A Study of the Impact of Flood Events on Settlement Areas in the Kish River Basin

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Received: 01.11.2025 Accepted: 15.11.2025 Published: 25.12.2025

https://doi.org/10.54414/YCBN6132

Abstract

The research will seek to understand the factors that cause flooding in the Kish River basin, the development of the flooding, and the effect of the flooding on the surrounding communities. The region is located on the southern slopes of the Greater Caucasus Mountains. It is under pressure from environmental factors as well as anthropogenic activities. At higher elevations, undulations typically begin with mud-like movements that carry large volumes of sediment down the slope. As you move further into the valley, the narrowing walls and steeper slopes cause the water to gain speed, further exacerbating soil erosion. The danger increases in areas close to the base because towns are situated on fan-shaped deposits of unstable material. The floods devastated life and the economy in Kish, Sheki, and the surrounding villages. Since sudden downpours often overwhelm drainage systems, weather conditions largely determine when floods will occur. As temperatures rise, melting snow puts additional pressure on rivers that are already rising due to stormwater runoff. Human activities such as cutting down trees, farming too close to slopes or allowing animals to destroy vegetation further worsen surface runoff. When vegetation on the slopes decreases, water flows more quickly into the streams below. Instead of relying on a single solution, a combination of green restoration and smart management is required to mitigate the risk. Deep-rooted varieties are planted to slow down the runoff. Changes are made in the methods of ploughing the land to retain moisture. Engineering is required to ensure safety during the management of excess water. Success is not achieved by individual measures, but rather by the extent to which the measures are combined with the principles. Safety is not achieved by using force, but rather by adapting to the environment, which means making a choice that takes the practical changes into account.

Keywords: mountain rivers, river basin, flood, geomorphology, hydrological processes, settlement, erosion.

1. Introduction

The floods in the mountainous regions of Azerbaijan, especially in the southern region of the Greater Caucasus, impact not only the land but also the settlements. The steepness of the mountains, geological changes, types of rocks, weather conditions, and anthropogenic activities altering the soil often result in floods. Out of all the flood-affected areas, the Kish River basin is considered one of the most flood-prone areas in Azerbaijan. This region, in the heart of Sheki-Zagatala, has a special characteristic of constant changes beneath its surface.

Steep slopes, deep river and canyon-type valleys, flood-prone areas covered with large rock fragments, and intensive erosion and denudation processes make the formation of flood flows in the Kish River basin inevitable. Studies show that the parts of the basin above 3.000 m are covered with bare cliffs, nival-glacial debris, and moraines, which activate the initial formation stage of flood masses. At the same time, agricultural lands, urban and rural settlements in the middle and lower reaches, especially the village of Kish, Oxud, and the city of Sheki, have suffered significant damage from flood events. According to historical sources, the Kish River almost completely destroyed the city of Sheki in 1772 and has repeatedly posed a serious threat to settlements in the 20th century and beyond. For this reason, the scientific study of the causes of flood events in the Kish River basin, their impact on populated areas, and flood mitigation measures is of current and strategic importance. Existing research proves that the prevention of flood events cannot be limited to hydrotechnical measures alone; it requires the comprehensive implementation of phyto-meliorative, agronomic, ecological management, and soil conservation measures. Geographic location and general characteristics. The Kish River basin is situated on the southern slope of the Greater Caucasus mountain system and represents one of the most complex and dynamically evolving natural-geographic regions of Azerbaijan in terms of relief, climate, and geological structure. In the center of the Sheki-Zagatala region lies a basin where high mountains meet low slopes and plains. The gaps between these different areas cause nature to constantly reshape the landscape. Observations show that erosion is progressing rapidly here, and floods occur with equal frequency. (Budagov, 1961). Starting near the Kish River - stretching roughly 34km – the basin spreads across over 265 km^2. High peaks of the Greater Caucasus rise along its north edge, yet toward the south, the terrain dips slowly into rolling hills and flat stretches. This setup forces quick shifts in height, making scenery shift fast within small spans (Budagov 1962). Because hills rise sharply here, rainwater rushes fast instead of soaking in. Pools of water rapidly collect and concentrate as they seep into narrow channels in the upper and middle parts of the basin. Rivers become turbulent within minutes because there is little room for them to spread. As the terrain strengthens the flow, its speed increases; floods become more severe because the ground does not allow it to slow down. (Budagov, 1963). People have lived around the Kish River for a long time. Near the village of Kish and the city of Sheki, houses are located in areas where flood waters often reach, that is, in large, flat areas formed by flood waters. Since rivers flow through that area, the danger is very great when storms begin. While this may have something to do with the landform, there is no reason for humans to survive. Scientists are carefully studying these areas to better understand flooding. This study examines the landforms, rock types, water flow, weather conditions, human impacts prior to floods, and current floods in the Kish River region. The main goal of this study is to examine the effects of floods on settlements. In addition, there is a need to come up with strategies that are effective in reducing the risks associated with floods. To achieve this objective, there is a focus on a series of steps. These steps are connected. There is a direction for every step. The direction is clear when all details are aligned. The steps follow one after another, but no progress is made.

Now we need to focus on what is important:

1. Floods in the Kish River basin usually start after heavy spring rains and rapid snowmelt. Steep slopes and saturated soils increase runoff, causing rivers to rise quickly. Water overflows into low-lying areas, especially in narrow valleys and forest loss further worsens flooding;
2. Examining the role of human activities in the development of flood processes;
3. Proposing comprehensive measures to reduce flood risk in the basin.

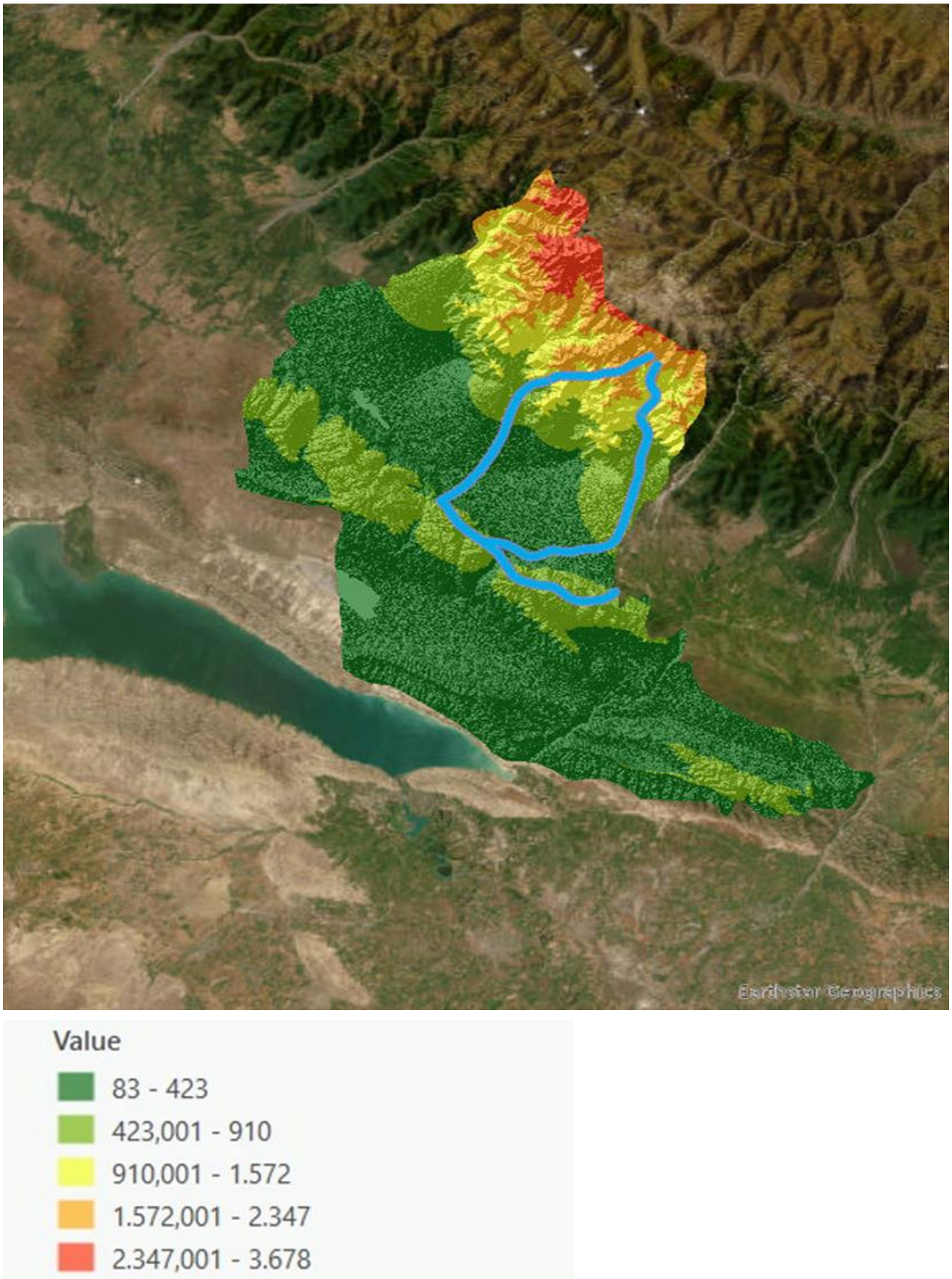
2. Materials and Methods

Flooding patterns in the Kish River basin were examined through landform features, water flow records, and map analysis, along with spatial tools instead of relying on just one method (GIS). Settlement zones felt these impacts directly when overflow occurred during heavy runoff periods. The material basis of the study is scientific publications dedicated to flood and erosion processes on the southern slope of the Greater Caucasus (Budaqov,1963; Rustamov,1978), regional physical-geographical descriptions, hydrological and geomorphological data, as well as cartographic materials reflecting the natural conditions of the Kish River basin, formed the material basis of the study.A digital elevation model (DEM) was used as the primary data source for the analysis of terrain features. Based on the DEM data, the basin's elevation differences, slope angles, and the degree of terrain ruggedness were determined. Height zones were identified and visualized using color imagery by applying the hipsometric analysis method. Geomorphological analysis methods were applied to assess the role of landforms in the formation of flood flows. The prevalence of circular and moraine landforms, steep and canyon-like valleys, the location of alluvial cones, and the steepness of the slope have been considered to be key factors in the occurrence of flood events (Budaqov, 1963; Mustafabayli, 2016). Hydrogeological analysis was conducted using digital elevation model (DEM)-based flow direction and flow collection methods. This methodology allowed us to identify the main river bed, its tributaries, and areas where surface runoff is concentrated, which allowed the identification of areas with high flood risk. Particular attention was paid to flow behavior within the hydrological framework of the study, the rapid increase in surface runoff following heavy rainfall, and the transport of solid materials during flood events.

Cartographic and cartographic-schematic methods were widely applied throughout the study. To assess the spatial distribution of flood events and their interaction with settlements, topographic features, and river networks, elevation zones were integrated and analyzed in a GIS environment. One way to assess the impacts of weather was to analyze heavy rainfall, snowmelt, and climate variability using local climate records and previous studies (Rustamov, 1968; Budagov, 1963). Another approach involved identifying indicators such as historical flood traces, eroded surfaces, changes in river channels, and areas of sediment accumulation through direct field observations and in situ imaging.

3. Analysis and Discussion.

Heavy rains here often lead to swollen rivers because the land tilts sharply down from high mountains. Found along the southe edge of the Greater Caucasus, this region carries water fast throught broken, uneved ground. When storms occur, rising rivers flow down the slopes instead of collecting in one place. The natural structure - steep hills and rugged geography - causes rapid flooding over large areas. The water is constantly moving, transforming isolated waves into widespread downstream movements. In the highest parts of the basin, the mountains are the starting point of events. Glaciers left sacred places there in ancient times. These cavities are covered with piles of rock fragments, and the sediments lie loosely on top of older layers. Rock types break easily when wet. When it rains heavily, the water moves everything around it. Sometimes, melting snow adds more volume, and the soil can't absorb it quickly enough. Water flows along the surface. Steep slopes cause the flow to increase rapidly. The river's speed increases imperceptibly downstream. Flood waters flow through narrow valleys where the riverbed descends step by step. Therefore, with each wave of the river, pieces of rock and gravel are carried downstream. With each wave, they sink deeper into the riverbed and erode the banks. As coastlines erode under pressure, new imprints are created in the soil. More damage increases the likelihood of flooding occurring again. Flooding in the lower reaches of the basin is mainly due to mud accumulation. The risk of flooding is higher in areas where people live in fan-shaped sedimentary beds or in flat river regions. Even when the flow of water slows, piles of debris accumulate there, destroying homes, roads, and farmland. The floods in Kish and Sheki are causing serious damage to lives and livelihoods. People are unknowingly making the floods worse. Cutting down trees, overgrazing animals, and allowing bears to live there weakens the soil and causes it to retain less rainwater. On the contrary, water runs over it quickly. Doing construction work close to the river, performing unwanted excavations, and obstructing the natural water course interfere with the flow of water during a storm. Nature dictates the occurrence of floods. However, human activities provide an added force that further adds to the threat. When both factors occur together, the threat is enhanced. The buildup of water in the Kish River area happens in a complex manner that cannot be addressed in a single manner. Since landforms, water flow, and human activities are interrelated with each other, the solution to the hazard must consider these three factors as interrelated components. By analyzing these three areas together, it is possible to get a better understanding of where the floods might spread and what might be affected. Looking back at the floods in the Kish River area, there is a significant threat. Nature and human life go hand in hand here. These factors act as guides that help construct better strategies in dealing with future threats of floods.



Map 1. The topographic description and elevation band distribution of the Kish River basin were prepared based on a digital elevation model (DEM).

The data collected from the DEM on the GIS device showed the path the water took along the Kish River. Using the hypsometric methods, the different elevations on the terrain were identified and categorized according to their elevations. Then. In the slope-based computation, the streamlines were generated to indicate the source of the main stream. Then, the streams were superimposed on the elevation bands to give a simple illustration of the relationship between landform and drainage. The Kish River runs through different areas, from mountain tops to plains. Its path is determined by the changes in the terrain. Its path is guided by steep slopes rather than gentle slopes. The speed of the water changes where the terrain changes sharply from one level to the next. The river runs from elevations between 83 meters and 3678 meters above sea level. Dark green indicates the areas that are lowland and plain, located at elevations between 83 meters and 423 meters. The rivers run slowly, their beds are wide, and the land slopes gently. The light green indicates the foothills of the mountains. The altitude ranges from 423 to 910 meters. This section is like a bridge, with the mountains allowing the water to flow gently. At this point, when the water is at intermediate levels, it is stable in behavior. From an altitude of 910 meters, the terrain is rough with steep slopes, with the middle section marked in yellow and ending at 1572 meters. At this point, the slopes thicken, which makes the water flow faster downstream. The orange color is shown above, indicating the section rising from 1,572 meters to 2,347 meters. At this point, erosion increases rapidly, with rivers eroding deeper layers in the earth. The red color shown above, rising from 2347 meters, indicates the peaks rising up to 3678 meters, which is the source of the Kish River. The melting of snow and ice from the rivers at this point determines the amount of water flowing downstream. The terrain increases rapidly from a low altitude of 220 meters to a height above 3,500 meters. In this period of growth, changes on this scale occur in a very short period. Because of the different altitudes, transparent layers appear along the path. Climate changes rapidly with altitude. The unique characteristics of the different regions depend on the altitude. The behavior of the terrain, like the weather, is always changing (Rustamov, 1975). The plain area is below 500 meters. It extends for more than 200 meters upwards. The land is very fertile. Crops are grown because of the efforts of the people in the area. In the fields formed naturally, villages develop densely compared to the rest of the land (Rustamov, 1980). Broadleaf forests are present at altitudes between 500 and 1500 meters. However, the cutting down of trees increases the risk of flooding, despite the protective effect of the forests (Mustafabayli, 2016). Subalpine meadows are widespread at elevations of 1500-2500 m, while alpine landscapes are common at 2500-3000 m. These zones are considered the main formation areas for flood flows, as the accumulated snow reserves and precipitation here undergo an intensive melting process during the spring-summer season (Budaqov, 1963). At elevations above 3000 m, cirques, glacial remnants, and bare rock outcrops predominate. In these areas, the weakness of the soil cover and the susceptibility of the rocks to weathering create the initial foci for flash flood events. As a result of vertical zonality, water and rock fragments accumulated in the upper slopes are transported to the lower zones as powerful flood flows, which increases the inevitability of flood events (Budaqov, 1961).

The table below shows the distribution of the basin by elevation intervals.

Table 1. Distribution of Elevation Zones in the Kish River Basin

Elevation Interval (m)	Area (km²)	Share of Total Area (%)
230-520	99	37,5
520-1200	38	14
1200-1700	37	14
1700-2200	41	16
2200-2700	20	8
2700-3200	14	5
3200+	15	6
Mean elevation:1190m		

As this table shows, more than 53% of the basin is above 1,500 m, meaning that the mountainous areas where flash floods form are very extensive. As shown in the table, the largest portion of the area in the Kish River basin belongs to the 230-520 m elevation zone, accounting for 37.5% of the total area. The middle and high mountain belts (1200-2200 m) also have a significant share, which indicates that the terrain is predominantly mountainous. The average elevation of 1190 m proves the diversification of elevations and the existence of geomorphological diversity in the basin. Down in the Kish River basin, land cuts sharply into itself - this shaping plays a big role when floods start up.

Where the mountains rise, the slopes curve sharply; water flows rapidly through narrow ditches shaped by the winding terrain (Budagov, 1961). Above, you'll see bowl-like depressions carved by the ice, and sharp rocks cutting through the landscape, narrow valley extensions; however, they stretch across the landscape in broken lines. On these slopes, the inclinations generally range from 60° to 70° and sometimes exceed the point where cracks sharply divide the soil. Large areas of bare stone are visible on the surface; this prevents the formation of thick layers of soil and causes the material to be quickly washed away when water moves through it. This situation creates moments when flash floods are more likely to occur compared to calmer areas (Alizadeh, 2010). Sellers rush through narrower valleys where steep slopes along the waterway accelerate the flow. Riverbed steps sharpen that rush downstream. Erosion carves out deeper paths here, widening channels across mid-basin stretches. Faster surges follow when terrain funnels rising waters into confined spaces. The active erosion of the slopes causes a large volume of coarse material to be incorporated into the flood flows (Mustafabayli, 2016). *In the lower reaches,* broad alluvial cones have formed as a result of the deposition of soil and rock particles. It is on these cones that the village of Kish and the surrounding settlement areas are located. This factor maximizes the damage potential of flood events, as flood flows here both reduce their velocity and deposit large volumes of material. As a result, settlements are more exposed to the risk of flooding (Mustafabayli, 2017). This structure causes the main source points of the flood flows to be concentrated at elevations of mainly 2000-3000 m (sch 1).

Scheme 1. Orographic Structure of the Kish River Basin

North (3300-3600 m) :	• Main Caucasus Range:rocky outcrops,nival zone
Upper reaches (2500-3000 m) :	• cirque formations, moraines, landslide masses
Middle reaches(1200-2000m) :	• deep valleys, canyons, and steep slopes
Lower reaches(220-800m) :	• wide valleys, alluvial fans, and settlements

This structure causes the primary sources of flood flows to be concentrated mainly at elevations of 2,000-3,000 m.

A river cuts through layers shaped by ancient shifts deep below. Fault lines twist beneath its path, common where mountains fall toward lowlands. Layers from long-ago seas appear alongside newer rubble washed down over time. Hard stone from ages past mixes with loose mud carried by rain and gravity. Much of what lies underfoot comes from times when dinosaurs walked near rising cliffs (Budagov, 1961). Floods often carry chunks of rock because some layers break apart so easily. Water moves through weak spots in

Jurrasic limestone, softening everything nearby. Slippery mud forms when clay-rich shale gets wet, making slopes give way without warning. Rock debris pours into streams after heavy rain eats at sandstone walls. Downstream, big chunks of rock get carried along when sudden floods happen. Cracked and heavily worn Cretaceous limestones mixed with muddy layers add variety to the types of stone found here. These broken-up formations make it easier for slopes to fail, helping trigger slides and similar ground shifts. The power of rushing water grows stronger because debris adds weight and impact (Budagov, 1963). Spread across much of the basin - especially toward its central and lower zones-are layers of loose material like deluvial, proluvial, and alluvial sediment. Reaching dozens of meters thick in certain spots, such buildup shapes how fan-like landforms develop over time. Because floodwaters move them so readily, these poorly bound particiles shift often when rivers swell. As a result, waterways here alter their paths quite regularly. Down in the Kish River basin, waterways twist tightly through the land, feeding frequent floods. Ranging between 0.62 and 1.25 km/km^2, the web of rivers packs more channels than most highland areas hold. Up higher among steep slopes, these streams cluster thickest, speeding up how fast rainwater rushes across the ground (Budagov, 1961). High up where the land climbs sharply, Damarchin begins its flow, shaped by melting snow. Rain pours down on rocky ground, pushing water fast through Chuxadurmaz's narrow paths. From cold springs and sudden storms, Sariguney gathers strength without warning. When clouds burst above, Qaynar surges forward, pulled downhill by gravity's pull. Deep in cracked stone layers, hidden waters feed Goytapa, at odd times. Steep walls of earth channel every drop into quick, sharp rises downstream. Small valleys here react violently when rain hammers the soil for too long (Budagov, 1962). Water rushes fast where streams drop sharply, carrying chunks of stone far downstream. When floods hit, boulders roll alongside gravel while sand shifts under muddy swirls. Instead of smooth runs, drops pop up now and then, mostly higher up or midway along the path. These jumps crank up the force, scraping away rock more aggressively (Budagov, 1963). Flow slow down across flat areas, so sand and silt settle out. Near towns, shifting paths become common because of loose bed material. Where the land flattens, streams spread wider, building fan-shaped deposits over time. Unstable beds emerge when sediment drops at bends and blockages form midstream. Close by villages face greater danger from rising water levels during heavy rains. Steep side valleys feed fast-moving flows into main branches downstream. Branch patterns multiply through wet seasons, shaping how floods grow in size (Table 2).

***Table 2**. Key Hydrological Characteristics of the Main Tributaries of the Kish River*

River Name	Length (km)	Catchment Area (km²)	Average Slope
Damarchin	12	46	0.207
Chuxadurmaz	14	48	0.189
Sariguney	9	12	0.262
Qaynar	11	19	0.300 (upper)
Donuzcha	2,7	5-7	high

Down below, several rivers cut through tight gorges-narrow passages where rising water surges forward without slowing. The data reveals how each arm feeding into the Kish varies widely in size and reach, shaping its movement pattern uniquely. Take Qaynar or Sariguney- they drop sharply, rushing with force due to sharp inclines along their path. Even Donuzcha, though brief in stretch, plunges just as abruptly downhill. From above, it looks like nature carved these paths amid peaks, proving elevation drives much of what happens here.

Floods in the Kish River are do not happen by chance or stand alone. Because of land shape, rock type, weather patterns, together with people's actions they emerge. The way often floods come, also how strong they are, ties tightly to how easily soil washes away there (Budagov, 1962). Hills shape how floods happen. Slopes here often tilt between 35° and 70°, sometimes nearly vertical. Because of such angles, rain slips fast instead of soaking in. Water races downhill without delay. Gullies carved by Damarchin, Chuxadurmaz and Sariguney streams push that rush even harder. Steep-walled channels turn sudden flows into forceful surges. High up in the basin, land climbs fast, starting near 220m and rising to the summit between 3500 and 3685m. Because of this steep change in height, rainwater rushes down slopes while carrying rocks and soil along with it. Weather patterns shape how floods form in the Kish River area. Sitting on the south face of the Great Caucasus, the region shifts in climate as elevation changes - this alters rain, heat, and watr flow (Budagov, 1963). Flooding here often starts with brief yet heavy downpours. When rain falls too quickly, the soil is unable to absorb the water. In this case, the water quickly runs off the surface instead of penetrating the soil. Steep slopes speed up the work, especially in areas where vegetation provides little protection. Changing weather patterns and rotating weather systems are altering the distribution of precipitation across the sky. Floods usually occur within a few hours of heavy rain. Spring and summer storms have a greater impact - rapidly increasing water risks (Rustamov, 1978). The strong volume reductions that occur during sudden and rapid rainfall events alter the soil's ability to withstand these conditions. The sky suddenly turning gray can cause problems downstream when night falls. Snow melting during the winter months plays a significant role in the formation of floods. Rising temperatures in summer accelerate the melting process, especially in areas where snow accumulates at high altitudes in the mountains. If heavy rain falls while the snow melts, the floods will become even more severe. When both forces combine, water levels in rivers rise rapidly and carry tons of trash (Budagov, 1963). The risk of flooding increases, especially in areas where landforms and rock types are similar, when heavy rain combines with melting snow. Weather forecasts are extremely important because they help identify problems before rivers flood. Important things manifest themselves in patterns that are almost impossible to ignore. When floods occur, the movement of water becomes important. Due to the steep slopes and numerous streams, rainwater runs off rapidly; flash floods occur violently and quickly (Budagov,1961). The Kish River, flowing from the mountains, receives its water mostly from melting snow, and some from storms; groundwater contributes less. At higher altitudes, snowmelt directs runoff. Further downstream, heavy rains take the place of runoff. These changes cause river levels to fluctuate sharply throughout the seasons. As spring gives way to summer, rivers often swell rapidly; melting snow mixes with torrential rains, raising the water level so high that it overflows the banks (Budagov, 1985). Floods cause the water level of streams to rise in minutes, shattering riverbeds and dragging rocks and debris downstream. Steep slopes accelerate the flow, causing floods to strike with greater force (Budagov, 1962). In the lower reaches of the basin, floods often carry significant amounts of mud that float in the water. Instead of remaining where they are, rocks that break off from high mountain slopes are carried along rivers. These debris form fan-shaped deposits in areas where streams slow down. These changing flows often reshape river courses, leading to further expansion of alluvial deposits. As the water moves toward lower areas, it carries less material but leaves more material behind. The accumulated debris increases the danger when nearby homes are flooded. Near the village of Kish and the town of Sheki, the behavior of the Kish River significantly influences the outcome of floods. The seasonal patterns are closely linked to the harm felt by the people living there. Floods are becoming more severe across the basin due to human activities. When forests disappear, the soil holds less water, water runoff increases, erosion worsens, and bare areas expand with each heavy rain, especially in the middle parts of the mountains (Alizadeh, 2010). Whereas the soil is kept together by roots, the stakes leave it bare, and this is worsened by overgrazing, which makes it prone to leaching. Unsustainable use of land on steep slopes makes water find new paths to flow rapidly. Construction works that do not follow natural order cause rivers to flow in different beds from their natural courses. Even changing or digging channels alters the rate and distance water can flood. Land that used to remain stable is sliding towards chaos faster when floods come (Alizadeh, 2005). In places like those near Kish and Sheki, agriculture is done in the plains, and during floods, pressure is applied, making restoration works more challenging with each flood (Mustafabayli, 2016). The floods that occur in the Kish River region are a result of a combination of natural and human factors. Land use regulations for the reduction of flood risk must be carried out in conjunction with the protection of trees and forests. Similarly, agriculture must be carried out in accordance with proper scientific principles. As you peruse Table 3 above, you will notice that the slope of the land is a major contributor to flooding. The slopes of the land in this region vary between 37° and 70°. As a result, the rainwater does not seep into the soil but rather runs off the surface. As a result of the speed with which the rain runs up the surface when the slopes are steep due to storms, the angle of the slope is regarded as very important in the formation of floods.

Table 3. Strength of Main Factors Influencing Flood Formation

Factor	Impact Strength	Brief Explanation
Slope gradient	high	Slopes of 37-70°
Geological fragmentation	high	Layers of schist and sandstone
Rainfall intensity	high	Short, torrential rains
Snowmelt	high	Intensifies in spring
Deforestation	high	Increases erosion
Overgrazing	medium	Soil compaction and erosion
Channel modification	high	Occurs on alluvial fans

Cracks in the soil play an important role in increasing flooding in the Kish River region. Layered rocks such as shale and sandstone are widespread in the region, are weak against pressure, and disintegrate quickly when wet. Slope debris flows into the flood waters, increasing their force, but not slowing down once they start. When rocks are so easily displaced, rising waters intensify faster than expected. This structure means that what lies beneath directly determines how serious the flood will be. The amount of precipitation is more important than other weather conditions. Even if it is short-lived, heavy rains overwhelm the soil's ability to absorb moisture and cause water to run off the surface rapidly. Since such floods often cause flash floods, their impacts are serious. Warm weather in the spring causes snow to accumulate quickly in the higher parts of the mountains. As temperatures rise rapidly, water flows down from the melting hills. Flooding is worse than usual because it can rain while it's snowing. This mixture quickly turns slow currents into raging waves. Thus, the role of melting snow in measuring hazard levels is clearly evident. Floods become more severe when people cut down forests. Without trees, the soil holds less water. Rain runs off faster instead of soaking into the bare soil. This flowing water erodes the slopes more quickly. When storms occur, larger areas become vulnerable. Flood patterns feel a touch of grazing, but this is less important than many forces. When animals graze too much, vegetation becomes sparse and soil becomes compacted; flooding changes through chain reactions rather than direct causes. Considering how events are connected behind the scenes, the process of bringing the cattle ashore takes it a step further. When the flow of rivers changes due to human-induced changes, flood patterns change dramatically. Instead of flowing freely, water is pushed into new paths, especially into flat areas where soil is formed. These altered routes tend to bring floodwaters closer to homes and roads. Because of this, changing a river’s path ranks among the most serious actions that raise flood danger. Floods in the Kish River area happen because nature and people’s actions mix in tangled ways. To handle flood risks well, each cause needs to be looked at on its own - yet also how they link together. Not just isolated pieces, but parts of a shifting whole.

4. Conclusion

The conducted research and a comprehensive analysis of the geomorphological, geological, hydrological, and anthropogenic conditions of the Kish River basin indicate that the basin is one of the mountain systems in Azerbaijan with the highest flood risk. The intensity and frequency of flood events are primarily associated with the steep topographic dissection, the widespread presence of steep slopes, the tectonic instability of the geological structure, the easy weathering of schist and sandstone, high rainfall intensity, and strong anthropogenic impacts. In the upper reaches of the basin, especially in Damarçin, in the headwaters of the Chukhadoruz and Sariguney rivers, the flash flood sources are enriched with debris from high mountain rocks, and the downstream transport of these materials in large masses causes successive flash flood events. The middle-order zone is characterized by erosion and deepening of river valleys, which increases the velocity of the flood mass.

Downstream, especially in the areas of Kish village, Baltali, Oxud, and the city of Sheki, the settling of materials in the alluvial cones, frequent channel shifts, and intensified flooding are observed. Human activities such as deforestation, overgrazing, farming on steep slopes, river channel changes, and unplanned construction increase the natural processes that lead to floods. Therefore, flood risk reduction in the basin cannot depend solely on engineering structures. Ecological and landscape management approaches that protect natural systems are also important. As a result, flood safety in the Kish River Basin requires long-term and comprehensive management strategies. These strategies should focus on regulating land use, restoring natural ecosystems, and promoting sustainable environmental practices. Such measures should help protect soil and vegetation, regulate riverbeds, and increase the safety of local communities.

References

1. Budaqov, B. A. (1961). *Sel'evye yavleniya v gornykh rekakh Azerbaydzhana* [Mudflow phenomena in the mountain rivers of Azerbaijan]. Baku: Azerneshr.
2. Budaqov, B. A. (1962). *Fiziko-geograficheskie osobennosti yuzhnogo sklona Bol'shogo Kavkaza* [Physical-geographical features of the southern slope of the Greater Caucasus]. Baku: Elm.
3. Budaqov, B. A. (1963). *Erozionnye i selevye protsessy v gornykh rayonakh Azerbaydzhana* [Erosion and mudflow processes in mountainous regions of Azerbaijan]. Baku: Elm.
4. Budaqov, B. A. (1985). *Fizicheskaya geografiya Azerbaydzhana (gornye rayony)* [Physical geography of Azerbaijan (mountain regions)]. Baku: Elm.
5. Rustamov, S. K. (1978). *Gidrologicheskiy rezhim rek Azerbaydzhana* [Hydrological regime of the rivers of Azerbaijan]. Baku: Azerneshr.
6. Rustamov, S. K. (1980). *Reki i selevye opasnosti Sheki-Zakatalskoy zony* [Rivers and mudflow hazards of the Sheki–Zagatala zone]. Baku.
7. Rustamov, S. K. (1982). *Prirodno-geograficheskie usloviya i landshafty Sheki-Zakatalskogo regiona* [Natural-geographical conditions and landscapes of the Sheki–Zagatala region]. Baku: Elm.
8. Budaqov, B. A., & Rustamov, S. K. (1975). *Osobennosti razvitiya selevykh protsessov v gornykh rekakh* [Features of the development of mudflow processes in mountain rivers]. Baku.
9. Əlizadə, Z. M. (2005). *Şəki-Balakən bölgəsində təhlükəli təbii proseslər* [Hazardous natural processes in the Sheki–Balakan region]. Bakı: Elm.
10. Əlizadə, Z. M. (2010). *Kiş çayı hövzəsində sel prosesləri və onlara qarşı tədbirlər* [Mudflow processes in the Kish River basin and protective measures]. Baku.Əlizadə, Z. M. (2010).
11. Mustafabəyli, H. L. (2016). *Kiş və Şin çay hövzələrində sel hadisələrinin formalaşması* [Formation of flood events in the Kish and Shin river basins]. Baku.
12. Mustafabəyli, H. L., & Rəhimov, Y. R. (2017). Causes of flood events in the mountain rivers of the Sheki region. *Geography and Natural Resources*, (1), 45–52.