The Study of Socio-Economic Vulnerabilities of the communities living nearby flood area: Case Study of Nullah Lai, Rawalpindi

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Abstract: - The purpose of this study is to examine the socio-economic susceptibility of communities located near Nullah Lai in Rawalpindi. Nullah Lai is notorious for its devastating floods during monsoon season, caused by heavy rainfall, resulting in significant losses of property for surrounding communities. Additionally, the contaminated water of the stream also poses a threat of waterborne diseases to nearby localities. The current study used a quantitative research design to explore the study objectives. The data were collected through questionnaires and observation. The data was collected from the 9 towns nearby Nullah Lai. The Union Councils were chosen based on their proximity to known flood-prone areas and their location. A sample of 290 households was selected using proportionate random sampling and located near Nullah Lai. The data was analysed using IBM SPSS Statistics 20 and Microsoft Excel 2010. The results demonstrate that significant number of residents in the area near Lai have relocated from rural areas due to affordable house cost and low rent in the area. They are poor daily wager whose income is very low so they only afford the cheap place to live. Beside this some people are also living illegally and have built home on the bank of the Nullah Lai. The result also shows that the some of the communities' member (nomads) doesn't have access to basic facilities (clean drinking water, neat washrooms, electricity) and suffer easily from water borne diseases also can hit by flood. People of the communities are not satisfied from government and other relevant department who is working for floods mitigation and management. Due to the lack of education, awareness, resource availability, and low coping capacity they are most vulnerable to flood.

Key-Words: - Flood, Socio-economic, vulnerability, Nullah Lai, Capacity, Mitigation, Nullah Lai, Household Income,

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1 Introduction

Most often people live in certain localities where opportunities for their livelihoods and hazards exist, but exposure to these hazards and opportunities is not the same (Wisner et al., 2004). The rapid growth of the population, rapid growth of cities, and the increased use of floodplains for development purposes have made the effects of floods even more pronounced and harmful to society and the environment. This has resulted from conflicting demands for development and other resources (Vlachos, 2005).

The Rapid economic growth has Chongqing, China has caused major ecological challenges, including widespread water contamination, as revealed by water quality inspections. To evaluate the financial repercussions of this contamination, a study was conducted using the human resources approach to estimate the monetary losses and harms resulting from the water pollution in the area (Gangcai & Yongguan, 2004). The research also indicated that there has been a recent interprovincial migration flow towards the Metropolitan area and surrounding areas, and that a diverse patterns observed in internal migration movements (Quisumbing & McNiven, 2020). The impact of climate change also affects the surrounding areas, the research also highlighted that the socio-economic characteristics of different communities play a role in influencing the proximity of their residents to sewage areas. As a result, the communities living near sewerage areas often have a low standard of living due to various socio-economic reasons (Yanda, 2005). Lack of essential services and ineffective management in some regions pose a threat to the public health and environment of both surrounding suburban areas and urban regions in general (Hogrewe et al., 1993).

Poor people don't have enough resources to live in a safe area so they tend to live in hazard-prone areas.

Which makes them more vulnerable to disaster (Fankhauser et al., 2001; Chan, 1995).

Vulnerability of an area is intensified by low income, population, socioeconomic differences, weak governance and poor knowledge about the risk (Adger 1999; Cutter et al., 2003).
Rawalpindi is a city located in northern Punjab, Pakistan with a total area of 5,286 square kilometers. The population of the district was recorded as 540,563 in the year 2017, as per the Pakistan census. (Pakistan Bureau of statistics, 2017).
Rawalpindi, is home to a historically significant tributary river known as Nullah Lai Basin. The stream carries wastewater from various parts of the city, including untreated sewerage water and both industrial and domestic waste (Malik et al., 2014). Nala Lai flows through the city's heart and down to the River Soan in the southeast, with a catching basin of 73.6 Kilometre and a length of 30 Km. It also collects rainwater from side drains in the city (Islam-ul-haq et al., 2007; GOP, 2010; Imtiaz et al., 2020). The 2001 flood in Rawalpindi resulted in widespread destruction of homes and assets, and it is estimated that full recovery would take between 15 to 20 years. Many buildings sustained significant damage, and residents feared that even a milder future flood would cause their structures to collapse. The loss of property and infrastructure has led to severe economic difficulties, further exacerbating their vulnerability. The floods also resulted in the death of many young girls, causing both economic and social harm to affected families (WMO/GWP, 2001).
The origin of the Lai Nala and its tributaries is traced back to the Margalla Hills. The significant branches of Lai Nullah include Saidpur Kas, Kanitwali Kas, Bdarwali Kas, and Tnawali Kas (JICA, 2003). These tributaries traverse multiple regions of Islamabad before converging into Rawalpindi from two main areas, Satellite Town and Khyaban-e-Sir Syed. The two major stream branches eventually come together at Dhok Dalal to join the Lai Nala.

2 Material and Method

The current study was conducted in the nearby localities of the Nullah Lai to discover their socioeconomic vulnerability and suggest appropriate measure for it. The study used quantitative research design to explore the study objectives.

The data were collected via “questionnaire” which were conducted in the surrounding area of Nullah Lai, Rawalpindi. Nine towns were selected which are located nearby Nullah Lai. In this study, questionnaire was filled from 270 respondents of these nine localities (thirty each from one locality). The questionnaire and interview were conducted in Urdu and Punjabi language. Interviewees were asked about their age, family income, flood intensity, socioeconomic conditions, and exposure to floods. They were asked about their knowledge about flood, mitigation measure, their attitude toward flood and also about the social life and economic status. The residents were selected through specified random sampling.

During the data collection process, a series of standardized questions were asked from the respondents in face-to-face interactions through an interview method. This approach was deemed the most suitable due to its ease in gathering information. This technical procedure allows for accurate information gathering. The interview schedule consisted of a mix of structured questions, including both open-ended and closed-ended inquiries (Good & Hatt, 1952).

2.1 Socio Economic Vulnerability

The backgrounds of the respondents can be understood by examining their socio-economic characteristics. A person's socio-economic status can be determined by considering various factors such as average cultural standard, effective income, material possession, and participation in community group activities (Chapin, 1971). These include age, education, income, profession. The detail is shown in below table.

Table:1: Social and Economic Vulnerability

Social	**Economic**
Population (family size/family type)	Income/expenditure
household use water, satisfaction on quality and source of drinking water	House occupation
Accessibility, proximity and frequency of water procurement from the filtration plant,	household assets (kitchen, fuel type, toilets)
waterborne illnesses among family members in the past 12 months	Living standard
flood forecasting/prediction system and sources of information regarding the 2001 flood and its damages	reason for living

types of damages, migration during the flood, government help and types of help during flood	House structure, type ownership, & rent

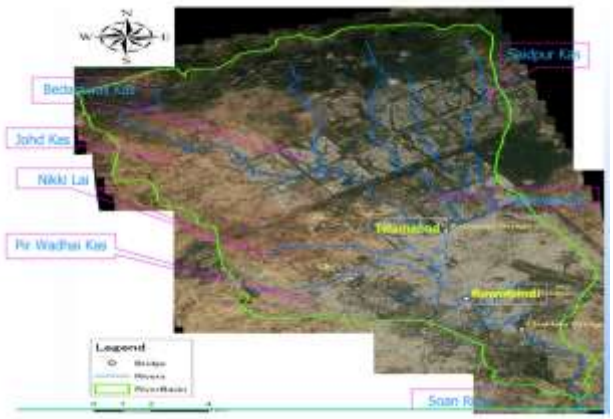

Figure 2.1: Nullah Lai with other tributaries, source PMD

2.2 Data analysis

The results were derived by analyzing the collected data through the use of statistical techniques. The data was first edited and then processed using the Statistical Package for Social Sciences (SPSS). The study utilized various frequency distributions to analyze the problem. Both primary and secondary data collection methods were employed, including questionnaires and field surveys, to gather information. The collected data was then edited and analyzed using statistical techniques and the Statistical Package for Social Sciences (SPSS). The results of this analysis were presented in the next stage.

2.2.1 Percentage

In the present study, simple percentages were calculated to understand the basic characteristics of households and to assess the socio-economic difficulties faced by the respondents. To make the data more comparable, the frequencies of various categories were expressed as percentages. The calculation was performed using the following formula:

Percentage = (Frequency / Total Number of frequencies) x 100 _____ (1)

2.2.2 Mean

The mean is a commonly used average and is calculated by dividing the sum of all observations by their total number (Chaudhry, 1996). The formula used to calculate the mean is:

Mean = Sum of all observations / Total number of observations _____ (2)

2.2.3 Median

The median of the data set was calculated with following formula:

$Median = L + h/f\ (n/2-C)$ _____ (3)

Where,

L= Lower class boundary of median class
n= No. of items in a data
f= Frequency of median class
h= Size of class interval of median class
C= Cumulative frequency of the preceding of the median class

3 Results and Discussion

3.1 Social Vulnerability:

3.1.1 Water borne disease:

Access to clean water is critical for human survival. Pakistan is fortunate to have abundant surface and groundwater resources. However, the rapid growth of its population, urbanization, and unsound water utilization practices have put a great deal of strain on both the quality and quantity of its water sources. According to the World Wildlife Fund (WWF, 2007), an estimated 250,000 children die each year in Pakistan due to water-borne diseases, causing not only human loss but also significant economic harm.

The frequency distribution of respondents' experiences with diseases among their family members over the past 12 months is shown in Figure 3.1. The data indicates that 39% of the respondents reported that a family member suffered from diarrhea, while 61% did not. 31.7% of the respondents reported that their family had experienced hepatitis, and 68.3% reported that they had not. Additionally, 25.2% reported a family member having cholera, 20.3% reported a case of malaria, and 20% reported yellow fever. In terms of skin allergies, 37.9% reported a family member having suffered from it, while 46.6% reported abdominal pain and

45.5% reported vomiting among their family members over the past year. The most common diseases in the community were found to be diarrhea, hepatitis, skin allergies, abdominal pain, and vomiting, while no respondents reported a case of dengue fever.

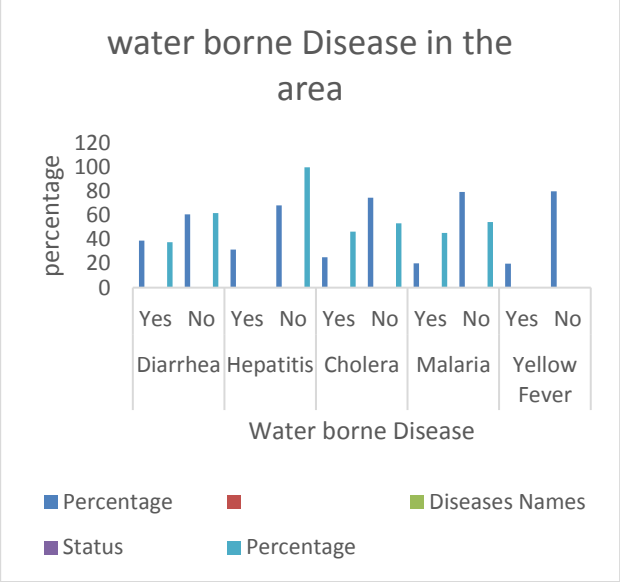

Fig.3.1: Water borne disease

3.1.2 Source of the drinking water:

The source of drinking water is a critical factor in determining the quality and safety of the water consumed by individuals. According to the data collected, it was found that a majority (45.8%) of respondents reported using public tap water as their source of drinking water. 29% of the respondents indicated that they used water from filtration plants, while a small proportion (15.9%) used a combination of tap and filtration water. The remaining 9.3% of respondents relied on hand pump water as their source of drinking water. This information highlights the importance of considering the sources of drinking water in ensuring its safety and suitability for consumption.

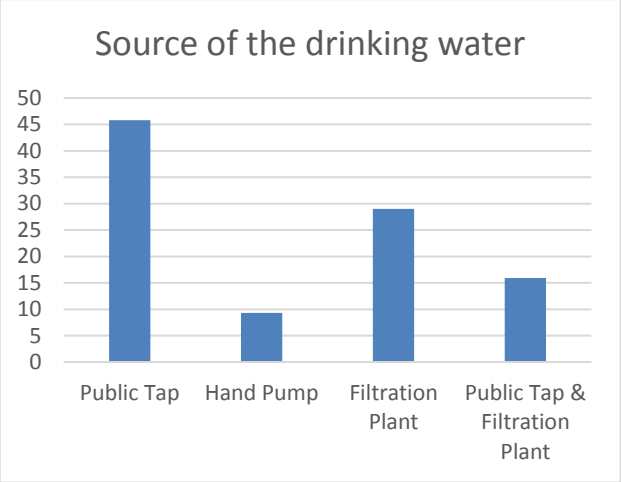

Fig.3.2: Source of Drinking Water

3.1.3 Proximity of the respondent's house to the filtration plant:

The survey results indicate the proximity of the water filtration plant to the respondents' homes. A majority (50%) of respondents reported that their water filtration plant was located half a kilometre away from their homes, while 29.7% reported not having a water filtration plant in their area. Meanwhile, 16.9% had a water filtration plant located less than 500 meters away, and only 3.4% had a water filtration plant located one kilometre away. The data shows that the most common distance of the water filtration plant from the respondents' homes was half a kilometre.

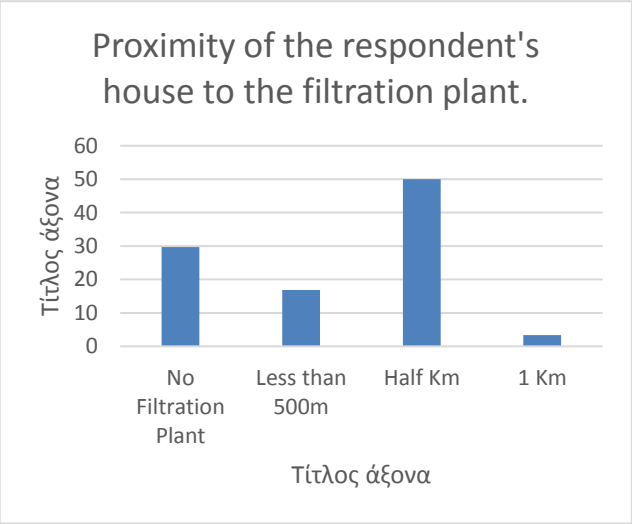

Fig.3.3: Proximity of the respondent's house to the filtration plant

3.1.4 Family size:

The number of family members living under one roof is referred to as the household size. In traditional societies, it is common to have larger households due to the high fertility rate and the practice of extended families living together that prevails there, in contrast to Western societies. The survey results show that the majority of respondents (51%) had a household size of 6-8 members, 21.7% had 5 or fewer members, 14.9% had 9-12 members, and the remaining 12.4% had more than 12 members. Overall, the largest portion of respondents had households with 6-8 members.

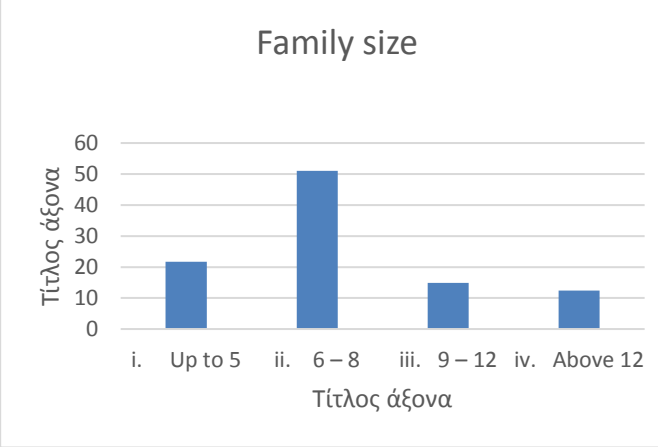

Fig.3.4: Family Size

3.1.5 Family structure:

The data collected provides information on the family structures of the respondents. In general, a family can be defined as a group of people living together. There are three main types of families: nuclear, joint, and extended. A nuclear family is comprised of a husband, wife, and their unmarried offspring, in contrast to a combined family consists of the couple's married children and parents living together with their kids. The extended family includes grandparents, aunts, uncles, and other extended relatives. The data shows that the many of them, almost 48% lived in combined/joint family structure, while 46.5% lived in nuclear family setups and the remaining 5.5% lived in extended family setups.

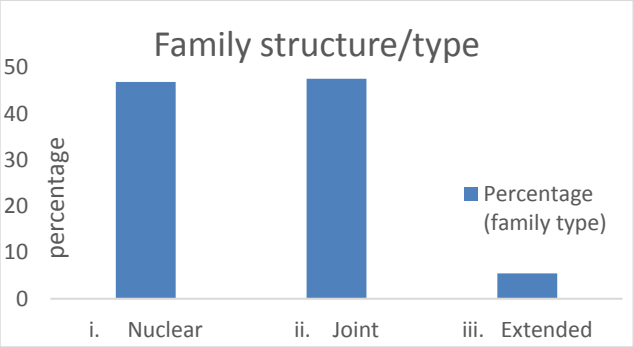

Fig.3.5: Family type

3.1.6 Flood Awareness and damages:

A flood warning is an indication that a flood is likely to occur soon and people in the affected area should move to higher ground promptly. Flood forecasting uses real-time precipitation and stream flow data to predict the water levels and flow rates over the next few hours to days, based on the size of the watershed or river basin. This forecasting process may also consider future precipitation forecasts in order to increase the lead-time available. The data also shows the percentage of respondents who obtained dissemination details about the Lai Nala flood from various sources. The graph demonstrates that the majority of respondents (49%) received information about the flood from alert sirens, while 27.6% learned about it from mosque speakers, 15.9% had no source of information about the flood, and 7.6% got their information from media reports. The figure highlights that the majority of respondents, 49%, received flood

information from alert sirens.

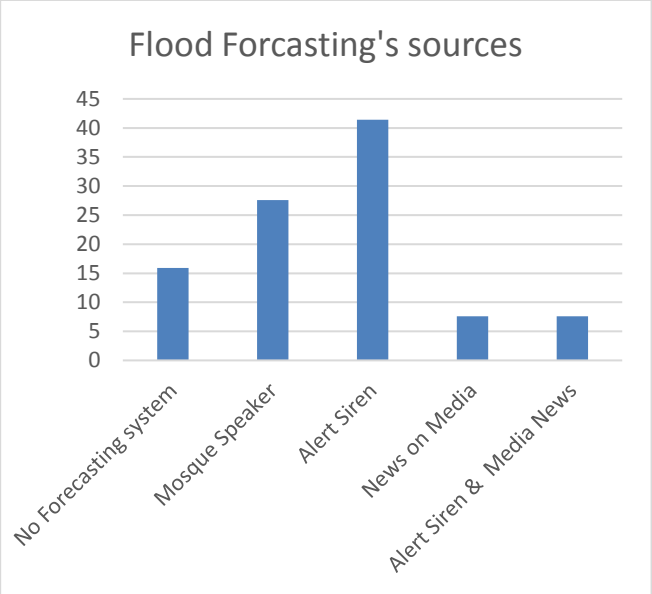

Fig.3.6: 2001 Flood damages:

3.2: Economic Vulnerability:

3.2.1 Income Level:

Income is the amount of money earned by an entity over a specific period of time and is a crucial factor that affects various other aspects. For individuals, income includes all sources of earnings such as wages, salaries, profits, rents, and interests. The income level of individuals can be seen as a critical aspect, as it is directly linked to their ability to make purchases and save money.

Figure 3.6 displays the frequency distribution based on participant's household earnings and expenses. The data shows that 25.2% of the participants have a monthly earning is10,000 PKR, while 20.7% of participants have an income of 15,001-20,000 PKR. 10.3% of participants have an income from 25,001 to 30,000, 7.9% of participants have an income of 20,001-25,000, and 7.2% of participants said that their monthly income is above thirty thousand (30,000) rupees. The average income of the participants is 17,335 rupees, and the standard deviation is 9,685.5.

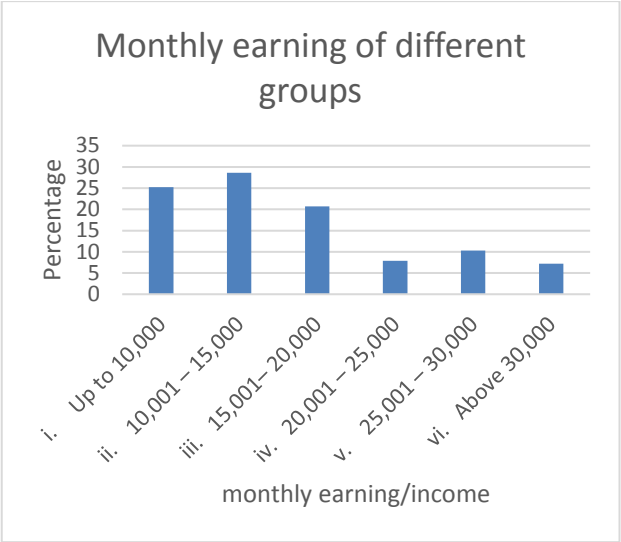

Fig:3.6: Monthly Income

3.2:2 Monthly Expenditure:

The data presented in Figure 3.10 showcases the monthly household expenditures of the respondents. The figure reveals that the largest percentage (29%) of the participants estimated that their monthly household expenses fall between Rs. 15,001 and 20,000. This was followed by 23.8% of respondents who reported their monthly household expenditure in the range of Rs. 20,001-25,000, 18.3% of respondents said that their household spends more than Rs 30,000 each month, 10.7% who reported their monthly household expenditure to be up to Rs. 10,000, and 10.3% who reported their monthly household expenditure to be within the range of Rs. 10,001-15,000. A small percentage of respondents, 7.9%, reported their monthly household expenditure to be in the range of Rs. 25,001-30,000. The mean monthly household expenditure of the respondents was calculated to be PKR 23,441 with a standard deviation of PKR 10,476.

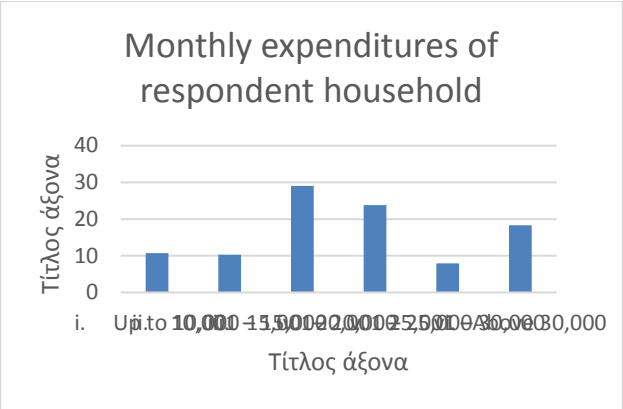

Fig:3.7: Monthly expenditures of respondent household

3.2.3 Occupation:

A person's chosen line of work, which they perform in exchange for payment, is known as their occupation. This can be in the form of employment, volunteering, or running a business. Occupation plays a crucial role in shaping one's living standard and social status within the household and society.

The frequency distribution of respondents based on their occupation is shown in Figure 3.12. According to the data, the largest group of respondents (36.6%) were working in private jobs, followed by skilled labor (21.4%) and government employees (14.8%). Additionally, 10% of respondents were unemployed laborers, 7.6% were self-employed, 6.9% were running their own businesses, and 2.8% did not have an occupation. The Figure highlights that the most of the participants worked in private industry.

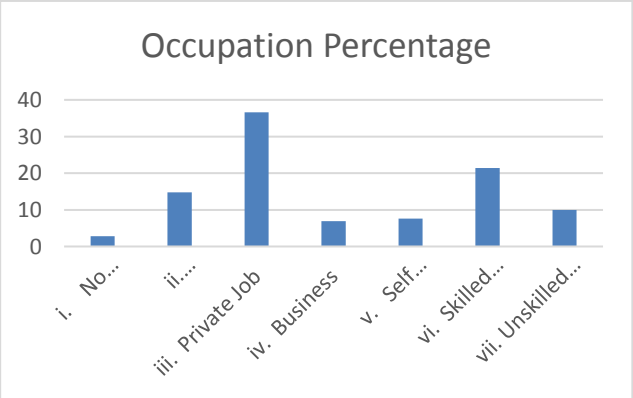

Fig:3.8: Frequency distribution of respondents by their profession

3.2.4 Living standard

a. House structure:

The ownership status of a person's house can be an indicator of their economic standing. Figure 3.8 displays a frequency distribution of survey participants based on their house rental status, the structure of their house, and the number of rooms in their home. The data presented shows that the majority of respondents (63.4%) own their homes, while 31.4% rent their homes and a small fraction (5.2%) reside in a home free of charge.

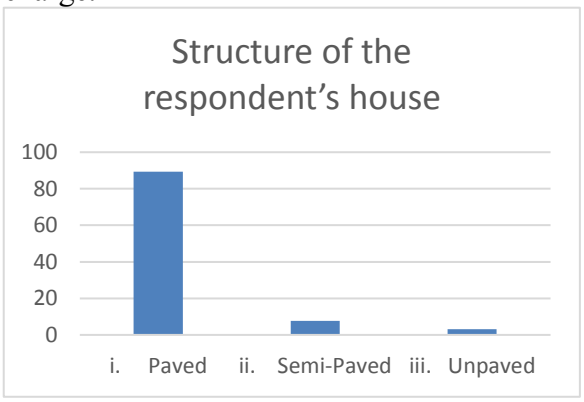

Fig:3.9: House structure

b. House rent

The Figure 3.8 also highlights the percentage of respondents who pay house rent. The data suggests that the majority of respondents (68.6%) either own their houses or live in them for free. Meanwhile, 10% of the respondents pay a monthly rent of between 3001 to 5000 rupees, 19.3% pay a rent above 5000 rupees, and the remaining 2.1% pay a rent of up to 3000 rupees per month.

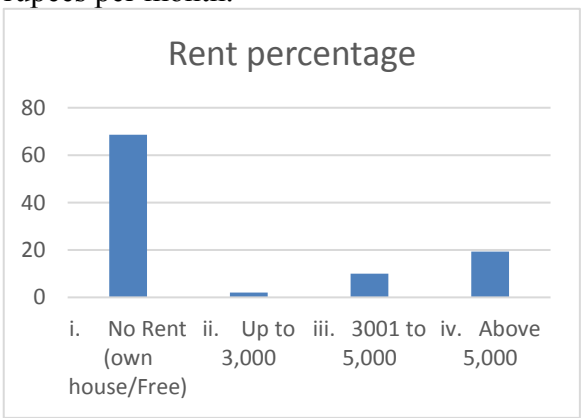

Fig:3.10: Rent percentage

c. Living reason

The information also reflects the respondents' living circumstances in the research area. 25% are local, while 15% said they arrived there after their relatives were living here. 23% said they are shifted here for better facility in city area. 18% were for job opportunity in city suburb. 9 % revealed they are living due to low rent in the study area. while 5% each were there for relative job, and facility.

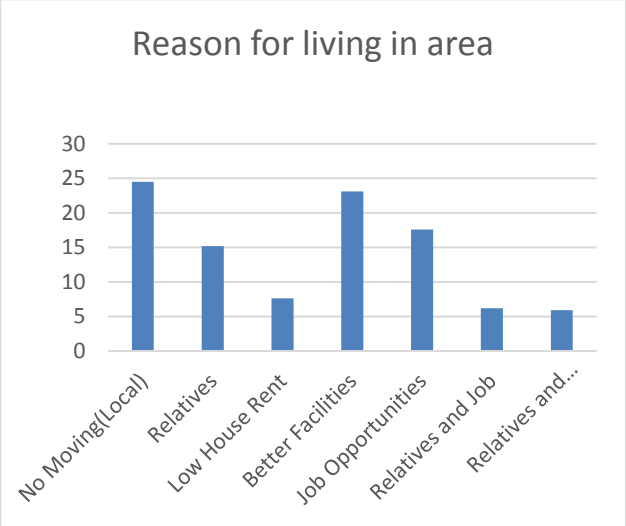

Fig:3.11: Reason for living in area

d. Basic facility:

The Figure also highlights the distribution of respondents by the type of fuel they use in their kitchen. It is observed that the majority, which is 88.3%, of the respondents have access to Sui gas as their kitchen fuel source, while a smaller percentage of 7.9% uses firewood, 2.1% uses coal, and 1.7% uses Liquefied Petroleum Gas (LPG). The data highlights that Sui gas is the preferred choice for most of the respondents as their kitchen fuel.

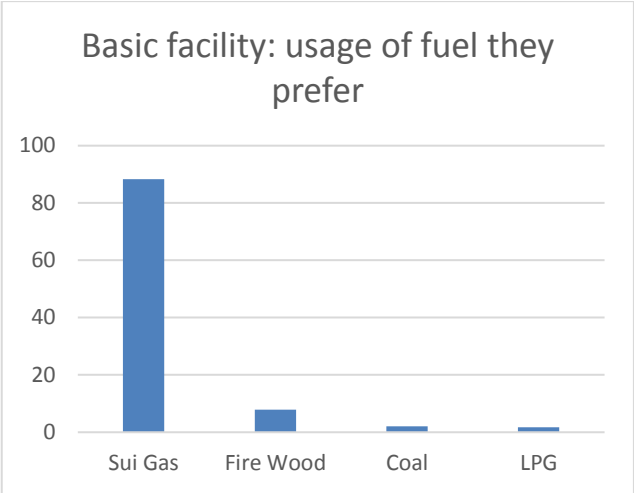

Fig:3.12: kind of fuel the the resident used

4 Conclusion

The Lai Nullah Basin in Rawalpindi city has a rich history and a catchment area of 73.6 Km and a length of 30 Km. It flows through the city center and down to the River Soan in the South-Eastern part of the city. The basin is connected to several side drains, which carry the rain water of the city through it to the Soan River.

Human health and the local economy are strongly correlated with the environment in the studied area. Minorities and low-income communities are not as well protected against environmental hazards and risks as compared the community who financial stable. Solid waste landfills and chemical facilities are frequently situated near low-income neighborhoods of Nullah Lai. Communities living close to contaminated water of Nala Lai frequently have diarrhea, skin allergies, abdominal pain, and hepatitis due to the unfavorable climate.

The goal of this study was to investigate the socioeconomic vulnerabilities that the people near Nullah Lai were dealing with. Most of the people residing in the area are migrants from remote regions who have settled there due to affordable housing. These families typically rely on a single male earning member for financial support. The importance of education is increasing among the communities, but still, there are many children who do not have access to education.

Numerous socioeconomic vulnerabilities are brought up for the people living in the neighbourhood of Nala Lai. They are the first victims of flood and after flood affects. The community who live in the surrounding area of Nullah Lai are mostly poor. The vulnerabilities such as income level, jobs, living standard, house type, house rent, occupation and

access to basic facilities of study area shows that they are economically vulnerable which force them to live in the flood risky area because it is affordable for them. Although they have basic flood knowledge and they timely received siren and other flood dissemination but due to limited resources they are easily victims and affected. Further the communities people don't have enough knowledge about evacuation centre in case of emergency.

According to the residents the quality of the drinking water in these towns is unsatisfactory, and the help provided by the government during floods is also not cooperative. Many suffer from water-borne diseases and have not received any assistance from government agencies to compensate for damages. The communities residing close by Nala Lai are also dissatisfied with the performance of the local administration and feel that the administration's behavior towards solving their problems is insulting and ignorant.

In conclusion, Nullah Lai has a significant impact on the local populations' health and has also disturb the environment. It is important to address the socio-economic vulnerability of these communities to ensure that they receive the protection and support they need to live healthy and sustainable lives.

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