somewhat accessible to not accessible at all. This data shows that a high number of this research’s targeted population faces significant barriers in receiving or proactively accessing early warning information. While this information might be available to the public, the current channels used for providing such information are not adept at transmitting effectively this information to these communities and providing it on time. There is an urgent need to implement new systems that allow last-mile communities to receive this information

promptly when a warning is issued, while also providing regular updates that can be easily accessed by them. Television and social media are the two main channels through which respondents receive such information. Therefore, TV channels and reliable social media pages (whether from public institutions, non-profits, or private entities) need to adapt their technology and capacities not only to provide accessible early warning information but also to provide it promptly.

Comprehending early warning information allows individuals and communities to take the necessary steps when an extreme event or disaster is approaching. This helps individuals and communities build and improve resilience, which can help save lives and property. This research data shows that almost half of respondents (46%) consider their understanding of such information from neutral to poor. A barrier preventing their comprehension appears to be the way this information is communicated, which is described as not clear and understandable. This is further exacerbated by limited access to information sources and misinformation. Providing reliable and diversified channels for communicating this information, along with tailoring the language in which early warning information is provided to last-mile communities can improve these communities' comprehension. Television and social media channels can be combined with printed materials and used as means to distribute information. Furthermore, the amount of information can be reduced by making it clearer and more straightforward, and the language used can be less technical or scientific, allowing individuals from different backgrounds and education levels to understand it.

The ability to act based on early warning information is directly linked with preparedness. This research shows a significant lack of preparedness in targeted communities, with 94% saying that they have not taken any measures to prepare for emergencies. This is also supported by their general perception of this matter, with only 8% of respondents feeling adequately prepared. Training, workshops, and exercises can help build preparedness and improve the ability to act on information about a potential emergency approaching. With 70% of respondents reporting never taking part in training exercises, there is a clear need for wide-scale involvement of these communities in these types of exercises.

Established frameworks that include various stakeholders, such as public institutions, humanitarian or non-profit organisations, and private businesses help improve humanitarian aid and support. A very small number of respondents are able to access adequate humanitarian assistance (15%), while only 16% of respondents identify themselves as resilient. As discussed above, resilience can be enhanced by adequate preparedness, which in turn can be created by appropriate training and exercises. Most respondents (81%) report that they have not received training on disaster preparedness

or response. Successful examples taken from high-income economies demonstrate that this gap can be filled by non-profit or humanitarian organizations.

Published authors have suggested that the development of effective early warning systems should take into account the unique socio-economic and cultural factors present in last-mile communities to facilitate better engagement and response strategies, as leveraging local insights can greatly enhance the reliability and effectiveness of these systems in mitigating disaster impacts (Shi et al., 2020). Non-profit organisations in general and humanitarian organizations in particular, have the ability and capacities to work closely with last-mile communities, tailoring training programs to address local needs while relying upon a deeper knowledge of the local socio-economic and cultural circumstances. The research community, through studies such as this, can support identifying concrete needs and providing recommendations that can support these organizations in tailoring training materials. Access, understanding, and action on early warning information from last-mile communities should not be seen as an isolated task of one agency or organization, but rather, as a joint effort between public institutions, the research community, volunteers, non-profit organisations, and private businesses, to provide these communities with what they need to become more resilient.

This research has tried to provide a platform where last-mile communities can not only describe their experience but also express their needs and first-hand recommendations. Respondents from these communities themselves are aware of the need for more information, so the main suggestion from them is to direct more focus towards awareness raising and education campaigns. Along with these, targeted and regular training sessions not only improve communities' ability to deal with early warning information but also improve interactions between communities, local authorities, and non-profit organizations. Trusted sources providing clear and reliable information are also needed to access, understand, and act on early warning information. In particular, for last-mile communities in Lezha, the best tools for disseminating information are television channels, social media networks, mobile apps in Albanian language, and face-to-face meetings.

Further, the role of community volunteers has been suggested as an important factor. Whether it is to help distribute aid, organise training programs, or be more present at the local level. Volunteer groups can be organized and trained by both governmental agencies and non-profit organizations, to be subsequently deployed in various areas. Working together with local communities, these volunteers can understand, report back, and adapt curricula or assistance provided in continuously changing local circumstances.

The results of this research underline a wide range of gaps and challenges of Lezha County's last-mile communities in accessing, comprehending, and acting on early warning information. Based on these findings and results, recommendations aimed at creating a more inclusive early warning system can be directed to all actors – public institutions, the research community, non-profit and humanitarian organizations, and private businesses:

1. *Diversified information channels and use of a simpler language.* A combination of television broadcasts, social media pages, mobile applications in Albanian language, and written and printed materials are information channels and tools that can be used to target community members from all backgrounds making such information more accessible. Attention should be paid to using clear and straightforward language that can be easily understood. It is also extremely important to help these communities distinguish reliable and trustworthy sources of information. The role of public authorities can vary from creating dedicated social media channels to providing grants for television channels to adapt their technology to reach last-mile communities. Non-profits and public authorities in collaboration with research institutions can create and deploy new technologies, as well as tailored communication strategies.
2. *Training exercises, awareness raising, and educational programs.* Humanitarian organizations can collaborate with local authorities and educational institutions to prepare targeted and regular training exercises aimed at increasing preparedness and building resilience within these communities. Furthermore, wider awareness campaigns can be organised by volunteers to attract community members and build interest by explaining the importance of early warning information. These activities will ultimately help build resilience among these local communities.
3. *Community engagement.* Last-mile communities remain loyal to a face-to-face approach. Regular meetings between various actors can on one side help them understand the importance of an early warning system, while on the other hand, help encourage community engagement and participation in training, exercises, awareness-raising, and educational activities. Members from the local community can also be engaged in forming volunteer groups that can help access early warning information for people with limited access to technology, assist vulnerable community members during extreme events, help distribute aid, and provide a point of contact for local communities.
4. *Humanitarian aid and assistance.* Humanitarian and non-profit organisations in collaboration with public institutions can help with humanitarian assistance,

establish gathering points during and after events, and improve aid distribution and support in rural areas and last-mile communities. Coordinated humanitarian support can help improve resilience in these communities.

This research provides important data related to challenges in accessing, comprehending, and accessing early warning information from last-mile communities in Lezha County, Albania. While this sample is representative and this research is the first of its type in the area, it is important to mention limitations in the broader context. The study is based on a specific geographic scope, utilizing a non-probability sampling technique, which means that findings may not represent other areas. In addition, data gathered present individual respondents' experiences, whose perception about the same event can be overestimated or underestimated. Therefore, these findings cannot be generalized but they provide a baseline to help analysing communities with similar socio-economic, geographic, cultural, and disaster-prone contexts. Furthermore, this research captures these communities' experiences up to the time of the survey implementation. Repeating the same research over time and in different areas can help understand trends in last-mile communities' access, comprehension, and action on early warning information.

6. Conclusion

The findings of this research highlight significant challenges and barriers that last-mile communities in Lezha Country face in accessing, comprehending, and acting on early warning information. This research underlines the urgent need for an all-round improvement of the early warning system. Although information may be available, findings demonstrate that it is challenging for these communities to access and comprehend it. These barriers lead already disadvantaged communities more exposed to disasters, leaving them highly vulnerable.

The vast majority of respondents have not taken any measures to prepare for emergencies. This points to a concerning lack of preparedness, which further exacerbates their vulnerability leading to their inability to respond and being worse affected by these events. Furthermore, limited participation in training, awareness-raising, and educational activities isolates these communities even further, making them even less resilient.

Limited access to humanitarian aid, assistance, and support, described as concentrated in urban centers or because of lack of information, leaves these communities more exposed and vulnerable to emergencies. Needs for such support nevertheless are widespread,

from support in providing training and education before a disaster occurs, to financial and material aid after such events.

To address these challenges, better cohesion between various actors should be created. Research organizations, public institutions, private businesses, and non-profit and humanitarian organizations can work towards more inclusive strategies and activities to ensure timely access to early warning information, better comprehension, and increased preparedness to act. Improved communication, reliable and diversified sources, and clear language can improve information dissemination and accessibility. Awareness-raising campaigns, educational materials, community meetings, and community-led initiatives can improve understanding of the information received. Training exercises and humanitarian support can help increase preparedness and action before the outset of disasters.

This research is intended to be a valuable source for policymakers, researchers, community leaders, and non-profit and humanitarian organizations. Inclusive strategies and targeted interventions built by a collaboration of multiple actors will empower last-mile communities to protect their lives and livelihoods and to become more resilient.

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Annex I. Survey questionnaire in English

Thank you for participating in our survey. Your input is crucial for understanding the barriers faced by last-mile communities in rural Lezha, Albania, in accessing, comprehending, and acting on early warning information. Your responses will be kept confidential and will only be used for research purposes. Please answer the following questions to the best of your ability.

Part I - General

1. Questionnaire serial number*:
2. Date*:
3. Start time*:
4. GPS Location*:
5. Did the person refuse to answer *:
 - a. Yes
 - b. No

Part II - Interviewee profile

6. Name: _____
7. Telephone number: _____
8. Gender:
 - a. Female
 - b. Male
 - c. Other (please specify): _____
9. Age group:
 - a. 18 - 27
 - b. 28-37
 - c. 38-47

- d. 48-57
- e. 58 - 67
- f. 68 - 77
- g. 77+

10. Highest educational level achieved:

- a. Primary school
- b. Eight-/nine-year school
- c. Secondary school
- d. Professional school/ professional certificate
- e. University studies (Bachelor, etc.)
- f. Post-graduate studies (Masters, etc.)
- g. Other (please specify): _____

11. Employment status:

- a. Student
- b. Employed full time
- c. Employed part-time
- d. Self-employed
- e. Daily employment (whenever given the opportunity)
- f. Seasonal employment
- g. Unemployed
- h. Retired
- i. Other (please specify): _____

Part III. Accessing early warning information

12. Do you receive early warning information about potential natural disasters or emergencies?
 - a. Yes
 - b. No
 - c. I don't know

13. Are you aware of the sources from which you can receive or search for early warning information?
 - a. Yes
 - b. No [If selected, move to question 16]
 - c. I don't know [If selected, move to question 16]

14. On a scale of 1 to 5 how easy is it for you to access early warning information?
 1. Very accessible
 2. Somewhat accessible
 3. Neither accessible nor not accessible
 4. Not very accessible
 5. Not accessible at all

15. How do you usually receive early warning information about potential natural disasters or emergencies in your community? [*Select all that apply*]
 - a. Radio broadcasts
 - b. Television broadcasts
 - c. SMS/Text messages
 - d. WhatsApp, Viber, or other communication apps
 - e. Phone calls
 - f. Community meetings
 - g. Social media platforms (e.g., Facebook, Twitter)

h. Other (please specify): _____

16. What barriers do you encounter in accessing early warning information in your community?

Part IV. Comprehending early warning information

17. How well do you understand the early warning information received?

- a. Excellent
- b. Good
- c. Neutral
- d. Fair
- e. Poor
- f. I don't know

18. Is the early warning information communicated in a clear and easily understandable manner?

- a. Yes
- b. No
- c. I don't know/ I have never received early warning information

19. Are there any specific aspects of the information that are particularly challenging to comprehend?

- a. Yes (please specify): _____
- b. No

20. What factors contribute to difficulties in understanding early warning information?

- a. Very large amount of information
- b. Difficulty finding information sources

- c. Limited access to the Internet or media
- d. Other (please specify): _____

21. Do you utilize additional resources or support to enhance your understanding of early warning information?

- a. Yes (please specify): _____
- b. No

22. What types of resources or support would you find helpful in improving your comprehension?

Part V. Acting on early warning information

23. Have you taken any measures to prepare for potential emergencies or disasters upon receiving early warning information?

- a. Yes (please specify): _____
- b. No

24. When you receive early warning information or otherwise understand that a potential emergency is approaching, what specific actions do you typically take to mitigate risks and protect yourself and your family? [*Check all that apply*]

- a. Stock up on food and water
- b. Evacuate to a safer location
- c. Secure important documents and belongings
- d. Seek shelter
- e. Inform neighbours/ family members
- f. Other (please specify): _____

25. Are there any obstacles or challenges that hinder your ability to implement preparedness measures in response to early warnings?

- a. Yes (please specify): _____
- b. No

26. Do you feel adequately prepared to react in various circumstances based on the information received?

- a. Yes
- b. No
- c. I don't know

27. To what extent do you participate in exercises to practice responding to early warning information?

- a. More than twice a year
- b. Twice a year
- c. Once every year
- d. I have participated, but not regularly
- e. I have never participated
- f. Other (please specify): _____

28. What factors contribute to the delay or inability to take necessary actions based on your understanding that a potential emergency or disaster is approaching?

Part VI. Humanitarian aspect

29. Are you able to access timely and adequate humanitarian aid and assistance during and after natural disasters or emergencies (such as alternative shelter, food aid, medicine, etc.)?

- a. Yes
- b. No
- c. I am not sure

30. What barriers or challenges do you encounter in accessing such support??

31. How satisfied are you with the support provided by humanitarian organizations during and after extreme events?

- a. Very satisfied
- b. Somewhat satisfied
- c. Neutral
- d. Somewhat dissatisfied
- e. Very dissatisfied
- f. I don't know

32. How satisfied are you with the support provided by government agencies during and after extreme events?

- g. Very satisfied
- h. Somewhat satisfied
- i. Neutral
- j. Somewhat dissatisfied
- k. Very dissatisfied
- l. I don't know

33. What aspects of the support received do you find helpful or lacking?

34. How resilient are you in coping with the aftermath of extreme events?

- a. Very resilient
- b. Somehow resilient
- c. Neither resilient nor not resilient

- d. Somehow not resilient
- e. Not resilient
- f. I don't know

35. Have you or anyone in your community received training or support from humanitarian organizations on disaster preparedness or response?

- a. Yes (please specify): _____
- b. No
- c. I am not sure

Part VII. Overall feedback

36. In your opinion, what could be done to overcome the barriers to accessing, comprehending, and acting on early warning information?

37. What resources or support do you think would improve your and your community's participation and engagement with early warning systems?

38. What improvements do you suggest for humanitarian organizations and/ or government agencies to better support you and your community during emergencies or disasters?

39. Would you like to add anything related to your personal, your family's, or your community's access, understanding, and acting on early warning information?