



Spatial Analysis of Water Supply and Demand in Patna

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Water is one of the most precious natural resources and becomes an important element in the socio-economic development. It is the most important limiting factor for many aspects of daily life. It is essential for drinking, bathing, washing, and a host of other purposes. Demand and supply of water is not constant but varies during the day and according to the seasons. As life has become more complex and technology more sophisticated, the need for water has increased exponentially. Water demand in Patna is rising at an alarming rate. According to census 2001, Patna is the largest populated city of Bihar with 14, 32, 209 people. Therefore demand of water for different purposes has much increased. Water for drinking, personal hygiene and sanitary purposes have high demand as these ensure the health and well being of any society. A sample study has been carried out in Danapur and Boring Canal Road area of Patna in which 50 families have been interviewed with the help of a questionnaire, regarding the spatial variation in the demand and supply of water. It was found that a great number of families in Danapur have been facing problems with regard to supply of water due to their dependency on Public water supply systems, whereas the families in Boring Canal Road hardly faced any problems as majority of them have their own boring systems.

Key words: Resource, Water Supply, Scarcity, Water quality.

Introduction :Water is one of the most precious elements of life on the planet. It is essential for satisfying the basic human needs, health, food production, energy and maintenance of regional and global ecosystems. It is an important limiting factor for many aspects of life, including economic growth, environmental stability, biodiversity conservation, food security and health care. As life has become more complex and technology more sophisticated, the need for water has increased geometrically.

“Bihar Rajya Jal Praiyojna (BRJP)” is responsible for designing and implementation of water supply infrastructure in Patna. The operation and maintenance of the systems are undertaken by Patna Municipal Corporation (PMC) in its jurisdiction and BRJP in other areas. There is no Master Plan for water supply sections in Patna. Water is supplied through a water supply system maintained by the civic agencies.

Water is a precious natural resource, vital for sustaining all life on the earth. Its demand in all fields and sectors like domestic, agriculture, industry, power is increasing at a faster rate. Due to increasing population,

water demand is increasing rapidly in the domestic sector. The demand for water varies from region to region. There are variations in demand for water in west and South Patna. Many factors contribute to this variation but the most important factor is variations in population size.

Bihar, in particular Patna, is endowed with huge water resources but they are not being utilized properly. Consequently, the state is affected by floods and droughts occasionally. Agriculture consumes a large proportion of water and therefore it is an important factor for assured food supply in our state. Demand for water is not constant but varies during the day and according to seasons. Therefore a study was conducted on the spatial analysis of water supply and demand in the Boring Canal Road and Danapur area of Patna in which 50 households each were interviewed. The objective of this paper is to analyse spatial variation in the demand and supply of water in Patna Urban region, to study the problems of water supply and demand, seasonal variation in water availability, utilization of water, and the ways to meet the rising future demands of water in the city.

Methodology :

This paper is based mainly on primary data collected through a detailed questionnaire. For this 50 households each in Boring Canal Road and Danapur area of Patna were interviewed on a random basis. Our survey involved collection of published data, preparation of a base map of the study area, preparation of questionnaire through which primary data was collected, compiled and processed. A detailed analysis was then done on the basis of the primary and secondary data collected from various sources.

Results and discussion:

Source of Water :

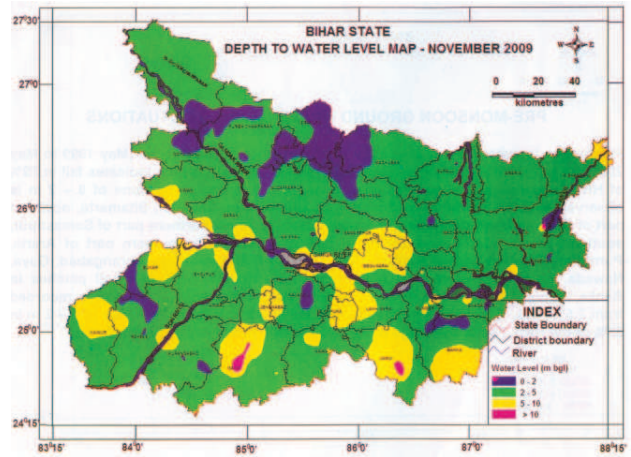
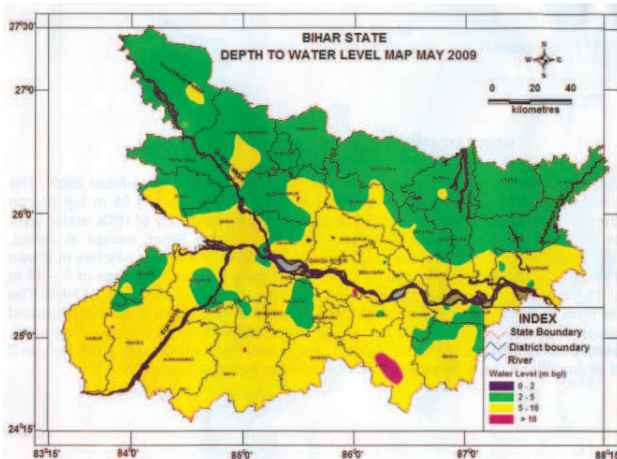
Rainfall is the main source of fresh water in India. Large part of rain water percolates into the ground and is available to us in the form of ground water. Water constitutes 70% of the earth and only 3% of the total water is considered to be fresh. Out of 3%, 2% is locked away in the form of ice caps and glaciers in polar regions. Only 1% of the total amount of water in the hydrosphere is available to human beings and other biotic communities from various sources like groundwater, lakes, rivers, and atmosphere.

Distribution of water on Earth

Oceans, Saline Lakes	97.20%
Ice Caps, Glaciers	2.15%
Lakes, Rivers, Streams	0.0085%
Atmosphere, Biosphere	0.00015%
Ground Water	0.64%

Patna, is also blessed with a rich surface water in the form of rivers like Son and Ganga. Son River water is mainly used for irrigation purposes.

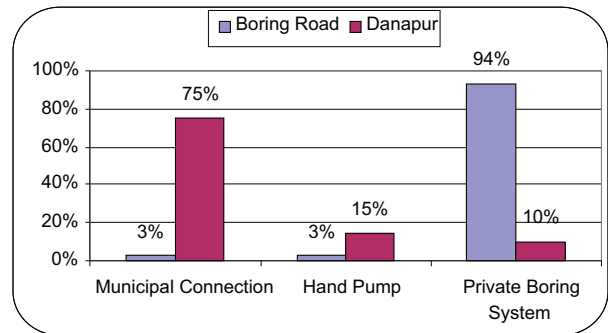
Main Rivers and Depth of Water level in Bihar



Source : Ministry of Water Resources, Central Ground Water Board, Mid Eastern Region, Patna

During our survey of two areas in Patna, i.e. Boring Canal Road and Danapur, we found different sources from which water is supplied to the families for household uses.

Sources of Water



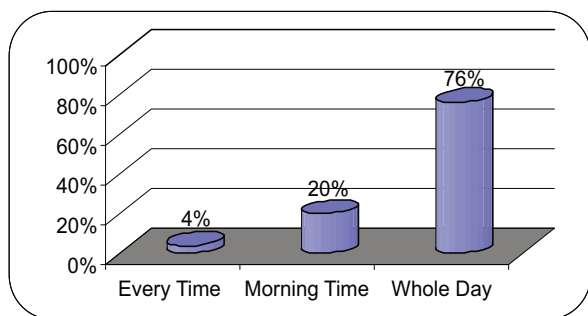
*Based on Sample Survey

It was found that in Boring Canal Road, 94% households have private boring system, 3% households have hand pumps and only 3% of households have water from the Municipal Corporation whereas maximum number of households rely on Municipal Connection as a source in Danapur while 15% and 10% of households have hand pumps and private boring system respectively.

The households which depend on city water have fewer taps in their homes whereas families who depend on their own boring system have more taps and their consumption of water is more. Since the supply of water from the Municipal Corporation is time bound and scarce, the concerned families are forced to use water sparingly.

Duration of Supply :

With regard to the duration of water supply, the families who own their private Boring system have water throughout the day, except when electricity fails. Municipal Corporation supplies water every morning and evening. However all the families have their own water tanks where water is collected for their use throughout the day.



*Based on Sample Survey

From the study it is clear that 76% of the families in the study area receive water throughout the day and 20% of the households get the supply in the morning hours of the day. Water scarcity is a problem in the months of April, May & June both in Boring Canal Road & in Danapur.

Demand and Utilization of Water :

Water is a wonder liquid which is essential for sustenance of life. Due to increasing population, water demand is also increasing. The city and in particular the study area has high dependability on ground water. Due to varying requirement and spatially explicit characteristics of individual users, water demand is determined separately for individual user groups. Water demand indicates both current and / or expected water consumption in any given area over a specific time period. Multiple uses of water can be differentiated according to the demand for portable water, industrial/commercial processes, as well as for irrigation. The population explosion witnessed in the latter half of the last century and the rising demands in various sectors of consumptions of fresh water to improve the quality of life are putting a severe strain on the limited fresh water resources.

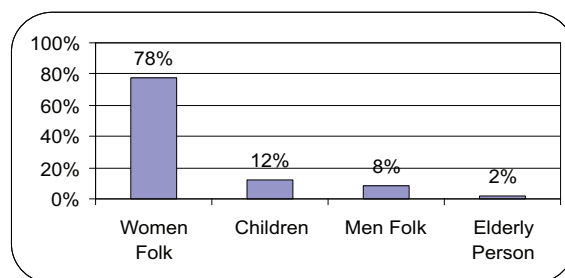
In the study area most of the families had cooking and drinking as their first priority in the utilization of water, which was 80%. However 12% of the families

had washing as their first priority and 8% of the families had bathing as their first priority. It was noticed that those families who had large family size, had washing and bathing as their first priority.

Water utilization is an interplay of demand and supply of water. In the study area, it was noted that in terms of importance, cooking and drinking were their first priority but in terms of quantity of water it was for washing and cleaning that the maximum water was used.

Water is used for domestic activities like cooking, cleaning, washing, gardening etc. Since women in families look after the household chores they seem to be the maximum users of water.

Users of Water



*Based on Sample Survey

From the study it is clear that women folk are the maximum users of water with 78% followed by children, men and elderly persons with 12%, 8% and 2% respectively. As maximum number of women are housewives their level of consumption of water is high, in maintaining their homes.

Seasonal variation

India is a tropical country with seasonal variations in rainfall and regional disparity in the distribution of water resource. Bihar receives rainfall between 90cm-100cm on an average. The pre-monsoon temperature condition in the State is quite severe. The temperature rises to 45°-48°c in the months of May and June. The underground water level begins to fall with the increase in temperature, causing water scarcity in some parts of state. Patna, however is blessed with sufficient underground water resources. It was found that in the study area maximum number of households face maximum problem of water availability in the months of May and June. It may be due to the dry and hot months

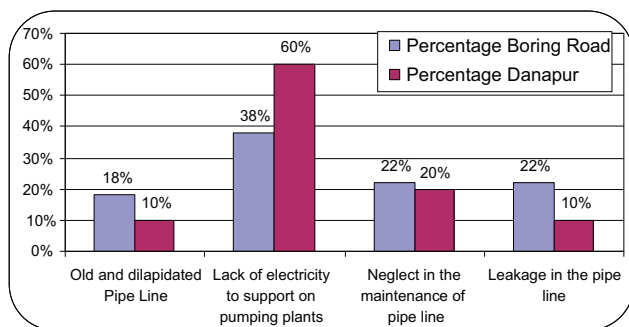
when the level of water table goes down. Consequently there is lack of government water supply. In some cases water scarcity is due to frequent electricity failure.

MONTHS	NO PROBLEM	MODERATE	MAXIMUM
January	96%	4%	—
February	84%	16%	—
March	74%	26%	—
April	52%	48%	—
May	8%	6%	86%
June	8%	6%	86%
July	100%	—	—
August	100%	—	—
September	98%	2%	—
October	98%	2%	—
November	96%	4%	—
December	96%	4%	—

*Based on Sample Survey

Problems of Water Supply

Much of the municipal water supply is lost before it reaches consumers, leaking out of water tanks or faucets or disappearing through illegal taps. This is the common feature that is seen in the urban area. Most of the surveyed house holds say that the problem of water supply is due to frequent electricity failure .It is also found that due to old and dilapidated pipe line there is leakage and most of the water is lost before it reaches the consumers.



*Based on Sample Survey

In Boring Canal Road there is sufficient availability of water. This is mainly because most of the families have their own boring system or hand pumps. Very few people rely on Municipal water connection for water supply. However if the scarcity to be found, it is mainly during the summer season. It is due to voltage fluctuation and electricity failure which is more frequent in summer. This hampers the supply of water to the

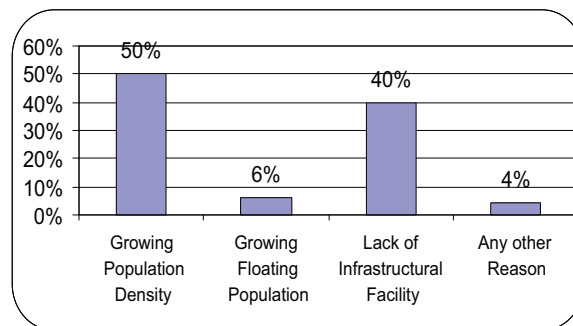
houses which have either their own boring wells or Municipal Connection. In order to solve this problem a few households in the surveyed area have hand pumps as an alternative.

In Danapur 75% of households have Municipal Connection and 20% of households have cantonment connection and very few have private boring. They face maximum problem of water supply due to ill maintenance and lack of supply of water by the Municipality. It was found that there is wide dissatisfaction among consumers due to improperly managed water supply which leads to wastage of water.

Causes of Water Scarcity

Water scarcity though not a common phenomenon in Patna, in the summer months and in the rainy season, both surface water and ground water is seriously contaminated by human beings.. This causes unhygienic environment and polluted water which affect the health of the consumers. Therefore, it is found that though there is plenty of water, yet it is scarce

Causes of Water Scarcity



*Based on Sample Survey

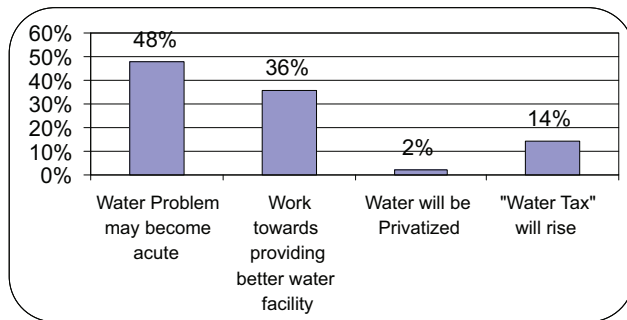
50% of families believe that the abnormal increase in the population of the city with the natural growth as well as migration, results in the inadequacy of the existing water supply and water pollution. As population grows rapidly and the use of water per person rises, there is high demand for fresh water goes up. Because of the huge population size, the population growth pattern will be an important factor for future water resource development and management. However 40% of the surveyed households believe that lack of infrastructural facilities is the main cause of water scarcity. So to cope

up with the growing scarcity of water in city, Bihar Government must initiate to work on the lack of infrastructural facilities and proper management of water resource, available in plenty in the state.

Water Situation in the Coming two Decades

Water is abundant as well as scarce. Almost 71% of the earth surface is covered with it but what is available for human consumption can be narrowed to a few drops in some places. Its availability is so uneven spatially that its range swings between extreme flooding to extreme aridity. 'If the Second World War was fought for petroleum, the third one will definitely will be fought for this water'. (Prof. M.H.Qureshi – 'Essays on Water' pg 203)

Water Situation in the Coming Two Decades



*Based on Sample Survey

In the opinion of the people of the study area, 48% of them believe that water problem may become acute, 36% of the households believe that Municipality/Water Board will work towards providing better water facilities, 2% of the households believe that water will be privatized and the remaining 14% of households think that "Water Tax" will rise. The majority of households believe that water problem may become acute in the coming two decades. If we continue to take it for granted, much of the earth is going to run short of water. Today there is a need to conserve this precious natural resource. The best way to conserve water is its judicious use.

Ways to meet the rising future Demands of Water in the City

There is a great demand for water and it will further increase in future. Therefore efforts should be made by

each and every citizen to conserve it in the best way for the better sustenance of life in the present and in the future.

Regarding the ways to meet the rising future demands of water in the city, it was found that 60% of the households believe that it could be met by implementing better means of water conservation, 8% of them believe that it could be met by making "Water Towers", 26% of households believe that it could be done by replacing the old pipes by the new ones and 6% of households believe that it could be met by laying down wider water pipes. Majority of the surveyed households believe in implementing better means of water conservation methods and among the conservation techniques the most significant one being **Rain Water Harvesting system.**

Suggestions:

- The water once used can be reused in industries for example in cotton textile industries water is used for dyeing and can be purified and reused.
- The industrial and domestic waste should be purified before dumping them into the rivers.
- Wastage of water should be controlled by individual users themselves.
- There should be check on the use of ground water. Underground water is excessively used for irrigation and domestic use. During irrigation water is wasted which can be minimized by using recent irrigation techniques like drip and sprinkle irrigation.
- Rain water harvesting should be practiced to maintain the underground water level.
- Afforestation is also important to conserve water as it regulates the flow of underground water.
- People should be made aware of the scarcity of water, specially women should be made aware of the importance of conserving water as they are found to be the maximum users of this precious element.
- Training and awareness campaign and frequent dialogue to establish linkage between PMC and

water users is very essential to improve its performance.

Realizing the significance of water, Indian Government has taken several measures with respect to water management, maintenance and conservation and laid down policies and programs for development and regulation of the country's water resource.

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