

# Sustainability Appraisal and Economic Valuation of North Delhi Ridge Using Participatory Research Approach

Govind Singh<sup>1\*</sup>, Alok Sharma<sup>2</sup>, Ishani Gupta<sup>2</sup>, Pratibha Baveja<sup>2</sup>

<sup>1</sup>Department of Environmental Studies, Indraprastha College for Women, University of Delhi

<sup>2</sup>Delhi Greens, P.O. Box 4855, New Delhi

**Abstract:** Delhi Ridge is the Northern extension of the Aravalli hill range and is a prominent landscape feature of the National Capital Territory (NCT) of Delhi. Presence of Delhi Ridge, along with River Yamuna, has been of strategic significance in the selection of Delhi as a capital city since ancient times. Modern Delhi has grown beyond the physical boundaries of the Ridge and the Yamuna. The once barren Ridge has now been transformed into a forest, which provides useful ecosystem services to Delhi. Despite the large number of benefits provided by the Delhi Ridge, the latter is under a constant threat of encroachment and degradation. This is because land is a highly priced natural resource in Delhi. The approximately 78 sq. km area of the Delhi Ridge is thus seen by many as prospective real estate and several legal and illegal structures can be found inside the Delhi Ridge.

The present research contribution is an attempt to carry out sustainability appraisal of the Delhi Ridge by using the principles of environmental economics and participatory research. We focus on the North Delhi Ridge (NDR) and have carried out an economic valuation of NDR using survey based methods. A participatory-GIS approach has been followed to highlight the physical boundary of NDR along with the areas of encroachment. We find that economic value of NDR is much greater than the benefits that may be drawn by modifying its land use land cover to concrete. We also find that in the absence of existing notification on the extent of the NDR, there is rampant encroachment on its eastern and southern side.

**Keywords:** ecosystem services, Delhi Ridge, environmental economics, urban ecology, participatory research

## 1. Introduction

The Delhi Ridge is the vernacular name given to the Northern extension of the Aravalli Range as it passes through the Delhi megacity. The Delhi Ridge is also known as the 'green lungs' of Delhi and is a rocky hilly, reserved forest area, which lends a unique geographic character to Delhi (Mann and Sehrawat, 2008). The Ridge plays a vital role in maintaining salubrious environment in Delhi by acting as a barrier against the hot winds coming from Rajasthan. It also provides critical ecosystem services such as recharging the ground water, absorbing air pollution, purifying the air, providing habitat for urban biodiversity and giving Delhi a 'sense of place' as well as aesthetic beauty.

The once continuous Delhi Ridge is now found in four unevenly fragmented parts. These are: 1) Northern Ridge Forest (0.9 sq km), 2) Central Ridge Forest (8.6 sq km), 3) South-Central Ridge Forest (6.3 sq km) and 4) Southern Ridge Forest (62.0 sq km). The rapid pace of urban growth in Delhi is having a significant impact on the Delhi Ridge in the present day. This impact has been even more prominent in the last few decades and the Ridge is facing threats like encroachment, illegal construction, deforestation and garbage dumping. This is resulting in a gradual degradation of the Ridge (Mohan et al., 2000; Nath et al., 1993). There is also considerable ambiguity in the demarcation and governance of the Delhi Ridge and a large part of this forest land does not even come under the supervision of the Forest Department of the Government of NCT of Delhi.

It is interesting to note that the air quality in Delhi has simultaneously degraded in the same time period. While the degradation of air quality in Delhi may not be a direct result of the degradation of the Delhi Ridge, it is certain that the protection of the Ridge is certainly a pre-requisite

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\*Corresponding author. Email: contact@govindsingh.com

for ensuring clean air in Delhi. The Delhi Ridge therefore needs to be conserved and maintained in order to ensure the environmental health of Delhi.

According to the Geological Survey of India (GSI), 'the Ridge must be maintained in its pristine glory and no further infringements should be permitted'. Recent media reports indicate that the first step towards the conservation of Delhi Ridge is its demarcation. The National Green Tribunal (NGT) had already ordered Government of Delhi to carry out the demarcation of the Ridge in 2013. However, due to reasons that are yet to be established, the demarcation exercise is yet to be completed. It is therefore difficult to conserve the Delhi Ridge in a situation when its perimeter is not adequately mapped out. At the same time, land is a highly priced resource in a megacity like Delhi. Lack of demarcation as well as public interest and pressure could well lead to the modification of the land-use of Delhi Ridge from 'forest area' to 'residential' or 'commercial'. Indeed such modifications have begun to take place leading to a reduction in the overall area of the Delhi Ridge (based on media reports and personal visits).

The present research contribution is an attempt at carrying out the sustainability appraisal of the Northern part of the Delhi Ridge. The boundary of the Ridge has been identified using Participatory-GIS approach. Such an approach has been used previously for identifying the benefits of green spaces (Brown, 2014). The political status of the North Delhi Ridge (NDR) was ascertained along with carrying out a spatial vulnerability assessment of this study area. Various stakeholders of the NDR have also been identified along with attempting to carry out its economic valuation.

The Delhi Ridge is a natural heritage of Delhi and India and it provides some very useful services to the people at large. Despite this, its existence has now become threatened. There is thus a great disconnect between citizens and the very natural resources that support them which has been highlighted in this paper. Since land is a highly priced resource, greater efforts are needed to protect the Ridge. We have attempted to evaluate the economic benefits of the NDR which may prove useful in developing a conservation strategy for Delhi's life supporting system.

## 2. Study Area

The North Delhi Ridge is located in the North Delhi District of the National Capital Territory (NCT) of Delhi between 28°41'34.8"N 77°13'12.9"E and 28°40'04.8"N 77°12'34.4"E. The North Delhi Ridge (NDR) is also

called the Kamala Nehru Ridge and is the smallest among the four parts the Delhi Ridge. According to Government of Delhi, NDR occupies an area of 87 ha and constitutes 1.13 % portion of total Delhi Ridge area (DoE-GNCTD, 2014). There is, however, ambiguity on the total area of the NDR and the Survey of India has previously reported it to be 82 ha (SOI, 1976). NDR consists of quartzite rocks formation and is the rocky outcrop of the Aravalli Hill range. The NDR part of the Ridge has University of Delhi on its Western and South-western side, Civil Lines on its East side and *Timarpur* residential area on its Northern side (Fig. 1).

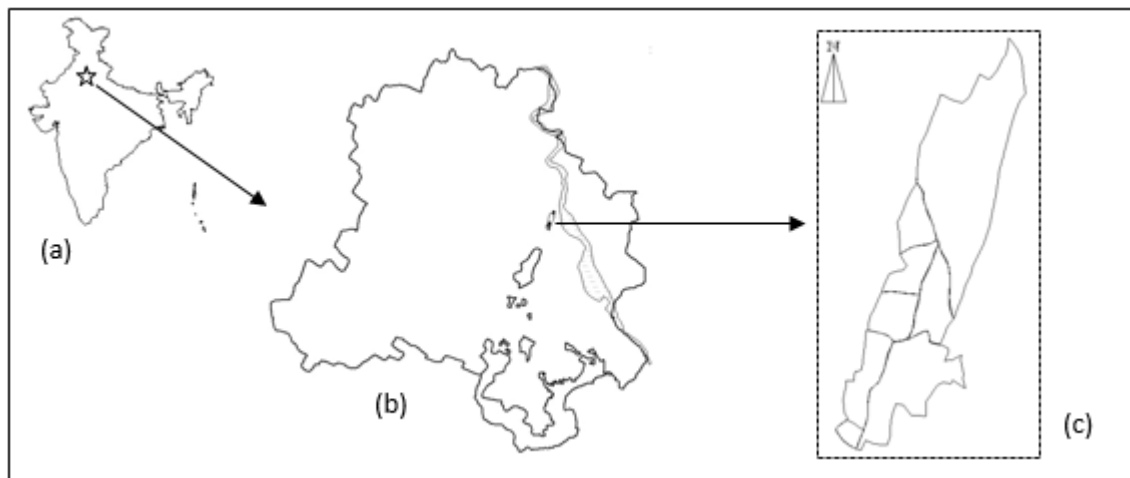
### 2.1 Ridge Management

Three different agencies manage different parts of the North Delhi Ridge and the parts are unequally divided. The Delhi Development Authority (DDA) manages the largest among these parts (73 ha) while the North Delhi Municipal Corporation manages 11 ha of total 87 ha. Interestingly, the Forest Department of the Government of Delhi manages only about 3 ha of the total NDR area. It needs to be noted here that the Delhi Ridge has been notified as a 'Reserve Forest' under Section 4 of the Indian Forest Act, 1927 vide Notification No.F.10 (42) - 1/PA/DCF/93/2012-17 (I) dated 24th May, 1994. At the same time, the Hon'ble Supreme Court of India has directed that the Ridge should be maintained in its pristine glory (DoE-GNCTD, 2014).

### 2.2 Historical Importance

Delhi has a rich history which still remains unexplored. Delhi is known to be consisting of seven (+2) cities which have influenced its history and urban planning from time to time. The North Delhi Ridge (earlier a continuous part of the Delhi Ridge) is of considerable significance with respect to the history of Delhi. The oldest structure present inside the NDR can be attributed to the reign of Ferozshah Tughlaq.

Historians believe that Tughlaq had also made attempts to carry out afforestation activity in the Northern ridge in addition to developing it as a game reserve (Horton, 2008). The structures remaining inside the NDR from Tughlaq period are *Chauburja* Mosque, *Kushk-i-shikar* or Pir Ghaib and Ashokan Pillar. The Ashokan Pillar is 10 meter high and was brought to Delhi from Meerut in 1356 as part of a beautification project (WMF, 2014). It is believed that reckless deforestation of NDR took place during the Mughal period and continued till early nineteenth century. In the British period, the first efforts to plant the NDR were undertaken by J.R. Maconachie and Dr. Ross.



**Figure 1.** Map showing (a) location of NCT of Delhi on map of India, (b) location of North Delhi Ridge on map of Delhi and (c) North Delhi Ridge.

This was followed by few others like Rev. G.A. Lefroy and Deputy Commissioner C.A. Barron, all of whom attempted to increase the vegetation cover of NDR (Mann and Sehrawat, 2008). The Ridge holds tremendous relevance from the point of view of the First War of Independence in 1857. The British camped in and around the Northern Ridge after the mutiny took place. NDR was the centre of attention during the British period even before the mutiny. The British Cantonment was located in Civil Lines. The area around the NDR was the administrative hub and hosted buildings such as the Old Secretariat (present day *Vidhan Sabha*) and the Vice Regal Lodge (present day University of Delhi Secretariat). A flagstaff tower was constructed inside the NDR in the year 1826. NDR and the structures inside the Ridge provided refuge to the British army during the mutiny of 1857. A 29.5 meter tall ‘Mutiny Memorial’ was constructed inside the NDR in 1863 after the British regained power.

### 2.3 Ecological Significance

Ecosystem services are of critical importance in rapidly urbanizing megacities like Delhi. The city of Delhi has an alarmingly high population of 16.7 million (Census of India, 2011) and an increasingly consumerist culture. A recent study by Yale University has placed Delhi as the worst polluted city in the world. According to this study, Delhi has surpassed Beijing (EPI, 2014), the latter of which has been known for its pollution problems since a long time (Down to Earth, 2014). This makes it even more important for us to understand and appreciate the ecosystem services provided by the Delhi Ridge. The role of Delhi Ridge as the ‘Green Lungs’ of Delhi needs to be revisited. The ‘green lungs’ metaphor is very relevant as

the Delhi Ridge has been preventing the deleterious impacts of air pollution in Delhi to the greatest possible extent. The ecosystem services tendered by the Ridge can be classified broadly into four categories.

**Provisioning Services** are the supply of goods of direct monetary value to the people for example timber, fish, fiber, fruits etc. These are of immediate benefit to communities living on the fringes of the ridge or those who are encroaching up on it. **Regulating services** underscore the range of functions performed by the ecosystem that cannot be defined in monetary terms but are of great value. The regulating services of the Delhi Ridge are paramount for survival of the citizens of Delhi. The Ridge protects Delhi from the searing winds and sandstorms of Rajasthan and helps in lowering the temperature by retaining moisture. It checks soil erosion, purifies the polluted air, regulates rainfall and recharges the depleting ground water resource. It also regulates global warming by sequestering carbon. These functions are of enormous significance to present day Delhi, which is highly polluted and faces challenges like air pollution and water scarcity regularly.

**Cultural services** are not defined in terms of material benefits but are understood as the needs of society or are understood for the aesthetic benefits that they provide. The Ridge is the only cherished refuge to the threatened urban biodiversity in Delhi. This makes the Ridge an ideal spot for birding. The Ridge enhances the landscape and was in fact landscaped by the British for the beautification of the capital. NDR is inundated with morning walkers who profit from these cultural services. **Supporting services** are difficult to perceive as they are of no direct

benefit to the people. They are basically services that form the basis for provision of all other services and are crucial for the functioning of the ecosystem. Formation of soil, process of plant growth, habitat for species, oxygen from plants, nutrient cycling, primary productivity etc. are some of the supporting services provided by NDR.

### 3. Methodology

The objective of the present research contribution was to carry out a sustainability appraisal of the NDR using survey, participatory GIS and economic valuation tools. Three different survey sheets were prepared, one each for morning walkers, students and tourists visiting the NDR. A random survey was carried out (between 7.00 am to 8.30 am for morning walkers, 12.00 pm to 2.00 pm for students and tourists) to understand the public perception towards the Ridge. This was followed by carrying out an exploratory vulnerability assessment of the Ridge using GPS. Encroachments and other breach of the Ridge wall, as well as structures like waste disposal sites were noted and marked on the map of the NDR using MapInfo GIS software (v.10.0). An attempt has also been made to carry out the economic valuation of the NDR using rapidly developing environmental economics methods.

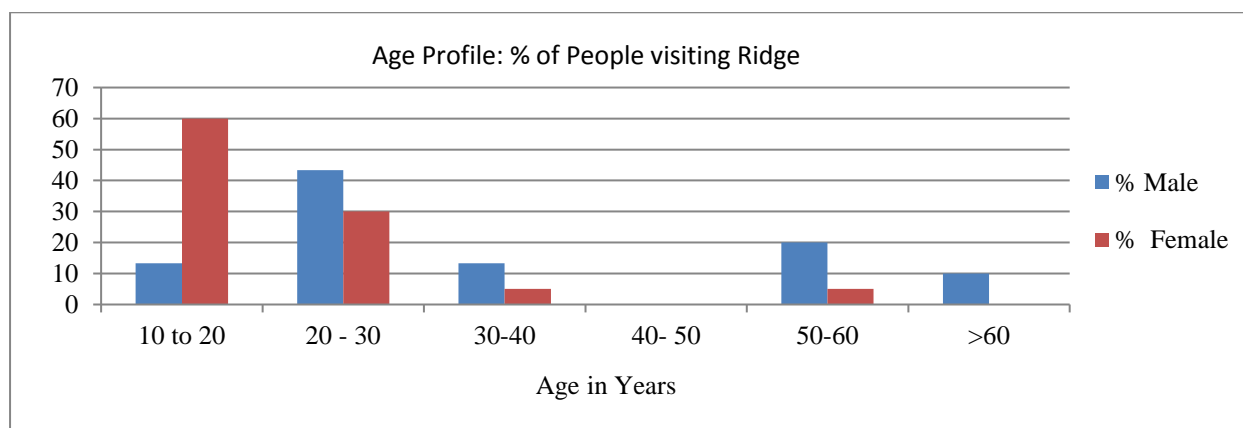
### 4. Public Perception about NDR

Preliminary survey conducted for identifying the population universe indicated that approximately 300-400 people visit the NDR as morning walkers every day. Approximately 100-200 students/ day visit the Ridge on a regular basis while approximately a similar number of tourists visit the Ridge on a daily basis. A sample size of n=20, 15 and 15 was then selected for morning walkers, students and tourists populations. The random survey encountered 85% males and 15% females among the morning walkers, 27% males and 73% females among the

students and 60% males and 40% females among the tourists. Among all males visiting the NDR, maximum percentage of visitors are between the age group of 20 to 30 years, whereas in females, maximum percentage of visitors lie in the 10 to 20 years age group (Fig. 2). Most of the visitors to Noth Delhi Ridge are youth under the age of 30 years. The main reason behind this could be the proximity to the North Campus of University of Delhi.

People visit the NDR largely due to its natural beauty and for obtaining health benefits. Apart from this, the Ridge also provides recreational space for college students and a peaceful place for couples (who visit the Ridge as tourists). Around 49% of total surveyed people visit the NDR daily, mainly for the purpose of morning walk. 17% of sampled visitors visit the Ridge weekly while 20% were found to be occasional visitors. Among the total sample size, 56% visitors prefer to reach the Ridge on foot while 16% use public transport. 28% of the surveyed population commuted to the NDR using their personal vehicle (cars and bikes).

Only 22% of the sampled population was aware about the history associated with the NDR. Detailed analysis revealed that those below the age of 30 years are less aware about the history of NDR as compared to those above this age. More than 50% of all visitors feel that the Ridge is threatened with encroachment and degradation. Littering (especially plastic waste) by visitors, municipal waste dumping as well as problems of law and order such as chain snatching and eve teasing are perceived by the sampled population. Among the total sampled population, 66% of people are willing to work for the conservation of the NDR. This percentage of population is keen to get involved with any conservation program initiated for the protection of the Ridge.



**Figure 2.** Age profile of the surveyed population visiting North Delhi Ridge.

50% of the sampled population is willing to pay for entering the Ridge, if such a conservation strategy is implemented. Those opposing such a measure are of the opinion that the poor will be severely affected and the NDR will become a public space for elite only. It was interesting to note that a large proportion of the sampled population consider the NDR as rejuvenation place which should not be regulated for any section of the people. 50% of the people, who are willing to pay to enter the NDR, are largely below 30 years age. The amount opined by more than 90% of this population, as entry fees for the NDR, is Rs. 20/-.

### 5. Participatory-GIS Analysis

A participatory-GIS process is a relatively new concept involving the integration of inputs from multiple stakeholders and technical experts with Geographic Information System (GIS) to establish pre-defined objectives (Zhang et al, 2013). The objectives in this case were to carry out a threat perception and vulnerability assessment of the NDR. It was deduced that the boundary of the NDR was yet to be demarcated (personal communication with Forest Officials). It was also found that the process of the declaration of the NDR as a "Reserve Forest" has not been completed. This implies that the protected status of the NDR does not hold true and required further investigation of encroachments around its entire perimeter.

The latter was done using personal visits to the entire perimeter of the NDR while simultaneously using inputs from daily visitors and management authorities of the NDR. A thematic map was prepared based on the participatory-GIS data. While existing management of the NDR considers it to be a single entity, participatory GIS research indicates the existence of at least eight distinct zones (Fig. 3). The zones are formed due to the road network that exists inside the NDR and are enclosed by a prominent boundary wall. An auxiliary zone of the NDR was also discovered during the participatory-GIS exploratory research.

The first zone is the largest among all zones and has been christened the **University Zone** based on its location. This is the zone which is frequented more often by morning walkers as well as students. The second zone houses the office of the Forest Department as well as a nursery. This is the zone managed by the Forest Department and has been christened as the **Forest Office Zone**. The third and the fourth zones are managed by the Municipal Corporation of Delhi. The third zone is forested while the fourth zone houses the Hindu Rao

hospital complex. These third and the fourth zones have been named **MCD II Zone** and **MCD I Zone** respectively. MCD II Zone is also interesting since a large solid waste dumping *dhallaon* (bin) is located in it. Preliminary investigation of the *dhallaon* indicates that both solid waste as well as hospital waste is dumped here.

The fifth zone is forested and has been christened **Zone 5** due to the lack of any prominent feature. The sixth zone is the second largest among all zones and is being called the **Mutiny Memorial Zone** due to the presence of the Mutiny Memorial in its vicinity. The seventh zone houses a large water reservoir and is being called the **Water Reservoir Zone**. The southernmost part of the NDR has been converted into a public park which is known as the **Kamala Nehru Park**.

The participatory-GIS approach identified a zone of the NDR which is no longer part of it. This zone lies in the adjacent Civil Lines area and has been christened the **Civil Lines Zone**. More than 90% of this zone is still forested and the zone lies approx. 250 m. from the perimeter of the present NDR. Residential and commercial structures exist between the present perimeter of the NDR and this zone. Encroachments on the South-eastern perimeter of the NDR were observed at several places. These were more prominent in the area between the Mutiny Memorial and the outer-wall perimeter towards Civil Lines where cattle grazing inside the NDR was also spotted.

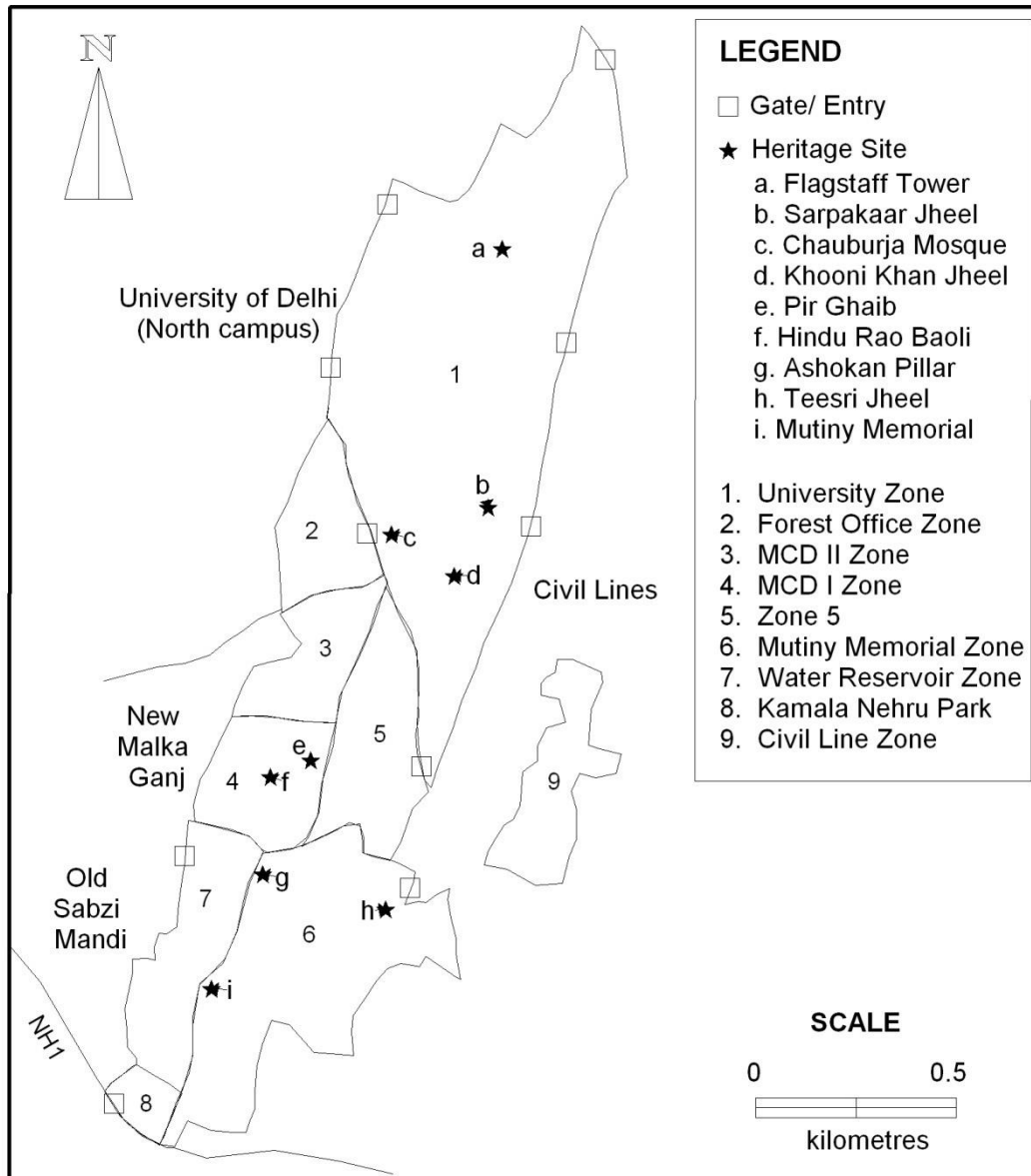
#### 5.1 Tourism Potential of NDR

The participatory-GIS analysis also highlights the tourism potential of the NDR. Participatory-GIS mapping added the logistic perspective to existing knowledge in the development of a tourism package for the NDR. The different heritage structures inside the NDR have attracted citizens of all age groups as well as tourists visiting the city. However, no concrete efforts have been made to promote tourism in the NDR. We would like to maintain here that while tourism in itself could lead to adverse exploitation of the natural beauty of the NDR, the NDR can become a hotspot for ecotourism. An experimental attempt to initiate urban ecotourism in the NDR has carried out by Delhi Greens NGO and is discussed elsewhere (Singh, 2011).

The participatory-GIS approach indicated two distinct sectors for carrying out ecotourism in the NDR. The first Sector includes Zone 1, which further includes the following heritage structures: a) Flagstaff Tower, b) *Sarpakaar Jheel* wetland, c) *Chauburja* mosque and d)

*Khooni Khan Jheel* wetland (Fig.3). The second sector includes geographically linked Zone 4 and Zone 7 and includes the following heritage structures: e) *Pir Ghaib*, f) *Hindu Rao Baoli*, g) Ashokan Pillar, h) *Teesri Jheel* wetland and i) Mutiny Memorial. A third and larger

Sector can be conceived which could include both these sectors. Each of the aforementioned structures are part of the natural and historical heritage of Delhi and India, and have tremendous economic potential with respect to conducting ecotourism.



**Figure 3.** A Participatory-GIS map showing the identified zones and heritage sites of the NDR.

## 6. Economic Valuation of NDR

The knowledge of ecosystem services has long existed (Tallis, 2013). The methods for the economic valuation of such services are now being developed (Whitehead, 2013; Laurans, 2013). The success of such an approach is validated by the fact that it has also been extended to valuing historic environments (Provins et al., 2008). The

present research contribution attempts to initiate an economic valuation of the NDR. While the economic valuation methods could be used on several attributes i.e. above discussed tourism potential, ground water recharge ecosystem service etc., the oxygen producing service was selected as the chosen attribute. This was based on a previous study on the economic valuation of healthy trees

(Delhi Greens, 2013). There is no official census of the trees for the NDR. Consequently, a tree census was made in the fourth zone (MCD I Zone) which has the least tree density due to the presence of Hindu Rao Hospital complex. A total of 68 healthy trees were counted in this zone. Since this is the pilot investigation, the age of the tree was not taken into account. The latter will play an obvious role in the oxygen generating capacity of the tree. The figure so obtained was multiplied by the economic value (EV) of one tree with respect to (maintenance free) oxygen production (~Rs. 23,72,50,000/-) (Delhi Greens, 2013).

$$\begin{aligned} EV_{\text{MCD I Zone}} &= 68 \times \text{Rs. } 23,72,50,000 \\ &= \text{Rs. } 16,13,30,00,000 \end{aligned}$$

We deduce that the economic valuation of the 'oxygen producing' ecosystem service of the most disturbed zone of the NDR is at least one thousand six hundred and thirteen crore rupees. The EV so obtained will increase multifold if other ecosystem services of this zone are calculated and included in the valuation. The EV of the other zones of the NDR (which are both larger and less disturbed) is bound to be several times more than the above calculated EV.

## 7. Discussion

The North Delhi Ridge provides useful ecosystem services to the student population and the residents living close to it. However, there is a need to recognize these services and understand the importance of the NDR with respect to these services. There is a good level of understanding of the importance of the NDR with the residents living in its vicinity. A similar level of understanding is wanting with the administrative authorities managing the North Delhi Ridge. The NDR and the entire Ridge was notified as Reserve Forest on 24 May, 1994. But the process has not been completed due to pending land dispute cases and the Ridge continues to be managed by agencies other than the Forest Department. The NDR is managed by three agencies, out of which the Forest Department manages only a small part of the entire NDR. Interestingly, this is also the part of the NDR which is most conserved and has least encroachment. Consequently, it is reasonable to believe that the complete transfer of the NDR to the Forest Department will aid in the conservation of the NDR. The study recommends the speedy settlement of all pending land disputes and the transfer of the Ridge Forest to the Forest Department.

The NDR has been found to exist in eight distinct and continuous zones based on the participatory-GIS analysis.

These zones are divided by roads and have variable pressures. Consequently, it is suggested that the management of the NDR needs to be carried out in a zone wise manner. Such a micro-management of the NDR will help enhance the green cover and also address environmental challenges such as habitat fragmentation and loss of biodiversity. Absence of clear demarcation of the Ridge limits any methodological approach in its conservation. The ninth zone of the NDR, as identified in the participatory-GIS approach, is an interesting find. It is an indicative that there exist areas in the vicinity of the Ridge, which have retained the Ridge Forest character, but have been fragmented due to urbanisation. These areas could serve the purpose of ecological corridor and could aid in the enhancement of the urban biodiversity.

Encroachment from the South-east perimeter and heavy traffic movement are some other challenges being faced by the NDR. While littering is observed as a problem, the presence of an open-air waste disposal municipal *dhallaon* adjacent to the Hindu Rao hospital is an indirect public health hazard. It is highly recommended that either this municipal *dhallaon* should be removed outside the NDR or it be covered and frequently emptied. Preliminary economic valuation of the NDR shows that it provides high economic gains. Indeed, a more comprehensive economic valuation is needed to identify the exact economic benefits derived from the NDR. Such a study is much needed and should be carried out by (or in collaboration with) the Government for more effective results. Such a study will also aid in developing education and awareness programmes on the benefits of the NDR. This will then sensitize the people and the administration machinery about the importance of protecting and preserving the NDR in its present state.

The participatory-GIS assessment also highlighted the tourism potential of the NDR. Almost 1.89 million foreign tourists visit Delhi every year, making it the third most preferable tourist destination among all states in India (ITS, 2010). In addition to the foreign tourists, a large number of Indians also visit their state capital each year. According to 'Identification of Tourist Circuits across India' Interim report, the top four most visited places in Delhi are Qutub Minar, Red Fort, Delhi Zoo and Pragati Maidan (IL&FS, 2012). Strangely, the Northern Ridge and its monuments do not find mention in the list of the tourist destinations of Delhi in this report. This highlights the lack of awareness in the people and in the administration about the North Delhi Ridge and its historical importance. This lack of awareness has indeed robbed the ridge of its tourism potential. The NDR has immense tourism potential and is already frequented by

those who are aware of its ecological and heritage importance. Hence, it can be inferred that if more awareness is generated in this direction, the North Delhi Ridge will certainly see a spurt in the number of (eco)tourists. The latter could also boost conservation measures taking place for protecting the NDR and enhance its ecosystem services.

## 8. Conclusion

The conservation of NDR is critical to the sustainability of the urban growth of Delhi. However, concrete efforts towards sustainable management of the NDR are wanting and there is ambiguity in its political status. While the entire NDR should be under the supervision of the Forest Department, that is not the case. Only a small fragment of the NDR is under the Forest Department, which was found to be the most protected among all zones appraised in this study. The entire NDR must be brought under the Forest Department before any further conservation measures can be taken.

Participatory GIS has been found to be useful tool for promoting people based conservation efforts. The NDR was found to be divided into eight continuous zones largely due to the presence of a road network traversing through it. These eight zones are of unequal sizes and are marked by the presence and absence of concrete structures. There is also a difference in the number of visitors frequenting the different zones. Consequently, individual zones face unique anthropogenic pressures thereby requiring zone specific management strategies for the conservation of the NDR.

The NDR is of greater relevance today due to ever increasing number of vehicles in NCT of Delhi. The inability of the state administration to put a check on unsustainable growth in the number of vehicles is concerning and further highlights the significance of the NDR in the present day. The NDR is located adjacent to the University of Delhi and acts as a buffer to the air pollution contributed by vehicular exhaust and other emissions. In doing so, it acts as a green belt which absorbs the air and noise pollution and protects the health and wellbeing of a large number of youth who frequent the University of Delhi for education purpose.

The exact economic valuation of the NDR requires a detailed study of all the ecosystem services provided by it. Preliminary investigation of just one ecosystem service (oxygen production) reveals that the total economic valuation of the NDR may well be above two thousand crore rupees. Despite such high economic benefits being provided by the NDR, there seems to be lack of concerted

efforts towards its protection and preservation. There is thus a need to carry out a rigorous economic valuation of the entire Ridge. Such a research work needs to be complemented with awareness generation on the ecosystem service benefits of the Ridge to the people of Delhi.

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