Policy Research Journal
ISSN (E): 3006-7030 ISSN (P) : 3006-7022 Volume 3, Issue 12, 2025

CLIMATE CHANGE IMPACT ASSESSMENT, HAZARD RISK OF FLASH FLOODS AND PREPAREDNESS PLAN FOR DISTRICT DADU SINDH PAKISTAN

Mukhtiar Ahmed Mahar*[1], Mubashir Hassan[2], Altaf Ali Siyal[3]

*[1]*Department of Fisheries and Aquatic Science, University of Sindh Jamshoro, Pakistan.*
[2]*Sindh University Housing Society, Jamshoro, Sindh, Pakistan.*
[3]*Sindh Agriculture University, Tandojam Sindh Pakistan.*

*[1]mukhtiar.mahar@usindh.edu.pk, [2]mubashir.hyd@gmail.com, [3]siyal@yahoo.com

DOI: https://doi.org/10.5281/zenodo.22806359

Keywords

Article History
Received: 28 October 2025
Accepted: 12 December 2025
Published: 26 December 2025

Copyright @Author
Corresponding Author: *
Mukhtiar Ahmed Mahar

Abstract

District Dadu is especially vulnerable to flash floods originating from the Kirthar mountain ranges sides. Hazard risk assessment and effect analysis were carried out to reduce the risk of flash flood damage in District Dadu's vulnerable areas, particularly Taluka Johi and many Khairpur Nathan Shah Union Councils (UCs). Heavy rainfall can trigger flash floods and hill torrents, which are characterized by abrupt water surges and present serious risks to infrastructure and populations. This study demonstrates how these dangers can be considerably decreased with the appropriate combination of technology, infrastructure, and community involvement. In contrast to riverine floods, these floods inundate areas in a matter of hours, leaving very little time for preparation. The Nai Gaj, a notable hill torrent, is the best example of the devastating force of these floods. The 2022 and 2025 floods showed how devastating flash floods can be, submerging homes, forcing residents to migrate, and destroying agricultural areas. The study identifies a number of critical steps that must be implemented to increase flood preparedness and resilience, such as updating and renovating drainage networks and improving existing irrigation and drainage systems to handle increasing floodwater capacity. Restore canals like Western Nara to promote the water's natural flow. Boost the capacity of the RBOD/MNVD drainage systems to manage floodwaters. To improve water flow in waterways, remove obstructions. Restoring and protecting trees in riverine areas and natural waterways, replacing and repairing barriers that safeguard rivers and drainage systems on a regular basis, and using satellite technology for quick reporting and monitoring are all ways to absorb excess water. To offer accurate forecasts, deploy weather stations with equipment in strategic locations. Strengthen the MNVD and FP bunds' left bank for additional security. Create mechanisms to monitor Baluchistan runoff throughout the monsoon season and alert residents of approaching floods. The study promotes a multimodal approach to forecasting by using satellite photos and weather radar to determine the intensity and course of precipitation. Create rainfall-runoff models and track soil moisture content to forecast the probability of floods. For mapping land use and topographic analysis, GIS.

Install Automated Weather Stations (AWS) and river/stream gages for ongoing observation. Launch public awareness efforts and train local observers. Make use of remote sensing technologies and machine learning methods. Promote interagency cooperation and integrate data from multiple sources. Run simulations and look at historical data to improve forecasts. Following analysis of the data, it was suggested that District Dadu establish a strong FEWS since it offers several advantages, including early alerts that enable locals to take the appropriate precautions and evacuate if needed. permits local government agencies to gather resources and put flood prevention plans into action. To boost general resilience, promote community readiness. aids in the efficient distribution of resources by the government and humanitarian organizations. Protect homes, companies, farms, and important habitats that are impacted by flooding to minimize financial losses. Above all, to increase community trust and promote collaboration with local authorities in the case of floods.

Because of the devastating and frequent flash floods in District Dadu, a comprehensive Flood Early Warning System (FEWS) is necessary. The district may greatly lessen the effects of floods, save lives and property, and boost community resilience by putting the suggested strategies into practice. In order to establish a safer and more prepared environment for everyone, the study highlights the significance of a complete approach that involves technical breakthroughs, infrastructure upgrades, and community involvement.

Introduction

In recent years, Sindh province in Pakistan has faced natural hazards in form of heavy rains, flesh floods riverine floods, cyclones and sometime drought one of the most disaster. These disasters driven by climate change have been observed in the form of floods, heavy rain, drought, cyclones, sea level rise, coastal land erosion, and high tidal surges. These environmental hazards have adverse effects on the infrastructures, agriculture, livestock, fisheries, and income sources. District Dadu, located in Sindh, Pakistan, is particularly vulnerable to Hydro-Meteorological disasters. The mighty River Indus flows on the eastern side, while several hill torrents lead from the Kirthar Mountain situated on the western side. Additionally, numerous drains are linked to the RBOD project, and Lake Manchhar covers an area of 350 sq. km at the foot of the Kirthar range in the district. The water volume of these aquatic resources, when increased, leads to disasters that wash away everything in their path. Due to its geographic position about the Indus River and its effluents as well as the hill torrents, District Dadu is affected by floods quite often. Flood affects the lives of human beings, properties, farming, and livelihood in the region. Familiarizing the spatial distribution of flood vulnerability is significant in the development of efficient disaster mitigation and preparedness plans. Location, elevation, physical features, irrigation network, hill torrents, wetlands, flood vulnerability in irrigated and rain-fed areas' geospatial maps were also prepared under this project. GIS-based mapping illustrating hazard risk vulnerability occurring in the areas was formulated using Geographic Information System (GIS) technology for preparing maps of hazard-prone and vulnerable areas in the study region. This mapping provided an important understanding of the risks, aiding in the strategic placement of early warning technologies for effective disaster preparedness and response. The hotspots and locations of the study area were identified and visited where flash floods hit. There are four talukas in Dadu district - Mehar, Khairpur Nathan Shah, Johi, and Dadu - where climatic impacts have seriously destroyed infrastructures, agriculture, livestock, and fisheries. Historical records showed that Talukas Johi and KN Shah were the most vulnerable. Surveys by the Revenue

Department and local government, along with FRDP, have revealed about 40 dehs in Johi Taluka as completely or partially submerged under flash flood water during the 2022 flash flood.

Significance of the study

This study aims to strengthen institutional capacity, streamline processes and practices, enhance coordination mechanisms through DRR units, integrate disaster losses and impact data across all disaster management governance units at national, provincial, and district levels, and boost ex-ante disaster response decision support systems. Furthermore, it will strengthen the implementation of PDMA/DDMA through the formulation of implementation frameworks/strategies.

Justification

District Dadu is prone to flash floods, and the absence of a functional EWS exacerbates the risks faced by its inhabitants. This study is based on data related to water flow from hill torrents, rivers, ephemeral streams, floods, and flash flood risks in the district. The Sindh Resilience Project has not looked at the effects of flash floods in the multi-hazard vulnerability risk assessments (MHVRAs) of the District Disaster Management Plans (DDMPs). Further study on hazard risk and impact evaluations is needed to close this gap. It is obvious that District Dadu needs an efficient early warning system. The data gathered from this study will contribute to the development of an all-encompassing EWS, which will eventually improve the preparedness and resilience of the area to disasters.

This study intends to greatly enhance the safety and well-being of residents of District Dadu by addressing the research objectives and utilizing stakeholder feedback. Given the previously given information, a long-lasting early warning system mechanism focused on proactive rather than reactive measures during a crisis is required.

A comprehensive EWS typically includes:

- Risk Knowledge: Understanding and mapping flood-prone areas.
- Monitoring and Predicting: Using technology to monitor weather patterns and predict floods.
- Dissemination and Communication: Ensuring timely and effective communication of warnings to those at risk.
- Response Capability: Building the capacity of communities and authorities to respond effectively to warnings.

Methodology

Despite the evident need for an effective early warning system (EWS) in District Dadu, no functional system is currently in place to warn inhabitants of impending flash floods. The Sindh Resilience Project has not analyzed the impact of flash flooding in the recently developed multi-hazard vulnerability risk assessments (MHVRAs) in the District Disaster Management Plans (DDMPs). As a result, there is a pressing need for comprehensive research on hazard risk and impact analysis concerning flash flooding in the district.

Key Informant Interviews:

Since we were focused on collecting real-time data, and geographic locations were scattered, researchers decided to apply the purposive sampling method, with the help of this method we were flexible to add new respondents/ samples based on referrals from the participants following the snowball approach. Participants were selected using purposive sampling to include diverse groups from villages, hamlets, hilly areas dwellers, KIIs from the district admirations, experts, and practitioners. The Target sample size is 60 survey respondents, 4 FGDs, and 15 KIIs. A cross-sectional survey was conducted in Dadu District, 60 respondents belonging to targeted communities were purposively selected as a sample for the survey. The respondents were served with a close-end questionnaire, developed to address the research objective of the study. Four focus group discussions were held, at Khairpur Nathan shah and Johi Taluka. A discussion point instrument was developed based on the findings of the survey and key themes emerged in KIIs to further explore the topic understudy. The primary data was collected through in-person visits and

conducted surveys, Key informant interviews, and Focus group Discussions. Instrumental Data Collection and Assessments Survey (Structured questionnaire). Interviews with Key Informants (semi-structured questionnaire). Focus Group Discussions. Participant Categories for FGD and KIIs:

- Government Representatives
- Academic Scholars
- Lawyers
- Community Representatives/Local Leadership
- Media Representatives

The secondary data was collected through the researchers from the relevant reports, articles, blogs, libraries, and all available / published material.

- Historical Flood Data
- Relevant Reports, Plans, and Articles
- Remote Sensing Images
- Meteorological Reports
- Meteorological Data
- Local Community Surveys
- Satellite Imagery

Quantitative data is analyzed using descriptive and inferential statistics. Thematic analysis is used to examine qualitative data in order to find common practices.

- GIS Mapping
- Quantitative Analysis
- Qualitative Analysis
- Pressure and Release (PAR) Model
- Disaster Risk Reduction (DRR) Framework
- Community-Based Early Warning System (CBEWS) Model
- Sustainable Livelihoods Framework.

Results

Climate change impacts

The Dadu district is particularly susceptible to the effects of climate change, which show up in a number of important ways. The region's already common extreme temperatures are predicted to worsen due to climate change, resulting in hotter summers and more severe heatwaves. Water resources may be stretched, agricultural production may decrease, and the local people may be at risk for health issues. The change in precipitation patterns is another important impact. Despite the region's generally low rainfall, climate change may result in more frequent and intense downpours, which might lead to flash floods that damage infrastructure, ruin crops, and erode soil. Prolonged droughts, on the other hand, can happen more frequently, further taxing the already limited water supplies and making it more difficult to use water for domestic and agricultural uses. The district's agriculture, which primarily relies on the Indus River for irrigation, faces additional challenges due to decreased river flows and rising salinity, both of which are exacerbated by climate change. These circumstances could result in decreased agricultural production and land degradation, endangering food security and farmers' livelihoods. Droughts and floods brought on by climate change also pose a major danger to the district's biodiversity. Temperature and precipitation variations can change ecosystems, stress native plant and animal species and perhaps reduce biodiversity.

Flood vulnerability

During the monsoon season, when the Indus River and its tributaries are flooded by significant rains, Dadu District is especially susceptible to flooding. Pluvial and river floods are common in the district. Low-lying areas in the irrigated sector are susceptible to floods, endangering people, property, and crops. The Main Nara Valley Drain (MNVD) once followed the district's natural depression to link Manchhar Lake and Hamal Lake(Fig.1).

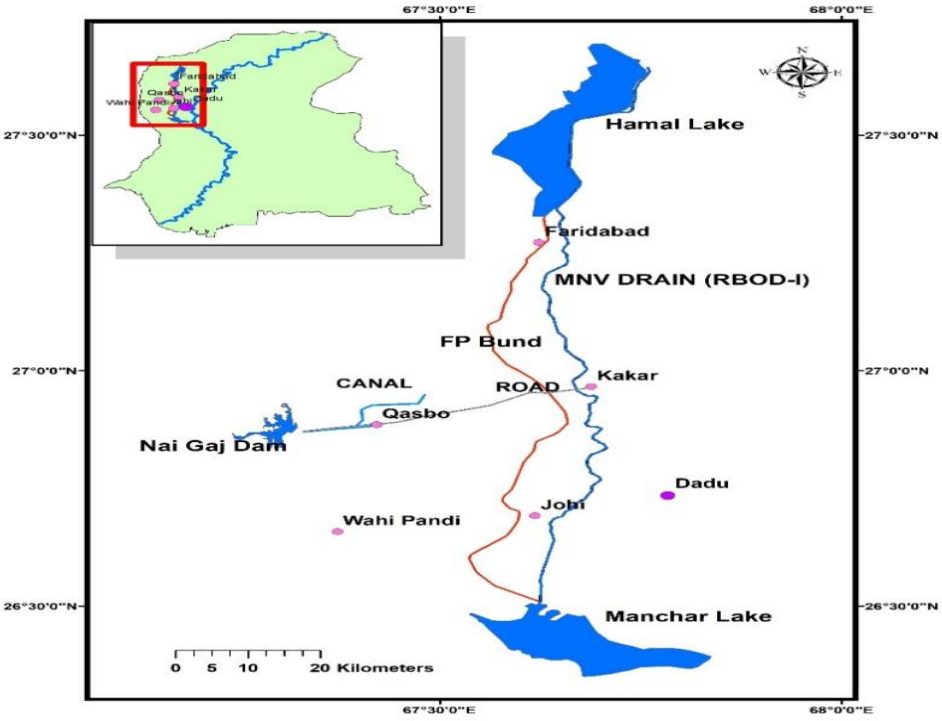


Fig. 1: An illustration of the Dadu District's Main Nara Valley Drain (MNVD).

The elevation map provides a comprehensive overview of the topography by illustrating the district's diverse altitudes. The highest elevation is 2143 meters above mean sea level (MSL), while the lowest elevation is about 33 meters above MSL. The district's elevation varies from 33 to 2143 meters above mean sea level.

The MNVD has the lowest elevation. Different elevation ranges are indicated on the map using color coding, such as blue areas (33–40 meters). Areas with natural depressions are indicated by these lowest elevation zones. These areas, which include towns like KN Shah, Dadu, and Johi, are mostly found in the district's eastern section.

The elevation of the beige-colored regions (40–60 meters) is still quite low, while being slightly higher than the blue areas. Important locations in this range include Mehar, Sita Road, Faridabad, and Radhan. Mid-range elevations are shown by the purple-colored sections (60–80 meters) that reach westward from the district's center. Orange-colored parts (80–300 meters) represent higher elevation zones, which are mainly located in the district's western mountainous sections, including Wahi Pandhi.

The red sections (300–2,143 meters) show the highest elevation levels in the district's far western section, which contains the Gorakh Hill Station.

The elevation gradient from the low-lying eastern plains to the high western mountains is vividly depicted in the chart. This geographic disparity has a major impact on the district's infrastructure development, agriculture, water management, and flood danger.

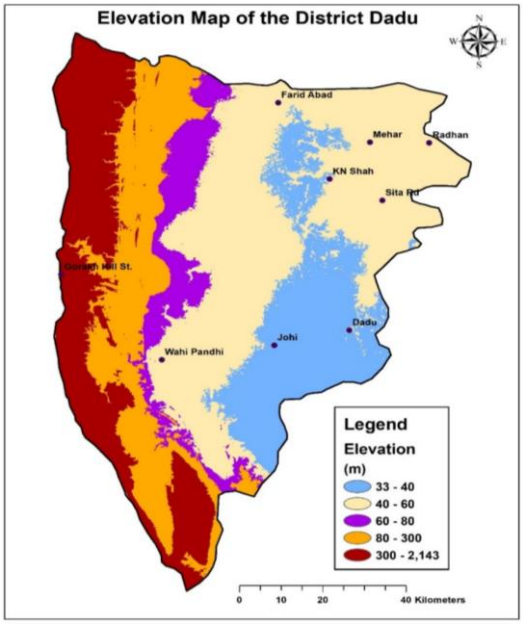


Fig. 2: An elevation map of Sindh, Pakistan's Dadu district.

The elevation-based flood susceptibility map is displayed in Fig. 3. The map displays the various flood hazard levels in the Dadu district of Sindh, Pakistan. The map is color-coded to indicate the different flood threat zones. Blue areas are those with a high risk of flooding. Yellow patches indicate areas with a medium risk of flooding. Green areas indicate low-risk areas for flooding. The district's topography is depicted; the western part, which includes Gorakh Hill, is higher and less prone to flooding, while the eastern part is lower and more susceptible to flooding. This representation highlights the need for targeted flood management and mitigation efforts in high and medium-risk areas, making it easier to understand the geographical distribution of flood susceptibility in District Dadu.

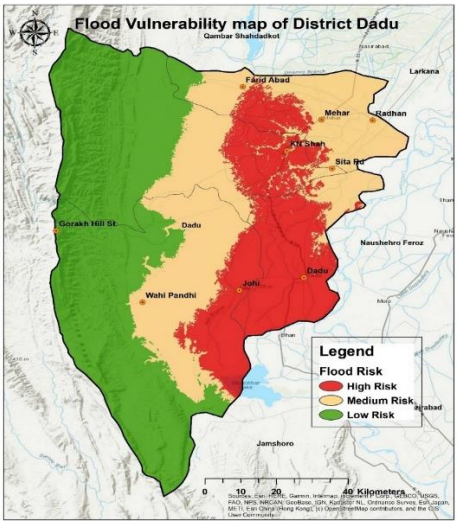
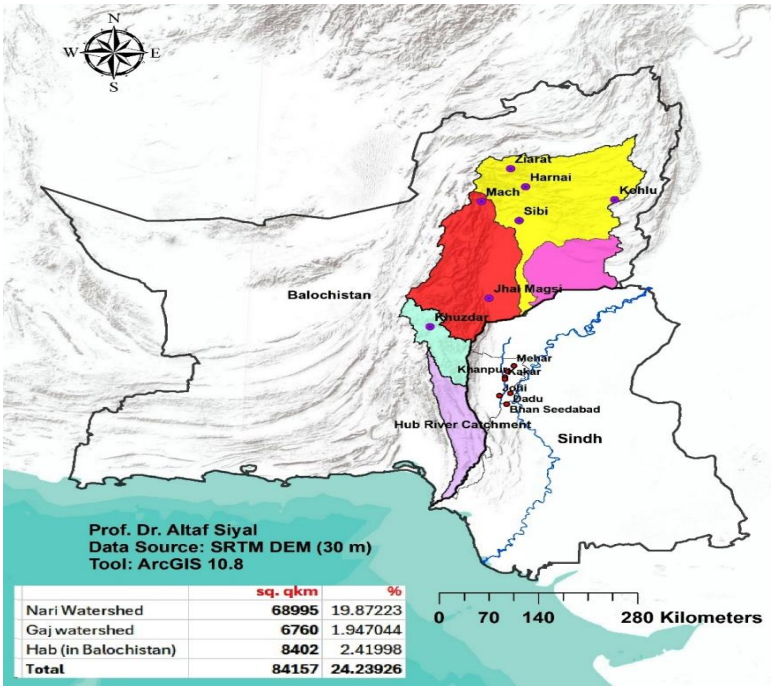


Fig. 3: An elevation map of the Dadu district in Sindh, Pakistan.

The district is particularly vulnerable to floods because of runoff from the Nari, Mula, and Kachhi basins in Balochistan as well as hill torrents from the Khairthar Mountains. About 25% of Balochistan's drainage is sent to Sindh (Fig. 4). Runoff from the Nari, Mula, and Kachhi basins travels to Sindh and passes through Chukhi to reach the Kambar Shahdadkot region. Following a 4–8 km wide natural depression strip (high flood risk zone), it then traverses the whole region along the MNVD path until draining into the Indus River via Manchhar Lake via the Aral and Danistar Canals (Fig. 4).



	sq. qkm	%
Nari Watershed	68995	19.87223
Gaj watershed	6760	1.947044
Hab (in Balochistan)	8402	2.41998
Total	84157	24.23926

Fig. 4: Map of the area of Baluchistan draining into Sindh.

Different communities, civil society, academia, district bar associations, NGOs, and Government authorities were engaged to gather accurate ground knowledge through FGDs, KIIs, and workshops. The questionnaire consisted of semi-structured and structured questions; however, the respondents were asked at the end if they could add any other information or experience.

Interviews were conducted with sixty community members from Taluka Mehar, Khairpur Nathan Shah, Johi, and Dadu. Most respondents (82%) stated that to swiftly relocate to safe areas, they require an easy-to-use excess early warning system. Dadu district's rural inhabitants are severely impacted by the effects of climate change, particularly flash floods caused by rainfall flowing from Kirhar Mountain Row, which is located on the western side. It is currently thought that global climate change is a fact that is eradicating.

About 81% of rural community participants pointed out that flesh flood is the most common disaster among other calamities like river floods, heavy rains, cyclones heat waves, and droughts, etc. They said that they are losing jobs and face threats to their lives and livelihoods. Responding to questions related to government and NGO roles they said that there does not exist any streamlined mechanism to help and support vulnerable communities. Some NGO helped vulnerable communities at the time of the incident in connection by building and repairing boats and houses, making available food items, drinking water facilities, and clothes, arranging medical camps, and providing training on

alternative livelihood opportunities. Our survey indicates that people in District Dadu are well-informed about flash floods. The catastrophic floods that struck in 2010 and 2022 are still fresh in everyone's memory. Locals recounted their horrific experiences while highlighting the lack of pre-disaster protocols.

Several enhancements to the EWS were recommended by participants, including:

- **Enhancement of Communication Channels**: To spread early warnings, use the phone, loudspeakers, wireless, mobile, electronic media, colored flags, sirens, colored beam lights from the mountains, and social media.
- **Training and Awareness Programs at regional basis**: To educate the community about early warning indicators and what to do, schedule frequent training sessions. Additionally, the majority of respondents suggested that exercises and drills could improve the community's ability to deal with such circumstances.
- **Improvements in Infrastructure**: Make sure there are boats and cars available for evacuation and bolster the transportation system. According to some responses, afforestation in mountains and in drainage corridors might further increase lead times by one to two hours.

Understanding the needs and perspectives of those who are directly affected by catastrophes is the aim of focus group discussions (FGDs) with the targeted groups. This methodology ensures that the study considers the local environment, community dynamics, and practical challenges of implementing Early Warning (EW) systems in disaster-prone locations. To complete the research study paper and other resources, key stakeholders, including village organizations and prominent people from the targeted areas participated in a variety of exercises and workshops. In order to enhance the Flash Flood Early Warning System (EWS) and readiness in District Dadu, community organizations, activists, journalists, and attorneys employed in Dadu were suggested for this Hazard Risk and Impact Analysis Research Study.

FGDs and consultation meetings were planned. Data, both quantitative and qualitative, were collected with precision. Using inclusive techniques ensured that every member of the community was considered during the Hazard Risk and Impact Analysis Research Study to enhance the Flash Flood Early Warning System (EWS) and preparation in District Dadu.

The poll's findings and the focus group discussions show how urgently District Dadu requires an all-encompassing Early Warning System (EWS). By improving infrastructure, putting training programs into place, and bolstering communication lines, we can significantly reduce the impact of flash floods on vulnerable communities. The importance of improving early warning systems to protect people and property was emphasized by experts and community members. Participants emphasized the necessity for a scientific approach to managing natural disasters, which is currently lacking in our area. The most crucial responsibility is to use a warning system to alert the community that they might be impacted by the disaster and to conduct evacuations if needed. Additionally, only one acknowledged and authorized accountable agency or official should issue the warning at the district level. This will help avoid misunderstandings and ensure that people respond appropriately because too many warnings from different sources could lead to confusion and non-responsiveness.

Discussion

Along the border between the Dadu district and the Khuzdar, Baluchistan catchment area, an automated weather radar system that can monitor the movement and intensity of precipitation in real time must be installed locally. PMD's radar and satellite data must be connected to validate the locally provided AWS data. Track precipitation and weather patterns across large areas using satellite data [1], [2]. Rainfall models are used to assess the volume and velocity of water as well as predict how rainwater will move over catchment regions [3]. Soil moisture monitoring should determine the moisture content of the soil to forecast the probability of floods.

Topographic analysis uses GIS to analyze the topography of the region based on slopes and

drainage networks. Charting Land Use and vegetation shows how cover affects water infiltration. Install automated weather stations (AWS) to collect real-time meteorological data. Install gages to monitor water levels and flow rates in streams.

In order to monitor runoff volume and velocity and to immediately alert the community and DDMA in the event of a large flow, these devices should be positioned close to the Gaj Diversion, FP Band, MNV drain, and natural waterways [4]. Establish networks to quickly alert communities and authorities to warnings. Notify communities about approaching flooding by using cellphone alerts.

These alerts need to be linked to rain gage sensors so they can automatically send out messages in the case of an overflow. It is possible to designate community members as Local Observers, whose job it is to report weather conditions [5]. Campaigns to raise public awareness can inform residents about the warning signs of impending floods and the necessary precautions.

LiDAR and UAVs are two examples of remote sensing technologies that may produce high-resolution maps, precise flood models, flood extent forecasts, and mitigation strategies. Before, during, and after the floods, LiDAR-equipped UAVs (drones) can collect real-time data that could aid in prompt decision-making. Create methods that evaluate historical data using machine learning and artificial intelligence to improve flood forecast accuracy [6].

Boost interagency cooperation at all levels of hydrological, meteorological, and disaster management authorities. Data Integration: To obtain more precise estimations, combine data from multiple sources. The following suggestions are given considering the observations, the literature review, and the satellite data analysis.

The drainage system in the Dadu District is being renovated and upgraded [7]. The Dadu District's existing irrigation and drainage systems need significant improvements in order to handle increased water flow and reduce waterlogging.

To ensure that water is efficiently managed and drained from populated areas and agricultural grounds, the infrastructure must be updated. Increasing the networks' capacity to prevent floods, reducing the impact of heavy rains, and raising the district's total agricultural productivity are the objectives [8]. Restoring natural watercourses like the Wester Nara is crucial to maintaining ecological balance and improving water management. The goal is to revitalize and restore these natural streams, which have historically regulated the water flow in the area.

The restoration would reduce the risk of flooding and ensure that the water reaches areas that depend on it for agriculture and other uses by allowing these systems to increase natural water production.

The Right Bank Outfall Drain (RBOD)/Main Nara Valley Drain (MNVD) is a significant component of the local drainage system.

Enhancing its capacity is essential for more effective floodwater management. In order to prevent flooding of residential and agricultural areas, it is necessary to improve or expand the existing channels to manage higher water volumes, especially during the monsoon season [9]. In riverine areas, private embankments constructed by landowners, called zamindari bunds, can obstruct the water's natural flow.

They must be eliminated in order to restore the natural drainage patterns of rivers and streams. This will improve the overall efficacy of the water management system in the affected areas, reduce the possibility of local flooding, and permit the river's water to flow freely. This initiative involves planting trees and replanting in riverine and waterway belts.

The vegetation will act as a natural barrier by absorbing excess rainfall and stopping soil erosion. It also promotes biodiversity, preserves ecological equilibrium, and provides natural flood protection by delaying the flow of floodwater. Protective bunds along the Indus River, the Main Nara Valley (MNV), the RBOD, and other hill torrents need to be upgraded and renovated on a regular basis. This ensures that they will remain strong and capable of withstanding high water pressure during flood events. Upgrading these bunds is crucial to prevent breaches that could result in widespread flooding in the nearby areas. The use of satellite technology for drainage and

irrigation network monitoring is a significant advancement in water management. This technology enables real-time monitoring of water levels, the state of drainage systems, and the identification of potential issues before they become significant. The information collected by satellites can be utilized to make informed decisions and implement timely interventions to prevent floods and water logging.For precise weather monitoring and forecasting, weather stations must be installed in key areas like the Dadu District and the Baluchistan border. By providing real-time data on temperature, humidity, rainfall, and other weather-related variables, these stations can help authorities anticipate and prepare for unfavorable weather conditions that could result in droughts or floods. To improve the area's flood defenses, the FP bunds and the left bank of the MNVD must be strengthened. The purpose of strengthening these structures is to shield neighboring populations and agricultural areas from the erosive powers of floodwater.

This infrastructure update is a crucial component of the overall flood management strategy. Installing early warning systems is crucial to protecting communities from the dangers that floodwater poses. When flooding from hill torrents and runoff discharges at Chukhi approach, these devices will offer locals enough time to escape or take preventative measures.

In order to reduce the number of fatalities and property losses during flood catastrophes, early warning systems will be essential. To develop a trustworthy flood early warning system in Dadu, the following considerations should be made. A dedicated Early Warning Center in Dadu district may be: It is essential to have an effective district FEWS alarm system in place prior to approaching floods to minimize injuries and prevent fatalities during flood occurrences. This allows for the implementation of preventative actions, such as evacuation, if needed. Risk- reduction mechanism: Effective FEWS enables local authorities, emergency services, and even the military and police to pre-deploy available resources in order to implement flood defense measures, such as sandbagging and temporary flood barriers, which may be highly effective in preventing damage to real estate and infrastructure. Effective FEWS cultivates a prepared culture within the community. Residents are better knowledgeable about evacuation routes and are more skilled at packing and preparing what will likely be needed at the evacuation location, both of which increase community resilience. Resource allocation efficiency by authorities: In order to ensure that relief operations are more successfully organized and that aid is delivered to the most impacted areas, DDMA Dadu's specialized FEW centers would provide early warnings and timely alerts that would give government agencies and humanitarian organizations ample time to prepare. FEWS can lessen related financial losses from these calamities by limiting flood damage. By shielding homes, businesses, and agricultural land from floodwater, the local economy is bolstered and livelihoods are preserved. Environmental Protection Mechanisms: Early alerts will also help implement regulations that guarantee the conservation of a region's natural environments and biodiversity. Several steps can be taken to safeguard the significant ecosystems that the floodwaters may impact when floods are predicted. Community Trust and Cooperation to each other: Establishing an efficient FEWS will increase community trust in local government. People may be more inclined to follow evacuation instructions and flood protection measures if they believe that the government is concerned about their safety. An efficient FEWS must be put in place because of District Dadu's frequent and destructive floods. By protecting people, property, and the environment, this rapidly reduces risk and promotes long-term resilience and sustainable growth. To predict flood risks and manage water resources, runoff from Baluchistan must be routinely monitored, particularly during the monsoon season. By monitoring runoff at key sites like Chukhi, authorities may have a better picture of the volume and speed of water flowing into the region. This information is necessary to make informed decisions about water management, flood prevention, and disaster response planning.

REFERENCES

Qamar-ur-Zaman Chaudhry and Ejaz Rahim (2006). National Plan Phase 1: Strengthening National Capacities for Multi Hazard Early Warning and Response System. Published by Pakistan Meteorological Department Cabinet Division. P 1-77. https://www.pmd.gov.pk/Establishment%20of%20Early%20Warning%20System.pdf

PDMA SINDH (2016). *District Disaster Risk Management Plan Dadu*. Published by District disaster Management Authority District Government Dadu. P.1-90. http://www.spopk.org/wp-content/uploads/2018/09/dadu-drm-plan-draft-1.1.pdf

PDMA SINDH (2023). *MHVRA Informed Disaster management plan District Dadu*. Published by District Disaster Management Authority Government of Sindh. P. 1-136. https://pdma.gos.pk/Documents/District_Management_Plans/DMP%20Dadu.pdf

DDMP SINDH (2018). *District Disaster Management Plan Kashmore. Pub. By* District Government, District Kashmore, under the supervision of Provincial Disaster Management Authority, Sindh Province.P.1-76. https://info.undp.org/docs/pdc/Documents/PAK/DDMP%20for%20District%20Kashmore%20(New%20Design).pdf

PDMA SINDH (2023). *MHVRA Informed Disaster Management Plan District Kashmore*. ublished by Provincial Disaster Management Authority Government of Sindh. P. 1-122. https://pdma.gos.pk/Documents/District_Management_Plans/DMP%20Kashmore.pdf

District Government Ghotki PDMA (2018). ***District Disaster Management Plan District Ghotki.*** Published by District Government Ghotki Provincial Disaster Management Authority in collaboration with UNDP**.** Pp.57-62.https://info.undp.org/docs/pdc/Documents/PAK/DDMP%20District%20Ghotki%20(New%20Design).pdf

PDMA SINDH (2023). *MHVRA Informed Disaster management plan Sindh*. Published by Provincial Disaster Management Authority Government of Sindh. P. 1-79. https://pdma.gos.pk/Documents/District_Management_Plans/Provincial%20Disaster%20Management%20Plan.pdf

NDMA (2013). *Final Report National Multi Hazard Early Warning System Plan*. Pub. By Japan International Cooperation Agency OCO. P-1-271. https://openjicareport.jica.go.jp/pdf/12120507.pdf

DDMP Thatta (2017). *District Disaster Management Plan Thatta (2017-2027).* Published by District Thatta Government of Sindh. P. 1-110. http://resourcecenter.nhnpakistan.org/phocadownload/government/tools/DDMPthatta.pdf

PDMA SINDH (2023). *MHVRA Informed Disaster Management Plan District Thatta*. Published by Provincial Disaster Management Authority Government of Sindh. P. 1-133. https://pdma.gos.pk/Documents/DistrictManagement_Plans/DMP%20Thatta.pdf