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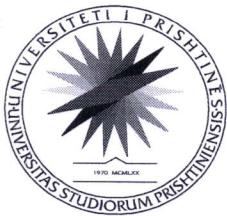
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EVALUATION REPORT OF THE MANUSCRIPT OF THE MASTER THESIS

FACULTY OF CIVIL ENGINEERING		
Department/ Programme	HYDROTECHNICS	IWRM
Project proposal	<i>Flood Risk and Community Engagement in Kosovo: An Integrated Water Resources Management Perspective</i>	
Candidate	BSc Burim Seferi	
Mentor	Prof. Dr. Laura Kusari	
Approval of the project proposal in the Faculty Council	Date: 03/11/2025 Decision no.: 2626/1	
For the Master Thesis "Flood Risk and Community Engagement in Kosovo: An Integrated Water Resources Management Perspective", submitted by the candidate Burim Seferi, the evaluation committee appointed by the Department of Hydrotechnics and approved by the Faculty Council of the Civil Engineering Faculty submits the following report. REPORT I. Master thesis analyses Master thesis "Flood Risk and Community Engagement in Kosovo: An Integrated Water Resources Management Perspective", by candidate BSc Burim Seferi, Hydrotechnical Department, IWRM program has a total 65 pages, including figures, tables, recommendations and literature references. Considering the increasing frequency and intensity of flood events caused by climate change, urbanization pressures, and governance challenges, the candidate has addressed a topic of considerable scientific and practical importance for Kosovo. The thesis focuses on examining the relationships between socio-economic vulnerability, flood exposure, community engagement, institutional factors, and household preparedness within the framework of Integrated Water Resources Management (IWRM). The research began with a comprehensive review of international and regional scientific literature related to flood risk, community resilience, disaster risk reduction, public health implications, governance challenges, and Nature-Based Solutions. The candidate critically examined contemporary approaches to flood risk management and identified significant research gaps in the Kosovo context, particularly regarding the social and institutional dimensions of flood resilience. The main objective of the thesis was to assess how socio-economic, institutional, and community engagement factors influence household flood preparedness and resilience in Kosovo. To achieve this objective, a quantitative research approach was employed using survey data collected from 299 households across the seven administrative regions of Kosovo. The collected data were analyzed using		



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advanced statistical techniques, including Binary Logistic Regression and Ordered Probit Regression models.

The specific objectives of the research included:

- Identifying socio-economic and institutional factors associated with household flood impacts;
- Examining the role of community engagement and institutional trust in shaping household preparedness for future flood events;
- Assessing the influence of hydrological exposure and socio-economic characteristics on flood risk perceptions;
- Providing evidence-based recommendations for improving flood risk management policies and practices in accordance with IWRM principles.

The thesis is logically structured and consists of the essential components of a scientific research study, including the introduction, literature review, methodology, results, discussion, recommendations, conclusions, and future research directions. The manuscript contains figures, tables, and statistical analyses that support the presentation and interpretation of the findings.

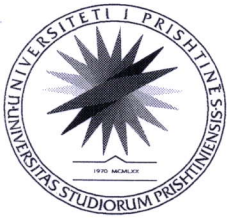
The results demonstrate that socio-economic and institutional characteristics significantly influence flood-related outcomes at the household level. Educational attainment, household size, participation in emergency communication networks, and perceptions of local authority preparedness were identified as statistically significant predictors of reported flood impacts. Furthermore, community cooperation, institutional trust, educational level, and participation in emergency communication groups were positively associated with higher levels of perceived preparedness for future floods.

In the discussion chapter, the candidate critically interprets the findings in relation to the existing scientific literature and highlights the importance of integrating social and institutional dimensions into flood risk management. The study emphasizes the need for more inclusive and participatory approaches to water resources management and disaster risk reduction.

Based on the research findings, the following main conclusions were reached:

- Flood vulnerability is determined not only by hydrological exposure but also by social and institutional factors;
- Community engagement and trust in institutions significantly enhance household preparedness and resilience;
- A considerable gap exists between risk awareness and practical preparedness measures at the household level;
- Effective flood risk management requires the integration of technical, social, and institutional approaches within the IWRM framework.

The thesis concludes with practical recommendations for national and local authorities, including strengthening emergency communication systems, increasing community participation in decision-making processes, improving institutional coordination, and integrating social vulnerability assessments into flood risk management policies



UNIVERSITETI I PRISHTINËS

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II. Evaluation of the Thesis

The thesis successfully achieves its stated objectives and provides well-founded answers to the research questions and hypotheses established at the beginning of the study. The literature review is comprehensive and relevant to the research topic, while the methodological approach is appropriate and scientifically sound. Statistical analyses have been conducted correctly, and the results have been interpreted critically and professionally.

The thesis represents a valuable contribution to the fields of flood risk management, disaster resilience, and Integrated Water Resources Management in Kosovo. It provides empirical evidence regarding the social and institutional determinants of flood resilience and offers useful recommendations for policymakers and practitioners involved in water and disaster management.

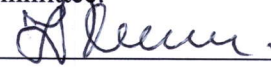
III. Proposal of the Evaluation Committee

The Evaluation Committee for the Master Thesis "Flood Risk and Community Engagement in Kosovo: An Integrated Water Resources Management Perspective" submitted by Burim Seferi concludes that the submitted manuscript fulfills the requirements established by the Law on Higher Education and the Regulations for Master Studies of the University of Prishtina.

Therefore, the Master thesis evaluation Committee notes that the submitted work meets the requirements set by the Law on Higher Education and the Regulations for Master Studies of the Faculty of Civil Engineering. Therefore, the committee proposes to the Council of the Faculty of Civil Engineering in Prishtina to approve this report and to continue the procedure for the public defense of the work.

Pristina, 18/06/2026

Committee:

1.  _____

Prof. Dr. Laura Kusari – mentor/

2.  _____

Prof. asoc. Dr. Lavdim Osmanaj – chairman/

3.  _____

Prof. Asoc. Dr. Naim Jerliu – member/

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Abstract

Flooding represents one of the most significant climate-related hazards in Kosovo, with increasing socio-economic and public health implications. This study examines the relationship between socio-economic vulnerability, hydrological exposure, community engagement, and household flood outcomes within the framework of Integrated Water Resources Management (IWRM). Using a quantitative cross-sectional design, household-level survey data were collected from 299 households across the seven regions of Kosovo, ensuring broad geographic representation of flood-prone and disaster-affected areas.

Binary logistic regression and ordered probit regression models were employed to analyze predictors of household flood impact and perceived preparedness.

The results indicate that socio-economic and institutional characteristics significantly influence flood outcomes. Educational level, household size, participation in emergency communication networks, and perceived readiness of local authorities were associated with reported flood impact. Furthermore, community cooperation, institutional trust, education, and membership in emergency communication groups were positively associated with higher perceived preparedness for future floods. In contrast, regional location did not demonstrate a significant independent effect after controlling for socio-economic and institutional factors.

The findings suggest that flood vulnerability in Kosovo is not determined solely by hydrological exposure but is strongly shaped by social and institutional dynamics. The study highlights the importance of integrating social vulnerability assessments, participatory governance mechanisms, and institutional trust-building strategies into national flood risk management policies. By linking hydrological risk with community engagement and public health considerations, this research strengthens the practical application of IWRM principles in Kosovo and supports evidence-based approaches to enhancing household-level resilience.

Keywords: Flood risk; IWRM; socio-economic vulnerability; community engagement; household preparedness.

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Abstrakti

Përmbytjet përfaqësojnë një nga rreziqet më të rëndësishme klimatike në Kosovë, me pasoja në rritje në aspektin socio-ekonomik dhe shëndetësor publik. Ky studim analizon marrëdhënien ndërmjet cenueshmërisë socio-ekonomike, ekspozimit hidrologjik, angazhimit të komunitetit dhe rezultateve të përmbytjeve në nivel familjar, në kuadër të Menaxhimit të Integruar të Resurseve Ujore (IWRM). Duke përdorur një dizajn kuantitativ ndër-seksional, të dhënat u mblodhën përmes një ankete në nivel familjar me 299 familje nga rajone të ndryshme të Kosovës, duke siguruar përfaqësim të gjerë të zonave të prekura dhe të rrezikuara nga përmbytjet. Për analizën e faktorëve parashikues të ndikimit nga përmbytjet dhe përgatitjes së perceptuar u përdorën regresioni logjistik binar dhe regresioni probit i renditur.

Rezultatet tregojnë se karakteristikat socio-ekonomike dhe institucionale ndikojnë ndjeshëm në rezultatet e përmbytjeve. Niveli arsimor, madhësia e familjes, pjesëmarrja në rrjetet e komunikimit emergjent dhe perceptimi për gatishmërinë e autoriteteve lokale u shoqëruan me ndikimin e raportuar nga përmbytjet. Për më tepër, bashkëpunimi komunitar, besimi në institucione, niveli arsimor dhe anëtarësimi në grupe komunikimi emergjent u lidhën pozitivisht me nivele më të larta të përgatitjes së perceptuar për përmbytje të ardhshme. Në të kundërt, lokacioni rajonal nuk rezultoi faktor i pavarur statistikisht pas kontrollimit të variablave socio-ekonomike dhe institucionale.

Gjetjet sugjerojnë se cenueshmëria ndaj përmbytjeve në Kosovë nuk përcaktohet vetëm nga ekspozimi hidrologjik, por formësohet në mënyrë të konsiderueshme nga faktorë socialë dhe institucionalë. Studimi thekson rëndësinë e integritetit të analizave të cenueshmërisë sociale, mekanizmave pjesëmarrës të qeverisjes dhe forcimit të besimit institucional në politikat kombëtare të menaxhimit të rrezikut nga përmbytjet. Duke lidhur rrezikun hidrologjik me angazhimin komunitar dhe aspektet e shëndetit publik, ky hulumtim kontribuon në forcimin e zbatimit praktik të parimeve të IWRM në Kosovë dhe mbështet qasje të bazuara në evidencë për rritjen e reziliencës në nivel familjar.

Fjalët kyçe: Rreziku nga përmbytjet; Menaxhimi i Integruar i Resurseve Ujore (IWRM); cenueshmëria socio-ekonomike; angazhimi i komunitetit; përgatitja në nivel familjar.

UNIVERSITY OF PRISTINA
“HASAN PRISHTINA”
CIVIL ENGINEERING FACULTY
Hydrotechnical Department - Integrated Water Resources Management
(IWRM)



Flood Risk and Community Engagement in Kosovo: An Integrated Water
Resources Management Perspective

Candidate:
Burim Seferi

Mentor:
Prof. Dr. Laura Kusari

Prishtina, 2026

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List of Abbreviations

CBDRR	Community-Based Disaster Risk Reduction
DRR	Disaster Risk Reduction
EU	European Union
GFDRR	Global Facility for Disaster Reduction and Recovery
HBDA	Household Building Damage Assessment
IPCC	Intergovernmental Panel on Climate Change
IWRM	Integrated Water Resources Management
NBS	Nature-Based Solutions
OECD	Organization for Economic Co-operation and Development
SDG	Sustainable Development Goal
UN	United Nations
UN DESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Program
UNDRR	United Nations Office for Disaster Risk Reduction
UNFPA	United Nations Population Fund
WASH	Water, Sanitation, and Hygiene
WHO	World Health Organization
WMO	World Meteorological Organization

Abstract

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Abstrakti

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Fjalët kyçe: Rreziku nga përmbytjet; Menaxhimi i Integruar i Resurseve Ujore (IWRM); cenueshmëria socio-ekonomike; angazhimi i komunitetit; përgatitja në nivel familjar.

1. Introduction

Floods represent one of the most destructive and recurrent natural hazards globally, increasingly intensified by climate change, uncontrolled urbanization, and inadequate land-use planning (Tellman et al., 2021). In Kosovo, climatic variability, aging infrastructure, and weak institutional coordination have heightened the frequency and impact of flooding events. The January 2023 floods, for instance, affected over 21,500 people across Mitrovica, Gjakova, and Skenderaj, causing extensive socio-economic and infrastructural damage (UNDP, 2023). This highlights both the scientific relevance and the urgent societal importance of the topic in the context of Kosovo. Despite national frameworks addressing water management, persistent challenges such as limited enforcement, fragmented institutional mandates, and low community preparedness continue to hinder effective flood governance. These conditions underscore the scientific and practical relevance of developing integrated, community-centered flood management approaches aligned with the principles of Integrated Water Resources Management (IWRM).

Both academic and societal needs justify this research proposal. Scientifically, it aims to fill a notable gap in empirical research on flood risk and community engagement in Kosovo, a field that remains underexplored in local literature. To the best of our knowledge, this study represents one of the first household-level quantitative assessments of flood resilience conducted in Kosovo. Practically, the study responds to the increasing demand for evidence-based policies that enhance resilience, strengthen community participation, and promote sustainable water governance. The proposed topic directly aligns national flood risk management strategies with global frameworks such as the Sendai Framework for Disaster Risk Reduction (2015-2030) and the Sustainable Development Goals (SDG 6 and SDG 13).

Recent disaster risk assessments conducted in Kosovo indicate that flood exposure is widely experienced at the household level. Survey findings show that approximately 61% of households live in areas perceived to be at risk of flooding, while around 51% report that their homes have previously been affected by flooding. These findings demonstrate that flood risk in Kosovo is not only a hydrological issue but also a widespread socio-economic challenge that directly affects communities and households.

Scientific Contribution of the Study

This study contributes to flood risk and disaster resilience research in Kosovo by integrating household-level socio-economic vulnerability, institutional trust, community engagement, and preparedness dimensions within the broader Integrated Water Resources Management (IWRM)

framework. While previous flood-related studies in Kosovo and the Western Balkans have primarily focused on hydrological hazards, infrastructure damage, and emergency response capacities, this research expands the analytical perspective by emphasizing the social and institutional determinants of household resilience.

The study further contributes by combining environmental risk considerations with community-centered preparedness indicators and institutional governance factors, highlighting the importance of public participation, communication networks, and local resilience capacities in flood-prone areas. In this regard, the research moves beyond traditional flood protection approaches focused primarily on structural measures and supports a more integrated and interdisciplinary understanding of disaster risk management.

Additionally, the study provides empirical household-level evidence from multiple municipalities in Kosovo using quantitative multivariate analysis, contributing context-specific findings that remain relatively limited within the regional IWRM and disaster risk reduction literature. The findings may support policymakers, local authorities, and disaster management institutions in developing more socially embedded, evidence-based, and community-oriented flood resilience strategies.

To provide a clear and systematic presentation of the research, the thesis is organized into eight chapters. Chapter One introduces the research problem, outlines the study's scientific and practical relevance, and presents the research objectives and contribution within the Integrated Water Resources Management (IWRM) framework. Chapter Two reviews the existing literature on flood risk, community engagement, governance, public health implications, resilience, and Nature-Based Solutions (NBS). Chapter Three presents the research methodology, including the study design, sampling strategy, data collection procedures, variable operationalization, and statistical analysis methods. Chapter Four presents the empirical findings obtained through descriptive and multivariate statistical analyses. Chapter Five discusses the findings in relation to previous literature and the broader IWRM and disaster risk reduction context. Chapter Six provides policy and practice-oriented recommendations at national and local levels, including recommendations related to Integrated Water Resources Management (IWRM) and GIS-based risk management approaches. Chapter Seven summarizes the main conclusions of the study, while Chapter Eight outlines limitations and directions for future research.

Figure 1. Structure of the Thesis

Introduction	Literature Review	Methodology	Results	Discussion	Conclusion & Future Research
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The structure of the thesis follows a logical progression, beginning with the theoretical and conceptual background, then the methodological framework, the empirical analysis, the interpretation of findings, and the final conclusions. This organization ensures clarity and facilitates understanding of the relationship between flood risk, community engagement, and Integrated Water Resources Management (IWRM) in Kosovo.

2. Purpose of the Study

The main purpose of this study is to assess the interrelationship between flood risk and community engagement within the context of Integrated Water Resources Management (IWRM) in Kosovo. The study aims to quantitatively analyze how hydrological conditions, socio-economic characteristics, community engagement, and institutional factors influence household preparedness and resilience to floods across multiple municipalities in Kosovo.

Specifically, the study seeks to:

- Identify the primary hydrological and socio-economic drivers of flood vulnerability at the household level.
- Assess the level of community preparedness and engagement in flood risk management activities.
- Examine the relationship between community engagement, local governance, and household resilience.
- Provide evidence-based recommendations for integrating community-based strategies into national and municipal flood management frameworks.

By linking flood risk assessment with social and governance dimensions, this research strengthens participatory approaches in disaster risk reduction and advances the application of IWRM principles in Kosovo.

2. Literature Review

2.1 Global Flood Risk

Floods are among the most common and devastating natural hazards worldwide (Fonseca Cerda, 2022). They affect millions annually and cause significant economic, environmental, and social damage. According to the World Meteorological Organization (WMO) (Petrochenko, 2023) the problem of flooding and analysis of the ways of its solution. Floods account for nearly 43% of all natural disasters globally, and their number continues to rise due to climate change and intensifying extreme weather events (Tellman et al., 2021).

Satellite data show a 20–24% increase in the global population exposed to flooding since 2000, highlighting the growing urgency of effective flood management strategies (Rogers et al., 2025). The drivers of flood risk are both natural and human induced. Extreme rainfall, rapid snowmelt, and sea-level rise increase the physical likelihood of floods, while unplanned urbanization, deforestation, and land-use mismanagement amplify community vulnerability (Khan et al., 2025). Urban growth often replaces natural floodplains with impermeable surfaces, reducing water absorption and increasing surface runoff, which leads to flash floods and higher disaster losses (World Bank, 2018).

Beyond direct physical devastation, floods precipitate disruptions to essential services, trigger economic downturns, and engender significant public health challenges, such as the proliferation of waterborne illnesses and the contamination of potable water supplies. Furthermore, the protracted effects of displacement and the depletion of personal assets can precipitate psychological distress within communities impacted by these events (Hartmann et al., 2019).

Therefore, global flood management approaches now emphasize resilience and adaptation, integrating structural measures with community-based strategies.

Recent scientific assessments confirm that climate change is intensifying global flood risk. The Intergovernmental Panel on Climate Change (IPCC, 2022) reports with high confidence that heavy precipitation events have increased in frequency and intensity across many regions due to rising global temperatures. Warmer atmospheric conditions increase moisture retention capacity, resulting in more extreme rainfall and higher flood probability.

Urbanization further exacerbates flood vulnerability. According to the United Nations Department of Economic and Social Affairs (UN DESA, 2019), over half of the global population now resides in urban areas, a proportion expected to increase significantly. Rapid urban expansion often replaces natural floodplains with impermeable surfaces, reducing infiltration and increasing

surface runoff. In informal settlements and low-income urban zones, weak infrastructure and inadequate drainage systems heighten exposure to flood hazards (Douglas et al., 2008).

Floods impose severe economic and developmental consequences. Annual global flood-related losses exceed USD 50 billion, with indirect economic effects frequently surpassing direct damages (World Bank, 2020). Hallegatte et al. (2017) emphasize that poorer households are disproportionately affected due to limited financial resilience, lack of insurance, and constrained recovery capacity. Consequently, flood risk increasingly intersects with poverty reduction and social equity concerns.

Disaster risk is not solely determined by physical exposure but also by socially constructed vulnerability (Wisner et al., 2012). The Global Assessment Report on Disaster Risk Reduction highlights that governance capacity, institutional coordination, and inequality significantly shape disaster outcomes (UNDRR, 2019). In response, global policy frameworks such as the Sendai Framework for Disaster Risk Reduction (2015–2030) advocate strengthening governance, enhancing early warning systems, investing in resilience, and promoting community participation (UNDRR, 2015). These principles align closely with Integrated Water Resources Management (IWRM), which promotes coordinated management of water, land, and related resources to balance environmental sustainability with social and economic development.

2.2 Community Engagement and Resilience

Community engagement is increasingly recognized as a cornerstone of sustainable flood risk management. Local communities are the first to experience flood impacts and possess critical knowledge about local hazards, resources, and vulnerabilities. Active participation in preparedness, early warning, and response efforts strengthens resilience and reduces disaster losses (Deng et al., 2019).

In this context, resilience refers to a community's ability to withstand, adapt to, and recover from flood events. According to McClymont et al. (2020), community resilience is contingent upon robust social capital, effective governance, equitable resource distribution, and the capacity to integrate lessons learned from past experiences.

Research shows that bottom-up approaches, in which communities are actively involved in decision-making and planning processes, tend to produce more legitimate and sustainable outcomes than purely top-down policies (Han & Kuhlicke, 2019). Practical tools such as household surveys, participatory mapping, and awareness campaigns help integrate local knowledge into municipal planning processes. For example, community-driven initiatives such as small-scale

drainage maintenance, riverbank protection, and locally coordinated early warning systems have reduced disaster losses in flood-prone regions (Anderson & Renaud, 2021).

However, without institutional support and long-term financing, these initiatives often lack sustainability, emphasizing the importance of coordination between communities and formal institutions. Integrated Water Resources Management (IWRM) promotes multi-level governance in which community participation plays a key role in ensuring the sustainability of water management strategies. By embedding local knowledge and collective action within water governance systems, IWRM enhances resilience to climate-related hazards such as floods.

Recent scholarship increasingly conceptualizes community engagement not only as participation but also as a determinant of adaptive capacity. According to Adger (2003), social capital, defined as networks, norms, and trust that facilitate coordination, plays a central role in strengthening collective resilience to environmental risks. Communities characterized by strong social cohesion and mutual trust are better positioned to mobilize resources, share information, and respond effectively during disaster events.

The concept of adaptive governance further highlights the importance of flexible and learning-oriented institutional arrangements that integrate community knowledge into formal decision-making structures (Folke et al., 2005). Adaptive governance emphasizes collaboration between public authorities, civil society, and local stakeholders, allowing policies and strategies to evolve in response to changing environmental conditions. In the context of flood risk management, this approach contributes to more effective early warning dissemination, evacuation planning, and post-disaster recovery coordination.

Community-based disaster risk reduction (CBDRR) has emerged as a widely endorsed strategy within global disaster governance frameworks. The United Nations Office for Disaster Risk Reduction (UNDRR, 2019) emphasizes that risk awareness and preparedness are most effective when local populations are directly involved in risk assessment and planning processes. Empirical studies demonstrate that participatory flood risk mapping and community drills significantly improve household-level preparedness and reduce mortality rates (Shaw, 2012).

Trust in institutions represents another critical dimension of resilience. Studies show that individuals are more likely to comply with evacuation orders, adopt preparedness measures, and engage in collective action when they perceive public authorities as competent and transparent (Siegrist & Zingg, 2014). Conversely, weak institutional trust can undermine early warning systems and reduce the effectiveness of formal disaster management policies.

Moreover, resilience must be understood as multidimensional, encompassing physical, social, economic, and psychological components (Cutter et al., 2008). Psychological resilience, including perceived preparedness and risk awareness, significantly influences behavioural responses during disaster events. Households that perceive themselves as prepared are more likely to take proactive protective measures and recover more rapidly following flood impacts.

Empirical evidence from Kosovo further supports this argument. A recent disaster risk reduction gap assessment conducted under the World Bank / GFDRR programme indicates that although awareness of emergency contact numbers among households is relatively high, only a small proportion report having a family emergency plan. This finding highlights a significant gap between risk awareness and practical preparedness at the household level. A growing body of research highlights the existence of a “knowledge–action gap” in disaster risk preparedness. While communities may possess general awareness of disaster risks and emergency procedures, this awareness does not always translate into concrete preparedness actions at the household level. Factors such as limited resources, lack of training, insufficient institutional support, and low perceived risk can prevent individuals from adopting practical preparedness measures (Paton, 2003; Becker et al., 2012). As a result, households may remain vulnerable despite having basic knowledge about disaster risks. Addressing this gap requires targeted community engagement strategies, including preparedness training, risk communication, and participatory disaster planning, which can help transform awareness into proactive behaviour and strengthen overall community resilience.

Within the IWRM framework, integrating community engagement mechanisms strengthens governance legitimacy and enhances the sustainability of water management interventions. Multi-level governance arrangements that connect municipal authorities, river basin organizations, and local communities facilitate knowledge exchange and coordinated action (Pahl-Wostl, 2015). Therefore, community engagement should not be considered a supplementary component but rather a structural pillar of integrated flood risk governance.

2.3 Flood Risk and Public Health Implications

Flood events represent not only hydrological and infrastructural challenges but also significant public health risks. Beyond immediate physical damage, floods are associated with increased incidence of waterborne diseases, vector-borne infections, injuries, and mental health disorders (Alderman et al., 2012; Du et al., 2010). Contamination of drinking water supplies, disruption of

sanitation systems, and overcrowding during displacement can lead to outbreaks of gastrointestinal and respiratory illnesses (WHO, 2018). The public health consequences of floods often extend beyond the immediate disaster phase. Studies have shown that affected populations may experience long-term psychological distress, including anxiety, depression, and post-traumatic stress symptoms (Fernandez et al., 2015). Vulnerability to these impacts is shaped by socio-economic status, housing conditions, and access to institutional support (Lowe et al., 2013). From a climate change perspective, the Intergovernmental Panel on Climate Change (IPCC, 2022) identifies flooding as a major climate-sensitive health risk, particularly in regions with limited preparedness and adaptive capacity. Therefore, strengthening household preparedness and community engagement is not only a matter of disaster risk reduction but also a public health protection strategy.

Community-based communication networks, early warning systems, and trust in institutions contribute to reducing health-related consequences by enabling timely evacuation, protection of essential supplies, and access to medical services (Saulnier et al., 2017). Integrating public health considerations into Integrated Water Resources Management (IWRM) frameworks enhances resilience by addressing both environmental and social determinants of vulnerability.

In the Kosovo context, where institutional capacity and community preparedness remain uneven, understanding the relationship between flood exposure, socio-economic vulnerability, and preparedness has direct implications for health system resilience and population well-being.

Flood-related health risks must also be understood within the broader framework of health system resilience. The World Health Organization defines resilient health systems as those capable of anticipating, responding to, and recovering from shocks while maintaining core functions (WHO, 2015). Flood events can overwhelm local health services through increased injury rates, contamination of healthcare facilities, medicine shortages, and interruption of emergency response systems. In regions with limited infrastructure capacity, these pressures can exacerbate pre-existing inequalities in healthcare access.

Moreover, flood vulnerability is closely connected to the social determinants of health, including income, housing quality, education, and access to social support networks. Lower-income households are more likely to reside in flood-prone areas and less likely to possess resources for rapid recovery (Hallegatte et al., 2017). Poor housing construction and inadequate sanitation

systems increase exposure to mold growth, contaminated water, and injury hazards. Thus, flood risk management intersects directly with public health equity.

Flood events frequently disrupt water supply and sanitation systems, increasing the risk of water contamination and waterborne diseases.

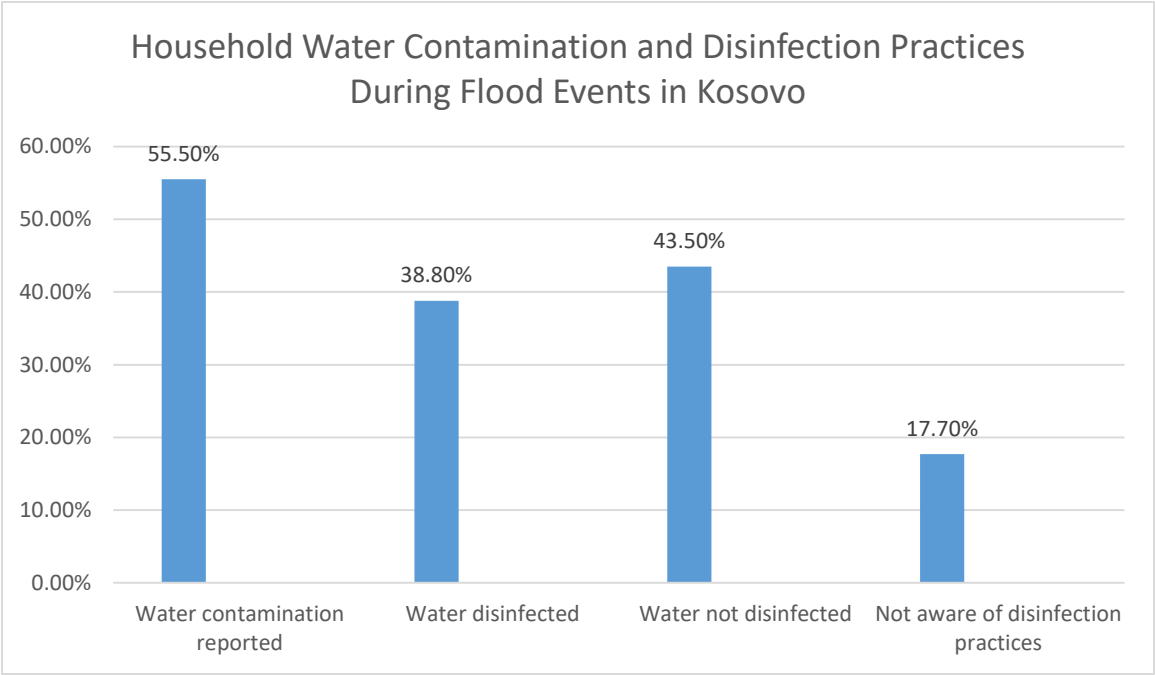


Figure 2: Household Water Contamination and Disinfection Practices During Flood Events in Kosovo

As illustrated in Figure 2, more than half of surveyed households report experiencing water contamination during flood events, while a considerable proportion do not disinfect drinking water or are unaware of appropriate hygiene practices. These findings highlight the importance of integrating WASH considerations into flood risk management and community preparedness strategies.

Beyond immediate physical health risks, flood disasters can also generate significant psychological and social impacts. Mental health consequences are increasingly recognized as one of the most persistent effects of flooding events. Prolonged uncertainty, displacement, and financial loss may contribute to chronic stress and psychological disorders among affected populations (Stanke et al., 2012). Perceived preparedness and trust in institutions can mitigate anxiety by increasing individuals’ sense of control and predictability during crisis situations.

Therefore, preparedness functions not only as a logistical mechanism but also as a psychological protective factor. From a policy perspective, integrating public health considerations into Integrated Water Resources Management (IWRM) strengthens multi-sectoral coordination between water management authorities, municipal emergency services, and healthcare institutions. Such integration ensures that flood preparedness planning includes the protection of water quality, the safeguarding of health infrastructure, the continuity of medical supply chains, and targeted support for vulnerable populations.

In Kosovo, where disparities in socio-economic conditions and institutional trust remain evident, incorporating public health considerations into flood risk governance can enhance both disaster resilience and long-term population well-being.

2.4 Governance and Institutional Challenges

Effective flood risk management requires strong governance systems ensuring national, municipal, and community coordination. In Kosovo, several laws and policies exist, such as the Law on Waters of Kosovo (No. 04/L-147, 2013), which provides a legal basis for water management and flood prevention.

Other related legislation includes:

- The Law on Environmental Protection (No. 03/L-025, 2009),
- The Law on Spatial Planning (No. 04/L-174, 2013), and
- The Law on Local Self-Government (No. 03/L-040, 2008).

While these frameworks are aligned with European Union directives, their implementation faces several obstacles:

Institutional fragmentation for overlapping responsibilities between ministries, municipalities, and agencies reduces efficiency.

Municipalities lack adequate technical and financial capacity to enforce regulations due to limited resources. Weak enforcement, illegal construction on floodplains, and poor maintenance of drainage systems remain widespread (Kosova 2.0, 2023).

The January 2023 floods exposed these weaknesses. In municipalities like Mitrovica, Gjakova, and Skenderaj, delayed responses and insufficient coordination increased damages and left many households unprepared (UNDP, 2023). Improving governance through integrated planning, transparency, and community participation is essential for sustainable flood management.

Beyond legislative alignment, governance effectiveness depends on institutional coordination, accountability mechanisms, and adaptive capacity. Multi-level governance theory emphasizes that flood risk management requires vertical coordination (national–municipal) and horizontal coordination (between sectors such as water, health, environment, and spatial planning) (Marks & Hooghe, 2004). In practice, fragmented authority structures often lead to duplication of responsibilities and policy gaps, particularly in decentralized systems.

The European Union Water Framework Directive (2000/60/EC) and the Floods Directive (2007/60/EC) promote integrated river basin management and risk-based planning approaches. Although Kosovo has harmonized several legal provisions with EU standards, implementation challenges remain due to limited technical expertise, insufficient monitoring systems, and constrained municipal budgets (World Bank, 2020). Effective compliance requires not only regulatory frameworks but also enforcement capacity and financial sustainability.

Decentralization presents both opportunities and risks. On one hand, local governments are closer to communities and better positioned to assess localized vulnerabilities. On the other hand, disparities in municipal administrative capacity can produce uneven levels of preparedness across regions (Smoke, 2015). This may explain why socio-economic and institutional factors at the household level remain more predictive of flood outcomes than geographic location alone.

Institutional trust also plays a critical role in governance effectiveness. According to OECD (2017), trust enhances compliance with risk reduction measures and facilitates cooperation between authorities and citizens. Weak transparency, politicization of resource allocation, and limited public participation can undermine governance legitimacy and reduce household preparedness levels.

Furthermore, governance challenges are often linked to urban planning deficiencies. Rapid urbanization without adequate spatial regulation increases exposure by permitting construction in flood-prone zones (UN DESA, 2019). In many transition economies, enforcement gaps enable informal settlements and infrastructure deficits that exacerbate disaster risk.

The January 2023 floods illustrate how governance weaknesses translate into tangible impacts. Reports highlighted delays in emergency coordination, insufficient early warning dissemination, and limited inter-municipal cooperation (UNDP, 2023). Strengthening governance therefore requires not only infrastructural investment but also improvements in planning integration, risk communication systems, and accountability mechanisms.

Within the IWRM framework, governance reforms should prioritize:

- Integrated basin-level planning

- Clear delineation of institutional responsibilities
- Capacity-building for municipal authorities
- Community-inclusive decision-making processes
- Transparent funding mechanisms for risk reduction

Embedding these elements into national water management strategies would enhance policy coherence and support long-term flood resilience.

2.5 Nature-Based Solutions (NBS)

Internationally, Nature-Based Solutions (NBS) are emerging as innovative, cost-effective approaches to complement traditional flood defenses. Examples include wetland restoration, river naturalization, and urban green spaces, which can absorb excess water, reduce runoff, and provide environmental co-benefits such as improved water quality and biodiversity (Hartmann et al., 2019; World Bank, 2018). In Kosova, the integration of NBS remains limited and primarily at the pilot project stage (Hessenberger & Popovicki, 2023).

Although this study does not directly measure NBS implementation, it acknowledges its potential as a future strategy for municipalities to consider alongside conventional infrastructure and community-based initiatives. Nature-Based Solutions (NBS) are defined by the European Commission (2015) as actions that are inspired and supported by nature, cost-effective, and capable of providing environmental, social, and economic benefits while increasing resilience. Unlike conventional “grey” infrastructure such as concrete embankments and drainage canals, NBS seek to restore natural hydrological processes and enhance ecosystem services.

In flood risk management, NBS function by increasing water retention capacity, reducing peak discharge, and slowing runoff velocities. Wetland restoration, reforestation of upstream catchments, riparian buffer zones, and green roofs in urban areas can significantly reduce flood intensity while simultaneously improving water quality and biodiversity (Kabisch et al., 2017). Research shows that combining green and grey infrastructure often produces more sustainable long-term outcomes than relying exclusively on structural defenses (World Bank, 2020).

From an Integrated Water Resources Management (IWRM) perspective, NBS align closely with basin-scale planning and ecosystem-based management principles. IWRM promotes coordinated land and water management, and NBS operationalize this by integrating ecological restoration with flood mitigation strategies (Pahl-Wostl, 2015). By restoring natural retention areas and

reconnecting rivers with floodplains, NBS contribute to both climate adaptation and environmental sustainability.

Beyond hydrological benefits, NBS generate important public health and social co-benefits. Urban green spaces reduce heat stress, improve air quality, enhance recreational opportunities, and support mental well-being (WHO, 2017). Therefore, NBS should be considered not only as flood control mechanisms but as broader resilience-building tools.

However, implementation challenges remain significant, particularly in transitional governance systems. NBS often require cross-sector coordination between environmental agencies, spatial planners, agricultural authorities, and municipal governments. Limited technical expertise, land ownership conflicts, and short-term political planning cycles may hinder large-scale adoption (Kabisch et al., 2017).

In Kosovo, where traditional infrastructure remains the dominant approach to flood management, NBS integration is still emerging. Pilot initiatives demonstrate potential, yet systematic incorporation into municipal spatial plans and river basin strategies remains limited (Hessenberger & Popovicki, 2023). Expanding NBS would require capacity-building, financial incentives, and integration within national IWRM and climate adaptation frameworks.

Although the present study does not directly measure NBS implementation, its findings on socio-economic vulnerability and institutional trust highlight the importance of participatory governance mechanisms that are essential for successful NBS adoption. Community involvement and institutional coordination represent foundational conditions for ecosystem-based flood management.

2.6 Kosovo Context and Evidence Gaps

Kosovo has experienced recurrent flood events over the past two decades, with increasing frequency and intensity linked to climate variability and land-use pressures. The January 2023 floods represent one of the most severe recent disasters, affecting approximately 21,500 people and 3,580 households across 11 municipalities, with Mitrovica, Gjakova, and Skenderaj among the most severely impacted (UNDP, 2023; UNFPA, 2023). The event caused extensive damage to housing, infrastructure, agricultural land, and public services.

Beyond physical destruction, the floods exposed structural weaknesses in governance, infrastructure, and preparedness systems. Reports identified inadequate drainage infrastructure, illegal construction in flood-prone areas, insufficient enforcement of spatial planning regulations, and weaknesses in early warning dissemination mechanisms (UNDP, 2023). These findings reflect

broader challenges typical of transitional governance systems, where decentralization and limited fiscal capacity constrain effective disaster risk management (World Bank, 2020).

Urban expansion and land-use mismanagement have significantly increased pluvial and flash flood risk, particularly in smaller river basins (Agaj, 2025). Hydrological modeling studies further demonstrate that intensified precipitation events combined with altered catchment conditions have amplified exposure in municipalities such as Skenderaj (Spiridonov et al., 2025). While these studies provide valuable environmental risk assessments, they primarily focus on hydrological and infrastructural dimensions.

Similar flood governance challenges have also been identified across other Western Balkan countries. Research conducted in Albania highlights that flood vulnerability is strongly influenced by rapid urbanization, insufficient drainage infrastructure, and limited implementation of flood protection measures (Selenica et al., 2013). Likewise, post-disaster assessments following the 2014 floods in Bosnia and Herzegovina identified significant institutional coordination challenges, weaknesses in early warning dissemination, and uneven municipal preparedness capacities (European Commission, 2014; World Bank, 2020).

Additional regional studies from Serbia and North Macedonia further emphasize the importance of institutional preparedness, community resilience, and integrated flood risk management approaches. Research from Serbia underlines the role of socio-economic vulnerability, social trust, and local preparedness capacities in shaping community disaster resilience (Cvetković, 2024). Similarly, flood risk assessments conducted in North Macedonia stress the growing importance of GIS-based flood susceptibility analysis, spatial planning, and public preparedness in response to increasing climate-related flood risks (Aleksova et al., 2024).

Regional assessments further indicate that many Western Balkan countries continue to face common governance and resilience challenges, including limited municipal resources, weak spatial planning enforcement, fragmented institutional responsibilities, and insufficient community-based preparedness mechanisms (OECD, 2021). These regional experiences demonstrate that flood risk in transitional governance systems is shaped not only by hydrological exposure but also by institutional effectiveness, socio-economic vulnerability, and community resilience.

From the perspective of the present study, these regional findings are highly relevant for Kosovo. Similar institutional and socio-economic patterns remain evident across many municipalities, particularly regarding uneven preparedness capacities, fragmented institutional responsibilities, and limited household-level preparedness mechanisms. The experiences of neighboring Western

Balkan countries suggest that structural flood protection measures alone are insufficient without stronger community engagement, institutional trust, and integrated governance approaches consistent with the principles of Integrated Water Resources Management (IWRM).

What remains underexplored in the Kosovo context is the household-level dimension of vulnerability and preparedness. Existing assessments emphasize physical damage and municipal-level response capacity but provide limited empirical evidence on how socio-economic vulnerability, community engagement, and institutional trust shape flood outcomes at the household level. This represents a critical knowledge gap, particularly within the Integrated Water Resources Management (IWRM) framework, which calls for integration of social, environmental, and governance dimensions (Pahl-Wostl, 2015).

Furthermore, limited data exist on how preparedness perceptions, communication networks, and trust in institutions influence resilience in flood-prone municipalities. Without such evidence, policy responses risk overemphasizing structural infrastructure while neglecting social and institutional determinants of resilience (Wisner et al., 2012).

The present study addresses this gap by conducting a quantitative household-level assessment across multiple municipalities, with focused analytical attention on Mitrovica, Gjakova, and Skenderaj as higher-exposure areas. By integrating socio-economic characteristics, community engagement indicators, and institutional trust variables into multivariate regression models, this research contributes empirical evidence linking vulnerability and preparedness within the broader IWRM and public health governance context.

In doing so, the study advances flood risk research in Kosovo from descriptive damage reporting toward analytical evaluation of resilience determinants, supporting more targeted and socially embedded risk reduction strategies.

Research Questions and Hypotheses

This study investigates the relationships between socio-economic vulnerability, hydrological exposure, community engagement, and household flood outcomes in Kosovo within the framework of Integrated Water Resources Management (IWRM).

The research questions are formulated to guide empirical testing using household-level survey data.

Research Questions (RQ)

RQ1: Which socio-economic and hydrological factors are associated with household flood impact in Kosovo?

RQ2: What factors predict household preparedness for future flood events?

RQ3: How do hydrological exposure and socio-economic characteristics influence perceived residence in flood-risk areas?

Hypotheses (H)

H1: Socio-economic and institutional characteristics are significantly associated with household flood impact.

H2: Higher levels of community engagement and institutional trust are positively associated with perceived household preparedness.

H3: Regional location contributes to variation in flood impact and preparedness outcomes.

3. Methodology

3.1 Research Aim

The primary aim of this study is to examine how socio-economic vulnerability, hydrological exposure, and community engagement influence household flood impact and preparedness in Kosovo within the framework of Integrated Water Resources Management (IWRM).

Specifically, the study seeks to:

- Identify socio-economic and institutional factors associated with household flood impact.
- Assess predictors of household preparedness and perceived resilience.
- Examine the role of hydrological exposure in shaping both actual and perceived flood risk.

By adopting a household-level analytical approach, the study provides empirical evidence to inform community-centered and integrated flood risk management policies in Kosovo.

3.2 Research Design

This study employs a quantitative cross-sectional research design based on household-level survey data collected across municipalities in Kosovo. The cross-sectional design enables the examination of relationships between socio-economic vulnerability, hydrological exposure, community engagement, and preparedness at a single point in time.

Data were analyzed using multivariate regression techniques appropriate to the measurement level of the dependent variables:

- Binary logistic regression was applied to the dichotomous outcome of household flood impact (Q8).
- Ordered probit regression was employed to analyze the ordinal outcome of perceived preparedness (Q23)

This analytical strategy enables rigorous statistical testing of hypothesized relationships between exposure, socio-economic characteristics, institutional variables, and household flood resilience outcomes.

3.3 Study Area

The quantitative survey included households from multiple municipalities across Kosovo's seven regions, ensuring broad geographic representation of flood-prone and disaster-affected areas. The study incorporates diverse geographical and socio-economic contexts, including urban, rural, and historically flood-affected communities.

To account for potential spatial variation in flood exposure and preparedness, regional variables were included within the analytical framework. This approach supports the examination of differences in household vulnerability, preparedness, and institutional perceptions across Kosovo's regions.

Figure 3: Administrative Regions of Kosovo Included in the Study Coverage



3.4 Sample Size

A total of 299 households participated in the survey conducted across multiple municipalities in Kosovo. The sample was selected to ensure broad geographical representation and to include households from areas with varying levels of flood exposure and socio-economic vulnerability.

Data collection was conducted during the broader Disaster Risk Reduction (DRR) gap assessment implemented within the World Bank / GFDRR program. Households were selected through field-based community data collection using a non-probability convenience sampling approach, considering accessibility, willingness to participate, and exposure to flood-related risks.

Attention was given to municipalities with prior flood exposure, particularly those affected by the January 2023 floods. The survey targeted adult household representatives familiar with the household's flood experiences, preparedness practices, and perceptions of institutional response and community resilience.

Data was collected electronically using the KoboToolbox platform by trained field teams and collaborating local actors. This approach enabled efficient data collection across different municipalities and facilitated standardized recording of responses.

Due to the application of listwise deletion in regression modeling, the effective sample size varied across analytical models depending on missing data patterns:

- Flood impact model (Q8): 254 valid cases
- Perceived preparedness model (Q23): 248 valid cases

3.5 Data Collection Tool

The primary data collection instrument for this study was a structured household survey adapted from the Household Building Damage Assessment (HBDA) framework developed and applied by the United Nations Development Program (UNDP) during the January 2023 flood response in Kosovo (UNDP, 2023). The survey was further expanded to include variables related to socio-economic vulnerability, household preparedness, institutional trust, community engagement, and resilience within the Integrated Water Resources Management (IWRM) framework.

While the original HBDA framework primarily focused on assessing physical damage to buildings and infrastructure, the questionnaire used in this study was expanded to capture additional dimensions relevant to Integrated Water Resources Management (IWRM). These additional components included socio-economic vulnerability, hydrological exposure, community engagement, institutional trust, household preparedness, resilience perceptions, and WASH-related experiences during flood events.

The questionnaire included sections related to socio-economic characteristics, flood exposure and impacts, preparedness activities, community participation, institutional trust, resilience perceptions, and recovery capacity. This multidimensional structure ensured that the survey captured both structural and social determinants of household-level flood vulnerability and preparedness across multiple municipalities in Kosovo.

All survey items were structured as closed-ended questions with predefined response categories to facilitate quantitative statistical analysis. The survey was administered electronically using the KoboToolbox platform. The collected data were subsequently exported to IBM SPSS Statistics for data cleaning, variable coding, and statistical analysis, including descriptive statistics and regression modelling.

The household survey used in this study was also part of a broader Disaster Risk Reduction (DRR) gap analysis conducted in Kosovo under the World Bank / GFDRR programme on improving disaster risk understanding and early warning systems. The dataset used in this thesis was derived from this broader assessment and includes responses from 299 households across multiple municipalities in Kosovo. This integration allows the present study to build on a broader evidence base while focusing specifically on the relationship between flood risk, socio-economic vulnerability, community engagement, and household preparedness within the IWRM framework.

3.6 Operationalization of Variables

To enable empirical testing of the research hypotheses, survey variables were operationalized and, where necessary, recoded into forms suitable for regression analysis. Dependent variables were selected to reflect key dimensions of flood impact and preparedness, while independent variables captured socio-economic vulnerability, hydrological exposure, community engagement, and institutional factors.

Binary variables were coded as 0/1 indicators, ordinal variables retained their ordered structure, and selected categorical predictors were transformed into dummy variables. The municipality of residence was included as a regional control variable in the regression models.

Table 1 Operationalization of Variables

Variable	Description	Measurement
Flood Impact	Indicates whether the household was affected by floods or natural disasters	Binary variable (Yes/No)
Preparedness Plan	Indicates whether the household has a family emergency plan	Binary variable (Yes/No)
Perceived Preparedness	Self-rated level of preparedness for future flood events	Ordinal scale
Perceived Risk Area	Perception of living in a flood-prone area	Binary variable (Yes/No)
Monthly Income	Household monthly income category	Ordinal income categories
Education Level	Educational attainment of the respondent	University education vs. non-university education
Household Size	Number of persons living in the household	Continuous variable
Housing Status	Ownership status of the dwelling	Owner vs. other housing status
Community Cooperation	Perceived level of cooperation within the community during flood events	Categorical variable
Emergency Communication Group	Participation in community or WhatsApp emergency groups	Binary variable (Yes/No)
Authority Readiness	Perceived readiness of local authorities to respond to floods	Likert-type scale
Institutional Trust	Level of trust in institutions during flood events	Likert-type scale
Financial Assistance	Receipt of financial assistance after flood events	Binary variable (Yes/No)
Hydrological Exposure	Residence in municipalities with higher flood exposure	Binary variable (Higher exposure vs. other areas)

The operationalization of variables was designed to capture the multidimensional nature of flood vulnerability and preparedness within the Integrated Water Resources Management (IWRM)

framework. The selected variables reflect socio-economic conditions, hydrological exposure, institutional factors, and dimensions of community engagement relevant to household resilience in flood-prone areas.

3.7 Data Analysis Strategy

Data were analyzed using IBM SPSS Statistics. The analytical strategy was designed to test the research hypotheses through multivariate regression techniques appropriate to the measurement level of the dependent variables.

The analysis proceeded in three stages: descriptive analysis, binary logistic regression, and ordered probit regression.

3.7.1 Descriptive Analysis

Descriptive statistics were computed to summarize the socio-economic characteristics of households, flood exposure patterns, and preparedness indicators across the study sample collected from multiple municipalities and regions of Kosovo. Frequency distributions were used for categorical variables, while means and standard deviations were calculated for continuous variables.

This stage provided an overview of household vulnerability, prior flood impact, and levels of preparedness before conducting multivariate modelling.

3.7.2 Binary Logistic Regression

Binary logistic regression was estimated to examine predictors of household flood impact (Q8), a dichotomous outcome variable coded 0/1. Logistic regression was selected because the dependent variable was binary. The models estimate the log-odds of the outcome as a function of socio-economic characteristics, hydrological exposure, community engagement, and institutional variables.

Model fit was evaluated using:

- Omnibus Test of Model Coefficients
- -2 Log Likelihood
- Cox & Snell R^2
- Nagelkerke R^2
- Hosmer–Lemeshow goodness-of-fit test
- Classification accuracy

Odds ratios ($\text{Exp}(B)$) were interpreted to assess the magnitude and direction of associations between predictors and outcomes.

Missing data were handled using listwise deletion, resulting in varying effective sample sizes across models.

3.7.3 Ordered Probit Regression

An ordered probit regression model was estimated to analyze predictors of self-rated preparedness for future floods (Q23), measured on an ordinal scale.

The ordered probit model was implemented using the PLUM procedure in SPSS with a probit link function. This method is appropriate when the dependent variable consists of ordered response categories and the proportional odds assumption is met.

Model adequacy was assessed using:

- Model fitting information ($-2 \text{ Log Likelihood comparison}$)
- Pseudo R^2 statistics
- Test of Parallel Lines (to assess proportional odds assumption)

The non-significant result of the Test of Parallel Lines indicated that the proportional odds assumption was satisfied, supporting the validity of the ordered probit specification.

Regression coefficients were interpreted in terms of their direction and statistical significance ($p < .05$).

3.7.4 Significance Level

Statistical significance was evaluated at the 5% level ($p < .05$). Where appropriate, results significant at the 10% level were noted as marginally significant.

3.8 Ethical Considerations

The study was conducted in accordance with general ethical principles for social science research, including voluntary participation, confidentiality, anonymity, and responsible data handling.

Prior to participation, households were informed about the purpose of the study, the voluntary nature of participation, and their right to refuse participation or withdraw from the survey at any stage without consequences. Informed consent was obtained from all participants before data collection.

No personally identifiable information was collected within the analytical dataset, and all responses were anonymized prior to statistical analysis. The collected data were securely stored and used exclusively for academic and research purposes.

Given that some survey questions referred to previous flood experiences and disaster exposure, particular care was taken to ensure respectful communication and minimize potential emotional discomfort during data collection. Participants were not exposed to coercion, pressure, or harmful procedures during the research process.

The study also adhered to principles of transparency, data integrity, and responsible reporting of findings within the framework of Integrated Water Resources Management (IWRM) and disaster risk research.

4 Results

4.1 Descriptive Statistics

4.1 Descriptive Statistics

A total of 299 households participated in the study, providing a broad overview of household flood exposure, preparedness, and socio-economic conditions across different regions of Kosovo. The sample was geographically distributed across seven regions of Kosovo, with the largest proportion from Mitrovicë (23.4%), followed by Gjilan (20.1%), Prishtinë (16.7%), Ferizaj (14.0%), Prizren (11.7%), Gjakovë (11.4%), and Pejë (2.7%) (see Table 2).

Regarding direct flood exposure, 48.8% of households reported that their home had been affected by floods or natural disasters, while 51.2% indicated no prior impact, suggesting a relatively balanced distribution between exposed and non-exposed households.

In terms of household preparedness, the majority of participants (79.1%) reported that they did not have a family emergency plan for floods or natural disasters, whereas 20.9% indicated having such a plan. This finding suggests that although flood risk awareness may be relatively widespread, practical household preparedness remains limited among many surveyed households.

Descriptive statistics further indicated variability across socio-economic and community-related variables, including the educational level of the head of household, household size, and monthly income, which were subsequently included in regression analyses.

Due to missing responses in selected variables, the effective sample size varied slightly across multivariate models following listwise deletion procedures.

Table 2 Distribution of households by region (N = 299)

Region	n	%
Prishtinë	50	16.7
Mitrovicë	70	23.4
Pejë	8	2.7
Gjakovë	34	11.4
Prizren	35	11.7
Gjilan	60	20.1
Ferizaj	42	14.0
Total	299	100.0

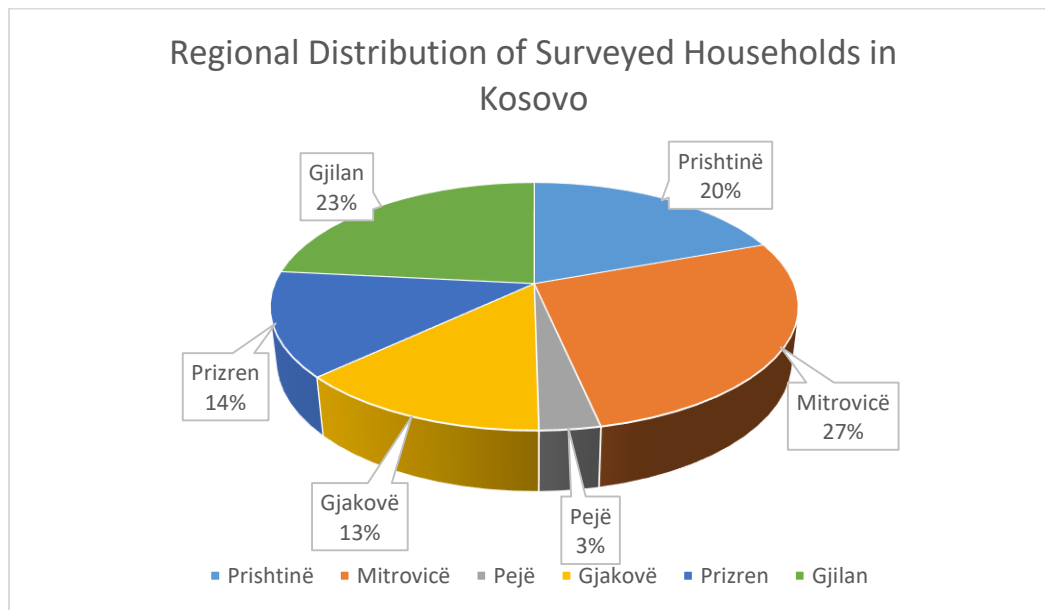


Figure 4: Regional distribution of surveyed households across municipalities in Kosovo (N = 299).

The regional distribution of surveyed households demonstrates broad geographical representation across Kosovo, allowing the study to capture differences in flood exposure, preparedness, and socio-economic vulnerability across multiple regions.

4.2 Multivariate Analysis

To examine the predictors of flood impact and household preparedness, binary logistic regression analyses were conducted.

Model 1: H1-Predicting Household Flood Impact (Q8)

To test Hypothesis 1, a binary logistic regression model was estimated to examine whether socio-economic and institutional characteristics were associated with household flood impact.

The overall model was statistically significant, $\chi^2(13) = 40.781$, $p < .001$, indicating that the set of predictors improved model fit compared to the null model. The model correctly classified 67.3% of cases.

The model explained between 14.1% (Cox & Snell R^2) and 22.0% (Nagelkerke R^2) of the variance in flood impact. The Hosmer–Lemeshow test was non-significant, $\chi^2(8) = 5.531$, $p = .700$, indicating good model fit.

Significant Predictors

Several variables were significantly associated with household flood impact:

- Educational level (University) ($B = .955$, $p = .006$, $OR = 2.599$)
- Household size ($B = .143$, $p = .043$, $OR = 1.153$)
- Membership in an emergency WhatsApp group ($B = 2.025$, $p = .006$, $OR = 7.573$)
- Perceived readiness of local authorities ($B = .640$, $p = .046$, $OR = 1.897$)
- One regional dummy variable (Region 1) ($B = -1.414$, $p = .010$, $OR = .243$)

The positive coefficient for educational level indicates that households with a university education had higher odds of reporting flood impacts than those without a university education. A larger household size was also associated with increased flood impact. Membership in emergency communication groups and perceptions of local authority readiness were positively associated with reported flood impact.

Other variables, including institutional trust and financial assistance, were not statistically significant.

Overall, these findings support Hypothesis 1, indicating that socio-economic and institutional characteristics are significantly associated with household flood impact.

Table 3 Binary Logistic Regression Predicting Household Flood Impact (Q8)

Model Fit Statistics

Test	Value	df	P
Omnibus Test of Model Coefficients (χ^2)	40.781	13	< .001
Overall Classification Accuracy	67.3%		

Model Summary

Model Summary			
Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	233.957 ^a	.141	.220

Goodness-of-Fit

Hosmer and Lemeshow Test

Step	Chi-square	Df	Sig.
1	5.531	8	.700

Logistic Regression Coefficients Predicting Household Flood Impact (Q8)

Variables in the Equation

		B	S.E.	Wald	Df	Sig.	Exp(B)
Step 1 ^a	Edu_University	.955	.350	7.445	1	.006	2.599
	Number of persons in the household:	.143	.071	4.090	1	.043	1.153
	Q19.Did the community cooperate during the flood/natural disaster?	.045	.185	.058	1	.809	1.046
	Q21.Are you part of any community/WhatsApp group for emergencies?	2.025	.733	7.639	1	.006	7.573
	Q26.How would you assess the readiness of local authorities to respond to floods?	.640	.321	3.984	1	.046	1.897
	Q27. How much trust do you have in institutions for assistance during floods?	.592	.321	3.400	1	.065	1.808
	Q10.Did you receive financial assistance after the flood?	.135	.450	.089	1	.765	1.144
	Region			9.454	6	.150	
	Region(1)	-1.414	.552	6.570	1	.010	.243
	Region(2)	-21.811	12376.818	.000	1	.999	.000
	Region(3)	-1.273	.755	2.845	1	.092	.280
	Region(4)	-.097	.554	.031	1	.861	.907
	Region(5)	-.192	.509	.142	1	.706	.825
	Region(6)	-.367	.573	.409	1	.522	.693
	Constant	-2.224	.786	8.005	1	.005	.108

a. Variable(s) entered on step 1: Edu_University, Number of persons in the household:, Q19.Did the community cooperate during the flood/natural disaster?, Q21.Are you part of any community/WhatsApp group for emergencies?, Q26.How would you assess the readiness of local authorities to respond to floods?, Q27. How much trust do you have in institutions for assistance during floods?, Q10.Did you receive financial assistance after the flood?, Region.

The logistic regression model was statistically significant overall. The Omnibus Test of Model Coefficients was significant ($\chi^2 = 40.781$, $p < .001$), indicating that the predictor variables included in the model significantly improved the explanation of household flood impact compared to a model without predictors. The Cox and Snell R^2 value of .141 and the Nagelkerke R^2 value of .220

indicate that the model explained between 14.1% and 22.0% of the variation in reported flood impact, suggesting a moderate level of explanatory power. The Hosmer–Lemeshow goodness-of-fit test was non-significant ($\chi^2 = 5.531$, $p = .700$), indicating that the model fit the observed data well. In addition, the model correctly classified 67.3% of cases, demonstrating an acceptable level of predictive accuracy.

Overall, the logistic regression results indicate that household flood impact is influenced by a combination of socio-economic and institutional factors rather than hydrological exposure alone. Educational level, household size, emergency communication group membership, and perceived readiness of local authorities emerged as important predictors of reported flood impact. These findings support the broader understanding of flood vulnerability as a multidimensional phenomenon shaped by both social and institutional conditions.

To facilitate interpretation of the regression results, Figure 5 visualizes the key predictors of household flood impact identified in the logistic regression model.

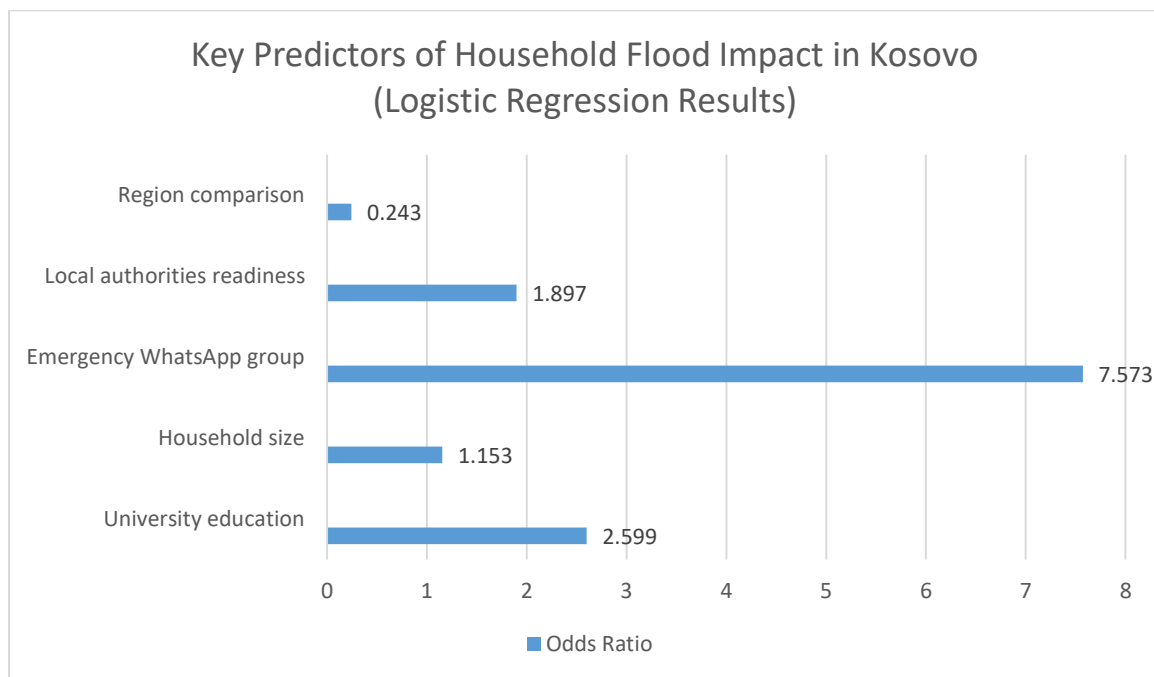


Figure 5. Key predictors of household flood impact based on logistic regression analysis. Odds ratios above 1 indicate an increased likelihood of experiencing flood impacts.

As shown in Figure 5, the visualization highlights the relative strength of different predictors associated with household flood impact. Participation in emergency communication groups

showed the strongest association with reported flood impacts, suggesting that prior disaster exposure may increase subsequent engagement in preparedness and communication networks.

Model 2: H2-Predicting Perceived Household Preparedness (Q23)

To test Hypothesis 2, which proposed that higher levels of community engagement and institutional trust would be associated with greater household preparedness, an ordered probit regression model was estimated using self-rated preparedness for a future flood (Q23) as the dependent variable.

The model was statistically significant, $\chi^2(7) = 63.718$, $p < .001$, indicating that the predictors collectively improved model fit compared to the intercept-only model.

Pseudo R^2 statistics indicated moderate explanatory power (Cox & Snell $R^2 = .227$; Nagelkerke $R^2 = .248$; McFadden $R^2 = .106$).

The Test of Parallel Lines was non-significant ($\chi^2(14) = 15.235$, $p = .362$), indicating that the proportional odds assumption was satisfied and the ordered probit model was appropriate.

Significant Predictors

Several predictors were significantly associated with higher perceived preparedness:

- Educational level (Estimate = .259, $p = .011$)
- Community cooperation during flood events (Estimate = .264, $p = .001$)
- Membership in an emergency WhatsApp group (Estimate = .745, $p = .026$)
- Institutional trust (Estimate = .350, $p < .001$)

These results indicate that households with higher education, stronger community cooperation, participation in emergency communication networks, and greater trust in institutions reported higher levels of preparedness for future floods.

Non-Significant Predictors

Monthly income, financial assistance, and residence in Mitrovicë were not statistically significant predictors of perceived preparedness.

Overall, these findings support Hypothesis 2, demonstrating that higher levels of community engagement and institutional trust are positively associated with perceived household preparedness for future flood events.

Table 4. Ordered Probit Regression Predicting Perceived Household Preparedness (Q23)

Predictor	Estimate	Std. Error	Wald	df	Sig.
Education	.259	.102	6.468	1	.011
Community Cooperation	.264	.079	11.249	1	.001
WhatsApp Group	.745	.335	4.938	1	.026
Institutional Trust	.350	.096	13.226	1	.000
Income	.048	.082	.338	1	.561
Financial Assistance	.221	.191	1.341	1	.247
Mitrović	-.059	.166	.128	1	.720

Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	500.921			
Final	437.203	63.718	7	.000

Link function: Probit.

Pseudo R-Square

Cox and Snell	.227
Nagelkerke	.248
McFadden	.106

Link function: Probit.

Test of Parallel Lines

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	437.203			
General	421.968	15.235	14	.362

To further illustrate the relationship between community engagement and household preparedness, Table 4 presents the ordered probit regression results, which demonstrate that perceived household preparedness is strongly associated with social and institutional dimensions, particularly education, community cooperation, institutional trust, and participation in emergency

communication groups. These findings reinforce the importance of community-centered disaster risk reduction strategies within the Integrated Water Resources Management (IWRM) framework.

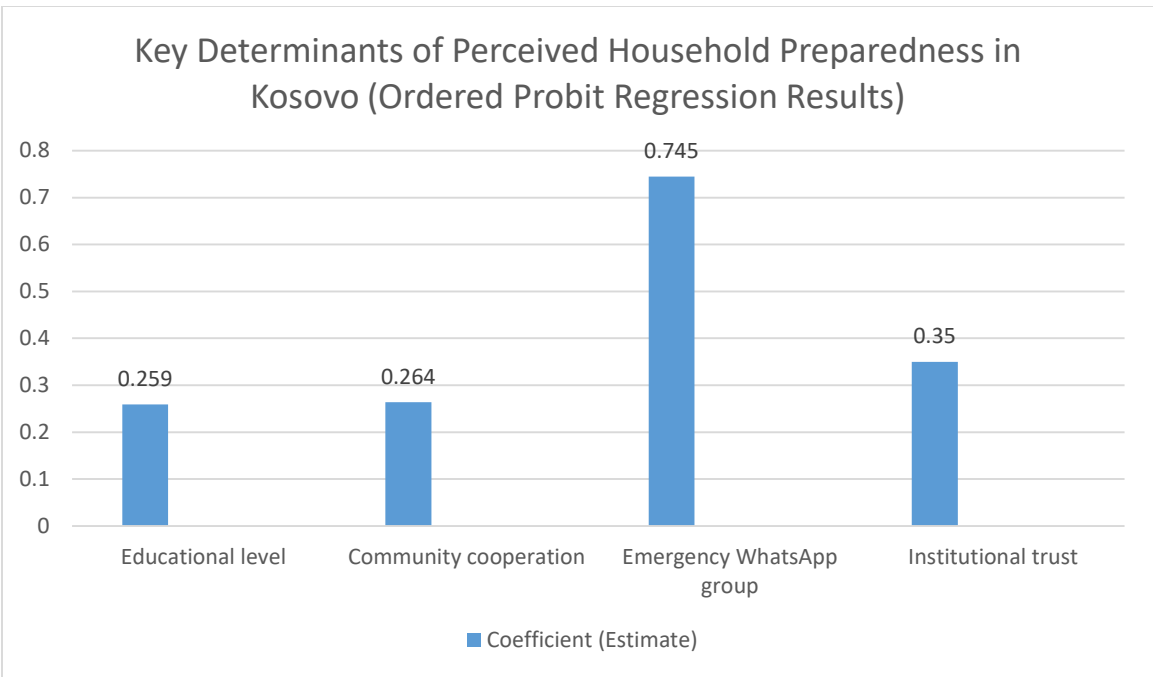


Figure 6: Determinants of perceived household preparedness based on ordered probit regression results. Positive coefficients indicate factors associated with higher perceived preparedness.

As shown in Figure 6, the graphical presentation of preparedness determinants illustrates the importance of social trust, communication, and collective engagement in shaping household resilience. The results suggest that preparedness is influenced not only by material resources but also by social cohesion and institutional credibility.

Model 3: H3-Regional Variation in Flood Impact

To examine Hypothesis 3, which proposed that regional location contributes to variation in flood impact outcomes, regional dummy variables were included in the logistic regression model predicting household flood impact (Q8).

The overall effect of region was not statistically significant (*see table 3*-Wald = 9.454, df = 6, p = .150), indicating that regional location did not independently predict flood impact after controlling for socio-economic and institutional variables.

However, one regional category differed significantly from the reference region (Region 1: $B = -1.414$, $p = .010$, $OR = .243$), suggesting that households in this region had significantly lower odds of reporting flood impacts than households in the reference region.

Despite this localized difference, the absence of a statistically significant overall regional effect suggests that geographical variation alone does not fully explain differences in flood impact once socio-economic and institutional characteristics are taken into account.

Therefore, Hypothesis 3 was not supported at the overall level, although limited regional variation was observed in one municipality.

5. Discussion

5.1 Socio-Economic and Institutional Predictors of Flood Impact (H1)

The findings of this study indicate that socio-economic and institutional characteristics are significantly associated with household flood impact in Kosovo. Specifically, educational level, household size, participation in emergency communication networks, and perceived readiness of local authorities emerged as significant predictors.

The positive association between university education and reported flood impact may appear counterintuitive at first glance. However, previous research suggests that individuals with higher levels of education often demonstrate greater awareness of environmental risks and are more likely to accurately report disaster-related impacts (Lowe et al., 2013). Thus, this finding may reflect differences in risk perception and reporting rather than an actual increase in vulnerability. Education may also influence household preparedness and disaster awareness through increased access to information, a stronger understanding of environmental risks, and greater engagement with institutional communication channels. Individuals with higher educational attainment are generally more likely to follow early warning information, participate in community communication networks, and seek institutional support during disaster events. In this context, education should not be interpreted solely as a socio-economic characteristic, but also as a factor shaping risk perception, adaptive behavior, and household decision-making processes related to flood preparedness and resilience.

From an Integrated Water Resources Management (IWRM) perspective, these findings highlight the importance of integrating public awareness, risk communication, and community education into flood risk reduction strategies. Strengthening educational and awareness-based interventions

may improve household preparedness capacities and contribute to more resilient communities in flood-prone areas.

Household size was also positively associated with flood impact. Larger households may experience greater exposure due to increased spatial and material needs and face more complex evacuation and recovery challenges. This finding aligns with vulnerability theory, which highlights demographic composition as a determinant of disaster sensitivity (Blaikie et al., 2014).

Participation in emergency WhatsApp groups was positively associated with reported flood impact. This may indicate that households affected by previous floods are more likely to join communication networks afterward, suggesting a post-disaster adaptive response rather than a causal protective effect.

Perceived readiness of local authorities was also positively associated with flood impact. This relationship may reflect increased interaction between affected households and local institutions during disaster events, reinforcing awareness of institutional roles.

Overall, these results partially support Hypothesis 1 and demonstrate that flood impact is not determined solely by hydrological exposure but is also shaped by socio-economic and institutional dimensions, consistent with the Integrated Water Resources Management (IWRM) perspective.

5.2 Community Engagement and Institutional Trust as Determinants of Preparedness (H2)

The results of the ordered probit model indicate that community engagement and institutional trust play a significant role in shaping perceived household preparedness for future flood events. Educational level, community cooperation, membership in emergency communication networks, and institutional trust were all positively associated with higher levels of perceived preparedness. The positive association between education and preparedness is consistent with prior research suggesting that higher educational attainment enhances risk awareness, access to information, and the capacity to interpret early warning signals (Lowe et al., 2013; Becker & Kreibich, 2021). Education may facilitate proactive planning and increase the likelihood of engaging in preparedness behaviors.

Community cooperation during previous flood events was also significantly associated with higher preparedness levels. This finding aligns with social capital theory, which emphasizes the importance of trust, collective action, and shared norms in enhancing community resilience (McClymont et al., 2020). Communities that demonstrate cooperation during disasters are more likely to develop adaptive capacities that persist over time.

Membership in emergency communication groups, such as WhatsApp networks, emerged as another important predictor. This aligns with the literature highlighting the role of informal communication systems in disaster risk reduction (Han & Kuhlicke, 2019). Digital communication platforms can facilitate rapid dissemination of warnings, coordination of response efforts, and access to institutional support.

Institutional trust showed a strong and statistically significant relationship with preparedness. Trust in public authorities is widely recognized as a key determinant of compliance with evacuation orders, adoption of protective behaviors, and engagement in preparedness planning (Mysiak & Bianchizza, 2019). In contexts where trust is low, even well-designed warning systems may fail to generate effective responses.

Interestingly, neither monthly income nor financial assistance was a statistically significant predictor of perceived preparedness. This suggests that preparedness may be driven more by social and institutional dynamics than by purely economic resources. Such findings reinforce the relevance of community-based disaster risk reduction approaches within IWRM frameworks.

Previous disaster risk assessments conducted in Kosovo highlight a significant gap between awareness of disaster risks and actual preparedness behaviour at the household level. Although many households are aware of emergency contact numbers and basic disaster information, far fewer have adopted practical preparedness measures such as developing a family emergency plan.

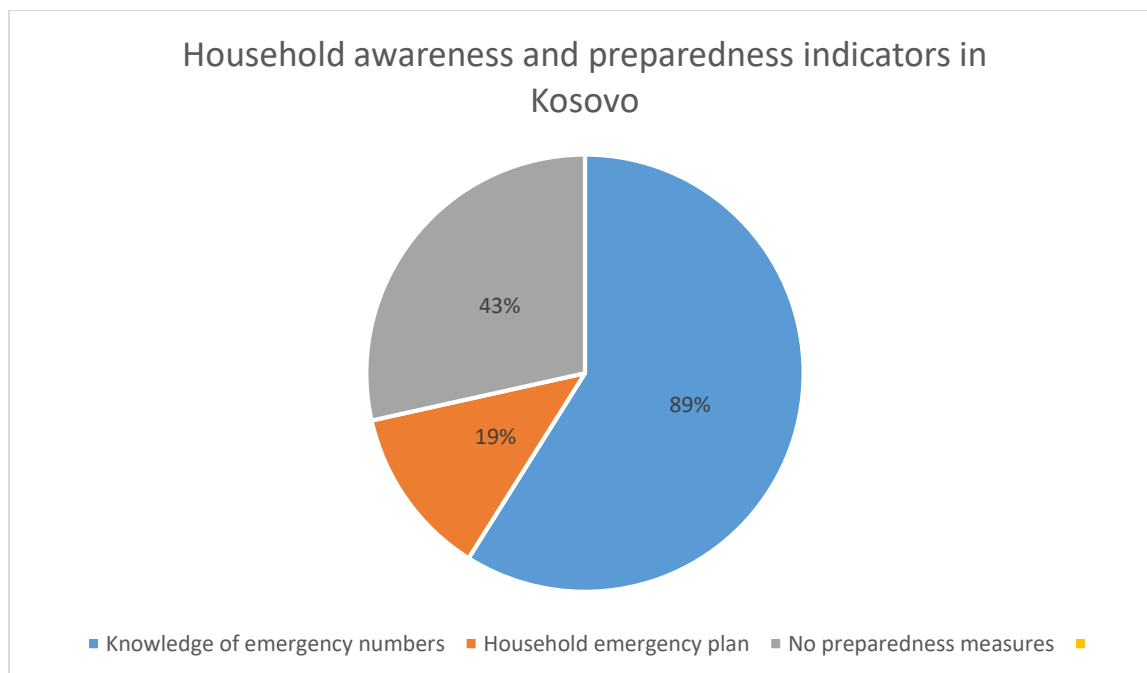


Figure 7: Knowledge-Action Gap in Household Disaster Preparedness in Kosovo

The findings presented in Figure 7 demonstrate a substantial gap between disaster awareness and practical preparedness at the household level. Although awareness of emergency procedures appears relatively high, considerably fewer households reported implementing concrete preparedness measures such as family emergency planning. This pattern highlights the importance of strengthening community-based preparedness interventions and risk communication strategies in Kosovo.

Overall, these results provide strong support for Hypothesis 2 and demonstrate that community engagement and institutional trust are central components of household-level flood preparedness in Kosovo. The findings of this study are consistent with broader disaster risk assessments conducted in Kosovo under the World Bank / GFDRR programme, which also highlights limited household preparedness despite relatively high awareness of flood risks.

5.3 Regional Variation and Spatial Heterogeneity (H3)

Hypothesis 3 proposed that regional location contributes to variation in flood impact and preparedness outcomes. To evaluate this hypothesis, regional dummy variables were included in the logistic regression model predicting household flood impact.

The results indicate that the overall effect of the region was not statistically significant after controlling for socio-economic and institutional variables. This suggests that geographical location alone does not independently determine household flood impact when broader vulnerability and engagement factors are considered.

However, one regional category differed significantly from the reference region, indicating localized variation in reported flood impact. This finding implies that while flood exposure may vary geographically, its effects are mediated by socio-economic and institutional characteristics at the household level.

From an IWRM perspective, this result is important. Integrated Water Resources Management emphasizes basin-level planning and regional hydrological coordination. Yet the findings suggest that structural exposure alone does not fully explain household-level outcomes. Instead, vulnerability appears to be socially structured and institutionally influenced.

This aligns with vulnerability frameworks that conceptualize disasters as the intersection of hazard exposure and socio-economic sensitivity (Blaikie et al., 2014). Even within flood-prone regions, differences in education, communication networks, and trust in institutions may buffer or amplify impacts.

Therefore, Hypothesis 3 was not supported at the overall regional level. The limited regional variation observed indicates that spatial heterogeneity exists but does not outweigh the influence of socio-economic and institutional factors.

Given the statistical instability observed in one regional category, reflected in unusually large standard errors, the interpretation of specific regional dummy coefficients should be treated with caution. Importantly, the overall regional effect was not statistically significant, reinforcing the conclusion that socio-economic and institutional factors are more robust predictors of flood impact than geographic location alone. These findings reinforce the need for policy approaches that integrate geographical risk assessment with social vulnerability analysis rather than relying solely on regional hazard classification.

5.4 Integration within the Integrated Water Resources Management (IWRM) Framework

The findings of this study contribute to the understanding of flood risk management within the Integrated Water Resources Management (IWRM) framework by highlighting the interaction between hydrological exposure, socio-economic vulnerability, and institutional capacity at the household level.

IWRM promotes coordinated development and management of water, land, and related resources to maximize social and economic welfare without compromising ecosystem sustainability (Pahl-Wostl, 2015). Traditionally, IWRM has emphasized technical and hydrological dimensions, including river basin planning, infrastructure, and regulatory frameworks. However, the present findings demonstrate that flood outcomes are not determined solely by hydrological exposure, but are significantly shaped by socio-economic and institutional factors at the household level.

The results show that socio-economic characteristics, community engagement, and institutional trust significantly shape both flood impact and preparedness. This supports the argument that effective IWRM implementation must integrate social vulnerability assessments and participatory governance mechanisms into technical flood risk planning.

The non-significant overall regional effect further suggests that basin-level exposure alone does not fully account for household vulnerability. Instead, resilience is mediated by local social and institutional dynamics. Therefore, IWRM in Kosovo should move beyond structural flood defenses and incorporate household-level preparedness strategies, community communication networks, and trust-building initiatives.

In this sense, the study reinforces the shift from reactive flood response toward proactive, integrated, and socially embedded risk governance.

Beyond water governance, these findings also carry broader societal implications, particularly in public health and community well-being.

5.5 Public Health Implications

Flood risk is not only an environmental and infrastructural issue but also a significant public health concern. The findings of this study carry important implications for health system resilience and population well-being in flood-prone regions.

Households reporting lower preparedness may be more vulnerable to secondary health consequences, including waterborne diseases, respiratory infections due to mold exposure, injuries, and psychological distress. Research has shown that inadequate preparedness increases the likelihood of prolonged displacement, contamination of drinking water, and disruption of essential services (Alderman et al., 2012; WHO, 2018).

The significant role of community cooperation and institutional trust in predicting preparedness highlights the importance of risk communication in protecting public health. Effective communication networks enable timely evacuation, safeguarding of medications, protection of vulnerable household members, and coordination with health services.

Furthermore, perceived preparedness reflects psychological resilience. Individuals who feel prepared are likely to experience lower stress and anxiety during disaster events. Thus, preparedness should be understood not only as logistical readiness but also as a determinant of mental health resilience.

From a policy perspective, integrating public health considerations into flood risk management strategies aligns with global frameworks such as the Sendai Framework and the Sustainable Development Goals (SDG 3; SDG 6, and SDG 13). Strengthening early warning systems, promoting community education, and enhancing institutional trust can simultaneously reduce flood losses and improve population health outcomes.

5.6 Policy and Governance Implications

The findings of this study provide several practical implications for flood risk governance in Kosovo.

First, policy interventions should prioritize strengthening community engagement mechanisms. Formalizing local communication networks, such as emergency messaging platforms and community-based information channels, can significantly enhance household preparedness and facilitate faster dissemination of early warnings.

Second, trust in institutions emerged as an important determinant of perceived preparedness. Strengthening transparency, responsiveness, and accountability within municipal flood management structures may therefore improve public confidence and increase compliance with risk reduction measures.

Third, education plays a critical role in shaping both flood impact awareness and preparedness behavior. Public awareness campaigns, school-based education programs, and community training initiatives should be incorporated into municipal disaster risk reduction strategies.

Fourth, the absence of a strong regional effect suggests that vulnerability reduction policies should focus primarily on socio-economic and institutional strengthening rather than relying solely on geographical risk classification.

Furthermore, the results highlight the importance of strengthening early warning systems and risk communication mechanisms. Improving access to timely flood alerts through community networks and digital communication platforms could significantly enhance household preparedness and reduce disaster impacts.

The findings of this study are consistent with evidence from other Western Balkan countries, where flood vulnerability is shaped not only by hydrological exposure but also by governance capacity, socio-economic conditions, and community preparedness. Similar to Kosovo, studies from Albania show that rapid urbanization, insufficient drainage infrastructure, and limited implementation of flood protection measures increase flood vulnerability. In Bosnia and Herzegovina, post-flood assessments have emphasized weak institutional coordination, uneven municipal preparedness, and challenges in early warning systems. Evidence from Serbia similarly highlights the importance of social trust, local preparedness capacities, and community resilience in shaping disaster outcomes.

Compared with these regional cases, the findings from Kosovo show a similar pattern: flood resilience cannot be strengthened through infrastructure alone. The significant role of education, community cooperation, emergency communication groups, and institutional trust in this study suggests that Kosovo shares many of the same governance and preparedness challenges identified across the Western Balkans. However, the Kosovo case adds household-level empirical evidence showing how these social and institutional factors influence reported flood impact and perceived preparedness. This comparison reinforces the need for integrated flood risk management strategies that combine structural protection, institutional coordination, community engagement, and social vulnerability assessment within the IWRM framework.

5.7 Study Limitations

Despite its contributions, this study has several limitations that should be acknowledged when interpreting the findings.

First, the study employs a cross-sectional research design, which limits the ability to draw causal inferences. While the regression models identify significant associations between socio-economic factors, community engagement, and preparedness outcomes, the data do not allow conclusions about temporal or causal direction. Longitudinal studies would be required to examine how preparedness and vulnerability evolve over time.

Second, the analysis relies on self-reported survey data. Variables such as perceived preparedness, institutional trust, and flood impact may be subject to recall bias or social desirability bias. Households may overestimate their preparedness or underreport vulnerabilities. Although structured survey instruments were used, measurement error cannot be fully excluded.

Third, the operationalization of hydrological exposure was based on municipality-level classification rather than precise spatial or geospatial flood mapping. While selected municipalities were categorized as higher exposure areas based on recent flood events and secondary data, more refined hydrological indicators (e.g., GIS-based floodplain mapping, elevation models, proximity to riverbanks) would allow more accurate assessment of exposure-risk interactions.

Fourth, interaction effects between socio-economic vulnerability and hydrological exposure were not formally tested in the regression models. As a result, the study examines combined predictors but does not statistically evaluate whether vulnerability amplifies exposure effects. Future research could incorporate interaction terms to better understand compound risk dynamics.

Fifth, the sample, while geographically diverse, does not fully represent all municipalities equally. Some regions had lower respondent counts, which may limit generalizability at the municipal level. Additionally, listwise deletion reduced the effective sample size in multivariate models, potentially affecting statistical power.

Sixth, although the study integrates public health and governance perspectives conceptually, it does not include direct measures of health outcomes. Future research could incorporate health system indicators, morbidity data, or psychological health assessments to more explicitly evaluate the health impacts of flood vulnerability.

Future studies could also integrate hydrological data, flood hazard maps, or long-term monitoring datasets to better capture the interaction between physical flood exposure and social vulnerability.

Finally, the study focuses primarily on household-level determinants of vulnerability and preparedness. Broader macro-level variables such as national funding allocations, infrastructure investment levels, and institutional performance metrics were not quantitatively included.

Despite these limitations, the study provides valuable empirical evidence linking socio-economic characteristics, community engagement, and institutional trust to flood impact and preparedness within the IWRM framework.

6. Recommendations

6.1 National-Level Recommendations

The findings of this study highlight the need for stronger integration of disaster risk reduction strategies within national water governance and public policy frameworks in Kosovo. National institutions should prioritize developing coordinated flood risk management policies that integrate structural flood protection measures with community-centered preparedness and resilience approaches.

Particular attention should be given to strengthening early warning systems, improving institutional coordination among relevant agencies, and increasing public access to clear and timely risk communication. The study findings suggest that household preparedness is influenced not only by hydrological exposure but also by institutional trust, educational level, and access to communication networks. Therefore, national flood risk management policies should incorporate public education, awareness campaigns, and community engagement as central components of resilience-building strategies.

In addition, greater investment is needed in climate adaptation planning, flood-resilient infrastructure, and integrated watershed management practices. National authorities should further strengthen cooperation among environmental, public health, emergency management, and municipal institutions to improve preparedness and response capacities across sectors.

6.2 Local-Level and Community Recommendations

At the municipal and community level, the study findings emphasize the importance of strengthening household preparedness and local participation in disaster risk reduction processes. Municipal authorities should increase support for community-based preparedness initiatives, including public training sessions, evacuation planning exercises, and local awareness campaigns focused on flood risks and emergency response.

The findings also demonstrate the importance of community communication and cooperation during disaster events. Expanding local emergency communication networks, including community-based digital platforms and WhatsApp emergency groups, may improve information sharing and coordination during flood emergencies.

Particular focus should be placed on vulnerable households and communities with lower socio-economic capacity and limited preparedness resources. Local authorities should encourage participatory approaches that involve residents directly in preparedness planning, risk mapping, and community resilience activities.

From the author's perspective, strengthening local engagement and institutional trust represents one of the most critical priorities for improving long-term flood resilience in Kosovo. While structural infrastructure remains important, sustainable disaster risk reduction also requires stronger social cohesion, public participation, and community ownership of preparedness processes.

6.3 Recommendations for Integrated Water Resources Management (IWRM)

The study supports the need for broader implementation of Integrated Water Resources Management (IWRM) principles within flood risk governance in Kosovo. Current flood management approaches remain largely focused on reactive emergency response and physical infrastructure protection, while social vulnerability and community preparedness dimensions receive comparatively less attention.

Future IWRM strategies should promote closer integration between hydrological risk assessment, spatial planning, environmental protection, and community resilience policies. Greater emphasis should also be placed on nature-based solutions, watershed protection measures, and sustainable land-use management practices aimed at reducing long-term flood exposure.

Furthermore, flood risk management policies should integrate socio-economic vulnerability indicators into planning and decision-making processes. This may help institutions identify communities with lower preparedness capacities and improve the targeting of prevention and support measures.

6.4 Recommendations for Future Institutional and GIS-Based Risk Management

The findings of this study indicate the need for more advanced and data-driven approaches to flood risk assessment and preparedness planning in Kosovo. Future institutional efforts should strengthen the use of Geographic Information Systems (GIS), spatial analysis, and hydrological modelling tools to support flood susceptibility mapping and identification of high-risk areas.

Integrating GIS-based environmental data with household-level vulnerability indicators may improve the accuracy of flood risk assessments and support more evidence-based policy development. Such approaches could also strengthen municipal preparedness planning, emergency response coordination, and resource allocation during disaster events.

In addition, future institutional development should focus on strengthening interdisciplinary collaboration among hydrologists, environmental experts, public health professionals, social scientists, and local authorities in order to support more comprehensive and integrated flood risk management strategies.

7. Conclusion

This study examined the relationships between socio-economic vulnerability, hydrological exposure, community engagement, and household flood outcomes in Kosovo within the framework of Integrated Water Resources Management (IWRM). Using household-level survey data collected across multiple municipalities and regions of Kosovo, and applying multivariate regression techniques, the research provides empirical evidence on the social and institutional determinants of flood impact and preparedness.

The findings demonstrate that flood outcomes are not determined solely by hydrological exposure. Instead, socio-economic and institutional characteristics significantly shape both reported flood impact and perceived preparedness.

Educational level, household size, participation in emergency communication networks, and perceptions of institutional readiness were significantly associated with household flood impact. These results reinforce the understanding that vulnerability is socially structured and mediated by institutional dynamics rather than purely geographically determined.

Furthermore, the analysis of perceived preparedness revealed that community engagement and institutional trust are central determinants of household-level resilience. Higher levels of education, stronger community cooperation, membership in emergency communication networks, and greater trust in institutions were all positively associated with higher perceived preparedness for future flood events. These findings highlight the critical importance of social capital, communication structures, and governance legitimacy in shaping adaptive capacity.

In contrast, regional location did not demonstrate a statistically significant overall independent effect on flood impact after controlling for socio-economic and institutional variables. Although limited localized variation was observed, the findings suggest that spatial exposure alone does not

fully explain differences in household vulnerability, which appear to be more strongly shaped by social and institutional factors. This suggests that while hydrological exposure remains important, spatial variation alone cannot fully explain differences in household vulnerability. The findings therefore support a shift from geographically deterministic models of flood risk toward integrated approaches that incorporate social vulnerability and institutional capacity.

From an Integrated Water Resources Management perspective, the study underscores the need to move beyond infrastructure-focused flood control strategies. Effective flood risk governance in Kosovo requires the integration of household-level preparedness, participatory mechanisms, and trust-building strategies into national and municipal water management frameworks. By linking hydrological risk assessment with community engagement and institutional dynamics, this research contributes to a more holistic understanding of flood resilience.

The study also carries important public health implications. Flood preparedness and institutional trust influence not only disaster response capacity but also the protection of physical and mental health during and after flood events. Strengthening communication networks, promoting public awareness, and improving governance transparency can reduce both material losses and health-related consequences of disasters.

Overall, this research fills a significant empirical gap in the Kosovo context by providing one of the first quantitative household-level analyses of flood vulnerability and preparedness within an IWRM framework. The findings offer evidence-based insights for policymakers, municipal authorities, and water management institutions seeking to enhance resilience through socially embedded and participatory approaches.

By integrating hydrological exposure, socio-economic vulnerability, and community engagement into a unified analytical framework, this study advances the application of IWRM principles in practice and contributes to the broader discourse on sustainable and inclusive flood risk governance

8. Future Research Directions

The present study contributes to the understanding of flood vulnerability, community engagement, and household preparedness within the Integrated Water Resources Management (IWRM) framework in Kosovo. However, several areas remain open for further investigation.

Future research should expand household-level flood risk assessments by incorporating larger and more regionally balanced samples across municipalities in Kosovo. Longitudinal research designs

may also provide deeper understanding of how preparedness, institutional trust, and community resilience evolve over time following repeated flood events.

In addition, future studies should integrate Geographic Information Systems (GIS) and spatial analysis techniques to improve the identification of flood-prone areas, exposure patterns, and spatial vulnerability dynamics. GIS-based flood susceptibility mapping and hydrological modelling could strengthen the integration of environmental and socio-economic indicators within flood risk assessments.

Further research may also explore the relationship between flood exposure and public health outcomes, including psychological resilience, access to healthcare services, water quality risks, and long-term community recovery processes.

Finally, future studies should continue strengthening interdisciplinary approaches that combine hydrological, social, governance, and public health perspectives in support of more integrated and community-centered flood risk management strategies in Kosovo and the Western Balkans region.

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10. Appendix

Household Flood Risk, Preparedness, and Community Resilience Questionnaire

The questionnaire used in this study was adapted from the Household Building Damage Assessment (HBDA) framework applied during the January 2023 flood response in Kosovo and expanded to include variables related to socio-economic vulnerability, preparedness, community engagement, institutional trust, and resilience within the Integrated Water Resources Management (IWRM) framework.

The questionnaire included a broader range of items related to flood exposure, preparedness, institutional trust, community engagement, and WASH-related experiences during flood events. However, only selected variables directly relevant to the study objectives and statistical modeling strategy were included in the final descriptive and regression analyses presented in this thesis.

Questionnaire ID: _____

Municipality:

☐ Mitrovica

☐ Skenderaj

☐ Gjakova

☐ Other: _____

Neighbourhood / Village: _____

Date: ____ / ____ / 2025

Estimated completion time: ~10 minutes

Participation is voluntary and anonymous. This questionnaire is conducted for research purposes related to flood impacts, preparedness, and community resilience.

SECTION I – Basic Household Information

1. Number of persons in the household: _____

2. Age structure of household members:

* 0–5 years: ____

* 6–17 years: ____

* 18–59 years: ____

* 60+ years: ____

3. Education level of the head of household:

☐ Primary education

☐ Secondary education

☐ Bachelor's degree

☐ Master's/PhD

☐ Prefer not to answer

4. Monthly household income:

☐ < 300€

☐ 300–600€

☐ 600–1000€

☐ > 1000€

☐ Prefer not to answer

5. Place of residence:

☐ Urban

☐ Rural

☐ Peri-urban area

6. Housing status:

- ☐ Owner
- ☐ Tenant
- ☐ Living with relatives/family

7. Do you live in an area at risk of flooding?

- ☐ Yes
- ☐ No
- ☐ Not sure

SECTION II – Flood Experience

8. Has your household been affected by floods?

- ☐ Yes
- ☐ No

If yes, when was the most recent event?

- ☐ Less than 1 year ago
- ☐ 1–2 years ago
- ☐ 3–5 years ago
- ☐ More than 5 years ago

9. What were the consequences? (multiple answers possible)

- ☐ Damage to the house
- ☐ Damage to furniture
- ☐ Agricultural/livestock losses
- ☐ Evacuation
- ☐ Health problems
- ☐ Psychological stress/problems
- ☐ Other: _____

10. Did you receive financial assistance after the flood?

☐ Yes

☐ No

If yes, from whom?

☐ Municipality

☐ Central government

☐ Red Cross / humanitarian organizations

☐ Relatives/community

☐ Other sources: _____

11. Did you have property/agricultural insurance?

☐ Yes

☐ No

SECTION III – Information and Early Warning

12. Did you receive any warning before the flood?

☐ Yes

☐ No

13. Source of information:

(multiple answers possible)

☐ Municipality

☐ Neighbours

☐ Facebook/WhatsApp

☐ Media

☐ No warning was received

The information was:

☐ Very useful

☐ Partially useful

☐ Not useful

14. Did you receive information/instructions after the flood?

☐ Yes

☐ No

If yes, what were the sources?

☐ Municipality

☐ Media

☐ Social media (Facebook/WhatsApp)

☐ Neighbours/community

☐ Red Cross / other organizations

☐ Other: _____

SECTION IV – Emergency Preparedness

15. Does your household have a family emergency plan for floods?

☐ Yes

☐ No

16. Do you know the local emergency numbers?

☐ Yes

☐ No

17. What preparedness measures have you taken?

(multiple answers possible)

☐ Basic emergency equipment (flashlight, batteries, power bank)

☐ Important documents stored safely

☐ Emergency food/water supplies

☐ Water removal equipment (pump, shovel)

☐ No measures taken

18. Have you received any training or information regarding emergencies?

☐ Yes

☐ No

SECTION V – Community Participation and Solidarity

19. Did the community cooperate during the flood?

☐ A lot

☐ Somewhat

☐ Very little

☐ Not at all

20. Who helped you during the flood?

(multiple answers possible)

☐ Neighbours

☐ Municipality

☐ Red Cross

☐ Police/Firefighters

☐ Nobody

21. Are you part of any community/WhatsApp emergency group?

☐ Yes

☐ No

☐ I do not know

22. Would you participate in community flood preparedness training?

☐ Yes

☐ No

☐ Maybe

SECTION VI – Capacity and Resilience Assessment

23. How prepared do you feel for a future flood?

- ☐ Very prepared
- ☐ Moderately prepared
- ☐ Slightly prepared
- ☐ Not prepared at all

24. How capable are you of recovering financially after a flood?

- ☐ Easily
- ☐ With difficulty
- ☐ Very difficult
- ☐ Impossible without assistance

25. Do you believe your community is capable of responding to floods?

- ☐ Yes
- ☐ Partially
- ☐ No
- ☐ I do not know

26. How would you evaluate the preparedness of local authorities to respond to floods?

- ☐ Very prepared
- ☐ Moderately prepared
- ☐ Slightly prepared
- ☐ Not prepared at all
- ☐ I do not know

27. How much trust do you have in institutions responsible for flood assistance?

- ☐ High trust

☐ Moderate trust

☐ Low trust

☐ No trust

SECTION VII – Suggestions

28. What should be improved in your neighbourhood/community to improve protection from floods?

SECTION VIII – Water, Sanitation, and Hygiene (WASH) During Floods

29. What was the main source of drinking water during the flood?

☐ Public water supply

☐ Private well

☐ Bottled water

☐ Water tanker

☐ Other: _____

30. Was the water supply contaminated during the flood?

☐ Yes

☐ No

☐ I do not know

31. Did you disinfect water during or after the flood?

(e.g., boiling, chlorination)

☐ Yes

☐ No

☐ I did not know it was necessary

32. Did you experience problems with water supply during the flood?

- ☐ Yes, complete water shortage
- ☐ Yes, limited supply
- ☐ No, supply was normal

33. Were there any water-related health problems in your household?

(multiple answers possible)

- ☐ Vomiting/diarrhea/gastroenteritis
- ☐ Skin diseases/infections
- ☐ Respiratory problems
- ☐ No health problems
- ☐ I am not sure
- ☐ Other: _____

34. How did you maintain personal hygiene during the flood?

- ☐ Public water supply
- ☐ Stored water reserves
- ☐ Water provided by municipality/Red Cross
- ☐ Hygiene could not be maintained normally

35. Did you receive water or hygiene assistance during the flood?

- ☐ Yes
- ☐ No

If yes, from whom?

- ☐ Municipality
- ☐ Red Cross
- ☐ Other organizations
- ☐ Nobody
- ☐ Other: _____