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CASE STUDY

Disaster Response and Recovery After the Bozkurt Flood in Kastamonu (Turkey)



Project full title: Enhancing Technical and Vocational Skills for Implementing Nature-Based Solutions (NbS) to Combat Land Degradation

Project acronym: NbS4LD

Project number: 2025-1-TR01-KA220-VET-000357096

Project activity: WP2 Developing Educational Resources on NbS for Combating Land Degradation

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1. INTRODUCTION

This case study has been analysed by [Kastamonu University \(KU\)](#), a partner organisation of the NbS4LD project. KU, founded in 2006, is a rapidly developing Turkish university located on a 237-hectare campus in Kuzeykent. It offers a wide range of academic programs through 15 faculties, 3 institutes, 2 higher education schools, and 13 vocational schools. KU is the only university in Türkiye specializing in forestry and nature tourism, contributing significantly to sustainability and regional development. With 120 international agreements, it promotes student and staff mobility through exchange programs such as Erasmus and Mevlana. The university is recognized globally for academic quality and sustainability, ranking in THE Asia University Rankings, QS Europe Rankings, and UI GreenMetric.

The Bozkurt–Ezine Stream Watershed, located in Kastamonu Province, West Black Sea Region, Türkiye, experienced a catastrophic flood event in August 2021. Rainfall began around noon on 10 August and continued until midnight, saturating the basin soils. On 11 August, extremely intense rainfall occurred in the upper watershed, exceeding a 500-year return period (133.7 mm/h, with 149.5 mm recorded in three hours). The resulting flood generated severe runoff and sediment transport toward Bozkurt District, causing the loss of **77 lives**, extensive infrastructure damage, and major impacts on settlements. The disaster highlighted the vulnerability of the watershed due to steep slopes, degraded forest areas, erosion, and insufficient flood regulation capacity.

Following the disaster, a large-scale watershed rehabilitation and flood risk reduction program was implemented from 2021 to 2026. The project, led by national authorities including the General Directorate for Combating Desertification and Erosion, focused on reducing flood intensity and sediment movement from the upper basin. The Ezine River Basin was divided into six micro-basins, where 6 Flood Control Projects and 44 flood control structures were developed. Main actions included afforestation, rehabilitation of degraded forests, construction of rehabilitation terraces, stream-bed stabilization structures, and sediment retention measures. The intervention improved vegetation cover, reduced erosion, enhanced water regulation, strengthened ecosystem resilience, and increased protection of communities and infrastructure against future extreme rainfall events. The project represents an integrated nature-based and watershed management approach for climate adaptation and disaster risk reduction.

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[The condition of Bozkurt district center before the flood event Before the flood, the Ezine Stream follows a regulated channel with relatively stable flow conditions and surrounding urban structures - Source: Bozkurt Municipality]

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[Flood impacts observed in Bozkurt district following the 11 August 2021 flood disaster. After the flood, the river channel was severely altered due to extreme rainfall, leading to massive sediment transport, channel widening, and extensive damage to residential areas and infrastructure. Significant sediment deposition, destruction of buildings, and expansion of the floodplain are clearly visible - Source: Bozkurt Municipality (2021)]

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[Post-disaster reconstruction and resettlement efforts in Bozkurt district following the 2021 flood disaster. Following the flood disaster, extensive reconstruction and resettlement activities were carried out in safer areas of the upper basin. New residential buildings were constructed to relocate affected populations, and infrastructure redevelopment was implemented to enhance resilience against future flood risks - Source: Bozkurt Municipality (2022)]

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[Structural flood control and sediment retention measures implemented in the upper basin following the 2021 flood disaster. Following the flood event, structural interventions such as check dams, sediment retention basins, and channel stabilization structures were constructed in upstream areas to reduce sediment transport, regulate flow, and mitigate future flood risks. - Source: Bozkurt Municipality (2022)]

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2. CONTEXT

2.1 LOCATION

Country: Türkiye Region: West Black Sea Region. Province: Kastamonu. Site: Bozkurt–Ezine Stream Watershed. Approximate GPS coordinates: Latitude 41.95° N – Longitude 34.00° E.



[Location of Kastamonu province on the map of Türkiye]

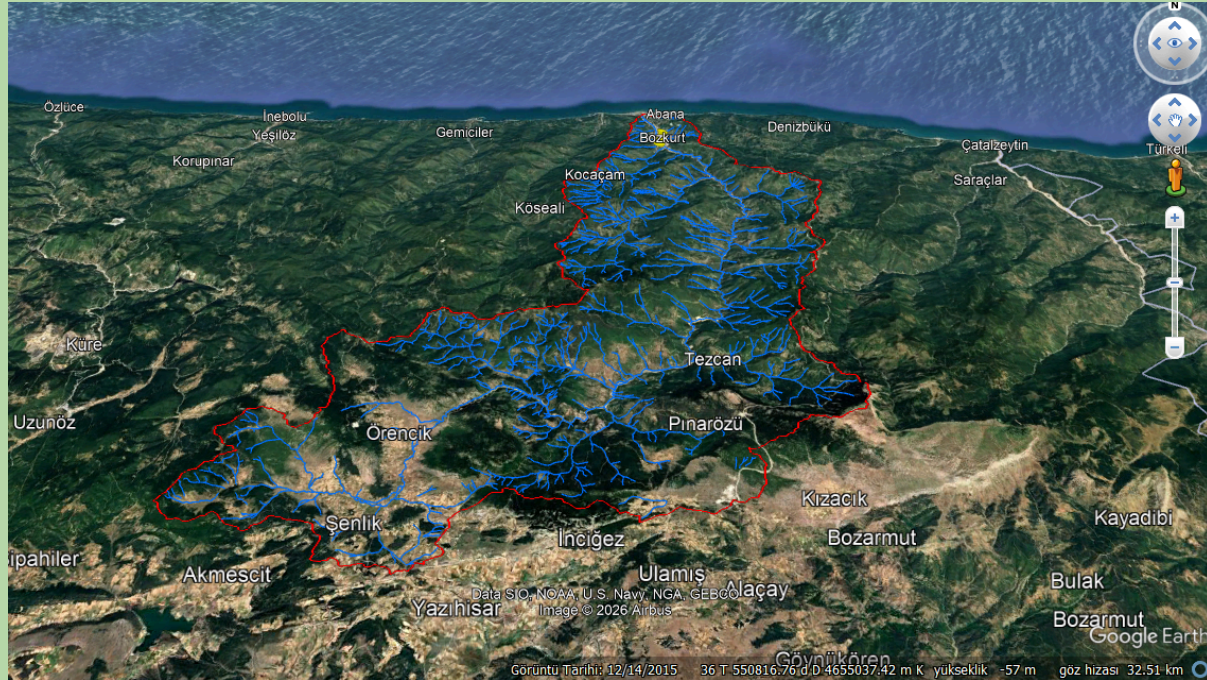


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[Location of Kastamonu province and Bozkurt-Ezine Watershed on the map of Türkiye]



[Location of Bozkurt-Ezine Watershed and drainage status on the map of Türkiye]

2.3 LANDSCAPE TYPE

Croplands. Forests. Grasslands. Urban ecosystems.

2.4 LAND DEGRADATION CHALLENGE

Deforestation. Poor land management. Urban expansion. Climate change. Soil erosion.

2.5 BASELINE DATA

Land condition	Site: the Bozkurt–Ezine Stream Watershed is located in Bozkurt District, Kastamonu Province, Türkiye. The watershed covers approximately 37,641.91 ha. Land use is mainly composed of forest areas (59.00%), agricultural areas (25.56%), and settlements (2.11%). Productive forests are mainly located in the downstream and middle sections, while degraded forests and forest clearings are more common in upstream areas. Agricultural and settlement areas are distributed from downstream to upstream, increasing pressure on forest resources.
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	• Soil: the soils in the watershed are mainly brown forest soils. Agricultural areas contain relatively fertile soils. However, exposed soils and degraded vegetation areas increase susceptibility to erosion, especially on steep slopes. • Vegetation cover: it is dominated by forest ecosystems. Productive forests with good canopy cover provide important soil conservation and hydrological functions. Degraded forests, caused by grazing pressure, illegal logging, and conversion of forest land to agriculture, have reduced vegetation protection and increased sediment production. Forest clearings (forest soil areas) require rehabilitation and afforestation. • Erosion status: the watershed is highly vulnerable to erosion due to steep slopes and degraded land cover. Approximately 55.96% of the area experiences moderate surface erosion, 40.21% slight surface erosion, and 3.80% normal erosion. Erosion is mainly concentrated in degraded forests, agricultural lands, and open forest areas. Steep terrain increases sediment transport into streams, contributing to flood impacts.
Environmental context	• Climate: the area has a humid temperate climate (Cfa according to Köppen classification). Annual precipitation is approximately 1,015 mm, with the highest rainfall occurring in winter. The average annual temperature is around 13.8°C. Intense rainfall events contribute to flood and landslide risks. • Hydrology: the watershed is characterized by irregular orographic rainfall patterns and steep stream channels. Heavy rainfall combined with high slopes increases runoff, flooding, and sediment transport in the Ezine Stream. • Biodiversity: the area contains forest ecosystems supporting local biodiversity. However, land-use changes, forest degradation, pollution, and climate variability have contributed to habitat fragmentation and biodiversity decline. • Ecological pressures: soil erosion, forest degradation, uncontrolled land conversion, climate variability, and increased sediment production due to loss of vegetation cover.
Socioeconomic context	• Population: the area has low to moderate population density, with scattered rural settlements and forest villages located throughout the watershed. • Livelihoods: local livelihoods mainly depend on agriculture, livestock farming, and forestry activities. Income sources are limited and strongly connected to natural resources.

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	• Land management: it is mainly based on small-scale agriculture and fragmented land ownership. Traditional farming practices and insufficient conservation measures contribute to soil degradation and erosion. • Resource dependency: communities depend heavily on land, water, forests, and pasture resources for agricultural production, livestock, and household needs.
Policy and governance	• Institutional framework: before the flood disaster, watershed management practices in the Bozkurt–Ezine Stream area were implemented in a fragmented way, with limited coordination between land, water, forest, and agricultural management institutions. Although Türkiye has policies related to erosion control and sustainable land management, local implementation and preventive measures in upstream areas were insufficient, reducing the effectiveness of flood risk management. .

3. INTERVENTION

3.1 TIMEFRAME

Implementation: 11.08.2021 - January 2026.

3.2 TYPE OF INTERVENTION

Afforestation. Watershed rehabilitation and soil conservation measures.

3.3 IMPEMETING ORGANISATIONS

Following the floods, the General Directorate for Combating Desertification and Erosion inspected the flood-affected areas and examined the upper basins. The Ezine River basin was divided into 6 micro-basins, and Flood Control Project studies were initiated. In this context, the work planned for the uppermost basin, encompassing the villages of Ambarcılar, Yaylatepe, Tezcan, and Şeyhoğlu, will contribute to reducing the amount and intensity of floodwaters flowing into the Ezine River during heavy rainfall through the construction of rehabilitation terraces in the upper basin.

The project will be integrated with the work to be carried out in the other 4 basins, and the intensity and amount of floodwaters flowing into the Ezine River after heavy rainfall will be reduced. It aims to control the runoff regime of the streams located in the upper basin of Bozkurt District, Kastamonu Province, within the project area boundaries, as part of the fight against desertification, erosion, and climate change.

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The main objective of the project is to eliminate or minimize erosion, soil loss, and damage that may occur as a result of bank erosion, bank collapses, bank slippages in the gully and stream beds within the project area, and shallow landslides affecting the main streams.

Within the scope of the project, transverse structures will be designed in the gully and stream beds within the project area to create toe-like structures on the banks, and the flow regime of spring and rainwater will be regulated to reduce the impact of sediment runoff as floods pass through the basin.

3.4 FUNDING SOURCES

Approximately 10.209.715,82 million TL has been spent on the project.

3.5 IMPLEMENTATION ACTIONS AND MEASURES

The following activities were carried out within the scope of the project:

Within the scope of the project, transverse structures will be designed in the gully and stream beds in the project area to create abutments on the shores, and the flow regime of spring and rainwater will be regulated, thereby reducing the impact of sediment runoff as floods pass through the basin.

Interventions:

- Ambarcılar, Yaylatepe and Kutluca Villages Upper Basin Flood Control Project;
- Tezcan and Şeyhoğlu Villages Upper Basin Flood Control Project;
- Elmalı Tekke Saraydurak and Kutluca Villages Upper Basin Flood Control Project;
- Sakızcılar and Kızılcaelma Villages Upper Basin Flood Control Project;
- Yaşarlı and Işığın Villages Upper Basin Flood Control Project;
- Kocaçam and Kutluca Villages Upper Basin Flood Control Project.

4. IMPACT

4.1 ENVIRONMENTAL IMPACT

☑ Increased vegetation cover or habitat restoration. ☑ Improved biodiversity. ☑ Improved water quality or water availability. ☑ Reduced land degradation. ☑ Improved ecosystem services.

The intervention contributed to reducing severe soil erosion in the Ezine River Basin through afforestation, rehabilitation, and erosion control measures. It mitigated the potential damage from future flood disasters. The safety of the people living in Bozkurt district was ensured. Vegetation increased, particularly in degraded forests and open areas, improving soil

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conservation functions. These improvements reduced pressure on natural resources and supported habitat recovery. Structural measures and watershed interventions contributed to improved water regulation and reduced risks associated with floods and sedimentation. Overall, the project supported the improvement of ecosystem functions and reduced land degradation at the watershed scale.

4.2 COMMUNITY IMPACT

☑ Increased household income. ☑ Flood control measures. ☑ Strengthened community resilience. ☑ Increased local capacity or skills.

The project primarily ensured the safety of the people living in the region. The measures taken in the upper basin reduced the risk of future floods and inundations. It also minimized the significant material damage that could occur in a potential flood disaster.

The activities carried out in the project area have provided a significant recreational space for academic and administrative staff and students at the university, transforming the previously unused landfill into a recreational area.

4.3 INSTITUTIONAL IMPACT

☑ Strengthened institutional coordination. ☑ Increased community participation in decision-making. ☑ Establishment of new management structures or partnerships. ☑ Capacity building for institutions or communities.

The project strengthened coordination between the General Directorate of Combating Desertification and Ethion, the General Directorate of Forestry (OGM), and the State Hydraulic Works (DSI). Agreement was reached on joint measures in the studies conducted in the Ezine River basin. These participatory approaches improved decision-making processes and contributed to more effective and integrated basin management practices.

4.4 SUSTAINABILITY OF THE RESULTS

☑ Integration into policies or development plans. ☑ Strong local community ownership. ☑ Institutional support or partnerships. ☑ Local technical capacity for maintenance. ☑ Monitoring and adaptive management systems.

The project ensures long-term sustainability through continuous coordination between institutional support and implementing organizations. Erosion and flood control, forest rehabilitation, and mitigation measures are expected to provide long-term environmental benefits, including reduced soil erosion and improved ecosystem stability. Flood control measures taken in river basins ensure the safety of people living in the district. Structural interventions such as sediment control and stream rehabilitation aim to protect agricultural and residential areas over time. These interventions reflect a transition toward risk-informed and

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resilience-based watershed management, consistent with the principles of the Sendai Framework for Disaster Risk Reduction (UNDRR, 2015).

5. CONCLUSION

- **Community relevance:** mostly.
The intervention addressed a significant community challenge related to flood risk and loss of life. The 2021 Bozkurt flood disaster caused severe impacts, including 77 fatalities. The implemented watershed measures helped reduce future disaster risks by improving water and sediment retention in the upper basin, decreasing downstream flood intensity and protecting settlements.
- **Technical effectiveness:** mostly.
The intervention improved ecosystem functions and reduced flood and erosion hazards through nature-based measures such as afforestation, erosion control, and watershed rehabilitation. Restoration of degraded forest areas increased vegetation cover, improved soil stability, reduced sediment production, and enhanced the basin's capacity to regulate runoff.
- **Economic efficiency:** mostly.
The intervention was financially supported through cooperation between public institutions, including forestry and erosion-control authorities. Investments in ecosystem restoration, afforestation, and flood prevention contributed to reducing potential future damages from floods, sediment accumulation, and infrastructure losses.
- **Institutional support:** fully.
Strong institutional cooperation supported the implementation of the intervention. Coordination between relevant governmental organizations enabled integrated watershed management, combining flood protection, erosion control, and ecological restoration activities.
- **Innovation:** mostly.
The intervention introduced nature-based solutions by combining ecological restoration with disaster risk reduction. Integrated watershed management practices, including afforestation and erosion prevention measures, increased ecosystem resilience while addressing flood hazards.

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- **Replication & Scaling Potential:** fully

The approach can be adapted and replicated in other flood-prone watersheds. Many settlements in Türkiye are located along river valleys and basin outlets, where similar flood risks exist. The combination of afforestation, erosion control, and watershed-based planning provides a transferable strategy for reducing flood and land degradation risks.



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