WORKING PAPERS

EAST-WEST CENTER WORKING PAPERS

Environmental Change, Vulnerability, and Governance

No. 68, January 2014

The Shadow of Urbanization: The Periurban Interface of Five Indian Cities in Transition

Vishal Narain, Poulomi Banerjee, and Pooja Anand

EAST-WEST CENTER
COLLABORATION • EXPERTISE • LEADERSHIP

EAST-WEST CENTER WORKING PAPERS

Environmental Change, Vulnerability, and Governance

No. 68, January 2014

The Shadow of Urbanization: The Periurban Interface of Five Indian Cities in Transition

Vishal Narain, Poulomi Banerjee, and Pooja Anand

Vishal Narain is associate professor, School of Public Policy and Governance, MDI, Management Development Institute, Gurgaon. He holds a PhD from Wagenningen University, the Netherlands. His research interests are in the analysis of public policy processes and institutions, water governance, and periurban issues.

Poulomi Banerjee is a senior fellow with South Asia Consortium for Interdisciplinary Water Resources Studies, Hyderabad, SaciWATERs. She holds a PhD on watershed management from Jawaharlal Nehru University, New Delhi. Prior to joining SaciWATERs, she worked as a researcher in the Water Resources Policy and Management Division (WRPM) of The Energy and Resources Institute (TERI), New Delhi.

Pooja Anand did her graduation in Mass Communications & Journalism and masters in Political Science from Hyderabad Central University, Hyderabad, India. She worked as a research associate with SaciWATERs, Hyderabad.

This paper presents the findings of five case studies conducted under an EWC project, "Rural to urban transitions and the periurban interface: Identifying, mapping, and understanding periurban areas in India and Pakistan," funded by the US Department of State.

EastWestCenter.org/publications

Publication Sales Office| East-West Center
1601 East-West Road | Honolulu, Hawai'i 96848-1601

Tel: 808.944.7145 | Fax: 808.944.7376
EWCBooks@EastWestCenter.org

EAST-WEST CENTER
COLLABORATION • EXPERTISE • LEADERSHIP

The Shadow of Urbanization: The Periurban Interface of Five Indian Cities in Transition

by

Vishal Narain, Poulomi Banerjee, and Pooja Anand

Abstract

Periurban areas refer to areas at the periphery of cities. They provide the land and water resources needed for urban expansion, while receiving urban wastes. This paper describes the process of periurban expansion around five major Indian cities, namely, Patna, Guwahati, Chandigarh, Chennai and Ahmedabad. These cities have expanded under the current regime of neo-liberal policies, infrastructure development and real estate growth. As spaces in transition, periurban areas around these cities have absorbed much of the migrant population. However, the cities have grown beyond the carrying capacity; this has caused the ecological foot-print of the cities to spill over into the peripheries. While conventional approaches to urban planning and rural development create a dichotomy between rural and urban areas, the concept of periurban raises questions both about the sustainability and equity dimensions of urban expansion, also raising issues of the politics of urbanization.

Introduction

The expression periurban interface is used to describe a zone and social space of transition characterised by the co-existence of rural and urban activities and institutions, diverse land uses and heterogeneity of economic interests (Allen 2003; Tacoli 2002, 2003; Narain and Nischal 2007; Iaquinta and Drescher 2000; Lerner and Eakin 2011; Simon 2008; Shindhe 2006). Its use has emerged to capture spaces of rapid transition from rural to urban concomitant to contemporary urbanization. The term serves as an analytic construct to denote core-periphery relationships in the context of urbanization, as well as to give a sense of how the ecological foot-print of urbanization is borne.

This paper describes the dynamics of periurbanization in five major Indian cities, namely, Chennai, Ahmedabad, Patna, Guwahati and Chandigarh. The focus is on the factors shaping the periurban expansion, the ecological and environmental implications of this as well as some recent initiatives and responses to address these issues, especially by NGOs and Civil Society Organizations. The paper concludes that current periurbanization processes happen both because of the prevailing legal and policy framework, as well as in spite of it. Neo-liberal economic policies giving a boost to the Information Technology and Real estate sectors and the growth of transport corridors have shaped the nature of periurban expansion, while location and topographical factors have shaped its geographical direction. The uncontrolled growth of these cities beyond their carrying capacity has caused their ecological foot-print to fall over the peripheral regions. This has compromised the ecological and livelihood security of periurban communities, while presenting new challenges for urban and periurban governance. In the absence of direct public or state engagement with periurban issues, CSOs and NGOs are playing a key role in ameliorating the ecological stresses created by this phenomenon, while lobbying to draw state attention to it.

The five cities mentioned above were chosen in order to understand the diverse nature of urbanization and periurbanization processes. They are located in different parts of the country with different underlying agro-ecological contexts. Chennai, located in the Southern Indian state of Tamil Nadu presents the case of a city expanding along a coast-line; while the Union Territory of Chandigarh, located in the North, is expanding into the foot-hills of the Shivaliks. Ahmedabad, in the Western Indian state of Gujarat, is located on the banks of the River Sabarmati. Patna is the administrative capital of the East Indian state of Bihar, located in the alluvial plains, while Guwahati is located in the North-Eastern state of Assam. Figure 1 below shows the location of the five cities on the map of India.

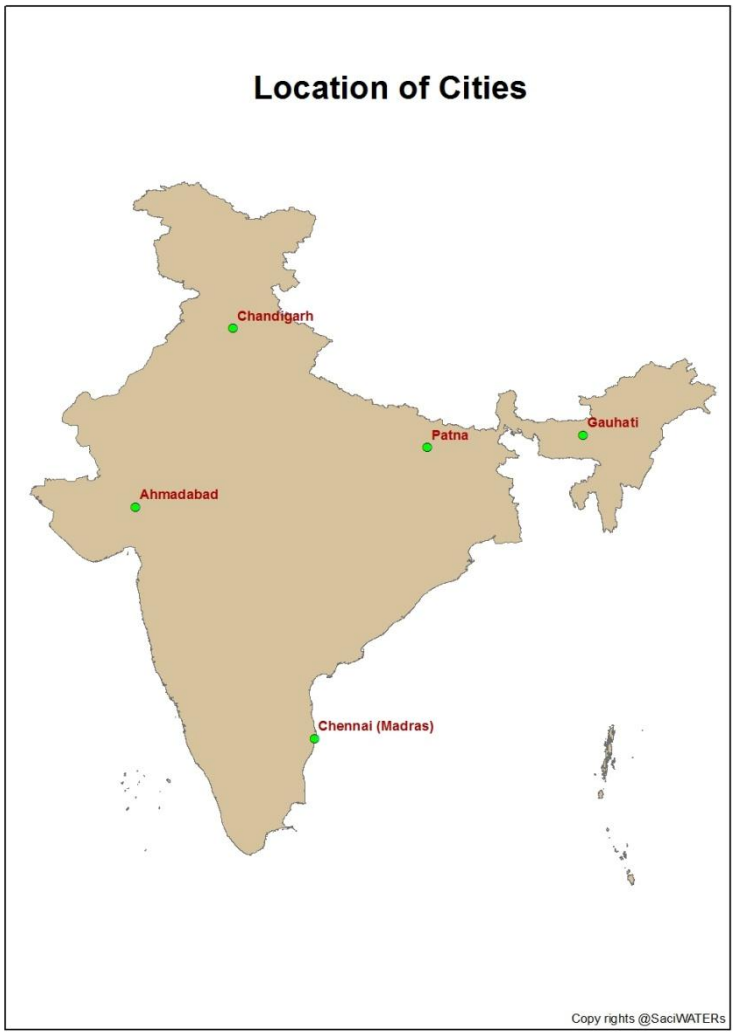

Figure 1: Location of the five cities on the map of India

In these cities, semi-structured interviews were held with key representatives from the Government, NGOs (Non-Government Organizations), academics, researchers and students working on periurban issues. They were interviewed regarding the drivers shaping the urbanization process, the major environmental challenges confronting periurban contexts, emerging governance and institutional issues, as well as some recent initiatives to address these concerns. A snowball sampling technique was used to select the interviewees; after an initial selection of respondents, further leads were obtained to interview other relevant informants.

Chandigarh

Geographical and administrative context

Chandigarh has a unique location in the Indian administrative system as well as on the map of India. It is surrounded by the districts of Punchkula and Ambala in Haryana and Mohali, Patiala and Roopnagar in Punjab. In the North, it is bounded by Himachal Pradesh. On the North-East periphery, it is bound by the Sukhna Lake. This part of the city is also under reserved forest area. As we shall see below, this aspect of location has had an important bearing on the pattern of urban expansion. Since it is bound in the North-East by Sukhna Lake and by reserved forests, it has looked for space to expand in the direction of Pinjore/Kalka, Panchkula and Mohali.

Chandigarh serves as the capital of two north Indian states, namely, Haryana and Punjab. It has the status of a Union Territory, implying that its administrative control is with the Home Ministry. Chandigarh was the first planned city of India, and has an international recognition and standing for its urban planning and architecture. It was planned and developed by the French architect Le Corbuiser; however, it expanded further, defying his plans - against legal provisions that sought to curtail its growth.

The notion of space: identifying a reference point for periurban

The periurban expansion of Chandigarh as had two important features; first, it has taken place defying legal provisions and initial plans to curtail the growth of the city. Second, it highlights particularly the limited validity of space-based definitions of periurban, emphasising instead that periurban is a relative concept, constituted in relation to what we consider as 'urban'.

Many scholars of the periurban interface note the limitations of space-based definitions of periurban (see, for instance, Iaquinta and Drescher 2000; Narain and Nischal 2007; Bowyer-Bower 2006). We can define periurban differently for Chandigarh, depending upon what we take as the reference point or bench- mark for 'urban'. Within the U.T (Union Territory) of Chandigarh, there are both rural and urban demarcated areas. The area comprising the urban designated areas of Chandigarh along with the Mani Majra village – that provided land for the construction of the city's new residential areas, the IT (Information Technology) park and SEZ (Special Economic Zone) - constitute the UA (Urban Agglomeration) [1]of Chandigarh.

[1] An urban agglomeration is a term used by the Census of India to denote a city and its outgrowths.

In other words, if we consider as "urban", only the urban designated areas of the U.T. of Chandigarh, Mani Majra would be considered as part of the periurban. Conceptually, this makes sense since Mani Majra has provided land and other resources for the expansion of the capital city, including land for several residential areas and the modern IT Park. If however we consider the UT of Chandigarh as a whole, then the periurban parts are the expanding frontiers of the city in the direction of Panchkula, Pinjore/Kalka and Mohali. Thus a frame of reference is important in defining what constitutes periurban; 'periurban' is a relative concept, and constituted in relation to what we see as "urban'.

A city expanding against the law

The periurban expansion of the city was against the formal legal provisions. The planning of the city started in the 1950s and most of it came to fruition in the 1960s. The Periphery Controlled Area Act, 1952, recommended a wide green belt (initially of 8km which later increased to 16 km) around the entire Union Territory of Chandigarh. The idea was to curtail further expansion. This Act sought to regulate the development and prohibited establishment of any other town or village and forbid commercial and industrial activities in the periphery zone. The idea was that Chandigarh would always be surrounded by the country side. However, the provisions of this Act were violated both by the state governments of Haryana and Punjab, as they sought to develop Panchkula and Mohali, respectively.

The original plan prohibited any construction activity within 16 km of city limits. The State Governments of Punjab and Haryana nevertheless created satellite townships within this prohibited zone. Besides, a large cantonment was set up at Chandi Mandir and the Union Territory Administration developed Mani Majra, a village just beyond the capital project area as a residential complex.

To the South of the city, the Government of Punjab created Sahibzaada Ajit Singh Nagar, or SAS Nagar informally known by its old name, namely, Mohali. To the East of the city lies Haryana's newly created town of Punchkula.

Under the influence of growing population in Chandigarh city and its surrounding areas particularly the three towns, i.e., Panchkula Urban Estate, Pinjore and Kalka of Haryana State, Chandigarh could not retain its originally conceived identity, namely, that of a fully planned urban core wrapped by a green belt of country side. The years that followed saw a particular unplanned development especially around its periphery. Several new projects came up around

Chandigarh to meet the demands of the population. Many of these projects lacked integration, were not self-contained and even lacked civic amenities.

The IT PARK

Two factors have played an important role in the spread of periurbanization in the city, namely, the coming up of the IT Park and the development of the Himalayan Express-way.

The expansion of the IT sector under a neo-liberal economic regime has been an important factor shaping the periurbanization process in many Indian cities (Narain 2009a, b; Reddy 2007; Prakash, Singh and Narain 2011). An important role in the periurban expansion of Chandigarh indeed has been played by the development of the Chandigarh IT Park (also known as the Rajiv Gandhi Technology Park) , that has marked the city's foray into the IT sector. [2] The IT industry has made space for itself into the city, lured by Chandigarh's good infrastructure and proximity to Delhi, Haryana, Punjab and Himachal Pradesh. Besides, there is an emerging pool of IT resources in the state. Indian and foreign multinational firms such as IBM, Dell, Infosys, Tech Mahindra and Quark have set up base in the city. The IT park has been located in the land belonging to Mani Majra Village, that – as also noted earlier - along with the urban part of the UT of Chandigarh, constitutes what is called the Chandigarh Urban Agglomeration.

The development of the Himalayan Express-Way

The second key factor shaping the periurban expansion of the city along the Pinjore-Kalka side has been the development of the Himalayan Express-way along the Zirakpur – Parvanoo section of the National Highway 22 connecting Chandigarh/Panchkula to Kalka and Shimla. A by-pass has also been built to connect directly with Shimla. The toll-way has been built under a PPP (Public-Private Partnership) model between the NHAI (National Highways Authority of India) and the Jaypee group. The building of the express-way has lessened commuting time on this route and eased traffic congestion for commuters.

New residential areas such as Amravati Enclave (the Pinjore Kalka Urban Complex) have been built along this highway. These have come up on the bed of the river Ghaggar. This aspect, as well as the coming up of the Kaushalya Dam on one of the tributaries of the river Ghaggar, threaten the viability of the fragile eco-system.

[2] It is interesting to note that as per a 2007 survey, Chandigarh was ranked ninth in the top 50 cities indentified globally as emerging outsourcing and IT service destinations.

Changing land use patterns

Changes in land use are often a basic driver of urbanization processes; these trigger off further changes in the social and economic profile of the periurban areas. Social and economic heterogeneity is thus a characteristic of periurban contexts (Allen 2003). On account of the factors described above, there has been tremendous growth outside the Chandigarh periphery zone. It is estimated that the population of the periphery portion (Haryana area itself) increased about five times during the last three decades. This happened because of several changes in land use patterns, such as the establishment of various government projects such as HMT, Chandimandir Cantonment, TBP complex, Terminal Ballistic Research Laboratory, Panchkula Urban Estate and the nearness to Chandigarh Capital periphery area. These factors acted to pull in migrants of the neighbouring regions. Migrants came in and settled from Punjab, Haryana, Himachal Pradesh, but also from as far as Tamil Nadu and Rajasthan. Many of them worked as construction labourers and workers.

Over the years, the agricultural area has declined constantly and has been replaced by the built-up area, on account of new planned residential areas (such as the Panchkula Urban Estate), increasing urban sprawl due to nearness to capital Chandigarh, good accessibility due to the network of roads including N.H. 22 and Delhi-Chandigarh rail route and increasing population pressure in the region.

Ecological implications of changing land use patterns: loss of vegetal cover and threats to ecological resilience

It is important to note that the expansion of the U.T of Chandigarh towards the N.E parts is constrained due to the presence of an environmentally sensitive zone ,i.e reserved forests as well as the cantonment area set up by the government of Chandigarh. A large portion of the land (in the Haryana peripheral region) comes under natural reserves including streams and reserved and protected forests. Hence, there are hardly any opportunities for expansion towards the north-east. Under these circumstances, the built-up area has instead extended along the Ghaggar river bed and the N.H. 22. Linear urban sprawl has happened with the development of HUDA (Harayana Urban Development Authority) sectors 23, 24, 25, 26, 27, 28, 29, 30, 31 and 32. As noted above, new residential areas such as Amravati Enclave and Virat Nagar have come up along N.H. 22 and the river Ghaggar.

Over the period 1972 to 2008, the natural vegetal cover is reported to have been depleted by about 50 per cent and may pose a serious threat to the ecological balance as the Haryana part of

the peripheral region in particular is environmentally sensitive and rich in biodiversity. The small hills and undulating terrain in Northern and Eastern parts of the study area fall in the catchment of the Sukhna lake. Deforestation of these hills for urban expansion of Panchkula, Pinjore and Kalka has enhanced the sediment load of the lake.

The role of NGOs in restoring the city's ecological balance

In the absence of specific state attention to periurban expansion and related issues, there is understood to be a strong role of NGOs and CSOs in addressing periurban challenges and reversing the damage to periurban environments (Tacoli 2002; Dahiya 2003). Some NGOs have been playing an important role in reversing the ecological damage caused by the urbanization process; prominent among these is the ESI (Environment Society of India). For instance, it played an important role in getting the Sukhna Lake declared as a wetland in July 1987 by the Chandigarh Administration and its later notification as a National Wetland in 1988. It also suggested a process of aerial seeding to spread the cover of greenery in the foot-hills of Shivaliks, which was implemented by the Chandigarh Administration in August 1988. [3]

Debates on master plan and further expansion

At the time that field visits were conducted for this study, there was a Master Plan for Chandigarh (that includes the peripheral cities of Panchkula and Mohali) under review and debate. There has been a debate among planners and architects between strict adherence to the original plan on the one hand, and creative ways of solving the newer growth problems faced by the region on the other. At the moment, there are several points of debate, such as

1. Increasing density and maintaining open space
2. Allowing some parts of the city to grow while keeping others at capacity
3. Determining the best use of currently undeveloped land

[3] The ESI team led by SK Sharma – its founder member - joined the *shramdaan* (Voluntary labour) campaign for 75 days in 1988. The Chandigarh Administration was suggested to carry out soil conservation measures and that desilting be done as a one-time exercise. On account of the change in ecological conditions caused by urbanization, parakeet and weaver birds had shifted to other areas. Thousands of displaced birds were discovered in the mango grooves of sector 21-C in the city. The ESI proposed that this area be developed as a city sanctuary under the Wildlife Protection Act 1972. On 1st October 1978 the Chandigarh Administration declared this as a bird sanctuary.

Chennai

Chennai, a coastal city on the Bay of Bengal, is the administrative capital of the Southern Indian state of Tamil Nadu. Like Chandigarh, its growth has been led by an IT boom, with a strong role for migrants and with its location shaping the direction and nature of the periurbanization process.

Much of Chennai's recent urban expansion has been southwards. It is bound on the East by the Bay of Bengal, and Northwards, it touches the boundary of Andhra Pradesh. Thus, it is predominantly the South that has provided space for the city to grow. In this context, the Old Mahabalipuram Road (OMR) has been the seat of urban expansion, expanding the frontiers of the city towards the World Heritage site of Mahabalipuram. Parallel to this is the East-Coast Road that has also witnessed some development over recent years.

Periurban areas often bear the ecological foot-print of urban expansion (Narain and Nischal 2007; Janakarajan 2009; Prakash, Singh and Narain 2011). Chennai has traditionally been an agglomeration of fishing and agricultural villages. As South Chennai has grown as an IT corridor, the city has engulfed several such villages and hamlets. This has created several ecological and environmental challenges that the current governance and administrative machinery is unable to cope with. Many of these problems have resulted from the growth of the city beyond its carrying capacity[4] and the disconnect between urban and environmental planning.

Socio-economic drivers of periurbanization

Chennai is basically a migrant city and there has been a cross-flow of people "in" and "out'; the new migrants into Chennai chose to settle at the outskirts. What was once mainly a centre for tourism and primarily a tourist road (the OMR), was engulfed by the IT industry. The IT boom converted this road into an IT corridor; it is now called the IT expressway. Infrastructural and road development followed. Policies for Special Economic Zones created an environment for urban expansion. There was a rise in the price of land and a real estate boom ensued. For all these reasons, the epi-center of the city moved towards the South. The rural-urban divide thinned and 'periurban' became more prominent.

[4] Carrying capacity of a city refers to the level of resource consumption to sustain it (Rees, 1992). A conceptual lens of periurban reveals how the impact of this consumption is borne by the peripheral areas.

Land use change and competing pressures on natural resources

Periurban areas are characterised by a wide diversity of social and economic activities, a co-existence of rural and urban land uses and activities and growing contestation and competition for land use (Allen 2003; Simon 2008; Narain and Nischal 2007). There may exist wide differences in terms of amenities and infrastructure developed for the urban elite and that accessible to local populations, that suffer from what Kundu (2008) calls 'degraded peripheralization'.

A drive along the Old Mahabalipuram Road makes it glaringly obvious that this is a periurban interface that faces a multitude of challenges and competing uses for land and water.[5] With an increase in economic activity and population as described above, the area at the outskirts of the city became a hot spot for settlements and a hub for economic expansion. The periurban residents sold off their lands and there is now a stark presence of urban high rise buildings catering to the residential needs of the urban elite co-existing with village settlement areas. Along the OMR there are also prominent up market medical facilities that cater to the urban elite; also coming up are educational institutions that dot the periurban stretch between Chennai and Mahabalipuram (the new name for Mammallapuram).

The villages along this road follow a mix of different economic activities such as agriculture, livestock rearing, fishing and labor. There are competing interests for land use – and that for water as well - with the agriculturists growing paddy thrice a year in the midst of emerging urban uses. Tourism is another interest that competes for local resources. Mahabalipuram is a tourist destination and several shops and up-market resorts are located on the shoreline. [6]

Ecological Impacts of unplanned urbanization

In the wake of the urban expansion described above, several ecological impacts of urbanization are emerging mainly because of the failure to integrate urban with environmental planning, and because of the growth of the city in excess of the local carrying capacity. These include problems of solid waste management, urban flooding, groundwater depletion and salinity intrusion, sand mining and the encroachment of water bodies by real estate.

[5] The authors of this paper drove along the OMR for a direct exposure to the emerging periurban interface and interacted with the representatives of one of the villages.

[6] For studies of growing competition on water and rural-urban water transfers in Chennai, see also Janakarajan (2009) and Du Pont (2007).

Problems of solid waste and sewerage management

First, an important emerging issue is urban waste disposal along Chennai's 50 km long coast-line; solid waste management and disposal of sewerage are apparently the most important issues, as they came up several times in the course of our discussions and interviews in the city.

Periurban areas of the city are affected because of lack of proper urban solid waste management techniques. At the time of this research, there were two landfills in Chennai, one each for North and South Chennai. During transport a lot of the waste gets dumped along the periurban areas. There are also complaints among representatives of NGOs and civil society organizations that the use of landfills is not in tune with the current land use policy. The government still seeks sites for landfills. Upto a distance of 75 kms from the core of the city, however, there are no sites left for landfills. Further, there is reported to be a gross underestimation of solid wastes generated and no long-term plan to deal with this problem. Solutions sought for solid waste management are in general, not in line with land use planning.

With an IT corridor booming towards the South of Chennai, there is a major sewage problem brimming. Though several sewage treatment plants have been built, there is inadequate capacity to deal with sewage. Even in the westward periurban areas of Chennai, there is dumping of sludge from the new gated communities. New residential areas have come up with reverse osmosis plants but with no concrete plans to dispose off the sludge. This sludge eventually finds its way into the wetlands.

Further, most periurban areas are still connected only with open drains rather than with underground ones. The sewage system in Peri Urban areas is not well connected and there are open drains. This raises several environmental issues and is a cause for serious health concerns. Health problems like skin diseases and water borne diseases have become common in periurban areas of the city.

Groundwater depletion and sand mining: disregarding the local carrying capacity

The fall in water tables and salinity intrusion are other emerging issues. Due to ground water extraction along the coast, the sea water enters and mixes with the ground water, making it saline. Fresh water is thus lost and this process is irreversible. Problems are compounded by the disposal of waste along the city's 50 km long coast-line.

Further, the building of embankments and roads is often done without any regard to the hydrology of the areas. Groundwater development has taken place without regard to the

carrying capacity of the aquifers. Sand mining for urbanization was identified as another emerging issue.

Urban flooding

Another major new problem is urban flooding. These floods are human triggered and the flooding duration has increased. Much of Chennai was a flood plain and the wetlands have been reclaimed. With an increase in concrete structures, the recharge has reduced. This has led to an increase in urban flooding. Flooding is a periurban issue that is human triggered because wetlands are converted to concrete and also because of the fact that slum rehabilitation is shifted to the wetlands and thus the natural course of water is severely tampered with. Furthermore, river beds and lakes are converted into real estate plots in the periurban locations; flooding in these locations causes a lot of damage.

Encroachment of local water bodies

Another major issue is the encroachment of water bodies and lakes by real estate. Given Chennai's unique agro-ecological context and climate, these water bodies have an important role to play. Many of them have been abandoned as sources of irrigation. Once authorities see that these water bodies have fallen into disuse, this becomes a justification to fill them up and use for other purposes.

A study by an NGO called the Dhan Foundation indicated that 60 per cent of water bodies are encroached upon by real estate. Real estate agencies occupy the catchment area first and then the *ayacut* and then dump the solid and liquid waste.[7] In Vellacherry, as much as 50 per cent of the water bodies are encroached upon; there is no policy to demarcate them. Some temple tanks are however still left intact because of the religious sanctity attached to them.

Academic involvement and emerging areas of research

An important issue with regard to the study of periurban areas in Chennai is the increasing involvement of several academics, researchers and NGOs in the city. A number of academic and research institutes are involved in studying periurban issues. These include Anna University's Center for Water Resources, Madras School of Economics, Madras Institute for

[7] Water bodies with an *ayacut* (command area) of less than 40 hectares or 100 acres are maintained by the Panchayat while others are maintained by the PWD (Public Works Department).

Development Studies, the Dhan Foundation and the Geography Department of the University of Madras. [8] [9] [10]

Governance issues and new approaches being advocated

As in the case of Chandigarh, we notice a strong role of NGOs and Civil Society Organizations in filling the void left by the absence of sustained state engagement to address periurban issues.

Strong role of NGOs: advocating alternative approaches to urban planning

A number of NGOs have been widely active on this front, such as Care Earth, Sustain and Dhan Foundation. NGOs as Care Earth seek a long-term engagement and work towards adaptive management plans. They have helped set up an authority on wetlands management in PPP mode.

Some NGOs are advocating new solutions or alternatives to the problems of urbanization, stemming from new ways of conceptualizing periurban issues. Urban ecologists, for instance, talk about periurban issues using the conceptual lens of 'ecotones'; an ecotone is a term in urban ecology used to describe a space where different habitats are in transition. Landscape ecology views periurban areas as shifting mosaics that makes it very difficult to take a long term view. Since a periurban space is where rural, urban and agricultural eco-systems converge and are in transition, it is considered to be an ecotone. Ecotones are very vulnerable and fragile; NGOs in the city are advocating the concept of adaptive management for periurban areas.

[8] Anna University's Center for Water Resources got into periurban water issues as part of the SaciWATERs' Crossing-Boundaries project. There was a research component that required the group to study water issues at the basin level. Since periurban issues were gaining ground, they chose to study periurban water issues around Chennai. The main themes of periurban research at this Center are water pricing and markets, solid waste management and its dumping in periurban areas and its impact on groundwater, urban flooding, assessing the ecological status of periurban water bodies and lakes and assessing health issues in periurban locations. Research at Anna University has been carried out by students at the Masters and Doctoral level; there have been some foreign interns as well. The subjects around which the students of Anna University have carried out research are the encroachment of urban bodies, the results and impacts of poor ways of waste disposal, the consequences of the working of ineffective treatment plants and poor treatment of urban wastes, over pumping of groundwater and illegal settlements. The Institute of Ocean Management at Anna University is studying the impact of urbanization on Chennai's coastline.

[9] Work at the Madras institute of Development Studies has shown how the flows of water from rural to urban areas – some times over a distance of 150 kms -have affected the livelihoods of the periurban farmers, inducing migration to the city and further stressing the already stretched infrastructure. Thus, there is a vicious cycle around migration. Rural-urban water flows reduce the availability of water for agriculture, causing farmers to migrate to the city, and further stressing the already stretched infrastructure.

[10] The University of Madras' Department of Geography has a new project on Sustainable Cities.

Likewise, architects in the city have been advocating the notion of more public spaces and green spaces in the city. There are 40 lakes and 450 water bodies that they claim can be developed and linked as a city. NGOs like CityConnect have been active in providing basic amenities and facilities to the growing city.

There have also been some successful civil society initiatives. For instance, in Pamal, the community took the initiative and roped in government representatives as well and revived a defunct water body. There has been an active interest in the media in these issues with frequent articles and editorials on the nature of the planning process; these perhaps have some potential to help focus public attention on these issues.

New government initiatives and legislation

The government is now responding through some initiatives to revive water bodies in collaboration with NGOs. Some new legislation seeks to prevent further damage. Chennai now has a Water Bodies Protection and Eviction of Encroachment Act (2007) by virtue of which authority is vested with the Executive Engineer of the Water Resources Department and the Police Department. A citizen can now file a PIL (Public Interest Litigation) if there is encroachment of a tank or water body.

Governance issues of man-power and data needs

The challenges with regard to water management described above are further complicated because of several other governance issues such as those dealing with man-power and data. For instance, several agencies are involved in supplying water in the city such as the TNWSDB (Tamil Nadu Water Supply and Drainage Board) and the CMWSSB (Chennai Metropolitan Water Supply and Sewerage Board) and there is understood to be a lack of co-ordination among them. The TNWSDB caters to the periurban areas. Further, most observation wells are shallow while most of the groundwater is being tapped from much below this. This does not get reflected in these observation wells. There is thus felt a need to evolve more elaborate groundwater monitoring systems.

The problem is compounded by the fact that norms to assess/estimate ground water resources in Urban and Peri Urban areas are not in place. Thus one cannot gauge how much water is being consumed and how much is recharged into the soil. Without this system in place, it would be very challenging to deal with water issues in periurban contexts. There is a lack of proper mapping of aquifers and pumps are set up randomly where water is available. This can have

long term negative consequences especially in the periurban areas where there are competing interests and where the rural poor are at a disadvantage. There was an emphasis – in several of our interviews - on the fact that Chennai has complex hydro geological conditions and this has to be taken into account in planning for water resources. There is a felt need to evolve an assessment strategy for groundwater; a more detailed strategy is needed.

Protecting water bodies

There is considered to be an urgent need for delineating and demarcating and classifying lakes and water bodies to prevent their further encroachment. A strong need is felt to delineate water bodies as a basis for their protection.

Need for alternatives to supply augmentation

Despite massive investment, water supply is poor and supply augmentation has not had the intended effects. While the government has laid much stress on desalination plants, NGOs have been against them, alleging that they are too expensive. Some representatives from NGOs interviewed suggested the need for a dual water supply system; there can be two different types or classes of water; first, for drinking and cooking and the second for other purposes such as cleaning and washing. This is a model of water use that limits the total consumption of water to a minimum level and uses recycled or Class 2 water for other purposes. Certain other solutions have been suggested such as a greater thrust on Integrated Water Resource Management, developing a monitoring system for groundwater use, grey water reuse and recharge, investigations into sub-surface ecology and the need for roping in civic institutions. In particular, it is felt that much more needs to be done on rain-water harvesting and wastewater recycling. That urban expansion plans need to reflect local carrying capacity and hydro-geological conditions was echoed by many in our interviews.

Areas for further research

In the course of discussion with several stakeholders in the city, several areas for further research were identified. The first of these was eco restoration of urban areas. Within the city, there are several marshy areas and wetlands that are gradually being encroached upon by the city. This constitutes an area for further research, moreso on strategies for reviving them and protecting the livelihoods of those who depend on them. Another area for research is reviving the agricultural systems in the periurban areas around Chennai. The traditional way of growing paddy in the region is not lucrative any more; horticulture has also not been very lucrative

because of several factors such as lack of a marketing chain. So there is a need for research and extension on alternative livelihoods options. There is a need for establishing norms for groundwater use. There is also a data need in terms of assessing how much is contributed in volumetric or econometric terms through recharge. Finally, rigorous studies are needed on resources and carrying capacity of aquifers and rain-water recharge.

Patna

Peri-urbanization in Patna is the result of a process of growth and reorganization of internal space, significantly affected by a host of political, cultural and socio-economic factors. The regional demands for the use and extraction of resources and aspirations for a better quality of life have made the city increasingly expand its economic base to its peri-urban fringes. The topography of the city is saucer shaped with three major river systems. River Ganga and Son mark its northern and western boundary, while river Punpun marks the south east.

Historically, old Patna has remained one of the significant port cities of the east and its growth was primarily along the major river banks. The period after 2006 brought structural changes in the urban sector, causing rapid extension of the urban agglomeration engulfing into the rural hinterland from all directions. During the first phase of its spreading out, the direction of growth was more towards east and south-east along the Patna Gaya express highway. The vast stretch of rural areas in the adjoining blocks of Patna city namely Sampak Chawak, Phulwari, Punpun, Dhanarua were brought into the fold of greater Patna Urban Development Authority. In the east, Patna Metropolitan Area started sprawling in a few pockets of Fatwa and Daniawan.

The long stretch of low and marshy land has been a natural barrier between Patna Urban Area and Fatwah restricting its growth further eastwards. Presently, Patna Urban Agglomeration is moving towards north, northwest and south wards with fast up market commercial and residential buildings, institutions and airport along the sides of Bhita, Naubatpur , Manher and Danapur. The Greater Patna Urban area comprises the Patna Municipal Corporation (PMC) and outgrowths of PMC namely Pataliputra Housing Colony, Digha – Mainpura, Sabazpura, Khalilpura, Badalpura, Phulwarisharif (Notified Area), Danapur Nizamut (Municipality), Danapur Cantt., Khagaul (Municipality), Saidpura (Out Growth of Khagaul). Patna, like many other 35 million plus cities in India, is undergoing dramatic changes in physical, social and

cultural spaces. In the absence of any revised master plan[11] the city started showing the signs of decay both within and along its fringes.

Understanding the Drivers of Growth

Patna is undergoing rapid urbanization process with fast changing land use and land cover in its suburbs. Largely, migration from the hinterland as well as the internal growth of population has contributed to this phenomenon. Interestingly, there are three critical factors responsible for the peri urbanization process in Patna. These are an improvement in the law and order situation, connectivity through high level transit corridors and promotion of primary and secondary level education especially for girls.

The period after 2005 marked a change in the political regime of Bihar which had its greatest implications on the law and order situation of the state. Primarily, law and order stability provided a psychological boost to the people to invest more in real estate. This sky rocketed the land prices of the city's core area eventually pushing the middle and lower middle class to the fringes. Law and order stability further stimulated the rich landowning community of Bihar (locally known as Bhumihars) to sell off their rich agricultural lands situated in the rural fringes for commercial use, further accelerating the peri urbanization process. People are now in a position to invest as the fear of ransom has reduced.

An Improved road network is another crucial driver of the peri-urbanization process. Regional road connectors pass through all the blocks within Patna Urban Agglomeration (PUA) resulting in increased road accessibility of the Blocks to the city core. PUA is directly connected to the hinterland by National Highways NH-30, NH-31, NH-83 and NH-98. PUA is connected to NH-2, which is a part of the Golden quadrilateral, by NH-83. Such improved road networking particularly under the patronage of the present Government has resulted in heavy flow of traffic from the urban fringe. The rural landscape has thus got dotted with commercial and residential buildings. Several up-market educational and research institutes have come up in the southern and south western part of the city.

Improved road connectivity coupled with pro poor educational policy of the present Government, emphasizing, for instance, increase in the number of government schools and the supply of free bi-cycles to girls has improved the attendance ratio in schools. This in turn has

[11] The Last Master Plan for Patna was done in 1990-91.

increased daily commuting from the surrounding fringe areas to the city, thus expanding the city's zone of rural-urban links and movement.

Implications of fast changing landscape in Peri-Urban Patna

As noted above, Patna has undergone multiple transformations—physical, morphological, socio-demographic, cultural, economic and functional - in its peri urban interface. It became a space constituting underprivileged settlers (brought in by migration to the city by the rural poor and the resettlement of slum dwellers from the city after the demolition of their homes) coexisting with the urban affluent. This has resulted in diverse and conflicting stakes, culminating in several environmental and socio economic hazards. Wetlands encroached by buildings, random dumping of solid waste, the illegal coming up of industries and degraded environment are a common scene all along National Highway 30 (NH-30) that connects the region of the PUA to its hinterland.

Solid waste management: The Most pressing Problem

Much like Chennai, Patna city is struggling with managing its solid waste. Talking with both academicians and civil society organizations revealed that solid waste management is among the most poorly rendered services here – the systems applied are unscientific, out dated and inefficient; and population coverage is extremely low. There is no specified landfill site and the wastes are dumped in the low-lying areas along the periphery. The situation is all the more worse in the fringe areas coming outside the ambit of the Patna Municipal Corporation. Heaps of untreated wastes all along the bypass have become the root cause for several physical and health hazards. The problem not only lies in dumping the waste, but also the mode of transport used and the time of dumping.

Mostly uncovered vehicles are used to transport the waste, resulting in frequent droppings. Besides, there is no fixed time for dumping. During the rainy season, such heaps of environmentally hazardous waste become a cause of critical water borne diseases. There is no practice of storing the waste at source in a scientifically segregated way. The problem of solid waste management is crucial for Patna; yet very few NGOs are reported to be working towards this. Officials from Patna Urban Development Authority however, reported some efforts undertaken in systematic management of the wastes. In the year when this research was carried out, under the UIG (Urban Infrastructure and Governance) Scheme Ramky Environ Engg Ltd and A to Z had been entrusted with the task of executing Municipal Solid Waste Management

for Patna and Integrated SWM in the Patna Urban Agglomeration. As a part of these schemes a landfill site has been identified in the outskirts of the city in Khagol.

Sewerage and Drainage system

Patna has an open drainage system, with only 10 per cent of it being closed in select pockets. The peri urban areas of the city are completely neglected in terms of sewerage treatment. In most cases there are no drainage lines and all the untreated domestic and industrial waste gets dumped in the open ground or in the nearby river. While going along the NH 30 cutting across Sampat Chawak, Punpun and Dharwa, some untreated waste water irrigation can be seen. The farmers interviewed reported that they are forced to use the toxic water as they don't have a treatment mechanism at their disposal. Dumping of untreated wastes and open drainage has resulted in a preponderance of water borne diseases.

Water Supply and sanitation

Water supply in peri urban Patna is entirely groundwater based. Use of shallow tube wells and bore wells is rampant, both in the city and its outskirts. The average depth of the water table is 200ft- 250 ft. Since Patna has a rich groundwater resource, extraction of the same has increased over the years. This is more so in the peri urban areas catering to the high demand of newly established commercial, residential colonies and institutions. Discussion with government officials and civil society representatives pointed out that Patna is still not facing shortage in the supply of water per se. However, researchers and academicians working intensively in the groundwater sector gave a slightly different picture. Groundwater usage is increasing in the city; very soon the whole of Patna will be transformed from a water rich to a water scarce city. An important immediate problem associated with groundwater is of arsenic; most of the shallow aquifers of the Peri Urban Areas of Danapur and Maner are heavily polluted by arsenic. There is a lack of efforts both from Government and NGOs in addressing this issue effectively.

Like poor drainage condition, access to sanitation in terms of the construction of toilets and improved hygiene practices is extremely poor in peri urban Patna. Initiatives undertaken under the Total Sanitation Campaign have failed to generate desired results. Civil society activists complained that the corruption and nexus among Government and service providers is primarily responsible for such poor coverage.

Governance Issues

Urban reforms in Bihar started in 2005, under which the town administration got extended to the rural hinterland. Thus, after 2006 many of the village panchayats in the fringe areas got converted into municipalities. Their structure got transformed without adequate training and capacity building. This eventually resulted in an unorganized governance structure in the peri urban areas.

Emerging issues of concern and the initiatives undertaken by different stakeholders

The urbanization process of Patna is fairly new compared to many other million plus cities in India. Patna, which was for long neglected by planners and policy makers, is now getting its due importance. The Patna Urban development Board is coming up with a new Master Plan. Although there is a long way to go, the city has definitely been able to tackle some of its fundamental law and order problems. Among several emerging issues associated with peri urbanization process of Patna, managing solid waste is most crucial. A local NGO, B-TAST with the support of the DFID and the government of Bihar is undertaking a project on sector wise approach to strengthening Health in Bihar. Second, research with regard to arsenic pollution has been largely restricted at an institutional level. A mass awareness programme is required to sensitize the issue. Third, Patna falls under the seismic zone 5 and is highly sensitive to earthquakes and flooding. No systematic study has been undertaken to assess the nature and extent of natural hazard zones in Patna. Such studies would be urgently needed.

Guwahati

Historically, Guwahati has been a port city, where its built-up area was confined around two major river ports of Brahmaputra, namely, Sukleswar and Kachari Ghat. The city experienced piecemeal growth since the 1970s with the shifting of Assam's capital from Shillong to Dishpur (Guwahati). During the initial period of its expansion the pattern of the growth was linear along the roads in the periphery.

Over the period 1990-2000 the city started growing in all directions more pronounced on the southern side to the Dispur-Basistha plain across the narrow corridor between Japorigog and Fatasil hills. The growth was also seen along the National Highway 37 from Basistha to Tetelia. After 2000, the direction of growth changed; physically constrained

by the presence of Meghalaya plateau, the presence of large wetlands restricted the city's growth further south (CEPT 2011).

The city was founded by Narakasur in 1910-11 and the built - up area was confined to 7 sq km of the city core. The area increased to 83.80 sq km in 1970s and the growth was primarily linear in nature along the road network. During 1990s the total built- up area was 132.19 sq km and the growth of the city was along the corridors. Presently, Guwahati Metropolitan Area (GMA) covers Guwahati Municipal Corporation, North Guwahati Town Committee, Amingaon Census Town and 21 revenue villages .The total area covered under GMA has increased from 262sq km to about 315.72 sq.km within two years (i.e 2010-12). The total population of greater Guwahati is about 1,244,713; in addition, daily commuters and floating population, comprising, for instance, tourists, is estimated to be a few lakhs. Today, fringe areas of the city are in speedy transition from rural to a peri urban landscape. Inclusion of 5 more municipal wards and satellite townships west and north of Guwahati testifies to such fast sprouting peri urban corridors (Master Plan 2011, CEPT 2011).

Land use change and competing pressures on natural resources

Guwahati has always had a rich natural resource base of forests, hills and natural wetlands. Interestingly, for the past 10 years, the city has experienced deranged growth leading to drastic change in its land use and land cover. In a span of two years (2010-2012) the metropolitan area of the city expanded from 262sq km to about 318.72 sq km engulfing a vast stretch of rural hinterland. Travelling in the outskirts along transit corridors of NH31 and 37 clearly shows fast developing peri urban landscapes consisting of an intense mixture of agriculture, industry, commercial and residential use. Much agricultural land and several water bodies have been filled up to give place to high rise apartments. Disappearing wetlands, decreasing forest cover and declining cultivable area have not only disrupted the natural ecosystem but also displaced many of the aboriginal tribes like Kargies, Boros, and Garos, who occupy these fringe areas. Peri urbanization has also affected the agricultural practices in these fringe villages. Traditional paddy variety got replaced by a hybrid one; ground water irrigation became rampant and the cropping pattern shifted from food to cash crops.

Ecological Impacts of peri urbanization

Discussions with policy makers, researchers, academicians and civil society organizations time and again brought to the fore the issue of ecosystem disruption due to unplanned city growth. The interviewees all agreed to the fact that peri urbanization has caused the city to lose a considerable amount of its land of high ecological value. Invasion of city's space into the rural hinterland has disrupted the micro ecosystem of forest, wetlands and hilly landscape. Encroachment into the forest area for either residential or commercial purposes has increased soil erosion. There are important emerging problems of hill cutting, soil erosion, siltation and associated urban flooding. Siltation of the open drains mostly due to flash floods from the surrounding hills has increased the frequency and duration of urban flooding over the years. Besides, the thinning down of forest cover has promoted illegal poaching and selling of woods to the Meghalaya border. Hill cutting for construction of hotels or institutes has forced the animals to intrude into the human habitation. In fact, frequent attacks by elephants and panthers have been reported over recent years.

Peri urbanization process and its impact on natural wetland

Guwahati's natural terrain consists of a bowl shaped valley interspersed with numerous water bodies. For centuries, these wetlands, locally known as 'beels', have helped in natural recharge of the ground water aquifer. Besides, they have formed the livelihood base of small and marginal farmers of the fringe villages. Over the last couple of years, with the rapidly expanding city's built-up area, these wetlands are getting filled up. A number of such water bodies suffer from environmental degradation due to rapid urbanization. The coming up of several institutions, apartments and industries over these wetlands has not only jeopardized the micro ecosystems of these water bodies but also snatched the livelihood source of the marginalized village communities. Villagers are often lured by unscrupulous middle men to sell off their land.

Deepar beel, which is one of the protected sites under the Ramsar Convention on Wetlands, 1971, is an important case in point. A majority of the biological wealth of the beel is in a state of gradual depletion due to the increased impact of human interference. The area in and around the beel has been heavily encroached upon for the last couple of years. The beel is suffering from environmental degradation mainly because of encroachment and waste dumping. One of the dumping sites of the Guwahati Municipal

Corporation (GMC) is Paschim Boragaon Garchuk, which is closer to the beel. The site now faces various natural and anthropogenic threats, primarily from the development of the road network, industries within the periphery of the site, illegal hunting of wild animals and deforestation.

Urban Flooding

Urban flooding is a not a new phenomenon for Guwahati as the city is bowl shaped, and 40 per cent of its area is susceptible to flooding. For the last couple of years the incidence and duration of floods has increased noticeably. Civil society representatives have pointed out that disappearing wetlands, rock cutting and siltation of the open drainage system are the factors responsible for this situation. Furthermore, river beds and wetlands are converted into real estate plots causing reduction in the recharge and consequent incidence of urban flooding.

Today Guwahati faces a unique phenomenon, named plinth height dilemma. Every year the road levels are raised to avoid getting flooded during monsoons. Over a period of time, this has further deteriorated the water logging in adjoining areas as the plinth level of existing buildings has gone below the road level. This is an outcome of an inadequate storm water drainage system.

Situation of water supply

The city of Guwahati is presently served by piped water supply in limited quantity (only 30 per cent) and in specific areas. These facilities neither cover the entire Greater Guwahati Metropolitan Area marked by Town & Country Planning Department nor fulfil the standard of per capita demand within and outside the Municipal boundaries. Most of the existing schemes are running with very low capacity utilization.

Peri- urban Guwahati is entirely ground water dependent. In fact, though some pockets of the outskirts are served by piped water, the source always remains the groundwater aquifers. According to the Central Groundwater Board, the city falls under 'safe' category, and sufficient resources are still available for future development. However, researchers and civil society representatives complained about the fast growing groundwater extraction leading to groundwater depletion in parts of Guwahati and the problem becomes more severe in winters. It is important that groundwater extraction is not allowed indiscriminately as possibilities of extracting are remote in the hard rock areas. Of

late, the presence of excessive fluoride and arsenic has also been detected in underground water in certain pockets of peri urban Guwahati. Such arsenic pollution is essentially man made; a result of mixing of sewage and storm water.

Problems of solid waste and sewerage management

Guwahati does not have any integrated sewerage system operational till now except for certain pockets in the railway colony and in the IOC Refinery establishments. Most of the residential colonies in the suburbs have septic tanks without any provision for collective disposal of effluents. Moreover, there is no provision for the treatment of sewage, because of which untreated sewage is released into the nearby drains and low-lying areas. Not only the domestic sewage but the industrial wastes also are disposed off similarly. This results in environmental and aesthetic degradation of the city area. There are soak pits connected to individual septic tanks, which do not function well due to high sub-soil water.

The problem of dumping of non bio degradable wastes in the water bodies and drainage channels in the peri urban areas has taken a serious toll in recent years. A Rs. 102.16-crore ambitious integrated solid waste management project for Guwahati, launched by Gauwahati Municipal Corporation in 2008, has been grossly unsuccessful in mitigating the growing issue of waste management for the city and its periphery. Although some sporadic efforts of Civil society representatives have been seen in collection, transportation and disposal of the bio and non- bio degradable wastes, it is still not sufficient with the galloping peri urbanization that the city is currently going through. Further, most peri urban areas are still connected only with open drains rather than with underground ones. The sewage system in Peri Urban areas is not well connected and there are open drains. This raises several environmental issues and is a cause for serious health concerns. Health problems like skin diseases and water borne diseases have become common in peri urban areas of the city.

Governance issues involved with the Peri urbanization process of Guwahati

The city is expanding fast as seen from the inclusion of 5 municipal wards, which otherwise were under gram panchayats, into the greater Guwahati Muncipal Area. Such notification came suddenly leaving the local governance functionaries no space to develop their capacities. Civil society organizations often complained about the loss of the work due to such transformation in the governance. Like any other million plus city peri urbanization process is very much apparent in Guwahati. Although crucial, very little

effort has been made so far to understand these issues exclusively. Discussion with the Government officials from the Guwahati Metropolitan Development Authority and Guwahati Municipal Corporation revealed that the zoning of the city is very important and needs immediate attention. It is reported that the department will be undertaking a study on peri urban mapping to see the maximum zone of influence of the city to its fringes. Understanding and mapping the peri urban areas with a view to understanding the carrying capacity of the city is another area being explored.

The GMDA is coming up with huge 24*7 water supply project for the city and part of its periphery. People are very hopeful about this initiative as it promises to supply surface water from Brahmaputra to the city and its fringes.

As noted above, solid waste management is one of the areas which were highlighted by the civil society organizations. To them successful solid waste management needs a decentralized approach, where door to door collection and separation of waste at the source is advocated. In this regard a local NGO called Environ has come up with an innovative approach of creating entrepreneurships from solid waste collection.

Ahmedabad

Ahmedabad is one of the fast expanding cities in India. Located on the banks of the river Sabarmati, it is very close to Gandhinagar (about 30kms) which is the capital of the western state of Gujarat. The major features characterizing Gujarat's economy are high levels of industrialization, faster urban growth, commercialized but unstable agriculture, moderate availability of physical as well as social infrastructure and dwindling natural resources.

Until the second half of the 19th century, Ahmedabad grew on the river's eastern banks, after which it emerged as India's leading textile manufacturing centre, attracting labor from different parts of the south Asian subcontinent. The working class colonies expanded the city's limits towards the north and the south, but remained confined to the eastern banks, close to the industrial estates. The decline in their pre-eminence and the consequent closure of mills has led to the relocation of the services sector and casual labor to suburbs that emerged on the river's western banks, and to transitional areas- the peripheries – on the east and west of the city (Roy, 2006).

There is a new industrialization in the city driven by the automotive industry along the peri urban road leading towards Sanand. This is one of the stretches in the outskirts of the city that exhibits urban and rural characteristics defining it as a peri urban area. Because of the Tata Motors set up that was established recently, this place is now an auto hub. Today there are other major automobile manufacturers in this area and also several service stations.

A multitude of factories can be seen in Sanand – the biggest and perhaps the most prominent being the Tata Motors. They have a service centre and an industrial production unit of the Tata Nano. This plant is a township in itself and a 3 to 4 km long line of Nanos are seen lined up in this plant. Given its huge size, the plant requires its employees to commute by bus within the campus. Several other industries – chemicals, concrete, cement, and flour are present along this peri urban stretch. A couple of years ago, the industrialization in this area was textile led. In fact it was called the 'Manchester of the East' but the current scenario is that it is pharmaceutical- chemical based products that are leading to the current process of industrialization.

Industrial Expansion along peri urban Ahmedabad – Threat to Environment

Right next to the industries along the peri urban stretch towards Sanand, agriculture is carried out. The local people allege that there are several problems that arise due to these heavy industries being located here. The most prominent one being pollution: Severe air and ground water pollution occurs due to these industries. This could have severe consequences in terms of health due to inhalation of polluted air and drinking of polluted water. Further, agricultural crops are adversely affected due to the high levels of carbon emission.

Another problem is that of competition for water resources. With heavy industries and gated communities making a claim for huge amounts of water, it poses a problem for agricultural needs. At present this is not a grave situation but if this competition continues then the situation could deteriorate.

The changing face of peri urban Ahmedabad

Apart from heavy industrialization that characterizes parts of peri urban Ahmedabad, there are several residential complexes coming up here. Farm houses, golf clubs and other such luxury housing complexes are part of this stretch as this is conveniently outside the main city

yet not too far to commute. There are other competing interests on the land like the establishment of elite schools like Ekalavya and Shanti that have mushroomed along this road. Business schools and other educational institutions that cater to the upmarket elites also dot this stretch. All this changes the very face of peri urban Ahmedabad.

Agriculture is no longer a main occupation. Villagers have turned to a plethora of construction sites to work as laborers. Four fundamental reasons are responsible for agriculture no longer being the main economic activity in this region. The reasons include the declining profitability of agriculture in the peri urban areas, the demonstration effect of the urban lifestyle and aspirations towards an urban way of life, the speculation push from the real estate and finally the need for access to urban amenities. People want to move to urban centres even if they have less income as they have urban facilities like uninterrupted power supply, hospitals and schools.

Rural – Urban Linkage: Transport

The development in the peri urban areas of Ahmedabad is closely linked to transport routes. The city is growing radially. It is encompassed by the Sardar Patel Outer Ring Road and the areas where the ring road converges with the National highways are being developed more rapidly than the others. This is suggested to be because constructing urban infrastructure along such a route is very lucrative for real estate developers.

Thus the idea is that growth and development are not uniform in all peri urban areas of Ahmedabad though the city is expanding radially. Rural distress, development and connectivity to the city are inter linked and connectivity to the city is considered one of the most important reasons for development in the peri urban areas. The transport for the peri urban poor is mainly through shared autos and other private and semi private motor vehicles that serve as important linkages between peri urban Ahmedabad and the main city.

The Riverfront Development Project and Slum Rehabilitation

One cannot talk about Ahmedabad and peri urban areas of Ahmedabad without mentioning the Riverfront Development project in which many families have been evacuated from the riverside to temporary residential sites in the peri urban areas. The Sabarmati Riverfront

Development Project is an initiative of the Ahmedabad Muncipal Corporation to develop the Sabarmati Riverfront.

Close to 2000 families have been moved as part of the Riverfront Development Project temporarily to wasteland areas outside the city, near Ganeshnagar, Pirana. The argument is that this slum rehabilitation, even if temporary, can have dire consequences as the area (Pirana) is a major dumping site for waste. There could be several consequences in terms of health. Further, the idea is that these people who were in a regular urban residential area, albeit in slums, when moved to an area near industries or waste dump yards with no or poor public transport, face a host of problems including denial of access to basic amenities and conveniences that were available to them in the city. While the distance of relocation may not be much on the map, but on ground such relocations were suggested to be very difficult for those being relocated. [12]

On the other hand, is an opposite view taken by others who opine that this move of providing housing for the slum dwellers is in fact a welcome one. Instead of living in slums, they are given pucca (concrete) houses which increases their asset value and which would be lucrative for them.

This has been an ongoing debate. While several agencies are working in parallel for this cause, the slum dwellers are not being asked directly about whether the peri urban housing is in fact convenient for them. Another view in this regard is that the economic strata that one belongs to decides how one is dealt with; in other words, the politics of urbanization plays a role in shaping its equity and justice implications. A further detailed exposition of this issue is provided by Mathur (2012).

[12] They were given 10ft x15ft houses that are not enough for a 5 – 7 family house hold and have minimum access to toilets and have no provision for drinking water. They have bore wells that function for 1 hour, twice a day. This is the water provision for the many families relocated to the urban fringes. Apart from water insecurity, there is also the issue of pollution and contamination of water due to the fact that these sites are located close to industries or dump yards.

Infringement of Citizenship Rights

Periurban areas can face unique governance challenges, arising from the transition in their jurisdictional status between rural and urban governance authorities; this may have implications for the infringement of human rights.

Indrajit Roy (2006) brings to light the appalling conditions in Juhapura (south western periphery of Ahmedabad) vis-à-vis human development and that proactive intervention by the state government was anticipated. Increasingly, this role is being executed by the Ahmedabad Urban Development Authority (AUDA), a parastatal initially constituted by Gujarat's state government for land acquisition and town planning, throughout Ahmedabad's suburbs. The agency's Draft Developmental Plan 2011 describes its principal functions as "preparing growth plans for expanding urban areas, preparing draft schemes for urban development and implementing the finalised plans, regulating growth so as to keep it in accordance with the plans and developing infrastructure such as roads, drainage and water supply" [AUDA 2001: 1]. AUDA has no tax-based income, and is dependent on state government grants and donor support for its activities.

However, the contention is that AUDA often steps beyond its jurisdiction. Roy elaborates that its Draft Development Plan frankly states that "despite the fact that AUDA's operational sphere is primarily limited to creating planned infrastructure in an urban agglomeration, people expect it to fulfil all municipal functions" [AUDA 2001: 18]. Ahmedabad's western peripheries have been singled out for AUDA's "developmental" interventions. In fact, informed opinion indicates that AUDA will de facto replace elected village and town councils as the body responsible for managing resources available for development. Such interventions have caused confusion among local communities vis-à-vis AUDA's role (Roy 2006).

Referring to this it was thus suggested by one of the key informants interviewed that even in terms of citizenship there is a problem that is being faced. Peri urban Ahmedabad falls under the AUDA (Ahmedabad Urban Development Authority); it is no longer under the jurisdiction of the panchayat (village Council). Where they are still under the panchayat, the AUDA still has more say in the District Collector's office. Therefore these areas are not yet urban wards but they are urbanizing in the sense that AUDA is planning and acquiring land but they are in limbo as they don't have representation; this is seen by many as an assault on their citizenship rights.

Conclusion

This paper has described the process of periurban expansion of five Indian cities. While they differ in terms of the major drivers of urbanization, they face similar environmental, social and ecological challenges. The periurban is therefore best seen here as an ecological and social space that bears the residue of urban expansion; it is the receptacle of urban waste as well of evicts from the mainstream.

Contemporary processes of urbanization aggravate a rural and urban dichotomy. A conceptual lens of periurban instead serves to place these processes much better in their larger political context, characterized by unequal power relations between the urban and the rural. This paper thus emphasizes the value of 'periurban' as a conceptual entry point to study the biases and politics of urban expansion and planning. Modern urban planning assumes the needs of modern cities and those who live there to be more important than those of the periphery. As noted by Shatkin (2007), the literature on urban planning has failed to consider the significance of politics and power relations, assuming instead that all actors have equal amounts of power at their disposal. City planners end up catering to the interests of those who are politically powerful (Roy 2004). Periurban studies can serve to challenge this rural-urban dichotomy and question the implicit biases in contemporary urban expansion.

References

Allen, A. 2003. 'Environmental planning and management of the periurban interface', *Environment & Urbanization*, 15(1): 135-147.

Bowyer- Bower, Tanya A.S. 2006. 'The inevitable Illusiveness of 'sustainability' in the periurban interface: the case of Harare', in D.McGregor, D.Simon and D.Thompson, (eds) *The periurban interface: approaches to sustainable natural and human resource use,* pp.151-164. USA: Earthscan VA.

Dahiya, B. 2003. Hard struggle and soft gains: environmental management, civil society and governance in Pammal, South India. *Environment and Urbanization*, 15(1): 91-100.

Du Pont, J. 2007. Conflicting stakes and governance in the peripheries of large Indian metropolises – an introduction, *Cities,* 24 (2): 89-147.

Iaquinta, D.L. and A.W. Drescher. 2000. *Defining periurban: understanding rural-urban linkages and their connection to institutional contexts*. Paper presented at the Tenth World Congress of the International Rural Sociology Association, Rio de Janeiro, August1, 2000.

Janakarajan, S. 2009. 'Urbanization and periurbanization: aggressive competition and unresolved conflicts - the case of Chennai city in India', *South Asian Water Studies*, 1 (1): 51-76.

Kundu, A. 2008. 'Socio-economic segmentation, inequality in micro environment and process of degraded peripheralization in New Delhi', in A.L. Singh & S. Fazl (eds.) *Urban Environmental Management,* pp. 45-75. Delhi: B.R. Publishing Corporation.

Lerner, A. M., & H. Eakin. 2011. 'An obsolete dichotomy? Rethinking the rural-urban interface in terms of food security and production in the global south', *The Geographical Journal* , 177 (4): 311-320.

Mathur, N. 2012. 'On the Sabarmati Riverfront. Urban Planning as Totalitarian. Governance in Ahmedabad', *Economic and Political Weekly*, Vol. XLVII Nos. 47 and 48.

Narain, V. and S. Nischal. 2007. 'The periurban interface in Shahpur Khurd and Karnera, India', *Environment and Urbanization* 19 (1): 261-273.

Narain, V. 2009 a. 'Growing city, shrinking hinterland: Land Acquisition, transition and conflict in periruban Gurgaon, India,' *Environment and Urbanization*, 27 (2), 501-512.

Narain, V. 2009b. 'Gone land, gone water: crossing fluid boundaries in peri-urban Gurgaon and Faridabad, India', *South Asian Water Studies,* 1(2): 143-158.

Shindhe, K.C. 2006. 'The National Highway bypass around Hubli-Dharwad and its impact on peri-urban livelihoods', in D.McGregor, D. Simon and D. Thompson, eds. *The periurban interface: approaches to sustainable natural and human resource use,* pp. 181-195. USA: Earthscan VA.

Simon, D. 2008. 'Urban-Environments: Issues on the Peri-Urban Fringe', *Annual Review of Environment and Resources,* Vol. 33., pp.167-185.

Tacoli, C 2002. '*Changing rural-urban interactions in sub-Saharan Africa and their impact on livelihoods: a summary*.' Working Paper 7. London: International Institute for Environment and Development. 40 pp

Tacoli, C. 2003. 'The links between urban and rural development', *Environment and Urbanization,* 15 (1), 3-12.

Roy, D. 2004. From home to Estate, Seminar, 533: 68-75.

Prakash, A., Singh, S and Narain, V. 2011. Changing waterscapes in the periphery: understanding periurban water security in urbanizing India. India Infrastructure Report. New Delhi: Ocford University Press.

Rees, W.E. 1992. Ecological foot-prints and appropriated carrying capacity: what urban economics leaves out. Environment and Urbanization, 4(2): 121-130.

Shatkin, G. 2007. Global cities of the South: emerging perspectives in growth and inequality. Cities. 24(1): 1-15.

Acknowledgment

This research was carried out as part of a project titled Rural to urban transitions and the periurban interface: identifying, mapping and understanding periurban areas in India and Pakistan. The project is led by the East – West Center, USA and executed in collaboration with SaciWATERs, South Asian Consortium for Inter-Disciplinary Water Resources Studies, Hyderabad, India and SDPI, Sustainable Development Policy Institute, Islamabad, Pakistan. The project is supported by U S Department of State (Grant No. SPK33011GR063).

Thanks are expressed to U S Department of State for financial support provided. We thank Sumeet Saksena for support and guidance at various stages of the research and Anjal Prakash and SaciWATERs for organizational support provided. Finally, we thank the many representatives of government, NGOs, researchers and periurban communities who gave us their time and support in the conduct of the study.