Sectoral Study; 2009

Saving a Dying Lake : The Case of Ramgarh Tal in Gorakhpur, Uttar Pradesh

Gorakhpur Environmental Action Group

Supported by :

ISET Institute for Social and Environmental Transition

The Rockefeller Foundation

DRAFT NOT TO BE QUOTED

Saving a Dying Lake: The Case of Ramgarh Tal in Gorakhpur, Uttar Pradesh

Abstract

India signed the Ramsar Convention on Wetlands on 1st February, 1982. There are 25 sites in the country, deemed of international importance, with a surface area of 677131 hectares, which come under the ambit of the convention. However, thousands of wetlands in the country, of various shapes, sizes and structures, that are crucially important for local eco-systems and communities, stand threatened. Based on a case study of the freshwater Ramgarh Lake of Gorakhpur town, Uttar Pradesh, this paper argues that protecting the wetlands actively, in keeping with the 'wise use' concept of the Ramsar Convention enables building up the climate change resilience of the nearby habitats. The paper examines how growing human pressures on the wetlands, including on the Ramgarh lake, caused by urban expansion and the unplanned growth of Gorakhpur, led to the degradation of the water bodies. However, the Ramgarh lake continues to be of utmost importance to Gorakhpur town. The lake and other water bodies, many of which are dead now, played a vital role in the traditional drainage system of the city. It supported the livelihoods of many fishing communities who not only cultivated fish but also grew paddy on its banks. These livelihoods are endangered. But even today, the Ramgarh lake plays an important role in the sewage disposal as untreated domestic wastes are discharged into it and solid wastes are dumped on its banks. The paper argues that to enhance Gorakhpur resilience to climate change impacts, the lake has to be protected and rejuvenated through measures that include proper treatment of effluents (sewage) and solid waste management. The lake plays an important role in the city's ecology too. Finally, the paper shows how the first steps towards the systemic transformation that is necessary to building up this resilience have been taken due to the efforts of an NGO. In many ways, this can potentially become the model for other similar projects in the country and set an example of earning green house gas credits under the clean development mechanism.

Introduction

"Wetlands provide food, store carbon, regulate the water flows, store energy, and are crucial for biodiversity. Their benefits to people are essential for the future security of humankind. Conservation and the wise and use of wetlands are vital for people, especially the poor. Human well-being depends on many benefits provided to people by ecosystems, some of which come from healthy wetlands. Policymaking, planning, decision-making and management action by a wide range of sectors, at all levels from international to local, can benefit from the global consensus input that the Ramsar Convention provides. This includes the identification of the relevance of wetlands, the importance of their conservation and wise use, and ensuring security of the benefits that wetlands provide in terms of water, carbon storage, food, energy, biodiversity and livelihoods. It also includes technical know-how, guidance, models and support networks to help in putting this knowledge to practical use." Preamble to the Changwon Declaration.[1]

India signed the Ramsar Convention on Wetlands on 1st February, 1982. There are 25 such sites in the country, deemed of international importance, with a surface area of 677131 hectares are covered by the Convention.[2] However, thousands of other water bodies, of vital importance to the local ecosystems and the lives of the people dependent on them are gradually deteriorating, primarily due to changing human usage patterns. This has grave consequences for the environment and the human populations dependent on such eco-systems. Further, many of these wetlands traditionally played a vital role in the drainage systems of the human habitats, especially urban ones that developed near them. Conserving the wetlands and reviving them can be of vital importance to enhancing the climate change resilience[3] of the human habitats surrounding them.

As such, globally freshwater habitats house 126,000 species or 7 percent of the estimated 1.8 million described species. This includes a quarter of the 60,000 vertebrates (Balian *et al* 2008, McNeely and Mainka, 2009: 153). Economically, the value of goods and services provided by the world's wetlands is estimated to be US$70 billion annually (Schuyt and Brander, 2004).

Biodiversity and human well-being are both affected by changes to freshwater. On an average freshwater species populations were reduced by half between 1970 and 2005, a sharper decline

---

[1] The Changwon Declaration is a statement and call to action from the 10th meeting of the Conference of Contracting Parties to the Ramsar Convention on Wetlands, held in Changwon, Republic of Korea, from 28 October to 4 November 2008 cf. http://www.ramsar.org/cda/ramsar/display/main/main.jsp?zn=ramsar&cp=1-31-434^19388_4000_0__
(Accessed on 28/1/10).

[2] Cf : http://www.ramsar.org/cda/ramsar/display/main/main.jsp?zn=ramsar&cp=1^16561_4000_0__
(Accessed on 28/1/10).

[3] In this paper resilience implies a combination of activities that reduces risks and vulnerability to those risks, and provides a safety net or recovery path. Building up resilience implies then a dynamic, systemic transformation that is needed to respond to the consequences of climate change, especially future impacts that are difficult to predict (cf Rockfeller 2009

http://www.rockefellerfoundation.org/uploads/files/c9725eb2-b76e-42eb-82db-c5672a43a097-climate.pdf

than for other biomes (World Water Assessment Programme, 2009, McNeely and Mainka op cit). The Red List Index for birds living in freshwater habitats shows one of the most serious declines for all habitats, second only to marine habitats (Butchart *et al*., 2004.). A global Red List assessment for freshwater crabs found that, of species for which enough data were available to carry out an assessment, 32 percent was threatened (Cumberlidge *et al*., 2009). Reviews of the status of freshwater fishes across particular regions report figures ranging from 11 percent threatened in southern Africa (Darwall *et al*., 2008) to 56 percent of endemic Mediterranean freshwater fishes being threatened (Smith and Darwall, 2006).

More than 60 percent of the world's largest 227 rivers are fragmented by dams, diversions or canals (McNeely and Mainka, op cit) leading to widespread degradation of freshwater ecosystems. Overfishing and destructive fishing practices, pollution, invasive species and climate change are additional major concerns for most freshwater systems. Darwall *et al*., (2008) report that 85 percent of threatened fish in southern Africa, 55 percent of threatened freshwater fish in Europe, and just under 45 percent of threatened freshwater fish in Madagascar are affected by invasive species. In the latter case, this is largely the result of implementation of a plan to re-establish local fisheries through the introduction of 24 non-native fish species (Benstead *et al*., 2003). Climate change will cause further vulnerability and result in further impacts on freshwater systems (McNeely and Mainka op cit).

The problem is accentuated in the developing countries where urban growth often tends to kill freshwater bodies. Very often these water bodies were surrounded by rural habitats on the periphery of an urban centre. The water bodies were essential for the livelihoods of the rural population. Apart from being a source of irrigation for agri-horticulture, they provided fish and other fauna (eg. crustaceans and mollusks), flora (eg. water chestnut) and also domestic water. These fresh water bodies were kept healthy through institutional arrangements.[4]

Climate Change and Wetlands

In a healthy intact condition, wetlands can greatly contribute to the attenuation of climate change impacts, especially those related to water. As was recognized by the Changwon Declaration, wetlands "play an important role in sequestering and storing carbon. They are particularly vulnerable to climate change impacts, while human disturbances of the same wetland systems can cause huge carbon emissions. Degradation and loss of wetlands make climate change worse and leave people more vulnerable to climate change impacts such as floods, droughts and famine. Many climate change policy responses for more water storage and transfers, as well as energy generation, if poorly implemented, may deleteriously impact on wetlands. Water and well-functioning wetlands play a key role in responding to climate change and in regulating natural climatic processes (through the water cycle, maintenance of biodiversity, reduced greenhouse gas

[4] Religion played an important role as often a water body is declared sacred and many folk tales associated with it (cf Jain et al, 2004). Rules to prevent over-fishing are for instance found in almost every large freshwater body in India. However, there is a dearth of research on such arrangements.

emissions, and buffering of impacts). Conservation and wise use of wetlands help to reduce the negative economic, social and ecological effects that may result." (Changwon Declaration, op cit).

In countries like India, wetlands support many human communities, who are especially vulnerable to climatic changes as due to various historical and social factors they are already marginalised. Many of these communities belong to indigenous groups. The loss of the wetlands or their degradation will affect them further by impacting their livelihoods and exacerbating poverty. Women will be the worse affected.

When policies in different sectors are not harmonised, many major developments and infrastructure schemes aimed at poverty reduction can actually lead to the degradation of wetlands, thus undermining their ability to provide vital services for local communities and ultimately leading to further and deepening poverty (Changwon Declaration, op cit)[5].
However, short-sightedness of policy makers on the one hand and the rationale of "mainstreaming" communities who depend on natural ecosystems for livelihoods and indeed their very social and cultural sustenance often leads to displacing them from their habitats (cf. Mitra & Rao, 2009; Baviskar, 2009). Ultimately, they are reduced to the status of footloose labour or wage-hunters and gathers in urban habitats (Breman, 1996, 1994; Mitra, 2002).

This paper, based on secondary materials and discussions with an NGO, the Gorakhpur Environmental Action Group (GEAG)[6] presents a case study of Ramgarh *Tal* (lake), a fresh water body of Gorakhpur town in Uttar Pradesh. The paper argues that protecting the wetlands actively, in keeping with the 'wise use' concept of the Ramsar Convention enables building up the resilience of the nearby habitats[7]. The paper examines how growing human pressures on the wetlands, including on the Ramgarh lake, caused by urban expansion and the unplanned growth of Gorakhpur, led to the degradation of the water bodies. However, the Ramgarh lake continues to be of utmost importance to Gorakhpur town. The lake and other water bodies, many of which are dead now, played a vital role in the traditional drainage system of the city. Even today, the Ramgarh lake plays an important role in the sewage disposal as untreated domestic wastes are discharged into it and solid wastes are dumped on its banks. The paper argues that to enhance Gorakhpur resilience to climate change impacts, the lake has to be protected and rejuvenated through measures that include proper treatment of effluents (sewage) and solid waste management. The lake plays an important role in the city's ecology too and provides livelihoods to hundreds of people living around it. Finally, the paper shows how the first steps towards the

[5] As was accepted at Changwon, "Action is needed to maintain the benefits provided by wetlands for economic development and the livelihoods of people, especially the poor. Wise use, management and restoration of wetlands should help to build opportunities for improving people's livelihoods, particularly for wetland-dependent, marginalised and vulnerable people. Wetland/livelihoods linkages need to be better analysed and documented. Capacity and partnerships should be promoted at multiple levels to support learning, collecting and sharing knowledge about these linkages" (Changwon Declaration, op cit).

[6] GEAG is leading a campaign to save the lake.

[7] At the centre of the Ramsar philosophy is the "wise use" concept. The wise use of wetlands is defined as "the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development". "Wise use" therefore has at its heart the conservation and sustainable use of wetlands and their resources, for the benefit of humankind. (cf. http://www.ramsar.org/cda/ramsar/display/main/main.jsp?zn=ramsar&cp=1_4000_0__ (accessed on 28/1/10).

systemic transformation that is necessary to building up this resilience have been taken due to the efforts of GEAG.

Gorakhpur City

Gorakhpur City, the headquarters of Gorakhpur District, is the second most important town in Eastern Uttar Pradesh, after Varanasi. Spread over an area of 147 sq kms, it lies in the basin of the Rapti and Rohini rivers and is shaped like a bowl. According to the 2001 Census, its population was 622701 (329,807 males and 292,894 females). It has a number of rural villages or peri-urban habitats[8] around it where agriculture is practiced.

Gorakhpur district is situated in the Terai region of the Nepal Himalayas. The district has numerous annual and perennial freshwater ponds and lakes of different dimensions. These water bodies have emerged either by abandoned channels of rivers that have been blocked by the accumulation of silt or by the deep natural depressions in which the upper surface water collects without finding adequate outlets (Wajih, 1980:9; GoUP, 1978:7).

Over time, primarily due to human activity and use, like dumping solid wastes and land-filling for construction activities, many of these have disappeared or are on the verge of doing so.

Gorakhpur comprises mostly low lying areas with low slope gradients. 74.29 percent of the total city area has 0-1 degree slope with 61-67 percent area having elevation of 80-85 m. only. 59 spots have been identified by Municipal Corporation as permanently waterlogged. The slope in the city is generally from north to south but this slope is not uniform and with the development of city the evolved drainage system is such that water flows were linked to water bodies (small and big ponds) in the city. A potential impact of climate change will be the higher intensity of rainfall, over a lesser number of days. The propensity of the low-lying areas to flooding is higher, more so if the wetlands into which the run-off flowed are degraded or filled up.[9]

The city (being in the terai region) had 103 small and big water bodies during 1960's and these water bodies played a major role in the water drainage system.

However, with increasing land demand for housing and escalating land costs, people-especially powerful have encroached upon those water bodies and developed houses on the leveled lands. The present number of such water bodies in the city has reduced to 43.

Thus in 1975-76 Wajih found 9 fresh water lakes and ponds within a 15 km radius of the Gorakhpur Universityersity Campus. Only three have partly survived the pressures of a rapidly growing city (cf. Table 1).

Effluents and solid wastes are still disposed in these water bodies. The city has no adequate and effective sewage and solid management system. This leads to further degradation of the wetlands. The biggest lake of Gorakhpur, Ramgarh Tal, faces extinction.

[8] There are 25 such villages with a population of approximately 100,000.
[9] Interview with GEAG personnel 26/01/10.

Table 1: Some Wetlands of Gorakhpur and Their Present Status

No	*Name of Water Body*	*Description (c. 1975)*	*Present State*
1	Asuran Pond	3 km north of University, on Gorakhpur Maharajganj Road, Perennial, surrounded by dense habitation and constructed buildings.	Lost; privatized and residential colony built
2	Bus Station Pond	1 km north-east of University Campus facing bus station. Seasonal, dries up in summer.	Lost; Govt Sports College built on it
3	Chilwa Lake	11 km north of University, on GKP-Nepal highway. The metalled road crosses the lake. A long stretch of water that joins the Rohini river near Maniram.	50 percent lost to various urban pressures
4	Domingarh Pond	5km north of University, beside GKP-LKO railroad. Formed due to the overflowing of the Rapti during monsoons. A shallow pond that sometimes dries up in summer- the water stays for 6 months normally	Has merged with the Rapti mainly due to filling.
5	Jalwania Pond	1 km north-west of University on the GKP-LKO highway. A perennial pond.	Lost; land development project
6	Jatashankar Pond	In the midst of a densely populated area, 1.5 km from University. Perennial, used mainly for sewage disposal by the inhabitants of the area.	Lost; illegally encroached
7	Morarka Mill Pond	Behind Morarka Mill, 1 km from University.	Lost; illegally encroached
8	Ramgarh Lake	Located on the eastern border of GKP town, just behind University. A shallow perennial water body connected with the Rapti on its southern side. The total area of the lake is about 20 sq.km	Now only 17 sq.km
9	Narhi Lake	A large perennial waterbody about 13 km from University on the GKP –Deoria road. The lake is used for cattle feeding, fishing, shooting and cultivation of *Narkat* (Arundo donax).	30 percent lost

Source: Wajih, 1980: 14-17.

In the next section, the Ramgarh Tal is analyzed in detail to understand the processes that contributed to the degradation. The lake has been studied from time to time by various scholars, mostly botanists and geographers from the Gorakhpur University. GEAG too has conducted some studies. Sociological or Anthropological studies on the human populations and communities dependent on the lake and living around it do not seem to have been conducted. This points to a gap in the eco-system analysis and has to be fulfilled in order to understand not only the impact of climate change on vulnerable populations but also to find indigenous answers to enhancing climate change resilience and building adaptation.

Ramgarh Tal

The Ramgarh Lake is a shallow, eutrophic, perennial ox-bow lake towards the eastern side of Gorakhpur town, just behind the university campus. It has a saucer shaped basin with a gentle slope from the margin (Sinha, 2007). It presently spreads over seven sq.km (1700 acres) though in 1916-17 its spread was 1980 acres (GEAG, 2008: 9).

The lake is one of the biggest in eastern Uttar Pradesh and finds place in the local folklore and mythology.[10] Researchers of the Geography departments of Gorakhpur and Benares Hindu University have claimed that the Rapti was famous for its meandering from ancient times. They claim on the basis of geographical and geological evidence that it used to flow once through almost the centre of the city, where the Gorakhnath temple is situated at present. Over the centuries it shifted westwards. The many lakes in an around the city, including the Ramgarh Lake, are ox-bow lakes formed by the meandering of the river, they claim. If these water bodies be connected, a parallel river stream is discernible (GEAG, 2008:2).

Geography of Ramgarh Lake

Presently the Ramgarh Lake stretches 7 km (1700 acres) from 83 degrees 23 mins 6 sec to 83 degrees 25 mins 51 sec East longitude and 26 degrees 42 mins 21 sec to 26 degrees 45 mins 22 sec North Latitude. Its north-south length is about 5 km and east-west about 3 km. The shoreline perimeter is 18.335 km (GEAG, 2008:2).

The depth of the lake differs from place to place and also according to the season. According to Verma (2007), in April, the depth of the lake ranges from 50 cm to 145 cm, in September, just after the monsoons from 275 cm to 380 cm and in November from 150 cm to 280 cm. In a study conducted in 1991, the total volume of water in the lake was estimated to be 7.044 million cubic meters in April, just before the monsoons, 23.662 million cubic meters in September just after the monsoons and 15.535 million cubic meters in November (GEAG, 2008:2).

The water sources for the lake are the 12.5 km long Godhoia nala and the 10 km long Jungle Tulsiram (Bichia) nala that drain the waters of the north-east and northern areas of the city respectively. Additionally, the run-off from surrounding highlands and fields drains into the lake. The total catchment area of the lake is estimated to be120 sq.km (GEAG, 2008: 3). Further, during the monsoons, the lake catches the precipitation and in that sense is a rainwater harvesting system too.

The Tarkulahi regulator that checks the inflow of the Rapti into the lake during the monsoons is to the south of the lake. There is a very deep well in the lake, about 4 m lower than the average depth, near the railway bridge to the west of the Kudaghat railway station.

[10] Two legends are popular about the origins of the lake. According to one, this was the seat of the mythological kingdom *Janakirna.* A ruler of this kingdom incurred the wrath of a sage and the kingdom sank into the netherworld but subsequently emerged as the lake. The other legend, dating back to c 600 BCE, has it that there were several republics in this region, all owing allegiance to the Kosala kingdom. One of these, the Kol republic spread from the Rapti river in the south to the Himalayas in the north and from the Rohin river in the west to Rudrapur in the east. The capital of this kingdom, Ramgram, grew out of the Ramgarh village on the banks of the Ramgarh Lake. Overtime, with the decline of the Kol republic, Ramgram too lost its importance and due to geological disturbances subsided into the Ramgarh Lake (GEAG, 2008: 1)

The Status of the Lake

Traditionally, the lake was of immense value to the citizens of Gorakhpur. However, over time, with the lake dying a slow death, many are adversely affected. The watershed year seems to be 1980, after which the depletion of the lake really began.

The Pre-1980 Scenario

Before 1980, the lake was not as polluted as at present. The only source of pollution was the effluents were discharged by the Gorakhpur Municipal Corporation (GMC) through the Bichia Nala. The quantum of the discharge was low enough for the lake to re-generate itself. The aquatic plants were abundant and the dissolved oxygen was 13-14 mg/litre (GEAG, 2008:4).

The lake played an important role in the water supply and sanitation of the city. The water got purified biotically and flowed through several channels to meet the domestic water needs of several localities such as Ramgarh, Rampur, Singdia, Mahadev Jharkhandi (1), Gaighat Old and Mohadipur, with a total population of approximately 50,000 around the lake. This continues even today, though the quality of the water has deteriorated and is no longer used for drinking.

As mentioned earlier, the lake plays an important role in the city's sanitation too. Gorakhpur slopes from the west to the east, the run-off from the western, northern and eastern parts of the city drains into the lake situated to the east of the city. To the north of the lake, the 10 km long Goddhoia nala and the 12.5 km Bichia nala drains the waters of the north-east and northern areas of the city respectively.

In 1928, a thermal power plant was commissioned in Mohadipur to supply power to the railways. The plant was run on coal obtained from Bihar and the waters of the lake.

The waters are channelised to irrigate the fields nearby even today. Thus, a channel was cut through the present Indira Nagar Colony to irrigate fields across the National Highway 28 in villages like Daudpur, Rustampur, Bagrani, Pathra, Badgon, Rampur and Kajakpur. The canal was in operation till 1972. With growing population pressures, the canal was filled and residential colonies constructed.

The villages[11] around the lake formed a part of the unique ecosystem. The livelihoods of many fishing communities, such as the Nishads and Kewats (officially classified as Other Backward Castes) depended on it. Around 1980, there were 40 species of fish existing in the lake, along with tortoise, frogs, crabs, prawns and water-snakes. Numerous insects, including the water bug Ranatra that feeds on mosquito larvae, existed in the lake.

The fish was abundant because the pollution load was insignificant. Only municipal sewage drained through the Bichia Nala and a sewer line in the north polluted the water. Otherwise, the physico-chemical parameters of the waters were very healthy for the growth and colonization of flora and fauna in the lake. The phyto-plankton, so essential for the growth of the fish, being an essential part of the food cycle of aquatic fauna, bloomed only for two months during the

[11] Some of these villages are: Rampur (Bhagta), Ramgarh, Rasulpur, Gopalpur, Bharwalia Khurd, Bharwalia Bujurg, Bagrani, Gaighat Khurd, Gaighat Bujurg, Sictor, Madhalla, Bindtolia, Bhaironpur, Lakshmipur, Bhagta, Karmhiya, Kudaghat, Mahrabari, Bishunpura and Singadia (cf GEAG, 2008:5).

monsoons due to the enrichment of the water by the run-off from the cultivated fields. The plankton cleanses the water and increases the dissolved oxygen (Sinha, 2007).[12] In 1969, Sinha had found 31 species of plankton in the lake (Sinha, 1969). Around 79 species of aquatic flora were found in the lake (GEAG, 2008:6)

The lake was surrounded by marshy lowlands. The fisherfolk cultivated Boro paddy (*Oryza sativa)* and vegetables for their subsistence. Also, numerous species of grasses (such as *Narkat, Sarpat, Gaun*) grew in and around the lake. These were used by the local inhabitants for fodder, thatch, and making mats, baskets and brooms. The dried grass was used as fuel too.

In effect, the lake was a complete eco-system and provided sustenance and livelihoods to many people living around it. It was vital for Gorakhpur city in the sense that it acted as a drainage for the precipitation run-off and an untreated sewage discharge reservoir. Solid wastes were dumped on its banks.

After 1980

Major changes took place during the 1980s and 1990s that adversely affected the lake's ecosystem. The lake shrank in size. The dryland mass increased. The marshlands or the low-lying lands surrounding the lake too increased but were soon usurped by colonizers for urban construction.

Most alarming was the increasing pollution of the lake during the 1990s. As mentioned above, the lake was used to discharge municipality wastes, including solid wastes, but now the quantum increased. The growth of residential colonies, tourist and entertainment facilities, museums and a growing population contributed to this. Also responsible was the lack of awareness about the importance of the water body and the short-sightedness of the authorities.

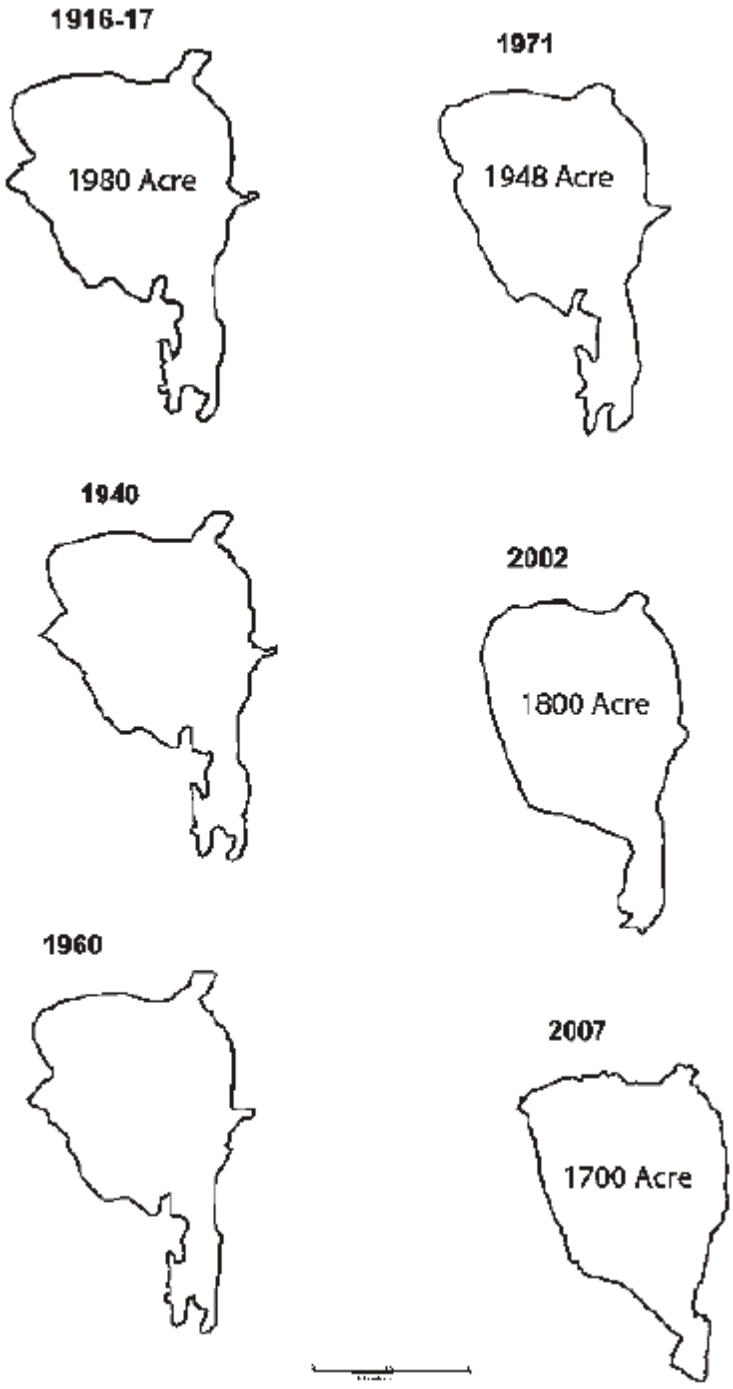
Around about this time the lake became a source of revenue too. The lake came under the jurisdiction of the Gorakhpur Development Authority (GDA), a body that started auctioning the fishing rights. This affected the local livelihoods tremendously (GEAG, 2008:6). The over-exploitation by the contractors affected the diversity of the fish and also their weight. For these contractors, profit making was the prime objective and they didn't care much for giving the time for the fish to spawn or grow. On the other hand, for the local people, fishing was prohibited during the spawning season. A 2006 survey revealed that it was a tradition amongst the Kewats that they would not fish in the months that didn't have an 'r' in its name. Thus, in May, June, July and August not only was fishing taboo, even fish was not eaten by these communities[13]. These months are also the spawning season for most fish GEAG, 2008: 7.

Construction of residential colonies, embankments, bore wells and mining of silt from the lake by the GDA has reduced its area substantially. According to the available data, the lake measured 1948 acres in 1971; 1800 acres in 2002 and 1700 acres in 2007. This is shown in graph1 (GEAG, 2008:8):

[12] Sinha, 2007, mentions that during the bloom of planktons, it creates problems of nocturnal oxygen depletion and fish mortality.

[13] Note that fishing was not the sole and only source of livelihood for these communities. They work as casual urban daily wage labour too.

GRAPH 1: LOSS OF AREA OF RAMGARH LAKE 1916 TO 2007 (Source: GEAG, 2008:8).



MAP 1: REDUCTION IN AREA OF RAMGARH LAKE 1916-2007

(SOURCE: GEAG 2008: 9)

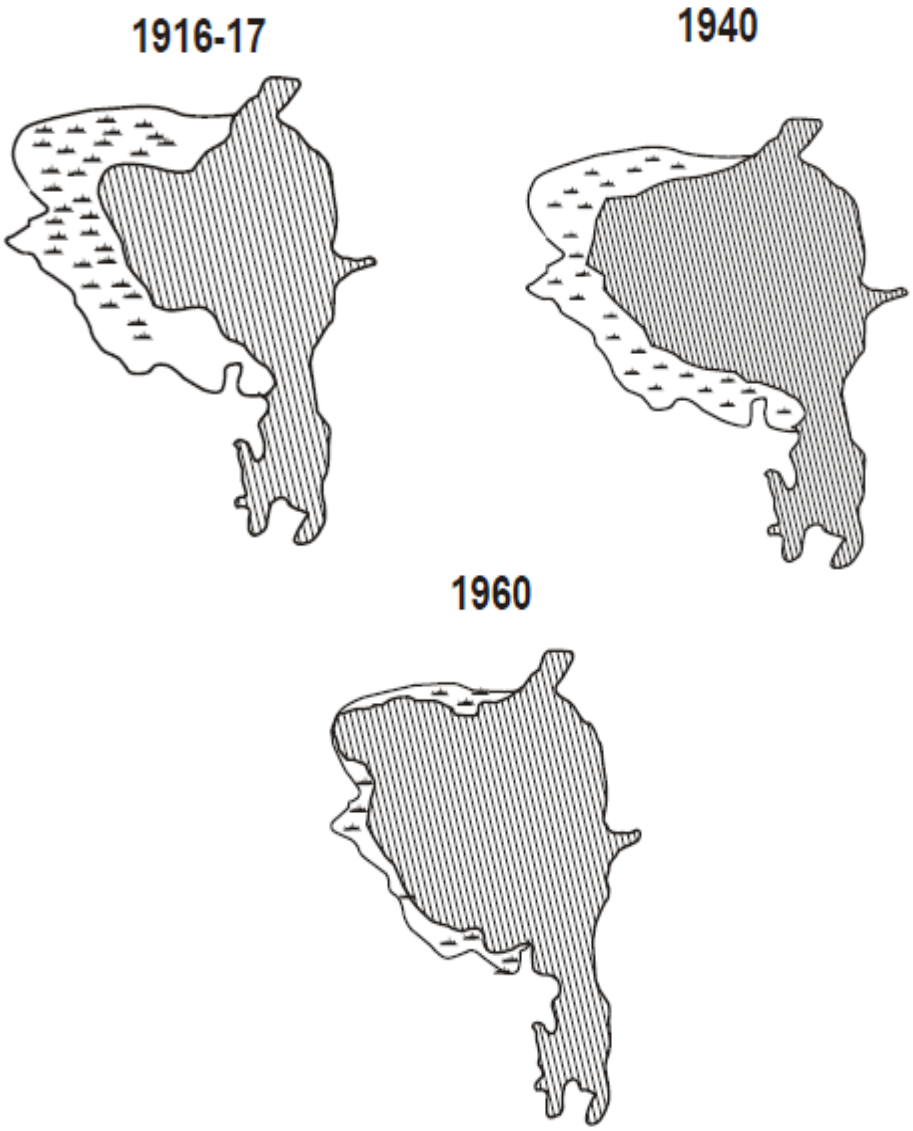
The lake has shrunk 32 acres in the 55 years between 1916 and 2007. In the last 30 years period alone the lake's size reduced by 12 percent of that in 1916 to about 1700 acres.[14] It is apprehended that at this rate, the lake will soon live in people's memories.

The shrinking in size is accompanied by a reduction of the lake's depth. In 1969, the depth of the lake was 4.5 m while in 2006 it was found to be 3.8m. In 1996, the sedimentation rate of the lake, due to solid wastes deposited in it, was 5 cm annually (GEAG, 2008:10).

The primary reason for the shrinking of the lake is the dumping everyday of 300 to 400 kg solid wastes on its banks by the GMC. Gorakhpur till date doesn't have an official municipal waste dumping ground and the GMC finds the water bodies/low lands surrounding them very convenient. Consequently, the lake is silting fast and the marshy lowlands increasing. But as the lowlands increase, they are filled up and encroached on by the citizens for both construction of houses and cultivation. Those who had already built houses, like towards the east, are gradually encroaching further. Most of the residential colonies around the lake have been developed by filling up the marshy lands around the lake – a process that continues unabated. Thus to the east of the lake, the Singdia Colony, Telephone Colony, Kudaghat, Mohadipur, have been developed. Many commercial establishments, such as shops and showrooms for cars have come up in these areas. These have been built on the landfills that were once the Ramgarh Lake. Similarly, a vast residential colony has been constructed by the GDA south of the lake by filling up the lowlands.

In fact in 1976, the low-lying marshlands measured 1632 acres. Today there are hardly any such lands left (see Map 2).

[14] According to the topographical sheets, the lakes area was as follows: 1916-7. 79 sq.km; 1940-7.70 sq.km; 1960-7.68 sq.km; 1971-7. 67 sq.km. After 1990, data from satellite imagery shows that the lakes area to be as follows: 1990: 7.40 sq.km; 2000: 7.22 sq.km; 2002: 7.09 sq.km; 2007:7.01 sq.km. (Source: GEAG, Ramgarh Tal File).



MAP 2: Shrinking Lowlands around Ramgarh Lake

Source: GEAG, 2008:12

The municipal sewage of the northern portion of the city are discharged untreated into the lake through two major drains, the Godhoia nala (10 km) and the Bichia nala (12.5 km), along with the drains of Mohadipur (4 km) and Daudpur (7 km). Ten other smaller drains too flow into the lake. A UP Jal Nigam study carried out in 2004 reported that the nalas/drains catered to a population of

294400 and discharged on an average 3082 mld (million litres/day) into the lake. The BOD, COD and the total coliform of all the drains was much higher than the accepted norms.[15]

At two places about 400 kgs solid wastes are dumped into the lake. The Dhobighat (washermen's ghat) on the banks too discharge effluents (about 3 kg detergents daily).

Deadly effluents containing remnants of synthetic fertilizers and pesticides are discharged into the lake from the agricultural fields around them. Carcasses of dead animals too are dumped into its waters.

The GDA is responsible in a major way for the reduction in size of the lake as well as the deterioration of its eco-system. In 1916, there were 1632 acres of catchment area land to the west and north-west of the lake. This was appropriated under the Ramgarh Tal Project and the Circuit House, Planetarium, Buddhist Museum and several residential and commercial complexes constructed on 1235 acres. The remaining 397 acres has been grabbed by land-sharks.

Impact of the deterioration of the lake on the fauna and flora

The shrinking of the lake and the pollution has severely affected its flora and fauna. Till the 1980s, there was considerable diversity in the flora and fauna of the lake. The fish was in great demand in Gorakhpur town. Human interference since then has affected both the fish, the fish trade and those dependent on fishing for a living. Only a few fish are saleable. Before 1980, there were 40 species of fish in the lake. In 1990, 28 species were reported but by 2006 just 18 were extant. Commercially only three indigenous species, *rohu (Labeo rohita), catla (Gibelion catla) and magur (Clarius batrachus)* and three other hybrid varieties are found. Eight species have disappeared and 14 are on the verge of doing so. The removal of sand from the lake bed and the reduction of dissolved oxygen has led to this. Crabs, prawns and frogs too are disappearing fast (GEAG, 2008: 15-16).

The deterioration of the waters and the absence of food have affected the avian fauna too. At one time birds like the Sarus crane (*Grus antigone),* several species of storks and egrets, wild ducks and pheasants used to abound. Now these birds are rarely seen (ibid).

Human interference has affected the aquatic flora too. According to Sinha (2007), 79 percent of the floral species found in the lake in 1969 have disappeared. The density of another 4 percent has reduced. Water hyacinth grows profusely, covering some 35 percent of the lake. This is not a good sign. Submerged plants like Hydrilla, Ceratophyllum, Najas have disappeared totally. Floating plants like Pistia and Salvinia too have gone. Excess nutrients lead to eutriphication and prevent the penetration of sunlight into the waters. The lake has a greenish hue now instead of the bluish color previously.

Impact on Human Settlements and Livelihoods

[15] The data was presented in the proposal presented to the Central Government by the UP Jal Nigam in 2003. A copy of this exists in GEAG's Ramgarh Tal files.

The population of villages like Ramgarh, Rampur, Singadia, Kuraghat, Bindutolia and Lakshmipur has increased due to urbanization. Many of these villagers have encroached on the lake. But this and the pollution of the lake have affected most those who depended on it for domestic water. Filtration is insufficient to remove the pollutants from their drinking water. There is a perpetual stench now due to the dumping of solid wastes. In a survey of residents of the localities mentioned above carried out by GEAG, 43 percent of the respondents felt that the water has got absolutely spoilt. Another 23 percent said the waters were unfit for consumption by animals. 26 percent opined that the waters were unfit for bathing (GEAG, 2008: 17)

The loss of lowlands around the lake has meant the loss of grazing grounds for cattle. This has affected many graziers and also those who sold milk for a living. The depletion of fish has affected severely the livelihoods fisherfolk; that is the Nishads and the Kewats. Only 40 percent of the fisherfolk now partly depend on the lake for a livelihood. The rest have been forced to leave their traditional occupation and work as casual wage labour. Just 60 percent of the population fish for consumption (Ibid).

Impact on Gorakhpur Town

Gorakhpur is expanding fast and in the process generates nearly 300 tonnes of solid wastes a daily.[16] There is no sewage treatment plant or any effective solid waste management system. A substantial amount of the effluents are discharged into the Ramgarh lake[17]. Solid wastes too are dumped into it. This is severely affecting the water quality. Residents of several localities depend on this water for their domestic needs. Drinking and using the polluted water has affected the health of these people, evidenced by the increase in gastro-enteric diseases. Children are the most affected. The growth of mosquitoes has led to a rise in malaria, dengue and encephalitis (GEAG, 2008:19).

Climate Change Impacts

A consequence of climatic changes due to global warming is an increase in the quantum of rain but a lesser number of rainy days. In such a scenario, the role of water bodies like the Ramgarh lake become more important. Gorakhpur is all the more vulnerable due to its topography (a large part of it is low-lying and has a low slope). Already 18.7 percent of the area is prone to acute water logging. The development pattern, that sees common/public lands as wastelands or swampy marshes to be colonized, is leading to greater usurpation of water bodies for building residential colonies and commercial complexes. But the buffers for storage of storm waters and excessive

[16] Estimate given by the GMC; cf. GEAG 2010: 1&2.

[17] The municipal sewage of the northern portion of the city are discharged untreated into the lake through two major drains, the Godhoia nala (10 km) and the Bichia nala (12.5 km), along with the drains of Mohadipur (4 km) and Daudpur (7 km). Ten other smaller drains too flow into the lake. A UP Jal Nigam study carried out in 2004 reported that the nalas/drains catered to a population of 294400 and discharged on an average 3082 mld (million litres/day) into the lake. The BOD, COD and the total coliform of all the drains was much higher than the accepted norms.At two places about 400 kgs solid wastes are dumped into the lake. The Dhobighat (washermen's ghat) on the banks too discharge effluents (about 3 kg detergents daily).

rainfall water are declining. This will increase the flooding and water logging in the city. The poor who inhabit these areas will be the most affected.

The maximum and minimum temperatures in the city are widening and expected to widen further. Thus, in the period 2003 to 2008, the maximum temperature grew by 9.51 percent and the minimum temperature decreased by 22.84 percent. The average temperature remained around 25 degrees centigrade. Water bodies like the Ramgarh lake play an important role in stabilizing the temperature variations locally.

The most affected will be the city's poor, many of them women. These are the people who live off the lake or eke out livelihoods based on it. This includes the fishing communities too. Climate induced changes will deprive them of livelihoods.

To sum up, the Ramgarh lake is vital for Gorakhpur city. It met the water needs for many people living around it, in addition to providing livelihoods for some. It is a part of the city's natural drainage system and a part of the waste disposal system too. In a scenario of climate change where the city can expect greater volumes of precipitation over shorter periods, the lake can play a vital role as a buffer for excessive precipitation. Conversely, the demise of the lake will lead to greater climate change vulnerability.

Role of GEAG[18]

Understanding the importance and the significance of the Ramgarh lake for Gorakhpur city, especially in enhancing its resilience to climate change, the GEAG has been campaigning to save and protect it. This struggle is almost a decade old and includes getting studies conducted, disseminating information, mobilizing public opinion and using all its advocacy skills to lobby with the government. One positive outcome of its prolonged and multi-faceted campaign was that the average citizen of Gorakhpur is aware of the importance of the lake. Due to its efforts, the Ramgarh Lake was included in the National Lake Conservation Plan[19] and the preliminary proposal accepted as early as February 2003. Various bureaucratic hurdles, including consents of the District Commissioner and District Magistrate, held up the clearance of the project. Meanwhile, the encroachments and the pollution continued unabated. GEAG brought out a Hindi booklet, submitted several memorandums to the relevant authorities but to no avail. In May 2009, a large number of fish died in the lake. This led to the formation of a citizen's committee by GEAG. The citizen's of Gorakhpur demonstrated peacefully at many places using novel methods like begging to collect money to hand over to the authorities to conserve the lake. Finally the Commissioner and the Gorakhpur Development Authority took cognizance and pushed the Ramgarh Development Plan that was originally developed in February 2003, with some modifications. Finally, in November 2009 the project was cleared with the Central Ministry of Environment and Forests and the Central Government sanctioning a Rs 1476.90 million project to develop the lake[20]. What is interesting is that the project has the potential of earning green house

[18] This section is based on discussions with GEAG staff, especially Shiraz Wajih and perusal of the Ramgarh Tal File in the GEAG archives.

[19] Under this plan, 70 percent of the total capital work is to borne by the Government of India and 30 percent of the total capital work by the Government of UP.

[20] Of this amount, 70 percent is to be paid by the central government and the remaining by the state government, vide letter of Deputy Chairperson, GDA to Commissioner Gorakhpur Division dated 13/11/2009.

gases (GHG) credits under the clean development mechanism (CDM), becoming the first project of its kind in the country to do so[21].

In the initial stages, the area of the lake has been demarcated and the encroachments removed. Plans are afoot for de-silting the lake, removal of water hyacinth, as well as setting up sewage treatment plants. The GMC is also working towards the setting up of a modern solid-waste disposal facility.

Conclusions

Lakes, reservoirs and other wetlands all over India without exception, are in varying degrees of environmental degradation. The degradation is due to encroachments eutrophication (from domestic and industrial effluents) and silt. There has been a quantum jump in population during the last century without corresponding expansion of civic facilities resulting in lakes and reservoirs, especially the urban ones, becoming sinks for contaminants (Reddy and Char, 2004). On the other hand, sustaining and restoring wetlands can be a cost-effective strategy for climate adaptation with strong benefits for poverty reduction and biodiversity conservation. Such measures can also enhance the climate change resilience of the surrounding/nearby habitats as in the case of Gorakhpur's Ramgarh lake.

The case study of Ramgarh lake presented here shows how concerted action in the form of informed and researched campaigns, advocacy and lobbying by an NGO can change the mindsets of the concerned authorities in saving a water-body. The NGO is also involved in raising awareness about issues related to water, sanitation and solid waste disposal, the latter two being the bane of the wetlands. It has been able to get the city's development authority and the municipal corporation to garner funds for setting up an efficient solid waste management system. The national government too has been drawn into the action plan. Apart from providing 70 percent of the funds, it has recommended that the State Government explore GHG credits under CDM.

In the building up of climate change resilience, the NGO has demonstrated several things that can be examples of good practices. These can be adopted elsewhere too.

The first of these relate to the systemic and multi-sectoral nature of the effort. Citizens and the government were mobilized into action as a result of a long drawn campaign that was well researched scientifically. The importance of the lake for Gorakhpur city as well as the populations dependent on it was sought to be understood. The campaign to save the lake went beyond mere aesthetics and is based on functional and practical needs of the citizens. It is based on the active collaboration of several departments, the State Government, the GDA and the GMC. An essential component of the effort is effective sanitation and sewage treatment. The existing institutions have been drawn into the plan. It should lead to effective harmonization and synergisation of various departmental activities.

[21] In the minutes of the Expenditure Finance Committee Meeting held on 09/10/09 to consider the proposal "Pollution Prevention and Conservation of the Ramgarh Tal in Gorakhpur (UP) under the NLCP, it was stated "State Government may consider posing the project under the CDM to earn Green House Gas (GHG) credits. With this Ramgarh Tal project may become a first project of its kind and set an example for other projects." (para 9.iv).

It is not that aesthetics will be ignored. In fact, in the long run, it is hoped that the revived lake becomes a source of business for many of the local inhabitants. The livelihoods of the fishing communities can be restored and in fact they can form fishing cooperatives, take charge of not only the cultivation of the fish but its day to day upkeep. [22]

However, a greater role will have to be played by the NGO and the citizen's in ensuring that the money is spent for the purposes it has been allocated.

References

- Balian, EV; H Segers, C Leveque and K Martens, 2008. 'The Freshwater Animal Diversity Assessment: An Overview of the Results. *Hydrobiologia* 595: 627-637.

- Baviskar, A. 2009. Breaking Homes, Making Cities: Class and Gender in the Politics of Urban Displacement. In L. Mehta (ed.) *Displaced by Development*.

- Benstead, J. P., P. H. De Rham, J. L. Gattoliat, F. M. Gibon, P. V. Loiselle, M. Sartori, J. S. Sparks and M. L. J. Stiassny. 2003. Conserving Madagascar's freshwater diversity. *Bioscience* 53 (11): 1101-1111.

- Breman, J. 1994. *Wage Hunters and Gatherers*. Oxford University Press.

- Breman, J. 1996. *Footloose Labour*. Cambridge University Press.

- Butchart, S. H. M., A. J. Stattersfield, J. Baillie, L. A. Bennun, S. N. Stuart, H. R. Akcakaya, C. Hilton-Taylor and G. M. Mace. 2005. Using Red List Indices to measure progress towards the 2010 target and beyond. *Phil. Trans.* R. Soc. B 360: 255-268.

- Cumberlidge, N. *et al*., 2009. Freshwater crabs and the biodiversity crisis: Importance, threats, status, and conservation challenges. *Biol. Conserv*. Doi: 10.1016/j.boicon.2009.02.038. In press.

- Darwall, W. R. T., K. G. Smith and D. Tweedle (eds.). 2008. *The Status and Distribution of Freshwater Biodiversity in Southern Africa.* IUCN, Gland, Switzerland.

- GEAG, 2008. *Ramgarh Tal: Ek Bihangavlokan*, Gorakhpur Environmental Action Group (GEAG), Gorakhpur, June.

[22] There are many instances of such efforts. A prime example is that of the East Kolkata wetlands, declared a Ramsar site in August 2002. One of these is the wetlands maintained by the fishing cooperative of Mudially; the site being called the Mudially Nature Park. The wetlands are used to treat the city's sewage and the nutrients contained in the wastewater sustain fish farms. The sewage is treated through settling ponds and biotic treatment. The nature park is now a very popular picnic spot.

- GEAG, 2010. 1: Gorakhpur 2031: Sanitation –Clean Up or Perish

- GEAG,2010.2: Gorakhpur 2031: Solid Waste Management ---The Solid Waste of a City.

- Government of Uttar Pradesh, 1978. Uttar *Pradesh District Gazetteers, Gorakhpur* Department of District Gazetteers, UP, Lucknow (1987 reprint).

- Jain, A., H. Birkumar Singh, S.C. Rai and E. Sharma. 2004. `Folklores of sacred Khecheopalri lake in the Sikkim Himalaya of India' in *Asian Folklore Studies,* vol. 63: 291-302.
- McNeely, J. A and SA Mainka. 2009. *Conservation for a New Era,* IUCN, Gland, Switzerland.
- Mitra, A. 2002. *Training and Skills Development for Decent Work in the Informal Sector: Case Studies from South India,* ILO, Geneva, IFP/SKILLS Working Paper no. 8
- Mitra, A. & N. Rao. 2009. Displacing Gender from Displacement: A View from the Santal Paraganas, Jharkhand. In L. Mehta (ed.) *Displaced by Development*.

- Reddy M. S. and N. V. V. Char. 2004. Management of Lakes in India. www.worldlakes.org/.../Management_of_lakes_in_India_10Mar04.pdf *(accessed on 27/1/2010).*
- Schuyt, K. and L. Brander, 2004. *Living Waters Conserving the source of life. The economic value of the world's wetlands.* WWF, Gland, Switzerland.

- Sinha, A. B. 2007: Changes in Various Ecological Conditions of Ramgarh Lake due to Increasing Human Interference and Planning of GDA, unpublished mimeo, Botany Department, Gorakhpur University, Gorakhpur.

- Sinha, A.B. 1969: Investigations on the Ecology of Ramgarh Lake, Gorakhpur. Unpublished PhD thesis submitted to the Department of Botany, Gorakhpur University, Gorakhpur.

- Smith, K. G. and W. R. T. Darwall (compilers). 2006. *The Status and Distribution of Freshwater Fish Endemic to the Mediterranean Basin*. IUCN Red List of Threatened Species – Mediterranean Regional Assessment No. 1. IUCN, Gland, Switzerland and Cambridge, UK.
- Verma, S. 2007: *Ramgarh Tal (Gorakhpur): Bhougolik Parivesh*, unpublished mimeo. Geography Department, Gorakhpur University, Gorakhpur.

- Wajih, S. A. 1980. Ecological Studies of Fresh Waterbodies of Gorakhpur in Relation to Floating Macrophytes, Unpublished PhD thesis, Department of Botany, University of Gorakhpur, Gorakhpur.

Compiled by :

Amit Mitra
Independent Researcher, New Delhi