ASSESSMENT

Flood risks in Ukraine in 2024

Area-based assessment for Tiachivska hromada

March 2024 | Ukraine

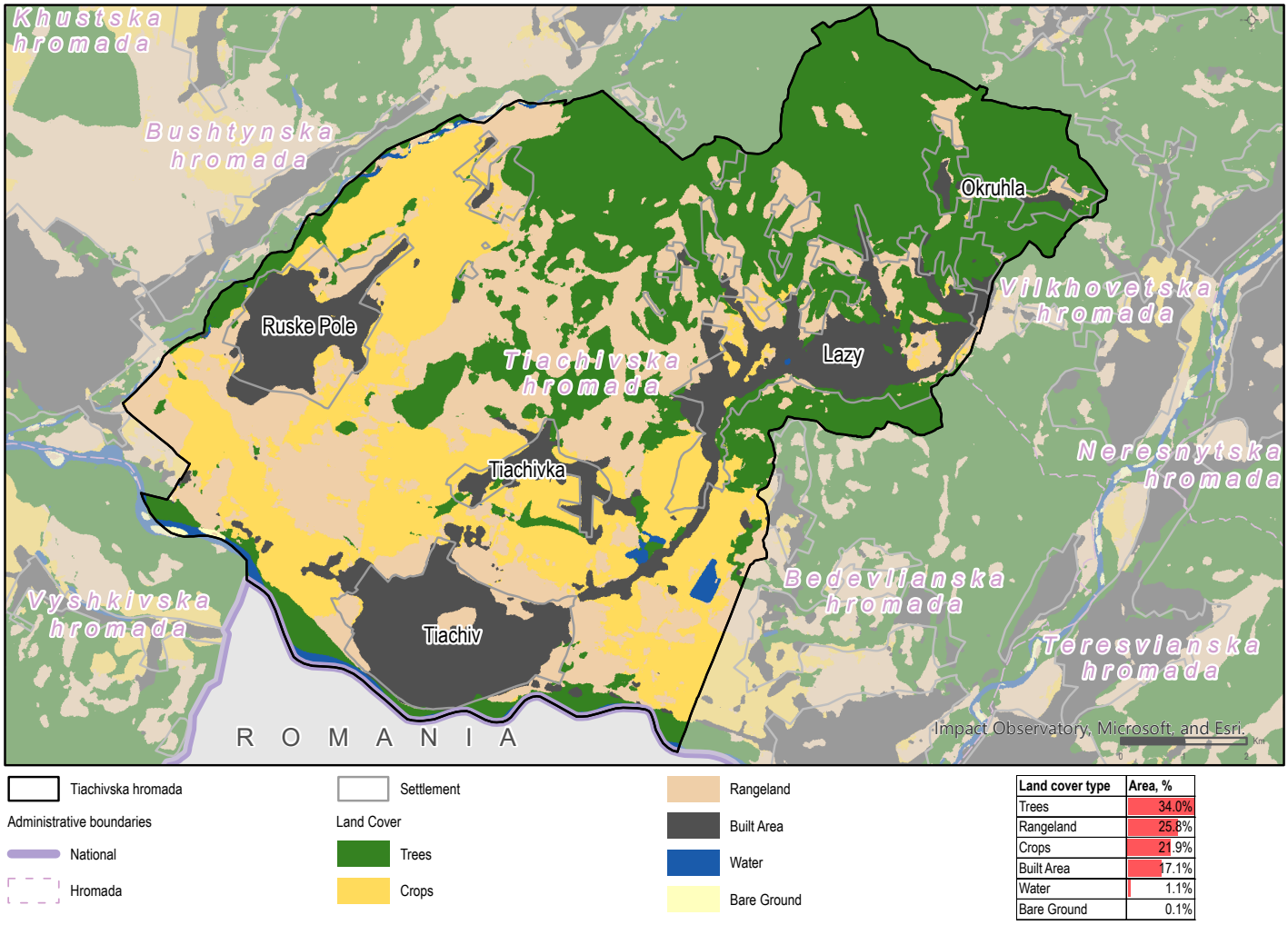
Introduction

Tiachivska hromada (district) is situated in West Ukraine's Zakarpatska oblast, which literally means "across the Carpathians", stretching as it does across the country's largest mountain range. Consisting of one city, Tiachiv, and four villages, the hromada had an estimated pre-war population of 19,378 as of January 2022.[1] Tiachivska lies in the Tysa River basin, a subbasin of the Danube. The basin's namesake runs through Tiachivska to the south, marking the border with Romania. The Terebysa River is on the western side of the hromada, and the Teresva River on its eastern side.

The presence of these rivers, along with geomorphological and hydrometeorological characteristics of the Carpathian region (e.g. type of land cover, elevation and topography, days of rainfall), leaves the hromada highly susceptible to flooding. The predominant land cover is tree cover, occupying 34% of the territory, though rangeland and cropland occupy 25.8% and 21.9% respectively (Map 1). Generally, tree cover and rangeland mitigate the extent of flooding by acting as barriers that can absorb increased river levels or overland flow.

These factors have resulted in three catastrophic flood events in 1998, 2001, and 2008 in Tiachivska and it is expected that major floods will reoccur in the future. Indeed, REACH's 2024 Ukraine Nationwide Flood Risk Assessment found that the Carpathian region is more susceptible to flooding than other regions under the control of the Government of Ukraine as of 20 November 2023.[2] Tiachivska ranked as the hromada with the third-highest flood risk level of government-controlled areas (Map 2). Generally, armed conflicts add an extra layer of complexity to natural hazard risk, leading to situations of double vulnerability, where the impacts of conflict and natural hazards can potentially exacerbate each other.[3] This assessment found that the ongoing full-scale Russian invasion has indeed impacted flood resilience at the institutional and individual levels, reducing the capacity of authorities and households to mitigate and cope with flooding, as will be explored in more detail below. Furthermore, there is evidence from previous REACH assessments in Ukraine that security threats associated with the war, the presence of substantial IDP populations,[4] and decreased tax revenues associated with a slowdown in economic activity, impact local authorities' prioritisation of services and expenditure,[5] with consequences for portfolios considered to be of lower priority, such as planning for natural hazards.

Calculating the flood risk level[6] of Tiachivska was the first step to obtaining a comprehensive understanding of the flood risk profile of the hromada. This report delves further by assessing flood risk management capacities at the institutional and individual levels, firstly, to understand the hromada's resilience to future flood events; and, secondly, to identify opportunities for strengthening area-specific flood risk management capacities in the context of conflict.

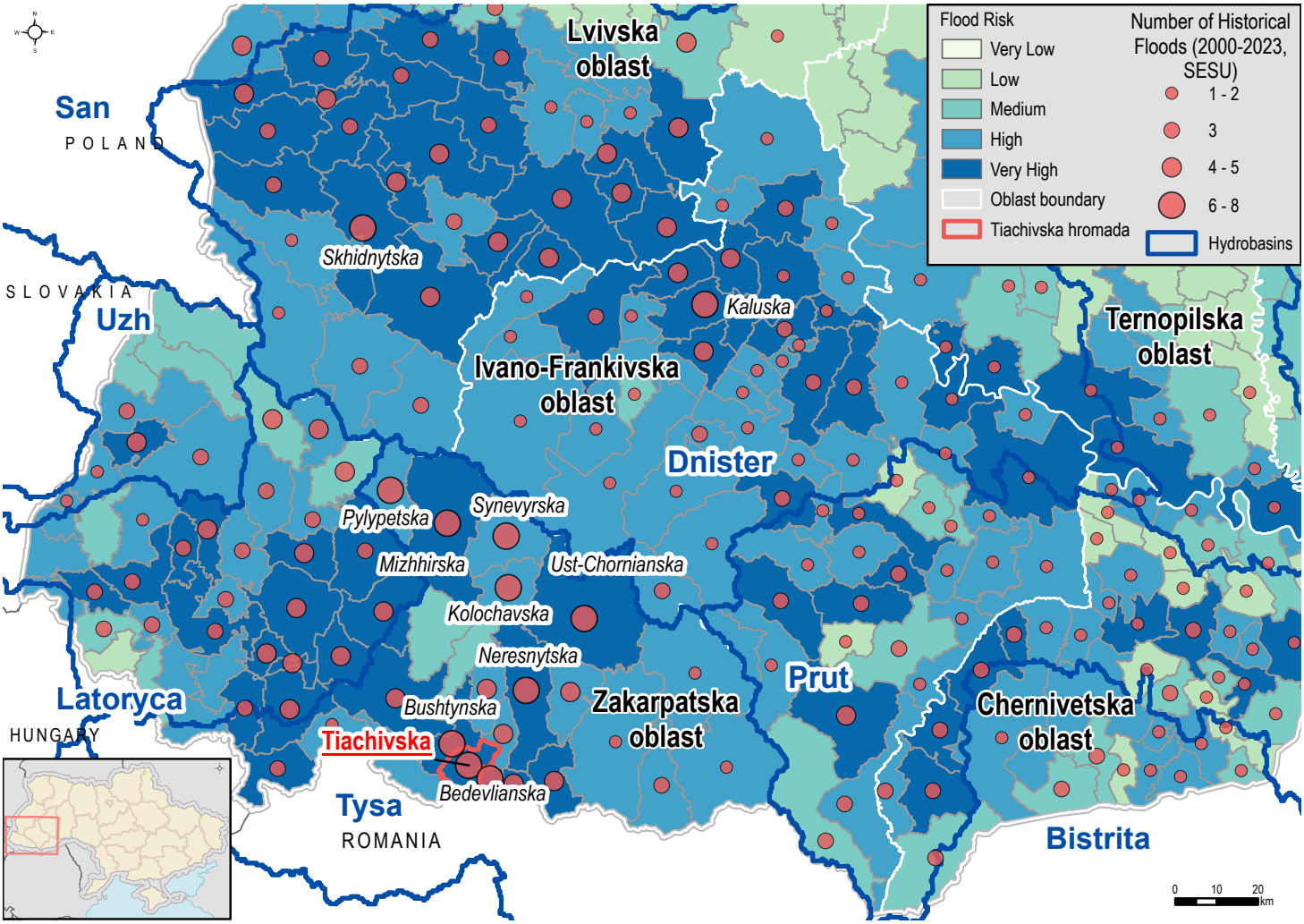


Land cover type	Area, %
Trees	34.0%
Rangeland	25.8%
Crops	21.9%
Built Area	17.1%
Water	1.1%
Bare Ground	0.1%

Map 1. Land use distribution in Tiachivska hromada by 2023.

Key findings

- **Tiachivska hromada faces significant flood risk**. The **main drivers of flooding in Tiachivska** include climatic conditions, terrain characteristics, insufficient flood protection infrastructure, and deforestation. Climate change and deforestation are particularly significant, leading to more frequent and intense floods and reducing the effectiveness of natural flood barriers. There is some evidence to suggest that the conflict has worsened deforestation trends and deprioritized environmental protection measures. The ongoing conflict further complicates the situation, reducing institutional capacity and exacerbating vulnerabilities, financial resources and a shortage of personnel.
- Participants identified several important **challenges for flood management at the institutional level**, including insufficient funding, lack of personnel, and coordination issues among stakeholders. What's more, a lack of awareness about flood preparedness measures and limited access to information leave the population vulnerable.
- Identified **measures to enhance flood resilience** include installing flood barriers, elevating properties, improving drainage systems, enhancing water regulating infrastructure, and conducting educational activities on flood preparedness. However, implementing these measures during the conflict may require external support due to resource constraints.



Map 2. Flood risk levels in the Ukrainian Carpathians region with Tiachivska highlighted.

Objective and data utilisation

The objective of this area-based assessment (ABA) is to support government and humanitarian actors in the development of flood preparedness, response and recovery strategies adapted to the context of the ongoing conflict in Ukraine. It achieves this by:

- Assessing the compounding impacts of conflict on flood vulnerabilities and local risk management capacities at the household and institutional levels.
- Identifying modalities for strengthening local flood resilience within the context of the conflict, drawing upon best practices and lessons learned from previous experiences.

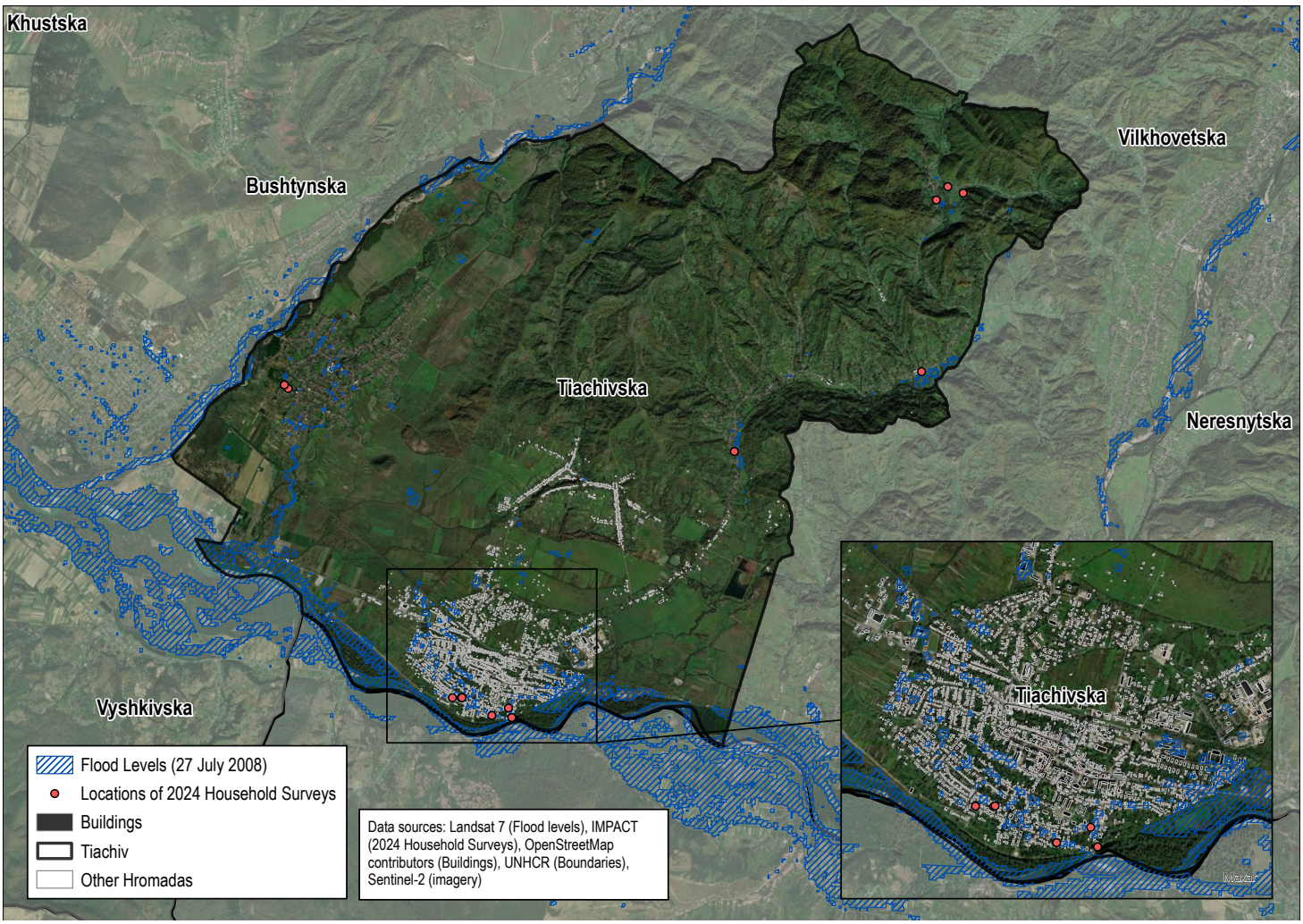
The assessment's focus on a specific geography ensures the operational relevance by identifying specific areas where conflict-sensitive DRM measures might be integrated into humanitarian and recovery programming in Tiachivska. This information can be leveraged by various stakeholders involved in flood risk reduction, including government authorities, humanitarian actors, emergency responders, and donors.

Methodology

This ABA covers the totality of Tiachivska hromada. Based on a standardized flood assessment approach,[7] which has been adapted to the local context, it leverages secondary data analysis and qualitative insights from expert consultations.

The flood assessment approach allowed for the ranking of hromadas against a Flood Risk Index (FRI), a composite indicator sensitive to both the likelihood of flooding and the potential human impact of flood events in a given area. The 2024 Nationwide Flood Risk Assessment identified Tiachivska as the hromada with the third-highest FRI, resulting in its selection for this ABA.[8]

Primary data collection was then conducted, comprising six key informant (KI) interviews with expert personnel from the local authorities and other institutional actors, as well as 13 interviews with households (HHs) located in flood-prone areas to capture community perspectives of historical flood events. Refer to the methodology note in the Annex for further details on the FRI calculation.



Map 3. Flood levels experienced as of 27 July 2008 in Tiachivska.

Flooding in Tiachivska

Historical flooding

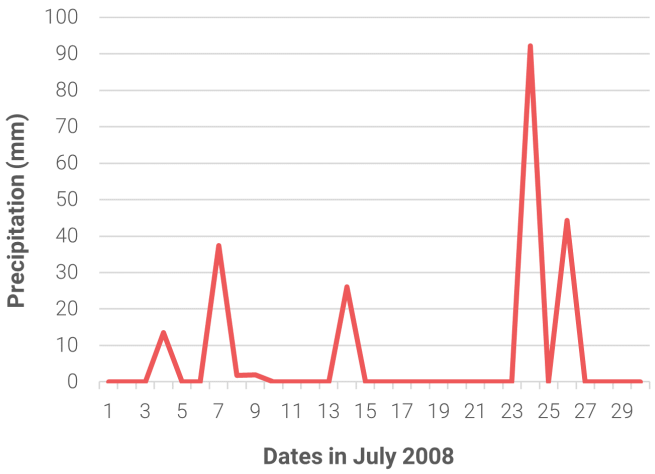
Since the establishment of the Tiachiv Interdistrict Water Management Department in 1993, the highest water level was observed at the water measuring station in Tiachiv and peaked at 7.9m in 2001.[9] The department's network of 10 stations has recorded at least three catastrophic floods in 1998, 2001, and 2008. REACH was able to locate satellite imagery for the 2008 flood from Landsat 7 and use this to visualise the extent of flooding across the hromada, especially the impact on the main urban area.

A majority of HHs indicated that the most recent flooding occurred during the winter of 2023/24, with one respondent noting that this kind of non-catastrophic seasonal flooding is a regular occurrence. The reported depth of the 2024 flood varied, with some recalling flood waters that were ankle-deep, others knee-deep, and in one case, waist-deep. This variation can be explained by the different elevation levels of sampled HHs.

All HHs reported that the house, land plot, or other real estate in the place of residence had been flooded in the last 10 years, and most reported that flooding represented

Image 1. Flooding from 8 to 10 December 2010 in Ruske Pole village, Tiachivska.[10]

one of the biggest hazards to the household in the next 3 to 6 months. In terms of impacts of previous floods, disruptions to electricity was most commonly reported, with some respondents also mentioning disruptions to water supply, food, and medical services.



Graph 1. Daily rainfall in Tiavchivska hromada, July 2008.[11]

Drivers of flooding

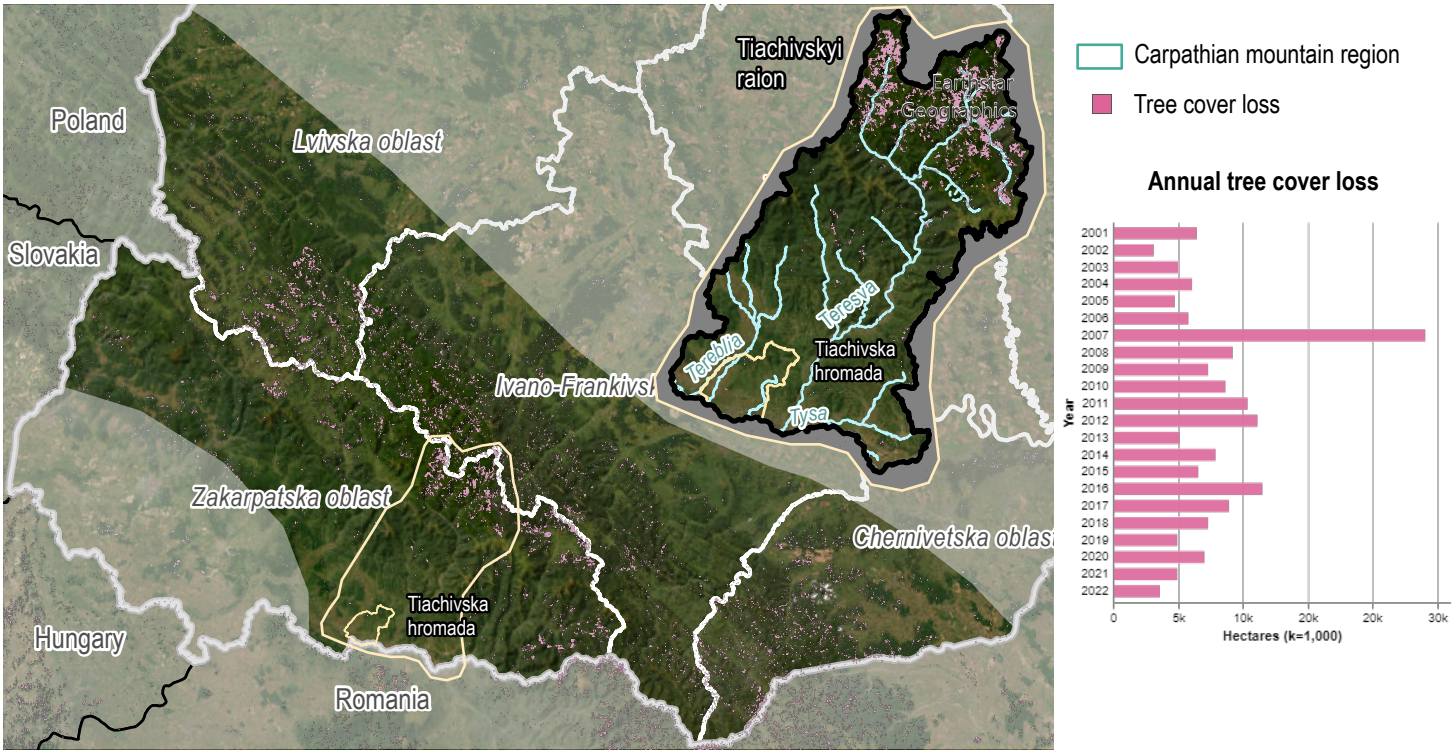
Tiachivska's high exposure to flooding is caused by a combination of factors. HHs and KIs consistently identified climatic conditions, terrain characteristics, insufficient flood protection infrastructure, and deforestation as the main drivers of flooding in the hromada. Notably, Ruska Mokra, a village with a population of 1,898 in northern Tiachivska, is a peculiar "humidity pole": the average annual amount of precipitation per year is 2,499 mm, compared to an annual precipitation level of 1,200-1,400 mm in the neighbouring areas of the upper reaches of the mountainous part of the catchment basin of the Tysa River.[12] This may also contribute to the higher flood risk in Tiachivska.

As a result of human-made climate change, influenced by such factors as emissions and deforestation, climatic conditions are evolving in such a way as to increase the likelihood of flooding. The projected seasonal precipitation change for Ukraine indicates an increase during the wettest season (March-May), a period of re-occurring floods, snowmelt, and river level rise. A 4.2% increase in precipitation for 2020-2039, and a 5.2% increase for 2040-2059 are anticipated in the most-likely scenario.[13]

> *"Climate change can lead to more frequent and intense floods, which can make them more difficult to predict and prevent. The martial law makes it difficult to develop and implement long-term plans to respond to floods."*
> *- KI from the Department of Water Protection*

Deforestation can lead to increased flooding by reducing the natural barriers that absorb and slow down rainfall, such as trees and vegetation. This can result in faster runoff and reduced water absorption, leading to higher peak flows and more frequent flooding downstream.[14] Deforestation in the Carpathian Mountains heavily impacts the flood scale and speed in Tiachivska due to its location downstream. This problem has been worsening: between 2001 to 2022 the Carpathian Mountains region in Ukraine has lost 170 kha of tree coverage, equivalent to a 10% decrease since 2000, and this trend is expected to continue.[15]

Since the beginning of the full-scale invasion, there are signs that environmental protection in Ukraine has been deprioritised. For example, a few months after the invasion started, international sanctions were imposed on the timber trade from the Russian Federation (the world's largest exporter of softwood in 2019). Such sanctions created a supply shortage on the international



Map 4. Tree cover loss in Tiachivska hromada. Data source: Global Forest Watch.[20]

market, causing producers in other countries to increase production to meet the demand. Ukraine lifted a regulation prohibiting logging in protected forests (including forests in the Carpathian Mountains), looking to increase export earnings and redirect them towards the defence budget.[16]

Some deforested land, particularly near villages or towns, may be used to expand the built area with land cover such as asphalt, concrete, or wood, that increases the volume and velocity of overland flow.[17] Even where good tree cover and rangeland exists, increased precipitation driven by climate change can result in saturated soils, negating their beneficial role in flood mitigation.[18] Deforestation trends in Ukraine and the aggravating impacts of the war on the same are discussed in greater detail below.

Tiachivskyi, the raion in which Tiachivska hromada is located, has experienced a net loss of 180 ha (-0.13%) of tree cover from 2000 to 2022.[19] Tiachivska has experienced the most significant tree loss in the north, at higher elevations (Map 4). This can lead to increased flow downstream, as less precipitation is absorbed and flows to lower elevations, putting settlements such as Tiachiv, Lazy, and Ruske Pole at greater risk of floods.

Flood management in Tiachivska

Preparation for flooding

There are certain **measures that households can take to prepare for floods**. Those surveyed in Tiachivska reported taking measures such as protecting the house, stocking food and water, and nearly all reported having permanent stocks of essential items (food, potable water, medicines, etc.) in case of flood or other emergency. In terms of best practices for mitigating the impacts of flooding, HHs discussed installing flood barriers, elevating the property, and improving the drainage system. Despite preparations, most households felt that they were insufficiently prepared due to a lack of municipal services to maintain best practices identified.

In terms of institutional preparedness, previous successes cited by KIs include the dredging done by the City Council and Department of Water Management, awareness and preparedness plans in Ruske Pole and Lazy, river basin protection, and construction of flood management infrastructure. While all KIs confirmed the availability of flood response equipment such as pumps, boats, sandbags, etc., half reported an overall lack of equipment and, more concerningly, most KIs acknowledged the **hromada's preparedness level to be insufficient**, citing rural areas, such as Ruske Pole and Okrugla, as unprotected.

In terms of **challenges in coping with floods at the institutional level**, there was a consensus among KIs about a lack of funding. The majority of KIs mentioned that the war had contributed to this, although it is important to note that the same group of KIs indicated that local authorities hadn't received additional budget for flood mitigation in the past five years, possibly suggesting issues with funding pre-dating the war. In any case, it seems likely that a lack of funding would constrain local authorities' ability to enhance flood resilience in the area, including the replenishment of material stocks.

> *"There are no comprehensive approaches to flood prevention, coordination of local and regional authorities. For example, it is expedient to create some kind of coordination agency that would coordinate the water structures of Ukraine and Romania."*
> *- KI from Tiachiv.*

Another challenge related to capacity for flood mitigation identified by most KIs was a **lack of stakeholder coordination**. When invited to make suggestions for better response coordination, KIs pointed to a number of possibilities, including enhanced coordination at the local level to ensure coordinated planning between local and regional authorities taking into account the specificity of each hromada affected by flooding. Taking a wider perspective, one KI discussed the need for intergovernmental coordination with Hungarian and Romanian counterparts on the issue of dam building given that the Tisa River passes through each of the three countries. A third KI suggested the creation of a workplan that would clearly delineate the relevant procedures, powers, and responsibilities of all stakeholder bodies and organisations.

However, another KI from Tiachiv and a KI from the Department of Water Management noted examples of international collaborations of the kind that can lead to financial opportunities for stakeholders in the region.

> *"Dam project plan – protection of Tiachiv from the Tysa River (Danube River tributary), Tiachivets River Regulation Project (Tysa River tributary). There was also the Framework Agreement "Hungary - Slovakia - Ukraine" of 2003. This will increase the flow of funding to solve the problem and provide publicity that can attract foreign partners."*
> *- KI from the Department of Water Management*

International partnerships, particularly those focused on development initiatives, can open avenues for funding. There have been various transboundary agreements to manage the watershed, including the Hungary-Slovakia-Romania-Ukraine Cross-border Cooperation Programme 2014-2020, which selected seven areas along the Tisa River for partnership and development, including Zakarpatska Oblast, where Tiachivska is located.[21] Looking ahead, the Joint Secretariat of the Interreg VI-A NEXT Hungary-Slovakia-Romania-Ukraine programme (2021 – 2027) has called for proposals for small- to medium-scale projects, providing funding for selected projects from a budget of 49,993,185 EUR.[22]

Awareness of flood preparedness and response

Nearly all HHs reported a lack of awareness around appropriate flood preparedness measures in addition to a lack of training or educational activities on flood response in the hromada and its individual settlements. In contrast, most KIs reported that trainings and educational exercises for flood preparedness and response do exist, often conducted by the State Emergency Service of Ukraine.

In terms of access to information, HHs reported limited awareness of official evacuation routes and population gathering points, though KIs confirmed that they exist. Similarly, results of the HHs survey suggest that members of the public living in flood prone areas are unaware of flood risk maps, while KIs reported that these maps are available to the public, even if they are in need of updating.

The discrepancy between HH and KI perceptions of the availability of educational activities and the accessibility of information may relate to a lack of effective communication of such opportunities by the relevant agencies, suggesting a lack of awareness among the population and potentially a need for authorities to conduct awareness raising activities. If given the opportunity to participate in such activities, HHs expressed the most interest in learning how to prepare their homes for flooding and what actions to take in case of flooding.

Concerningly, a majority of KIs reported a lack of early warning systems (EWS) and hazard monitoring. The vast majority of HHs reported receiving warnings about the threat of flooding through social media or face-to-face interactions.

Impact of the conflict on flood preparedness

A full-scale war consumes significant national resources: human, material, and financial. In Ukraine, the fighting has resulted in the mobilization of hundreds of thousands of working age individuals and forced the state to prioritise security and defence for public spending. Mass mobilisation, increased social spending, and conflict-related disruptions to economic activity have resulted in Ukraine's GDP shrinking by 18.2% between 2021 and 2023.[23] At the local level, this means reduced economic activity, reduced revenues from taxes on businesses, alongside a greater need for social support for struggling households. Such dynamics squeeze local budgets, which are simultaneously being diverted towards the imperatives of security and defence.

To address the sudden skills shortage caused by the war, the Ministry of Digital Transformation has introduced a range of vocational training programmes via the Diia Education platform, aimed to provide technical and practical skills to the remaining population.[24] Nevertheless, such large-scale labour force development initiatives will take time to achieve their objectives, with human resource gaps continuing to be felt across both the private and public sector. At the household level, this means reduced income and a shortage of individuals capable of supporting with flood preparedness measures.[25]

The twin challenges of reduced financial resources and reduced manpower were discussed by both KIs and HHs in connection with flood preparedness. Indeed, a consensus among KIs suggests that a lack of funding is the main challenge associated with flood risk management and most identified a lack of personnel as a constraint on capacity for flood mitigation. For their part, when asked about the impact of the conflict on their ability to prepare for floods, HHs most often referred to a lack of finances and lack of people at home.

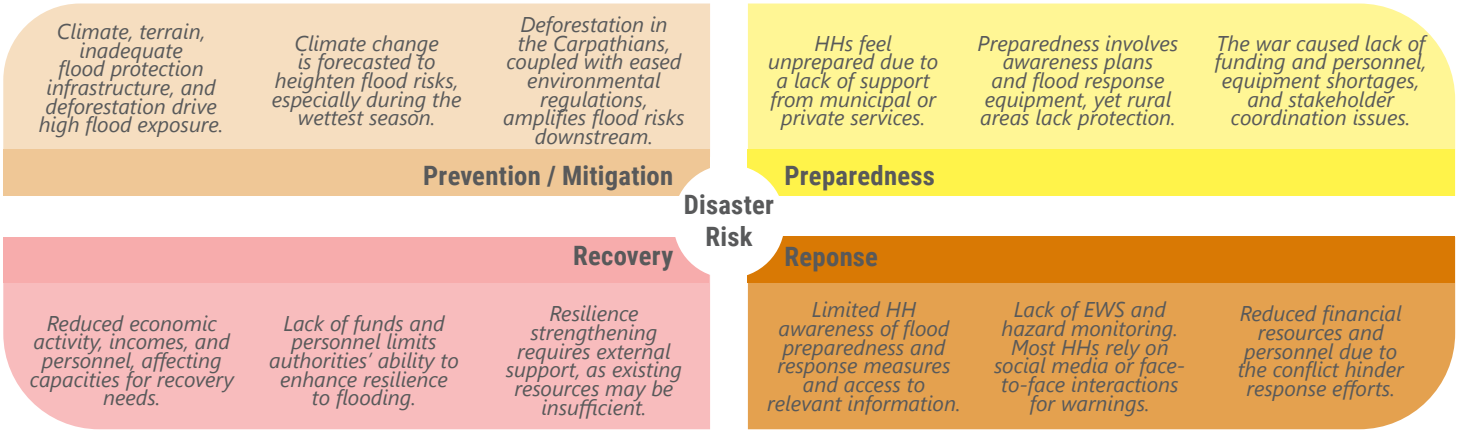
This lack of funds at the institutional and household levels limits the ability of local authorities and individuals to enhance their resilience to flooding. For example, in terms of drivers of flooding in the hromada, all KIs discussed insufficient flood infrastructure and nearly half of the HHs identified the lack of an embankment and the lack of drainage systems. Indeed, nearly all HHs expressed the view that the hromada should engage in building more dams and strengthening the banks of the river in preparation for the next flood event. Similarly, when asked about recommended resilience-building measures for vulnerable populations, KIs tended to discuss the importance of flood management infrastructure. At the level of individual resilience, the majority of HHs indicated that the hromada should offer financial support to help them prepare for flooding. Qualitative data from this and other REACH assessments suggest that significant investments are currently beyond the means of local authorities.

The lack of personnel at organisations involved in flood risk management clearly exacerbates some of the challenges described above. For example, the rehabilitation and expansion of water regulating infrastructure requires technical expertise in addition to financial means. Another area where personnel are needed to support flood risk management is the implementation of educational and training activities on flood response with members of the community. Staff shortages in relevant agencies may hamper their ability to conduct such activities.

Image 2. Water drainage channel in an urban area of Tiachiv city.

Summary of DRM capacities

The following graph summarizes Tiachivka's flood risk management capacities:



Graph 2. Summary of Tiachivska's flood risk management capacities.[26]

Conclusion

Tiachivska is naturally prone to flooding due to its location in the Carpathian Mountains, where it experiences high levels of precipitation and is situated between three rivers. While not unique to the hromada, climate change is amplifying the already elevated flood hazard by bringing more precipitation during the wet season and increasing chances of drought during the dry season. With the main urban settlement sitting in a valley, the population is highly exposed to flood hazards. The ongoing war centered mainly in the East of Ukraine is having profound impacts even on places as far removed as Tiachivska. On the one hand, it has degraded institutional capacities to manage natural hazards: reduced financial, material, and human resources undermine plans to strengthen flood risk management at the local and national levels. On the other hand, it has exacerbated the vulnerability of the population, with IDPs now constituting approximately 7% of the population and many households experiencing the loss of working age individuals and reduced income.

This assessment identifies specific areas where household and institutional resilience can be strengthened. Depending on their location, households may benefit from the installation of flood barriers, elevation of the property, and improved drainage systems. At the institutional level, there is need to enhance the water regulating infrastructure in the area, update EWS and ensure proper forest and rangeland management to avoid loss of natural flood barriers. All of these measures are relatively resource intensive and may be difficult to implement without outside support while the country is at war.

Mitigating flood risks doesn't necessarily involve large investments, however. This assessment found that existing informational resources may be underutilised by the population due to a lack of awareness. Trainings and educational activities would help to ensure that residents are fully informed of evacuation routes, gathering points, and flood risk maps. Information sessions on flood preparedness measures for households would also contribute to the mitigation of flood impacts. At the institutional level, information provided by KIs suggests that improved coordination between local, regional and national authorities would also ensure the efficient utilisation of existing resources.

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REACH Initiative facilitates the development of information tools and products that enhance the capacity of aid actors to make evidence-based decisions in emergency, recovery and development contexts. The methodologies used by REACH include primary data collection and in-depth analysis, and all activities are conducted through inter-agency aid coordination mechanisms. REACH is a joint initiative of IMPACT Initiatives, ACTED and the United Nations Institute for Training and Research - Operational Satellite Applications Programme (UNITAR-UNOSAT).

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Annex - Methodology note

The calculation of riverine flood risk level across Ukraine employed various open geospatial datasets available both globally and nationally. While some of them were ready to use, others were used for extraction of necessary indicators, or had to be geo-coded to be suitable for processing in GIS. In general, flood risk is defined as the combination of hazard exposure (susceptibility) and vulnerability, while the latter is composed by people's general susceptibility and lack of coping capacities (LOCC). All the indicators used for estimating risk level were first aggregated at the hromada level by calculating the mean values for each of them. The indicators were then converted to relative values using the scale from 1 (lowest) to 5 (highest) by applying the "Jenks natural breaks optimization" algorithm.[27] The geographic scope of the analysis included 1,318 hromadas under control of the GoU as of November 2023, within 23 oblasts of Ukraine, excluding Luhanska and the Autonomous Republic of Crimea.

For estimation of the hazard exposure component, a standardised set of indicators have been used from similar assessments conducted by REACH in different national contexts.[28] However, to account for local environmental settings and triangulate results, three additional indicators were added for calculation of the flood hazard exposure. They included granular national data on recent historical floodings (2000-2023), length of river courses with significant risk (probability) of flooding officially defined by the State Emergency Services of Ukraine (SESU) in the Flood Risk Management Plans adopted in October 2022, and global data set on probable water levels for 100-year flood event developed by European Commission's Joint Research Centre (JRC).[29] Thus, the hazard exposure component was defined as a sum of the four mentioned above indicators with equal weights for each.

Vulnerability includes both people's susceptibility to be impacted by flooding and their LOCC, which might be decreased due to the protracted conflict. For each of the two components, four indicators were used. People's susceptibility component was the weighted sum of indicators such as numbers of IDPs in each hromadas, shares of older and younger population per hromada, and mean distance from settlements within hromada to flood-prone river courses. For the first three indicators, the weight was set at 0.5, while for the latter it was assigned as 1.

The LOCC component entailed the availability of water-regulating facilities to mitigate flood risks, density of war-related incidents, area contamination by explosive remnants of war (ERW) and incidents to hazardous facilities recorded from February 2022 to October 2023, provided by REACH's partner Zoi Environment Network under their joint Hazardous Events Monitoring Initiative. Since the primary focus of the assessment was flooding, for all indicators besides the first one, a weight of 0.5 was used and the weighted sum calculated similarly as for the susceptibility component.

Finally, all three components of flood risk were overlaid to calculate the hromada's "Flood Risk Index" (FRI) using the following formula.

$$\textbf{FRI} = \text{Hazard} \times \frac{(\text{Susceptibility} + \text{LOCC})}{2}$$

FRI values were then classified in five classes (from 'Very Low' to 'Very High') to rank hromadas accordingly.

In conjunction with the comprehensive FRI calculation, **six key informant (KI) interviews**, expert personnel from various local authorities, and **13 household (HH) interviews** were conducted, aiming to obtain information at the institutional and individual levels. These interviews helped to enrich and contextualise the interpretation of FRI results and understand further the flood risk management capacities of the hromada.