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Address:-Ashok Yakkaldevi 258/34, Raviwar Peth, Solapur - 413 005 Maharashtra, India
Cell : 9595 359 435, Ph No: 02172372010 Email: ayisrj@yahoo.in Website: www.aygrt.isrj.net

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ANTHROPOGENIC IMPACT ON URBAN AGRICULTURE IN YAMUNA RIVER BED, DELHI

Krishna Kumar

Senior Research Fellow , Department of Geography, Delhi School of Economics University of Delhi.

Abstract:-The cultivation of food crops within the overall boundaries of towns and cities is not new, but has been forgotten or ignored in the last 20 years, while urbanisation has, it is thought, absorbed a disproportionate share of national resources. Though primary activities are absent in urban areas of developed countries but it has its presence in urban areas of developing countries. Urban agriculture is practiced within the city and outside the city boundary. Though small in area and production its worth is noting. The role of agriculture in metros especially in Delhi is undermined due to its low contributions in urban economy. However; it plays a key part in influencing food supply chain as well as in stabilisation of prices of agricultural produces.

Keywords: Anthropogenic , Agriculture , urban economy.

INTRODUCTION

Agriculture is being practiced in rural part of Delhi as well as along the transect of Yamuna, especially in Yamuna-Pusta region. While agricultural land is quite away from city in northern and western part of Delhi, it is close to the city and practically sandwiched within the city in the east and north-eastern part of Delhi. The anthropogenic impact in eastern part of Delhi is more pronounced owing to its proximity with thermal power stations, industrial areas, slum clusters, real estate industries, etc. Many agricultural geographers and environmentalists have raised questions regarding the quality of food and non-food crops produced in the region. Some agriculturists have also faced the problems of extra cost in farming operations especially in cleaning of agricultural produce.

This study is quite relevant in the sense that it touches the larger questions of food security, environmental sustainability and nutritional aspects. The study also opens some policy question relate to urban development versus agricultural development, development for whom; rich or the marginalized and environment versus development.

CONCEPTUAL FRAMEWORK

Being a developing country India is getting urbanized at a moderate rate i.e. 25% (2001 Census). Most of the metropolitan cities like Delhi are facing the problem of over urbanization and due to this urbanization urban sprawl has been taking place very slowly but continuously. Due to over urbanization and urban sprawl the urban area are capturing the rural areas especially the agricultural land by anthropogenic activities which includes the activities like construction of roads, buildings, real estate development, formal and informal industries development, etc which affects the quality of the agricultural land and its productivity. Anthropogenic activities are real threat for the agricultural land especially in urban areas and in the rural-urban fringe areas as the anthropogenic activities are grabbing the agricultural fields on the name of development as it is in the case of Delhi where the vast stretch of agricultural field are taken away for real estate development, road construction, Akshardham Temple Complex, Commonwealth Game 2010 Village complex, etc. Due to human induced activities or anthropogenic activities the agricultural land in urban area or rural fringe area are not losing their fertility, soil is getting degraded and thus the agriculture pattern are changing with decrease in production.

THE ISSUE

The stretch of 22 kms and an area of 9000 hectare of Yamuna-Pusta is very fertile for agricultural practices but due to recent anthropogenic activities like construction of Akshardham complex and Common wealth Games Village Complex; this area is under threat and thus it has become a talk of nation these days. There are numbers of research problems in this region.

The main problem of this region is in its background. During the tenure of Smt. Indira Gandhi as Prime Minister of India the whole Yamuna floodplain was given on lease for 100 years to the farmers (especially to Gurjars who were in mass at that time) for practicing agriculture which was at that time uneconomic. But later on when the small farmers turned the uneconomic land into economic farm land and enjoying the fruits of good agriculture production then DDA (Delhi Development Authority) starts grabbing the floodplain by saying that it belongs to them and asking the small farmers to vacate the floodplain. DDA is grabbing the floodplain and selling it and even giving it on lease to the real estates for the commercial purposes which is very unfair to the small farmers who have been living there for over almost 30 years and whose lease are still not over. Over the last ten years DDA has sold vast stretch of floodplain for Akshardham complex to a private Olympic society in case of Games village, to Delhi Metro (Shastri Park Depot), etc. In addition a large tract of river bed is currently being converted by Delhi Metro Ridge, for a depot and many other complexes including residential in the river bed between the ITO (Income Tax Office) Barrage and the new railway bridge are coming.

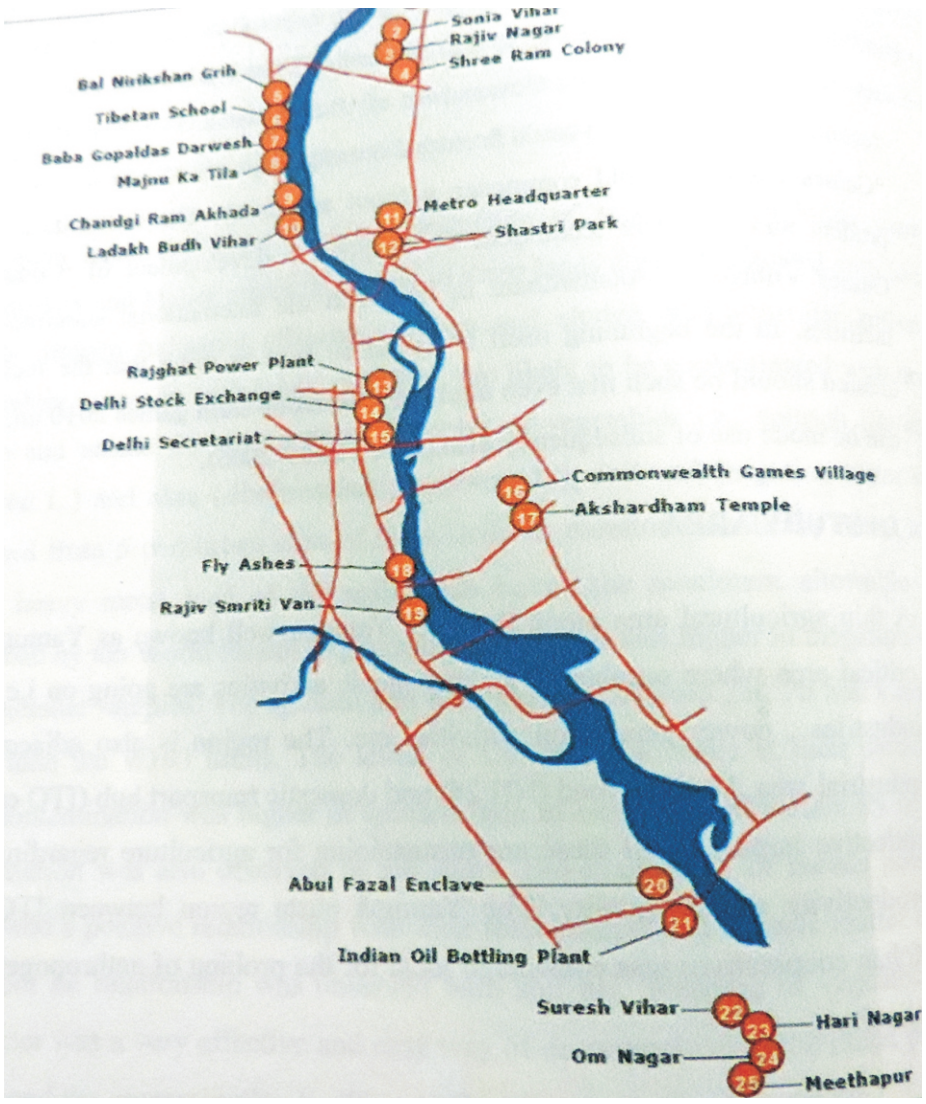

Figure 1. Showing the encroachments on the Yamuna river floodplain in Delhi

The Yamuna floodplains within Delhi used to be owned by the Delhi Peasants Cooperative Society (DPSC). Till now whatever work had been done on this land was carried out by the government, requesting land from the DPCS to use for the nation's interest. But in the case of Akshardham complex and Games Village no such request for land was made to the DPCS.

This was because both of these construction projects were initiated by the private sector. Both are the examples of illegal construction with collusion of the DDA.

Besides these anthropogenic activities, Yamuna floodplain also has three thermal power plants: i) Indraprastha Power Plant (ii) Rajghat Power Plant and (iii) Badarpur Power Plant whose harmful chemical waste, fly ash, etc. are taking toll on the agricultural productions by polluting the soil and the river which are used for agriculture practices.

STUDY AREA

A thin agricultural area along the river Yamuna well known as Yamuna-Pusta is a critical area where numbers of anthropogenic activities are going on i.e. real estates industries, power generation activities, etc. The region is also adjacent to Okhla Industrial Area, Mathura Road (NH 24) and domestic Transport Hub (ITO crossing). The collective impact of all these are unsustaining for agriculture regarding production, productivity and its quality. The Yamuna- Pusta region between ITO crossing to Mohan Cooperatives has been considered for the probing of anthropogenic impact on agriculture.

Yamuna-Pusta is approximately 6.5% of the total area of Delhi. Of the total stretch of the corridor present in Delhi, the 25 kms stretch extending from Wazirabad to Okhla is perhaps the most threatened riverine ecosystem in the world because of the immense anthropogenic pressure on this corridor. This river corridor has been continuously confronted by the encroachments and conversions of land for various commercial purposes putting threat to very existence of agricultural practices and associated wetlands.

OBJECTIVES

i.To identify the nature and characteristics of agriculture in Yamuna Pusta Region.
ii.To access the Impact of anthropogenic activities on urban agriculture especially in terms of real estates activities, power generation stations and transport activities.

DATA SOURCE AND METHODOLOGY

Data has been mainly generated from primary sources through questionnaire from villagers as well as office bearers from related agencies. Apart from it some secondary data will be gathered from Census and Central Pollution Control Board (CPCB), Delhi.

No specific statistical techniques has been used rather it is based on some simple cross tabulation, content analysis and field survey.

THE ROLE OF FLOODPLAINS OF RIVER YAMUNA IN DELHI

There is a wide ranging impact of the floodplains of Yamuna especially in Delhi. Some of the important impacts have been identified below:

It provides safe passage of flood waters in the city.
It has been much need source of surface and ground water to meet the city's growing needs of water for domestic, industrial and agricultural uses;
It acts as a means of spread and passage of flood waters during monsoon every years and containing exceptional floods once every decade or more (1978, 1988, 1995);
It provides a much needed natural buffer zone between the two sides of the sprawling city;
It neutralizes the affect of heat islands developing over the city in the peak summer as an affect of climate change and global warming.
It provides a natural habitat to numerous life forms; and
It meets the city's growing needs of vegetables, flowers and fruits and stabilizes the price of agro-produce by domestic supply.

NATURE OF AGRICULTURE ON YAMUNA PUSTA

Yamuna Pusta has been the cradle of agriculture since it was leased out to the farmers for cultivations. During the tenure of Smt. Indira Gandhi as Prime Minister of India the whole Yamuna floodplain was given on lease for 100 years to the farmers (especially to Gujjars who were in mass at that time) for practicing agriculture which was at that time uneconomic. Since then this floodplain is being used as an agricultural land and different types of food grains and vegetables has been growing there. Over the years this agricultural belt has been passing to many hands but still the original farmers are intact in the region i.e. Gujjars. The Gujjars are mainly engaged in pastoral activities who do agriculture in few patches for pastures for their animal consumption and grains for their own consumption. The other land owing groups are non- existent by parting all of their lands to the tenant farmers who mostly comes from the adjoining part of Delhi like Bareily, Aligarh, Moradabad, Meerut, etc. They are the enterprising groups who do agriculture on commercial line by growing vegetables, horticulture produce, etc.

While most of the tenant farmers are from the adjoining part of Delhi, the farm workers are from distant places like Bihar, Uttar Pradesh, Jharkhand, West Bengal, etc.

Over the years the agricultural Pattern of this belt has been changing due to encroachment in the riverbed. The various anthropogenic activities including construction of flyovers, thermal power plants, real estates developments, industrial activities, slum dwelling, etc. are encroaching in the

Figure 2. Vegetables and Flowers cultivation on Yamuna River floodplain in Delhi

riverbed and thus taking a toll on agriculture by reducing the farm size and polluting the farmlands. Due to decrease in the farm size, land degradation and rising pollution; the operational cost become much higher and farm profits become smaller. Leaving few lands under cereal rest of the lands are under remunerative crops like vegetables and flowers. The agriculturists are feeling the heat and facing innumerable troubles while carrying out agriculture operations. It was revealed by the farmers that the government is insensitive towards the needs and aspirations of the marginalized groups operating in the region and acting as a pawn in the hands of the private builders and Delhi Development Authority (DDA). Inspite of all odds; agriculture in this belt holds a great importance for Delhi as it supplies fresh vegetables and flowers and stabilizes the high soaring prices.

AREA UNDER AGRICULTURE:

Agriculture is confined to near by villages including Yamuna Pusta region. The stretch of this region is about 25 km and covers almost 9,600 hectare fields. Some of the main area coming in this region is Police Training Camp (Wazirabad), Sonia Vihar, Rajeev Nagar, Majnu ka Tila, Laddakh Buddh Vihar, Delhi Metro Head-Quarter (Shastri Park), Rajghat Power Plant, New Delhi Secretariat, Delhi-Noida-Delhi Flyover (DND Flyover), Abul Fazal Enclave, Indian Oil Bottling Plant, Suresh Vihar, Hari Nagar, Om Nagar, Meethapur, etc. Due to Construction and encroachment in these areas the Yamuna bed has lost huge piece of land.

Figure 3. Agriculture field in the Yamuna River floodplain in Delhi

Most of the agricultural land has been acquired by the Delhi Development Authority (DDA) for non agricultural uses. Similarly many migrants have built their slum cluster in the bed of Yamuna. They have exerted pressure on agricultural land by adding pollutants i.e. liquid and solid waste.

Table: Area under agricultural practices in Yamuna Pusta

Land Under Agriculture	4,600 Hectares
Land Under Floriculture	5,000 Hectares

Source: Delhi Peasant Multipurpose Cooperatives Society, Delhi, 2001

Table: Different Crops Cultivated in Yamuna Pusta

S.No.	Crops	Land Under Cultivations for Each Crops (in hectare)
1	Wheat	88.90
2	Cabbage	186.44
3	Onion	161.00
4	Radish	256.32
5	Tomato	194.40
6	Turnip	187.46

Source: Delhi Peasant Multipurpose Cooperatives Society, Delhi, 2001

Table: Crops and Fodder Grown in Yamuna Pusta

S.No.	Variety	Yields (Q/Ha)
1	Jai	134.21
2	Jwar	185.40
3	Barseem	185.40
4	Grass	309.00
5	Wheat	247.60

Source: Delhi Peasant Multipurpose Cooperatives Society, Delhi, 2001

Table: Cucurbits Production

Area Under Cultivation (in ha)	64.77
Varieties	Watermelon, kakri, Cucumber, Sweet Melon
Total Production (in Quintal)	6399.28
Total Production (in Rs.)	1,919,784
Season	November-June

Source: Delhi Peasant Multipurpose Cooperatives Society, Delhi, 2001

Table: Flower Grown in Yamuna Pusta

Annual Flowers	Seasonal Flowers
Motia	Dahaliya
Sadabahar	Marigold
Vairigota	Murgafool
Rose (English)	Guldadi
Duranta	Lavandra

Source: Primary Survey

METHODS OF AGRICULTURE AND IRRIGATION

Since most of the agricultural land of the Yamuna Pusta has been given on lease and the size of the farm land is mostly small, most of the farmers are doing subsistence agriculture where they mostly produce wheat, Maize, Jai, Bajara, and some vegetables for their own consumption. If some time produce are more then they sell them to the market to earn quick money.
As the water is being stored by the Wazirabad Barrage, the Yamuna River contains very less amount of water in its course from Wazirabad Barrage to Okhla Barrage. Due to this farmer has to use boring and tube well irrigation methods to water their crops, vegetables and flowers.

MARKETING AREA OF THE AGRICULTURAL PRODUCE:

The agricultural produce raised by the big farmers is being sold to big vegetable mandis like Okhla, Azadpur, Shakarpur and Gazipur present in the city directly with the help of mashakhor. While the small farmer who has no means of transport or money to carry their agricultural produce to the big mandis, sell their produce in local markets of their nearby areas. Small farmers even sell their produce along the road side of their agricultural field at low price and thus gets very less or no profit.

MAJOR CONSTRUCTION WORKS ON YAMUNA RIVERBED

i.Akshardham Temple complex: Akshardham temple complex has been made by the Sawaminarayan trust which is a Gujarat based trust whose trustees are mostly NRIs. It has acquired more than 100 acres of fertile agricultural land of Yamuna Riverbed which belongs to the Delhi Peasant's Co-operatives Society with the help of DDA; for its complex and has converted more than 70 acres of land in a concrete plain.
ii.Delhi-Noida-Delhi (DND) Flyover: To reduce the time to reach Noida to Delhi and vice-versa and to reduce the traffic pressure on Nizamuddin Bridge a six lane toll bridge (Delhi-Noida-Delhi (DND) Flyover) has been constructed with the help of a Swiss Construction Company. To construct the DND Flyover almost 324 acres of fertile riverbed has been taken by DDA.
iii.Commonwealth Games Village: for the Commonwealth Games 2010 in Delhi; Delhi Development Authority (DDA) has acquired more than 100 acres of land of Yamuna riverbed. This vast stretch of land is just lying behind the Akshardham temple complex and is very fertile in nature, but for the sake of an event which has lasted only 10 days; this vast stretch of land has been grabbed by the DDA from the farmers without analysing the cost of loss in terms of agricultural field loss and even more important the Yamuna River Ecosystem.
iv.INDRAPRASTHA POWER (I.P.) PLANT: Indraprastha power plant is a coal based power plant located in very close proximity of Yamuan Riverbed. First Unit of 36.6 MW at I.P. Station was commissioned in 1963 and was inaugurated by the first Prime Minister of India Late Pt. Jawaharlal Nehru. The I.P. Power Station was further expanded in 1967-68 with installation of three Units of 62.5 MW each. In 1971 one more Unit of 60 MW was commissioned. The first Unit of 36.6 MW retired by CEA in February 2000 and is under disposal. The present available capacity of this station is 247.5 MW.
v.RAJGHAT POWER PLANT: Rajghat Power Plant is also a coal based power plant situated on Yamuna Riverbed near Rajghat. Two Units of 67.5MW were installed in 1989-90 at Rajghat Power House as replacement of Old Units. The present generation capacity of this power station is 135 MW.

vi.BADARPUR THERMAL POWER HOUSE: Badarpur Power Plant is a coal based power plant situated on the Yamuna river floodplain. Beginning its power generation in 1973, this plant generates an average of 705 MW of power from its 5 units annually.

Rajghat Thermal Power Plant **Akshardham Temple complex**

Commonwealth Games Village **Indraprastha Thermal Power Plant**

Figure 4. Showing some encroachments on Yamuna River Floodplain

IMPACT ON ACQUATIC LIFE:

Due to pollution discharge by the industries, the aquatic life is most affected in the region. Aquatic ecosystem is affecting due to eutrophication in Yamuna river which is liable to happen because of the fact that industrial wastes harmful chemicals and even oil in some form also. When this oils come in contacts with the water it makes a shields on the top layer of the water and prevents oxygen to mix with the water and this lack of oxygen leads to the death of aquatic animals. Over the years, the quantity of the fish production has declined many folds in the Yamuna River. In 1996-97, the fish production of the Yamuna river was 1215.30 (000' kg) while it becomes 1,200 (000'kg) in 2000-01.

Table: Fish Catch from Kalindi Kunj Stretch of the Yamuna during last 5 Years

S.No.	Year	Quantity (Q)
1.	1996-97	1215.30
2.	1997-98	1257.30
3.	1998-99	1337.70
4.	1999-2000	1257.60
5.	2000-01	1200.00

Source: Fisheries Department, Govt. of NCT of Delhi

POWER PLANTS EMISSIONS

Delhi has three power plants, all coal fired, located within its city limits: 235 MW Indraprastha Power Station, 135 MW Rajghat Power House and 720 MW Badarpur Thermal Power Station. The total quantity of fly ash from the three power plants is about 6000 tons per day (Indraprastha 1200-1500, Rajghat 600-800 and Badarpur 3500-4000 tons per day), GOI, 1997. In these power plants, ash is collected by ESPs which have collection efficiencies that are higher than average for India- 99.3% (Indraprastha Power Station), 99.7% (Rajghat Power House) and 98% (Badarpur Thermal Power Station) (Mehra et al 1998). Nonetheless, there are episodes of major particulate pollution around the thermal power stations from fly ash dispersal. While Badarpur and Rajghat Power plants have fly ash collection facilities, they do not have adequate storage facilities. The fly ash is generally disposed in ash ponds generally located near the Yamuna river and tend to overflow, particularly during monsoon and affects the agricultural fields and crops productivity. Besides this, groundwater and Yamuna floodplain could be also contaminated from the leaching of heavy metals present in the fly ash. According to the Central Pollution Control Board (CPCB), despite the regulatory directives none of the thermal plants has an action programme for large scale utilization of fly ash. In order to provide an impetus to the utilization of fly ash (say, in the building of roads, making of bricks and so on) the use of topsoils has been prohibited for upto 50 km radius from a unit generating fly ash. Fly ash from the Rajghat Power Plant is being used by the Cement Corporation of India (CCI) for its cement plant in Delhi.

IMPACT OF EMISSIONS OF POWER PLANTS ON AGRICULTURE IN YAMUNA PUSTA

Delhi has three power plants and all of them are coal fired. Since Indian steam coal is high in ash content (30-50%) but low in Sulfur (< 0.5%). More than 99 percent of the coal used in the generation of electric power in India is domestic steam coal. Additionally, the ash is very high in silica and aluminum (> 90%). This results in very high resistivity for the fly ash (1,013 to 1,015 cm), which makes it difficult for conventional electrostatic precipitators (ESPs) to collect fly ash efficiently (Lookman & Rubin, 1998). Conventional electrostatic precipitators (ESPs) are the only devices used in Indian Power Plants for control of particulate matter (PM); thus more efficient pre and post combustion methods such coal washing and the use of flue gas conditioning are not being applied. Existing efficiencies of ESPs of 85-95 percent result in emissions of > 45 million tons of fly ash from the Indian Power Plants each year (Confederation of Indian Industry, 1996). The main method of disposal of fly ash from thermal power stations is mixing it with water; the resultant slurry is pumped through pipes to ash disposal ponds. Coal combustion in thermal power plants also emits a variety of toxic heavy metals, such as Pb, Zn, Ni, Co, Cd, Cr and Cu.

The fly ash, the variety of toxic heavy metals and the other power plants waste have very adverse affect on Yamuna Pusta region. Some of the adverse affects are discussed below:

i.Soil (Yamuna Riverbed) Pollution

When the fly ash or toxic heavy metals, such as Pb, Zn, Ni, Co, Cd, Cr and Cu are being emitted or discharged by the power plants come in contact with the Yamuna riverbed; it pollutes the riverbed and affects its fertility to a great extent. Where heavy metals pollute the riverbed and prevent the germination of seeds mainly, the fly ash check the growth of the crops or the vegetables grown in the fields as they gets deposited on them.

ii.Water (Yamuna River) Pollution

When the fly ash or toxic heavy metals, such as Pb, Zn, Ni, Co, Cd, Cr and Cu are being emitted or discharged by the power plants by mixing in water it also pollutes the Yamuna River and even the ground water in the region. As the farmers use these polluted water for irrigation purpose it affects the quantity as well as the quality of the agricultural produce. Direct contact of polluted water during irrigation has also some health impacts on the farmers and the people living in the region.

iii.Air Pollution

The coal which has been used in the thermal power stations is high in ash content (30-50%) but low in Sulfur (< 0.5%). More than 99 percent of the coal used in the generation of electric power in India is domestic steam coal. Thus when these coals are being burnt in the thermal power plants in Delhi, fly ash comes out in a good amount and pollutes the air but the nearby areas of Yamuna river bed of these power plants are most affected. These fly ash comes down and gets deposited on the agricultural fields and the standing crops and affects their quantity and quality both.

IMPACT ON AGRICULTURE PRODUCTION AND PRODUCTIVITY

During the field survey, it was revealed by the farmers that the agriculture operation has become a tough task in nearby areas of coal based thermal power plants due to the fly ash. A thin layer of ash content is often deposited on the leaves of the vegetables and flowers and due to this the proper growth of vegetables and flowers are restricted. Farmers require extra labour to clean their agricultural produce before sending it to the market. Due to reduction in the quality and quantity of the agriculture produce, the truck farming and floriculture has becomes highly uneconomic in this region.

CONCLUSIONS

Present era is of globalization and development is an inevitable phenomenon to take place. Development is taking place in every domain of life i.e. social, economic and others. In this global world, economic development has been getting more emphasis. Establishment of industries, power plants, real estates, etc is taking place at a rapid rate all over. These impacts are human induced, anthropogenic, which is very clearly visible on the Yamuna riverbed region of Delhi.

With the development; its impact on nature is also evident everywhere. The impact which these developments made is somewhat against the ecosystem. In Delhi, too, development in the fields of industry, real estates, etc is going at rapid rate and this is causing a great concern over these development and its impacts on nature of air, land, water, agriculture and overall the environment. For the better future we must stop playing with the nature. We should conserve River Yamuna and its related ecosystems for better future of our Delhi and the coming generations.

This study is quite relevant in the sense that it touches the larger question of food security, environmental sustainability and nutritional aspects. The study also opens some policy questions related to urban development versus agricultural development, development for whom, rich or the marginalized and environment versus development.

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