

Spatial Planning – A DRR Strategy for Reducing Vulnerability in Flood Prone Areas of Punjab, Pakistan.

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Received: 09th April 2021

Revised: 5th July 2021

Accepted & Published: 15th July 2021

ABSTRACT:

The potential of spatial planning in developing resilience within the flood prone villages in Pakistan is well-thought-out as very high achiever solution. The flood risk management policy is dependent on implementation of disaster risk reduction (DRR) strategies through decentralised management system in close compliance to water controlling policies. In this research, spatial planning measures have been focused to prove their multi-perspective performance roles in reducing the risks of losses caused by floods occurring in rural settlements of Punjab. With the rapid increase and uncertain occurrences of floods as recorded in recent history the disasters have proclaimed it mandatory to address the first hand vulnerability risk of the flood prone regions in Punjab. Lenient modifications and slightly advanced techniques for zoning of flood prone sites, are considered appropriate to downsize the rate of vulnerability of affected people in flood hit areas.¹ These strategies comprise of necessary standards such as zonal section making, pre-emptive regional designs, construction regulations and provision of standardized amenities in urban and rural areas². A methodological analysis of effectivity of spatial planning as a key DRR strategy will be established in this paper. The rural settlements are the sample of research design and smart analysis have been made with primary and secondary resources. The step-by-step protection method creates a multi-dimensional set of flood mitigation strategies under spectrums of spatial planning and flood management and henceforth a measured and shared mechanism between the two elements is proposed in the end of this paper.³ The 'Path Dependency' of zones in flood affected areas has been taken as a variable for assessing vulnerability in flood hit areas of Punjab through case studying selected regions in Punjab. Capacity management is the adjoining remedy to assert the DRR strategies and this is phenomenal in case of various hierarchal sets ups of government and private sector organizations and institutions dealing with pre and post disaster situations in Punjab, Pakistan.

Keywords: Floods, Spatial Planning, Vulnerability, Path Dependency, Riverine Activities, Punjab.

¹ (Wong et al. 2014)

² (Revi et al. 2014)

³ MSc Thesis Land Use Planning – 80436 Wageningen University , Roel van de Wouw

FLOOD PRONE AREAS IN PAKISTAN

The geographical location of Pakistan is found as between latitude 24° N and 37° N latitude and amid 62° E to 75° E, and this projects the climatic conditions pertinently referential to water management and floods in the country. The land use as per topographical features in the country correspond to unique geographical details. The physical location of Pakistan as on World map shows the country being linked to China at its north boundary, Afghanistan to its north-western, Iran to western, India to its eastern boundary while southern with Arabian Sea. This geographical placement of Pakistan further develops the fact that water management is an interdependent issue with origins of Sutlej and Ravi rivers positioned in neighbouring India as shown in Figure 1 below and henceforth the water management to avoid floods is a higher end challenge to the State of Pakistan⁴. Pakistan stands at 145th position out of 187 in the Human Development Index established in 2011, the literacy rate in women is one of the lowest in the world and nutritional level of children under five years is below the required level in half of the children population in Pakistan.⁵

The 1/3rd of overall population of Pakistan lives in province of Punjab⁶. The 63 % of overall population in the country lives in rural areas and out of the rural population 70 % lives in flood plains.⁷Floods largely occur as a major result of monsoon rainstorms from Bay of Bengal as their initiating region and then these rainstorms travel to Pakistan through northern territory of the country.⁸

The yearly flood loss in Pakistan since 1973 accounts for cyclones, flash floods, riverine and glacial melted torrent floods. Out of these the riverine floods have occurred the most. The Indus, Jhelum, Chenab, and Kabul rivers are counted as triggers to floods. Engineered solutions include dams, link canals, and barrages, devised for water management to minimize the losses caused by floods. Due to the changing climatic conditions, Pakistan is particularly vulnerable to climatic disasters. The variation in climatic conditions has also led to increase in flood occurrences⁹. Pakistan is termed as one of the most affected countries to have natural hazards impacting the life.¹⁰

⁴ Conservation Ecology And Phylogenetics Of The Indus River Dolphin (*Platanista gangetica minor*).. Braulik, Gill. (2012).

⁵ Pakistan – 2010-2014 - Floods – Overview https://www.shelterprojects.org/shelterprojects2013-2014/SP13-14_A18-A21-PakistanFloods-2012.pdf

⁶ .Bureau of Statistics, 2015)

⁷ PDMA 2011

⁸ Sayed & González, 2014

⁹ NDMA 2012

¹⁰ (Kreft & Eckstein, 2013).



FIGURE 1: GEOGRAPHICAL DESCRIPTION OF RIVERS & FLOOD RATE IN PAKISTAN – SATELLITE IMAGERY FOR 2010 FLOODS IN PAKISTAN – A PAGE ARCHIVED BY NEWYORK TIMES ¹¹.

¹¹ https://archive.nytimes.com/www.nytimes.com/interactive/world/20pstan_map.html

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The additional resources of water in country are the Karakorum and Himalayan glaciers and this water supply is further linked to 50 smaller rivers and this establishes an important pool of water supply to quality of life in the country¹².

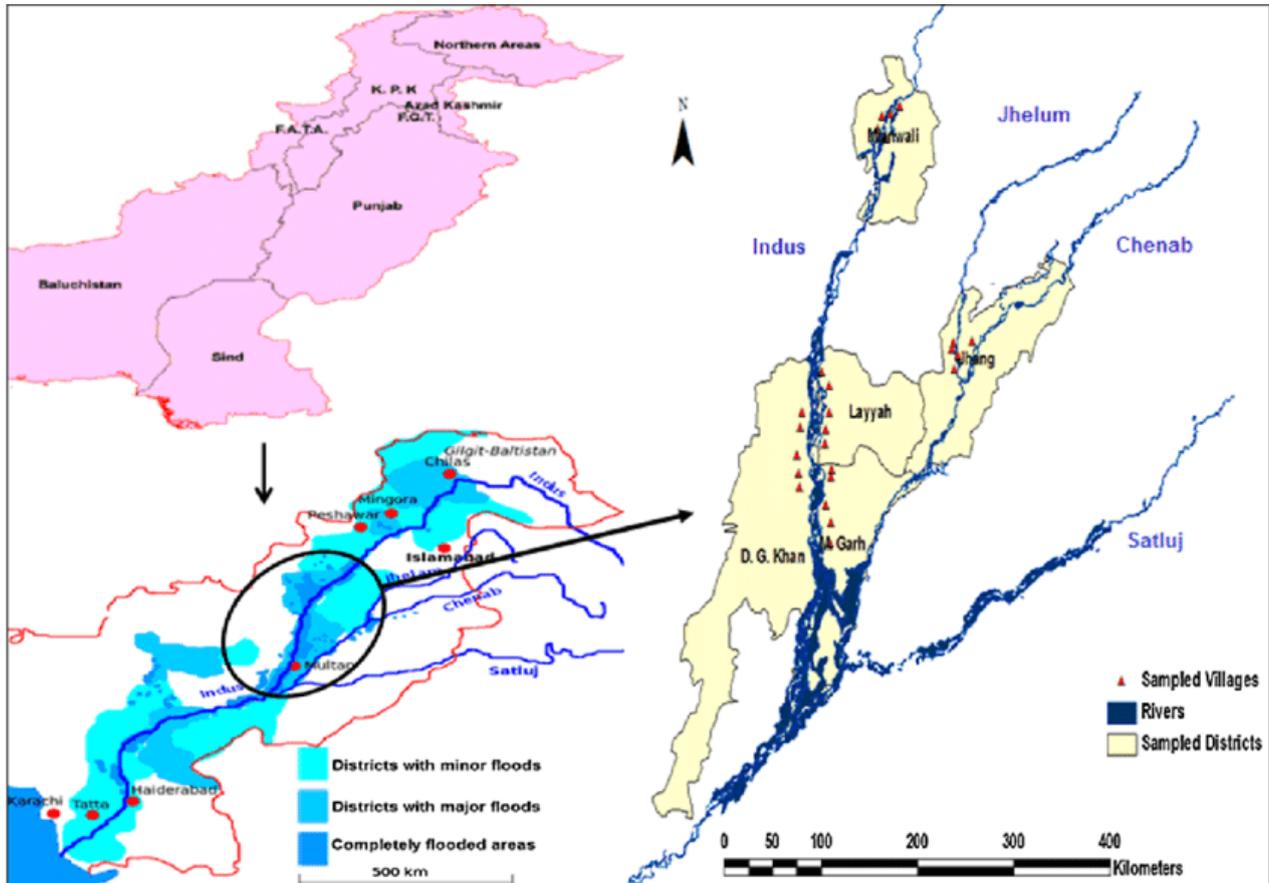


FIGURE 2: FLOOD AFFECTED AREAS IN PUNJAB, CASE STUDIED IN RESEARCH

Source for Map: ¹³

The population count is highest in province of Punjab out of the 4 provinces in Pakistan and its total residents are 99 million.¹⁴ Punjab's literary meaning is "land of five rivers." There is a conventional system of irrigation in Punjab which not only facilitates the irrigation of crops but also caters the requirements of life in villages. With particular focus on selected case study of flood prone areas, the unplanned rural settlements in Punjab will be discussed in this paper. It is an established finding that the unplanned rural settlements are more prone to having losses during the floods as compared to the planned villages¹⁵.

The high water table in the plains located in Southern part of the country is responsible for flood occurrences. These plains can withhold the flood water for months during the floods in summers when the crops are already soaked for irrigation purposes and with the disastrous floods the physical amenities, roads, homes and all the services are damaged. A similar destruction goes on with the livelihood, crops and natural environment of the regions due to floods, and thus making the recovery and prevention a real challenge to institutions. As mentioned in the previous section of this paper that having women literacy rate as low than 3 % and children facing malnutrition the rural areas already face so much of difficulty in keeping up with the standard of life, and thereafter with minimalistic preparatory programs by the authorities the condition of life reaches worst for population.

¹² Rehman, H., and A. Kamal. "Indus Basin river system-Flooding and flood mitigation." In *8th International River Symposium*, pp. 2-11. 2005. available on <http://www.riversymposium.com/index.php?element=38>

¹³ Non-Structural Flood Risk Mitigation Under Developing Country Conditions: An Analysis On The Determinants Of Willingness To Pay For Flood Insurance In Rural Pakistan. *Natural Hazards*. 75. 10.1007/s11069-014-1415-x. Abbas, Azhar & Amjath Babu, Ts & Kaechele, Harald & Müller, Klaus. (2014).

¹⁴ (Bureau of Statistics, 2014)

¹⁵ (Puckle and Beazely, 1922 p.244).

1.1. FLOOD RISK AND VULNERABILITY IN PUNJAB

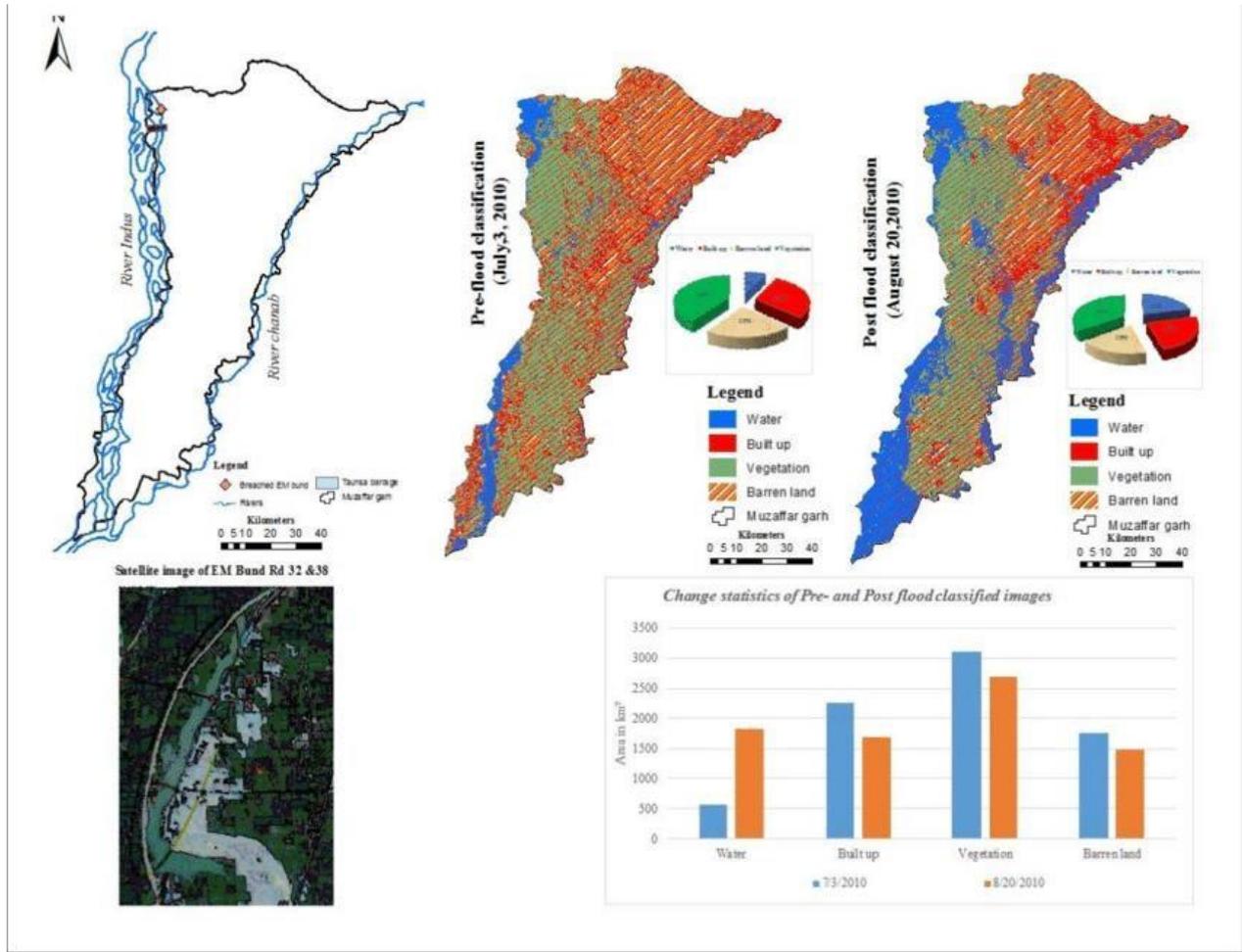


FIGURE 3: ASSESSMENT OF PRE AND POST FLOOD DAMAGES OF CASE STUDY AREAS IN PUNJAB

Source : ¹⁶

The Deforestation in Northern Punjab has made the province more vulnerable to floods. The other environmental factors for increasing flood rates are glacier melting and heavy monsoons. This leads to poor agricultural and utilities conditions¹⁷. The population living below poverty line cannot afford for qualified engineered solutions for making their houses disaster resilient and therefore it becomes an obligation with the state to provide them with safety measures to safeguard their habitats during floods¹⁸. Illiteracy and unawareness to problems of flood increase the vulnerability of population. The non- cohesive working mechanism of flood mitigation institutions during the floods impose another challenge to reducing the losses.¹⁹The deterioration and total loss in income level of people due to damages of crops and livelihood in rural settlements make it further worse for the population to sustain their lives in the areas, and this results in their movement towards urban areas in search of getting their earnings. This movement therefore concerns in an excessive load to the resources of areas where flood affected population migrates to.

¹⁶ THE RIVERINE FLOOD CATASTROPHE IN AUGUST 2010 IN SOUTH PUNJAB, PAKISTAN: POTENTIAL CAUSES, EXTENT AND DAMAGE ASSESSMENT. Applied Ecology and Environmental Research. 17. 14121-14142. 10.15666/aer/1706_1412114142. Sajjad, Asif & Lu, Jianzhong & Chen, Xiaoling & Chisenga, Chikondi & Mahmood, Shakeel. (2019).

¹⁷ (Bureau of Statistics, 2014).

¹⁸ Sumra, 2014).

¹⁹ Khan, Mohammad Aslam, Jawed Ali Khan, Zulfiqar Ali, Imran Ahmad, and Muhammad Nauman Ahmad. "The challenge of climate change and policy response in Pakistan." *Environmental Earth Sciences* 75, no. 5 (2016): 412.

CHARACTERISTICS OF 2010, 2013 AND 2014 FLOODS

The rate of vulnerability of various flood affected regions in Pakistan during floods occurring in Pakistan between 2010 and 2014 is given in Table 1 below:

Sr No	Flood Years	Details of Losses
1	2014	20 million people were affected in 2014 floods and casualties were declared as 1781. The injured were 29,66 and 1.89 million homes were damaged in the 82 flood affected districts . ²⁰
2	2013	1.5 million people were affected in 2013 floods and casualties were declared as 178. 80,000 houses were smashed.
3	2011	4.85 million people were affected in 2012 floods and 640,000 houses got hurt and 140,000 people had to be moved to relief camps.
4	2012	8.9 million people were affected in 2011 floods and 1.5 million of houses were devastated.
5	2010	21 million people were affected in 2010 floods and casualties were 1800 people. There was a severe loss to livelihoods peculiar to agricultural lands and crops.9000 cattle were vanished and 2.4 million area of crops was destroyed. Flooding affects 20 million people (a fifth of Pakistan's surface area is submerged) and over 500,000 houses damaged.

TABLE 1: STATE OF VULNERABILITY DURING 2010 , 2011 ,2012 & 2014 FLOODS)

SOURCE : AUTHOR

2010 flood damaged a large section of the land and this flood was driven by Chenab and Indus rivers. A relatively mild response to mitigation and protection to the flood affectees made the rate of losses higher and henceforth the country faced severe damages. In September 2014 the flood was prompted by the overflow of water in rivers originating from India and travelling to Pakistan, as shown in Figure 1 and Figure 2, in addition to the monsoon rains.²¹

The characteristic losses of 2010 and 2014 floods were different in their physical occurrences and impacts on population and salient features have been described in the Table 2

²⁰ Pakistan Floods: The Deluge of Disaster - Facts & Figures as of 15 September 2010 <https://reliefweb.int/report/pakistan/pakistan-floodsthe-deluge-disaster-facts-figures-15-september-2010>

²¹ Khan, Mohammad Aslam, Jawed Ali Khan, Zulfiqar Ali, Imran Ahmad, and Muhammad Nauman Ahmad. "The challenge of climate change and policy response in Pakistan." Environmental Earth Sciences 75, no. 5 (2016): 412. Mahmud, Shaista & Hamza, Salma & Irfan, Muhammad & Nawaz-Ul-Huda, Syed & Burke, Farkhunda & Qadir, Anwar. (2022). Investigation of groundwater resources using electrical resistivity sounding and Dar Zarrouk parameters for Uthal Balochistan, Pakistan. Groundwater for Sustainable Development. 17. 100738. 10.1016/j.gsd.2022.100738.

<i>Indicators</i>	<i>Variables</i>	<i>Flood 2010</i>	<i>Flood 2014</i>
<i>Occurrence Time</i>	Last week of July		First week of September
<i>Causes</i>	Monsoon	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Snow Melt	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Political Discharge	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Transboundary water discharge	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<i>River bodies</i>	Indus	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Chenab	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Jehlum	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Ravi	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Sutlej	<input type="checkbox"/>	<input type="checkbox"/>
<i>Exposure</i>	Districts affected	12	15
	Settlements	3000	35000
	No. of people (Approx.)	7 million	3 million
	Land area (million acre)	3.5	3
<i>Loss and Damages</i>	Deaths	112	284
	House Damage (million)	0.4	0.1
	Standing Crops (million acre)	7.5	2.4

TABLE 2: CHARACTERISTICS OF FLOOD EVENT 2010 AND 2014.

SOURCE: NDMA, 2010, 2014A; BBC NEWS, 2014.

An overall estimate of losses in flood accounts that in **2010 the catastrophic floods** the physical amenities related to the health, public administration, education, and infrastructure were destructed in many rural settlements in South Punjab. 7.5 million acres of crops were devastated and about 40,000 small scale businesses were shattered, and this led to a huge toll of loss in the livelihood of the region²². The displaced population in affected rural settlements were largely farmers and out of this population the most vulnerable were the 73% who had to migrate to neighbouring cities to earn their immediate living.

The most vulnerable age group in the affected population was teenage children who could neither resume their schooling nor become helping hands to their families as bread earners as no opportunities available immediately. A similar scale of vulnerable population was experienced in district of Jhang , even though the intensity of flood was less severe than 2010 , however the destruction of 750 institutions and 70% of the daily wagers / farmers had to opt for migration to neighbouring cities/ subUrban areas after the flood occurrence.²³

RESEARCH METHODOLOGY

Alongside engineered solutions a variable of spatial planning is pertinent in defining and executing multi - layer solution for flood resilience in Punjab Pakistan. The water use as known, is not only for survival of life but also caters the irrigation purposes. Therefore, a permanent solution with reference to land use planning is to be standardised in master planning of rural settlements. In this study, the timeline of catastrophic floods since 2010 till 2014 has been studied for the ratio of vulnerability of population. Even though there is a noticeable progress in response mechanism to mitigate post-floods impacts still there lies a colossal shortage of institutional management for spatial planning strategies as an applied solution to avoid disasters of flood.

The research covers the losses and geographic detail of the flood hit areas caused by overflow of rivers as well as monsoon rains in the region. In this regard, a discussion has been established on potential geographic plains of Pakistan with a special focus on Southern Punjab as shown in Figure 1 , 2 , 3 & 4. The

²² NDMA, 2010 NDMA Data Available on <Http://Floods2010.Pakresponse.Info/Factsandfigures.aspx>

²³ NDMA 2014a

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demographics and surveys are found to be extremely important to be carried out for future feedbacks, as the observed figures and numbers can determine the actual requirements to be fulfilled for reducing vulnerability to floods. The interactive sessions with the stakeholders revealed the state of management for spatial planning in flood affected areas, possibilities and preambles for carrying out the path dependent architectural solutions under various legislations and policy protocols practised by provincial or federal governments.

Few interesting international case studies have been referred to, where land use planning, heightening of dikes, river widening and building dams have been used in combinations to deal with the floods; these phenomenal solutions were studied for determining the feasibility of using them as smart control systems for flood prone areas of Punjab Pakistan.

Innovative strategies under umbrella of relevant laws and standards of planning the rural settlements, it is derived that disaster cannot be blocked or barricaded, it has to be smartly dealt with a combination of solutions, in order, to minimize the risk of vulnerability of life caused by floods.

SPATIAL PLANNING - A DISASTER RISK MANAGEMENT STRATEGY

In view of chronological record of engineered solutions for flood resistance and mitigation such as dams, barriers and water channels the phenomena of land use planning qualifies as a more advanced and applicable strategy. The objective of spatial planning as a subsidiary of the land use planning is to minimize risks and extent of losses to life in flood hit areas. The institutional authorities in exercising the relevant solutions with reference to spatial use planning, in Punjab, can be the instrumental phenomena and therefore there arises a dire need to address the issues.²⁴ It includes shifting the people from flood prone sites to safer locations as well as introducing the safe evacuation routes²⁵. The theoretical instrument executed in this research is based on three main components which are: path dependency, institutional programs and policy proposals. The potential of reducing vulnerability of population and livelihood in Punjab is assumed to be achieved through zonal distribution plans and adequate institutional management. The bureaucratic challenges in the way of implementation of four-dimensional arrangement in flood affected areas are to be reduced and therefore optimized for smooth functionality of resources to achieve the target of reducing losses due to floods. The routine governance set-ups are to be revised for better modes of DRR strategies; and by far the first hand solution in this research as proposed to be spatial planning of the flood affected areas. Here the role of policy designs is established where goals, objectives and targets are equated for the potential conclusions to the problem statement²⁶ and this also includes the research tools through which the whole process of determining DRR strategies is conducted. The policy instruments are the mechanisms and techniques which institutions apply for flood risk reduction. This three step model is to validate the subsequent 'Multi-Layer' solution to deal with floods and minimize the losses, if not completely stopped. The set of solutions as developed by the history of occurrences of same catastrophe is termed as Path Dependency. The method devised to avoid threat of flood risks in flood management corresponds to using the three layers of actions with prevention, protection and preparedness as being the stages respectively.²⁷ In order to practice the spatial planning for reducing vulnerability to floods, the path dependency is categorized as four phases process. 1) Pre-Realization Phase 2) Path Conception Phase 3) Lock-In Phase 4) Path Conclusion Phase²⁸. To explain further, the path dependency as in case of flood management may not be an altogether new solution; however a study of history and proceedings of phenomena may suggest more active and energized response to floods. Similarly innovation through technology and industry is also mandatorily arbitrated as effective disaster risk management strategy²⁹.

²⁴ Rehman, H., and A. Kamal. "Indus Basin river system-Flooding and flood mitigation." In *8th International River Symposium*, pp. 2-11. 2005. available on <http://www.riversymposium.com/index.php?element=38>

²⁵ Twigger-Ross, Clare & Kashefi, & Weldon, & Brooks, Katya & Deeming, Hugh & Forrest, Steven & Fielding, Jane & Harries, Tim & McCarthy, S. & Orr, Paula & Parker, Dennis & Tapsell, S. (2014). *Flood Resilience Community Pathfinder Evaluation Rapid Evidence Assessment*.

²⁶ **Farooq A.** "Effectiveness of Projects for Flood Disaster Management: A Case Study of Jhang District of Central Punjab", City and Regional Planning department, Lahore College for Women University, Lahore, (2014).

²⁷ Directive 2007/60/EC., 2007, article 7.3

²⁸ Twigger-Ross, Clare & Kashefi, & Weldon, & Brooks, Katya & Deeming, Hugh & Forrest, Steven & Fielding, Jane & Harries, Tim & McCarthy, S. & Orr, Paula & Parker, Dennis & Tapsell, S. (2014). *Flood Resilience Community Pathfinder Evaluation Rapid Evidence Assessment*.

²⁹ Twigger-Ross, Clare & Kashefi, & Weldon, & Brooks, Katya & Deeming, Hugh & Forrest, Steven & Fielding, Jane & Harries, Tim & McCarthy, S. & Orr, Paula & Parker, Dennis & Tapsell, S. (2014). *Flood Resilience Community Pathfinder Evaluation Rapid Evidence Assessment*.

AN OVERVIEW OF INSTITUTIONS FOR DISASTER RISK MANAGEMENT IN PAKISTAN

The spatial planning is decided and executed by a set of departments in Pakistan at federal and provincial levels. Urban framework at provincial level is more dynamic and is administered by following institutions/departments:

1. Ministry of Housing, Urban Development and Public Health
2. Department of Planning and Development (P&D)
3. Department of Local Government and Community Development (LG&CD)
4. Pakistan Housing and Town Planning Agency (PHATA)

“Development Authorities (DAs)”, “Cantonment Boards (CBs)”, “City District Governments (CDGs)”, “Town/Tehsil Municipal Administrations (TMAs)” and “Union Councils (UCs)/Village Councils (VCs)” (CKDN, 2013) are responsible at local level for spatial planning of areas. The detail of the exercising authorities is given in Table 3

Administrative Levels	Ministries	Legislation	Institutions
Union/Village Level	Ministry of Local Government	Punjab Local Government Ordinance`2001	Union Council/Village Council
Tehsil Level	Ministry of Local Government	Cantonment Act 2002, Punjab Local Government Ordinance`2001	Cantonment Boards, Tehsil Municipal Administrations (TMAs)
District Level	Ministry of Housing, Urban Development & Public Health Engineering, Ministry of Local Government	Development of Cities Act 1976, Punjab Local Government Ordinance`2001	Development Authorities (DAs), City District Governments
Provincial Level	Ministry of Finance, Revenue, Planning and Development, Ministry of Housing, Urban Development & Public Health Engineering, Ministry of Local Government	Punjab Housing and Town Planning Agency (PHATA) Ordinance 2002	Housing, Urban Development & Public Health Engineering Department (HUD&PHED), Punjab Housing and Town Planning Agency (PHATA), Department of Planning and Development (P&D), Department of Local Government and Community Development (LG&CD)

TABLE 3: SPATIAL PLANNING INSTITUTIONS AND LEGISLATIONS AT DIFFERENT ADMINISTRATIVE LEVELS IN PUNJAB

SOURCE: AUTHOR’S OWN, 2015 BASED ON HAMEED & NADEEM, 2011; AHMAD & ANJUM, 2012.

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The Punjab Local Government Ordinance 2001 beholds the significance of zoning and spatial planning but the conflict of terms of reference in various departments have not earned a collective solution for spatial planning of flood hit areas in Punjab³⁰

ROLE OF LOCAL GOVERNMENT IN RURAL DEVELOPMENT PLANNING

In context of provincial authorities dealing with flood prone areas, following a top-bottom approach the 'poverty reduction strategy'- this policy document support the activities related to improve the living quality of population in rural settlements. Appropriateness of building regulation with rural character. All the building regulations which are formulated for rural areas are irrelevant and invalid considering the rural insufficient technical manpower.

The Central District Government (CDG), Tehsil Municipal Authority (TMA), and Union Councils are the three preeminent administrative structures in the Punjab provincial administrative structure (UCs). Strategic planning initiatives, zoning plans, land use plans, housing and development plans, and river rejuvenation plans are all handled at the district level.

Tehsil Municipality is stake holder for spatial planning and rural development. Following functions are performed by the TMAs :³¹

- ❖ Infrastructure services and proposals
- ❖ Land use proposals
- ❖ Reclassification plans
- ❖ Zoning plans
- ❖ Exercises authority over land use, land subdivision, and housing systems for its area of jurisdiction.

POLICY DESIGNS FOR DISASTER RISK MANAGEMENT IN PAKISTAN

The policy designs for spatial planning as per law of state attribute to facilitate and build a mutually shared mechanism of resources for stabilizing the flood hit areas in Punjab. This implies to proactive emergency preparedness as the most targeted aim of the concerned departments.

The "Calamity Act of 1958" also focuses on devising a strategy of responding to an emergency. A Provincial level assistance committee was developed. As per policy design the government actors to do the needful will be the federal government first for giving relief to the affected population as first hand help after flood occurs; and secondly the Emergency Relief Cell (ERC) will monitor disaster relief. This ERC will be located at the Cabinet Secretariat. The repercussions of Ordinances that deal with development of rural lands and flood prone villages are mentioned as follows:

1. "Development of Cities Act 1976",
2. "Punjab Local Government Ordinance (PLGO) 2001",
3. "Punjab Housing and Town Planning Agency (PHATA) Ordinance 2002", and
4. "Cantonment Act 2002"

The advanced planning policies for rescue of livelihood are narrated in Table 4. These regulations correspond to PLGO 20021, and according to the ordinance there is permission for rural development within the criterion regulations at Tehsil level. The conclusion of an interview with a policy maker personnel at Communication & Works Department Punjab Government, as contacted for interview purpose, expressed and quoted here that the Act under which Spatial Planning is facilitated in areas it is required in case of Urban Settlements under rules of Punjab Housing & Town Planning Authority. However, the Zoning Regulations-2007 the framework for spatial zoning in flood affected areas of villages termed as 'special zones' exists³².

³⁰ Akhtar, Sharmin & Joy, Ashikur & Suchi, Sanjida Anjum & Hossain, Mosharaf. (2021). Preparedness Planning and Management: A Literature Review Emergency Fire. Teikyo Medical Journal. 44. 1897-1921.

³¹ Provincial Disaster Management Authority Punjab 2017- Provincial Disaster Response Plan

³² Govt of Punjab Manual, 2008.

Regulation/Rule/ Guidelines	Role	Implementation institutes	Jurisdiction of applicability	Flood prone area Consideration
National Reference Manual (NRM) on Planning and Infrastructures Standards-1986	Provision of homogenous standard and guidelines for development of areas in the whole country.	Municipal Corporations (MCs), Development Authorities (DAs).	Urban areas within the jurisdiction of MCs and DAs	No
Model Building and Zoning Regulations-2007	Provide standards and guidelines for preparing zoning plans for different uses (residential, industrial, commercial, and special zones).	DAs, TMA, and its offices (Tehsil Officer Planning and Coordination (TOP&C), Tehsil Officer Infrastructure and Services (TOI&S) and Tehsil Officer Regulation (TOR).	Jurisdiction of urban and rural areas of each tehsil	Yes
Land Use Classification, Reclassification and Redevelopment Rules-2009	Provide rules for preparation of maps and plans for land use classification, reclassification, and redevelopment of areas.	DAs, CDGs, TMAs and its officers, UCs.	Jurisdiction of urban and rural areas of each tehsil	Yes
Punjab Housing and Town Planning Agency (PHATA) Building and Zoning Regulations	Prepare plans for low-cost housing schemes and other development projects in urban hinterland.	PHATA and its offices.	Hinterlands including the areas of rural character.	No

TABLE 4 SPATIAL PLANNING RULES, REGULATIONS, AND GUIDELINES AT LOCAL LEVEL

SOURCE: GOP, 2008; HAMEED & NADEEM, 2011; CKDN, 2013

LEGISLATIONS RELATED TO SPATIAL PLANNING OF FLOOD PRONE AREAS

There are several ordinances and legal acts that many public institutions follow, for a broad spectrum of planning purposes in the province of Punjab³³. The operative and functional steps for spatial planning for special zones in villages are given hereby:

5. "Development of Cities Act 1976", "Punjab Local Government Ordinance (PLGO) 2001",
6. "Punjab Housing and Town Planning Agency (PHATA) Ordinance 2002", and
7. "Cantonment Act 2002"
8. The realization of these initiatives adds to the. Also the initiator of is carrying the full responsibility of the costs for the river widening measure.

The legislation establishes a statutory framework for the creation of planning agencies at regional, district and local level, and specifies various responsibilities and activities to urban and rural areas as referred in Table 3.

³³Chan, Ngai Weng. "Institutional arrangements for flood hazards in Malaysia: An evaluation using the criteria approach." *Disasters* 21, no. 3 (1997): 206-222.

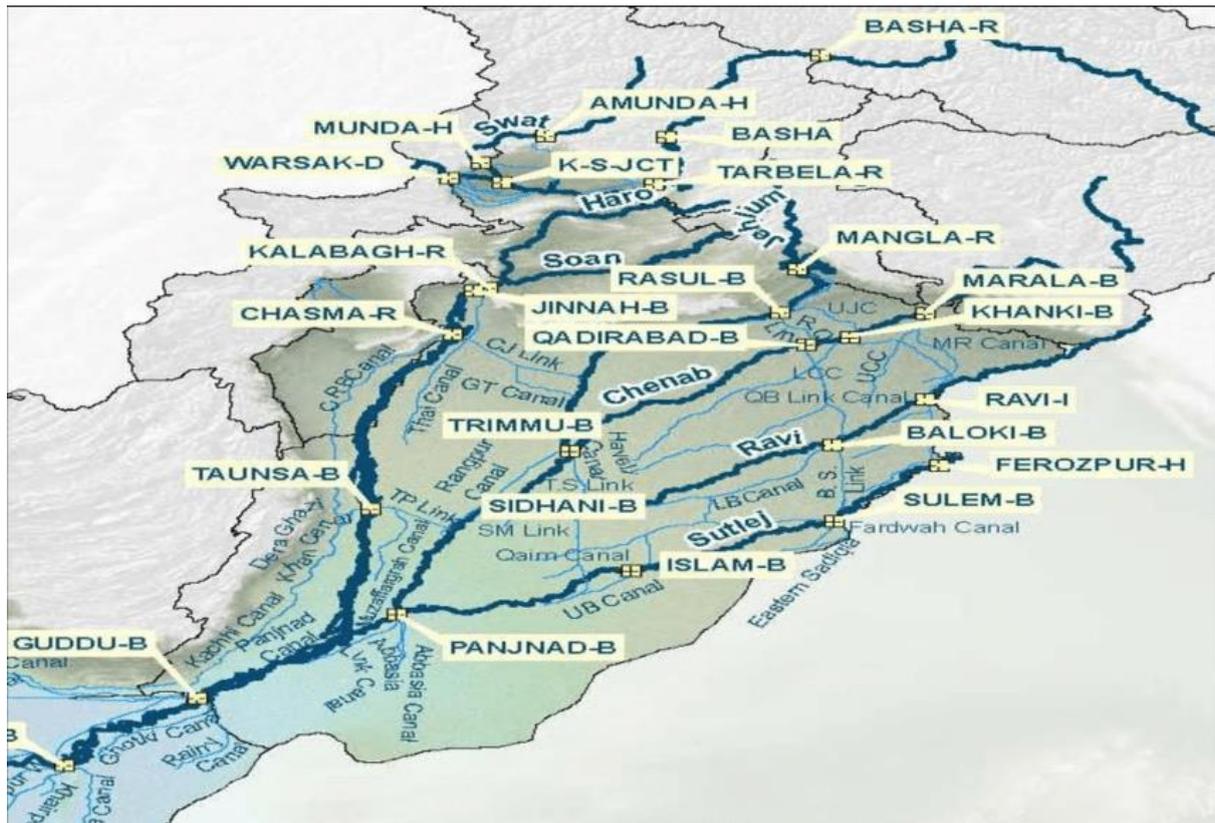


FIGURE 4 LOCATION OF DIFFERENT STRUCTURAL MEASURES FOR MANAGING FLOODS IN PUNJAB. B STANDS FOR BARRAGES, R FOR RESERVOIR, H FOR HEADWORK

Source: IRSA, 2013.

DISCUSSION

In this era of modern technology and international practices, the engineered solutions in form of dikes/dams are reliable as applied in Limburg, and therefore are dependable as short term strategies for flood resilience. ‘Room for the River’ implies that Water Discharge for useful functions should be carried out. Any other activity that has a fear of being damaged due to water discharge in flood / emergency times needs to be abandoned by the policy makers. This process is to be ideally attempted with all possible involvements of various groups of communities living within the sites³⁴.

Theoretical Reflection of Pathway Dependency for Spatial Planning

For achieving a well buffered rural zone that rescues the population and livelihood from disasters of flood is to be achieved in a sustainable manner and the acquiescence must be in order of multi-layer safety programs. In this regard the example of River Meuse in Limburg is studied for drawing a solution to flood hit areas in Pakistan. The lesson learnt from increasing the heights of dike in case of the River Meuse are that dike breach forces a larger water volume into the hinterland, causing larger areas to be flooded or higher flood levels, enlarging the consequences of a flood³⁵.

While safety is considered as the first layer of spatial planning practices, it is to revert and redirect the flood to minimize its effects as the second layer of the spatial planning policy to deal with the hazards of floods. This calls for a more strategic need of developments because the larger sizes of land will be required for retaining flood water.

For deriving Path Dependency in recent history of floods the Joint venture of public and private

³⁴ Climate-Change Adaptations in Land-Use Planning; A Scenario-Based Approach [Eric Koomen](#), [Willem Loonen](#) & [Maarten Hilferink](#)

³⁵ How spatial planning measures and tools are used to reduce the risks of a flood An exploration of the institutional barriers for spatial planning in flood risk management-Roel van de Wouw MSc Thesis Land Use Planning LUP – 80436 Wageningen University

stakeholders the project of Model Villages Development in Punjab precisely in South Punjab was a new initiative. The significant methodologies applied in these MVs were to improve household conditions of selected group of society, as found to be most affected by floods in the regions like Shakargarh, Layyah and Jhang. This joint venture of public and private sector rendered improvement in physical infrastructure to public sector. The physical amenities such as solar power stations, solar pumps and biogas were introduced in these areas as post flood rehabilitation measures in these MVs. To maintain the diversification of livelihood opportunities further through acquisition of dairy farming, adult literacy programs, skills growth, and vocational training were established by the private sector. In order to maintain the villages on a continuous basis, both sectors created village council and associations to organize the population and to deliver their grievances to supporters or local governments. Community mobilization was, however, observed to be pursued in the true sense in model villages sponsored by NGOs.³⁶

Limitations & Delimitations

The NDMA Act of 2010 makes it very explicit that DRR measures must be included in development plans. Flood disaster risk mitigation strategies have been neglected in tehsil development planning as a result of the lack of cooperation between PDMA and TMAs and the absence of DDMA in districts. All of TMA's personnel and resources are diverted during a flood to control it, which causes land mafia to carry out illegitimate and illegal constructions during this time.

The country's economic system of spatial planning is heavily political. Every plan or rule must receive the head of the tehsil council, who is chosen by the general public. The creation of land use and zoning plans and the enforcement of building codes are not priorities for the public representatives. On the other hand, where such plans exist, political influence is the principal impediment to the development of plans and the enforcement of regulations.

The land use planning is manipulated by a multi directional mechanism of politicians and bureaucracy in Pakistan. It is the biggest barrier to the implementation of plans and the enforcement of regulations. Absence of technically qualified personnel while making and executing policy plans for physical zoning of the flood hit lands is another huge reason in not achieving disaster resilience. There are 128 TMAs, yet only 31 of them have a planning officer. On the other hand, those TMAs with planning officers appointed only have 1–2 members of the support personnel³⁷

The NDMA Act of 2010 makes it very clear that DRR measures must be included in development plans. Whereas the ground reality corresponds to authorities where basic level sharing of resources and information is not ideal, PDMA, DDMA, TMA and UCs all face a neglect in capacity building for human and technical resources, as required for flood resilience in Punjab.

The process of creating and implementing DRR plans is hampered by TMAs' constrained budgets. Rural towns cannot obtain building plan approval or use the required construction materials due to their economic situation. All building regulations intended for rural areas are invalid and irrelevant given the nature of the rural environment. Rural areas are exempted from the regulation's floor space ratio requirements.

The province of Punjab, as a whole lacks an adequate monitoring and evaluation system for tracking the development and execution of DRR plans. As a result, TMAs, where planning officers are present, neglect the process of drafting plans and do not effectively articulate construction codes in rural areas. Contrarily, the spatial plans that have been created do not include all the components that the PLGO 2001 stated, particularly the designation of flood zones and the creation of restrictions for these regions. None of these programs have started so far.

RECOMMENDATIONS

The multilayer approach to minimize the level of vulnerability of population and natural life of the flood affected areas in Punjab will be effective as to be the collaborative efforts and responsibilities of stakeholder institutions. The dedicated command and execution authority of relevant institution at local level should be delegated to incorporate accurate risk assessment system, public awareness programs, featured suggestive land use proposals for zoning and amicable revised uses and diversions/ slowdown of the floods hitting the life in villages in Punjab.³⁸ The risk sensitive land use programs as DRR strategies such as risk assessment and mapping, revised land use planning with riverine activities and localized

³⁶ PDMA 2013

³⁷ Sohrabizadeh, S., Shafeiei Moghaddam, O., Neiyati-Zarnaqi, B., Yousefian S., Pirani, D., Sahebi, A., Jahangiri, K. (2022) Challenges and Barriers of Non Governmental Organizations (NGOs) in Flood Management: A Qualitative Study from Iran Disaster Medicine and Public Health Preparedness 2022

³⁸ Climate-Change Adaptations in Land-Use Planning; A Scenario-Based Approach Eric Koomen, Willem Loonen & Maarten Hilferink

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engineered solutions are to be asserted in relevance to the location of flood hit areas as well as flood

severity. The safety of flood affected areas is a short term spatial planning strategy and water conservation is a long term goal that leads to a sustainable development strategy. In this regard spatial improvements such as developments of by pass are integrally very important.³⁹

Maps of hydrological parameters show many aspects of flooding as well as potentially hazardous locations including structures, infrastructure, and public facilities. Flood risk mapping as being carried out at the sub-district level in Punjab and throughout the nation, classifying districts as "strong," "medium," "low," and "very low." Should be done further at an advanced level for potential reduction in vulnerability through spatial planning. As discussed earlier that in the context of spatial planning path dependency for immediate history records must be referred to and therefore applied in relevancy to the hazardous situation.

The mapping format of flood hit areas as prepared by various institutions lacks information on the numerous risk factors. Currently, threat and vulnerability maps were created using only a limited set of indications, and therefore do not take into account the variables that affect susceptibility and consequently, potential outcomes. Therefore the flood vulnerability and risk mapping is another spatial planning technique that guides zoning and land use planning. Flood susceptibility mapping is done at the sub-district level in Punjab and throughout the nation, which classifies districts.

The risks to people who live in flood-prone areas can be further reduced by applying flood-resistant construction techniques. Architectural laws and standards are quite important in this regard. The rules outline the procedures for creating stable structures under various conditions and provide guidance on where to buy appropriate materials⁴⁰. These strategies when used in conjunction with land use plans and planning policies, these codes function effectively. Punjab has a number of building laws and regulations, which are detailed in Table 1-2 and henceforth it is now with the administrations to execute. The PLGO-2001 gives TMAs the authority to implement their building byelaws under jurisdiction of TMAs. Both in the BCOP of 1986 and 2007, the regulations for buildings specific to Punjab's rural districts were generally disregarded, and the seismic rules only took earthquake risk into account in 2007. Because BCOP 1986 and 2007 adhere to their own building codes, TMAs and DAs in Punjab do not follow these codes. All areas of the tehsil are subject to the Model Building Bye-laws of 2007, however only it is only urban areas are where these bye-laws are implemented. Contrarily, these restrictions lack any advice or building codes for areas prone to flooding. Additionally, as noted by PLGO 2001, neither TMA has created building standards and rules for flood-prone areas.

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To conclude , the adequate and referential standards of spatial planning in response to peculiar requirements of physical sites and vulnerability of a set of population , administrative measures through qualified opinion and strategy for flood resilience need to be executed ; and this will conclude in sustainable development of the agriculture based economy of Pakistan.

³⁹ <https://www.rijkswaterstaat.nl/en/cooperation/international-partnerships>

⁴⁰ Rehman, H., and A. Kamal. "Indus Basin river system-Flooding and flood mitigation." In *8th International River Symposium*, pp. 2-11. 2005. available on <http://www.riversymposium.com/index.php?element=38>

Regulation/Rule / Guidelines	Role	Implementation institutes	Jurisdiction of applicability	Flood prone area Consideration
Building Code of Pakistan (BCOP)-1986 and seismic provision-2007	Minimum standard requirements for designing buildings, test of soil and material used in construction in order to create awareness and ensure safe constructions against disasters.	Municipal Corporations (MCs), Development Authorities (DAs), Institutions dealing with disaster management	All the urban areas, rural areas fall in the seismic zone of Punjab and other provinces	No
Modal Building and Zoning Bye-laws-2007	Provide standards and guidelines for construction of different types of buildings	TMA and its offices (Tehsil Officer Planning and Coordination (TOP&C), Tehsil Officer Infrastructure and Services (TOI&S) and Tehsil Officer Regulation (TOR)).	Jurisdiction of urban and rural areas of each tehsil	Yes

TABLE 5: BUILDING CODES AND REGULATIONS FOR LOCAL LEVEL
SOURCE: GOP, 2008; CKDN, 2013

The federal government must incorporate standardized development planning for rural settlements into its "Development Programs" for the rational, uniform, and forward-thinking environment in both the Bet and Bar areas. For this reason, architects and rural designers, must be integrated into the Department of Local Government and Rural Development (DLG&RD) at both the federal and provincial levels. Here, suitable training programs can be maintained, and qualified architectural planners can play a key role in the development of rural Pakistan.

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