

CLUSTER INNOVATION CENTRE

Using ICT for Promoting Ecotourism and Urban Biodiversity Conservation

Semester Long Project Report

Aayushi Anand (70345), Swapandeep (70340), Taniya (70423)

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Abstract

This Report deals with the project undertaken to use the Information and Communication Technology for biodiversity conservation. The thorough appreciation of the concept of conservation has been brought about with a study of conservation dynamics at various levels. The methodology has been to undertake visits to various homes, colonies and institutions including the National Zoological Park, Yamuna Biodiversity Park and the Sultanpur Bird Sanctuary. The study area has been confined to the Delhi Ridge where its ecological and economic value and threats have been discussed. The Keoladeo Ghana National Park has been used as a frame of reference for comparison with the Asola Sanctuary. The two places have been reviewed at great detail to establish the potential of the Asola Sanctuary and reap this potential through the Bharatpur National Park's management practices. The concept of habitat fragmentation has been discussed and supplied with a case study for its better understanding. Birds have been identified as the urban sustainability indicator and bird-watching has been encouraged through the creation of a web-app that would aid for bird identification for the newbie users. The idea is that bird-watching will prompt the conservation of its habitat.

CHAPTER 1. The Delhi Ridge

1.1 Introduction

A ridge is a geological feature consisting of a chain of mountains or hills that form a continuous elevated crest for some distance. Ridges are usually termed hills or mountains as well; depending on size. Delhi is an ancient as well as historical city of India. Delhi, which is located in a crossover formed by the tail end of the Aravalli Mountain Range which is 800 km long (elevation: 1700 meters) and 1.5 billion years old (even more ancient than the young 50 million year old Himalayas), as it culminates at the river Yamuna, is the aspirational capital of over 15 million people. The hilly outgrowths in Delhi are known as the Delhi Ridge sometimes called “The Ridge” which once occupied almost 15% of the city’s land.

Delhi has two life supporting systems. These are the River Yamuna and the Delhi Ridge. While the former provides the much needed water resource to support the ever-increasing population of Delhi, the Delhi Ridge act as the green lungs of the city. The rise in population and the ambiguity in administration and management of Delhi’s urban ecosystem have led to the large-scale degradation of both these life supporting systems of Delhi. The status of River Yamuna in Delhi is that of a sewerage carrying channel while the Delhi Ridge is shrinking due to urban encroachment. Without the optimal functioning of these life supporting systems, the growth and development of Delhi will come to screeching halt.

The Delhi ridge consists of quartzite rocks and extends from the Southeast at Tughlaqabad, near the Bhatti mines, branching out in places and tapering off in the north near Wazirabad on the west bank of the river Yamuna, covering a distance of about 35 kilometers. It also protects Delhi from the hot winds of the deserts of Rajasthan towards the west. It is also responsible for making Delhi the world’s second bird rich capital of the world after Kenya’s Nairobi.

In 1993, parts of north Delhi, central Delhi, south West Delhi and south Delhi covering 7,777 hectares was declared a reserve forest. Thereafter in 1994 and 1996, a major part of the ridge was notified by the Government, thus stopping all construction. Over the years, pressures of urban development have seen forests of Delhi ridge under threat. In many areas, landscaped public parks, and public housing have come up, plus the area also faces dumping of construction waste. The forest status of the Ridge has been underlined by the Loveraj Committee, the Forest Department, Environment Impact Authority, Environment Protection Control Authority (EPCA), and Central Empowered Committee (CEC). It has conservation status from 1996 as per Geological Survey of India. The forest status means that no non-forest activity can take place and the ridge status means again that it can’t be touched. The encroachments on the Ridge started with the Home Ministry’s decision to establish a wireless station on nearly 17...acres of land right in the heart of the forest. Soon after, the Rabindra Rangshala - an open air theatre where cultural programs were to be held - was established on yet another 36 acres of prime land. It is interesting to note that the Rabindra Rangshala , with a seating capacity larger than the Colosseum in Rome, was used for barely a couple of weeks in a year.

Although it was built for the interaction to happen between the people of Delhi and ridge but it failed to serve its purpose and now remains as an abandoned structure right in the heart of the central ridge.

The Ridge Management Board, a seven-member non-statutory body consisting of representatives from the government, DDA and non-government organizations, supposed to protect the ridge, has been unable to prevent the construction frenzy.

1.2 Status

The Delhi Ridge has been awarded the status of being a protected area. The following are few instances of recognition of its importance:

1. In the Master Plan MPD 2001 'The ridge is defined as the rocky outcrop of the Aravalli range.
It is to be maintained in its pristine glory with no infringements permitted.'
It is demarcated by the Geological Survey of India.
2. The Central Ground Water Board has declared it as notified or protected area for water recharge.

It is protected as a forest under the Forest Act with no non forest activity allowed according to the Environment Protection and Control Committee (EPCA) and the Centrally Empowered Committee (CEC).

1.3 Values

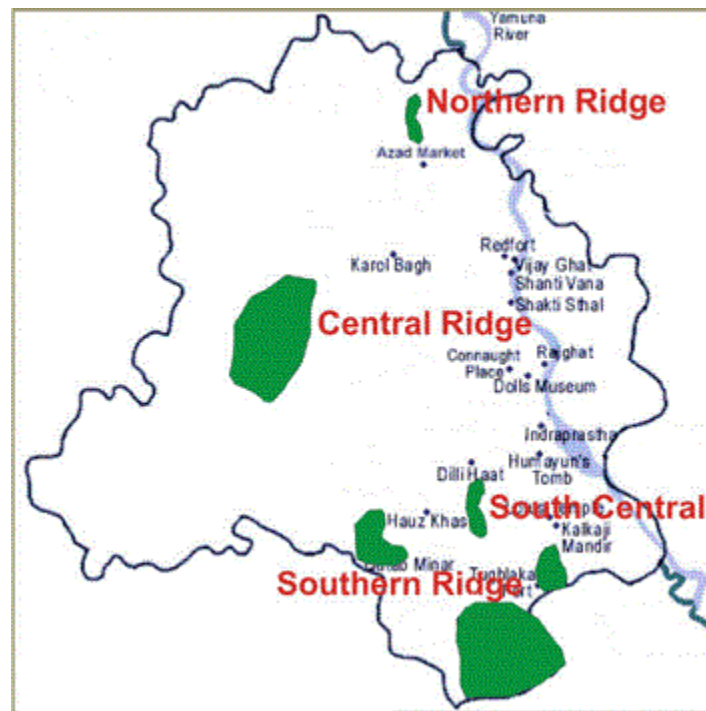
The importance of the Ridge lies in the fact that it provides us with pure quality water. The ridge has an annual recharge potential of 20 Million Cubic Meters (MCM). It could provide natural mineral water for the whole city, when, even the rich and famous drink processed water today. At commercial rates for processed water \$0.25 per litre, it works out to \$5 billion. In spite of untiring efforts by the citizens to preserve this strictly protected area it is being violated by building and builders, so much so that we may have lost a half of it. The loss is irreversible.

1.4 Geographical Segments

The Ridge today, for administrative reasons, is divided into 4 separate zones namely:

1. The **Old Delhi** or **Northern Ridge** denotes the hilly area near Delhi University and is by far the smallest segment of the Ridge. Nearly 170 hectares were declared a Reserved Forest in 1915. Less than 87 hectares remain today, which is slated to develop as Biodiversity Park by the Delhi Development Authority.
2. The **New Delhi** or **Central Ridge** was made into a Reserved Forest in 1914 and stretches from just south of Sadar Bazaar to Dhaula Kuan. It extends over 864 hectares, but some bits have been nibbled away.

3. The **Mehrauli** or **South-Central Ridge** is centred on "Sanjay Vana", near JNU and Vasant Kunj, and encompasses 633 hectares. Large chunks have been encroached and built upon.
4. The **Tughlaqabad** or **Southern Ridge** sprawls across 6200 hectares and includes the Asola_Bhatti Wildlife Sanctuary. This is the least urban of the 4 segments of the Ridge, but a lot of it is village-owned or privately owned farmland.



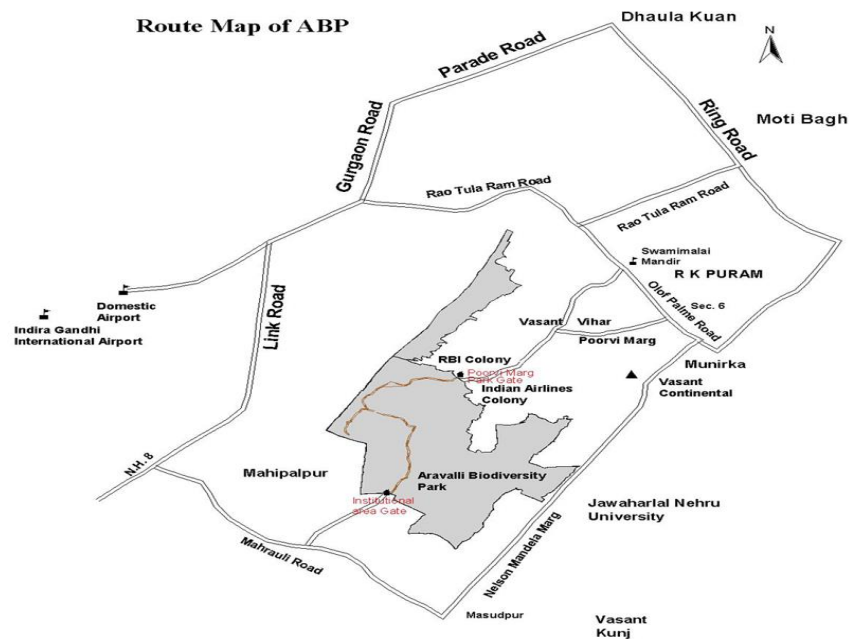
Out of these four geographic divisions, the old Delhi or Northern Ridge within which the North Campus of University of Delhi is situated is relatively a safe ground. The Central Ridge is situated behind the President's lodge and is therefore, bereft of any threat or harm and is rather taken very good care of. The major concerns are the latter two parts of the Delhi Ridge which are greatly threatened due to urbanization and related human activity. It is also noteworthy that the Southern Ridge is the largest in terms of area occupied by the Ridge. Its encroachment will render the Ridge as a whole an extinct and forgotten entity. Its absence shall be rather prominent given that its loss will adversely and irreversibly affect the life of the South Delhi population, where the groundwater table will reduce to almost nil given that its source of recharge will be done away with. All that it will leave behind will be a **GREEN LACUNA**. South Delhi is also the most densely populated part of Delhi. Our intention has been to highlight the need to conserve this very green lung of our city.

CHAPTER 2. South Central Ridge

The south central ridge is one of the two most threatened divisions of the Delhi Ridge. The South Central Ridge has many encroachments primarily in the form of the Vasant Kunj residential area and the hostels of Jawaharlal Nehru University (JNU) and various other concrete structures coming up in the vicinity or the clearing of the Ridge area. It also consists of the Aravalli Biodiversity Park which is an initiative to conserve a certain portion of the Ridge land which has not yet been destroyed due to the major grand scale selling of the land whose environmental value stands at INR 22,000 crore and yet has been done away at a mere rate of INR 1100 crore. The ‘Urban Political Ecology’ issue here is that a ‘park’ is a consumer while a forest is a ‘producer’. A forest requires no maintenance, unlike parks that need lots of water and constant care. Besides, the forest also provides us with water and oxygen without any charges.

It is however important to discuss the ABP initiative. It falls under the Delhi Biodiversity Foundation of the Delhi Development Authority. The Aravalli Biodiversity Park is located on the South Central Ridge and spreads over an area of 692 acres. The area is bounded clockwise by JNU (Nelson Mandela Marg), the Mehrauli - Mahipalpur road, NH-8 and the Palam road and the southern boundary of Vasant Vihar. The landscape is undulating with gentle slopes and dotted with numerous morrum and clay mined pits of different sizes, depths and shapes. One can approach to the Aravalli Biodiversity Park, at present, either from Vasant Vihar- Poorvi Marg gate located at about 4 km south west of Moti Bagh, and 2 km west of Jawahar Lal Nehru University (Munirka) or from the Vasant Kunj Institutional gate which is about 3.5 km north of Mahipalpur and one km west of Vasant Kunj Malls.

The Park features two major zones - the visitor zone and the nature reserve zone



The prime goal of the parks is conservation and preservation of ecosystems of the two major landforms of Delhi, the river Yamuna and the Aravalli hills. They seek to conserve keystone species and other threatened plant and animal species, preserve the biodiversity of any habitat that is likely to be converted into urban infrastructure, establish field gene banks for threatened land races and wild genetic resources, promote education on environmental awareness and nature conservation, establish native communities of the Aravalli hills and the River Yamuna basin particularly of the Delhi region, develop mosaic of wetlands that sustain the rich aquatic flora and fauna of the Yamuna and monitor short and long term changes in the ecology of Delhi region.

Thus, Biodiversity Parks act as heritage sites and repositories of the approximately 50, threatened communities of the Yamuna river basin and Aravalli hills, provide ideal alternative habitats for migratory and resident bird species, enhance ground water recharge and augment fresh water availability, act as sinks for CO₂ and other pollutants, ameliorate local weather conditions and buffer ambient temperatures, promote eco-tourism and social connectivity across the urban community, serve as gene pools, and represent unique ecological models possessing not only wildlife and natural values but also aesthetic, environmental and educational values.

CHAPTER 2. Southern Ridge

The southern ridge is the biggest with 6200 hectares of land while the total ridge area in Delhi is 7777 hectares. The issue is that this part of the Ridge is not entirely located in Delhi and so, its management is looked upon by 2 neighboring states. It is important to note that joint management of natural resources has almost always brought up conflict and resultant mismanagement. An important instance is the Cauvery river water sharing conflict between Tamil Nadu and Karnataka dating back to the 19th century. The idea is that water is a tangible natural resource and therefore is disputed upon however; the clean air that the Delhi Ridge charges our environment with is an intangible commodity. This property makes most people ignorant of its value and therefore, no conservation measures are as enthusiastically initiated. Many parts of the Southern Ridge which is notified as reserve forest are not demarcated on the ground. For the Southern ridge approximate areas are

NOTIFIED RESERVED FOREST

1) Official Area of notified reserve forest	62 sq km
2)Area of demarcated notified reserve forest (Forest Dept)	33.25sq km
Asola Sanctuary	19.4 sq km
Bhatti Sanctuary	8.5 sq km
Rajokri (4306 bighas), Rangpuri (1365 bighas), Ghitorni (732 bighas)	5.35 sq km
3)Undemarcated (or Missing) Area of notified reserve forest	28.75 sq km

PROTECTED and NON NOTIFIED FOREST

4) Area of notified protected forest	15.6 sq. km. (Forest Dept. data)
5) Area of non-notified forest surrounded by encroachments	1.22 sq. km.

FOREST ON GROUND FROM MAPS

6) Actual Area of all forest remaining	61 sq. km.
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MISSING NOTIFIED FOREST

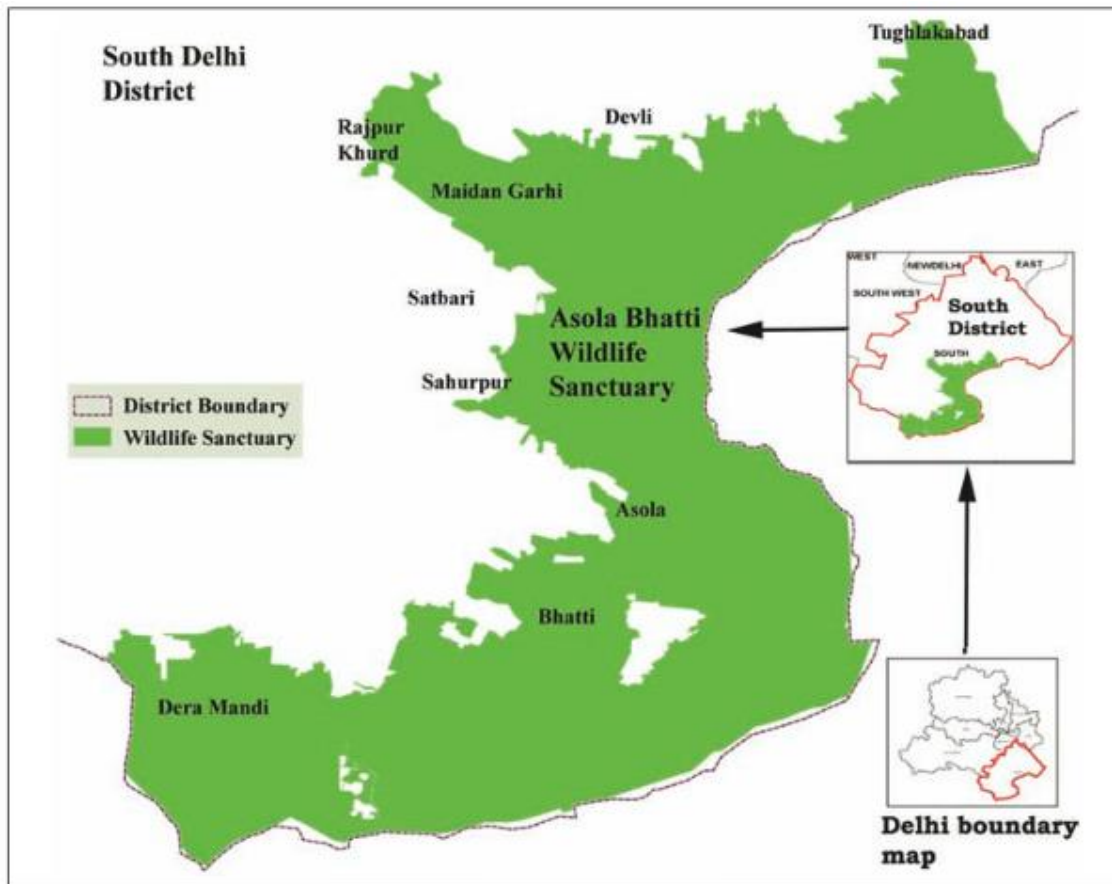
7) Actual Area of all notified (both reserve and protected) forest remaining = 59.8 sq. km.

8) Official Area of all notified (both reserve and protected) forest = 77.6 sq. km.

9) Missing Forest = 17.8 sq. km.

All the remaining forest needs to be urgently notified.

CHAPTER 3. Asola Wildlife Sanctuary



3.1 Introduction

Being the National Capital Territory, Delhi harbors a wide variety of opportunities for livelihood and related facilities both in the public and private sectors. This leads to an influx of people from all over the country, leading to a considerable rise in Delhi's population reflected in every census report. By 2015, Delhi is expected to be the third-largest metropolis in the world after Tokyo and Mumbai. The Asola Bhatti Wildlife Sanctuary is unique in being the only Sanctuary in the urban conglomeration of NCT of Delhi, harboring flora and fauna indigenous to oldest Indian Aravalli hills.

Asola-Bhatti Wildlife Sanctuary lies at the far southern edge of the city of Delhi, at Asola near Tughlaqabad in the Delhi National Capital Territory of India. It covers a vast area of over 6800

acres and contains many species of flora and fauna. It is located on Southern Ridge, the northern terminal of Aravalli Hill Range, one of the oldest mountain systems of the world.

The sanctuary has the following boundaries:

- **North** - Sangam Vihar and Durga Vihar colonies bordering Mehrauli - Badarpur Road.
- **South** - Inter - state border with Haryana.
- **East** - Haryana interstate border and road from Tughlaqabad Fort to Suraj Kund.
- **West** - Asola, Fatehpur Beri and some other villages of Delhi and Haryana State

In order to preserve the sanctity of the area, 12,860 Bigha and 12 biswa (2,679.29 acres) of land was carved out from the community land of three villages namely Asola, Sahurpur and Maidan Garhi and notified as Asola Wildlife Sanctuary under the Wildlife (Protection) Act, 1972 .After imposing a ban on the mining of Badarpur, and in the larger interest to protect the ecology of the area, 2,166.28 acres of village Bhatti was notified under section 18 of the Wildlife (Protection) Act, 1972 as the Asola Bhatti Wildlife Sanctuary (4,845.57 acres).

3.2 Bhatti Mines: A part of Asola Wildlife Sanctuary

The village Bhatti Mines was settled for the Pakistani Hindu Refugees by Late Shri Sanjay Gandhi. Refugees and laborers of Rajasthan, Haryana, UP, Bihar especially 'Kumhar' lived here with hard labor and all the few money saved was spent to make a shelter here. The laborers have contributed a lot in digging and making canals, water reservoirs, protection of forests etc. The villagers had their own mines in 1970. They had their licenses to run the mines. People of the village digging the rocks and mines and drawing BAJRI (Red Sand) from them contributed a lot in the developments of Delhi and the whole nation. There has been a history of illegal mining within the sanctuary and surrounding Delhi Ridge hill area for red badarpur sand and stone which are always in hot demand for building activity and construction. The surrounding area is also known as Bhatti mines. There are large open and deep pits in the ground all over the sanctuary and many are lying abandoned for years and turn into ponds of water in the rainy season.

3.3 Threats & challenges faced by Asola Wildlife Sanctuary

According to one of the reports of Times of India, Asola Bhatti Wildlife Sanctuary, a home to more than 100 bird species against just 74 found in the open in Delhi Zoo the place is a live birdsong orchestra. But just 10 years ago, it was a barren, strip-mined ecological ruin marked with dangerous pits. On one summer day, in 1990 when seven mine workers fell to death in one of them, rang the curtain down on three decades of unregulated mining in Bhatti, but it took the Army and the Delhi government a decade to transform the wasteland into a thriving forest with a

vibrant ecosystem. Since 2001 when the area with more than 200 mining pits was handed over to the Eco Task Force (ETF), a battalion of retired Army staff commanded by serving officials, more than a million saplings have been planted here. Many of them are now full-grown trees, making Bhatti Mines one of the most ecologically rich areas in the city. Also 36 of the 200 mining pits now serve as water bodies.

The absence of forest boundaries has also led to encroachments. In April, 2014 Hindustan Times has revealed how illegally-built sprawling farmhouses have wiped out hundreds of acres of precious forestland in south Delhi's Asola Bhatti wildlife sanctuary. As per the govt. sources the encroachers have altered forest boundaries and destroyed wildlife habitats by building illegal farmhouses and individual approach roads.

According to Delhi Forest Department, the number of wild animals from Asola Bhatti wildlife sanctuary and adjoining Aravallis being killed on the road is on the rise. Most of such kills happen due to speeding vehicles on the stretch. There are reports of such accidents almost every alternate day now. Jackals, blue bulls (nilgai), hare and reptiles are most vulnerable.

Also, the MCD is seeking possessions of Bhatti Mines area as an alternative landfilling site. "The present application is being filed due to immediate and urgent necessity of obtaining a fresh sanitary landfill site in Delhi," the MCD plea begins. The MCD plea also points out that Bhatti mines area has already been cleared by the Ridge Management Board and an Environment Impact Assessment study has been conducted which declared this area to be suitable for a sanitary landfill site to be used for solid waste disposal. The Government now believes that dumping municipal waste in the ecologically sensitive Bhatti Mines – which being far away from human habitation provided an ideal area in a congested city for disposal of municipal waste -- would lead to an ecological disaster.

3.4 Nearby slum area

Sangam Vihar is considered one of the largest unauthorized colonies of Asia and has a population close to 2 million. This is a slum colony with many small houses and temporary settlements. The area is mostly inhabited by underprivileged sections of the society who do odd jobs to sustain in the city. The area is a home to many domestic helpers and drivers. It has no water supply in many of its areas and the people here struggle day & night for the basic amenities of life.

3.5 Bombay Natural History Society (BHNS)

The Bombay Natural History Society, founded on 15 September 1883, is one of the largest non-governmental organizations in India engaged in conservation and biodiversity research. It supports many research efforts through grants, and publishes the Journal of the Bombay Natural History Society. It is designated as a Scientific and Industrial Research Organization (SIRO) by Department of Science & Technology, Government of India.

3.6 Tourism

The main Attraction in the Asola area now is the Conservation Education Centre (CEC) in the Forest Department building run in collaboration with the Bombay Natural History Society and Government of NCT Delhi. It is modeled on the CEC in Sanjay Gandhi National Park, Mumbai. The CEC in Asola Wildlife Sanctuary runs nature trails through the scrub jungle, exposing floral and faunal element, topography of the area. Here one can get a comprehensive package of information on Flora Fauna and also on how to help to conserve them.

CHAPTER 4. Bharatpur National Park

We had the pleasure of meeting **Mr. Navin Kumar Tiwari** who is currently working at the **Department of Environmental Science, University of Delhi** and is currently pursuing an extensive research project of studying the behavior of painted storks at Bharatpur Wildlife Sanctuary and visits the Bharatpur Wildlife Sanctuary almost every weekend.

He gave us a rich insight to the ecological and economic value of the place and also provided us with rich text regarding the place including the book – Gardens of God, The Waterbird Sanctuary at Bharatpur written by *Kailash Sankhala* for literature review. Being an enthusiastic bird-watcher himself, he has also provided us with numerous images for our web-app inventory.

The National Research Council (NRC 1992) illustrates a goal-oriented definition of ecological restoration: "the return of an ecosystem to a close approximation of its condition prior to disturbance." While attractively simple at first, this definition presents two questions that are at the core of restoration ecology.

First, what frame of reference should be used as the pre-disturbance condition? A true pre-disturbance condition almost never exists; some approximation must be chosen, which is often difficult in areas of extreme disturbance (e.g., urbanized landscapes).

Second, what comparisons should be made between recovering and reference areas?

We have chosen Bharatpur Wildlife Sanctuary as a frame of Reference for the Asola Sanctuary because of:

1. Geographical proximity of the two green areas
2. Climatic condition similarity
3. Comparable area
4. High incidence of common tourists visiting Delhi and Bharatpur as discussed in the tourism triangle mentioned below

Area

The district has an area of 5,066 km². It is bounded by Gurgaon districts of Haryana on the north, Mathura and Agra districts of Uttar Pradesh on the east, and the Rajasthan districts of Dholpur on the south, Karauli on the southwest, and Dausa and Alwar on the west.

Political Control

Presently, Bharatpur Lok Sabha constituency comprises seven Vidhan Sabha (legislative assembly) segments. These are Kaman, Nagar, Deeg-Kumher, Bharatpur, Nadbai, Weir, Bayana-Rupwas.

History

Maharaja Suraj Mal founded Bharatpur in 1733 AD and was a well bastioned city. According to a popular legend, Bharatpur derives its name from Bharat, the brother of Lord Rama who was one of the incarnations of Vishnu. Bharatpur was under the dominion of the Jats in the 17th century.

During the British Raj, the state covered an area of 5,123 km² and its rulers enjoyed a salute of 17 guns. The state acceded unto the Dominion of India in 1947. It was merged with three nearby princely states to form the "Matsya Union", which in turn was merged with other adjoining territories to create the present-day state of Rajasthan.

Bharatpur has been included as a part of Delhi's National Capital Region (NCR).

Bharatpur and surrounding areas including the sanctuary was believed to be part of Braj Bhoomi, which is closely associated with Lord Krishna. Mathura, birthplace of Krishna, is 40 km away, while Vrindavan is mere 15 km away.

The Bharatpur Lake was created as a result of efforts to save the princely capital from floods during monsoon. Maharaja Suraj Mal, the then ruler of Bharatpur, decided to construct an earthen dam (Ajan Dam) in 1760. The earthen dam was created at the confluence of Gambhir and Banganga rivers. The crater left behind by excavation of soil for the dam became the Bharatpur Lake. A system of barriers and drain gates were added to regulate the flow of water in different sections. With the growth of green cover soon attracted birds and over a period of time, it became the hunting preserve of Bharatpur royals.

The first duck shoot in Keoladeo Ghana was inaugurated by Lord Curzon along with Lord Kitchner, the Commander-in-Chief on December 1, 1902. Stone plaques near Keoladeo temple speak about the exploits of visiting dignitaries since 1902.

Economy

The economy of Bharatpur district is dependent to a large extent on agriculture and its products. The main crops grown are wheat, mustard, cotton, red-chillies and potatoes. There are more than 60 oil mills in Bharatpur due to mustard grown in large quantity in the surrounding areas. Bharatpur is famous for its sweets, and has a large number of shops also.

In some areas stone quarrying is also practiced. The Red Fort of Delhi, Agra Fort, and Fatehpur Sikari were built with local stone.

Keoladeo (Ghana) National Park

In the past it was the royal hunting preserve of the Bharatpur princes but now it has become one of the famous bird sanctuaries that is the abode of about 400 varied species of birds including water birds, exotic migratory birds from Afghanistan, Siberian cranes from the Arctic, Greyleg

Geese from Siberia and Bareheaded Geese from China. It is spread over an area of 29 square kilometers.

Keoladeo Wildlife Sanctuary, popularly known as Bharatpur Wildlife Sanctuary, is perhaps the only wildlife preserve, where the wildlife habitat has been created by a man - the Maharaja of Bharatpur. In earlier times, Bharatpur town used to be flooded regularly every monsoon. In year 1760, an earthen dam (Ajan Dam) was built, to save the town, from this yearly vagary of the nature. The cavity created by removal of soil for the dam was cleared and the Bharatpur Lake was formed.

At the commencement of this century, the lake was developed, and was divided into several sections. A system of small dams, barriers, drain gates, etc., was created to control water level in different parts. This became the hunting preserve of the Bharatpur royalty, and one of the best duck - shooting wetlands in the world.

Bharatpur District is famous for the Keoladeo National Park, a major wintering area for migratory birds. Established as a duck-hunting reserve by the Maharajas of Bharatpur, it was known as the best duck shooting resort in the British Empire. The site was declared a bird sanctuary in 1956 and later upgraded to National Park. Keoladeo National Park attracts 364 species of birds, including many from India, but also from Afghanistan, Turkmenistan, Siberia, China and Tibet, including the rare Siberian Crane. As the monsoons arrive and the wetlands and marshes start to fill with water, birds start pouring into the park. Hunting was prohibited by mid-60s. The area was declared a national park on 10 March 1982, and accepted as a World Heritage Site by UNESCO in December 1985.

The name "Keoladeo" is derived from the name of an ancient Hindu temple devoted to Lord Shiva in the sanctuary's central zone while the Hindi term "Ghana" implies dense, thick areas of forest cover. It is mainly famous for Siberian crane. It was the only habitat of Siberian crane in the world, other than Siberia. Now with course of time, this endangered species has stopped reaching the park. The main reasons for this are being cited as lack of conservation measures in India, diversion of water for farmers instead of saving the wetlands as per then Chief Minister Vasundhara Raje's orders hunting during migration in Pakistan and the Afghanistan as well as the war against Taliban in Afghanistan.

The Ecological System in Bharatpur Sanctuary

The Flora in the Bharatpur Bird Sanctuary

The Bharatpur Bird Sanctuary has a dense forest cover, which shelters a diverse flora. The vast flora is responsible in providing natural habitat to these migratory birds and also haven of free natural perpetuation. The diverse plant species found here are real exceptions to the region.

Avifauna in the Bharatpur Bird Sanctuary

More than 300 species of birds are found in this small wildlife park of 29 sq-km of which 11 sq-km are marshes and the rest is scrubland and grassland. The major attractions of tourists visiting the park are the numerous migratory birds, which come from places as far away as Siberia and Central Asia and spend their winters in Bharatpur, before returning to their breeding grounds. Migratory birds at Bharatpur bird sanctuary include, several species of Sarus Cranes, Pelicans, Geese, Grey Heron, Ducks, Eagles, Brown long eared bat, Hawks, Shanks, Stints, Garganey Teal, Wagtails, Warblers, Wheatears, Flycatchers, Buntings, Larks and Pipits, etc.

The Fauna in the Bharatpur Bird Sanctuary

The Bharatpur Bird Sanctuary is also inhabited by Sambar, Chital, Nilgai and Boar. The thick forest is an excellent breeding and survival ground for these animals. These are the four most prominently spotted animals in the premises of the Sanctuary.

Birding Trips in the Bharatpur Bird Sanctuary

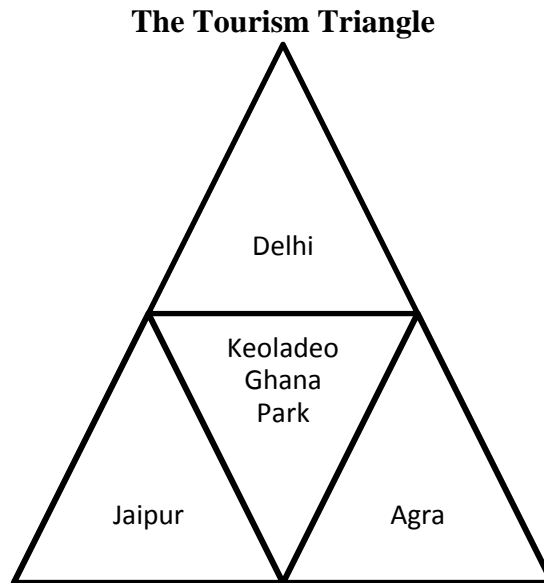
Walking & cycling along the raised embankments offer an opportunity to get close to the rich bird life. A cycle rickshaw is another way of exploring the sanctuary. There are well-defined forest paths, which can easily be reached by foot or on a cycle or you can also hire a rickshaw that are available on hire. Rickshaw pullers have been trained by the park management in bird watching and are quite knowledgeable. Boats are also available on hire.

Keoladeo Ghana Park and Eco-tourism

The Keoladeo Ghana Park reports an estimate of INR 1.2 crore – 2 crore revenue generation each year. This has enhanced its fund for protection as well as incentivized it.

It is now looked upon as income for the various stakeholders involved at Bharatpur and the local native who earlier fought for establishing a paddy field instead have now become closely involved with the conservation dynamics.

The park is very fortunate to have a huge locational advantage that brings a huge tourist inflow every year and that is:



Most tourists that visit North India tend to follow the tourism triangle of Delhi-Agra-Jaipur.

As has been depicted above, the Keoladeo Ghana Park falls exactly in the route of these tourist and most tourism agents add a visit to Bharatpur to the itinerary to generate more revenue. The other neighboring places like Sariska and Ranthambore do not receive as many tourists because the way to reach them lies outside the roads taken between Delhi-Agra-Jaipur triangle.

Bharatpur therefore, receives major revenue from the eco-tourism that it attracts by virtue of its accessibility and popularity which has come about through the initiatives of its effective Natural Resource Management.

An interesting initiative observed at Bharatpur is the creation of eco-resorts. These are very different from the conventional fancy resorts in the sense that they re-create the jungle ambience for people to reside in. This initiative is directly linked with eco-tourism.

Book:

Gardens of God; The Waterbird Sanctuary at Bharatpur

We consulted this book written by Kailash Sankhala to gain more knowledge about Bharatpur – its history and present.

“The sanctuary was once the happy hunting ground of duck shooters. It was well maintained during the princely regimes but since then has passed through many vicissitudes. Once it was thought that its water could be drained for more useful irrigation and the area could be put under deep water paddy cultivation for growing more food for the hungry millions. For many decades, it was subjected to excessive cattle grazing destroying its vegetation and threatening its very

existence. Fortunately, there were always some people to rescue it. Salim Ali was one to voice his concern and to appeal for its preservation three decades ago. Coincidentally, I picked up the issue of having it declared a Sanctuary in 1956. It was again my privilege to have it declared as a 1981 and to take the matter to its logical and effectively enforce the provisions of the law. All of this would have been in vain but for Srimati Indira Gandhi's personal interest which saved the sanctuary from disaster.” – *Kailash Sankhala*

“The sanctuary at Bharatpur is not a mere physical location. It is a rich complex of woodland, swamps, wet prairies, and dry savanna which supports 369 species of birds, representing the majority of the families of the avian kingdom.”

This book beautifully illustrates how Bharatpur as an ecosystem is crucial for our generational sustenance. It also focusses on how it is a place of rich avian diversity that should be protected for all indigenous as well as traveling people and that Bharatpur truly deserves being on the list of World Heritage Sites maintained by UNESCO (Unites Nations Educational Scientific and Cultural Organization).

CHAPTER 5. Eco-tourism

Eco Tourism is one of the latest additions to the tourism industry, which is fast gaining momentum. It is a responsible tourism to the natural areas, which conserve the ecology and promotes the welfare of the people. It entertains the visitors in a way that it does not affect the world's natural and cultural environments. In fact it is one of the fastest growing sectors of the tourism industry. The revenue generated from the tourism industry encourages the state and central government to fund various conservation programs in a country.

This culturally responsible and high quality environment friendly tourism is capable of satisfying the visitors in all aspects. Each one of us has a responsibility towards the environment, whatever it is, weather a nature camping tour or the trekking trip; one should always keep in mind not to disturb the nature. Well said “take nothing but photographs, leave nothing but footprints”. Eco tourism ensures the survival of the attractions of the nature and culture, without harming the resources. Eco tourism is a sound environmental tourism, which is promoting nature travel as the hottest eco correct activity available. It focuses tourism to the destinations where flora -fauna, cultural and historical heritage are the prime attractions.

Is the Eco Tourism Beneficial? Undoubtedly, Yes! That is because the eco-tourism is a nature based tourism which preserves the nature and the cultural values of the locals.

- Eco Tourism minimizes the negative impacts on the local people and the natural environment.
- Eco tourism directs economic and other benefits to the local people by providing them employment.
- It promotes conservation of natural assets and enhances the cultural integrity of the local people.
- Eco tourism has become the major source of income and is attracting lot of travel agencies than ever before.
- It promotes the preservation of wildlife and the natural habitats.
- Providing positive attitude and experience among the travelers.
- Eco tourism supports the international labor agreements.
- Ensures that the natural resources are conserved and managed properly so that they could be saved for the future generations

On the other hand if eco-tourism is not monitored properly it can be as damaging as the mass tourism:

- It is the major threat to the rich biodiversity and natural habitats of the wilds in the jungles.
- Eco tourism tends to conserve the environment at the expense of the development prospects for the third world communities.
- Located in the eco systems, eco-tourism projects it is the biggest obstacle in the way of the development of the environment.
- Competition for eco-tourism income between the various groups leads to social disharmony.
- Increased use of resources by the human population, even in the smallest sense cause problem to the environment.
- Another major threat to the environment is the production waste and effluent pollution as well as increasing human activities like logging, and agricultural clearance.

CHAPTER 6. Habitat Fragmentation

This concept can be best understood by the famous joke within the academic communities:

Why did the chicken cross the road?

“To get to the other side”

While one may expect a traditional punchline, twist and humor, this is an instance of anti-humor where the joke is on the fact that the chicken has been faced with the need to cross the road and that has happened because its habitat has been fragmented.

More scientifically, habitat fragmentation describes the emergence of discontinuities (fragmentation) in an organism's preferred environment (habitat), causing population fragmentation. Habitat fragmentation can be caused by geological processes that slowly alter the layout of the physical environment or by human activity such as land conversion, which can alter the environment much faster and causes extinctions of many species.

One of the major ways that habitat fragmentation affects biodiversity is by reduction in the amount of available habitat (such as rainforests, boreal forests, oceans, marshlands, etc.) for all organisms in an ecological niche. Habitat fragmentation invariably involves some amount of habitat destruction. Plants in these areas are usually directly destroyed. Mobile animals (especially birds and mammals) retreat into remnant patches of habitat. This can lead to crowding effects and increased competition.

Case Study: Elephant Corridors of India WTI project

Habitat fragmentation is one of the major threats to India's wildlife. Large, migratory mammals like Asian elephants, with vast resource requirements, are among the worst affected. Historically spread across most of the country, the Asian elephants' home range has now shrunk to about 110,000 sq km of fragmented forests scattered across northeast, northwest, central and south India.

Many of these isolated elephant habitats are further threatened by fragmentation due to developmental activities. Several of these habitats are crucially connected by corridors, which too are steadily being erased by human invasion.

Interference in their natural migratory paths has resulted in increased human-elephant conflict and also insidiously in the genetic isolation of Asian elephants in India. One of the main needs for the long-term survival of Asian elephants is connectivity in their habitats, allowing not only sufficient foraging grounds but uninterrupted gene flow to prevent inbreeding. The establishment of corridors and improvement in habitat quality of existing ones to consolidate elephant habitats has emerged as one of the most critically effective methods of maintaining this connectivity.

In 2001, Wildlife Trust of India (WTI) and its international partner International Fund for Animal Welfare (IFAW), with financial support from US Fish and Wildlife Services (USFWS), began an extensive country-wide study to identify critical elephant corridors as the first phase of its National Elephant Corridor Project.

The important lesson learnt in this case is that:

“EVERY GREEN SPACE NEEDS TO BE CONNECTED”

While the concept of habitat fragmentation has not been dealt with at detail for the avian community since they have the advantage of the skies connecting every corner with every other, a green continuity would naturally serve the avian community better. The mobile signal towers etc. and other concrete structures developed overtime with the growing incidence of urbanization are a severe threat to birds that have broad ranged habitats and prefer flying over long distances.

Ecological corridors are continuous regions that connect green spaces while on the other hand habitat patches are small patches of green areas that are created at short distances from each other. While these habitat patches are not suitable for the small or large mammal community, they work quite well for our avian friends.

To observe HABITAT PATCHES within our residential vicinity, we made a field visit to Lajpat Nagar where we observed that Lajpat Nagar – 2 Block A has a RWA (Residential Welfare Association) maintained park which is home to rabbits, white mice, and ducks which is maintained by a colony hired caretaker. The park also provides the ducks a wetland as their habitat. With the proper guidance of our mentor we understood that this park did not only carry its apparent aesthetic value; but it also served as a green habitat patch for habitat maintenance and was a fine example of conservation at work.

On our way we also observed other blocks in the vicinity. A noteworthy observation that emerged was that most colony parks were not well maintained however, most of the private gardens were either very well maintained or had simply been converted to a dumping space or parking space. We concluded that most people did not attach economic importance with the ecology and hence were unwilling to pay for the maintenance of the colony park. This is the mindset that we intend to challenge.

One of the emerging ecological concepts that intend to fix this issue is **Environmental Economics**. While one may be misled to simply think of this as a synonym to Eco-tourism, it is a much broader concept encompassing Eco-tourism under its purview. The important idea in Environmental Economics is to attach a price tag on nature. While it may not seem a very feasible idea to attach price tags with commodities of nature, it can prove to be a strong way to motivate conservation. If a builder is aware or is made to pay against the potential economic value of a tree he intends to fell in order to construct a shopping mall, he will be forced to analyze that the economic value in this case generated by the presence of the tree would exceed

whatever revenue the shopping mall may be capable of earning. This would be a simple economic incentive to discourage him with construction activity in that area where the higher price would reduce the demand. This process initiated by TEEB (The Environmental and Economic value of Biodiversity) which was a project undertaken by the United Nations is also referred to as 'contingent valuation'.

CHAPTER 7. Conservation at Various Levels

We visited the colonies to observe conservation at individual and colony level. At the individual level we observed the kitchen gardens and extensively decorated private gardens are emerging as contribution towards conservation as habitat patches.

We visited some colonies in Delhi where we found people having kitchen gardens at their residents.

Kitchen Garden

At colony level we observed that Lajpat Nagar – 2 Block A has a RWA (Residential Welfare Association) maintained park which is home to rabbits, white mice, and ducks which is maintained by a colony hired caretaker. The park also provides the ducks a wetland as their habitat.

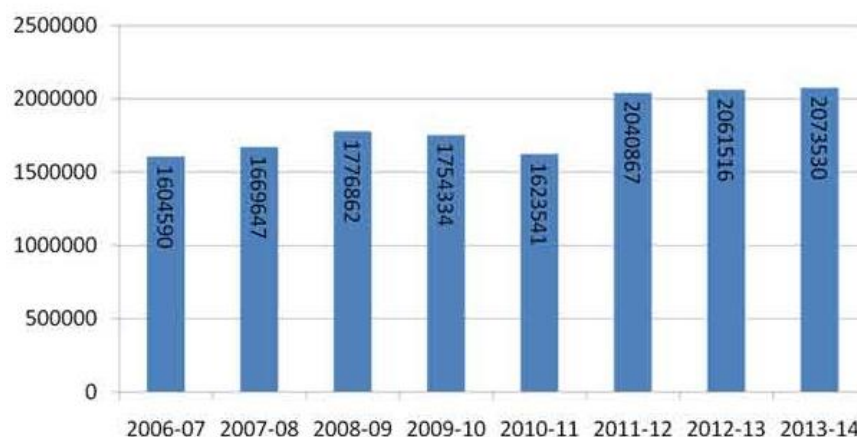
At institutional level we visited the National Zoological Park, Sultanpur bird sanctuary and Yamuna Biodiversity Park.

National Zoological Park

As a part of our semester long project, we visited the National Zoological Park situated in the national capital Delhi to watch conservation dynamics at work and to study the park and draw inferences based upon the observations made upon the visit to the place.

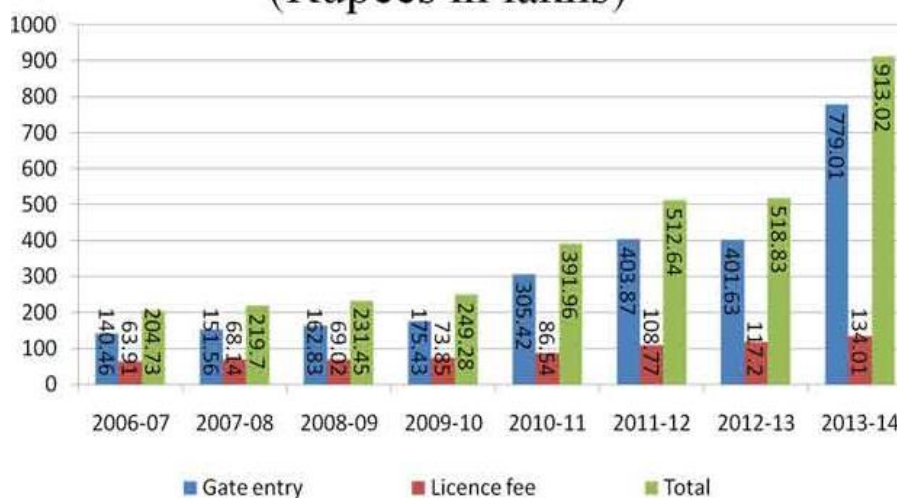
To begin with the entrance; the entry to the place is ticketed. The tickets of the zoo are priced at INR 40 for Adults and INR 30 for Children. The first thought we encountered while entering was whether this ticket price was appropriate enough? After a discussion with our mentor, we concluded that it was a rather wise economic selection. The reason behind this is that INR 40 is less than the round figure of INR 50 which usually raises the brows of most people. This way the demand would not reduce, drawing people to the place at more occasions than one. The foreign tourists are charged INR 200 which is an amount they are willing to pay; so the supply and demand forces concur at a higher price, which makes good addition to the economic revenue generated.

VISITORS



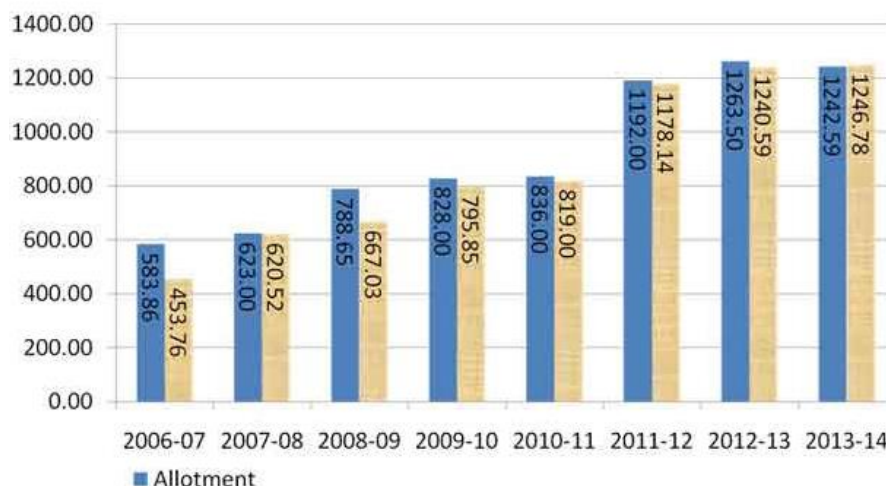
National Zoological Park attracts visitors not only from India but from abroad also. For the first time the total number of visitors who arrived at the National Zoological Park has crossed 2 million mark as 20,40,867 visitors arrived in the financial year 2011-12. This is an all-time record and an impressive growth of about 25% over 16,42,357 visitors who visited National Zoological Park in the previous year i.e. 2010-11. This is a clear indication of the growing popularity of the National Zoological Park in the country in general and NCR region in particular. An account of visitors who have arrived in the National Zoological Park over the last five years from 2007-08 to 2011-12.

REVENUE COLLECTIONS (Rupees in lakhs)



Zoological Park earns its revenue from the gate entry and from the license fee of the battery operated private agency vehicle in the premises of the park which is meant to take tourist in the field trip of the park. The zoological park is witnessing an increasing number of visitors since 2011. Therefore, the revenue earned by zoological park has also increased during the period of 2011-2014.

ALLOTMENT & EXPENDITURE: NZP



The above bar chart represents the revenue allotment to the zoological park and its expenditure. The authorities utilize the revenue earned in the maintenance of the park, for conversing species and by increasing the number of inmate species.

A zoological park is an ex-situ method of conservation as against in-situ. Ex-situ conservation refers to conservation of flora and fauna in premises that are not their natural habitat or places of occurrence. An important question that emerges is whether the zoological park is indeed a morally ethical place to be visited i.e. is it correct to cage an animal? A zoo is traditionally viewed as an instance of a man's dominance over nature. While it may be easily declared as morally unethical but the significant contribution that it has made towards conservation of wildlife cannot be ignored. Like all developing nations, India is obsessed with revenue generation and zoo functions as a revenue generating institution, so therefore the positives would weigh over the negatives of having a zoo.

It is also very important to note that while the numbers of wild animals and birds are staggeringly dwindling, the only way to save them is to primarily monetize their existence, i.e. incentivize people with money to actually save them. This makes people stakeholders who then get directly involved in conservation; which makes conservation a practical concept instead of a mere textbook terminology. It is a noteworthy fact that the involvement of people as stakeholders is more likely to encourage them to appreciate and conserve wildlife.

The National Zoological Park has been created with the intention of promoting education and awareness amongst the masses. The place is filled with sign posts that contain the information about the animal in each enclosure. However, it is very conspicuous that most visitors look upon birds as merely “birds” i.e. they are unable to identify the different birds.

This lack of information is perhaps what makes bird-watching a hobby that is limited only to the avid bird watching peer circles or academic groups. As a part of our project, we have made an attempt to encourage bird-watching for the commons through the creation of an app that helps users identify the birds that they spot. This will encourage the knowledge about birds and more people would be willing to come forward to contribute in their small ways towards conservation of these birds and their habitat.

The park also functions as a site to support scientific research and study, apart from providing tourism and recreation facilities. The endangered animal species are bred and their stocks are raised to be left in the wild when it is appropriate and desirable. The park also functions as a Rescue Centre for orphaned wild animals.

The park does not allow visitors to carry food with them. However, there is a canteen situated within the premises. This is a notable effort to generate revenue along with ensuring that no food is fed to the animals. The park also provides the amenities of a battery run trolley for transportation and transport for physically challenged tourists.

It is still debatable whether the visitors appreciate the idea of conservation or look upon the trip as a lousy afternoon of entertainment. The latter seems apparent from the fact that most visitors casually throw away the leaflet of instructions provided at the entrance.

We also chanced to observe ducks with their heads hidden within their feather and at a very short distance, we saw a rail track and we therefore concluded that the noise generated is a source of disturbance for the wildlife. Another interesting fact is that the cost of ticket for an individual adult is same as the price charged for parking vehicles. This is a clear initiative to reduce the number of vehicles in the vicinity of the National Zoological Park and hopefully, an effective one as well.

It is unclear whether the parents who show the animals to the children are conscious of heightening the children’s sense of appreciation and awe for the wildlife treasures housed at the National Zoological Park. It is definitely not the intention of the zoological park to establish that all wild animals can be caged and that their presence in small numbers in the enclosure ensures their unthreatened existence. Schools and other educational institutions operating in our country have the huge onus of developing these traits among the students. Children of all economic levels of our country have the Right to Education and therefore, assuming that a good proportion of these would actually exercise their right, it becomes extremely important and urgent to develop a culture of conservation among the future of our nation. Even if say roughly, one child

out of 100 families visiting is made environmentally conscious, we will be able to obtain a good number of conscious people.

Sultanpur National Park

As a part of our study we visited the Sultanpur national park. Sultanpur National Park is located at Sultanpur fifteen kilometers from Gurgaon, Haryana. It is an ideal ground for birding and is best visited in winters when a large number of migratory birds come here. Approximately 250 species of Birds are found at Sultanpur Bird Sanctuary. Some of them are resident, while others come from distant regions like Siberia, Europe and Afghanistan.



Sultanpur has a huge natural but man managed wetland which homes thousands of birds. Just like zoological park, national park too has information boards at various sites enlisting the important birds, the migratory birds and other water birds. Sultanpur National Park is in-situ type of conservation i.e. conserving the flora and fauna that occur in the natural habitat. As it homes various birds it was declared as a bird sanctuary due to the work of Peter Jackson, famous ornithologist, and honorary secretary of the Delhi Birdwatching Society, who wrote to then, Prime Minister of India, Indira Gandhi, founder of the society, in 1970 about the need to declare the *Sultanpur Jheel* near Delhi, a bird sanctuary. But it was cancelled at the last minute, but later instructed the Chief Minister of Haryana to protect the jheel and in 1972; the Sultanpur Bird Sanctuary was established. The area was declared a Bird sanctuary in 1972, and twenty years later in 1989, was made a National Park. It has an area of 1.43 square kilometers. It is a protected area where over 250 species of birds have been sighted.

Haryana government has carried out a number of development works at Sultanpur Bird Sanctuary like construction of mounds, widening of paths, four tube wells have also been dug.

Efforts are being made to improve vegetation in area by planting more trees, which are popular with the birds. Earlier before the construction of bandhs and drainage areas around Sultanpur remained waterlogged and attracted a large numbers of migratory birds and hunters, many from the Diplomatic Corps at Delhi. Now however the bird sanctuary is artificially revived using pumped water from the Yamuna River.

Although the visitors are required to take permission to visit the national park which remains closed on Tuesday yet it is most visited spot for bird watchers, environment lovers, researcher and foreigners especially during the winter migration months when thousands of birds visit here from across the globe. There are four watch towers located at different points, an education and interpretation center, a library, films, slides and binoculars for the benefit of bird lovers. A walk along the perimeter of the park takes up to two hours. There is public parking, bathrooms, drinking water facilities and a children's park in it. For those wishing to stay overnight, the park also has a well-appointed guest house with all amenities.

Recently, it has been shut down after nearly forty birds were found dead inside the national park. More than forty birds, mostly coots, which are migratory birds, were found dead the Animal Husbandry Department took blood samples. The authorities have decided to shut down the national park as precautionary measure because of possibility of bird flu.

Source:

<http://www.thehindu.com/news/cities/Delhi/sultanpur-national-park-shut-after-40-birds-found-dead/article6779292.ece>

Yamuna Biodiversity Park

As a part of our project we visited the Yamuna Biodiversity Park to observe the existing conservation dynamics. YBP is a hub of man-made and man-managed wetlands.

Biodiversity forms the basis of human survival on earth. Mutual interaction between the living resources provides them with a stream of tangible and intangible benefits to the human society. Unscientific and unsustainable use of these resources will threaten the very survival of humans. Biodiversity conservation, therefore, is of prime importance.

River Yamuna is a life support system for Delhi and is facing high biotic pressure due to over exploitation, conversion of floodplains and aquatic habitat, pollution and biological invasions. As a result, the river has almost lost its life supporting potentials and resilience and natural self-sustaining ameliorative capabilities.

Recognizing this, the Delhi Development Authority and the Center for Environmental Management of Degraded Ecosystems, University of Delhi initiated a joint-collaboration project

on establishing the Yamuna Biodiversity Park. It falls under the Delhi Biodiversity Foundation of the Delhi Development Authority.

This project is an excellent example of planners working in tandem and close coordination with the scientific community. The mission of this park is to serve as a repository and heritage of biodiversity of Yamuna river basin with ecological, cultural and educational benefits to the urban society and having conservation values.

An interesting aspect of this park is that the fruits grown inside the park are neither sold outside nor consumed by the park officials but are instead preserved as food for the wildlife.

There are two major wetlands along with a few other minor ones. The source of these wetlands is groundwater and rainfall. The park terrain has been constructed in such a way that all the vegetation appears on a slightly elevated platform due to which all the rainwater gets collected downwards, which is inside the water bodies. These wetlands have abundant dragonflies around which eat the larvae of the mosquito laid inside the wetlands thereby contributing to maintaining the hygiene of the wetlands. The park has two bamboo bridges constructed entirely out of bio-resources.

The park has an office of the Nature Interpretation Centre (NIC) which records all the facts related to the park and its transition over the years.

There is an amphitheater as well located next to one of the wetlands where important days/events are celebrated including the World Environment Day, Earth Day, International Wetlands' Day etc.

There is a separate area dedicated for a Butterfly Conservatory which provides a tunneling space for butterflies to lay eggs. The area is surrounded with ambient plants on which we saw eggs and crawling caterpillars. The butterflies help in pollination which is of great ecological value.

The Yamuna Biodiversity Park is presently spread over an area of approximately 457 acres near Wazirabad village on the flat alluvial plains of the Yamuna.



The park plays an important role in improving the environment of Delhi.

Challenges:

The soil in Yamuna Biodiversity Park was initially highly alkaline and sandy with pH up to 9.8 making it extremely difficult for the wild native species to survive. By undertaking the plantation of specific grasses and legume plants, remarkable habitat improvement has taken place with pH varying from 7.6 to 8.2 across the habitat types today. All this has been achieved through biological remediation and no chemical fertilizers (Urea/NPK), insecticides or pesticides are being used in the park. Than instance of biological remediation is of growing *Sueda* grass which is typically a floodplain grass whose leaves turn pink upon the absorption of salt from the surrounding soil.

Some other challenges include the fact that the park is not open to public but can be accessed for educational purposes. This is a challenge because this land is of great importance in the land scarce Delhi. The dogs that enter from nearby places are a menace because they attack birds and their nests. Another issue is that of a nearby tyre resale market which exists at the edge of the park. Initially the native people protested against the formation of this park but have now been allocated jobs as security men, and tourist guides for people visiting the park for educational purposes. These natives have resultantly become more aware and conscious of the importance of the park however, some of them tend to leave plastics and other contaminants within the park.

Certain birds tend to destroy the crops before they can reap to their full bloom for which Net houses and Poly-houses have been constructed. Poly-houses allow the modification of climate for the growth of plants and one can grow summer crops in winters and vice-versa. There are a lot of new buildings coming up in the vicinity, some of which are also factories that release contaminants. They also contribute to the noise pollution which affects the wildlife present in the park.

Goals:

- Conservation of keystone species and other plants and animals that are threatened
- Preservation of the biodiversity of any habitat that is likely to be converted into urban infrastructure
- Establishment of field gene banks for threatened land races and wild genetic resources
- Promotion of education on environmental awareness and nature conservation
- Establishment of native communities of River Yamuna basin particularly of Delhi region
- Development of a mosaic of wetlands that sustain a rich aquatic flora and fauna of Yamuna Monitoring of short term and long term changes in ecology of Delhi region through research

Functions of the Yamuna Biodiversity Park:

- Acts as heritage sites and repositories of approximately 30 threatened communities of Yamuna river basin
- Provides ideal alternative habitats for migratory and resident bird species
- Serves as field gene banks for wild genetic resources of economically important species
- Enhances ground water recharge and augment fresh water availability
- Acts as sinks for carbon di-oxide and other pollutants
- Ameliorates local weather conditions and buffer ambient temperature
- Promotes eco-tourism and social connectivity across the urban community
- Serves as repository of gene pools of 5000 native species of plants and animals of Delhi and its surroundings
- Serves as a field laboratory for understanding how nature works to maintain its diversity
- Represents unique ecological models having not only wildlife and natural assets value but also aesthetic, environmental and educational values

The flora observed includes vegetation of water lilies, *Typha* (bio filtration plants which cleans the water), *Phragmites*, Wood Apple trees, Pomegranate trees, Chikoo trees, *Sueda* grass, *Acacia catetchu*, Spinach, Castor, *Jatropha*, Bamboo, Fungi epiphyte, wild berries, *Hibiscus*, important medicinal plants including Sankhpushpi. The *Jatropha* plant is used to extract its oil which acts as a bio-fuel.

The fauna includes wild boars, Neelgai, porcupines, hare, mongoose, rat snakes, dragonflies, darter, coot, peacocks, grey heron, kites, spotbill ducks, purple swamp hen, shikra (bird of prey), cormorant, scaly breasted munia, spotted owlet, Indian peafowl, yellow footed green pigeon, common tailor bird, turtle, cobras, beetles, butterflies, frogs etc.

The wetlands of the park attract thousands of migratory birds each year. Some of the noteworthy ones include Red Crested Pochard, Eurasian Wigeon, Common Pochard etc.

CHAPTER 8: ICT in promoting Eco tourism

Since tourism has begun to play a key role in many socioeconomic and environment conscious development. So, nature oriented tourism or ecotourism can be used as an efficient and effective tool for protecting and conserving Southern and South central ridge. The International Eco-tourism Society has defined eco-tourism as “the responsible tour to natural areas that conserves the environment and sustains the well-being of local people”.

ICT acts as strong driver of the tourism industry as much attention has been paid to the possible use of ICTs in promoting sustainable tourism strategies. Therefore to conserve the southern and south central ridge from further encroachment an attempt has been made using ICT to promote ecotourism in Asola to encourage birders to visit the place.

Bird watcher web application

Bird watching, also called birding, is a recreational pastime that involves observing wild birds in their native habitat. Bird watching can be useful when discussions take place about possible damage to the environment due to urbanization and other factors. It helps in protecting the birds, because it helps in understanding their needs.

There are nearly 450 bird species in Delhi and it is very difficult to identify all of them. Therefore to encourage bird watching among people and to motivate budding birders, a customized CMS based web application has been made for the bird identification which provides users with google like simplicity to search any bird which they have spotted, just by using certain identifying keywords.

It can also be used as a participative research tool for citizens where users can leave a comment below the bird image about where and when they spotted it which in turn will create awareness about bird watching places in Delhi. Apart from identifying bird, the user can also get to know about few fun facts about the bird along with its scientific and common name. This platform will boost the interest of amateur birders and will help them in getting in touch with other bird watchers too.



FIND YOUR BIRD:



Search using keywords such as *yellow beak, green body, red eyes* etc. [Click here](#) to browse the full inventory.

Innovative methodology

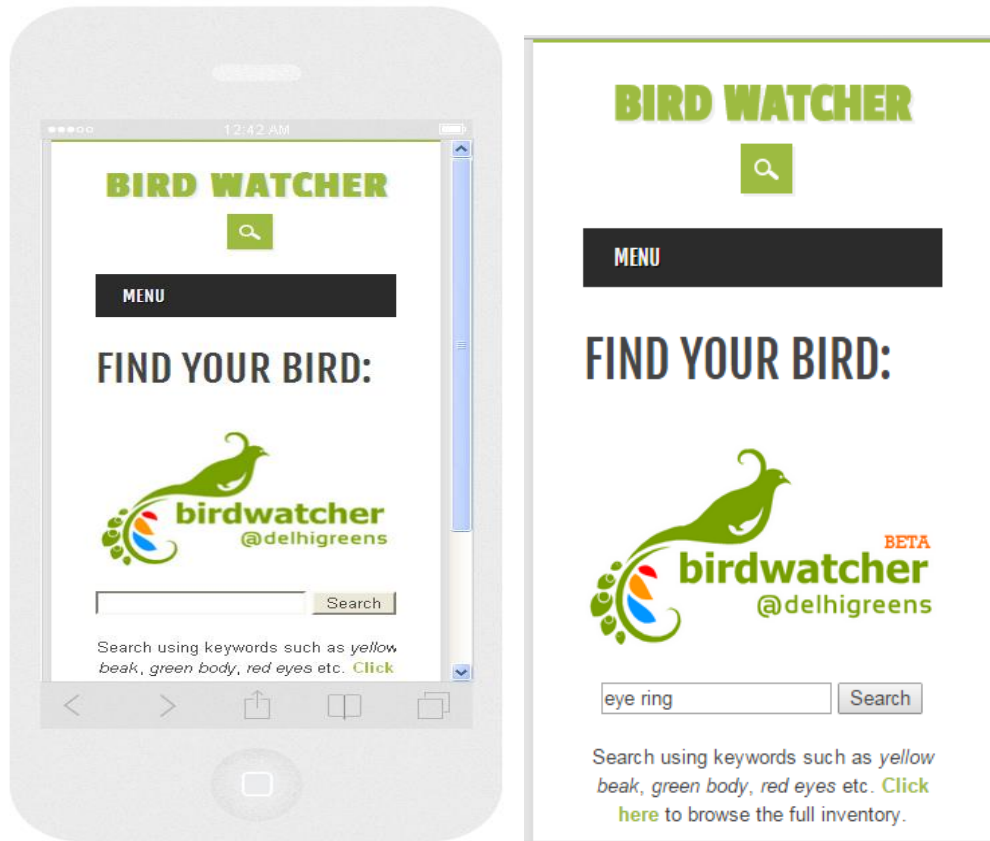
Delhi is a hub of birders. There are many bird watching sites in Delhi. According to a bird watching website, *fatbirder.com*, some of the prominent bird watching sites include North campus, South campus (JNU), Yamuna River, Asola. Birders usually try to capture the spotted birds in their camera. They only prefer to share those images with their peer groups through social media, bird forum, blogs etc. In order to keep the images clicked by them copy protected, they water mark them before putting it on internet as some of the images are of rare birds and are very difficult to be captured in camera.

The bird images used in web application, bird watcher, are the images donated by various bird watchers in Delhi. So, bird watcher is also a platform where birder can share the bird images clicked by them with others.

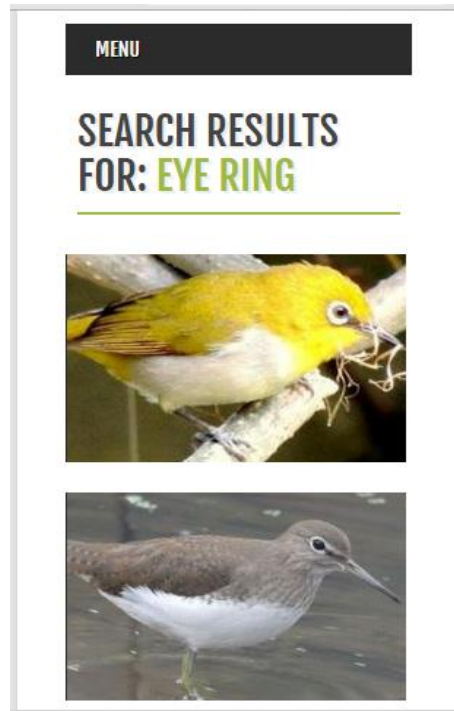
Bird watcher being a non-profitable web application, it will be published under creative commons licensing. It is a simple, standardized way to grant copyright permissions to their creative work. Creative common license creates a vast and growing digital pool of content that can be copied, distributed, edited, remixed, and built upon, all within the boundaries of copyright law. This license will help in building the inventory of the bird watcher web application.

User guide for the web app

- Spot a bird in the area
- Open the web-app: *birdwatcher.delhigreens.com*
- Identify any one of the features and use it to search. E.g., bird with eye ring



- The moment you press the search button a search list with the birds' images possessing that key feature will appear on your screen

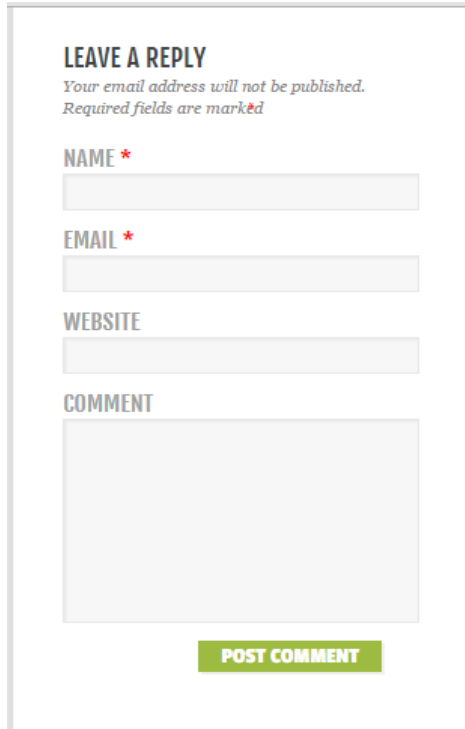


- From the given thumbnails the user has to identify the bird he or she had spotted
- Click on the image of the bird to be navigated to the information page about that bird



In case of “No Results Found”

- If you searched any bird using web-app and found no result then you can leave a comment or donate a photograph of that bird (if you have) to update the inventory. Your contribution will be acknowledged.



LEAVE A REPLY
*Your email address will not be published.
Required fields are marked **

NAME *

EMAIL *

WEBSITE

COMMENT

POST COMMENT

Why WordPress?

For making web application for bird identification, free and open source software was required. Various open source and free software like drupal, jumala, magento, wordpress were explored for this purpose. Like Drupal, Joomla is free to use on own web servers, but there is no option to have it hosted for free like WordPress offers. WordPress works well for small to medium sized websites & blogs while Joomla is good for E-commerce websites and is more tedious to work with than WordPress. Drupal is the most complex of them all but it has the most powerful CMS while Magento is majorly used for making E-commerce sites.

Therefore for making the web application word press was chosen over the rest because of its simplicity, ability to handle images and its blog like commenting or information sharing feature.

CHAPTER 9: Why have birds been chosen for our study?

Birds being mobile creatures are excellent “**URBAN SUSTAINABILITY INDICATORS**” because birds have two primary survival needs:

- Trees
- Wetlands

Birds occur on land, sea and freshwater, and in virtually every habitat, from the lowest deserts to the highest mountains. Our knowledge of bird species can tell us a great deal about the state of the world and wider biodiversity. Patterns of bird diversity are driven by fundamental biogeographic factors, with tropical countries supporting the highest species richness.

There is much debate over what factors have been important in driving global patterns in biological diversity. The existence of big geographic differences in bird species diversity is thought to result from the differing conditions experienced over evolutionary time. Particularly influential is the variety (and area) of different habitats present.

Birds are important components of the world’s ecosystems, so the state of the world’s birds tells us a lot about the state of the environment.

Delhi also stands as the second richest bird capital after Kenya’s Nairobi. An important observation we have made while reading related and unrelated literature for the project, is that in the Southern and North East part of India birds are a celebrated commodity in the sense that bird-watching workshops and training and bird festivals are organized in these parts.

For instance, “The Kerala Forest Department and the Cochin Natural History Society (CNHS) are jointly offering a training program for the bird enthusiasts for correctly identifying in wetland and common birds seen in Kerala” featured in the National Daily – The Hindu dated 31st December, 2014.

In Northern India none such initiative has emerged except for the traditional ‘**Big Bird Day**’ where peer groups race to note the highest number of species of birds in Delhi and at the end of the day meet at a common ground and compare their lists; the group with the highest numbers is awarded. This too, sadly, is limited to the academic or peer circles, leaving little enthusiasm for the commoners.

We suggest that Delhi holds its own Bird Festival for the civil society to come closer to its avian friends and we would also like to conduct a training session for people to use our web-app in order to enjoy bird-watching.

Scope and Limitations

The scope of the project includes:

- Since the collection of images from bird watchers is a tedious process, we are awaiting more bird images to complete our bird inventory.
- Currently only a single image has been featured for each bird on the web pages. More images of a bird can be added to the existing inventory. Images of bird from different sides will help the amateur bird watchers for better identification of the birds.
- The birds can be classified under various scientific categories. Once the inventory is completed, birds can be classified under the appropriate category.
- Birds are often associated with symbolism and mythological stories. By archiving these local stories and related myths along with the bird image, birders will be able to understand the behavior of people towards the birds and many other interesting facts.
- People also use sound as an identification feature for birds. An audio of each bird's voice can be featured on the web page next to its image. That will help facilitate the user to not only know what the particular bird looks like but will also get to know what the bird sounds like.
- A similar platform can be made for tree identification too which will also promote environmental awareness and the need of conserving it. This idea has been derived from the study of the book 'Trees of India – A field guide' which has been authored by a budding filmmaker turned environmentalist – Pradip Krishen.

Conclusion

Through the course of our project we have learnt to appreciate the ecological and economic value of the Delhi Ridge. We have also witnessed the conservation dynamics operating at the different levels. We have been familiarized with the concept of habitat fragmentation and have understood the importance of ecological corridors and habitat patches as in the case of avian kingdom. We have been able to closely associate ourselves with eco-tourism concept and familiarize ourselves with the basic idea of environmental economics. As a part of our detailed study we have learnt about the Bharatpur Wildlife Sanctuary and have been able to discuss at length its reference for the Asola Bhatti Sanctuary. After making a few detailed visits to the two, we would be able to identify and create a model for replacing the mismanagement of Asola with the Bharatpur model and our research work would have the potential to bring to light the crisis of the Delhi Ridge or the Southern and South Central Ridge to be more specific.

The idea of creation of a web-app for newbie bird watchers has been a thorough success where we have presented an app with Google like simplicity for the users. This app has been able to individually encourage us to engage in the pleasures of bird-watching. We have also found it to have a good response among few users which included some of our institution colleagues.

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- Book: Gardens of God; the Waterbird Sanctuary at Bharatpur by Kailash Sankhala