



The Economics of Alternative Development Pathways: Preliminary Scenarios Case Study Gorakhpur, India

PUBLISHED SEPTEMBER 2013

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THE STORY

Gorakhpur is a rapidly growing city and the second largest in eastern Uttar Pradesh, India. It is located in the mid-Gangetic plains between the Rapti and Rohini river basins. The current (2011) population of Gorakhpur is close to 700,000 and the city is spread in a geographical area of about 147 sqkm, divided into 70 administrative wards. Ironically, one of the most fertile areas in the country/region is also one where poverty is very high.

Gorakhpur city is bowl shaped with a low to flat gradient and high groundwater tables. Historically, there were 103 bodies of water that served as natural drainage to the city. With urbanisation, less than a third of these bodies remain. Since a large part of the city's elevation is below the river, water logging of lands and periodic flooding is present. The bulk of the water logging problem, affects about 40% of the city, specifically the south and west areas, however, the drainage system for the entire city is impacted. Water logging has been getting worse in recent years due to changes in rainfall and by the degradation of water bodies and unplanned development (land encroachment). Though there is little increase in total rainfall, average intensity in the summer months has increased. This has resulted in some areas of the city becoming waterlogged for almost 5-6

months of the year. Unmanaged solid waste disposal is another urban risk that the city is facing. With no incinerator or water treatment plant, the problem has become acute. Prolonged water logging together with poor waste management has caused an increase in incidences of vector-borne diseases and related health problems, as well as contamination of ground water. Malaria and dysentery have historically been a problem; recent years have seen a rise in diarrhoeal diseases and other vector-borne diseases like Japanese Encephalitis. Water logging also leads to disruptions in transport systems, roads and property damage, thus, affecting livelihood systems and increasing the vulnerability of the poor.

FIGURE 2:
GEAG, 2013



Climate change brings a new dimension to the problem as more intense and untimely rainfall may occur. In recent years, floods that occurred earlier than normal caught the population off-guard and caused more damage than normal. Climate change is likely to increase the intensity of rain events throughout Gorakhpur over the next 50 years. It is projected that by 2050, small intensity rain events might see a 10 to 20% increase. For more severe events, climate change might increase the intensity of these by 2 to 25%. Overall, climate change will impact rainfall amounts resulting in continued and potentially worse flooding scenarios (Opitz–Stapelton & Hawely, 2013).

GORAKHPUR'S CITY MASTER PLANNING PROCESS

In 1973, the Urban Planning and Development Act was adopted to ensure that Gorakhpur will prepare a development plan for city growth. The first master plan covered the period of 1971 to 2001, the second master plan (the current guiding plan) covers the period of 2001 through 2021 (Roy & Saha, 2010). There are a few key actors involved in the master planning process from the state to city/district level in Gorakhpur.

ACTORS

The Master Plan is guided by a number of departments at the state, district and city level. The Housing and Urban Planning Department, Uttar Pradesh was established to cater to the needs of urban housing and to ensure planned development of urban areas. The department manages many organizations and departments that work in different aspects of housing and urban development. The Town and Country Planning Department (TCPD) directly oversees planning for urban cities in Indian states. TCPD prepares Master Plans which include infrastructure plans for the state (rural and urban areas). They provide support and guidance to the local bodies, (urban local bodies as well as the rural bodies) towards comprehensive development and expansion planning. These local bodies at the city and district level in Gorakhpur include:

- Town and Country Planning Department (TCPD). The TCPD performs a number of the preliminary studies, to develop the Master Plan. In addition, they approve and seek approval to move forward with the Master Plan.
- Urban Development Authority. In the urban housing sector landscape, the most important stakeholder is the Urban Development Authority (UDA). In every city, there is a UDA that plans for and demarcates areas (land zoning) for future development (or expansion) of the city. However, once the urban area expands, some pockets of the new development zone are developed by the UDA while the rest are 'sold' off to the private developers/builders. In Gorakhpur, the Gorakhpur Development Authority is in charge of development planning and zoning of new areas for expansion of the city.

PROCESS

The master planning process for Gorakhpur contains a number of steps to get approved.

1. Physical Survey. This is often carried out by the TCPD. However, the base physical survey map is currently outsourced. The base map is provided to the Development Authority and the TCPD. The TCPD then carries out the physical verification and land-use survey based on this Base Map.
2. Data Collection. Data on population growth, commercial activities, housing demand, transportation, basic services, etc. is collected through secondary sources. The above two are generally parallel processes and led by the TCPD.
3. Draft Land-Use Map and Master Plan. After a number of surveys are completed, the TCP Office at Gorakhpur develops a draft land-use map and master plan. They are then sent to the Chief TCPD at the state capital in Lucknow. The TCPD reviews the document and can suggest amendments, which have to be addressed by the Gorakhpur TCPO.
4. Government Approval. Once approved by the Chief TCPD, the document is submitted to the Gorakhpur Development Authority (GDA) Board of which the Divisional Commissioner of Gorakhpur is the Chairperson. The GDA Board consists of 14 departments¹ and provides suggestions or recommendations before approving the Master Plan.
5. Approval by the Gorakhpur Development Authority (GDA). Once approved by the GDA board, the document is sent by GDA to the Screening Committee at Lucknow, which comprises of a Principal Secretary, Chief TCPD, Principal of Government College of Architecture, and Vice Chancellor-GDA. This Committee can also provide suggestions to be incorporated in the document.
6. Public Approval. After the State level Screening Committee approves the plan, the document is shared for public comments and suggestions for a minimum duration of 30 days. After this, the GDA Board holds a public hearing where all people who have commented are invited along with other GDA personnel, TCPO personnel, Municipal Commissioner's office and from other Departments of the city.
7. Final Land-Use Map and Master Plan. The final document is prepared based on the comments/suggestions accepted at this meeting. The GDA

¹ Under the Article 4 of Uttar Pradesh Urban Planning and Development Act 1973, GDA has constituted a board in which 14 departmental heads have been involved. They Divisional Commissioner (Chairman), Vice Chairman of GDA, District Magistrate, Chief Development Officer of Municipal Corporation, Secretary or nominated member of Housing department, Secretary (Finance) of Uttar Pradesh Government, Chief Town and Country Planning Department, General Manager of Jal Nigam, Executive Engineer of Uttar Pradesh State Electricity Board, Gorakhpur and Executive Engineer of Housing and Development Council, Gorakhpur.

Board sends the Plan to the State Department (UP State Housing and Urban Planning Department) for notification, which then becomes the officially approved Master Plan (P. Kumar, personal communication, August 26, 2013).

Overall, the master planning process can take up to 5 years to complete (it sometimes takes even 7–8 years for the official Plan document to be notified). The Plan document is generally reviewed every 5 years aligning with the current development statistic that suggests every 5 years substantial developmental changes will occur. The current 2001–2021 Master Plan is under the review period right now for updating with current land use trends in Gorakhpur.

THE PROBLEM

The current Gorakhpur Master Plan of 2001 to 2021 builds off of the previous Master Plan that covered the period of 1971 to 2001. The Master Plan includes a number of assumptions for future land use, population, housing allocation, commercial and industrial sector, transportation, communication and urban services. Overall, the Gorakhpur Master Plan states a number of key assumptions for the city’s future growth, however, many of those assumptions failed in the 1971 to 2001 plan, and the stakeholders did not investigate the main causes of why certain plan goals were not met.

LAND USE.

A number of targets are set by the land use plan to encourage and identify growth in different sectors. The land use plans allocate certain portions of the land for use by different sectors (see table below).

TABLE 1:

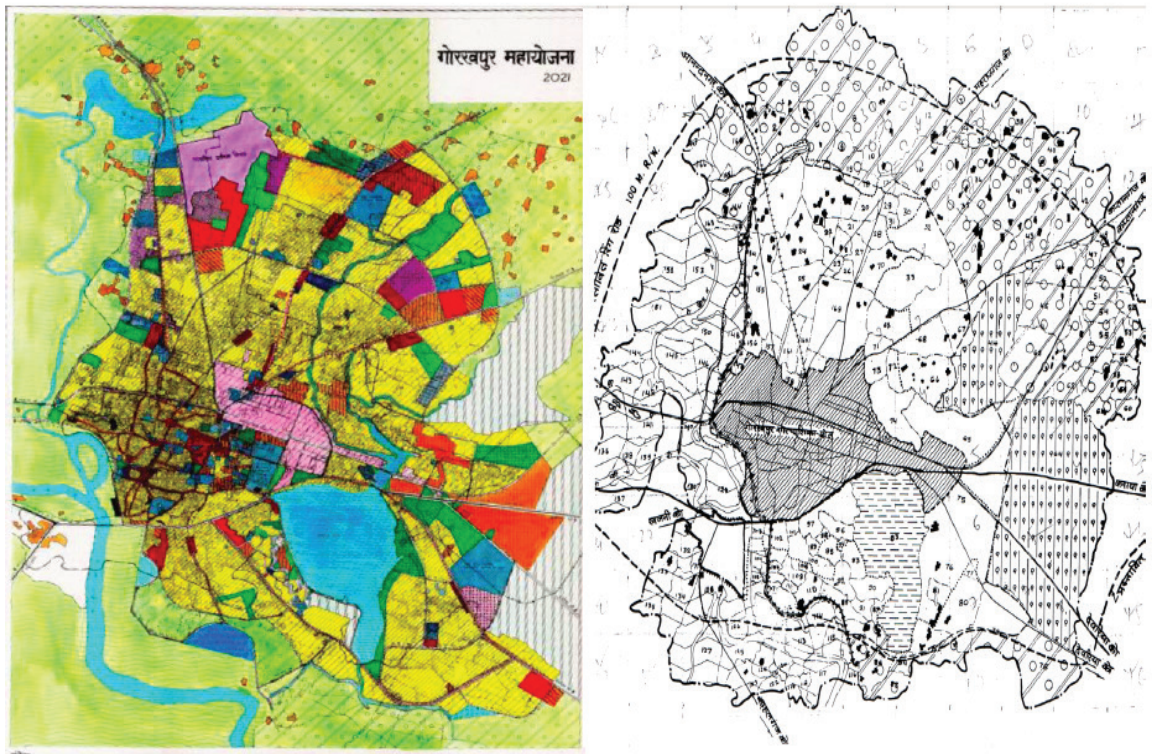
LAND USE CHANGE ACCORDING TO THE GORAKHPUR MASTER PLAN 2021

Source: Town and Country Planning (TCPD) & Gorakhpur Development Authority (GDA), 2007

Land Use	1971–2001	2001–2021
Total (ha)	6128.01	11188.33
Residential	49.34	51.14
Commercial	4.06	4.76
Industrial	11.40	5.24
Government	7.97	5.68
Public use	8.07	7.25
Recreation	13.40	8.75
Transport	3.76	6.27
Railways	-	3.68
Other	-	7.23

The table shows that land use changes declined from the 1971–2001 plan to the 2001–2021 plan. The causes for this decline, including allocation and inability to reach targets need to be investigated in order to develop a more realistic plan of Gorakhpur.

FIGURE 3:
PROPOSED LANDUSE PLAN, 2021, MASTER PLAN GORAKHPUR 2021 (TCPD & GDA, 2007)



POPULATION, HOUSING AND COMMERCIAL/INDUSTRIAL GROWTH

Gorakhpur is a major socio-economic, commercial, and cultural activity centre of North Eastern Uttar Pradesh. The current master plan predicts an increase in the number of workers from the informal sector, however, this plan does not address the need for adequate and affordable housing to accommodate these workers. Low-income housing is out of reach for working class families and the housing stock hosts significant discrepancies with reports developed by the Gorakhpur Environmental Action Group (GEAG & GMC, 2009). The housing stock requirements need to be re-evaluated to make adequate housing accessible for the working class. Furthermore, the Master Plan shows a large growth in the

informal sectors, whereas commercial and industrial sectors are being driven out of the city, thus enforcing the growth of unorganized and self-employed labour. This makes up a significant portion of employment of the city's residents and their place in the formal planning of the city has not been taken into consideration.

TRANSPORT SERVICES.

The 2001 Master Plan stated that 4 by-passes, a bus and truck depot and 3 overhead bridges were to be constructed during the period of 1971 to 2001. However, only 1 by-pass and 1 overhead bridge was built during that time period. The 2021 Master Plan proposes many new additions to the transportation infrastructure, including the building of 4 regional highways, 19 city roads, 24 local road and 35 crossroads. It is imperative to understand the failures of the past Master Plan to ensure that these critical transportation linkages get built in the future.

FIGURE 4:
TRAFFIC JAM AT GHOSE COMPANY CROSSING



URBAN BASIC SERVICES.

The 2021 Master Plan states the major issues with water logging, sewage, drainage, drinking water and disposal of solid waste. However, it does not estimate the actual extent of the problem. The Master Plan states that, “it will be necessary to make adequate provisions”, but include limited suggestions on how these problems should be resolved. As stated in GEAG’s Vulnerability Assessment (GEAG & GMC, 2009), a number of the critical bodies of water in Gorakhpur have been diminished. Traditionally, these bodies acted as polders for rainwater, etc. during high rain periods such as the monsoon. With the reduction of these bodies of water in Gorakhpur, waterlogging has increased significantly and is mentioned as a major problem in the 2021 Master Plan. However, the Master Plan does not attempt to address the waterlogging issues through restoration of water bodies or other means (Roy and Saha, 2010).

FIGURE 5:



Sewage and Sanitation

Sewage treatment and transport is another major issue facing the urban services of Gorakhpur and are a cause of major health concerns. The 2021 Master Plan states that only 20% of the city area has access to a sewage system. This limited access sewage system is only serviced by four sewage pumping stations. The rest of the population is serviced by private tanks or open drains. The open drains are often blocked and cause major issues with stagnant water that host

vector-borne transmitters. The Master Plan attempts to discuss the problem of sewage, but does not actually suggest how to expand the sewer system and the STPs. Recently, the UP Jal Nigam, Gorakhpur received a project worth Rs 8 crore (INR 80 million) by the state government for extending the drainage facilities of the city. It involves widening and upgrading five (trunk) kutchra drains. Untreated wastewater to the tune of 90 MLD is discharging into the Rapti River and Ramgarh Tal Lake through 4 sewer pumping station. The UP Jal Nigam submitted a proposal to the state government for an extension of the city sewage system. The development plan also includes the construction of a sewage farm at the Milauni Bandha road for disposal of city sewage. The National Lake Conservation Department of the Government of India is also implementing a project to clean Ramgarh Lake. This project is partially funded by both the central and state government at a cost of Rs 124.32 crore (70:30). Part of the project includes the construction of two sewage treatment plants (STPs of 30 and 15 MLD) for the treatment of wastewater being discharged into Ramgarh Lake.

Water supply

At present, the 21 water supply zones of the city cover 48 wards out of the 70 wards. In the wards that are not covered, hand pumps have been installed for public use. Residents have installed their own hand pumps within their plots. Four new water supply zones covering 13 wards are about to be constructed under the water supply extension scheme. A total funding of 19.8 crore (\$3.80 million) has been acquired from UIDSSMT for this project. The scheme involves the installation of new 90 overhead tanks, 22 tube wells and 115 km of pipeline. According to the

FIGURE 6:
CHILDREN DRINKING WATER FROM SPICKET



development plan, the population of the city will reach 1.3 million by the year 2021 and the required amount of water will increase from the current capacity of 12000 kl per day to 25500 kl per day. At the current population, water supplied is only 77.60 lpcd compared to the national level of 135 lpcd. Coverage of the water supply connection is 19.3 percent with water being supplied daily for 12 hours/day. Due to the acute problem of water logging and high ground water table, the first stratum of ground water is contaminated. Other sources of contamination are soak-pits, un-cemented toilets in the city and proximate of drains to the handpumps.

Solid Waste Management

Gorakhpur city also faces a huge problem with solid waste disposal. About 263.8 million tonnes² of solid waste is generated daily of which only about 240 tonnes is collected and disposed by the Municipal Corporation on a daily basis. The existing solid waste management (SWM) system for Gorakhpur does not have designated sanitary land-fills for disposal of solid waste.

2 Gorakhpur City Sanitation Plan Report 2011, published by Gorakhpur Municipal Corporation

FIGURE 7:
WILD PIGS FOUND IN LAND-FILL



Waste collected from secondary sources is dumped at three sites, Mahewa, Harbert Dam and near Rustampur Crossing. This waste is also disposed of in low-lying areas or on banks near bodies of water. The 2021 Master Plan mentions very little about the solid waste problem and does not make any suggestions for how we might attempt to address these issues.

Flood Management Systems

At present a large part of the city especially in the southern, western and central areas, face acute water logging. In order to minimize water flow into the city, more than 12 km of earthen bunds have been constructed along the length of the river and about 6–8 km have been constructed along the bank of Ramgarg Lake. In addition, four pumping stations have been established in the city to pump out the water. The City Resilient Strategy (CRS) has highlighted the following causes of flooding and water logging in the city

- Bowl shaped topography of the city
- The city falls in the Rapti catchment area. The water from Rohin and Kuoano River flows into the Rapti River endangering the city. Constant silting of the river has also reduced the capacity to river to hold water.
- Inadequate drainage system in the city
- Encroachment and reclamation of drain and water bodies in the city
- Highly irregular and increasing rainfall patterns predicted for the future with high probability of extreme flooding events

The District Disaster Management Authority (DDMA) in Gorakhpur has prepared the District Disaster Management and Risk Reduction Plan 2011 with the support from UNDP under the provision of the Disaster Management Act 2005. As part of the plan, the Urban Risk Reduction Plan for Gorakhpur municipal area has also been prepared. In 2013, this DDMP has been revised and a climatic

component has been incorporated. The earlier plan has now been modified and more emphasis has been given on preparedness options for the disaster. This plan has been prepared using evidence from historic floods of 1998, 2001, and 2007. The plan has identified 59 hotspots of water logging and outlined the various measures for management of flooding and inundation in the city.

SCENARIO DEVELOPMENT

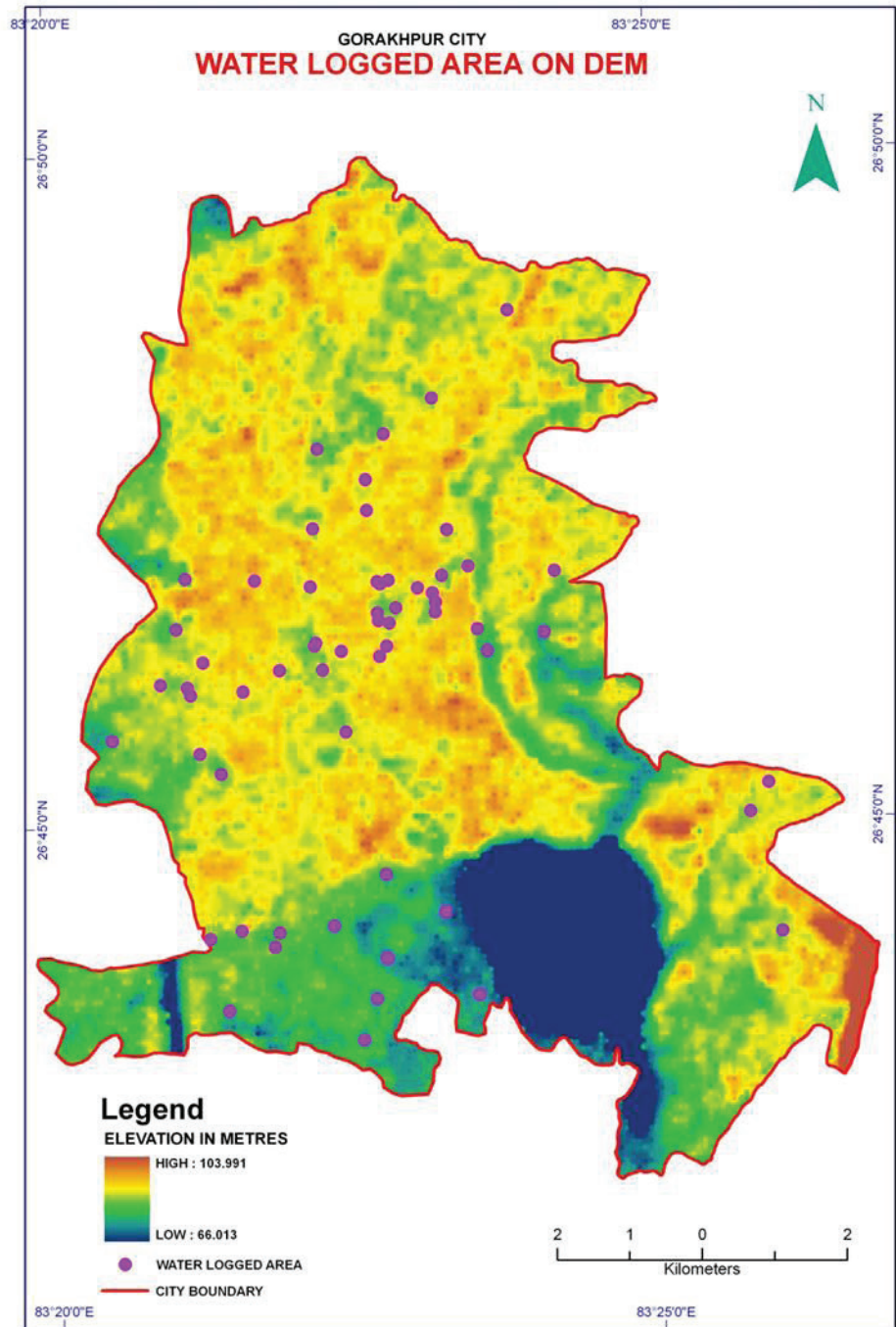
Through the use of scenario development, the research team is investigating transportation, housing and flood/storm management systems as well as identifying economic returns to building more resilient pathways within the Gorakhpur Master Plan. These three key development pathways can help to uncover other vulnerabilities within cities and serve as a great opportunity for influencing the decision-making processes.

- **Transportation.** Transportation systems strongly influence where people settle and what areas can be kept as open space—both of which are key factors influencing exposure. The actual transport systems (bus, train, etc.) will not be investigated, but the placement of transportation infrastructures will directly influence the settlement patterns of poor and vulnerable households, which serve as pathways for us to explore.
- **Housing.** The environment greatly influences the direction water flows during flooding events. Commercial and industrial parks will not be analysed, but major residential and community-use areas will be looked at to see how resilient alternatives in housing structure can reduce overall flooding and waterlogging.
- **Flood/Storm Management.** Flood management systems can be broken down into two different categories, 1) structural elements (embankments, polders), and 2) non-structural (early-warning systems, zoning, etc.). The team will investigate newly planned flood mitigation systems and determine if those systems will reduce overall damages or increase damages during major flooding events.

It is this story of master planning that the ISET-International and GEAG are partnering to influence. Through funding supported by Rockefeller Foundation, the research team plans to investigate the economics of specific development pathways in Gorakhpur City's Master Plan and identify key resilient alternatives that might alter the traditional paths and challenges facing Gorakhpur City.

FIGURE 8:

Water Logged Area of Dem



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This project was funded by the Rockefeller Foundation

