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### IMPACT OF FLOOD DISASTER ON LIVELIHOOD PATTERN OF NORTH BIHAR & ITS MANAGEMENT

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#### ABSTRACT—

*This paper examines the impact of flood on livelihood pattern of North Bihar and addresses the need for an efficient and cost effective methodology for flood hazard mitigation and management. Because of heavy rain in the Tarai Region, a large number of rivers of North Bihar swelled, washing away roads, bridges and railway tracks, snapping power lines, marooning*



*villagers and wiping of kharif crops. As per one estimate, in Bihar flood affects about 6.880 million hectares of land out of about 9.416 million hectare which is about 73.06%. It not only affects the infrastructure but also the socio- economic life or livelihood pattern of North Bihar particularly. So there is a need to minimize negative consequences and ill effects of flooding by means of flood management which*

*includes both the structural and non structural measures. Thus, the purpose of this paper is to highlight the severity of flood impacts on livelihood pattern and to discuss the possible flood mitigation and management measures in context of North Bihar.*

**KEY WORDS:** Flood Mitigation and Management, Impact of Flood, Livelihood pattern, Structural and Non-structural Measures.

#### PROLOGUE

Floods are most recurring and frequent natural hazard in North Bihar causing huge losses to lives, properties, livelihood systems, infrastructure and public utilities affecting the development of the region. The North Bihar Plain Region is drained mainly by Ganga and two major river systems i.e. the River Kosi and the Gandak. In addition to these rivers there are several smaller systems like the Burhi Gandak, the Ghagra , the Bagmati and Adhwara group of rivers, the Bhutahi Balan, the Kamla and the Mahananda. All these rivers mainly originate in Nepal from the Himalayas whereas the River Kosi also includes its catchment in Tibet. Thus, the rivers of North Bihar mostly share their basins outside the country in Nepal and Tibet. According to Rashtriya Barh Ayog, Bihar has a proportion of about 13 % of nearly 400 million hectares of total flooded area of the country and 16.5% of the entire flood prone area, It is also estimated that about 24% of the total flood affected population of the country resides in the flood plains of the state. According to Bihar Govt's. Jal Prativedan, 76 percent of the total population of North Bihar is reported to be flood prone. The river Kosi

which was named as ‘Sorrow of Bihar’ alone has a contribution of 25 percent average annual flood affected area of the state. It is very notorious for shifting its coarses. Likewise Gandak, Burhi Gandak, Bagmati, Kamla Balan, Adhwara group of rivers and Mahananda River are also famous for their devastating floods. (Sinha, V.N.P *etal* Bihar, 2013). It not only affects the infrastructure but also the socio- economic life in North Bihar. So, there is need to minimize negative consequences and ill effects of flooding by means of flood mitigation and management. Thus, the main purpose of this research paper is to trace out the impact of floods on the livelihood pattern of North Bihar and to discuss the possible flood management measures in context of North Bihar Plain.

### 1. Causes of Flood in North Bihar.

The causes of flood include the role of both natural and manmade factors which may be noted below:

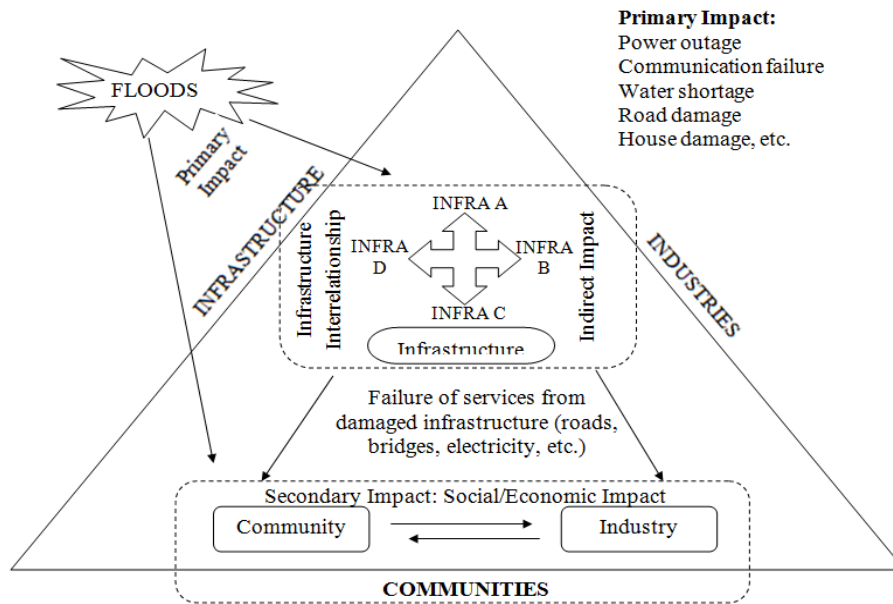
- i) Important natural factors causing floods are prolonged high intensity rainfall, meandering courses of rivers, extensive flood plain, risen riverbed through sediments, blocking of free flow of river water, native of valleys and channels.
- ii) The second important natural cause of flood is the gentle slope in North Bihar where average slope is about 3 inch per kilometer. But there are extensive areas having even less than 1 inch per kilometer slope. In such areas there is poor drainage causing large scale of water logging and flood.
- iii) One of the important factors causing flood in North Bihar are the changing coarses of Kosi, Kamla, Bhutahi Balan, Bagmati, Burhi Gandak. The most important river causing flood in North eastern Bihar is Kosi which has shifted about 148 km westward. Similarly Kamla has several coarses. The old coarses create flood at the time of excess rainfall but the existing channels damage habitating when embankment faces breach. In addition, heavy rainfall for long period in continuation is the main cause of river floods in North Bihar.
- iv) Anthropogenic or manmade factors include building activity and eventual urbanization, channel manipulation through diversion of coarses, construction of bridges, barrage and reservoirs, agricultural practices and deforestation. Similarly, breaches in dams and flood protection embankments also cause devastating floods (i.e Eastern Kosi Embankment in 1984 and 2008).
- v) Among anthropogenic factors, deforestation and urbanization are two major activities which aggravate greatly to the menace of floods. Large scale of deforestation in the upper catchment areas reduce infiltration capacity and consequently increases surface runoff which helps tremendously in increasing the magnitude of floods as all the major rivers of North Bihar. Increasing urbanization also increases the process of cementation, reducing the infiltration capacity resulting the increase in surface runoff and ultimately floods.

### 2. Impact of Floods on Livelihood of North Bihar

Floods have adversely affected the livelihood pattern of North Bihar. Flood impacts can be broadly divided into primary impact that occur due to contact with water like loss of life, livestock and property, damage caused to infrastructures like road, bridges, railways, disruption in services like electricity, telephone lines, water supply line, etc. and secondary impact that occur because of the flooding, such as disruption of services, prolonged health and malnutrition impacts. Secondary impacts cause indirect losses and its ill effect continues on-long time scales and sometimes may be more important. These include prolonged health impacts due to failure of water supply and sewage disposal system, shortage of food and other essentials due to failure in transportation network. A frame work of flood impacts in fig.1

Infrastructure networks sustain various activities and services of the communities and industries. Due to failure of services from damaged infrastructure economic activities in the region are also poorly affected. It may lead to partially or completely shut down of industries and business establishments causing reduced production followed by adverse impact on economic growth. There may be some long term impacts like sediment deposited by flooding may destroy farm land for coming few years leading to cultivator and

labours economically vulnerable. Based on the assessment of losses in monetary values, they are termed as tangible if can be assessed in terms of monetary values and if not then termed as intangible losses. Intangible losses are generally higher in less developed region because of the more consequences of flooding especially in case of frequent and devastating floods. (Kansal, Kishore *et al*, 2017 Pg. 1697



(Source: Deshmukh, A. (2010))

Figure 1:- Framework of Flood Impacts

“Impacts of flood depend on maximum depth and duration of flooding, the extent of inundation in the floodplains, velocity of flow and rate of rise of flood levels” (Gautam *et al.*). Flash flood causes immediate and huge impacts, whereas gradually occurring floods allows much time for evacuation and protection of properties.

**Flood Losses in Bihar**

Almost every year floods severely damages property both movable and immovable, destroys standing crops and food grains and badly cripples the infrastructure in North Bihar. The loss of life and limb caused due to flood events cannot be compensated. However in monetary values, it costs several crores every year. The flood brings untold miseries to the people as they have to leave their damaged houses and spend a long time in relief camps, raised platforms or in temporary shelters. Governments has to allocate huge amount for rehabilitation, and relocation of people which requires diversion of capital required for maintaining production. Table 1 shows the extent of flood loss in North Bihar for last 15 years.

**Table.1:-Flood losses in North Bihar from 2000 to 2015.**

Year	River which caused flood	Number of Affected					Affected Area		House Damaged		Loss	
		Dist.	Block	Vill.	Human	Animal	Agric.	Non-Agric	Fully	Paertly	Live	Live-stock
		(Nos.)			(In Lac)		(Million ha.)		(Nos.)		(Nos.)	
2015	Gandak, Kosi	8	32	237	4.850	0.140	0.0090	0.0030	157	12	27	61
2014	Gandak	20	116	2018	30.000	1.000	3.6000	0.3000	3235	2977	158	34
2013	Gandak, Kosi	20	126	4810	72.340	5.600	1.6800	0.6900	9344	117572	253	6480
2012	Gandak, Ganga	11	28	277	2.400	0.080	0.0968	0.0100	322	151	15	0
2011	Bagmati, Gandak	25	166	3577	71.430	6.627	3.5420	0.2877	25840	59342	249	183
2010	Kosi	9	44	679	7.180	3.570	0.1602	0.0390	6187	8983	32	0
2009	Gandak, Kosi	16	91	1546	22.030	1.346	0.1710	0.9339	3867	3807	97	2
2008	Kosi	18	116	2585	49.952	12.166	0.6405	0.2119	104965	151461	258	878
2007	Gandak, Kosi	22	269	18832	244.420	27.130	1.3323	0.5510	369360	414968	1287	2423
2006	Bagmati, Ganga	14	63	959	10.890	0.100	0.1520	0.0297	9218	9419	36	31
2005	Bagmati, Gandak	12	81	1464	21.040	5.350	0.3343	0.1261	1031	4507	58	4
2004	Gandak, Bhutahi	20	211	9346	212.990	86.860	2.0990	0.6010	361017	568756	885	3272
2003	Gandak, Ganga	24	172	5077	76.020	11.960	0.9943	0.5140	43163	41261	251	108
2002	Bagmati, Kamala	25	6	8318	160.180	52.510	1.4446	0.5244	89021	329993	489	1450
2001	Gandak, Kosi	22	194	6405	90.910	11.700	0.9042	0.2910	128419	93589	231	565
2000	Kosi	33	213	12351	90.180	8.090	0.6570	0.1476	183670	159421	336	2568

(Source: Disaster Management Department, GoB)

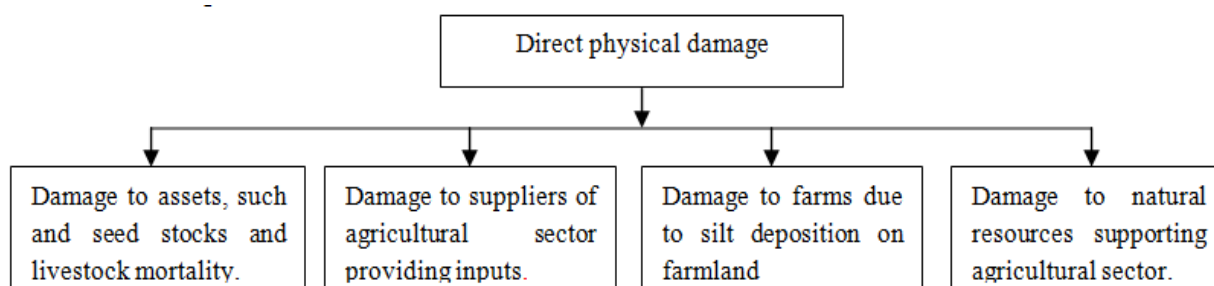
In addition, 2017 Bihar floods affected 19 districts of North Bihar-Kishanganj, Araria, Purnia, Katihar, East Champaran, West Champaran, Darbhanga, Madhubani, Muzaffarpur, Sitamarhi, Sheohar, Samastipur, Gopalganj, Saran, Siwan, Supaul, Madhepura, Saharsa and Khagaria causing death of 514 people, 2371 Panchayats, under 187 Blocks. Around 1.71 crore people were hit by the floods. Over 8.5 lakh people lost their houses with Araria District alone accounting for 2.2 lakh people homeless. 2017 flood has broken 9 year record of deaths in Bihar.

The 2017 flood was the result of sudden increase in water discharge due to torrential rains in the foot hill of the Himalayas in Nepal and adjoining areas in Bihar between August 12 to 20 led to flash flood in various rivers-Kosi, Gandak, Burhi Gandak, Bagmati, Kamla Balan and Mahananda due to heavy rain in the catchment areas.

Economy of Bihar largely depends on agriculture or agricultural activities. Agriculture is the backbone of Bihar's economy and socio-economic status. About 78% of population is involved in agriculture

and its allied activities either as cultivator or agricultural labor. The situation is more vulnerable in the region of North Bihar with large flood prone area.

In occurrence of flood, hectares of agricultural land get submerged and silted, which makes it uncultivable for few consequent years and remains as fallow field. A significant increase in fallow land can be visualised after 2008-09 which is the consequence of Kosi flood in year 2008. The area became uncultivable due to high silt deposition in the farm land. Several hectares of lands gets eroded and grains preserved by households gets destroyed which results into many small and marginal farmers becomes landless. Women from vulnerable families work as agricultural labour but due to flood this activity is completely stopped. Fig.2 summaries the direct physical impacts of floods on agriculture sector.



**Figure 2:- Direct physical impact of flood on agricultural sector**

Next to agriculture sector which is contributing to NSDP of Bihar and equally affected by negative impacts of floods are industrial and manufacturing sector. These sectors are closely linked with infrastructure like power supply, water supply, communication, etc. In case of any disruption in these services, the production will be affected immediately. In event of flood, these services are affected primarily causing its consequence as temporary stoppage of production due to lack of electricity or water, disruption of raw material availability and inflow, temporary unavailability or shortages of labour, etc. During the flood, the industrial sector may confront damage that may include buildings, equipment and machinery, stocks of raw materials and of manufactured goods. In addition, after flood the sector may face changes in its production flows, including production decline and possible higher costs of production arising from the destruction of assets or other causes such as lack of raw materials, strategic inputs of water and electricity, temporary absence of labour, lack of working capital, etc. Furthermore, some branches of industry – such as the food producers – that rely on the production obtained from agricultural sectors for raw materials may suffer production declines even if no damage has happened to their facilities. In case of damage to building, equipment and machinery there is a need of funding to ensure returning the sector to its normal level of functioning or production. So flood is playing a vital role in miserable growth rate of state and affects the livelihood pattern of life in this region.

**FLOOD MITIGATION AND MANAGEMENT IN NORTH BIHAR**

In the above context, to minimize negative consequences and ill effects of flooding to maintain the sustainable growth of the state, there is a need of planning for flood management. As for floods cannot be controlled completely so planning for flood management implies management of flood in such a manner to get maximum benefit in the given circumstances. Flood management measures can be broadly categorized in two types, structural measures and non structural measures.

**STRUCTURAL MEASURES.**

In North Bihar the following structural measures are adopted:

- I. Construction of Flood Embankments.
- II. Channel Improvements.

- III. Embankment Protection work.
- IV. Flood retention walls.
- V. Flood levees.
- VI. Detention basins.

#### Non- Structural Measures:

- I. Land use Planning.
- II. Zoning of Flood-Prone Lands.
- III. Redevelopment of Flood-prone Areas.
- IV. Flood Insurances.
- V. Compensation and Incentives.
- VI. Silt Management.
- VII. Flood Forecasting and Warning.
- VIII. Use of GIS and Remote Sensing

#### Epilogue

From the above study, it is clear that flooding is a perennial problem in the North Bihar with devastating impact on the livelihood pattern of the region. The effects of damage to life and property caused by flooding were severe for several years. The damage to infrastructure also badly affects the industry and agriculture sector. Agriculture is the mainstay to our large growing population and the backbone of the economy playing primary role in its development. However, due to recurrent floods, agriculture and allied sectors have accounted miserable growth rate but still play a vital role in the development of North Bihar and the state. Majority of rural population belongs to the lower socio-economic structure of the society suffers from the extreme poverty due to recurrent losses caused by the floods. In spite of the government's measures of flood management, households continue to live with suffering on account of severe damage to life and assets. It is not possible to avoid floods, but with appropriate planning and management, it is possible to reverse the uneven trend of growth in North Bihar and check the migration of labors in search of livelihoods. Recent techniques of Remote Sensing and G.I.S should be applied effectively for real time monitoring early warning and quick assessment of flood disasters.

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