

CHILDREN FOCUSED CITY RESILIENCE STRATEGY- PATNA

City Profile

Patna is located in the plains of southern side of river Ganges. The Patna Municipal Corporation (PMC) area covers 107.62 sq. km and is comprised of 6 sub-divisions and 72 wards. The city is also known for Buddhist and Sikh pilgrimage. The major industrial areas in the city are towards northern and southeast areas with railway units located in Hajipur and Sonapur areas.

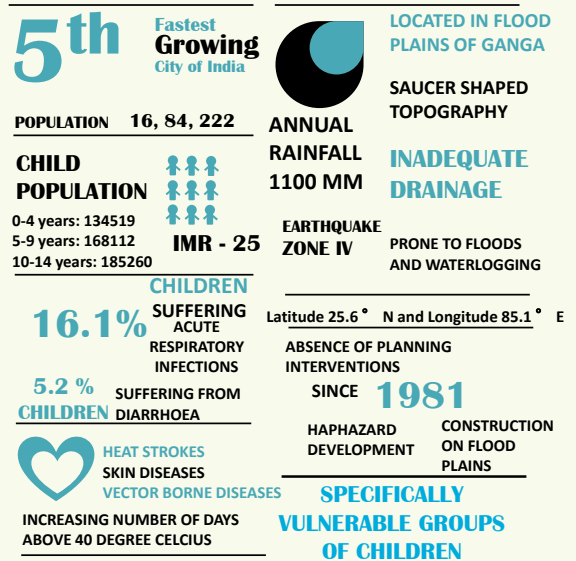
According to Census 2011, the total population of Patna is 16.8 lakhs whereas the population in Patna Metro Region is 20.5 lakhs. Over the last six decades, city's population has increased manifold. The reason behind such growth is the strong rural-urban connection in terms of flow of goods and services and peri-urban areas are playing a major role in this transition.

There are large numbers of slums in Patna with its higher concentration in central part of the city. According to Census 2011, the total households in the slum areas are 13,696 with a total population of 77,034. The total number of children in the age group of 0-6 living in the slums of Patna is 11,322. These slums have poor infrastructure with hand pumps and public stand posts being the main drinking water supply sources; very few households have toilets and there is a lack of public toilets.



Facts and Figures

Patna is the capital of Bihar and the second largest city in eastern India after Kolkata. It is a multi-hazard prone city vulnerable to floods, high wind damage and heat/cold waves etc. Being in the earthquake Zone- IV, the seismic vulnerability of the city is another perpetual danger. The impact of climate change is recognized as an important issue in the city which is highly prone to hydro-meteorological hazards. The city has been facing the challenge of acute urban flooding for the past few years.



MAJOR CLIMATE CHANGE SHOCKS

- Urban flooding and Waterlogging in new areas due to extreme rainfall
- Sunstroke
- Sudden increase in diseases such as Dengue and Chikungunya

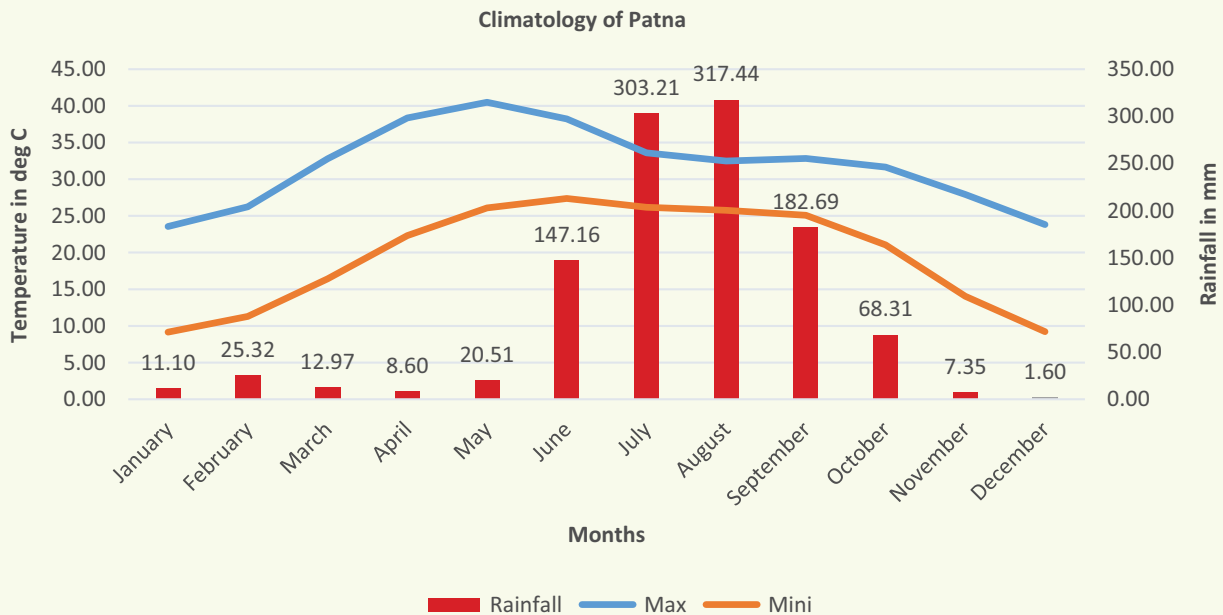


CLIMATE CHANGE STRESSES

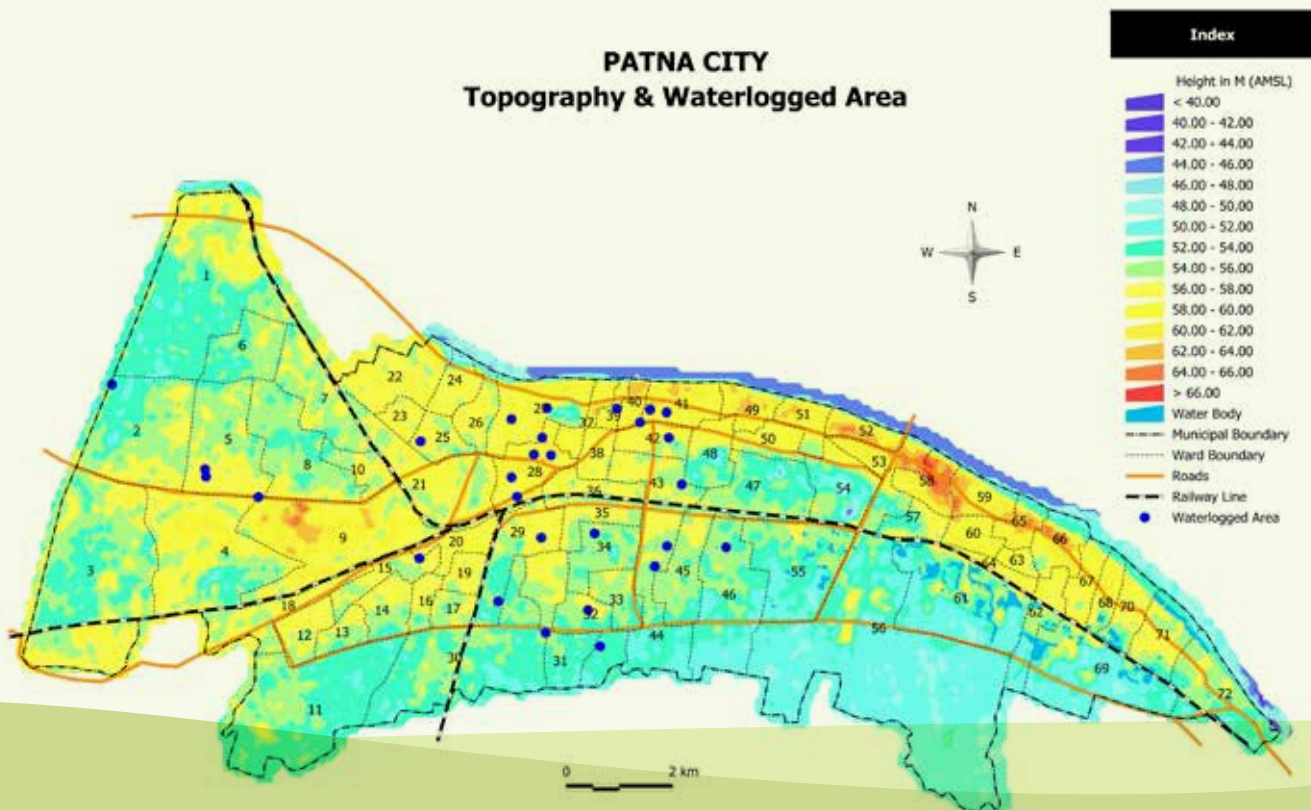
- Unexpected expenses of rehabilitation
- Agricultural losses due to climate change increase the prices of food grains
- Debts rising among farmers
- Women and children becoming more vulnerable to extreme hot temperatures
- Traffic congestion due to waterlogging
- Increasing frequency of road accidents due to dense smog during winters
- Water table goes down during extreme summers
- The advent of harsh summers creates hindrances for children's education as most of the schools are not equipped with fans
- Increase in expenses on treatment of diseases during summers
- The problem of shelter for homeless people during winters
- Decreasing working capacity due to extreme heat

Climate and Hazard Profile of the City

The city of Patna has gone hotter and humid during the last 115 years (1901-2015) which is forcing people to stay indoors to avoid being struck by the heat waves and sticky weather. Today, the climate of the city is recognized as humid sub-tropical with extreme hot summer from late March to early June, the monsoon season from mid- June to late September and chilly winter nights and foggy or sunny days from November to February. Annually the city, on an average, receives rainfall of 1145 mm in 80 days. The monsoon season (June– Sept) accounts for more than 80 per cent of its annual rainfall.



The annual mean temperature of Patna is 25.55 °C. Annual mean maximum temperature of the city is 31.30 °C and annual mean minimum temperature is 19.80 °C. Highest temperature during the last 115 years was ever recorded as 46.6 °C on 9th June 1966, while the lowest ever was 1.1 °C on 9th January 2013. In summers, the average maximum temperature however soars as high as 37.2 °C and winter average minimum drops down to 10.6 °C. Days with maximum temperature exceeding 40 °C varies from 35 to 57 days. The early or late onset of monsoon and large spatial and temporal variability of monsoon rainfall causes floods and affect the city.



The city is located in flood plains of Ganga and has a monotonously flat relief. With a saucer shaped topography and a slope in south direction the city, without adequate drainage provisions, is acutely prone to waterlogging. The organized settlements and developmental activities in the flood plains of rivers have added to the problems. Patna is located in Seismic Zone IV, which is a high-risk earthquake zone. It also falls in the risk zone of floods and high wind damage which is further aggravated by climate change.

Box 1: Resilient Cities and Children across Bihar Roadmap for Disaster Risk Reduction (DRR) 2015-2030

Bihar Roadmap for DRR is the first ever document of the state focussing on DRR. The Government of Bihar has duly recognized the importance of Resilient Cities in urban areas in the DRR Roadmap. It defines Resilient Cities as a “dynamic and proactive social unit wherein all individuals, households and the community as a whole is capable to assess the disaster and climate change induced risks and access the early warning systems; and address disasters including climate change induced disasters through risk informed development planning which includes preparedness, response and mitigation actions. Further, it also includes the component of preserving ecosystems through environmental impact assessment and recovering from disasters through building back better.”

The roadmap identifies children as vulnerable groups and acknowledges that the vulnerable groups also have the capacities which must be considered while designing and implementing DRR actions. Inclusive DRR being a guiding principle of the roadmap also takes into the different vulnerabilities faced by children in disasters. One of the most important guiding principles of the plan focussing on children is “investing in children and young population which will reduce the risks in present and future”. It also emphasises on school safety programmes for disaster risk reduction. Although the impacts of climate change on disasters and children are not mentioned, still the usefulness of the roadmap cannot be denied to reduce child vulnerabilities.

Climate change impacts and urban poor children

Rapidly urbanizing cities and towns in India are increasingly becoming vulnerable to the impacts of climate change and disasters. The urban poor children, those living in low income settlements, slums, and streets, those who are orphans or have physical disability are the most vulnerable ones with poor access to health, water, sanitation, education and physical safety and protection. They are frequently exposed to physical hazards, such as polluted water; open sewer systems; inadequate public transport; lack of local safe play areas or cultural facilities; toxic local environments; and overcrowding.

Policies and plans on climate change and disaster risk resilience often fail to take account of the disproportionate risks for children that are frequently compounded by pre-existing vulnerabilities in India’s fast urbanizing cities. Understanding these risks is important, as policies that lessen pressures on resources, manage environmental threats and increase the welfare of the poorest members of society can simultaneously advance sustainable development goals, enhance adaptive capacity and reduce vulnerability to climate change and other risks.



Child vulnerabilities were assessed across five domains of child development

HEALTH



Children's health is primarily determined by the socio-economic and physical conditions of the environment in which they live and nurtured. Climate change alters the frequency, timing, intensity, and duration of weather events.

Increasing rainfall and flood events due to changing climate increase the incidences of water borne diseases like diarrhoea; vector borne diseases such as malaria, dengue, chikungunya; jaundice, AES, skin diseases, etc.

EDUCATION



Proper schooling and education is closely linked with the elusive triangle of its access, equity and quality for the urban poor children. In the wake of changing weather patterns, this is influenced by declining livelihood opportunities, migration, inaccessibility to schools, health, etc.

Climate induced disasters hit the poor communities who are then forced to discontinue their children's schooling. Displacement due to rural-urban migration which leads to problem of identity also adversely impacts education.

PROTECTION



During extreme temperatures and rainfall, physical safety becomes a problem for the children. The poor children and also those living on the streets face extreme vulnerability and deprivation of basic entitlements.

Lack of proper upbringing due to various reasons makes them vulnerable to drug abuse, sexual abuse, substance abuse, trafficking, gambling, etc. Climate change and disasters cause large scale dislocation of poor people from rural to urban areas or even within the urban areas.

NUTRITION



Children, in their growth period are vulnerable and need proper food and nutrition for their overall development. Nutritional inadequacies results in the hampering of the development of their body. If this nutritional inadequacy persists for a longer period of time, it results in their improper growth manifested in the form of wasting, stunting, low IQ, etc.

Droughts that lead to food shortages are likely to lead to malnutrition, affecting the health and development of urban poor children.

WASH



Climate-induced disasters severely affect the infrastructure and services related to drinking water, sanitation and hygiene. Floods inundate tube-wells, ponds and water bodies and contaminate the natural sources of fresh water thereby forcing affected communities to use unsafe water. Toilets are generally fragile and mostly unsuitable to withstand high flood or cyclone. It leaves people with no other option but to go for open defecation. Such crisis in safe water supply and sanitation service severely disrupts hygiene practices. Because of water contamination, public health situation often deteriorates spreading water-borne diseases like diarrhoea, cholera, typhoid and hepatitis.

Child Centred Urban Resilience Framework – Understanding vulnerabilities and developing resilience actions

Urban Climate Change Resilience is the capacity of an individual, community, or institution to dynamically and effectively respond to shifting climate impact circumstances while continuing to function at an acceptable level. Simply put, it is the ability to survive and recover from the effects of climate change. It includes the ability to understand the potential impacts and to take appropriate actions before, during and after a particular consequence to minimize negative impacts and maintain the ability to respond to changing conditions.

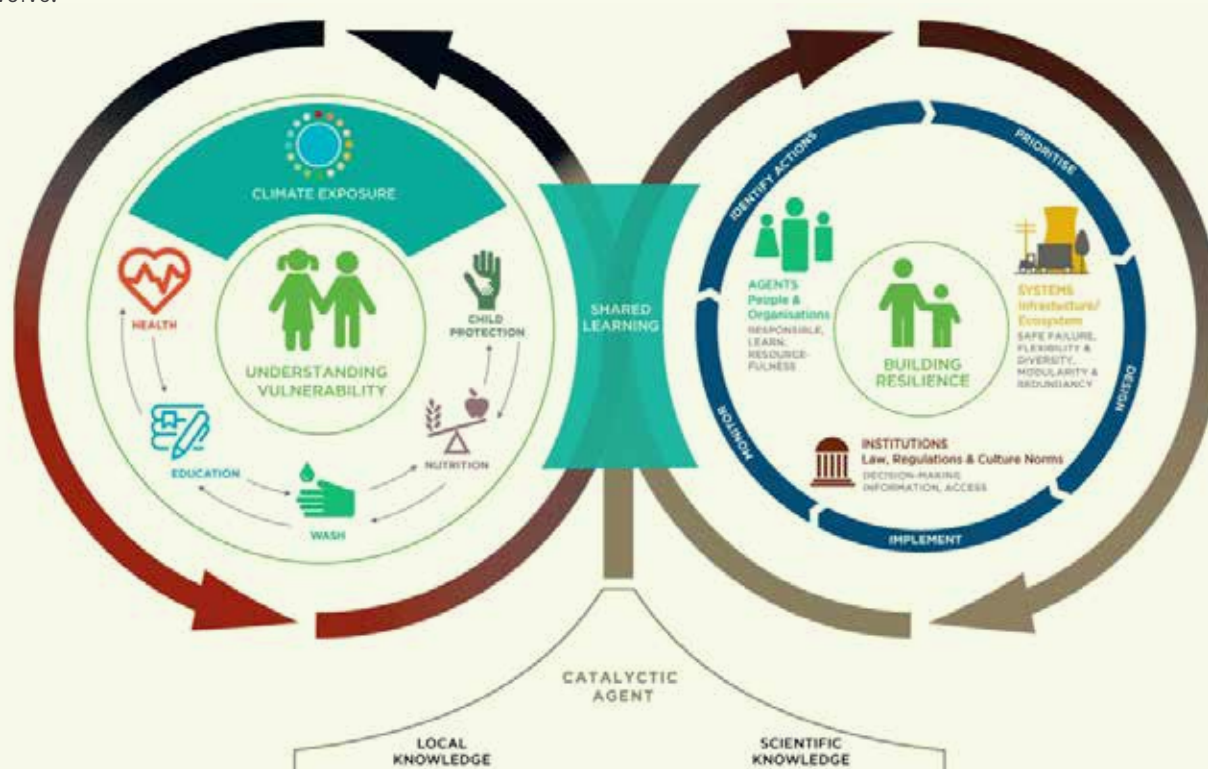
Child-Centered Urban Resilience Framework, adapted from the internationally acclaimed Climate Resilience Framework developed by ISET-International, is an integrated approach for understanding vulnerabilities of urban poor children, one on part, due to climate change impacts around their five key development parameters – **Health, Education, Child Protection, Nutrition and Water, Sanitation and Hygiene (WASH)**. The causes of vulnerabilities across these five development parameters are inter-linked and inter-dependent on each other.

The framework defines **Resilience** as high where system characteristics (diversification, flexibility, redundancy, modularity, and safe failure), agent capacities (ability to visualize, act, organize and reorganize, and learn), and enabling institutions combine in ways that enable all groups to access systems and ensure that those systems continue to function as climate conditions evolve.

The framework entails building resilient characteristics at three levels:

- **Systems:** Identify the fragile urban systems (infrastructure, ecosystems, water and food supply, energy, transport, shelter, and communications) and strengthen their characteristics which can contribute to build urban climate change resilience for children.
- **Agents:** Building the capacities of social agents (individuals, households, and private and public sector organization) to anticipate and develop adaptive responses, as well as access and maintain supportive urban systems.
- **Institutions:** Addressing the institutional factors (laws, policies, social and cultural rules or conventions that structure human behaviour and exchanges in social and economic interactions, including rights and entitlements, decision-making processes and access to information and knowledge) that limit effective responses to system fragility or undermine the ability of agents to take action.

It further guides that for resilience planning, it is important to *identify actions* across key thematic sectors, *prioritize actions*, *design* resilience options/solutions, *implement* them and *monitor* them around a set of key indicators. The framework incorporates the concept of shared learning as part of an iterative process in which analysis feeds into planning, planning into actions, action into learning, learning into further cycles of analysis, and so on.



Adapted from Climate Resilience Framework, ISET International

A participatory approach to child centred resilience building in Patna

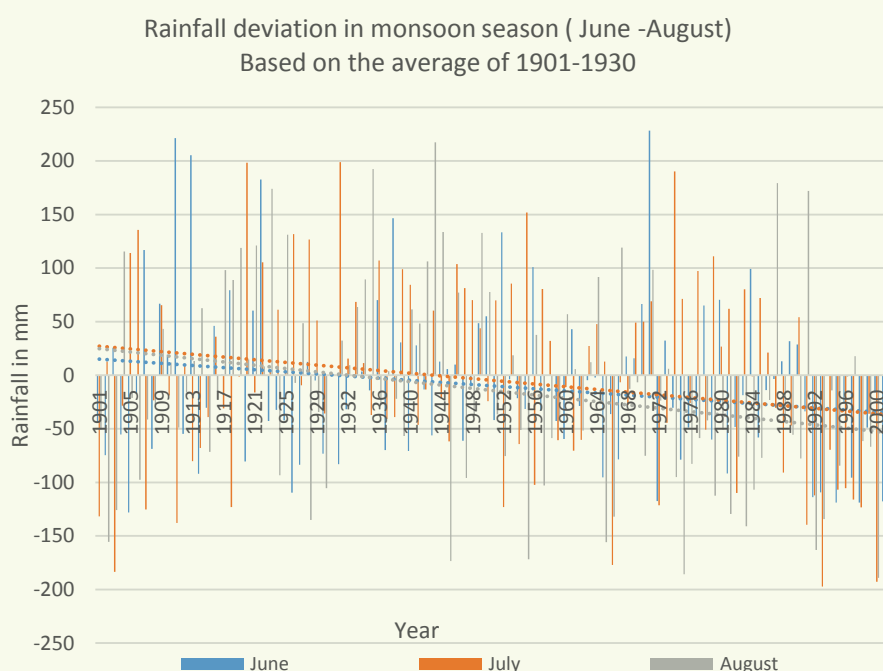
PROCESS	APPROACH/TOOLS	FINDINGS
Literature review; Collection of secondary data and information and Policy Review	Relevant Studies/Researches; Secondary Information; Concerned Organizations/Individuals	Climate Change Scenario; City Profile; Policies and Governance Framework and Existing Vulnerabilities.
Child Centred Vulnerability Assessment in the context of climate change impacts	Understanding vulnerabilities through "Child Centred Resilience Framework"; Historical climate data analysis and future climate change projections; GIS based hazard mapping of the city; Urban system analysis and identification of sectoral vulnerabilities	Climate change vulnerabilities of urban poor children: Health, Nutrition, WASH, Education and Protection.
Multi-Stakeholder Involvement	Multi-Stakeholder Participatory Workshops; Shared Learning Dialogues with: Urban Local Bodies, Para-statal, State Government, National Government, Civil Society Organizations and Academicians	Mapping urban poor children's vulnerabilities; Identification of major shocks and stresses and their causes because of climate change and induced disasters; Identification of resilience actions; Roles of stakeholders.
Field Visit and Community Consultation	Shared Learning Dialogues (SLDs) and Focussed Group Discussions (FGDs) with communities (slums, low-income settlements, geographically vulnerable hotspots and informal settlements etc); Causal Loop Diagram (CLD)	Identification of vulnerable wards, low income settlements and slums to understand the vulnerabilities of children in the face of climate change; Validation of the identified vulnerabilities through stakeholder workshops.
Formulation of Children Focused City Resilience Strategy	Multi-Stakeholder Engagement; Community consultation with participation of children	Children Focused City Resilience Strategy

Analysis of historic climate trends and future climate change projections

Knowledge of past, present and future climate trends and projections helps to determine how to address the projected changes and reduce the risks posed to effective functioning of city's systems, environment, lifestyle, economy and overall well-being of people.

Climate data analysis involved study of:

- Climate data (monthly average) of 115 years from India Meteorological Department
- Seasonal and temporal variation from baseline (1901-1930)
- Extreme event analysis through high resolution climate data of last ten years
- Participatory threshold analysis (historic signature events) and validation with high resolution data and
- Determining sector specific linkages.



HISTORICAL CLIMATE DATA ANALYSIS



The mean maximum temperature has increased in monsoon and post-monsoon season over the city, which is influencing the humidity content in the air.



The mean minimum temperature in winter and post monsoon season has increased. This is creating conducive environment for breeding of mosquitoes giving rise to vector-borne diseases, especially in children.



The number of days above 40 Degree Celsius in the city is increasing which is influencing children's health and causing heat strokes in school going and children working in the open spaces.



The absolute rainfall amount is decreasing while frequency of light rainfall (less than 7.5 mm) is increasing which have direct effects on food production in the peri-urban areas.

FUTURE CLIMATE CHANGE PROJECTIONS



1.82°C

Annual maximum temperature is projected to increase by 1.82 °C by 2050.



1.95°C

Annual minimum temperature projected to increase by 1.95 °C by 2050.



10-25 %

Extreme rainfall events might increase by 10-25 % by 2050.

Annual mean maximum temperature in post monsoon season is likely to rise by 1.75 °C by 2050. Whereas in winter season, this will rise by 1.85 °C by 2050.

Annual mean minimum temperature during post monsoon season is projected to increase by 2.85 °C by 2050.

Hot days and warm night might increase.

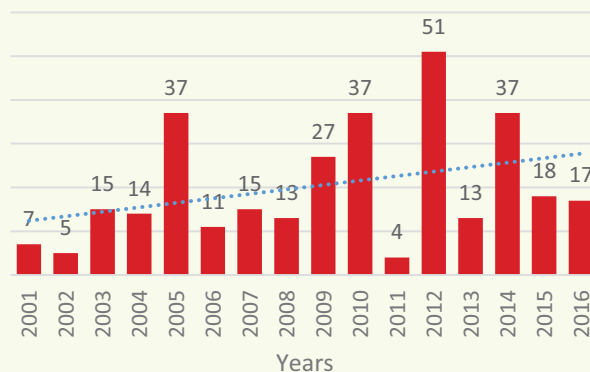
Mean annual rainfall is projected to increase by 8-12 % by 2050.

Mean monsoon rainfall might increase by 70-90 mm by 2050. Most of the increase will occur in the monsoon period.



Temperature above 40 degrees celcius

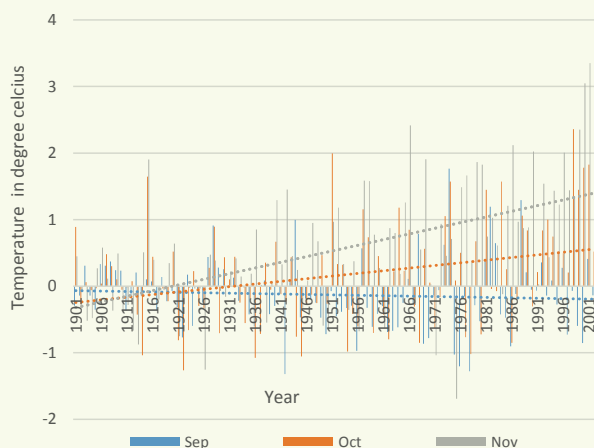
Number of days above 40 degree Temperature



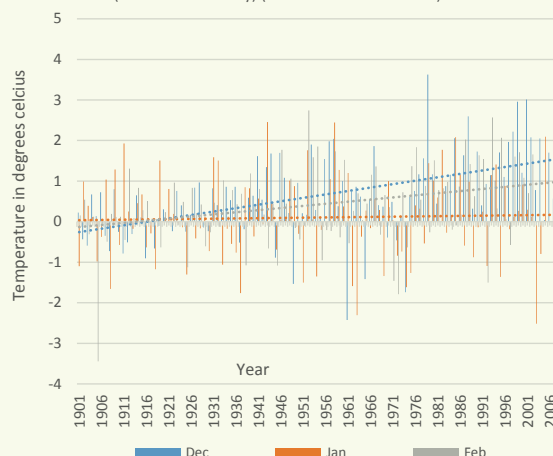
Seasonal Trends: Key Inferences

- Major change (negative) is being noticed during the monsoon season (June to August) which is a matter of concern for agriculture sector being carried out in and around the villages of the city.
- The number of rainfall events more than 20 mm in a day during monsoon season is decreasing while the frequency of light rain (0.1-7.5 mm) is increasing.
- Rainy days frequency of heavy rain (64.5-124.4 mm in 24 hrs) is in decreasing order whereas rainy days frequency of very heavy rainfall (124.5-244.5 mm in 24 hrs) is on an increase since the last two decades.
- Temperature trends (both minimum and maximum) shows an increasing trend.
- The striking feature is that the minimum and maximum temperature during the winter season (Dec-Feb) is increasing.
- The analysis of day wise data of maximum temperature during the summer months (March-June) of the city of last 16 years has inferred that extreme temperature events have increased significantly over the last 16 years.

Max Temperature deviation in post-monsoon season (Sep - Nov) (From baseline 1901-1930)



Minimum temperature deviation in winter season (December-February) (from base line 1901-1930)



Urban Systems Analysis and Sectoral Vulnerability

An analysis of urban systems helped to assess their fragilities with respect to the climate change impacts identified earlier. These urban systems include core systems such as water, sewerage, solid waste, drainage, etc. which are essential for running the city, and secondary systems such as public health, sanitation which rely on the core systems. Vulnerabilities of each of the identified urban systems in the context of climate change impacts that the city of Patna is experiencing were detailed out. Each sector focuses especially on the vulnerabilities of children. An analysis of the status of wards in terms of the presence of basic amenities was done using the Census 2011 data. Below is the matrix depicting the status:-

Ward wise presence of basic amenities

Ward No			Main Source of Drinking Water				Location Within premises	Number of households having latrine	Waste water outlet connected to		
	Good	Dilapidated	Tapwater from treated	Tapwater from un-treated	Handpump	Tubewell/Borehole			Closed drainage	Open drainage	No drainage
8	12	14	72	73	76	77	82	91	106	107	108
0001	65.5	2.3	9.6	6.5	47.7	26.5	75.1	83.8	36.7	35.1	28.2
0002	85.4	3.9	19.9	14.3	7.2	56.9	93.3	93.7	82.9	7	10.1
0003	64.6	9.2	9.9	5.8	49	32.8	82.5	78.1	34.1	38.9	27
0004	66.7	8.7	51.6	3	17.1	25.5	79.5	85.8	53.5	33.6	13
0005	77.3	3.2	32.6	6.5	5.3	54.3	91.4	92.6	87.8	10.8	1.4
0006	78.7	1.3	5.1	4.9	14.3	74.4	96.5	98.7	66.9	9.5	23.6
0007	86	0.7	20.6	10.1	6.5	62.5	96.7	98	91.6	8.2	0.2
0008	74.4	1.8	66	7.4	0.7	25.2	90.1	92.8	78.1	21.2	0.7
0009	30.4	22	41.8	19.5	28.1	9.9	56.9	58.7	35.7	36.7	27.6
0010	76.3	4.8	20.4	14.2	16.3	47.3	88.8	90.1	51.8	29.6	18.5
0011	71.8	4.5	5.8	3.9	40.1	44.8	88	87.3	24.6	39.2	36.3
0012	70.3	4.2	31	19.1	17.4	30.3	91.9	95.4	83.3	12.3	4.4
0013	75.1	2.6	22.2	1.5	22.7	50	91.6	96.8	59.4	28.3	12.3
0014	79.8	2.9	37.6	11	10.6	39.5	91.8	96.4	72.4	19.9	7.6
0015	68.2	4.9	51.3	11.8	3.6	30.5	90.6	93.6	69.9	27.1	3.1
0016	75.4	1.7	49.3	11.6	6.3	32.2	99	99.2	83.4	13.2	3.4
0017	75.2	3.8	27.9	6	14.8	46.8	90.9	97.7	67.7	18.2	14.1
0018	77.5	2.1	33.7	31.7	3	30.5	95.3	98.8	93.1	6.5	0.4
0019	57.7	10.7	55.1	28.7	7.8	7.8	81.7	80.8	67.7	25.2	7.1
0020	77.6	2	30.6	12	3.9	52.8	96.3	95.9	91.4	7.6	1
0021	48.4	13.3	48.2	18.7	23.6	8.6	62.2	64.9	65.5	24.5	10
0022	87.2	1.8	43.8	12.3	1.8	41.6	97.9	99.3	91	8.7	0.3
0023	90.1	3.6	48	10.8	0.9	39.6	98	99.4	92	7.7	0.3
0024	75.3	4	70.6	4.9	3.4	20.8	91.4	97.6	77.8	20.1	2.1
0025	83.1	0.6	51.9	11.4	0	36.5	95.5	99.4	87.6	12	0.4
0026	71.7	6.4	59.6	12.1	10.4	16.6	91.4	93.7	84.8	13.9	1.3
0027	49.1	9.3	69.3	11.2	5.6	13.5	84	86.8	79.7	15.8	4.4
0028	89.2	1.4	64.6	2.9	0.3	31.9	97.3	96.3	94.7	5.1	0.1
0029	73.8	2.7	47.1	11.9	3.7	35	93.9	96.2	80.8	17.2	2
0030	87	1.7	7.8	6.8	30	53.1	94.2	96.8	32.5	42.3	25.3
0031	72.8	1.6	31.5	19.4	14.2	34.1	97	99.2	80.8	11.8	7.3
0032	61.4	1.5	19.8	11.2	26	37.8	91.4	95.7	73.6	10.8	15.6
0033	78.4	1.6	50	14	6.7	27.9	93.8	96.8	90.8	8.2	1.1
0034	66	6.2	67	4.1	1	24.9	96.3	95.6	86.6	8.9	4.5
0035	68.3	1.9	35	7.2	2.3	52.9	92.6	97.2	93	5.6	1.4
0036	61	3.3	63.9	11.4	6	16.6	91.7	95.5	90.3	8.5	1.2
0037	80.7	5.1	58.6	27	0.7	12.8	92.7	94.4	85.7	13.6	0.7
0038	78	1.6	59.4	21.7	1.9	16.2	93.3	98.6	92.6	6.5	0.9
0039	64.8	5.5	72.4	19.2	0.2	7.2	84.1	94.8	91.5	4.5	4
0040	70.8	2.4	75.7	18.3	0.1	5	95.3	98.3	85.4	14	0.6
0041	59.4	5	69.5	8.2	1	20.9	87.6	94.9	85.2	13.9	0.9
0042	77.4	3.5	67.2	11.5	2	18	94.1	97.6	88.9	10.3	0.8
0043	80	4.2	63.7	6.4	2.6	26.2	91.3	96.3	93.6	3.7	2.7
0044	80.6	2.3	45	7.6	5.8	40.7	95.7	97.7	88.7	6.9	4.4
0045	83.8	1.4	43.9	1.3	4.3	50.1	96.7	98.1	97.9	1.1	1
0046	57.7	5.8	44.5	2.2	8.3	39.9	90.7	92.8	76.5	17.6	5.9
0047	78.7	2.8	39.4	3.8	5.3	46	88.8	93	77.2	12	10.8
0048	63.2	4	73.4	13.9	4.4	7.8	92.5	92.4	48.3	51.3	0.4
0049	59.7	8.6	59.2	36.5	0.8	2.4	88.4	93.6	73	24.4	2.6
0050	67.9	3.9	71	14.1	2.5	7.8	89.8	96.6	75.9	22.1	2
0051	65.6	3.6	58.7	15.8	13.3	10.5	83.6	93.3	66	29	5
0052	54.9	7.3	73.3	19.3	4.2	1.7	81.9	94.9	42.7	53.5	3.8
0053	62.1	6.3	73.9	17.6	1.4	3.2	84.2	91.8	63.3	29.5	7.2
0054	67.6	5.2	46.6	11.5	8.2	27.5	88.9	94.8	58.7	33.3	8
0055	84.1	1.3	42.8	1.2	14.8	38.9	89.4	91.7	55.2	21.9	22.9
0056	47.3	9.7	24.8	6.6	35.4	15.2	62.6	73.3	37.8	48.5	13.6
0057	50.6	4.1	65.2	17.8	4.9	4.9	74.1	84.8	50	45.5	4.5
0058	61.9	5.7	67.5	14.8	6.5	6.4	90.5	96	51.3	47.6	1.1
0059	63.4	7	69.3	23.5	2.7	0.7	83.7	91	64.6	30.7	4.6
0060	65.2	4.6	62.5	9	14.1	12.3	91.7	95.9	45.7	52.7	1.6
0061	44.7	6.1	69.2	10.2	8.8	1.2	76	82.6	19.8	68.8	11.4
0062	60.2	5	73.5	14.8	5.3	1.3	91.3	95.8	42.9	48.6	8.5
0063	71.1	3.7	66.8	19.8	6.9	4.2	93.6	98.2	57.9	40.9	1.2
0064	68.6	3.8	62.4	17.3	11.6	5.8	92.6	95.8	70.1	29.2	0.7
0065	57.9	6.8	77.9	12.9	4.3	2.1	91.2	95.9	56.5	39.7	3.8
0066	71.9	5.1	62.6	23.6	5.5	6.2	90.5	97	58.2	40.3	1.4
0067	64.7	4.9	56.4	25	5.1	5.6	84.6	95	45.7	52.2	2.1
0068	41.4	12.1	32.9	15.7	16.3	4.7	56.2	75.8	29.7	48.2	22.1
0069	47.6	8.8	69.6	18.2	4.4	2.8	71.4	84.3	39	50.5	10.5
0070	60.3	3.6	80.6	4.1	4.6	2.7	81.8	93.5	46.3	49	4.7
0071	57.6	4	65.7	6.8	9.1	2.2	75.1	88.8	34.3	59.2	6.4
0072	44	9.4	46.7	21.3	18.3	1.3	46.5	68.2	13.8	54.4	31.8
0074	63.4	3.4	46.6	12.4	18.4	16.5	86.1	92.1	72.5	23.1	4.4

Legends: Dark Red cells denote worst condition; Green cells denote good condition

In this analysis, the condition of houses, sources of drinking water, availability of toilet and situation of wastewater management has been taken into account.

Drinking Water

- South-eastern Patna has more slum like situation in terms of condition of houses.
- In nine wards (9, 21, 27, 56, 57, 61, 68, 69 and 72), more than 50 per cent housing conditions are not good. People are living in slum like situation.
- In ward number 9, 19, 21 and 56 more than 10 per cent houses are in dilapidated condition.

Housing

- More than 20 per cent households in the city defecate in open.
- Ward number 1, 2, 3, 9, 21, 56, 68 and 72 have poor accessibility to toilets. 30- 40 percent households do not have toilets and defecate in open in these wards.
- In Western Patna, in ward number 1, 3, 5, 9 and 11, around 50 to 60 per cent area lacks drainage facilities.
- In south-eastern part, the situation of wastewater management is not good.

Sanitation

- Availability of safe drinking water is also a serious issue in the city.
- Western and south-western Patna has poor access to treated drinking water facilities.
- Ward numbers 1, 2, 3, 5, 6, 7, 10, 11, and 30 have poor access to treated water. Majority of households in this region have their own borehole.

Vulnerability Risk Frame of the city

Based on inferences gathered from the interactions with children, community members, stakeholder consultation and urban system analysis, a Risk Frame comprising of key shocks and stresses of the city has been identified as shown which are especially impacting urban poor children in Patna.

CLIMATE RISK FRAME OF PATNA



“

Due to poor nutrition and prevalence of water borne diseases in the low lying areas of Ramji Chak slum the attendance of children in school declines during heavy monsoon, impacting education. At times, the schools are located in low lying areas, and water gets filled in them and children have to miss out on studies”- says Munni, a 15 year old girl, Musahar Community, Ramji Chak slum, Patna

“

During climate events like floods, our parents do not get wage labour work, rag picking or sale of homemade brew. This leads to low incomes leading to food shortage. This directly has an impact on our nutrition. Also, here in the floodplains we do not have farms or homestead gardens that produce diverse food like vegetables and fruits that provide adequate nutrition,” says Rani, a 17 year old girl from Nach Bagicha slum, Digha, Patna.

Key Inferences

- Patna is experiencing unplanned infrastructural development and the ill effects of climate change are further exacerbating vulnerabilities, with grave impacts especially on children.
- The lack of adequate planning and effective enforcement of rules and regulations increase the vulnerability of city.
- The impact of such hazards also depends on natural systems of the city like vicinity of the city to rivers; topography, low slope gradient and high ground water table.
- The haphazard development without adequate drainage considerations has enormously increased the problem of waterlogging and the city is not even able to deal with 60 mm rainfall in 24 hours.
- The increase in summer temperature has started affecting people of Patna city. The reduction in green and open areas, shrinking water bodies have created situations for heat islands in city.
- The incidences of heat strokes have increased in city particularly in low-income population who are engaged in outdoor livelihood activities (labourers, street vendors etc.).
- The temperature variability has also resulted in situations where the duration of temperature regime between 10^o-20^oC has increased which is congenial for mosquito breeding.
- There is a lack of responsible behaviour towards the up-keep/maintenance of city's services. Lack of ownership, in general, in the people of the city is also a limiting factor, which enhances vulnerability.
- Lack of proper enforcement of Master Plan, poor governance mechanisms and administration of basic services are some of the key issues enhancing the city's vulnerability.
- All the above factors are contributing and enhancing the climate risks in Patna -giving rise to several **shocks and stresses**, ultimately rendering serious vulnerabilities to the people, especially those who marginalized and live in fragile settlements in the city.

Child Centred City Resilience Strategic Directions - Patna

Sector	Children's Vulnerability	Development Deficit	Needed Actions	Policy/ Programmes	Institutions
Health	<ul style="list-style-type: none"> Rapid increase in vector-borne diseases like Malaria, Dengue, Chikungunya Increase in air-borne diseases like asthma, bronchitis, etc. Skin related diseases such as rashes and itching, etc. Water-borne diseases such as diarrhoea, typhoid and jaundice, etc. Illness due to heat stroke (Loo) Illness due to cold waves Increasing bacterial diseases such as pneumonia and T.B. 	<ul style="list-style-type: none"> Dumping garbage and waste in inhabited areas Inadequate waste disposal system in residential and public places Large extent of open and choked drains (indiscriminate polythene use) Surface/Groundwater contamination Conducive environment for vector breeding due to waterlogging Air pollution due to burning of solid waste, increasing traffic congestions Lack of gas connections for migrants in the absence of identity proofs leads to wood stove cooking which causes fire and air pollution Unsafe disposal of bio-medical waste Improper disposal of e-waste No separate drains for storm water and sewer water Small, disconnected sewerage accumulation areas getting developed in various locations 	<p>SOLID WASTE MANAGEMENT:</p> <ul style="list-style-type: none"> Develop comprehensive Decentralized Solid Waste Management Plan aligned with Service Level Benchmarking norms; Facilitate 100% door to door collection of waste in the city Phasing out current dumping grounds, particularly those in the low lying areas of the city Appoint "Safayi Mitras" at ward level Need assessment of incinerators to be done for bio-medical waste and their installation Deployment of adequate human and financial resources for solid waste management and sewerage management Citizen led (especially children) monitoring systems and actively working "Local Mohalla Samitis" <p>DRAINAGE & SEWERAGE:</p> <ul style="list-style-type: none"> Special cleaning drives for cleaning drains in pre-monsoon period and during the monsoon Covering the open drains Banning use of polythene - Prepare a project for plastic recycling and its implementation Deployment of adequate human and financial resources for solid waste management and sewerage management Citizen led (especially children) monitoring systems Strict action on encroachment of drains in dense localities/slum areas Renovation of existing underground drains specifically in low lying areas Develop integrated sewerage network for the entire city 	<ul style="list-style-type: none"> Manual on MSW Management 2016, CPHEEO guidelines on solid waste management Swachh Bharat Mission (Urban), GoI Waste Plastic Rules, 2016, GoI Namami Gange Guidelines of Bihar State Pollution Control Board SMART City Guidelines 	<ul style="list-style-type: none"> Municipal Corporation NGOs CBOs Pollution Control Board Citizen Forums Media Concerned Technical Departments Private Sector Resident Welfare Associations National Health Mission Bihar State Water and Sanitation Mission ICDS State Health Society Private Hospitals Indian Medical Association

Sector	Children's Vulnerability	Development Deficit	Needed Actions	Policy/ Programmes	Institutions
Education		<ul style="list-style-type: none"> Groundwater contamination due to raw sewage dumping No sewerage system in slum areas and dumping on roads Open defecation Lack of safe drinking water Inadequate health posts in urban areas Lack of human resources at health posts Irregular fogging Behavioural problems - civic sense, personal hygiene, etc. Poor ventilation in houses, congested settlements especially in slums, etc. 	<p>HEALTH:</p> <ul style="list-style-type: none"> Developing Health Atlas for health risk assessment and preparedness Develop real time disease surveillance system to monitor and reduce incidences of water and vector borne disease outbreaks Regular and extended fogging during monsoon/ winter season Banning the burning of tyres and plastics <p>HOUSING/BUILDING:</p> <ul style="list-style-type: none"> Cool roof technology for resilience against heat strokes in schools, Anganwadis, Health Centres Awareness and Capacity Building Community Awareness for behavioural change on SWM Awareness drives like weekly campaigns like "Chakachak Patna", educational institutions, hospitals, etc. to be done to keep the city clean School campaigns on waste management 		<ul style="list-style-type: none"> Patna Medical College AIIMS Bihar Rajya Jal Parishad Patna Jal Parishad Flood Management Information System DDMA DMD
	<ul style="list-style-type: none"> Absenteeism due to extreme weather events (heat waves, cold waves and excessive rainfall) Absenteeism due to seasonal illness Lack of access to school due to waterlogging and flooding conditions Drop out reasons - seasonal, labour oriented, livelihood loss, distressed migration Behavioural problems - education is not a priority, especially for the girl child Low enrolment, irregular return of girl child after challenging weather events 	<ul style="list-style-type: none"> Lack of separate, clean toilets for girls and boys in schools Lack of drinking and hand wash water in schools Construction of schools in flood plain areas/ inappropriate places such as below flyover (Adalatganj) - leading to inundation due to excessive rains Lack of proper ventilation, safety escape routes and plans in case of fire and other disasters in schools Lack of classrooms, open play areas, green spaces and infrastructural problems (fans and lights) leading to lack of interest among students Ageing and dilapidated school building - seepage during rains Inappropriate student teacher ratio Lack of awareness on the importance of education among parents due to absence of regular counselling 	<p>POLICY/ENFORCEMENT:</p> <ul style="list-style-type: none"> School Safety Policy to be operationalized Strict implementation of building bye-laws and penalty provisions Considering resilient infrastructure under Sarva Shiksha Abhiyan norms Education department to be part of DDMP/CDMP Geo-tagging of urban schools Coordination mechanism with traffic police department to prepare a "Traffic Plan" <p>SCHOOL PROGRAMMES:</p> <ul style="list-style-type: none"> School Eco-Clubs for taking up climate resilience initiatives Formation and implementation of school disaster management, fire safety and evacuation plans with signage, mock drills governed by an active School Management Committee (SMC) Alternate school timings in extreme temperatures (summer and winter) Children to develop school resilience plan; Regular mock drills on disasters Regular health check-ups in government schools with the involvement of medical students/interns. <p>EDUCATION MANAGEMENT:</p> <ul style="list-style-type: none"> Climate change and urban resilience aspects to be included in the school curriculum Formulation of "Child Parliament" in schools Parent Teachers Meeting to be made compulsory in all the schools Special programmes for mainstreaming of drop out children (crash courses) 	<ul style="list-style-type: none"> Sarva Shiksha Abhiyan Guidelines School Safety Policy DDMP Chief Minister's School Safety Programme 	<ul style="list-style-type: none"> Education Department Sarva Shiksha Abhiyan Municipal Corporation DDMA BSDMA Traffic Police Department Health Department Bihar Education Project Council (BEPC)
	<ul style="list-style-type: none"> Water-borne diseases Open defecation due to lack of toilets Intake of contaminated water from shallow hand pumps, especially in flood plains 	<ul style="list-style-type: none"> Open defecation due to lack of community/public toilets; Individual Household Latrine Lack of spaces in slums for toilets Inadequate water supply infrastructure and system, especially for slums (damaged pipelines, inadequate number of sanitation workers, high nitrate concentration in groundwater with no treatment facilities) Behavioural problems - hand wash, personal hygiene, use of toilets, etc Lack of separate toilets in school for girls and boys Open drains which usually overflow Dumping waste in water bodies Indiscriminate use of polythene bags leading to choking of drains, creating impermeability of soil 	<p>DRINKING WATER:</p> <ul style="list-style-type: none"> Quality monitoring of water at source and destination levels (Setting up of decentralized lab equipped with modern testing instruments, trained personnel, and financial allocation for conducting sample surveys for water quality testing in a professional manner, available on demand) Localized treatment of drinking water at home and at schools - children to be oriented on this at school level. Identification and renovation of broken pipelines <p>WATER MANAGEMENT:</p> <ul style="list-style-type: none"> Groundwater recharge and rainwater harvesting- Use of roof top water for collection and storage made mandatory for schools and public buildings Seasonal Aquifer mapping to identify strata of safe drinking water availability Conservation and restoration of natural water bodies and catchment areas with the involvement of community by using approaches such as Self Help Groups Natural cleaning processes of water bodies (floating gardens) in Patna <p>SANITATION:</p> <ul style="list-style-type: none"> ODF Patna Urban in a strict phased manner Construction of community toilets with proper discharge of waste Separate toilets for girls and boys in schools Community approaches to sanitation to solve behavioural issues 	<ul style="list-style-type: none"> Saat Nishchay BSWSM Guidelines WHO Guidelines BIS Swachh Bharat Mission (Urban) SMART City Guidelines CGWB Guidelines 	<ul style="list-style-type: none"> Bihar State Water and Sanitation Mission Groundwater Board Bihar Rajya Jal Parishad Municipal Corporation Patna Jal Parishad Municipal Corporation NGOs like Sulabh International and UNICEF CGWB

Sector	Children's Vulnerability	Development Deficit	Needed Actions	Policy/ Programmes	Institutions
Nutrition	<ul style="list-style-type: none"> Disturbance in regular income affecting food availability (Livelihood losses affecting food security of children) Malnutrition Agriculture production and diversity losses (rural-urban connect) Reduced accessibility to nutritious food due to floods and waterlogging in surroundings Absenteeism from schools affects child nutrition due to non-access to Mid Day Meals Unhygienic food practices Burden of diseases causing malnutrition 	<ul style="list-style-type: none"> Dumping of solid waste and sewage in peri-urban areas Inadequate enforcement of land use plan Soil mining Flood plains/inundation Irrigation of crops with sewage contaminated water Encroachment and contamination in water bodies Crop losses and decreasing net gains in peri-urban areas Encroachment on agricultural lands leads to more production on small lands with excessive use of chemical fertilizers which have less nutritional value Unorganized street vendors facing loss of livelihood and income Non-inclusion of migrants in nutrition schemes Access to food supplements especially in slums and low income settlements (ICDS) Less number of Anganwadi and ICDS centres as per the population requirement Lack of awareness among young mothers on complimentary breast feeding Poor Housing infrastructure leads to unsanitary conditions 	<p>URBAN, PERI-URBAN AGRICULTURE</p> <ul style="list-style-type: none"> Promotion of climate resilient agriculture in peri-urban areas Segregation and household composting options Identification and demarcation of common property resources (water bodies, open spaces, orchards, etc) Develop model water bodies for aquaculture (water nut, etc) <p>URBAN LIVELIHOOD:</p> <ul style="list-style-type: none"> Promotion of agro based industries like poultry, dairy, etc. Vendor Plan to be formulated at the city level <p>POLICY/PROGRAMMES/SCHEMES</p> <ul style="list-style-type: none"> Ration cards to be provided to migrant labourers Formation of a "City Health Sanitation and Nutrition Committee" with the involvement of communities and creating awareness on consuming the available food hygienically, promoting traditional food like Aam Sattu which can be easily prepared at home There is a need to develop an "Urban Agriculture Policy". <p>SCHOOLS:</p> <ul style="list-style-type: none"> Promotion of nutrition garden at school and Anganwadi levels Promotion of urban farming in housing societies 	<ul style="list-style-type: none"> Master Plan 2031 National Food Security Mission National Horticulture Mission National Health Mission 	<ul style="list-style-type: none"> Municipal Corporation Patna Regional Development Authority Revenue Department Forest Department Agriculture Department Education Department Housing Board Women and Child Development Department Social Justice Department NASVI
	<ul style="list-style-type: none"> Child labour to support families Children involved in extremely hazardous activities such as segregation of syringes and needles, e-waste, etc. Substance abuse Child sexual abuse Issues of privacy in congested slum houses Extreme weather events are threat to child safety especially for homeless children Building collapse (school, home, healthcare centre) Electrocution by open unauthorized wire Children fall in open drains 	<ul style="list-style-type: none"> Improper drainage system (open drains) Unsafe habitat in terms of infrastructure (lack of ventilation, fire events, earthquake, waterlogging) Enforcement of laws and rules relating to child safety and protection to be taken on priority (POCSO) Improper maintenance of school and healthcare infrastructure Developmental plans and policies lack child friendly approaches. 	<p>ENFORCEMENT:</p> <ul style="list-style-type: none"> Strict enforcement of laws governing child safety and protection (POCSO) Linking every child with Aadhaar to ensure child protection Shifting schools from hazard prone locations to safer places Maintenance check of all school buildings during pre monsoon period and carrying out repairs <p>AWARENESS:</p> <ul style="list-style-type: none"> Awareness among parents and children on child safety and protection issues School campaigns on anti-tobacco and anti-drug <p>POLICIES/PROGRAMMES:</p> <ul style="list-style-type: none"> Demand driven actions from community for new child protection policies and programmes Review of existing Child Policy from a climate change and disaster resilience lens. Implementation of school safety policies with a special focus on fire evacuation plan, provision of safety equipments at school and installation of bad conductors to lightning in school buildings Specific vulnerability mapping of children in high risk zones and the needed measures to be taken up 	<ul style="list-style-type: none"> National Plan of Action for Children School Safety Policy Shelter for Urban Homeless Chief Minister's School Safety Programme Building Bye Laws 	<ul style="list-style-type: none"> Education Department DDMA Labour Department Urban Development Department Social Welfare Department (ICDS, Children's Home) Police Department Childline NGOs

Building Climate Change and Disaster Resilience for Urban Children:

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