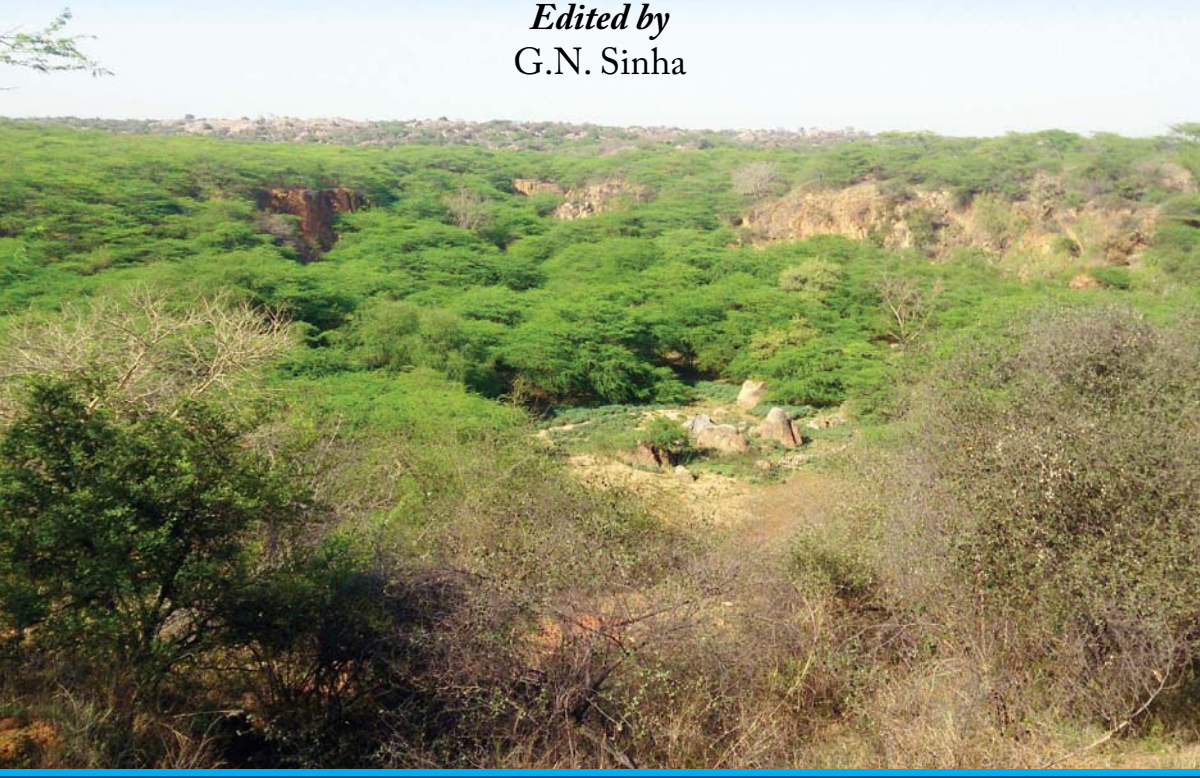
AN INTRODUCTION TO THE
DELHI RIDGE

Edited by
G.N. Sinha



Department of Forests & Wildlife
Government of National Capital Territory of Delhi
New Delhi
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New Delhi – 110002
Telefax: 011-23378513

EDITOR

G.N. Sinha, IFS
Additional Principal Chief Conservator of Forests
& Head, Department of Forests & Wildlife,
Govt. of NCT of Delhi

ADVISORY TEAM

A.K. Shukla, IFS, CCF & CWLW
Dr. Suneesh Buxy, IFS, CF
Tarun Johri, IFS, DCF (Headquarters)

AUTHORS

G.N. Sinha, IFS, APCCF	Prologue
Varsha, Project Associate (Ridge)	The Delhi Ridge
Srishti Solanki, Project Associate (Land)	Evolution of Statutory and Management Framework
Nitisha Singh, Project Associate (Forestry)	Conservation of Delhi Ridge Forest
Arnab Basu, Project Associate (Wildlife)	Asola Bhatti Wildlife Sanctuary
A.K. Shukla, IFS, CCF, Arnab Basu, Project Associate (Wildlife), Nitisha Singh, Project Associate (Forestry)	Flora and Fauna of Delhi Ridge
Bhavna Sharma, Project Associate (Ridge)	Technological Intervention for Protection of Delhi Ridge
A.K. Shukla, IFS, CCF	Epilogue

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M/s Bishen Singh Mahendra Pal Singh
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Department of Forests & Wildlife
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A-Block, 2nd Floor, Vikas Bhawan, I.P. Estate
New Delhi – 110002
Telefax: 011-23378513
E-mail: apccfgnctd@gmail.com

अरण्यान्यरण्यान्यसौ या परेव नश्यसि | कथाग्राम न पर्छ ि न ा भीरिव ि ती.अ.अ.अन ||
.....आञ्जनगन्धिं ुरभिं बह्वन्नामक्रष लाम | पराहम्मृगाणां ातरमरण्यानिमश म ||

-Rig Veda, Book 10 Hymn 146

Goddess of wild and forest who seemest to vanish from the sight.
How is it that thou seekest not the village? Art thou not afraid?
…..Now have I praised the Forest Queen, sweet-scented, redolent of balm,
The Mother of all sylvan things, who tills not but hath stores of food.

-Rig Veda, Book 10 Hymn 146, tr. By Ralph T.H. Griffith [1896]

Prologue

The importance of the Ridge for the ecological security of the capital city of Delhi can hardly be overemphasized. There are records that the Ridge was accorded some degree of protection during the later period of the Mughal rule in India. The British India's Gazetteer of Delhi 1883-84 records the presence of a vast faunal diversity in Delhi. The British Indian Government had also put in place robust statutory framework by way of notifications in 1913, declaring an area of 796.25 ha in 8 villages of Delhi as a Reserved Forest under the provisions of Indian Forest Act, 1878. Later on, some more notifications were issued which provided protection to the Ridge in Delhi.

Serious initiatives to protect the Ridge started in the mid-1980s by a couple of Non-Governmental Organizations under the banner of Joint NGO Forum to Save the Delhi Ridge Forest, with prominent NGOs like WWF-India, Kalpvriksha, Srishti, People's Commission on the Environment and Development of India, Conservation Society of Delhi, Drag and Kare. In the aftermath of spirited action by the NGOs and intervention by Prime Minister Indira Gandhi, a roadmap for protection of the Ridge started unfolding. This led to the Government of Delhi appointing a Committee to recommend the pattern of management of the Delhi Ridge under the Chairmanship of Mr. Lovraj Kumar. The Lovraj Committee submitted its report in 1993, which was welcomed by the members of Joint NGO Forum to Save the Delhi Ridge Forest.

The Supreme Court further directed the Delhi Government to issue the process for constitution of Reserved Forests of the area under the Ridge. As a result, the Government issued two notifications, one in 1994 and the other in 1996. These notifications were issued without a prior assessment of the availability of the Ridge land free from encumbrances. The Delhi Government also appointed Forest Settlement Officers to conduct the proceedings of constitution of Reserved Forests as per the provisions of the Indian Forest Act, 1927.

The imperatives of protecting the Ridge were further amplified by the Supreme Court of India in Writ Petition No. 4677/1985 in the matter of

M.C. Mehta vs. Union of India and others. The Supreme Court also cajoled the Delhi Government to constitute a Ridge Management Board for protection of the Delhi Ridge through their orders on 1st September 1995 in the M.C. Mehta case. The M.C. Mehta case directions led to the constitution of the Ridge Management Board on 6th October 1995 under the Chairmanship of the Chief Secretary with Head of the Forest Department of Delhi Government as its Member Secretary. This Board had members from Government and NGOs. The Ridge Management Board, on its own volition, took a series of measures not only to carry out the directions of the Supreme Court, but also for the protection of the Ridge.

There is a possibility that the Ridge was at one time continuous, but due to developmental expansion of the city and anthropogenic pressures, the continuity of the Ridge got wiped out intermittently. Today, it comprises of the Northern Ridge, Central Ridge, South-Central Ride and Southern Ridge. The rights of the claimants could not be settled in their entirety. Due to recent interventions by the National Green Tribunal, Forest Settlement Officers have expedited the process of settlement of the rights of the claimants, and it is hoped that the entire process of constitution of Reserved Forests will be completed soon.

I joined the Government of Delhi in February 2012, without a formal taking over of charge. This was because my predecessor in the Department had retired three months prior to my arrival. I was, therefore, deprived of the briefings about the ongoing works in the Department. The records and works in this Department were scattered in various places, and there was nobody to apprise me of the availability of basic documents of the Department. This was coupled with a big fire which broke out in the Department on 20th April 2012 bringing to ashes all furniture, fixtures and records. This further brought down the departmental memory, which was already negligible, to ground zero.

For better management of the Delhi Ridge, as also to attend to various Court's interventions, I thought it desirable to first put together all the previous minutes of the Ridge Management Board, so that a consistent view may be taken for protection and conservation of Ridge. These minutes were

also required by the Ridge Management Board in its normal transactions of business. I, therefore, started collecting previous minutes of the Ridge Management Board from countless files.

Ms. Varsha, Project Associate (Ridge) under the Ridge Management Board, Mr. Rohit Kumar, Data Entry Operator and my support staff assisted me in the task of compilation of previous Ridge Management Board minutes. While looking for the minutes of the previous Board meetings in files which were spread in the Department, I came across a wealth of information not only about the Ridge matters, but also about the Department as a whole lying buried in files gathering dust. It struck me that the information buried in files may be of use to interested persons. The idea to bring out this book was born at that time. But executing this plan alone was a difficult task for me, due to my cumbersome and at times distressing and annoying nature of duty under the Delhi Government compared to my previous assignments.

There was, however, a silver lining to the cloud. And this was the presence of five Project Associates under the Ridge Management Board engaged by me after a fair and competitive written test and interview. I, therefore, decided to entrust the responsibility of preparation of the manuscript into the competent hands of Ms. Varsha, Project Associate (Ridge), Ms. Srishti Solanki, Project Associate (Land Management), Ms. Nitisha Singh, Project Associate (Forestry), Mr. Arnab Basu, Project Associate (Wildlife) and Ms. Bhavna Sharma, Project Associate (Ridge) under my direct supervision. The Epilogue has been very ably written by my colleague Mr. A.K. Shukla, Chief Conservator of Forests & Chief Wildlife Warden in the Department. He was eminently suited for this, as he has distinction of organizing the work of the Department during 2000-2003. The manuscript was also reviewed by a team of officers comprising of Mr. A.K. Shukla, CCF, Dr. Suneesh Buxy, CF and Mr. Tarun Johri, DCF (HQ).

Much of my service career was spent in Arunachal Pradesh before coming to Delhi, except for 4 years spent at the Indira Gandhi National Forest Academy, Dehradun from 1993-1997 as a faculty member. Due to my being a member of Indian Forest Service for three decades, I developed an interest in exploring the history of British India's forestry and the evolution of forest

laws prior to independence. This passion still continues. I liberally spread my ideas in these areas among my colleagues. As a result, much of the text of this book will show influence of my findings on the subject.

This book positions the Delhi Ridge in the broader context of the evolution of statutory framework and management interventions for conservation of natural resources initiated during the British regime, and traces the same afterwards. I have planned it deliberately. This is because I wanted the story of conservation to reach the hands of school students who are spread in more than 2000 Eco-clubs being supported by the Department of Environment and Forests, Government of NCT of Delhi. Therefore, a small book on the Delhi Ridge with a background of conservation initiated in Colonial times was found appropriate for school students for easy and fast dissemination of the story of forest conservation in context of the Delhi Ridge. I would now like to state the rationale of how the chapters have been divided.

Chapter 1 introduces the subject of the Delhi Ridge from its ancient past and traverses the journey of its protection passing through the Mughal era, the British India and culminating in the constitution of the Ridge Management Board and their interventions in protection of the Ridge. It touches upon the meaning of the Delhi Ridge as per the stand taken by the Department in the Supreme Court in the case of DDA vs. Kenneth Builders Pvt. Ltd. in the SLP (Civil) No. 35374 of 2010. The Delhi Government treats the morphological Ridge as per Geological Survey of India Map, *Gair Mumkin Pahar* as per revenue records, area notified as forest and area included in the Regional Park under Master Plan of Delhi-2001 to be covered under the description of Delhi Ridge. This chapter brings out recognition of the morphological Ridge in the category of Ridge as ruled by Delhi High Court in Ashok Tanwar vs. Union of India Writ Petition (Civil) 3339/2011 and CM No. 12417/2011 and further earmarking of 5% of the project cost of developmental project to Ridge Management Board as ruled in the case of National Highway Authority of India in the matter of T.N. Godavarman vs. Union of India and others. The chapter highlights role of the Central Empowered Committee (CEC) which acts as an adjunct to the Supreme Court. Therefore, clearance from the Ridge Management Board or the Supreme Court through the Central Empowered Committee is to be obtained before carrying out any

construction. Such permission is a pre-requisite in view of directions of the Supreme Court.

Chapter 2 traces the evolution of a statutory and management framework which influenced protection of the Delhi Ridge from the early part of the British rule in India. It mentions all the statutes issued from 1913 onwards which were vital to the Ridge protection. There are multiplicities of agencies which own the Ridge areas, and are also responsible for their protection. In addition to these, there are a number of agencies which have been permitted to continue their activities in the Ridge land. All these facets find mention. This chapter also illustrates progressive increase in green cover in the capital city, and touches upon the endeavors of the Department in sustaining growth in green cover through its various afforestation drives. The Department has also completed the second phase of a 8-year project on Conservation Education Centre in Asola Bhatti Wildlife Sanctuary through the Bombay Natural History Society (BNHS). The Department has embarked upon the third phase of the Conservation Education Centre initiated in Asola Bhatti Wildlife Sanctuary in 2013 for 5 years. The plans and strategies in respect to the Conservation Education Centre find mention in this chapter.

Chapter 3 puts the Delhi Ridge in the centre of the forest conservation initiative of the Department. A detailed statement on the core forestry principles, and ecological significance of the Delhi Ridge find mention in this chapter. Snapshots of management strategies conceived by the Department for conservation of the Ridge forests are highlighted. This chapter highlights concrete steps taken by the Department in consolidation and protection of the Delhi Ridge, following interventions by the National Green Tribunal. It also highlights the lone Clean Development Mechanism (CDM) project initiated by the Department in Dera Mandi in 2008.

Chapter 4 highlights the historical background and present state of the Asola Bhatti Wildlife Sanctuary. It then discusses the initiative of the Department in deploying 132 Battalion of Eco Task Force for eco-rehabilitation of about 2100 acres of Bhatti mines, about 1400 acres of Dera Mandi and about 1500 acres of Asola. Noticeable improvements achieved in eco-restoration of the habitat find proud mention in the achievements of the 132 Eco Task Force.

This chapter touches upon the work done for improvement of habitat for wildlife in the sanctuary under the State Compensatory Afforestation Fund Management & Planning Authority (State CAMPA). The chapter also deals with relocation of monkeys to the sanctuary following directions of the Delhi High Court in 2007, and concludes with a statement of the activities of the wildlife enforcement wing, touching upon issues like importance of spread of conservation awareness and initiative of Delhi Government in declaring an Eco Sensitive Zone around the sanctuary.

Chapter 5 deals with flora and fauna of the Delhi Ridge which is unique and displays characteristics of ecological changes due to being part of a transition zone of two contrasting ecosystems. This transition zone is significant due to confluence of semi-arid and arid desert of the west and the fertile Gangetic plains of the east. Therefore, the Delhi Ridge possesses flora and fauna of both these biogeographic zones.

Chapter 6 deals with the impact of technology on improvement in management of the Delhi Ridge and its protection. The Department initiated the work of geo-referencing of forest areas in 21 villages of the Southern Ridge through a Special Task Force (STF) in February 2012.

This was following the order dated 06.07.2011 by the Supreme Court of India in IA No. 1868 of 2007 in W.P. (Civil) No. 202 of 1995 asking the State/ UT Government to identify forest areas, irrespective of whether they are notified, recognized or classified under any law, and irrespective of the land of such forests and the areas which were earlier forests but stand degraded, denuded and cleared, shall be culminated in preparation of geo-referenced district forest maps containing the details of the location and boundary of each plot of land that may be defined as forest for the purpose of Forest (Conservation) Act, 1980.

The STF comprised of Forest and Revenue officials. The STF was charged with the responsibility of geo-referencing forest boundary in 21 villages of the Southern Ridge. The STF had to take into account the masavis of these villages dating back to between 2008 and 2012, and also collected basic revenue records like field books, *khasra*, *girdwari*, *khatuani*, *jamabandi*, *sizra*

and all the notifications relating to constitution of Reserved Forests and the Asola Bhatti Wildlife Sanctuary. The STF was supported with Total Station Method of survey in their attempt to geo-reference the forest boundaries of the Ridge area.

The Nodal Officer of the STF was Conservator of Forests who, with the help of Revenue and Forest officials and STM service providers, developed a unique methodology for geo-referencing the forest boundary of the Southern Ridge. This is an inspiring story initiated and completed during my time. I will soon be demitting my office under the Delhi Government consequent to my promotion to the level of Principal Chief Conservator of Forests. But I wish that the story of development of methodology of geo-referencing of forest boundary in the Southern Ridge be recorded and told some day for posterity.

The Department has completed preparation of geo-referenced maps for 21 villages, and 15 such maps have been validated by the Delhi Geospatial Ltd. (GSDL), a public undertaking under the Delhi Government. These geo-referenced maps of 15 villages have also been uploaded on the website of the Forest Department. Remaining geo-referenced maps of 7 villages in Southern Ridge will be uploaded on the website of the Forest Department after their validation by the GSDL. The geo-referenced data will help in detection of encroachment and their removal. This Department has already started work of identification of encroachment and has initiated steps for their removal.

This chapter highlights the efforts of the Department in formulating a proposal of ground-truthing the geo-referenced data as well as to develop a Ridge Protection Management System. After the ground-truthing is completed, the Department contemplates to erect munara/ boundary pillars around the Ridge forest areas.

The Department is also in the process of tweaking the design of the boundary wall around the Ridge area, as the boundary wall in some areas appears quite monolithic, and as a result acts as an obstruction to the movement of small animals, besides obstructing vision of passersby. It is expected that

improved design of the boundary wall will make the Ridge forest friendlier to the smaller animals, and at the same time people may also enjoy the sight of the greens in the heart of the capital city.

The last chapter, under the title Epilogue, traces the trajectory of the Delhi Ridge and highlights problems of its protection and management. It mentions the initiative of the Department in using the Total Station Method of survey of the Southern Ridge for geo-referencing their forest boundary, and the achievements of the Eco Task Force in eco-rehabilitation. This chapter concludes with a roadmap for the Delhi Ridge on the principles of conservancy, initiated and perfected in India in the late 19th century. It also deals with the contribution of the NGOs for protecting the Ridge on the principles of conservancy, instead of developing it as parks and gardens for the city dwellers. The role of the Conservation Education Centre, a joint venture of BNHS and the Department of Forests & Wildlife towards imparting *in situ* environmental education to the citizens of Delhi finds special mention.

I have benefitted much from the records left by Mr. Tarun Coomar and Mr. D.C. Khanduri, both former DCFs in the Delhi Government and their notable contributions in establishing the Department as well as organizing the activities under the umbrella of the Ridge Management Board.

I would like to record my thanks to Mr. S.K. Srivastava, Chief Secretary and Chairman, Ridge Management Board, Mr. Sanjiv Kumar, Secretary (Environment & Forests) and other members of the Board for their words of encouragement to the works of the Department. I have great appreciation for Ms. Sunita Narain, Member, RMB, for her keen interest in initiating steps for consolidation and protection of the Ridge. My special thanks go to Mr. Tarun Johri, DCF (HQ) for going through the entire manuscript and for offering intelligent remarks for its improvement.

I also take this opportunity to extend my thanks to my colleagues in the Department namely, Dr. Suneesh Buxy, CF, Mr. Nisheeth Saxena, DCF (South), Mr. Prashant Rajagopal, DCF (West) and Dr. R. Gopinath, DCF (Protection and Monitoring). I also thank countless authors and NGOs whose works have been quoted in this book. My special thanks go to the

individuals and NGOs who initiated steps for protection of the Delhi Ridge in the early 1990s. I thank senior officers of the Irrigation and Flood Control Department (I & FCD) for the Total Station Method (TSM) survey conducted for geo-referencing of the forest areas in Delhi. I also express gratitude to Geo-Spatial Delhi Limited (GSDL) for providing geo-spatial support to the work done by the Special Task Force (STF) of this Department, responsible for geo-referencing of forest boundaries in Delhi.

I thank Col. Pradeep Sandhir, 132, ETF for providing necessary information required in preparation of this book. I am especially grateful to Mr. Ravi Agarwal, Director, Toxic Link and former member of the Ridge Management Board for going through the manuscript of this book and for offering critical and useful comments for its further refinement. Editorial suggestions provided by Dr. (Ms.) Nima Manjrekar and printing of the book by Bishen Singh Mahendra Pal Singh, Dehradun are gratefully acknowledged.

And finally, I have no words of praise for the above named five Project Associates and Mr. A.K. Shukla, CCF who toiled with me over the last six weeks, which has borne fruit in the form of this book. I commend their efforts and this book is theirs.

Finally, those associated with the preparation of the manuscript are not full time authors. The entire writing has been done under my overall supervision. It is possible that some errors might have crept in the book. I own them all up and would request the readers to enlighten us about the same for further improvement of the book.

G.N. Sinha
APCCF and Head,
Forests and Wildlife Department and
Member Secretary, RMB
Email: gnsinhauk@yahoo.co.uk

Date: 28 April 2014
Place: New Delhi

Authors' Note

The "Introduction to the Delhi Ridge" wasn't the book which we had set out to write, neither was it the book we had planned. A major part of Delhi's forests deal with the Ridge. For daily administration work we always resorted to records maintained by the Forest Department. The search for a particular query from the enormous amount of information was a hectic task everyday. So a need was felt for the consolidation of matters related to the Ridge – its administration, legal as well as ecological aspects.

Thus it was thought to compile various documents that will help as reference for daily administrative work, making the process less tedious. Through this process we came across a wealth of information concerning the Ridge, which we thought should be made available in the public domain as our responsibility towards the citizens of Delhi. As we indulged in this process, an idea fell upon us all of a sudden creating a 'eureka' moment. It was as if on the spur of the moment that idea for transforming the compilation of records into a book was declared, and everyone agreed to it without any hesitation. Now came the task of giving this 'enthusiastically-thought' book, a definite shape. But executing this task was a difficult one.

Individual responsibilities were assigned to respective associates of the Department under the guidance of their supervisors. The daily quest gave birth to new curiosities, and encouragement was provided at every step to view all matters with liberty of thought. Questions were asked not only to others but also to one's ownself which rarely led to answers, but more often to other questions, making us dig deeper and deeper on our quest. It would be right to say, that the process gave us greater insights to our Ridge – we surfaced upon various aspects which were hidden from our view so far.

That's how things became clear. All of a sudden, but driven by a persistent need. And then we realized how obvious they've been all along. It would be worthwhile to mention that during the preparation of the manuscript for this book under the guidance of our esteemed seniors, we experienced a great feeling of camaraderie amongst us, the authors, which we shall treasure for years to come. It would not be an overstatement, if we say that

the experience we gained from this is only because of the blessings of our supervisors and the trust they put into us.

This book is written to be used as a road map and portable tool for lovers of the environment; it requires no special knowledge, mental abilities or prior training beyond basic curiosity and intuitiveness. This book will take you on an unfolding journey of how our Delhi's pride – the Ridge – was born, how it was nourished, how it is taken care of and how it will grow in future to become a jewel in the heart of India. As is said that one has to set the chess board much earlier, we hope that this book may be a small step, but it will lead the posterity to better understand our Ridge and be motivated to conserve it.

Although persons mentioned in this book are few, it would not have taken its present shape without the help of many. This book belongs as much to them as to us, the authors. First and foremost we are indebted to Mr. G.N. Sinha, APCCF & Head, for entrusting us and giving us this golden opportunity. We would also like to thank him for introducing us to various aspects of historical knowledge pertaining to the Ridge forest land and laws governing it. It helped us in shaping many of our ideas. The research and writing of this book was aided by Mr. A.K. Shukla, CCF & CWLW, giving his objective analysis on various aspects of forestry and wildlife. It is his humble nature that inspite of such a busy schedule, he was always there to guide us whenever we approached him for help. We would also like to record our thanks to Dr. Suneesh Buxy, CF for enriching us with aspects of modern technology that could be used for the conservation of the Ridge. We owe a special debt to Mr. Tarun Johri, DCF (HQ) for giving his generous comments and criticism. He was there to patiently read our manuscript and made many valuable suggestions for which we are grateful. We take this opportunity to thank Dr. R. Gopinath (P & M), Mr. Nisheeth Saxena, DCF (South) and Mr. Prashant Rajagopal, DCF (West) for providing all necessary information and guiding us throughout the endeavor and standing by us through thick and thin. Their encouraging words always acted as a boost to lift up the working environment. Without the guidance and persistent help of our supervisors, this book would not have been possible.

We appreciate help from Mr. Paramvir Singh, Wildlife Inspector, who provided details on wildlife issues and previous records, as well as for his subjective analysis. We also extend our thanks to departmental record keepers for providing us previous records, without which the various subjects could not be dealt upon precisely. Special thanks to Mr. Rohit Kumar for providing help in segregating the records and typing of notifications. Lastly, we would also like to thank our office staff namely Mr. Rajender Singh, Mr. Bharat Singh, Mr. Gangacharan and Mr. Sahindar Pal for retrieval of old files and photocopying of necessary documents.

We all like to thank our families for their patience, love and support that helped in completing this project. Their contribution has been extensive and acted as a pillar of strength through the entire journey.

Ms. Varsha
Ms. Srishti Solanki
Ms. Nitisha Singh
Mr. Arnab Basu
Ms. Bhavna Sharma
Project Associates, RMB

Table of Contents

Chapter-1

The Delhi Ridge

> "Thus speaks the Beloved of the Gods, the king Piyadassi: when I had been consecrated for twenty-six years I forbade the killing of the following species of animals, namely: parrots, mainas, red-headed ducks, cakravaka-gees.....forests must not be burned in order to kill living things or without any good reason. An animal must not be fed with another animal."
>
> -The 5th pillar edict of King Asoka[1]

Delhi is an ancient as well as historical city of India. Delhi, which is located in a cusp 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[2]. The hilly spurs in Delhi are known as the Delhi Ridge sometimes called "The Ridge" which once occupied almost 15% of the city's land.

A Ridge is a geological aspect that features a continuous elevational crest for some distance. The Delhi Ridge is a northern extension of the old and ancient hill ranges of India called the 'Aravalli Hill Ranges' which extend from Gujarat through Rajasthan to Haryana–Delhi. The Delhi Ridge stretches over a distance of 35 km, from Bhatti Mines to southeast of the 700 year old Tughlaqabad, branching in different directions, and finally tapering towards the northern end near Wazirabad on the western banks of Yamuna river.

1.1 HISTORICAL SIGNIFICANCE OF THE RIDGE

The Ridge has played an important role in Delhi's history, and even its prehistory. The Delhi Ridge is made of quartzite rocks, of which Stone Age tribes used to make tools. In fact, archeologists have discovered Stone Age

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1 Divan, S. and Rosencranz, A. (2001) *Environmental Law and Policy in India: Cases, Materials and Statutes*, Second Edition, Oxford University Press, p. 25.

2 Agarwal, Ravi. (2010) Fight for a Forest, *Seminar Magazine*, September 613, available online at http://www.india-seminar.com/2010/613/613_ravi_agarwal.htm (visited 10 March 2014).

'factories' along the Delhi Ridge, evidence of the widespread production of tools. Stone Age tribes were also drawn to the dense forest cover of the Ridge, which provided food (both plant and animal) and shelter. Further, there was plentiful water, a point still relevant today.

The Ridge has been the topographic feature that attracted settlers to the area for thousands of years. From the eighth-century Lal Kot fort and 12th century Qutub Minar, to Shah Jahan's 17th century walled city and Lutyens' 20th century Delhi, much of the Capital's historical architecture is found in and around the Ridge.

Delhi has witnessed the rise and fall of seven cities namely Qila Rai Pithora, Lal Kot, Mehrauli, Siri, Tughlaqabad, Firojabad and the Mughal city of Shajahanabad, now known as Old Delhi which came under the sway of the British. During the medieval period, the first four of these cities were located directly on the Ridge for ecological reasons as well as the military security afforded by the hills. By the late Mughal period, the Ridge had been largely deforested because the city had moved towards the banks of the Yamuna river. However, it still served an important role as a ground water source and the grazing ground for local pastoralists[3].

In the more recent history of Delhi, the Ridge has been critical. During British period, the Ridge became exceptionally significant for a variety of reasons. The first significant event was the First War of Independence of 1857, in which revolt against the British rule was witnessed. Although the whole northern India took part in the revolt against the British, the riot was intense in Delhi as the rebels rallied around the Mughal "emperor" who was under close watch of the British. The British troops stationed themselves on the northern portion of the Ridge to gain advantage of its height; after that, the Ridge got the status of sacred monument when the rebels suffered martyrdom.

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[3] Crowley, Thomas. (2011) *Save the Ridge: the Fight to Preserve Delhi's Urban Forest*, available online at http://base.d-p-h.info/pt/fiches/dph/fiche-dph-8894.html (visited 14 March 2014).

Over the years, the pressures of an increasing population, excessive resource extraction, construction of landscaped public parks, public housing, dumping of construction waste, etc. have posed a serious threat and caused shrinkage of the Ridge. Once contiguous, it is now divided into five fragmented zones namely, Northern Ridge, Central Ridge, South Central Ridge, Southern Ridge and Nanakpura South Central Ridge.

- The **Northern Ridge** (also called Old Delhi) comprises of the hilly area near Delhi University. It is approximately 87 Hectares.
- The **Central Ridge** (also called New Delhi) consists of around 864 Hectares of forested area, from south of Sadar Bazaar to Dhaula Kuan, but some bits of the Central Ridge have been nibbled away.
- The **South-Central Ridge** (also called Mehrauli) consists of 626 Hectares of forested land around the Sanjay Vana area, near Jawaharlal Nehru University (JNU).
- The **Southern Ridge** (also called Tughlaqabad) consisting of 6200 Hectares is the biggest area of the Delhi Ridge.
- The **Nanakpura South Central Ridge** has an area of 7 Hectares.

All the 5 Zones make up for a total area of 7,784 Hectares spread over the entire city in different patches.

1.2 GENESIS OF MANAGEMENT OF RIDGE

Delhi is one of the most historic capitals in the world, finding mention in the ancient epic Mahabharata. Two natural features of the city – the Ridge and river Yamuna, have made it a protected and favourite place for rulers over the ages. Therefore, the battle for protecting Delhi's "Green Lungs" started long ago.

In the 14th century, the Ridge forest was covered with thorny scrubs with very little green cover. Emperor Feroze Tughlaq, who was very fond of hunting, afforested the rocky southern part of the Ridge on which Ghiyas-ud-Din Tughlaq built the fort city of Tughlaqabad.

1.2.1 Ridge management during British period

The massive afforestation of the Ridge forest was started by the British in the 19th century. The British map of 1807 shows the Ridge extending from

north to south continuously unlike the present day scattered Ridge forests. In the early 1900s, the British began restoring some of the Mughal gardens, and when their Imperial capital shifted from Calcutta (now Kolkata) to Delhi, the British focused on the development of the new city in the form of impressive buildings, wide and well-ordered roads, etc. that still get attention today.

They envisioned the Ridge as an appropriately majestic backdrop to the new city and thus, the Ridge again became the focus of attention, and afforestation work began in full swing. The idea was that the new Imperial capital would be "a sea of foliage". Various exotic species were introduced, including *Prosopis juliflora*, a Mexican mesquite tree now known in India as *vilayati* (foreign) *kikar*, which created extensive monocultures on the Ridge. While this greatly increased Delhi's green cover, it was not an entirely positive development. More aspects of *Prosopis juliflora* will be discussed in Chapter 3.

Afforestation of the Delhi Ridge by the British shows the exclusivity and colonial nature of British forestry. People living in villages near the Ridge were displaced, and locals who depended on the Ridge for fuel and fodder were kept out by fences and guards. In 1913, the British rulers decided to preserve the natural wealth of the Central Ridge by protecting it under Section 4 of Act VII of the Indian Forest Act, 1878. The Chief Commissioner of Delhi declared an area of 796.25 ha. in 8 villages namely, Dasghara, Khanpur, Shadipur, Band Shikar Khatun, Alipur Pilanji, Malcha and Narhaula as Reserved Forest vide notification dated 6th December 1913, and appointed Mr. Vincent Connolly, ICS, Additional District Magistrate, Delhi, as Forest Settlement Officer, thus placing it under more stringent British control.

Then again in 1915, the Chief Commissioner of Delhi declared part of the land under Patti Chandrawal village as Reserved Forest under Section 19 of Indian Forest Act VII, 1878 vide notification no. 5911-R & A, dated 7th September 1915, placed these forests under the charge of CPWD 'Notified Area Committee' and declared the Secretary of the Notified Area Committee as Forest Officer under Section 2 of Act VII of 1878 vide notification no. 5913-R & A, dated 7th September 1915.

But due to rapid urbanisation, pressure on the land increased, and during 1920-30, a major portion of the Ridge near Delhi University was blasted to provide access to the residential colonies and business premises and the new colony of Karol Bagh. Therefore, vide notification no. F. 14(122)/41-LSG dated 16th September 1942, which superseded and replaced Chief Commissioner's notification No. 59 11-R & A dated 7th September 1915, part of the land under the Patti Chandrawal Mahel village was declared as Reserved Forest under Section 4 of the Indian Forest Act, 1927 and Secretary of the Civil Station Notified Area Committee was appointed as Forest Officer vide notification No. F. 14 (122)/41-L. S. G. dated 10th April 1944. Thus, it shows that British employed a model of imperial forestry that still has some echoes in the modern environmental policy.

1.2.2 Ridge management after independence

After India's Independence in 1947, Delhi exploded into the megacity it is today, and the stress on the natural resources of the city increased manifold as a series of intrusions, legal and illegal, have devoured more and more area. The Ridge became prey to rampant 'urbanization' and 'development' which included construction work, road widening, quarrying, garbage dumping and encroachments, and this led to swallowing up of large chunks of the Ridge by the city.

Refugees were given land in the Central and Southern Ridges, causing severe damage to the natural flora and fauna, consequent ecological disruption through erosion caused due to the indiscriminate and unscientific denudation of forests. With the immigration increasing with time, the plateau-like arms that bounded the various cities over time were blasted to provide the area to accommodate thousands of new migrants.

With the birth of the forest wing in 1950, the Administration had taken up the planned work of managing the Ridges through norms of forestry. The Delhi Administration vide their notification dated 19.11.1958 appointed the Soil Conservation Officer (SCO) as Forest Officer and under his able auspices, the charge of management of both the Ridges was given to Development Department to maintain the Ridge with its natural status and keep encroachers at bay. Both the Ridges were fenced up, encroachments

were removed and work of plantation was initiated. The power of the Forest Officer to deal with forest offences was given by notification to the SCO.

The Chief Commissioner of Delhi decided to hand over the Southern Ridge, for its maintenance, to CPWD in the year 1962, and the Southern Ridge was transferred to CPWD on 01.04.63, for its beautification as parks and gardens. Further the Hon'ble Lt. Governor of Delhi ordered the transfer of the Northern Ridge to DDA in the year 1968, which was done on 30.11.1968, for maintenance and beautification. However, with the efforts of the then Development Commissioner, two nurseries namely Birla Temple and Kamla Nehru Ridge remained with the Forest Department, Delhi Administration.

However, some encroachments were still occurring, so to preserve the Ridge as forest land, some non-profit organizations and citizen's groups working on environmental issues started protesting in 1979 against encroachments and destruction of the Ridge. In response to these efforts, Lt. Governor of Delhi declared 25 sites in the Northern, Central and South-Central Ridge as Protected Forests under the Indian Forest Act, 1927 on 10th April, 1980.

In 1982, it was stated in a note of the Town and Country Planning Organization (TCPO) that 40% of the Ridge had already been destroyed[4] (found in a study done by Delhi School of Planning and Architecture) due to a large number of encroachments and use of the Ridge land for non-forest purposes, which led the Ridge to be left with only a few, lone *kikar* trees and a closely cropped rocky mound, a pathetic vestige of what once was a flourishing ecosystem.

The Hon'ble Lt. Governor vide 1986 notification declared 1880 ha. in the Southern Ridge as Wildlife Sanctuary (the Asola Wildlife Sanctuary) which includes, through another notification in April 1991, 840 ha. of the Bhatti mines, which will be discussed in detail in Chapter 4.

However, while some parts of the Ridge were given legal protection, the other Ridge areas unfortunately did not receive protection under forest laws,

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4 See generally, Kalpavriksha. (1991) *The Delhi Ridge Forest: Decline and Conservation*, New Delhi.

and by the 1990s, less than 5% of the city had green cover, and the Yamuna became little more than a sewage canal for industrial effluents, leading to many conflicts. So in the early 1990s, various voluntary organizations, citizens' groups, NGOs (like WWF, Kalpavriksh, Srishti, Development Alternatives, Conservation Society, etc.) and activists working on the issue banded together under the banner of the "Joint NGO Forum to Save the Delhi Ridge" to save the Ridge's forests from encroachment and widespread destruction. The Forum helped mobilize school and neighborhood organizations, and publicized the cause in various media outlets.

Given the public outcry and the complexity of the issues involved, the Delhi government appointed a 10 member committee (popularly known as Lovraj Committee) headed by Mr. Lovraj Kumar (then member Planning Commission) in 1993 to frame a management plan for the Delhi Ridge[5].

1.3 THE LOVRAJ COMMITTEE

The Lt. Governor of Delhi, vide Notification No.F.2 (11)/DCF/1990-91 dated April 24 1993, constituted a Committee, namely Lovraj Committee, to suggest a management pattern for the Delhi Ridge. The Committee was chaired by Mr. Lovraj Kumar and had the Development Commissioner as its Member Secretary, and had representatives from various Governmental and Non-Governmental Organizations (Indian National Trust for Arts and Cultural Heritage – INTACH, Kalpavriksh, Srishti, World Wide Fund for Nature – WWF) as members.

The primary objective of the Lovraj Committee was to protect as much of the Delhi Ridge as possible. Despite an 80-year-old intention to conserve the Ridge, no substantive efforts were undertaken to formulate or implement legal, administrative, managerial or scientific measures that would have helped in the conservation of the Ridge. And as the Ridge is said to be the Green Lung of the city and has its distinct biodiversity, its conservation was vital to any attempts at improving the environment of the city. The Committee held a number of meetings that were supplemented by a number of discussions and consultations with experts and NGOs, and recommended

[5] See note 2.

a management pattern for the Delhi Ridge. The recommendations are as follows[6]:

1. A Ridge Management Supervisory Committee should be set up under the chairmanship of Chief Secretary to consider all land-use matters and legal issues regarding the environmental conservation of the Ridge.
2. All areas of the Ridge should be declared as Reserved Forest under Section 4 of the Indian Forest Act, 1927. This declaration should be accompanied by the immediate erection of pillars along the boundary of the area. Settlement Officers should be immediately appointed and directed to complete their work under the Indian Forest Act, 1927.
3. The expertise of the Centre for Environmental Law of WWF- India should be utilized for proper adherence to the Indian Forest Act, 1927 and to avoid any legal errors.
4. Guidelines should be formulated to determine which areas, if any, should be excluded from the final notification that constitutes the Ridge as a Reserved Forest.
5. The Environmental (Protection) Act, 1986, should be invoked at the time of notification of the area as a Reserved Forest.
6. Application of the Wildlife (Protection) Act, 1972, should be planned when the Ridge's conservation has reached a level that would warrant its application. At present, the situation is not appropriate for the Act's application.
7. The Master Plan of Delhi 2001 (MPD 2001) should be amended to designate the Ridge as a Reserved Forest as defined in the Indian Forest Act, 1927.
8. The Delhi Development Act, 1957, should be amended to provide for a "Forest Area." The powers available to the Delhi Development Authority under this Act (for the removal of encroachments and unauthorized buildings, etc.) should be extended to cover such forest areas, and by consequence, the entire Ridge.

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[6] Jain, A.K. (2009) *Low Carbon City: Policy Planning and Practice*, Discovery Publishing House Pvt. Ltd. New Delhi and Lovraj Committee Report.

9. The construction or widening of new roads should be prohibited. This will be a natural consequence of declaring the Ridge a Reserved Forest under the Indian Forest Act, 1927.
10. Roads whose construction has led to the destruction of the Ridge's environment, and whose continued use damages the Ridge, should be closed. This decision should be promptly taken by the proposed Ridge Management Supervisory Committee. The roads that are allowed to remain should be converted into toll roads to discourage traffic. The tolls will also generate revenue for the Ridge's conservation.
11. The legal status of the Ridge's present occupants and resource use should be determined by Settlements Officers appointed under the Indian Forest Act, 1927.
12. The management of the Ridge (except the Asola Wildlife Sanctuary) should be entrusted to the DDA. For this purpose, the DDA should set up a separate Ridge Management Division under a Senior Forest Officer of minimum rank of Conservator of Forests, who will act as Member Secretary of the Ridge Management Supervisory Committee.
13. Efforts to conserve the Ridge should become central to the functioning of the DDA when planning neighbourhood schools, places of religious worship, parks, recreation centres, etc., so that activities can be relocated from the Ridge to the neighbourhood areas as planned.
14. The Ridge Management Division in the DDA should seek the advice of ecologists (especially those with knowledge of the Ridge), and involve them on a long term basis to plan and manage the conservation and restoration of the Ridge.
15. Transfer of ownership of land on the Ridge presently vested with the Union government should be considered only when the Ridge Management Supervisory Committee feels that the proposed DDA agency has demonstrated its capability to conserve the Ridge. In the meantime, the Union Government must not allot any land of its own for any purpose unless in accordance with the Indian Forest Act, 1927, the Forest (Conservation) Act, 1980, the Environmental (Protection) Act, 1986, and unless it is recommended by the Ridge Management Supervisory Committee.

16. Active cooperation of all sections of society should be sought to coordinate and enhance the efforts of the government and citizens groups to conserve the Ridge. The following steps are recommended to involve citizens in the conservation of the Ridge:
    - ✦ Approximately 20 honorary wardens should be appointed from NGOs active in environmental conservation. These wardens must possess the required knowledge and expertise to monitor the ecology of the Ridge, prevent the felling of trees, report on encroachments and unauthorized activities, etc., and help create environmental awareness in the public through discussions, meetings, etc. They should be appointed for a minimum period of two years, and their tenure should be renewable based on their performance.
    - ✦ Numerous Ridge monitoring volunteers should be selected with a demonstrated ability in environmental conservation from citizen/resident associations and schools and colleges (preferably those in close vicinity of the Ridge). These volunteers could assist the wardens in their tasks and carry out regular patrols to continue conservation attempts.
    - ✦ The Ridge Management Division should provide modest financial assistance to the wardens and volunteers to assist their conservation efforts.
17. A Scientific Advisory Committee should be established to advise the Ridge Management Division in all technical issues of conservation and biodiversity, and to assist the management of the Ridge based on sound scientific principles. This plan and progress reports on its implementation should be reviewed periodically by the Ridge Management Supervisory Committee.
18. The DDA should avoid public pressure on the Ridge for recreational landscaping and horticultural uses by publicizing the presence of alternative parks and recreation centers in the vicinity. Pathways for the joggers and walkers on the periphery of the Ridge will not conflict with conservation efforts and should be promoted in the Ridge's management plan.
19. Some slopes and deep pits created from past mining operations in the Asola Wildlife Sanctuary might need reshaping, this must first be

studied in greater depth by wildlife experts and ecologists to determine acceptable reclamation and reshaping methods. The Wildlife Institute of India in Dehradun should be consulted on this matter.

20. Management of the Asola Wildlife Sanctuary should remain with the Department of Forests and Environment, Delhi Administration, since the management systems required for its development are different from those necessary for the Ridge's conservation.

As recommended by the Committee, the Government notified about 7,777 ha. of the Ridge as Reserved Forest on 24th May 1994; the MPD 2001 and NCR plan designated the Ridge as Reserved Forest and emphasized that the Ridge forest and sanctuaries should be conserved with utmost care and should be afforested with indigenous species with a minimum of artificial landscaping.

Further, in 1996, the Delhi Administration declared uncultivated surplus land of 14 Gaon Sabhas along the Ridge as Reserved Forests under the Indian Forest Act, 1927.

1.4 JUDICIAL INTERVENTION TO PROTECT INTEGRITY OF RIDGE

Judicial intervention to protect the Ridge was initiated with a case filed by environmental lawyer Mr. M.C. Mehta in 1985. Mr. Mehta contended that since the Ridge was notified as a Reserved Forest (RF) under the Indian Forest Act (IFA), 1927, all encroachments on it in violation of the IFA provisions would be 'illegal' – irrespective of the government's permission.

The Hon'ble Supreme Court has directed through various orders that the Ridge should be protected and no further infringement of it should be permitted. The word "Ridge" has not been specifically defined anywhere. Its meaning may, however, be inferred from the provisions contained in the MPD 2001 and MPD 2021, as well as the order dated 09.05.1996 passed by the Supreme Court in Writ Petition (Civil) No.4677/1985.

1.4.1 Provisions contained in MPD 2001

Master Plan for Delhi Perspective 2001, as notified on 1.8.1990, contains the following provisions regarding Ridge:

(i) The preamble of the MPD 2001 states:

"Ecological balance to be maintained. Delhi has two distinct natural features – The Ridge which is the rocky outcrop of Aravalli hills and the river Yamuna. Some parts of the Ridge have been erased in the Central City Area. No further infringement of the Ridge is to be permitted; it should be maintained in its pristine glory"

(ii) In the section for Environment, the provisions relating to the natural features prescribed as follows:

"ENVIRONMENT..... NATURAL FEATURES

Conservation of major natural features in a settlement is of utmost importance to sustain the natural eco-system. Two major natural features in Delhi are the Ridge and the Yamuna river. The Ridge in Delhi is defined as a rocky outcrop of the Aravalli range stretching from the University in the North of the Union Territory boundary to the South and beyond.....

The Ridge thus identified should be conserved with utmost care and should be afforested with indigenous species with minimum of artificial landscape."

1.4.2 Provisions contained in MPD 2021

"INTRODUCTION:

Major Highlights of the Plan:

.....

20(f) Environment:

(a) Special emphasis on conservation of the Ridge...."

9.2 NATURAL FEATURES

The major natural features and eco-systems of Delhi are the river Yamuna, together with a network of streams/drains that empty into the river, and the Aravalli Range. Both of these are in a state of considerable degradation, and it is of vital importance to conserve and rejuvenate these ecosystems. This has regional bearing, and therefore, surrounding states also have to contribute towards their conservation and rejuvenation.

.....

.....

9.2.2 REGIONAL PARK

The Aravalli Range in the NCT of Delhi comprises of the rocky outcrop stretching from the University in the North to the NCT Border in the south and beyond, and sizeable areas of the

same have been designated as the Ridge. This is not a continuum as various intervening stretches have, over a period of time, been brought under urbanisation – for example, the Central Ridge area was planned as an integral part of New Delhi as the Capital in the early part of the twentieth century. The Master Plan of Delhi 2001 identified the Regional Park into four parts as below:

1.	Northern Ridge	:	87 ha.
2.	Central Ridge	:	864 ha.
3.	South Central Ridge (Mehrauli)	:	626 ha.
4.	Southern Ridge	:	6200 ha.

Subject to verification, the area of the Regional Park is 7777 hectares. Part of this has been notified as Reserved Forest under the Indian Forest Act, 1927 vide Notification dated 24.05.1994 and 02.04.1996. There are discrepancies between the area notified and the physical boundaries of the total are owned by various agencies – DDA, CPWD, NDMC, MCD, Forest Department, and the Ministry of Defence. Till the exact boundaries are identified by the Forest Department, the boundary indicated in the Master Plan for Delhi (land use plan) as Regional Park shall continue."

1.4.3 Supreme Court orders

Order dated 09.05.1996 in Writ Petition (Civil) No.4677/1985:

In the above mentioned order, the Supreme Court inter alia directed as follows:

".. It would be useful to refer to the statutory Master Plan for Delhi Perspective 2001 which provides as under:-

"2. ECOLOGICAL BALANCE TO BE MAINTAINED. Delhi has two distinct natural features. The Ridge which is the rocky outcrop of Aravalli Hills and the river Yamuna. Some parts of the Ridge have been erased in the Central city area. No further infringement of the Ridge is to be permitted; it should be maintained in its pristine glory.

River Yamuna is to be made pollution free through various measures. On the vast expanse of its banks, large recreational areas to be developed and to be integrated with other urban developments so that the river is an integral part of the city physically and visually."

Provisions of the Master Plan makes it mandatory that the Ridge is to be kept free from encroachers and its pristine glory must be maintained for all

times. It is a pity that neither the Central Government nor the NCT, Delhi Administration has ever applied its mind towards maintaining the Ridge and river Yamuna, which is necessary to maintain the ecological balance of the city."

1.4.4 Position taken by the Department of Environment & Forests, NCT of Delhi

The above mentioned provisions of the Master Plan and the order passed by the Supreme Court describe the Ridge as a natural feature distinct from a planned land use viz. "Regional Park". As is provided in the MPD 2021, Forest Department has undertaken the task for identification and demarcation of the Ridge, and the work is going on. This aspect will be covered in more detail in Chapter 6.

Based upon involved deliberations in the State Government, the following features have been identified as being relevant for classification of any area as "Ridge":

i. Morphological Ridge as per Geological Survey of India Map.
ii. Land recorded as "*Gair Mumkin Pahar*" in Revenue Record.
iii. Area notified as "Forest".
iv. Area included in the "Regional Park" in existing Land Use Plan contained in MPD 2021.

The stand to conserve the morphological Ridge was taken in the case of DDA Vs. M/s Kenneth Builders Pvt. Ltd. in the SLP (Civil) No.35374 of 2010. Forest Department of Delhi Government filed an affidavit in the Supreme Court on 4th March 2011 after obtaining approval from the Delhi Government, which stated the classification of the Ridge into the above mentioned four categories. Therefore, the Department of Environment & Forests has taken the position that prior approval of the Supreme Court will be required for undertaking any construction activity in these areas and thus morphological Ridge has also been provided legal protection.

Morphological Ridge may be defined as that part of Ridge area which is not falling under any notifications, but have similar features as the Ridge, and form part of the extension of the Aravallis. The practical implications

to protect the morphological Ridge can be drawn from the case of Ashok Tanwar Vs. Union of India W.P. (C) 3339/2011 and T.N. Godavarman Thirumulpad Vs. Union of India and others, I. A. Nos. 2899, 2897 in which the Central Empowered Committee was acting as an interface between the Supreme Court of India and the State Government of Delhi.

1.4.5 Legal protection to morphological Ridge

The matter of Ashok Tanwar Vs. Union of India W.P. (C) 3339/2011 & CM No. 12417/2011 holds importance for the management and protection of the geological / morphological Ridge as in this matter the High Court ordered that permission of Ridge Management Board (RMB) or the Supreme Court through the Central Empowered Committee (CEC) is required to carry out any construction on the morphological Ridge.

In this case the petitioner alleged unauthorized construction known as OTM accommodation for Supervisors/ORs of HQ DGBR at Naraina, New Delhi which is a part of Central Ridge and therefore, as per the orders of the Supreme Court, no construction is permissible there upon. As per the Government of NCT of Delhi, though it is not exactly the Ridge area, it is part of the geologically extended Ridge area. And therefore, permission of RMB and Supreme Court through CEC is required before carrying out any construction in such area.

It was also mentioned that DMRC and NHAI had taken permission of the RMB in the non-forest land having morphological features of the Ridge. Admittedly, no such permission was sought by BRO. Therefore, the High Court in its order dated 30.11.2011 mentioned that the land under question has the character of the 'Geological Ridge' though falling outside the notified forest Ridge land, and permission of Ridge Management Board or the Supreme Court through the Central Empowered Committee is to be obtained before carrying out any construction on such land. BRO was restrained from carrying out any further construction works till it obtains necessary clearance from the RMB and the SC through CEC.

1.4.6 User agency to contribute to compensatory afforestation

In the matter of T.N. Godavarman Thirumulpad Vs. Union of India and others (Forest Conservation Case), I. A. Nos. 2899, 2897, the National Highway

Authority of India was seeking permission of the Central Empowered Committee for the use of 2.8 ha of forest land of the Southern Ridge for the upgradation of NH-236 between Andheria More and Delhi-Haryana Border. The NHAI was taking up the upgradation and maintenance of NH-236, which included realignment of the road for smoothening of a sharp curve near the Indian Air Force (IAF) Station, Arjangarh at village Ayanagar. A Memorandum of Understanding (MOU) was signed between the NHAI and IAF whereby the latter agreed the use of the land of IAF station involved in the said project with certain terms and conditions. This project also involved the use of 2.8 ha of forest land and 1.041 ha. of non-forest land falling within the Ridge, which involved felling of 400 trees. The permission of RMB was sought for the use of the above said Ridge land.

After attaining approval of CEC in its report dated 21.07.2010 in application no. 1290, the Supreme Court in its order dated 30th August 2010 gave approval with the conditions suggested by Central Empowered Committee namely, approval of Forest (Conservation) Act, 1980, transplanting trees instead of felling wherever possible, the maximum area of the handed over land be maintained as green area / Ridge except the minimum area required for the security services of IAF and 5% of the project cost will be given by the user agency for Compensatory Afforestation Fund for undertaking conservation and protection of Ridge areas.

1.5 CENTRAL EMPOWERED COMMITTEE (CEC)

The Godavarman case (1995), ongoing before the Hon'ble Supreme Court with over a few thousand applications of intervention from various stakeholders, is one of the most prominent examples of judicial activism in the sphere of forests and wildlife. The case has emerged as the largest judicial forum on all aspects of forest management, and led to the creation of unique institutions for dispute resolution. In this regard, the role of National Level Committee on Forestry, popularly known as the Central Empowered Committee (CEC) constituted in pursuance of the Supreme Court order in the ongoing Godavarman Case has added a whole new dimension to forestry jurisprudence and hence merits a closer look.

The CEC was constituted on 17th September 2002 through a Gazette Notification issued by the Ministry of Environment and Forests under the

provisions of sub-section (3) of Section 3 of the Environment (Protection) Act, 1986 for a period of five years with effect from 9th May 2002 in pursuance of the order of the Supreme Court dated 9-5-2002 and 9-9-2002 in W.P. 202/95 and 171/96, to look into violations of the Forest Act and to monitor the implementation of the Supreme Court orders and to place the non-compliance cases before it. The need for a Committee was mentioned in I. A. No. 295, in which the Central Government admitted in principal that it is necessary and desirable that a National Empowered Committee should be constituted.

The CEC was, further, reconstituted vide Supreme Court order dated 14.12.2007 in I. A. No. 2016. After the expiry of the term of CEC, it had been directed to constitute CEC as a Court appointed committee, instead of the MoEF constituting it under the provision of the Environment (Protection) Act, 1986.

The CEC has played an important role for the management, protection and conservation of the Ridge. In its report dated 21.07.2010, CEC gave recommendations in application no. 1290 filed before it by the National Highway Authority of India seeking permission for the use of 2.8 ha. of forest land falling in the Southern Ridge for the upgradation of the NH-236 between Andheria More to Delhi- Haryana Border. The proposal was approved by RMB and then CEC permitted the use of the above said Southern Ridge land subject to some conditions like approval of Forest (Conservation) Act, 1980, transplanting trees instead of felling wherever possible, that the maximum area of the handed over land be maintained as green area/ Ridge except the minimum area required for non-forest purposes, and that 5% of the project cost will be given by the user agency for Compensatory Afforestation Fund for undertaking conservation and protection of Ridge areas. Using this Compensatory Afforestation Fund, the task of plantation of saplings was carried out, which, to some extent, helped in maintaining the green cover of Delhi.

1.6 BIRTH OF RIDGE MANAGEMENT BOARD

One of the bodies formed to protect and restore the Ridge forest is the Ridge Management Board (RMB), constituted vide Lieutenant Governor's order dated 6th October 1995. It was constituted following directions of the

Hon'ble Supreme Court in the M.C. Mehta case. It is a seven-member non-statutory body consisting of representatives from the Government, DDA and Non-Government Organizations, supposed to protect the Ridge.

The Board was chaired by the Chief Secretary of Delhi with Vice-Chairman, DDA, Secretary (Environment and Forests), Delhi, Secretary (Finance), Delhi, Conservator of Forests, Delhi and representatives from two NGOs namely, Indian Society of Environmental Management and Prakriti-Centre for Environmental Protection and Development as Members; and Deputy Conservator of Forests, Delhi as Member Secretary.

The Ridge Management Board is a high powered body which exists to protect the Delhi Ridge. Along with the Central Empowered Committee (CEC), appointed by the Supreme Court, the Board has become the nodal body for allowing any diversion of land for non-forest use on the Ridge. Its domain extends to the morphological Ridge also, which has Ridge like features but is not part of notified forests.

Functions of the RMB, as mentioned in its order of constitution, are as follows:

1. Execution of the management scheme for the Ridge Forests as the green lungs of Delhi.
2. Protection of the boundary and boundary fences of the Ridge.
3. Preparation and execution of detailed plans for upgradation of the Ridge in accordance with sound silvicultural practices applicable to city forests.
4. Control of the usage by the public of areas of the Ridge forests as may be declared as "open", by the Board.
5. Ensuring that there are no encroachments in excess of the areas allotted to the lawful allottees, till they are shifted from the Ridge forest under appropriate orders.
6. Any other functions ancillary to the above purposes.
7. The Board may co-opt for any of its meetings being attended by not more than two persons having special knowledge of forestry, regional ecology, nature conservation and related subjects.

1.7 CHANGING STRUCTURE OF RIDGE MANAGEMENT BOARD

At the outset, in 1995, the Ridge Management Board included representatives from Indian Society of Environmental Management (NGO) and Prakriti – Centre for Environmental Protection and Development (NGO) as members. Then, in 2002, with the approval of the Chief Secretary, Dr. Ravi Agarwal from 'Srishti'/Toxic Link and Mr. Ajay Mahajan from 'Kalpavriksh' were co-opted as members of the Ridge Management Board vide order dated 28th June 2002. The Ridge Management Board was re-constituted vide Lieutenant Governor's order dated 30th April 2013. Now the Board comprises of Chief Secretary as Chairman; Vice-Chairman, DDA, Secretary (Environment and Forests), Delhi, Secretary (Finance), Delhi, Director, Centre for Science and Environment (NGO), CEO, WWF- India and Chief Conservator of Forests as Members; and Additional Principal Chief Conservator of Forests as HOD of Forest and Wildlife Department, Delhi as Member Secretary.

1.8 MAIN DECISIONS OF RIDGE MANAGEMENT BOARD

Since 1995, the Ridge Management Board has taken some important decisions in various meetings for the protection, conservation and consolidation of the Delhi Ridge. Some of the important ones are mentioned below:

1.8.1 Decisions of the Ridge Management Board till 2012

The Ridge Management Board (RMB), after its constitution in 1995, was entrusted with the responsibility of protecting the Ridge, removing encroachments and taking up regeneration of the Ridge area by following robust principles of silviculture. As far as protection of the Ridge was concerned, the RMB decided fixing of boundary pillars or durable fencing around the Ridge area. In course of time, masonry wall was constructed around Ridge not only for its protection but also to prevent dumping of malba in the Ridge forests. In a series of meetings, the Board monitored the removal of encroachments and handing over of the vacated land to the Ridge land owning agencies.

Dumping of malba on the Ridge land had been a recurrent problem. This issue was deliberated upon by the RMB, and decisions were taken for their removal from time to time. The RMB decided that concerted action by Departments like Forest, Police, CPWD and MCD should be taken to prevent malba dumping on the Ridge land. It also directed that PCR vans

should be deployed for patrolling the Ridge area at odd hours for detecting offences relating to malba dumping which was damaging the already fragile ecosystem of the Delhi Ridge.

The RMB decided to prepare a conservation and management plan with support from experts. The Forest Research Institute (FRI), Dehradun was assigned the task of surveying the Ridge flora and suggesting ways and means for its improvement. The FRI completed their study of the Ridge flora in 2003.

The RMB took cognizance of the presence of three unauthorized colonies in the Asola Bhatti Wildlife Sanctuary. These colonies were Indira Nagar, Balbir Nagar and Sanjay Nagar. It deliberated upon the necessity to shift these colonies from the Sanctuary, pursuant to the order of the Supreme Court in the M.C. Mehta case. Two colonies namely, Indira Nagar and Balbir Nagar, have been relocated while Sanjay Nagar colony will be relocated soon. The RMB expressed its concern over the increase in encroachment on the Southern Ridge since 2001, and decided that the entire Southern Ridge should be surveyed, demarcated, secured by durable fencing and encroachments removed. A detailed survey was conducted intermittently before 2012, but was never completed. A systematic survey of the Southern Ridge began in April 2012, and has been discussed under Section 1.8.2.

The Supreme Court, in the M.C. Mehta case, allowed 63 institutions to continue their presence on the Ridge land, subject to the condition that they do not expand their occupation of the Ridge land. The RMB took note of the infraction of the orders of the Court by sub-allottee institutions, and decided that these organisations should be vacated from unauthorized occupation of the Ridge land, and the same handed over to the Ridge land owning agencies. The Board also took note of non-forest activities in Sanjay Vana and issues related to protection of the Central Ridge.

The RMB reviewed progress of the settlement of rights by claimants of the Ridge land by the Forest Settlement Officer, and took a series of decisions for its early completion, as well as to complete the process of notification of Reserved Forests under Section 20 of the Indian Forest Act, 1927.

The Lieutenant Governor also monitored the implementation of the directions of the Supreme Court in the M.C. Mehta case a number of times. The matter reviewed by him included progress of fencing of Ridge land, removal of encroachments, shifting of unauthorized colonies from Asola Bhatti Wildlife Sanctuary, and development and conservation plan of the Ridge land.

1.8.2 Decisions of the RMB after its re-constitution in 2013

As already mentioned, the Ridge Management Board was constituted vide Lt. Governor's order dated 06.10.1995 for the protection and conservation of the Delhi Ridge as green lungs of the city. Since 1995, the Ridge Management Board has worked with great vigour and enthusiasm and played a vital role by taking important and far reaching decisions which are part of the minutes of the meeting of the Ridge Management Board.

A few years ago, the Government desired to complete the survey of the Ridge by Total Station Method, but somehow it could not progress. The matter of survey of the forest area on the Southern Ridge was taken up by the Forest Department in right earnest in April 2012. Substantial progress has been made in this regard. Newly inducted members, namely Ms. Sunita Narain, Director General, Centre for Science and Environment and Mr. Ravi Singh, CEO, WWF- India have taken keen interest in geo-referencing of the Ridge forests and their protection.

The main decisions taken after the reconstitution of the Ridge Management Board during 2012-2013 and 2013-2014 are reproduced below:

1. To prepare a detailed action plan for conservation and enrichment of the Ridge forest land on priority before the next Board meeting (20.05.2013).
2. The Special Task Force (STF) was constituted for the purpose of identification and demarcation of the notified forest land in South and South-West Revenue Districts vide order No. F. 8 (328)/Forest Land/ Plg.2011-12/1204-25 dated 16.02.2012. The STF has to identify the notified forest land (WLS, RF, PF), as well as land allotted to the Forest Department by various authorities for the purpose of plantation and recreation of Reserved Forests (1996 Notification). The Task

Force has already finalized the assigned job in the following villages: Chattarpur, Satbari, Rajokri, Rangpuri, Neb Sarai, Devli, Jonnapur, Sahurpur, Mehrauli, Ghitorni, Dera Mandi, Rajpur Khurd, Ayanagar and Pulpehladpur. The progress in remaining 6 villages could not be completed due to their mutilated masavis. This table top exercise is being finalized by ground truthing through TSM.

The conservation action plan for the Ridge area requires following steps to be taken:

- The process of settlement of rights and claims to declare the area as forest area must be expedited and carefully monitored for progress.
- The process of demarcation of 'Ridge' area, proposed under Section 4 will require all the land owning agencies to submit land records, with khasra number of the Ridge area under their management. The area must be demarcated and physical boundary made.
- The exact boundaries as identified will be put with lat-long and all other data on map and will be publicly available.
- There must be conformity between the master plan, which categorizes Ridge land as Regional Park, and the Ridge conservation plan, which categorizes area as forest land. The list of permissible activities must be harmonized.
- Once the Ridge map is delineated, all land controlling agencies will be required to submit an action plan for its protection, rejuvenation and management to the RMB.
- The land falling under morphological Ridge will also be identified in consultation with Geological Survey of India and Delhi State Geospatial Data Infrastructure. The current confusion on the extent of this land is adding to the problem of encroachment as well as harassment of land owners.
- The RMB will do annual surveys, using remote sensing and spatial technologies, to assess tree cover under each agency. Any evidence of encroachment or degradation from the baseline will be severely penalized, including the takeover of Ridge/Reserved Forests from the management agencies to the Government of NCT of Delhi.

- ✦ It was also agreed that the RMB should take steps on the above mentioned lines. RMB agreed that to begin with the demarcation of the Southern Ridge be carried out on priority on the basis of the 1996 notification. This work can be used as a template to extend and further cover the entire Ridge Area. The Forest Department and DDA need to submit the Khasra Nos. of the Southern Ridge under their jurisdiction to Geospatial Delhi Limited (GSDL) at the earliest to facilitate the demarcation process. Once the area is demarcated on the map, it will clarify the specific problem areas, which require resolution on ground. It was agreed that this work would be undertaken in the following 15 days, and the map would be presented at the next meeting of RMB (18.07.2013).

3. Demarcation and mapping of the Ridge area

The conservation plan should ascertain the area under the Ridge on ground, and envisage steps to protect and manage the same. However, the first precursor to the preparation of such a plan requires ascertaining the exact extent of area under the Ridge and the present status of actual possession of such land by different agencies.

The task of preparation and validation of maps of the Ridge area as per the notifications of 1994 and 1996 had been entrusted to STF and GSDL. They have completed most of the maps showing details of area, boundaries, latitude, longitude and thematic details in compliance with the NGT order also. The STF, constituted in February 2012, have completed the geo-referenced maps for 15 villages of the Southern Ridge, while those of the remaining 5 villages could not be completed due to their mutilated masavis. Ground truthing of the completed maps is being finalized. It was decided that the remaining 5 villages should not be generalized, and the villages where the maps had been finalized should be taken on record so that their areas can be worked out for preparation of boundary wall.

There were 4 notified Ridge areas under GNCTD, with a total area of about 7,784 ha as per notification. The management of different Ridge areas has been vested with different agencies including the Forest Department, DDA, MCD, SAI and others, so the extent of area may be clarified to the Board by all agencies in the next meeting of RMB. Amongst all four notified Ridges,

the Southern Ridge has the maximum area of 6,200 ha, so it may be worked out first.

Of the 6,200 ha of the Southern Ridge, approximately 1,938 ha is under the management of the Forest Department (Asola and Bhatti Wildlife Sanctuary - ABWL). Apart from that, another 4,207 ha of uncultivated Gram Sabha land forms part of Southern Ridge as per the notification of 1996. Of this, 3,200 ha was handed over to the Forest Department as per the records. It was also stated that an area of 32 ha and 120 ha of the Southern Ridge is under the management of the Sports Authority of India (SAI) and Delhi Development authority (DDA) respectively.

The Board enquired the area of the Ridge under encroachment, and requested that each agency should categorically give a figure of encroachment in Ridge land under their possession.

It was stated that before the encroachment figures are brought on record, the exact area from all the land owning agencies of the Ridge and its compilation is necessary to avoid any duplication. It may be placed before the RMB in its next meeting.

In the Southern Ridge, as per records, the DDA has 125.38 ha under their management/control. It was decided that DDA will provide complete details of Ridge land under possession of DDA in the next meeting of RMB.

The Board expressed concern about the respective areas under the control of different agencies, specially the Forest Department and DDA, its jurisdiction and encroachments (if any) on it. The identification of the Southern Ridge area may involve the following three logical steps which need to be completed on top priority by each of the stakeholders, to enable the RMB to obtain authentic and conclusive data.

- Geo-referenced mapping of the area under possession.
- Ground truthing (done in the field).
- Assessment of encroachments and actual possession of land in the field.

It was concluded that all the agencies owning the Ridge should furnish details of the area under them as per notification, area under actual possession, steps taken to take over remaining area, area under encroachments, and provide protection to the Ridge in the form of construction of wall or fencing, etc. It was decided that complete details of the Ridge land under the 1994 and 1996 notifications, and those of the morphological Ridge be provided in the next meeting of RMB (10.09.2013).

4. The proposal for the Conservation Action Plan for the Ridge area was approved for four years by the RMB for the amount of Rs. 3.34 crore, which included various activities like plantation works, engagement of staff and procurement of infrastructure. The amount of Rs. 58.40 lakhs on sparrow conservation activities (annually) will be approved after modifications based on consultation with WWF-India (10.09.2013).

5. Demarcation and consolidation of Ridge land

It was decided by the Board that the consolidation of Ridge land has to be done in stipulated time. For that matter all the agencies have to conduct TSM and GPS survey and place the report before the Board prior to the next RMB meeting.

A. Northern Ridge: It was informed that in the Northern Ridge the area under the Forest Department is 3 ha. which is already geo-referenced. However, the 73 ha of DDA and 11 ha of MCD still need to be geo-referenced, and it was agreed that this would be done at the earliest and would be presented to the RMB in its next meeting. The DDA officials have been asked to provide necessary geo-coordinates and map of the Ridge area under their possession with suitable mechanism to close the traverse as per the 1994 notification.

B. Central Ridge: Of the 864 ha of the Central Ridge, 423 ha has been demarcated and geo-referenced. The remaining area with DDA and the Army needs to be demarcated and geo-referenced. It was agreed that the DDA and Army would be requested to provide information so that this could be done at the earliest.

C. South Central Ridge: This is totally under DDA as Sanjay Van. However, reconciliation on the data is required, as according to DDA officials present at the meeting, the boundary of the area has been changed and modified. Status on this would be provided at the next meeting of the RMB.

D. Southern Ridge: The Board was informed that the Forest Department has completed delineation of boundaries of 21 villages of the Southern Ridge through its Special Task Force. The mosaicing of 21 villages, which will provide the exact area of the Southern Ridge is under way. With the help of Quick Bird Satellite Imagery, the Forest Department is also doing an exercise with GSDL to detect encroachment areas village wise. After completion of the details of encroachment, it will be placed before the Board for taking a further view of the matter.

The progress by the Forest Settlement Officer was also discussed. Of 45 cases, the FSO has already settled 43 cases. The progress was found to be satisfactory. It was informed that 11 maps of the Southern Ridge have been uploaded on the Forest Department's website and the remaining maps of 10 villages will be uploaded soon.

The status of the Southern Ridge is as follows: 4,022 ha with the Forest Department to be finally demarcated after detection of encroachments; 1,957 ha with the Forest Department under Asola-Bhatti already demarcated; 42 ha with Sports Authority to be demarcated; 120 ha with DDA to be demarcated (as of 07.02.2014).

1.9 STATUS OF RIDGE MANAGEMENT BOARD

The Board was constituted by the Government of NCT of Delhi following directions of the Supreme Court contained in the M. C. Mehta case discussed above. Therefore, it can be said that the Board is a Court appointed body to fulfill the mandate of protection of the Ridge in all its descriptions. The overall objective with which the Board functions is preserving the habitat and ecology of the Delhi Ridge.

The Board communicates some of its decisions to the CEC, which also came into being following directions of the Supreme Court in 2002. For many years, the CEC is functioning as an adjunct to the Supreme Court. Therefore, in all cases of clearances accorded by the Board, it is the CEC which communicates the decision of the Supreme Court to the Government of Delhi and the Board. Therefore, the decisions of the Board have to fall

within the broad framework of the orders issued in M.C. Mehta case, and as in other cases by the Delhi High Court on the subject.

A closer examination of the first order constituting the Ridge Management Board reveals that it has members from the Government and NGOs. It further adds that the Board may co-opt for any of its meetings not more than two persons having special knowledge of forestry, regional ecology, nature conservation and related subjects.

The above provisions in the composition of the Board implies that the Board should endeavour to promote ecology and forests of the Ridge in addition to initiating measures of conservation of forests of the area. Though the order of the constitution of the Board is administrative in nature, it is heavily tilted in favour of habitat conservation of the Ridge due to presence of domain experts by way of NGOs and co-opted members. Therefore, the Board plays developmental, regulatory and advisory roles in respect of Delhi Ridge.

The normal channel through which RMB operates is through CEC in respect of some of the decisions taken by the Board, particularly with regard to clearance of public interest oriented developmental projects from the Ridge/ morphological Ridge.

The CEC came into existence in 2002 by way of the orders of Supreme Court in the famous Forest Conservation case, and this institution is also acting as an adjunct to the Supreme Court. Therefore, it is the CEC which communicates final clearance of the Supreme Court to the Board and the Government of NCT of Delhi.

In sum and substance, Delhi has two natural features namely, the Ridge and river Yamuna. If the Yamuna is the heart of Delhi, the Ridge, which overlooks the teeming city like a Giant sentinel, is its crowning glory.

The Ridge Management Board, since its inception in 1995, has taken concrete steps in consolidating the Delhi Ridge. In recent years, its activities have increased qualitatively in supervising the geo-referencing of notified forest areas in Delhi. The work of STF and GSDL in geo-referencing the Ridge areas

is proving to be of great help in not only protecting the Ridge forest, but also in taking adequate measures to prevent further encroachment of the Ridge.

Recent interventions by the National Green Tribunal has energised various arms of Government of Delhi to comply with the mandate of conservation of the Ridge in substantial measure. A number of initiatives are also being undertaken by the Government to remove pollution from the river Yamuna.

Determined action by various wings of the Government of Delhi in protecting the Ridge and cleaning up the Yamuna will one day, it is hoped, fructify the *vedic* and Athenian wisdom to the capital city of Delhi.

Chapter-2

Evolution of Statutory and Management Framework

"We will never bring disgrace on this our City by an act of dishonesty or cowardice. We will fight for the ideals and Sacred Things of the City both alone and with many. We will revere and obey the City's laws, and will do our best to incite a like reverence and respect in those above us who are prone to annul them or set them at naught. We will strive unceasingly to quicken the public's sense of civic duty. Thus, in all these ways, we will transmit this City, not only, not less, but greater and more beautiful than it was transmitted to us."[1]

– The Athenian Oath

2.1 A BRIEF RECAP OF LAW AND POLICY ON FORESTS

Till the early part of 19th Century, forestry as a profession was non-existent in India. The British required teak timber for ship building as well as surplus profit for supporting the expansion of the British Empire. This led to large scale extraction of trees for economic value like sal, teak and sandalwood in India. The value of conservation was not thought of in those days. By the middle of the 19th century, the depletion of forests began to assume serious proportions in India and the British Government was forced to recognize that the forests in India were, after all, not inexhaustible.

In 1847, Gibson was appointed Conservator of Forests in Bombay who played a major part in creation of the Bombay Forest Conservancy, which was the first case of State Management of Forests in the World. In 1855, Lord Dalhousie issued the Forest Charter in India, which decisively changed the status of wasteland into government property. In 1864, Dr. Dietrich Brandis in association with B.H. Baden-Powell, drafted the first Forest Act,

[1] Available online at http://www.nlc.org/build-skills-and-networks/resources/cities-101/city-factoids/the-athenian-oath (visited 12 March 2014).

which was notified as the Government Forest Act, 1865. This Act was aimed at stopping the destruction of forests and to protect the resources on a sustainable basis for future needs. It was amended in 1878 when a comprehensive law, The Indian Forest Act, 1878 (Act No. VII) came into force. The provision of this Act established a virtual State monopoly over the forests in a legal sense on one hand, and attempted to establish, on the other, that the customary use of the forests by the villagers was not a 'right', but a 'privilege' that could be withdrawn at will. This Act led to constitution of Reserved Forests under scientific management of timber harvesting and tree plantation based on silvicultural principles. These Reserved Forests in India, till today, house large biodiversity despite extraction of timber as per working plans for more than a century. This Act provided for three classes of forests- Reserved Forests, Protected Forests and Village Forests. It was finally amended in 1927, and continues to be the present law on forests in India.

The Forest Charter of 1855 and the Indian Forest Act of 1878 put Indian forestry on a solid scientific base. Lord Dalhousie introduced new environmental interventions that were paternalistic, radical and previously untried. The wisdom of Lord Dalhousie prevailed in appointment of Dr. Dietrich Brandis, a German, when he appointed him Inspector General of Forests to the Government of India in larger interest of Forests. These new forest policy interventions greatly expanded British authority over the land and people of India[2].

The last quarter of the 19th century British India is also known for recurrence of famines in erstwhile Bengal and other parts of the British India Territory. Famine Commissioners used to be appointed who were duty bound to transmit their report and recommendations to the Government. Because of the fact that the continuing process of reservation of forests in India was putting restrictions on the rights of indigenous people to clear forests and also due to heavy taxation and absolute poverty, people were finding it difficult to take up cultivation. The report of the famine commissioner was available in the 1880s, and it made many recommendations for improvement of agriculture.

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[2] Sinha G.N. (2006) British India's forestry and Modern Environmentalism, 29 September, *Arunachal Times*, Itanagar.

It was in this background that the government of India appointed Dr. Voelcker, Imperial Chemist, to investigate the pattern of Indian agriculture. Dr. Voelcker submitted his report in 1893 which formed the basis of the first forest policy issued in 1894. This policy supported clearing of forest for cultivation purposes to address the persistent problem of famines in India. This policy aimed at more custodial and timber-oriented management, which was later revised in 1952 and again in 1988.

An independent & democratic India saw a lot of new political initiatives. The Forest Policy of 1952 recommended that 33% of the total land area of the country should be brought under forest or tree cover. It provided detailed guidelines for management and protection of forests and wildlife. The first policy decision for people's involvement in forest protection and management was taken in the resolution passed by the Central Board of Forestry in 1987.[3] In 1988, the National Forest Policy was revised, which aimed at maintenance of environmental and ecological stability and the participation of the people to increase and protect forests.

In 1976, by 42nd amendment in the constitution, 'Forest' was brought under concurrent list from state subject followed by the enactment of the Forest (Conservation) Act in 1980. The Act made it mandatory for the states to take prior approval of the Central Government before diversion of any forest land for non-forestry purpose with a provision for compensatory afforestation preferably on non-forest area. It immediately withdrew the power of the State Governments to de-reserve the forests that have been reserved earlier.

2.2 THE INDIAN FOREST ACT, 1927

The Indian Forest Act, 1927, largely based on the previous Indian Forest Act of 1878, was implemented in British India. This Act embodied all the major provisions of the earlier one, extending it to include those relating to the duty on timber. The Act sought to consolidate and reserve the areas having forest cover, or significant wildlife, to regulate movement and transit of forest produce, and duty leviable on timber and other forest produce. As per section 41 of the Act, the control of all timber and other forest-produce

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[3] Mukerji, A.K. (2003) *Forest policy reforms in India - Evolution of the Joint Forest Management Approach*, paper presented at The XII World Forestry Congress, Quebec City, Canada.

in transit by land or water is vested in the State Government, and it may make rules to regulate the transit of all timber and other forest-produce. It defined, in detail, a forest offence, the acts prohibited inside a Reserved Forest, and penalties leviable on violation of the provisions of the Act.

Reserved Forests: The State Government was empowered to constitute any forest or waste land of public importance as Reserved Forests. All activities in Reserved Forests are prohibited unless permitted. Under section 4 of the Act, a preliminary notification is issued by the State Government to declare an area as Reserved Forest and a Forest Settlement Officer (FSO) is appointed to settle all the rights either by admitting or rejecting them, as per the provisions of the Act. Thereafter, the State Government issues final notification under section 20 of the Indian Forest Act, 1927, declaring that piece of land to be a Reserved Forest.

Protected Forests: The State Government retains the power to restrict some rights and privileges in larger public interest regarding the use of such forests, whereas, most practices are allowed. Further, in a Protected Forest, the Government may issue notifications declaring certain trees to be reserved, suspend private rights, if any, for a period not exceeding 30 years.

Village Forest: It is also controlled by the State Government, which may assign to any village community the rights over a land which for use of one/ more communities residing in the surrounding area. The State Government may also make rules for regulating the management of such forests.

2.3 STATUTORY INSTRUMENTS ON FORESTS

When the British shifted their imperial capital from Calcutta (now Kolkata) to Delhi – a decision announced in 1911 – the Ridge became the focus of attention. The British wanted their new capital to show the majestic grandeur and order of the empire, especially given India's status as the "jewel in the crown" of British power. This could have been the reason for the issue of notifications by the British in the early part of 20th century, declaring the constitution of Reserved and Protected Forests in Delhi, being the capital city, as was done in the rest of British India. In the backdrop of the above, it is worthwhile to categorise attempts of the Govt. in notifying forest areas in Delhi in the following three phases:

I. Phase I: 1913-1947 (prior to independence)

Year	Brief Information
1913	Parts of Ridge were proposed as Reserved Forests in 1913 and placed under the charge of CPWD 'Notified Area Committee'. Under section 4 of the Indian Forest Act, the then Additional District Magistrate (ADM), Delhi, was appointed as Forest Settlement Officer to enquire into and determine the existence, nature and extent of any rights alleged to exist in favour of any person. (Annexure 1)
1915	Patti Chandrawal Mahal (~395 acres) deemed to be Reserved Forest (under section 19 of Indian Forest Act, 1878) from 01.10.1915 and placed under the charge of CPWD 'Notified Area Committee' and the Secretary of the committee was declared as Forest Officer in 1915. (Annexure 2)
1942	Under section 4 of the Indian Forest Act, 1878, the Chief Commissioner, Delhi, declared part of village Patti Chandrawal Mahal to be Reserved Forest. This notification supersedes and replaces the Chief Commissioner notification No. 5911- R & A, dated the 7th September, 1915. (Annexure 3)
1944	Under sub-section (2) of section 2 of the Indian Forest Act 1927, the Chief Commissioner appointed the Secretary, Civil Station Notified Area committee, Delhi, to be a Forest Officer for all the purposes of the said Act, for the area specified in this 1942 notification. (Annexure 4)

II. Phase II: 1947 - 1980

Year	Brief Information
1958	Under sub-section (2) of section 2 of the Indian Forest Act, 1927, the Chief Commissioner, Delhi appointed the Soil Conservation Officer, Delhi, to be a Forest Officer to carry out all the purposes of the said Act for the areas specified in the 1942 and 1913 notifications, under the Indian Forest Act, 1878. (Annexure 5)
1965	Under clause (2) of section 2 of the Indian Forest Act, 1927 and in partial modification of the 1958 notification, the Chief Commissioner, Delhi, appointed the Assistant Director Incharge of Southern Ridge, CPWD, Horticultural Directorate, New Delhi to be a Forest Officer to carry out all the purposes of the said Act. (Annexure 6)
1980	Under section 29 of the Indian Forest Act, 1927, 25 forest areas (natural/ manmade) were declared as Protected Forests. (Annexure 7)

III. Phase III: 1980- till date

Year	Brief Information
1986	For the purpose of protecting, propagating or developing of Wildlife or its environment, the Administrator Delhi declared Wildlife Sanctuary in parts of Gaon Sabha land of villages Asola, Sahurpur and Maidan Garhi, under section 18 of the Wildlife (Protection) Act, 1972. (Annexure 8)
1991	In continuation of the 1986 notification, under the section 18 of the Wildlife (Protection) Act, 1972, an area of 2166.28 acres of Bhatti village was declared as Wildlife Sanctuary, considering the ecological, geological, faunal, floral, geomorphological and natural significance of the area, for the purpose of propagating and or developing of Wildlife and / or its environment. (Annexure 9)
1994	According to the notification issued in 1994, all forest lands and wastelands, which are the property of the government, and over which the government has propriety rights, were considered as Ridge and the Ridge, i.e., Northern, Southern, Central and South Central Ridge were declared as Reserved Forest, in pursuance of the provisions of section 4 of the Indian Forest Act, 1927. Under the section 4 of the Indian Forest Act, 1927 ADM (Revenue) was appointed as FSO to enquire into and determine the existence, nature and extent of any rights alleged to exist in favour of any person in or over any land comprised within such limits. (Annexure 10)
1996	Notification issued in 1996 directed that uncultivated surplus land of Gaon Sabha falling under the Ridge may be excluded from vesting the Gaon Sabha under section 154 of Delhi Land Reforms Act, 1954 and made available for the purpose of creation of Ridge forests. (Annexure 11)
2006	After the 1996 notification, more land was declared as Reserved Forests, which demanded the appointment of more Forest Settlement Officers for settlement of rights. Therefore, in 2006, as per the clause (c) of sub-section (1) and sub-section (3) of section 4 of the Indian Forest Act, 1927 (16 of 1927), Lt. Governor, Delhi, appointed ADM (HQ), ADM (South), ADM (South District) and ADM (South-West District) to be the FSOs to enquire into and determine the existence, nature and extent of any right alleged to exist in favour of any person in or over any land comprised within such limits, as notified notifications issued in 1994 and 1996. (Annexure 12)

The above classification concerning the Delhi Ridge is for the pre-independence era, where the policies were framed by the British;

notifications post- independence but prior to the commencement of the Forest (Conservation) Act, 1980; and notifications after the commencement of Forest (Conservation) Act, 1980, which envisaged protection to forests in a much more holistic approach and prevented de-reservation of forests and use of forest land for non-forestry purposes, without the prior approval of the Government of India.

2.4 RIDGE AS A NATURAL FEATURE

The oldest Fold Mountains in India, the Aravallis, rose in a Precambian event called the Aravalli-Delhi orogen. Old Fold Mountains are characterised by not growing any further due to cessation of upward thrust caused by stopping of the movement of tectonic plates in the Earth's crust under that region. The Aravallis stretch about 800 km in north-eastern direction across the states of Gujarat, Rajasthan, Haryana and Delhi. It covers an area of about 50,000 km^2 and acts as a barrier against advancement of desert to the east, thereby protecting the indo-gangetic plains. The northern end of the range, which is the Mewat branch of the Aravallis, continues as an isolated hill and rocky Ridges towards Haryana state, ending in Delhi, where these rocky outcrops get designated as the Delhi Ridge.

The geography of Delhi can be physically divided into three segments: the Ridge, the Yamuna flood plains and the plains. Much of the Delhi area is plains. The Delhi Ridge, being the most dominating feature of Delhi's physiography, apart from other physical features like the Yamuna flood plains, represents an ecosystem with its own distinct biodiversity. It stretches from Delhi University in the north towards Jawaharlal Nehru University in the south and beyond, covering a distance of about 35 km.

2.4.1 Geology of the Ridge

Entire area of NCT of Delhi is grouped into three broad geomorphic units: Rocky surface (the 'Ridge'), Older Alluvial Plain– gently undulating surface with rolling topography and flood plains of Yamuna river– low lying surface. The area immediately south of Delhi, which includes the Ridge, is rocky and undulating. This low plateau consists mainly of bare, unconsolidated rocks.

The rocky surface represents structurally controlled relict linear Ridges and isolated hillocks comprising of rocks of Delhi Supergroup and isolated hills

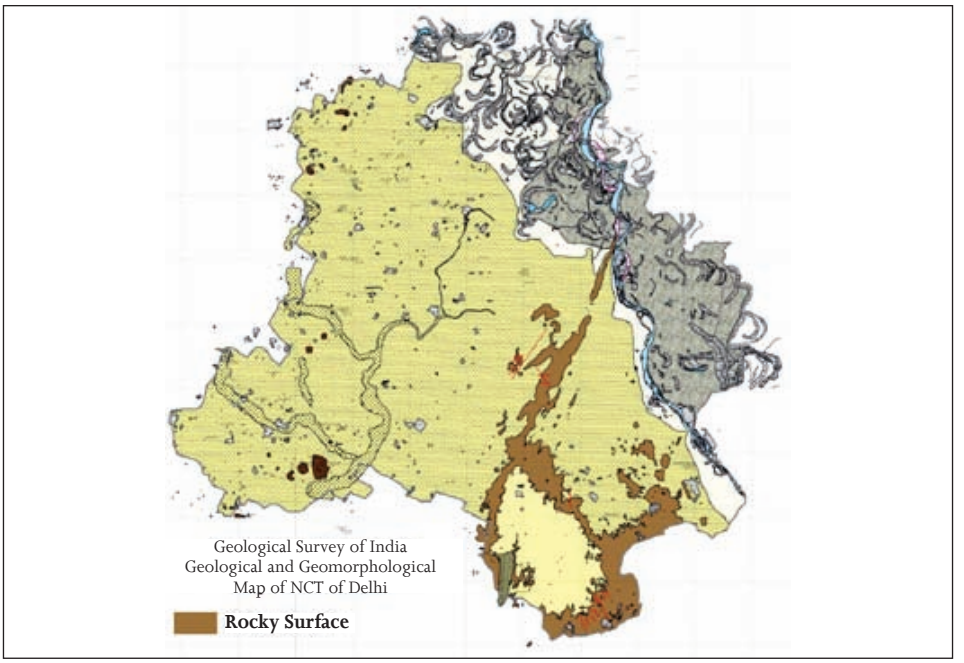

Figure 1: Map showing various geomorphological features of Delhi.
Source: Geological Survey of India (GSI), 2011

mostly occurring in the south-central part, and extending from Mahipalpur to Wazirabad in the north. This is one of the oldest geological units comprising rocks of Delhi Supergroup of Middle to Upper Proterozoic age. The Delhi Supergroup comprises quartzite, gritty quartzite, arkosic grit with thin intercalations of micaceous schist. The micaceous schist occasionally contains crystals of garnet, andalusite and staurolite.

South of Mahipalpur, the Ridge gets bifurcated, one arm extending towards Mandi and further south, while the other arm takes a turn towards southeast up to Tughlakabad-Greater Kailash-Nehru Place and Okhla. It lies at an elevation of 305-335 m above mean sea level or about 90 m above the alluvial plains of the Yamuna, gradually diminishing towards the north where rocks are exposed on the western bank of Yamuna near Wazirabad.[4] The northernmost end of the Ridge is only 2.5 m above the plains.

[4] GSI (2011) *Geological and Geomorphological Mapping of parts of NCT Delhi for Seismic Microzonation*, Geological Survey of India, Ministry of Mines, India.

2.4.2 Morphological Ridge

Of Delhi's total area, 10.9% is in the very high seismic risk zone (Zone-V) while 17.3% of the area falls under high risk zone (Zone-IV). As per the prerequisite, the Geological Survey of India (GSI) carried out geological and geomorphological mapping of about 1482 km^2 on a 1:10,000 scale in Delhi area, to provide a base map for the seismic micro zonation of Delhi.

The morphological Ridge is described on the basis of seismic zonation provided by Geological Survey of India Map of Delhi of 2006. Though falling outside the notified Ridge forest land, it has Ridge like features in respect of Aravalli outcrop and vegetative cover. Morphological Ridge, having similar features to the notified Ridge, is of immense ecological importance, and should also be conserved and kept free from unrestricted and unplanned development. It should work as a buffer zone to protect the core forest area of the Ridge.

Also, morphological Ridge area comes under high risk zone; so, construction of high-rise buildings in the morphological Ridge area may be dangerous. The State Government identified morphological characteristics, land recorded as '*Gair Mumkin Pahar*' in Revenue records and area notified as Ridge forests as part of the Delhi Ridge. In view of this, the Department of Forests and Wildlife took the position that any land falling under the category of morphological Ridge will be considered as part of the Delhi Ridge and clearance of Ridge Management Board (RMB) & Central Empowered Committee (CEC) constituted by the Hon'ble Supreme Court of India will be required for undertaking any developmental activities in that area (as per the order of the Delhi High Court dated 30.11.2011 in the case of Ashok Kumar Tanwar Vs. UOI & Ors. in WP(C) no. 3339/2011).

2.4.3 Ridge management by various agencies

The Hon'ble Supreme Court of India, in its order dated 09.05.1996 in the matter of M.C. Mehta Vs. UOI & Ors. in WP (C) 4677/85, had directed that the Ridge be maintained in its pristine glory. The operative part of the order read as under:

"Delhi has two distinct natural features. The Ridge, which is the rocky outcrop of Aravalli Hills and the river Yamuna. Some parts of the Ridge have been erased in the central city area.

No further infringement of the Ridge is to be permitted; it should be maintained in its pristine glory."

Subsequently, the Government of NCT of Delhi constituted the Ridge Management Board, with the Chief Secretary as its Chairman, to ensure that Delhi's Ridge is protected and conserved with the best management practices.

The Ridge forest land in Delhi was notified under section 4 of the Indian Forest Act, 1927 by Government Notification issued in 1994. Later on, a notification issued in 1996 directed that uncultivated surplus land of Gaon Sabha falling under the Ridge may be excluded from vesting of the Gaon Sabha under section 154 of Delhi Land Reforms Act, 1954 and made available for the purpose of creation of Ridge forests. The notification under section 20 is to be issued after settlement of rights, claims and objections by the Forest Settlement Officers, the process for which is underway. Moreover, the Government also notified other areas with natural/manmade forests as Protected Forests.

The Ridge in Delhi is comprised of the following, break up of which is given in the table below:

S. No.	Ridge	Area (in ha.)	Proportion in percentage (%)	Managing agencies
1	Northern	87	1.12	DDA, MCD & Forest Deptt
2	Central	864	11.1	Forest Deptt, DDA, Army, CPWD, NDMC, MCD.
3	South Central	626	8.04	DDA
4	Southern	6200	79.65	Forest Deptt, DDA, Sports Authority of India, Revenue Deptt.
5	Nanakpura South Central	7	0.09	DDA
	Total	**7784**	**100**	

The position of different parts of the Ridge and their present status of management is given below:

A. Northern Ridge: Northern Ridge, located near Delhi University, has an area of 87 ha and is under the control and management of various agencies, which are mentioned below.

Managing agency	Area
DDA (Jahanuma Park)	73.00 ha.
MCD (Hindu Rao Hospital)	11.00 ha.
Forest Department	03.00 ha.
Total	**87.00 ha.**

Management status: Whole of Northern Ridge is secured through boundary wall. There is no encroachment in Northern Ridge and the area is well demarcated. However, the area is deficient in tree species native to the Ridge ecosystem, which needs to be introduced to create natural food base for various species of fauna existing in the forest area.

B. Central Ridge: Central Ridge has an area of 864 ha and is under the control and management of various agencies which are mentioned below.

Managing agency	Area
Forest Department	423.00 ha.
Army (Signal Regiment) B/W	202.00 ha.
DDA (Bhuli Bhatiyari Park, R Block Rajender Nagar)	85.00 ha.
CPWD (Buddha Jayanti Park, Mahavir Vanasthali)	37.00 ha.
NDMC (Talkatora Garden)	25.00 ha.
MHA (Wireless Stn.)	06.00 ha.
MCD (Nursery)	03.00 ha.
Railways (Sardar Patel Rs)	11.00 ha.
Areas Allotted By L & DO	70.00 ha.
Total	**864.00 ha.**

Management status: Out of the total area, 423 ha have been accredited by CPWD to Forest Department. Whole of Central Ridge is secured through boundary wall. No encroachment so far has been reported in Central Ridge.

C. South-Central Ridge: South Central Ridge has an area of 626 ha including Sanjay Van and is located near Mehrauli. The whole of this Ridge is under the control & management of Delhi Development Authority.

D. Southern Ridge: The Southern Ridge has an area of approximately 6200 ha, the agency-wise details of which are as under:

Managing agency	Area
Forest Department	1938.00 ha.
DDA	120.00 ha.
Sports Authority of India	32.00 ha.
Gaon Sabha & Ors.	4207.00 ha.
Total	**6200.00 ha.**

Management status: The Forest Department is undertaking surveys and demarcation of the Southern Ridge and South-Central Ridge by Total Station Method. Uncultivated surplus Gaon Sabha lands of the Southern Ridge have been excluded from vesting of the Gaon Sabha and transferred to the Forest Department for afforestation vide notification dated 02.04.1996 under Section 154 of the Delhi Land Reforms Act, 1954. Out of the total 4207 ha. of Gaon Sabha lands so notified, approximately 3200 ha. have already been handed over to the Forest Department, which is maintained as forests.

E. Nanakpura South-Central Ridge: Nanakpura South-Central Ridge has an area of 7 ha. The whole of this Ridge is under the control & management of Delhi Development Authority.

2.5 GREEN COVER STATISTICS OF DELHI

With a population of 16.75 million i.e. 1.38% of the country's population, development has always been a dynamic process in Delhi. However, activities carried out by the State Government, Forest Department and greening agencies have helped a lot in striking a balance between ecology and development. The vegetation of Delhi is thorny scrub, which is found in arid and semi-arid zone. As per classification of Champion and Seth (1968), the Ridge forest falls in the category of 'Tropical Thorn Forest' and more especially as 'Semi-Arid Open Scrub'.

The National Forest Policy, 1988 provides that a minimum of 1/3rd of the total land area of the country should be under forest or tree cover. Taking the above in view, the Govt. of NCT of Delhi is making all endeavours to meet the national goal as set by the Central Govt. and is constantly adding to the green cover of the State which is reflected in the change in forest and tree cover given in next page:

S. No.	State of Forest Report	Forest & tree cover (in sq. km.)	Percentage of geographic area
1	1993	22	1.48
2	1995	26	1.75
3	1997	26	1.75
4	1999	88	5.93
5	2001	151	10.2
6	2003	268	18.07
7	2005	283	19.09
8	2009	299.58	20.20
9	2011	296.20	19.97

Source: Forest Survey of India, Ministry of Environment and Forests, G.O.I.

The Forest Survey of India (FSI) is responsible for monitoring the forest and tree cover of India. FSI has been regularly assessing the forest cover of the country every two years using satellite data with reference to Champion and Seth classification.

According to the FSI State of Forest Report, a reduction in green cover of Delhi may be due to the spatial resolution of LISS-III sensor data which cannot capture the imageries of linear strips of tree plantation along roads, bunds, etc., which are less than 23.5 m in width. Likewise, young plantation and small trees with less chlorophyll content and poor foliage are also not decipherable in satellite image. Such small patches are left unrecorded. Due to these reasons, young plantations undertaken in the recent past are not reflected in the imageries till they form canopy enough to send reflectance. With such limitations, the report of FSI may be considered as indicative only. It is also crucial to mention that, the plantations of at least 5 to 7 years are remotely sensed on satellite imageries. Surely, plantation drives carried out by the Forest Department in collaboration with other agencies has had a definite positive impact on the green cover of the city.

The Indian State of Forest Report, 2011, published by FSI records a total of 296.20 km^2 of forest and tree cover in Delhi, which accounts to 19.97% of its geographical area. This depicts a marked increase in Delhi's forest and tree cover from 22 km^2 i.e. 1.5% of its geographical area in 1993. Various plantation activities carried out by the Forest Department has resulted in a

dense stock of trees on the available land, which shows an increase in the dense forest cover from 38.02 km^2 in 2001 to 56.24 km^2 in 2011. The area under open forest has also increased from 73.31 km^2 in 2001 to 119.96 km^2 in 2011 (State of Forest Report, 2011).

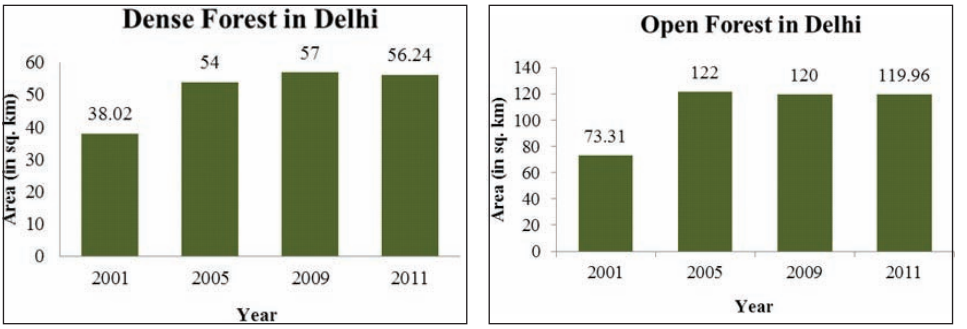

Figure 2: Graphical representation of change in dense and open forest cover in Delhi.

2.5.1 Forest and tree cover in Delhi

Tree Cover of the state has been estimated using Tree Outside Forest (TOF) inventory data collected over a period of six years (2004-10). The estimated tree cover in the state is 120 km^2, which is 8.09% of the geographical area of the state. The forest and tree cover of NCT of Delhi is presented in the table given below:

Category	India SFR-2003 (area in sq. km. /% of geographic area)	India SFR-2005 (area in sq. km. /% of geographic area)	India SFR-2009 (area in sq. km. /% of geographic area)	India SFR-2011 (area in sq. km. /% of geographic area)
Tree Cover	98 (6.61%)	107 (7.22%)	123 (8.29%)	120 (8.09%)
Forest Cover	170 (11.46%)	176 (11.87%)	176.58 (11.91%)	176.20 (11.88%)
Total	**268 (18.07%)**	**283 (19.09%)**	**299.58 (20.20%)**	**296.20 (19.97 %)**

Source: Forest Survey of India, Ministry of Environment and Forests, G.O.I.

2.5.2 District-wise green cover

The extent of division-wise and district-wise forest cover of Delhi as per the latest satellite imageries is as under:

Forest Division-wise forest cover in Delhi

Forest Division	Revenue District	Geographical area (in Sq. Km.)	Forest cover (in Sq. Km.)	% of geographical area
South Forest Division	Central Delhi	25	5.05	20.20
	New Delhi	35	16.31	46.60
	South Delhi	250	78.32	31.33
North Forest Division	East Delhi	64	2.99	4.67
	N-East Delhi	60	4.10	6.83
	North Delhi	59	4.81	8.15
West Forest Division	N-West Delhi	440	16.49	3.75
	S-West Delhi	421	41.80	9.93
	West Delhi	129	6.33	4.91
	Total	**1,483**	**176.20**	**11.88**

Source: State of Forest Report 2011, Forest Survey of India, MoEF, G.O.I, Dehradun.

South Delhi district of the South Forest Division bears the maximum area of forest cover in the city.

2.6 REGIONAL PARK/ RECREATIONAL FORESTRY

Delhi has a much larger green cover than any other metropolitan city in the country, and could well be called a "Green City". The green / recreational use constitutes 8,722 ha of land as per MPD 2001, which is around 19% of the total urban land area of 44,777 ha.[5] This also includes the area under the Ridge. The remaining area is under recreational/green uses i.e. 7,145 ha is in the form of district parks, city parks, community parks etc. comprising around 15% of the total urban land area. The system of district parks enables people of all age groups to enjoy recreational activities. In addition to this, a large chunk of green area is provided in the form of neighbourhood parks/ tot lots in the gross residential use zones, plantations/greens in large

[5] See generally, Jain, A.K. (2009) *Low Carbon City: Policy, Planning and Practice*, Discovery Publishing House Pvt. Ltd, New Delhi.

campuses like President's Estate, JNU, IARI, Delhi University, plantations along drains and roadside plantations. There are 42 City Forests in Delhi (12 old + 30 new) under DDA and the Department of Forests and Wildlife, GNCTD, comprising an area of 1,443.66 ha. In addition to the above, two Biodiversity Parks, i.e., Aravalli and Yamuna Biodiversity Parks are under development by the DDA.

Regional Park is a term used for an area of land preserved on account of its natural beauty, historic interest, recreational use or other reason, and under the administration of a form of local government. As per the MPD 2001, the Delhi Ridge as a whole is regarded as Regional Park. The MPD 2001 identified the Regional Park into four parts, i.e., Northern Ridge, Central Ridge, South Central Ridge (Mehrauli), Southern Ridge. But it has been suggested by the Forest Department that since the scope and extent of the Regional Park and forest areas are entirely different, the Ridge forest should be mentioned as a separate section in the Master Plan of Delhi 2021. This is because Delhi Ridge forest is constituted under the Indian Forest Act, 1927, where the land use is regulated as per the procedures established by the Forest (Conservation) Act, 1980, whereas for the Regional Park, land use is regulated under the Delhi Development Authority Act, 1957 under the Master Plan of Delhi, which is basically a document on urban planning.

2.7 CONSERVATION EDUCATION CENTRE (CEC)

The Government had approved the setting up of a Conservation Education Centre at Asola-Bhatti Wildlife Sanctuary in association with Bombay Natural History Society (BNHS) in the year 2004, to impart education in nature and wildlife conservation to sensitize students, teachers and citizens of Delhi about the issues related to conservation of nature, natural resources, biodiversity, etc. The main purpose of establishment of the CEC was to create awareness about conservation of biodiversity among children and adults through field based educational programmes. Various academic institutions, nature lovers, corporations and government agencies have been making good use of the CEC and its resources for the cause of nature conservation.

The initial project period, i.e., Phase I of the CEC Project at Asola-Bhatti Sanctuary was for three years, which was later extended till 2008. Phase II of the project was from the year 2009 to 2013. The project activities of

CEC were further extended for the third (III) Phase for a period of five years w.e.f. Aug 2013 to March 2018. Since its inception, almost 49,000 visitors participated in various activities conducted at the CEC. The performance of the centre in Phase I and II since inception is as follows:

Number of visitors: As per information provided by BNHS, the details of the total number of visitors to the Centre are given below:

S. No.	Financial Year	No. of Visitors
1	2005-06	8,251
2	2006-07	5,692
3	2007-08	7,967
4	2008-09	7,473
5	2009-10	2,897
6	2010-11	3,745
7	2011-12	6,444
8	2012-13	6,284
	Total	**48, 733**

Though the agreement was entered into on 18.06.04, the Centre had to face some startup delays and therefore, could be operational only with the effect from March 2005. The main target group of CEC programmes is school and college students, teachers, government employees, corporate groups, citizen groups and tourists. The visitors to the Sanctuary mostly included students and teachers from various schools and colleges, bird watchers, and citizens of Delhi who were keen on gaining knowledge about the importance and conservation of nature, natural resources and the wildlife around them.

2.7.1 Major activities conducted by CEC, BNHS

CEC organizes nature trails, workshops and school and college programs like 'walk in woods', 'be a scientist for a day', nature walks in green zones of Delhi, etc., exposing the participants to the wilderness and giving them firsthand experience of the dynamics of nature. Audio-visuals and film shows on conservation of wildlife and protection of their habitats including climate change are also being regularly arranged in a makeshift auditorium in the office complex of the DCF (South) at Tughlakabad for the students and other stake holders. In addition to the on-going activities, BNHS has prepared handbooks/ field booklets for the teachers for de-centralization

Figure 3: Conservation awareness programmes for children

of conservation education. Besides, the Centre, with the support of the Department of Forests and Wildlife, also organizes quiz, painting, clay modeling and face painting competitions for a large number of school children.

The performance of the CEC has been satisfactory, and has reached a stage where a new and diverse range of activities has been proposed. Accordingly, a range of educational installations and new nature trails will be developed for CEC. A systematic biodiversity survey of Asola-Bhatti Wildlife Sanctuary is also included in the activities. BNHS is an NGO of repute and has done commendable and unparalleled work in this field.

Chapter-3

Conservation of Delhi Ridge Forests

"What we are doing to the forests of the world is but a mirror reflection of what we are doing to ourselves and to one another."

– Mahatma Gandhi

Protection of the environment has been getting attention from the ancient times. In *vedic* times, nature was worshipped and protected. Sacred groves were kept protected and undisturbed, and harming these was believed to offend forest deities and spirits. Trees were worshipped in the past, rivers were considered goddesses. *Rishis* were against deforestation as it would result in poor rainfall. To purify the surrounding air, *yagnas* were performed in *vedic* societies[1].

During the Aryan civilization, forests were exploited to meet the needs (such as building carts, chariots and cottages built of wood) of the people. Kautilya, who was the prime minister of the Magadh Empire during the reign of Chandragupta Maurya, envisaged a systematic management of forests in Arthashastra's (which was written between 321 and 300 BC) Book Two (some *shlokas* are found elsewhere in the work of Kautilya), which included principal provisions dealing with the environment. It also included laws for protecting the forests. The laws regarding forest protection included[2]:

- **State to maintain forests**: Protection to produce-forest and elephant forests was given and constitution of new ones was promoted.
- **Selling of trees**: For uprooting or cutting parts of the trees in the city parks, in places of pilgrimage, cremation grounds or in the sanctuaries, fine was levied.
- **Damaging forests**: Forest based industries were promoted, and fines and compensations were levied on those who caused any damage to productive forests.

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1 Leelakrishnan, P. (1999) *Environmental Law in India*, Butter worths India, New Delhi, p.6.

2 Divan, S. and Rosencranz, A. (2001) *Environmental Law and Policy in India: Cases, Materials and Statutes*, Second Edition, Oxford University Press, pp. 23-25.

- **Forest produce**: Forest based industries to increase goods were promoted.
- **Forest reserves for wild animals**: Full protection was given to animals, and establishment of animal forests was promoted.
- **Protection of wildlife**: Entrapping, killing or injuring wild animals was prohibited, and persons involved in such activities were punished.
- **Fee for hunting**: Of those whose killing was permitted and who were not protected in enclosures, the superintendent of slaughter-house received one-sixth share of fishes and birds, one-tenth share of deer and beasts, in addition to a duty.

The importance of forest protection is also mentioned in the edicts inscribed on the pillar of King Asoka.

Emperor Firoz Tughlaq made an attempt to maintain the green cover by planting a number of trees and building hunting lodges in a park called Kushak-i-Shikar[3]. In 1526, after defeating Ibrahim Lodi in the Battle of Panipat, Babur laid the foundation of Mughal rule in India. He established a chain of gardens (like Shalimar Bagh, Nishat Gardens, Yadavindra Gardens, Khusro Bagh, Roshanara Bagh, Brindavan Gardens, Ram Bagh, Mehtab Bagh, etc.), parks and fruit orchards, and earmarked hunting grounds as he was very fond of nature and hunting. To protect Delhi from the harsh desert sands of Rajasthan, green belts were created by Mughal rulers in India.

3.1 FOREST CONSERVANCY PRINCIPLES IN BRITISH ERA

The art and science of forestry aimed at conserving natural resources was initiated and perfected by the British in the second half of the 19th Century in India. Their experience shaped the course of formulation of forest policies and laws in India.

From the mid-eighteenth century onwards, the Indian subcontinent was convulsed by political and economic upheaval as the British East India Company extended its influence over territories and kingdoms. Beginning as a successor state among others, the East India Company had by 1818

[3] See generally, Kalpavriksha. (1991) *The Delhi Ridge Forest: Decline and Conservation*, New Delhi.

succeeded in assuming and consolidating political leadership of the Indian sub-continent. The fact of company success and the assertion of British corporate and private commercial interests generated important and identifiable changes in the Indian economy. However, the ecological impact which the British rule produced has not received same attention.

The British period is still remembered for marked deforestation because of limited and patchy foresight in the first crucial decades of colonial rule. However, those studies of deforestation that do exist for the period 500 BC to AD 1760 indicate that periods of relatively rapid change did take place in pre-colonial times, particularly in connection with periods of military expansion by aspiring new state builders.

A growing awareness of such pronounced pre-colonial deforestation episodes leads one to seriously question the objectivity of some recent historical essays that have tended to characterize the pre-British period as an ecological and pre-capitalist golden age of common property rights and sustainable resource use. In fact, far from being a paradise of so-called common property, the non-arable Indian environment has, from a very early date, been subject to attempts at management and control by both states and dominant groups, some of a geographically very extensive nature.[4]

Thus, the perspective of the British rule over forest management can be understood by the stand taken by various government bodies and officers such as the Public Works Department, which held that forests were to be regulated in a manner that ensured long-term and steady supplies of timber for infrastructure projects.[5] The Revenue Officials used to regulate extraction of forest resources for increasing the income for the company. The East India Company's scientists and medical officers argued that watershed protection was paramount, and urged the government to restrict forest extraction so as to prevent diseases that might spread as a consequence of deforestation.[6]

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4 Grove, Richard. (1995) *Green Imperialism*, Cambridge University Press, p. 386.

5 See generally, Cleghorn, H., Royle, F., Smith, H.B. and Strachey, R. (1851) *To Consider the Probable Effects in an Economical and Physical Point of View of the Destruction of Tropical Forests*. Edinburgh: British Association Report.

6 See generally, Mc Clelland, John. (1835) *Some Inquiries in the Province of Kemaon Relative to*

Therefore, State intervention in forestry in colonial India was a product of four competing perspectives and concerns: (1) the need to ensure steady supplies of timber for public works and infrastructure activities; (2) managing forests for sustained yield of commercially valuable resources to meet the demands of a growing internal economy; (3) increasing revenues by regulating and taxing a lucrative and burgeoning sector of economic activity; and (4) ensuring stability of regional climatic conditions, water supply, and soil fertility for the social and economic welfare of the populace.[7]

Thus, the conservation of our forest resources were and are necessary and will always be. It is well known that the urban green cover makes a quantifiable contribution to the long-term livability of a city. With Delhi being an urban conglomeration with the highest population density in the country, it becomes all the more imperative to maintain a sizeable green cover in order to maintain a healthy environment.

3.2 ADVENT OF FORESTRY PRINCIPLES IN INDIA

Lord Dalhousie's new forest policies greatly expanded British authority over the land and people of India. British India's forest administrators had feared the potential long-term environmental effects of deforestation caused by indiscriminate logging. Mr. J.D. Hooker, director of the Royal Botanical Garden at Kew in London, also alerted Dalhousie to the potential economic and climatic effects of deforestation. This had convinced Dalhousie to support modern scientific forestry methods and conservation. Thus environmentalism and British imperialism have a shared past and the newly created reserved forests marked a symbiotic alliance of environmental concern with expansion of state power in India.

Scientific forestry was first transported to India from continental Europe because of a lack of expertise in the British Empire. In the late eighteenth century Scottish botanists and scientists helped to transmit climatic, botanical and forestry ideas to India. The forestry principles in India have influence from German, French and Scottish Forestry traditions.

Geology, and Other Branches of Natural Science. Calcutta: Baptist Mission Press.

7 Rangan, Haripriya. (1997) Property vs. Control: The State and Forest Management in the Indian Himalaya, *Development & Change*, Blackwell Publishers, UK, Vol. 28, p. 77.

By the early nineteenth century, German forestry had developed into a systematic science of measuring, predicting and controlling the growth of forests and the production of wood mass in order to secure resources for the future and extract a maximum sustainable yield and profit. The **German forestry tradition** was a centralized scientific enterprise based on statistical models of tree growth and the creation of single-species, even-aged forest plantations. The second important continental influence on forestry in India was the **French forestry tradition**. French forestry was characterized by a more flexible approach with attention being given to broad leaves, coppices and mixed stands, as well as to the natural regeneration of forests and traditional user rights. **Scotland** played a founding role in modern forestry because of the availability of 'wilderness' for afforestation and the presence of landowners who wanted to 'improve' their privately-owned estates. Scottish enlightment traditions in turn encouraged experimentation with plantation forestry and the introduction of exotic tree species, and the combination of these factors created a decentralized and adaptive forestry tradition in Scotland.[8]

Environmentalism thus did not arrive in the early 20th century from the USA as most people believe. It was infact born in India in the form of forestry policies of Lord Dalhousie and Lord Canning. India is still relying on the laws enacted by the government of British India in the matter of abatement of environmental pollution and forest conservation. British imperialism therefore mothered environmentalism and gave environmentalism all the nourishment it required to grow, namely rule of law, absolute property rights (for individuals and government), police action, romantic concern for nature, concern for global climatic stability and great amount of fair play to settle the conflicting land claims[9].

Thus, with these various schools of thoughts growing and developing in the mainland of India, it influenced scientific forestry tradition in India, extracting the good out of every tradition and managing the forests of India.

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8 Oosthoek, Jan (2010) Worlds Apart? The Scottish Forestry Tradition and the Development of Forestry in India, *Journal of Irish and Scottish Studies*, 3:1, pp. 69-82.

9 Sinha, G.N. (2006) British India's Forestry and Modern Environmentalism, 29 September, *Arunachal Times*, Itanagar.

3.3 PROVISION IN CONSTITUTION OF INDIA FOR ENVIRONMENTAL PROTECTION

In context of our country, forestry by the time of partition in 1947 showed evidence of solid progress. A complicated science, developed in temperate Europe, had been adapted to the sub-tropics and tropics. Indian forestry was influential in transmitting the science of forestry to underdeveloped parts of the world. During the more than two decades following the partition of India, international technical aid, through bilateral programs and projects of the Food and Agriculture Organization of the United Nations, strengthened forestry in many parts of the world, mostly in the tropics and sub-tropics.[10]

The Constitution of any country is the fountain head of all laws. All the laws and policies in all the sectors of governance have to conform to the broad framework of the Constitution. The Indian Constitution is amongst the few in the world that contains specific provisions for environmental protection. The national commitment to protect and improve the environment can be seen in the chapters of directive principles of state policy and fundamental duties.

Environmental protection and improvement were explicitly incorporated into the constitution by the 42nd amendment in 1976. The forty-second amendment added to the Constitution of India had certain significant provisions relating to environment. It is mentioned in the new provision as added to the body of directive principles of state policy (Article 48 A) that the state shall endeavour to protect and improve the environment and to safeguard the forest and wildlife of the country. The Indian Constitution even went one step ahead by inserting Article 51 A (g), which states that every citizen shall have a fundamental duty to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures. The judicial interpretation of Article 21 has empowered Article 48 A and Article 51 A (g) by including the right to a wholesome environment too[11].

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10 Winters, R.K. (1975) Forestry Beginnings in India, *Journal of Forest History*, 19:2.

11 Sinha, G.N. (2010) *Strengthening Indian Environmental Laws: New Lessons and Approaches*, Bishen Singh Mahendra Pal Singh Publishers, Dehradun, India, pp. 21-23.

Forests were declared as State subject at the time of independence, thus having exclusive power to make laws. In the forty-second amendment of the Constitution in 1976, the subject of forests was moved to Concurrent List from State List. So now, Concurrent List enables both the Centre and the States to make laws in these areas.

3.4 CONSERVATION INITIATIVES AFTER INDEPENDENCE

After independence, the concern for wildlife preservation and environmental conservation was initiated in India when Indira Gandhi was Prime Minister. She was Prime Minister of the India for two terms that totalled fifteen years. During these years, her engagement with environmental issues was strongly evident. Even her biography provides a good vantage point to examine the broader issues of conservation as these issues held a special place throughout her political career at the top. In 1971, when the war with Pakistan had begun, the first meeting of the newly created Committee on Environmental Planning and Coordination (NCEPC) was held on 6 December.

At the Stockholm Conference in June 1972, her speech led her to the zenith of her political career. The speech was marked by an awareness of the inequities across nation states, which could be a barrier to joint action to keep the earth habitable. Nations could not be 'preserved as museum pieces' in the name of diversity. 'One Earth' could work as a concept only if the ideals of humanity faced up to the inequities of access to wealth and knowledge.

During her political career, the Wildlife Protection Act, 1972 came into existence,giving wildlife legal protection that was previously ignored. Wildlife was left to sustain at its own risk after independence when food security for population, industrialization and developmental activities were the main focus. In 1973, the launch of Project Tiger shows the work of conservation of forests and wildlife. Valmik Thapar, famous tiger conservationist and photographer, asserts that, "if we have any ecological security left, it is due to Indira Gandhi"[12]. In 1980, a keystone Act was made, namely, Forest (Conservation) Act of 1980 which is one of the most landmark Acts in India after independence, in her regime. This Act halted

[12] Rangarajan, Mahesh. (2009) Striving for a Balance: Nature, Power, Science and India's Indira Gandhi, 1917-1984, *Conservation and Society*, 7:4, pp. 299-312.

the forest degradation in the country. Also, she took steps to protect the Delhi Ridge greenery in the summer of 1980, when petitioned by a student group.

Her contributions to the protection and conservation of forests have been enormous. And therefore, every year Indian nationals or any Indian organizations are awarded with Indira Priyadarshini Vriksha Mitra Award as a tribute to her, by the Ministry of Environment and Forests for doing pioneering and extraordinary work in the field of afforestation and wasteland development, which has a measurable impact on the protection/overall improvement of the environment. In 2008, the Department of Forests and Wildlife, Govt. of NCT of Delhi was honoured with this award for providing outstanding contributions made towards the increase in forest and tree cover, along with Lakshadweep.

Thus, the development of Indian forestry was a significant factor in the development of world forestry. It constituted the first major emigration of professional forestry from its birthplace in western Europe. From India professional forestry spread to many parts of the British Empire and to other nations as well.

In the present scenario, forest management has a wider scope and application. It requires holistic, generalist's understanding of the issues involved. Forest management is not so much a subject or a science as it is a process. It is development and execution of a plan integrating all of the principles, practices, and techniques necessary to care properly for the forest. Conservation of floral wealth and improvement of wildlife habitat are the two cardinal principles of the art and science of forestry.

Forestry in India needs awareness from all sectors of our society. Every citizen can contribute toward the cultivation of trees, which would improve and protect the environment and provide many direct benefits. What we need at the moment is an all-out effort on conservation and improvement of existing forest lands. And that is the motive of our Forest Department, Government of NCT of Delhi.

The further sections of the chapter deal with the importance of the 'green jewel' of Delhi, its management strategies and achievements of the Forest Department, Government of NCT of Delhi.

3.5 ECOLOGICAL IMPORTANCE OF DELHI RIDGE

Delhi state stretches along the western bank of the Yamuna river between 28°12' and 28°53' north latitude and 76°50' and 77°23' east longitude. It is surrounded on the south-east by Thar Desert, on the north-east by the Indo-Gangetic plains and in the south by the Aravallis. Due to its location, the State, which is 58.3 km in length and 48 km in width, has a diversity of physiographic features as well as vegetation. The 32 km long Delhi ridge is an inseparable part of Delhi City.

The Ridge has played an important role in Delhi's history, and will continue to do so. The forest of Delhi is being maintained for the environmental and ecosystem services being imparted by these forests, and production forestry is not the aim.

It serves many valuable ecological functions, protecting Delhi from westerly winds loaded with sand from desert areas of Rajasthan, lowering the ambient temperature, pollution absorption, cleaning the air, sheltering flora and fauna, and – perhaps most importantly – filtering and preserving groundwater in a parched city, amelioration of environment. Providing recreational spots and a calming soothing green look to the other-wise concrete city of high skyscrapers are just to name a few of the objectives met by these forests.

It is a well-known fact that vegetation/ forests play a key role in ameliorating pollution and maintaining healthy environment. Having said this, the importance of the Ridge increases manifold as it harbors many such species which help in amelioration of pollution. The compact branching and arrangement of leaves increases dust collecting ability of trees. Some of the tree species suitable for the purpose are *Ficus religiosa* (Pipal), *Albizzia lebbek* (Siris), *Cassia fistula* (Amaltas), *Zizyphus jujube* (Ber), *Azadirachta indica* (Neem), *Dalbergia sissoo* (Shisham), *Butea monosperma* (Dhak), *Ficus glomerata* (its broad leaves collect highest rate of dust fall due to its simple, elliptical and hairy structure), *Ficus infectoria* (Pilkhan), *Alstonia scholaris* (Chitvan/ Chattaun), *Acacia*

nilotica (Desi kikar). These species are also helpful in reducing noise pollution by absorption, deflection, reflection, refraction and masking.

Apart from performing various useful environmental functions, the Ridge of Delhi is also rich in medicinal plants. Out of 31 plant species, which are in high demand both in domestic and international markets, 11 species are found in Delhi, which is dealt in detail in section 3.8.6.

The importance of Ridge can be well understood from the lines quoted from the book 'The Delhi Ridge Forest – Decline & Conservation' published by Kalpavriksh.

"….it serves as a sort of giant central air-conditioning plant – enter its precincts on even the hottest of summer days and you will immediately experience a perceptible drop in temperature. Further it provides the increasingly polluted capital with oxygen, as well as absorption of pollutants; it blocks the dust and tames the hot dusky 'loos' that sweep across the city in summer; it acts as a massive sound insulator, absorbing some of the hubbub of the city. And finally of course it gives the jaded city-dweller a taste of nature, at the doorstep, a place where one can jog, walk or exercise, and replenish one's aesthetically battered senses."[13]

3.6 ECOLOGY OF DELHI

Delhi lies in the landlocked northern Plains of the Indian Subcontinent. Its climate is greatly influenced by its proximity to the Himalayas and the Thar Desert, causing it to experience both weather extremes. Delhi has 5 distinct seasons, viz. summer, rainy, autumn, winter and spring. Broadly speaking, Delhi has long and scorching summers – sub-divided into summer and monsoon seasons, short and cold winters, and two bouts of pleasant transition seasons. Two important occurrences influencing Delhi's climate are Western Disturbances and South-West Winds.

3.6.1 Climate

The climate of Delhi is mainly influenced by its remote inland position and prevalence of air of continental character, which is characterized by extreme

[13] See note 3.

summer heat alternating with great winter cold. Such type of climate is unfavorable for the growth of luxuriant vegetation. The climate is of semi-arid nature due to marked diurnal differences of temperature, high saturation deficit and moderately low rainfall. The desert area of Rajasthan in the west and south-west and the Gangetic plains of Uttar Pradesh to east, across which the monsoon air travels and reaches Delhi, have their respective share in affecting the climate of this region.

The climate is markedly periodic and is characterized by a dry and increasingly hot season from March to June, a dry and cold winter from October to February and acute warm, monsoon period from July to September.

3.6.2 Rainfall

A study of the meteorological events of Delhi reveals that maximum onset of monsoon occurs in the first week of July and last week of June. The normal annual rainfall at Delhi is 66.6 cm of which nearly 80% is recorded from the middle of June to the middle of September. Annually, 90% of the days are rainless, the monthly distribution varying from the maximum number in October and November to the minimum number in July and August.

As a result of uncontrolled grazing and deforestation, rain has caused extensive soil erosion. Depressions and deep ravines have been formed on the hill slopes of the Aravallis.

3.6.3 Relative humidity

Relative humidity is minimum during the dry weather months i.e., April and May, and maximum during the monsoon months i.e., July, August and September. It is to be noted that the periods of high relative humidity are optimum for plant growth, but as Delhi endures high temperature and low humidity, the situation is not that favorable. Thus, a rise in temperature coupled with decrease in humidity favors the growth of xerophytic plant species.

3.6.4 Wind

Wind is an important climatic factor for Delhi. For most of the year, wind is mild with a mean velocity of 0.9-2 mph. The prevailing direction of wind during September to May is west to north-west. Winds are strongest in June and lightest in November. In the summer months, hot and dust-

raising winds, popularly known as 'loo' are experienced, and may result in thunder-storms or dust-storms (aandhi).

3.6.5 Soils

Delhi can be divided into four well-defined physiographic divisions. These are:

1. Khadar (Riverine zone)
2. Bangar (Area irrigated by wells and canals)
3. Dabar (Low-lying, rain-fed areas)
4. Kohi or Pahari (Hillsides)

The first three physiographic divisions, the Khadar, Dabar and Bangar, are part of the plains of the region, and are now the centre of various human activities like housing and agriculture.

The Kohi or Pahari includes the Ridge, Tughlaqabad, Mehrauli, Fatehpur Beri and Dera Mandi, all of these being highly rocky and undulating areas. This low plateau is mostly composed of bare and unconsolidated micaceous rocks. Its soil is mainly dry and sandy, lacking humus, and supporting sparse vegetation.

3.7 *Prosopis juliflora*

Drylands are resilient ecosystems and capable of returning to their natural balance as soon as the disturbances are controlled (ecology similar to that of Delhi). The first introductions of *Prosopis juliflora* into India took place in 1877, with seeds from Jamaica that arrived in the country one year earlier. The seeds were first sown in various arid areas around Kamalapuram, in the Cuddapah District of Andhra Pradesh, in south India. At the time of its introduction, the plant was named "the exotic lady of South America". In the same year (1877), *P. juliflora* was sown in Sindh (Pakistan) to prevent sand dune encroachments. *P. juliflora* was introduced in Jodhpur (Rajasthan) in 1913 and in 1940 it was named a "Royal Plant", by the ruler of the state at that time, because of the excellent growth-rates of the plant. Further introductions followed gradually into the states of Haryana, Punjab, Uttar Pradesh, Madhya Pradesh, Maharashtra and Tamil Nadu. Although the initial plantations in India were mainly established for the purpose of conservation,

Prosopis has become the main source of fuel in rural areas and today, also to a large extent, in urban and semi urban areas.[14]

Due to their broad ecological amplitude, *Prosopis* trees have adapted to a wide range of different types of soil and sites and are able to survive on the poorest lands which are unsuitable for many other tree species. The tree can be found on various soil types from pure sandy soils to heavy clay and stony soils. *Prosopis* trees are able to out-compete the indigenous vegetation and spread rapidly, in the worst case becoming agricultural weeds. The woody legumes of *Prosopis* species have a competitive advantage on soils with low levels of nitrogen, creating islands of fertility through nitrogen fixation. Thus, for instance, under the influence of overgrazing, eroded and degraded poor nitrogen-deficient soils give *Prosopis* seedlings a competitive advantage. The ecological advantages of *Prosopis* compared with many native species and the resulting invasion of the tree causes a reduction in biodiversity of the native flora.

Research has revealed that underneath *Prosopis* canopies, the number of species and the evenness, frequency and density of indigenous species are significantly lower compared to the situation in open space.[15]

But, before coming to any conclusion, it is necessary to understand various aspects of this species, as it cannot be outrightly termed to be a menace for Delhi.

The positive aspects of *Prosopis* can be summed as follows:

- *P. juliflora* is playing a vital role in sustaining the livelihoods of the rural poor, including the landless, small farmers and artisans.
- The leguminous tree *P. juliflora* due to is useful qualities can be termed as ideal crop for minimal energy input agriculture.
- *P. juliflora* wood burns evenly and hot. The wood has a high calorific value, estimated at 4216 kcal/kg by Khan *et al.* (1986). The positive qualities as firewood are present even in juvenile wood, and *P. juliflora*

[14] Walter, Kurt. (2011) *Prosopis, an Alien among the Sacred Trees of South India*, Faculty of Agriculture and Forestry, Department of Forest Sciences, University of Helsinki,p. 26.

[15] See note 14.

wood burns well even when green. This is a benefit as firewood does not require storage and drying, avoiding losses from theft and decay.

- *Prosopis* makes excellent charcoal.
- Its popularity is linked to its ubiquity, i.e. that where trees are present they are generally present in large numbers and are often found on common land and are, thus, freely available to all sections of society.
- Large branches and trunks yield a high quality timber, comparable in colour, finish and physical attributes to Indian rosewood and other commercial hardwoods. Also used for posts and poles, the wood is also called 'wooden anthracite' in some areas.
- Fruit pods are high in protein and sugar, easy to digest, and are a rich food source for livestock like sheep, goats and cattle.
- When planted in earlier times, it has served its due function, by combating desertification of Delhi from the incoming westerly winds and was able to grow in nutrient deficient soil thus increasing greenery of Delhi.

In recent decades, however, and with evolution in perceptions and scientific knowledge about the practice of introducing exotic species, some drawbacks have become apparent. Some of the negative impacts of *P. juliflora* can be summed up as:

- Prohibits grazing and farming.
- Has formed thick monospecific scrub.
- Depletes soil nutrients.
- Have poisonous spines, harmful to livestock and people.
- Impairs the growth of forage (grasses).
- Reduces total biodiversity of area by reducing their abundance, distribution and ecosystem function.

However, the poor man's timber has provided enormous help to the ecology of Delhi. The Ridge as we see it today – a purifier of air, a sink for pollution, a replenisher of oxygen, a barrier against desertification, a natural sound insulator – can be attributed to the afforestation practices undertaken in the British era. It has duly served the purpose for which it was planted in earlier times.

Local people, policy-makers, scientists and technicians have to be aware of all aspects. *Prosopis* trees and shrubs have become naturalized constituents of many natural and cultivated ecosystems; their total eradication is not only ecologically risky but in many areas technically and economically impossible. There needs to be a well-designed plan for the future. Thus, future efforts must be concentrated on integrated management, i.e. far-sighted and sustainable control of the species, while its potential to fight desertification and to provide fuelwood, good-quality fodder and sometimes even human food should be respected. The management of *Prosopis* should include arrest of its regeneration. Another possible option is to plant indigenous species on the open patches. The shade that is cast by the new seedlings would give them an advantage and hinder the growth of new *Prosopis* seedlings. The Department of Forests, Government of NCT of Delhi is aware of all the aspects, and has always encouraged the growth of native species through its various plantation programs. The task of management of *P. juliflora*, effectively and efficiently, has been entrusted to Eco Task Force, keeping in mind that the greenery of Delhi should not be put at stake. Thus the best option might be to adopt land use management, as in using open patches to plant native trees and reduce stocking rates which can encourage good grass cover and prevent seedling establishment.

The Forest Department as a part of management has already undertaken plantation of various indigenous species, the list of which can be seen in Annexure 13.

3.8 MANAGEMENT OF RIDGE – STRATEGIES

There has been a paradigm shift in the outlook about the priorities of forest management. The environmental, social and ecological values of forest wealth are now being recognized. Forests are no longer seen as an isolated entity but in relation to the other constituents of our ecosystem like the quality and quantity of our water resources, the purity of the air we breathe and fertility of farmlands. These issues should be kept in mind while formulating the management objectives of the forests of Delhi. Thus the general objectives of management can be summed up as:

i. To improve the environment and to reduce the ill-effects of pollution by preserving existing vegetation and through plantations of suitable local species as per the site conditions.
ii. To increase the green cover of the area.
iii. To gradually suppress the monoculture plantations of exotic species by raising mixed plantations of local species.
iv. To protect the forests from encroachment.
v. To create favourable conditions for protection and development of wildlife.
vi. To enhance aesthetic beauty of the forest, provide shade along the length of strips passing through the city and to create recreational centers.
vii. To ensure people's participation in the conservation program by involving NGOs, voluntary agencies and educational institutions.

3.8.1 Protection of forest area

There is a tendency of the people, especially migrants living around the forest to encroach upon the forest area. They tend to dump their domestic waste inside the forests, thus polluting it. There are many workshops, small industrial units near the boundary of the forests. They not only pollute the water sources inside the forests due to their toxic discharges, but they also tend to dump their wastes inside the forests. To stop these menaces, it is imperative to undertake fencing of the areas that are in the vicinity of the industries, workshops, housing estates, slums, etc. Live hedges in combination with barbed wire fence can be very effective. It increases the stability of the main fence. They also act as soil binders. A species chosen for live hedge should be fast growing with long and stout spines or horns, thick and bushy in form. Apart from this, the Forest Department has developed a Ridge Protection Management System to deal with the issue of encroachment, which will be dealt with in later chapters.

3.8.2 Urban plantation

The objectives of management of urban forestry in Delhi are as follows:

i. Enrichment plantation of indigenous species in vacant gaps inside the reserved/protected forests besides Gaon Sabha lands vested with forest department.

ii. To enhance the aesthetic appeal of the city and arrest vehicular pollution.

iii. Establishment of avenue plantations and tree parks in new layouts

iv. Distribution of free tall seedlings to the general public to drive home the need for planting in urban areas, on all available vacant patches.

The Forest Department acts more like a facilitator to motivate the general public to take up planting works, by providing required technical knowledge and high quality seedlings. The following criteria may be kept in mind while choosing the appropriate species for roadside plantations:

i. Seasonal changes of foliage-color which will impart distinct character and individuality to a section of landscape at different times of the year.

ii. Plants resistant to air pollution and able to grow in such environment.

iii. Trees with dense foliage to reduce noise pollution.

iv. Shape of their crowns are regular and geometrical.

v. Hardy enough to withstand the extreme environmental conditions of the urban area.

vi. Have already been used in roadside plantations and their nursery techniques are known.

Thus, some of the examples of different avenue trees planted in Delhi are:

- Jamun, *Syzygium cumini* (on Rajpath, Tughlak Road, Rajaji Marg, Tyagraj Marg, Motilal Nehru Marg, Ferozeshah Marg, SunheriBagh Road, etc.) by far the commonest avenue tree of all.
- Neem, *Azadirachta indica* (Safdarjung Road, Lodi Road, Prithviraj Road, Ashok Road, etc.)
- Arjun, *Terminalia arjuna* (Janpath, Teen Murti Marg, Baba Kharak Singh Marg)
- Pipal, *Ficus religiosa* (Baba Kharak Singh Marg, Mandir Marg)
- Paakad, *Ficus virens* (Zakir Hussain Marg, Dalhousie Road)
- Imli, *Tamarindus indica* (Akbar Road, Tilak Marg, and (mixed) along one stretch of Baba Kharak Singh Marg).

The less common ones, confined mostly to single avenue are:

- Putranjiva, *Putranjiva roxburghii* (Racecourse Road, Hukumi Mai Marg)
- Jadi, *Ficus amplissima* (Krishna MenonMarg)
- Khirni, *Manilkara hexandra* (Maulana Azad Marg, Man Singh Road)
- Maharukh, *Ailanthus excelsa* (only (mixed) on Copernicus Marg).

3.8.3 Proper development of nursery

The site for a new nursery should be selected so as to minimize the cost of transportation of plants to the plantation site. The quality and quantity of water availability must be ensured before finalizing the site. The terrain that best suits a nursery is gently sloping terrain followed by flat terrain. Species which are naturally suitable with respect to the climatic conditions of Delhi – Khair, Kikar, Neem, Pipal, Papri, Jungli jalebi, Jamun, Gullar, Sheesham, etc, should be raised. In addition to this, sound selection of seeds should also be a criteria.

3.8.4 Soil and moisture conservation works

To stop further deterioration of forest and degradation of ecosystem, soil and moisture conservation measures are of utmost importance. These vary from site to site and therefore each site should include in its treatment plan carefully designed site-specific soil and moisture conservation measures, however certain standardization of such structures will help in the advance planning process.

Harvesting of rainwater and reduction of runoff is of critical importance. Various measures for in situ moisture harvesting and conservation include contour trenches, contour-V ditches, bench terraces, and contour furrows.

Species like *Dendrocalamus strictus* have been found suitable for afforestation of gully beds, whereas *Dalbergia sissoo* and *Acacia catechu* come up very well on river beds, gully slopes and humps. Other plant species suitable for restoration of gullied lands are *Acacia nilotica, Azadirachta indica, Albizia lebbeck*. The soil and moisture conservation works carried out by the Delhi Forest Department for eco-restoration have been addressed in Chapter 4.

3.8.5 Protection and improvement of vegetation cover

The NCT of Delhi bears a total of 19.97% of its geographical area under Forest and Tree cover (State of Forest Report, 2011). This needs to be further augmented to achieve more area under greenery in Delhi. Afforestation, enrichment and maintenance of existing forest areas under the management of the Forest Department are carried out along with co-operation of the citizens of Delhi to achieve the desired goals.

Under this plan the Department has proposed plantations on vacant forest/ non forest land available/to be made available, their maintenance, planting and development of existing nurseries, development and maintenance of City Forests, development of new City Forests, regular survey and monitoring, consolidation of forest land and mapping, development and maintenance of water bodies, providing adequate protection through fencing and boundary wall creation, eco-restoration of riverine areas, etc.

3.8.5.1 *Transplantation of trees*

The transplantation of young trees of suitable species may be done to inculcate a new lease of life to such trees, which would have been felled otherwise. This would ensure that environmental services would continue to be received from these trees when fully grown.

The following considerations are to be made for transplantation of trees.

- Before preparation of a project, the environmental and forestry aspects should be properly studied.
- Provisions for transplantation of trees should be kept in the project estimates and adequate funds should be kept for this purpose.
- Process for removal/transplantation of trees should be initiated by applying to the concerned Tree Officer designated by the Forest Department, well in advance before actual start of work.
- Proper transplantation site should be selected before removal of tree and kept in readiness.
- The tree species should be suitable for plantation.
- Transplantation should be done in the rainy season. The roots of tree should be carefully lifted without causing damage. The pit should be ready before the tree is transported for transplantation.

3.8.5.2 *Replacement of old/over mature trees*

The old, dried, dead and over matured trees should be replaced. Proper replacement plan should be made after thorough assessment. The steps involved are as follows:

- Identification of trees likely to be replaced in the next ten years.
- Replacement planting should be scheduled in such a manner that at the time of removal of old tree, new crop of trees is at least 10 years old or crown of tree is developed enough to provide shade and mature enough to withstand various climatic and biotic pressures.
- Emphasis should be given to species like Neem, Pipal, Jamun, Pilkhan, etc. at the time of replacement planting or in accordance with landscape planning. Replacement planting should be done with the same species to be replaced so as to maintain symmetry.
- Along the roadside where miscellaneous avenue plantations was done in the past, replacement should be done with indigenous species for ensuring better survival.
- While doing replacement planting of tall saplings of six feet and above should be used so as to reduce establishment period and maintenance cost.
- At the time of replacement planting it should be ensured that saplings of same age group and same height are planted for maintaining symmetry. Sufficient protection measures should be taken to avoid casualties, which normally results in gaps giving an unequal look to the avenues.

3.8.5.3 *Removal of tiling/black topping and embedded tree guards around trees*

Concretizing, tiling and black topping close to the tree stem checks percolation of ground water and proper aeration of roots and suffocates the trees, adversely affecting their growth and at times resulting in dying of the tree. Tiling/concretizing around trees should be discouraged and a space of 6 feet × 6 feet around the tree should be maintained. Old and embedded tree guard should be removed. It would be worth mentioning here, that the Department is already engaged in such activities with National Green Tribunal providing further legal support.

3.8.5.4 *Compensatory afforestation*

The Delhi Preservation of Trees Act, 1994 has been an effective tool for the conservation and increase of green cover in Delhi. Any individual or user agency who wants to cut a tree needs prior permission from the Forest Department by approaching the concerned Tree Officer and fulfilling the required formalities under the Delhi Preservation of Trees Act, 1994. It should be ensured that for every single tree felled, a total of 10 saplings are planted and maintained by the Forest Department as well as the user agencies. This has not only resulted in the area under green cover, but has also ensured densification of the existing forest patch.

3.8.6 Herbal gardens

NCT of Delhi has a good variety of medicinal plants. Of 31 plant species, which are in high demand both in domestic and international markets, 11 species are found in Delhi. These are: *Emblica officinalis, Saraca asoka, Withania somnifera, Aegle marmelos, Phyllanthus amarus, Tinospora cordifolia, Andrographis paniculata, Solanum nigrum, Rauwolfia serpentina, Asparagus racemosus* and *Ocimum sanctum*. The National Medicinal Plant Board, Government of India has recommended that these species be cultivated, as these constitute a bulk of the ingredients used in the preparation of ISM & H and herbal products. The demand of raw material is increasing day by day in local as well as in global markets. Therefore, cultivation of selected species should be promoted in a big way.

The National Medicinal Plant Board has developed a medicinal Herbal Garden in the Rashtrapati Bhavan, where about 200 species have been planted. The garden is elliptical in shape, divided into 8 sectors; each sector dedicated to specific therapeutic category. These sectors represent eight organ systems, viz., digestive system, blood and circulatory system, skeleto muscular system, skin care system, urinogenital system, respiratory system, inflammations and fevers and nervous system. The State Government should develop a few such gardens at appropriate places to create awareness among the society.

3.8.7 Rejuvenation of degraded areas

The ecologically and environmentally sensitive sites need to be specially examined, and suitable provisions be made for them in the prospective plans. The reclamation of the degraded Bhatti area through afforestation

and grassland development being undertaken by Eco-Task Force for last few years, has been a success and needs to be replicated. For other degraded areas or areas which require densification in relatively short time period, plantation of bamboo is also an option. Bamboo is a cultural feature of south-east Asia. No country in the region is without an indigenous bamboo flora. Its plethora of essential uses has led to the use of terms such as 'bamboo culture', 'green gold', 'poor man's timber' and 'bamboo friend of the people'. It is the fastest growing plant amongst the woody species, attaining harvestable maturity in less than five years. India has 120 bamboo species belonging to 23 genera (Naithani, 1993). *Dendrocalamus strictus* and *Bambusa bambos* (*B. arundinaecea*) are the most common bamboo species in the country.

Recently aerial seeding was done in the Palani Reserve forest in Dindigul Forest Division, Tamil Nadu. This area is classified as a degraded, dry deciduous and thorny forest. Of the species selected for seeding, *Acacia ferruginea, A. leucophloea, A. planifrons* and *D. strictus* are recognized for their ability to better withstand adverse conditions, and for the presence of rhizomes that facilitate recovery and reestablishment.

As the conditions of Delhi are similar to Palni, the introduction of *D. strictus* may be quite useful in restoring the green cover in the degraded area.[16] The Forest Department of Delhi has already understood the importance of this fact and was engaged in plantation of bamboo in the year 2009-10 and 2010-11 in Garhi Mandu and area near ITO Chungi respectively.

3.9 NATIONAL GREEN TRIBUNAL ACT, 2010 – FOUNDATION STONE TO GREEN LAW

"It is a multi-faceted, multi-skilled body which would combine the services provided by the existing courts, tribunals, and inspectors in the environmental field. It would be a 'one-stop shop' which should lead to faster, cheaper, and more effective resolution of disputes in the environmental area."

-Lord Harry Woolf,
Lord Chief Justice of England & Wales (2000-2005)

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[16] Delhi Development Report (2009) Planning Commission, Govt. of India, Academic Foundation, New Delhi.

The Indian Constitution, as a part of its Directive Principles of State Policy, states that "The State shall endeavor to protect and improve the environment and to safeguard the forests and wildlife of the country," and bestows upon the citizens the duty to protect the environment, "it shall be the duty of every citizen of India … to protect and improve the natural environment including forests, lakes, rivers and wildlife, and to have compassion for living creatures." While these words might be an integral part of our Constitution, environmental degradation is one of the most visible and threatening realities that we face at the present.

While we have stringent laws in place, the Supreme Court itself highlighted the difficulty faced by judges in adjudicating on complex environmental cases and laid emphasis on the need to set up a specialized environmental court.

In the M.C Mehta Vs. Union of India case in 1986, the Supreme Court observed that environmental cases involve assessment of scientific data. Setting up of environmental courts on a regional basis would require professional judges and experts, keeping in view the expertise required for such adjudication. In an another judgment, Indian Council for Enviro-Legal Action vs. Union of India in 1996, the Supreme Court observed that Environmental Courts having civil and criminal jurisdiction must be established to deal with environmental issues in a speedy manner.

Supreme Court of India in A.P. Pollution Control Board Vs. M.V. Nayudu in 1999 referred to the need for establishing Environmental Courts which would have the benefit of expert advice from environmental scientists/ technically qualified persons, as a part of the judicial process, after an elaborate discussion of the views of jurists of various countries.

The 186th Report of Law Commission of India on the Proposal to Constitute Environmental Courts in September 2003, stated that the "National Environmental Appellate Authority constituted under the National Environmental Appellate Authority Act, 1997, for the limited purpose of providing a forum to review the administrative decisions on Environment Impact Assessment, had very little work. It appears that since the year 2000, no judicial member has been appointed. So far as the National Environmental Tribunal Act 1995, the legislation is yet to be notified after eight years of

enactment. Since it was enacted by Parliament, the tribunal under the Act is yet to be constituted. Thus, these two tribunals are non-functional and exist only on paper". In its recommendation, the Commission proposed the setting up of environmental courts with judicial members and technical experts.

After years of deliberation, the National Green Tribunal Bill was introduced in the Indian Parliament on July 29, 2009. The bill provides for the establishment of a National Green Tribunal (NGT), which will offer effective and fast redressal of cases related to environmental protection and conservation of natural resources and forests. National Green Tribunal Act is a path breaking legislation which is unique in many ways. It will provide a new dimension to environment adjudication by curtailing delays and imparting objectivity. The Tribunal, given its composition and jurisdiction, including wide powers to settle environment dispute and providing relief, compensation including restitution of environment, is envisaged to be a specialized environmental adjudicatory body having both original as well as appellate jurisdiction. Thus came into being NGT for effective and expeditious disposal of cases relating to environmental protection, conservation of forests and other natural resources.

The term "tribunal" denotes a body that has quasi-judicial function with the authority to pronounce judgment on matters based on evidence. The green tribunal comprises a chairperson, judicial officers and environmental expert members who will hear the cases regarding infringement of environmental protection and rights around the country, and have the powers to decide and dispense compensations.

3.9.1 Concrete steps of NGT in Delhi

The NGT has fulfilled its due function by protecting the green cover of Delhi. One such case is of NGT case no. 58 of 2013 in the matter of Amicus Curiae - Three Illegal Roads cut through forest Vs. Govt. of NCT of Delhi & Ors. It issued comprehensive directions for consolidation of the Ridge, prevention of encroachment and improvement of staff strength. It also directed the settlement of rights and deterred malba dumping in Ridge forest land with imposition of fine on doing so. Due to the dedicated work of the Forest Department and orders of NGT, commendable work has been

done. The department has developed a unique approach termed Ridge Protection Management System which will help in locating forest offences in case of encroachment, and help in generating change data analysis through satellite imageries. Financial sanctions for those works have been obtained by the Department from the Government of NCT of Delhi and the Ridge Management Board. Now the department is endeavoring to develop a mosaic of forest areas on geo-portal. This will help in identification of the Ridge on ground as well as encroachment.

Another such case is 82 of 2013 in the matter of Aditya N. Prasad Vs. Union of India & Ors. wherein the court has ordered for de-concretization around trees. Such an action has resulted in various de-concretization activities taking place in different parts of Delhi, thus saving Delhi's greenery. Appreciably, the NGT taking a practical stand, has tried to make a balance between development and conservation which can be inferred from case no. 149 of 2013 in the matter of Dr. P.C. Prasad & Ors. Vs. Govt. of NCT of Delhi & Ors., wherein NGT has implied that development is necessary but not at the cost of environment, thus giving orders for plantation of ten times the number of trees that are felled for construction of flyover on Vikaspuri to Meerabagh road.

3.10 GREENING ACTION PLAN – DELHI

With the postulation of the National Forest Policy, 1988 and the more recent Green India Mission, there has been a shift in the principles of management of forests, laying greater stress on the maintenance of environmental stability through preservation and where necessary, restoration of ecological balance that has been adversely disturbed by serious depletion of forests. Another aim is increasing substantially the forest/tree cover in the country through massive afforestation and looking at conservation with a much more holistic approach, so as to ensure livelihood security to at least one-fifth of the poor population of the country.

A rapid rate of urbanization in the last few decades has put an immense pressure on the green cover of Delhi. With increasing human population, there has also been an increase in the number of vehicles plying in the city. Though the introduction of CNG has seen a significant reduction in air pollution, there is no better alternative to green cover for combating

air pollution. It is good to see a spark of realization amongst the citizens of Delhi to strengthen measures for protection of trees and forests, and hence enhance the green cover of Delhi.

The Government of NCT of Delhi has laid great emphasis on the protection of trees and afforestation at a large scale. Plantations have been raised wherever suitable land has been found available, such as Gaon Sabha lands, Yamuna banks, etc., and even densification of forest lands have been undertaken. However, the Government is of the view that people's active participation in afforestation programmes is essential for rapid success of greening Delhi.

The Department of Forests and Wildlife, Govt. of NCT of Delhi, is one of the main greening agencies in Delhi. The activities of the Department include development, protection and conservation of forests and trees, enhancing the functions of carbon sinks. The Department ensures the enforcement of the Forest Conservation Act, 1980, Indian Forest Act, 1927, Wild Life (Protection) Act, 1972, the Delhi Preservation of Trees Act, 1994 and the Rules made there under for protection of forests and wildlife in the territory. The Tree Authority, constituted by the Department, oversees the implementation of the Delhi Preservation of Trees Act, 1994 and includes representatives of Government, Non-Government Organizations, eminent scientists and environmentalists as its members for preserving and further increasing the greenery of Delhi. More than 1200 Eco-Clubs have been established in various schools/colleges of Delhi, which include more than 50% Government schools. These Eco-clubs conduct various environmental activities throughout the year. At the end of every year, Annual Eco Meet and environmental exhibitions are organized wherein the representatives from all the Eco-club schools participate and exhibit various eco-friendly products.

3.10.1 Objectives

A major section of the works carried out under the 'Greening Delhi Action Plan' involves generation of public awareness to create a safer, cleaner and healthier Delhi. The major objectives of creating public awareness are:

1. Motivating people to plant trees.
2. Inculcating a sense of responsibility towards trees in particular and nature in general.

3. Increasing awareness among the citizens of Delhi about the protection of trees.
4. Motivating students and hence the youth to actively participate in combating pollution at a local level and hence, be a part of the State's resolve to improve the environment of Delhi.

3.10.2 Awareness activities

Various kinds of activities are undertaken by the Government of NCT of Delhi to create awareness amongst the commons of Delhi. They include spreading awareness through audio visual, print and electronic media as well as organizing plantation activities on various auspicious occasions.

i. **Radio:** A short message to be delivered on air is proposed.
ii. **Newspaper:** Advertisements through English and Hindi newspapers are proposed to be published in public interest.
iii. **Posters, Kiosks and panels on buses and bus shelters:** Messages both in English and Hindi are placed at different places, and the Government plans to increase its impact through publicizing the same.
iv. **Non Governmental Organizations and voluntary bodies:** Various NGOs, such as Kalpvriksh, Srishti, BNHS, ATREE, Development Alternatives, educational groups, Rotary Clubs, Lions Cub etc. are involved in motivating people, students and RWAs. The department of Forests & Wildlife, Government of NCT of Delhi, intends to involve more and more agencies to make it a peoples' movement.
5. **Residents Welfare Associations:** Various Residents Welfare Associations (RWAs) are involved as a co-ordinating unit in plantation programmes. A pilot tree census programme has also been launched by the Forest Department along with the co-operation of the RWAs.
vi. **Role of Corporate Sector:** The corporate sector can play a major role in the awareness programmes for greening Delhi by providing sponsorships.

3.10.3 Targets and achievements

Under the Greening Delhi Action Plan 2012-13, targets were set, and achievements recorded for the Forest Department and other Greening agencies can be seen in Annexure 14. The Department of Forests & Wildlife,

Government of NCT of Delhi intends to take up plantation of 2.5 lakh saplings in areas available under its jurisdiction, namely Gaon Sabha lands, City Forests, Ridge, Asola Bhatti Wildlife Sanctuary, Protected Forests, etc. The Department is encouraging natural regeneration in the Ridge area through enrichment plantation of indigenous species and supplementing it with soil and moisture conservation techniques. In the year 2013-14 the Department will also distribute 6 lakh saplings completely free of cost. The details of plantation by different agencies till February 2014 are given in Annexure 15.

The Planning Commission in a recent communication has appreciated the efforts of the Department of Forests & Wildlife of Delhi Government for maintaining its tree/green cover despite multiple pressures of developmental projects on the land resources of Delhi

3.11 CDM PROJECT – DEPARTMENT OF FORESTS & WILDLIFE

The purpose of the Clean Development Mechanism (CDM) is defined in Article 12 of the Kyoto Protocol to the United Nations Framework Convention on Climate Change. The CDM has a two-fold purpose: (a) to assist developing country Parties in achieving sustainable development, thereby contributing to the ultimate objective of the Convention, and (b) to assist developed country Parties in achieving compliance with part of their quantified emission limitation and reduction commitments under Article 3. Each CDM project activity should meet the above two-fold purpose. India is one of the world's largest hosts of such clean development projects. From 2003 to 2011, a total of 2,295 projects – around one-quarter of the global total – had been registered with India's Designated National Authority for the Clean Development Mechanism.

Delhi is one of the cities that had been worst affected by pollution and natural resource degradation due to urban pressures. Urbanization and decrease in plant cover made Delhi an urban heat island, and the plant cover in the Ridge areas proved to be ineffective in providing relief to people.

The project "Rehabilitation of Degraded Wastelands at Dera Mandi in Southern District of National Capital territory of Delhi through Reforestation"

is being implemented by the Department of Environment, Forests & Wildlife, Government of NCT of Delhi, by specially engaging Eco-Task Force of Indian Territorial Army for reforestation of the erstwhile-degraded grasslands in the project area. The project boundary is comprised of degraded grasslands in Dera Mandi with a geographic spread of 365.7 hectares. The project in its mission envisages demonstrated and credible carbon sequestration through reforestation forestry and in meeting the objectives of Sustainable Development.

The main aims of the CDM project activity is to achieve the following objectives:

a. To earn carbon credits from the growth of trees considered in the project area under the CDM provisions of Kyoto Protocol.
b. To provide climate change mitigation services by planting trees.
c. Eco-restoration of the degraded land areas falling in the Southern District of New Delhi, and biodiversity conservation.
d. To improve the soil and land productivity.
e. To provide critical environmental sustenance to the megapolis of Delhi.
f. Generation of economic, social and educational options to the direct and indirect stakeholders, protection of plantation area with fencing of the site and social fencing involving local people.

The proposed small scale A/R CDM project activity and its crediting period started from 01.07.2008. The project is funded through the allocation made by the Department based on the cost estimate proposals submitted by the ETF annually. Presently, the project has been registered with UNFCC.

3.12 CONCLUDING REMARKS

Delhi has been termed as the greenest capital. This has been possible because of the dedication over these years by various departments of the Government of NCT of Delhi. The Department of Forests, GNCTD has worked dedicatedly to attain and maintain this goal. The conservation of our resources can only be possible by enthusiastic participation of its people, thus the department ensures the same by conducting various awareness programs. Moreover, it works in collaboration with different departments such as Public Works

Department, Land & Development Office, NDMC and CPWD, to conserve the pride of Delhi – its Ridge. The National Green Tribunal has given additional legal strength to this cause and the department tries to fulfill its various orders, as the prime objective of the Forest Department has been and will be to protect, conserve and glorify the green resource of Delhi.

Chapter-4

Asola Bhatti Wildlife Sanctuary

– An escape to solace...

Being the National Capital Territory, Delhi harbours 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, harbouring flora and fauna indigenous to oldest Indian Aravalli hills.

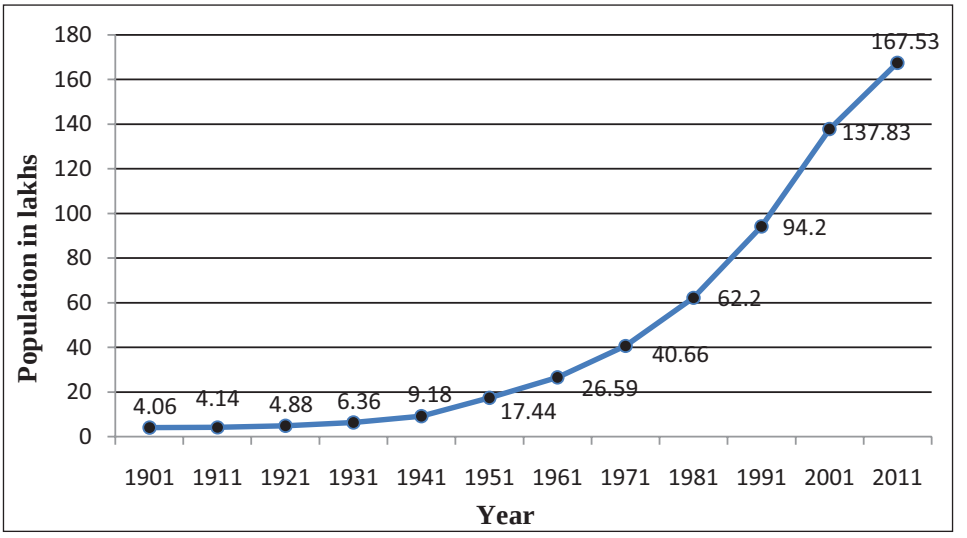

Figure 4: Population growth trend of Delhi.

Source: Census of India reports

4.1 HISTORY

The Ridge acts as a barrier to the sand laden westerlies from the deserts of Rajasthan, thereby protecting Delhi from the harmful effects of desertification. With varied elevation from 2.5 metres to 90 metres above the plains, the Ridge has been put to various landuse practices from time immemorial. The active mining of quartzite, commonly known as 'Badarpur' had heavily seared and severely degraded the Southern Ridge. The area also used to act as a cattle/goat resting and grazing site for herds coming from Rajasthan and nearby areas, severely affecting the vegetation of the region. To safeguard the potential biological values and ecological functions by providing sufficient protection, and to put a check on any further degradation of the impoverished land, the mining activity was stopped and Asola and Bhatti areas were notified as Wildlife Sanctuary.

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 vide notification No. F.3(116)/CWLW/84/897/to 906 dated 09.10.1986 (Annexure8). 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 vide notification No. F.2(19)/DCF/90-91/1382-91 dated 15.04.1991 (Annexure9)as the Asola Bhatti Wildlife Sanctuary (4,845.57 acres).

4.2 LOCATION

Geographically, the sanctuary is located in the Southern Ridge and extends from 28°30'15.454"N 77°15'35.514"E to 28°24'42.147"N 77°13'2.181"E and 28°29'17.408"N 77°16'19.757"E to 28°29'11.876"N 77°12'18.407"E. 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

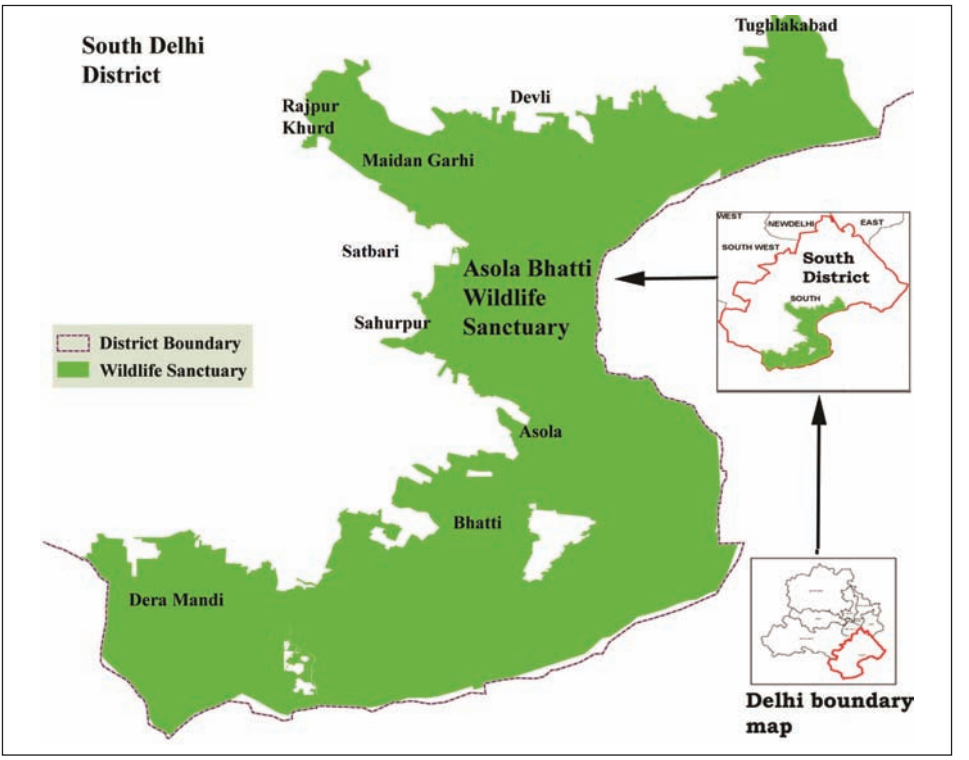

Figure 5: Map of Asola Bhatti Wildlife Sanctuary

4.3 ECOLOGICAL SIGNIFICANCE

Situated on the western edge of the Indo-Gangetic plain, the Asola Bhatti Wildlife Sanctuary is the transition zone between the semi arid physiographic zone and the northern plains physiographic zone. It is the only Protected Area bordering the Delhi-Gurgaon – Faridabad urban conglomeration and serves as a potential carbon sink, literally symbolizing the 'green lungs' of the densely populated Delhi and adjoining areas of Haryana.

The sanctuary not only acts as a barrier against the advancing aridity from the southwest direction, but its good soil porosity also helps to act as an aquifer

from where Delhi's ground water gets recharged with good quality water and plays a major role in the overall control of the water regime. It further functions as a thermo regulator by creating its own evapo-transpiration regime.

4.4 FLORA AND FAUNA

The vegetation of the Sanctuary falls under 6B/C Tropical Dry Thorn Forest type as per Champion and Seth (1968).The area is mainly dominated by sparsed middle storied thorny trees with open patches.

Today large parts of the sanctuary are covered with *Prosopis juliflora*. Wherever the soil profile and moisture regime are found to be good, the Forest Department is undertaking plantation of indigenous species to prevent any further invasion of *P. juliflora*. The department is also taking up artificial plantation of indigenous species through improvement of soil profile and irrigation facility augmentation to contain the expansion of *P. juliflora region*.

The sanctuary area is home to the major wildlife population of the Ridge. Adequate conservation and protection activities are undertaken by the Forest Department to conserve the wildlife population of the sanctuary. The number of individuals of all species has seen marked increase in the last decade.

Figure 6: Striped Hyena captured during camera trapping in Asola Bhatti Wildlife Sanctuary.

The floral and faunal compositions have been dealt with in detail in Chapter 6.

4.5 MONKEY MENACE

To redress the problem of monkey menace in the inhabited areas of Delhi, the Hon'ble High Court of Delhi passed a milestone judgement on 14.03.2007 in WP (C) 2600/2001 in the matter of New Friends Colony Residents Welfare Association Vs. Union of India and others.

The civic agencies were directed to trap the problematic monkeys from their respective jurisdiction with the help of cages to be provided by Forests & Wildlife Department and translocate them to Asola Bhatti Wildlife Sanctuary. The whole process was directed to be carried out within a period of 3 months. This decision highlighted the wisdom behind the judgement as it would prevent the further growth of monkey population in residential areas. However, the work was not carried out in a time bound manner which resulted into partial removal with simultaneous addition to monkey population in the residential areas of Delhi.

As the sanctuary is deficient in fruit bearing trees, and new trees proposed to be planted will take several years to bear fruits, the relocated monkeys need to be fed in the Forest. Since the Court banned feeding of monkeys in public places, it was hoped that food offered as religious offering may be collected by civic agencies in various food collection centres and sent to the forest area to be fed to monkeys. No provision for collection of cooked food was made as it might aid in population growth or epidemic in translocated monkeys. The Court had, however, ordered that in case food collected as religious offering is not sufficient, Forest Department should make arrangements for rehabilitation of the translocated monkeys:

> "It will be obligatory upon the Government of NCT of Delhi to provide food and water to these rehabilitated monkeys" and "... principally it would be the obligation of the Delhi Administration and the Chief Wildlife Officer to ensure that the food is provided to the monkeys who are shifted to the Bhatti Mines".

At present, monkeys are being trapped by the Municipal Corporations of Delhi (MCDs) and New Delhi Municipal Corporation (NDMC) and released into forest area since the second week of March 2007, and till 28.02.2014, a total of 17,138 monkeys had been released. In turn, the Forests & Wildlife Department, Govt. of NCT of Delhi rehabilitates the translocated monkeys by providing supplementary food to them at 20 feeding platforms in the Sanctuary every day. The whole process of supply and feed to monkeys is meticulously monitored with in built checks. The translocated monkeys are also seen to feed on the pods of *P. juliflora* and fruits of other fruit bearing trees. The monkeys are also responsible for large scale damage to the young saplings of the Protected Area.

The members of the Enforcement Committee formed by the Hon'ble High Court periodically visit the area where the translocated monkeys are being rehabilitated, to see that they are adapting to the changed habitat. With a view to prevent the translocated monkeys from going back to residential colonies, the boundary wall has been raised upto 15 feet along a stretch of 1500 m facing the residential areas. Further, people are also advised through leading dailies of Delhi to stop feeding monkeys in public places, instead their feed can be handed over to collection centres set up by MCDs and NDMC. It will be a better strategy if a periodic drive is conducted in a time bound manner in the National Capital Region (NCR) to save the area from Monkey Menace. Any delay in such a drive may lead to the possibility that the monkey problem may co-exist with the people in this area.

4.6 ECO-RESTORATION THROUGH ECO TASK FORCE

Extensive mining of Badarpur had left the Bhatti mines devoid of natural vegetation with heavily leached and eroded top soil, fragmented land and relegated moisture regime. As discussed earlier, the area was also used as livestock resting site for the nomadic herders from Rajasthan and nearby areas. This further degraded the ecology of the area denying even a blade of grass the chance to regenerate on its own.

Reclamation of the area all by itself was always a major challenge for the Forest Department as it falls in the rain shadow area. Various environmental organizations and institutions were approached to assist the department in

restoring the ecology of the region. In most cases the proposal could not get fruitful results due to the vastness of the area.

Finally, the Forest Department, Government of NCT of Delhi undertook a project on eco-rehabilitation of about 2,100 acres of Bhatti Mines area since 2000, about 1,400 acres of Dera Mandi area since 2006 and about 1,500 acres of Asola area since 2011 through 132 Infantry Batallion (TA) ECO Rajput (Eco-Task Force - ETF).

The project aimed at mitigating the adverse effects of extreme climatic conditions such as drought and desertification for the overall improvement of the ecology. The intention was to restore the ecological balance by harnessing, conserving and developing natural resources i.e. land, water, vegetative cover.

The eco-rehabilitation of degraded forests and abandoned mine pits of Bhatti in the Southern Ridge through plantation and soil conservation measures was implemented in the year 2000 for an initial period of five years with the following objectives:

1. Reclamation of Bhatti areas through afforestation.
2. Protection and development of biodiversity of the Aravalli ecosystem.
3. Restoration of habitat for indigenous wildlife of Delhi.
4. Improvement of groundwater regime of the area.
5. Improvement of the soil fertility in the area and adjoining areas as well.

Since the inception of the project there has been significant improvement in the ecology of the area. The protection accorded by ETF has resulted in considerable natural regeneration in the degraded habitat, resulting in increase in green cover of the area, further complementing the wildlife habitat. The evident success resulted in subsequent extensions of the project and incorporation of areas of Asola and Dera Mandi under the umbrella of the project.

Land Development activities including *in-situ* soil and moisture conservation measures like contour and graded bunding fortified by plantations,

and bench terracing have been undertaken. Afforestation activities like block plantations are complemented with drainage line treatment and a combination of vegetative and engineering structures for soil improvement.

The development of small and large water harvesting structures such as low-cost ponds, nalla bunds, check-dams, contour bunds and other ground water recharge measures have been carried out to improve the soil moisture regime.

Pasture development and creation of forage patches have also been undertaken in conjunction with plantations to support the increasing wildlife population.

The ETF, along with the Forest Department, encourages growth of indigenous species to restore and conserve the ecology of the region, and also undertakes plantation of fruit bearing trees to support the population of translocated monkeys. The details of plantations raised under this project up to 2012-13 are as follows:

S. No.	Years	Plantation Raised (Number of trees)
1.	2001-02	58,800
2.	2002-03	92,400
3.	2003-04	1,51,500
4.	2004-05	1,26,000
5.	2005-06	1,30,267
6.	2006-07	1,40,000
7.	2007-08	2,00,000
8.	2008-09	1,67,000
9.	2009-10	1,50,000
10	2010-11	1,50,000
11.	2011-12	1,84,017
12.	2012-13	1,54,144
	Total	**17,04,128**

During the initial years the survival rate of saplings was very poor, at times even less than 20%. However, with improvement of soil profile and soil

moisture regime by undertaking various measures like addition of humus, etc., the regeneration has improved resulting in far better survival rates.

In addition to plantation works and inherent protection to forest land, the ETF has also undertaken various soil and moisture conservation works to improve the groundwater regime of the area. Seven mines in Bhatti area were chosen to retain rain water for maximum period during a year. All these seven mines were developed into water bodies, which retain water throughout the year. A total of 17 large water bodies have been developed in Asola, Bhatti and Dera Mandi areas. In addition to this, 32 small water holes have been created to provide water for the increasing wildlife. In addition

Figure 7: Jitsinghwala waterbody at Asola Bhatti Wildlife Sanctuary

Figure 8: 10 km long trenching done to check rainwater runoff.

to contour trenching, 5 check dams have also been constructed and 6 more are under construction to check rainwater runoff. Further soil and moisture conservation activities are also planned to be implemented in near future in the sanctuary area under this project.

The activities undertaken have already shown its positive impact in the following ways:

- Rainfall: There has been a vast improvement in the number of rainy days in the area. The change is depicted in the following chart:

S. No.	Year	Remarks
1.	2000-04	No Rainfall
2.	2005	Rained for 05 days
3.	2006	No Rainfall
4.	2007	Rained for 12 days
5.	2008	Rained for 45 days
6.	2009	Rained for 33 days
7.	2010	Rained for 58 days
8.	2011	Rained for 47 days
9.	2012	Rained for 46 days

- Natural regeneration: The area has seen improvement in its ecology in the form of augmentation of natural regeneration reflected in the following chart:

S. No.	Year	Remarks
1.	Till 2004	Nil
2.	As on date	Species regenerating on their own
	a) Trees	09 species
	b) Shrubs	11 species
	c) Herbs	23 species
	d) Grasses	07 species
	e) Climbers	05 species

4.7 COMPENSATORY AFFORESTATION UNDER DELHI CAMPA

Development is a country's basic need. However, in lieu of long term benefits for the human race, there is an inherent need to maintain a balance between

development and the environment surrounding it. Thus, development and conservation should go hand in hand for the betterment of a society.

The Forest (Conservation) Act, 1980 provides the provision for diversion of forest land for non-forestry purposes for public utility projects in exchange of compensatory afforestation on double the area of diverted land and realization of Net Present Value (NPV) of the forest land being diverted. The approval to carry out these developmental activities is duly accorded by the Ministry of Environment & Forests, Government of India, on recommendation of the State Government.

To efficiently undertake the works of compensatory afforestation, a State specific authority, known as the "State Compensatory Afforestation Fund Management and Planning Authority" (State CAMPA) was formed to accelerate activities for preservation of natural forests, management of wildlife, infrastructure development in the sector and other allied works.

The State CAMPA receives money collected from user agencies towards compensatory afforestation, additional compensatory afforestation, penal compensatory afforestation, NPV and all other amounts recovered from such agencies under the Forest (Conservation) Act, 1980 and presently lying with the Adhoc CAMPA, Ministry of Environment & Forests, Government of India.

The State CAMPA is entrusted to utilize the amount received from the Adhoc CAMPA for undertaking activities of compensatory afforestation, assisted natural regeneration, conservation and protection of forests, infrastructure development, wildlife conservation and protection and other related activities. It deploys funds as per guidelines governing the use of funds for conservation, protection and management of forests. The amounts are also to be deployed for wildlife preservation and enhancement of wildlife habitats.

As per guidelines furnished by the MoEF, Govt. of India, Delhi CAMPA was formed on 05.10.2009 vide notification No. F.1/CF/FCA/07-08/Part-II/3517-3540 (http://www.delhi.gov.in/wps/wcm/connect/2c09e800451988f4bdeffd985fe6f3a9/NOTIFICATIONCAMPA.pdf?MOD=AJPERES&lmod=1390740818).

The abandoned open pits and degraded habitat resulting from illegal cattle grazing by nomadic tribes in Asola Bhatti Wildlife Sanctuary demanded special attention and judicious undertaking of activities to improve the wildlife habitat of the region. Hence the sanctuary was covered under activities of CAMPA with an aim to improve natural regeneration, conservation, protection and development of wildlife and its habitat.

Compensatory afforestation and its allied activities have been undertaken in the sanctuary against 11 (eleven) developmental projects. A total of 1 (one) lac saplings have been planted under this scheme of compensatory plantation. An additional 1 (one) lac saplings have also been planted utilizing the money realized as NPV from the user agencies.

The plantations are regularly maintained and inspected by officials deployed by the department. Proper irrigation system and trenching are also facilitated to support the plantations raised. Various allied activities have also been undertaken to improve the overall habitat. Forage patches and various large and small water bodies have been developed to support and improve the wild herbivore population of the sanctuary. Activities are also undertaken to improve the soil and moisture regime of the area.

The success is reflected in an increase in the wildlife population of the sanctuary. Several species which had almost got erased from Delhi have started re-establishing here, indicating an improvement in their habitat. The area also acts as a resting site for various species of migratory birds. Many of the water bodies are holding water throughout the year, which indicates an improvement in the moisture regime. The number of rainy days in the region has also increased considerably. Today the erstwhile impoverished sanctuary reports natural regeneration of trees, herbs, shrubs, grasses and climbers.

4.8 RELOCATION OF COLONIES

The Hon'ble Supreme Court in its order dated 03.01.1996 in WP(C) No. 4677/1985 in the matter of M.C. Mehta Vs. UOI & Others showed its concern about the encroachments of the Ridge area of Delhi and identified three clusters, namely Sanjay Nagar, Balbir Nagar and Indira Nagar as encroachments. Together they occupied an area of approximately 93 ha.

Further, the Supreme Court in its order dated 09.04.1996 directed the relocation of these three villages.

In its order dated 07.02.2006 the Supreme Court added that the shifting would clear the Ridge area and directed that since the infrastructure and development work at Bawana and Holambi Kalan were complete,shifting was to commence within four weeks and be completed within 8 weeks. The remaining families were to be shifted by 31.05.2006.

Indira Nagar and Balbir Nagar were relocated in the year 2006 whereas the relocation of Sanjay Nagar was stayed by the High Court of Delhi vide its order dated 30.05.2007 in the matter of Nav Yuwak Gram Vikas Samiti Vs. Govt. of NCT of Delhi & Others in WP(C) No. 4362/2007. The High Court later dismissed the matter and asked the respondents to comply with the orders of the Supreme Court. Nav Yuwak Gram Samiti had further filed applications no. 579 in CM APPL NO. 10851 of 2009 which was finally disposed off on 14.12.2009.

The Ridge Management Board had been pursuing the matter of relocation with MCD since 1996. The Slum and JJ Wing of MCD had taken up a biometric survey of Sanjay Nagar with the officials of Department of Forests & Wildlife, GNCTD on 04.06.2008 for relocation. The officials were forcibly prevented by the illegal occupants from undertaking the exercise, whose formal complaint was also lodged. The matter was again taken up with MCD and the joint biometric survey was arranged on 12.11.2009, but the same could not be carried out due to stiff resistance of the illegal occupants of Sanjay Nagar.

It was decided by the concerned authorities that the Delhi Urban Slum Improvement Board shall take all measures necessary for the relocation of Sanjay Nagar slum & JJ clusters to Sawda Ghera and comply with the directions of the Supreme Court of India in a time bound manner as no human habitation is permissible in the Wildlife Sanctuary.

It was further decided that all necessary measures will be taken up by the DUSIB for early relocation of Sanjay Nagar outside the Wildlife Sanctuary in a planned and coordinated manner with full government support and

commitment, in faithful compliance of the directions of the Hon'ble Supreme Court.

4.9 ILLEGAL TRADE IN WILDLIFE

The trade of wild flora and fauna has severe ramifications on the survival of endangered species and sustenance of the ecosystem as a whole. While many a time the limelight is caught by large charismatic species like tigers, lions, rhinoceros, etc. there is also a major threat posed for numerous other wild floral and faunal species as well. Due to its accessibility and excellent transport facility, Delhi is often recognized as a major hub for the illegal trade in such species and their products. The Department of Forests & Wildlife is entrusted with implementing the provisions of the Wildlife (Protection) Act, 1972 for regulation of hunting and trade of wild flora, fauna and its products.

Hunting and trade of wild animals, specified plants and its parts are prohibited under the aforesaid Act. The Department of Forests & Wildlife, Government of NCT of Delhi enforces the provisions of the Act through its Wildlife Enforcement Wing comprising of officials like the Chief Wildlife Warden, Wildlife Officers, Wildlife Inspectors, Forest Guards, Wildlife Guards, etc.

The Wildlife Enforcement Wing of the Department, in the process of its tirade against poachers, has made record seizures of wild animals/products in Delhi since the commencement in 1973 of the Wildlife (Protection) Act, 1972. A few of numerous raids/seizures conducted by Wildlife Inspectors may be taken note of, where seized goods amounted to truckloads.

Date	Name of person/firm recovery made from	Property seized	Remarks
09.02.1976	Susheel Trading Co.	4279 Red fox skins	Then biggest ever
19.02.1979	Srinagar Golden Transport Company Limited	4298 wild animal skins	Then biggest ever
01.03.1983	Khurana Goods Carriers	4727 wild animal skins	Then biggest ever
26.10.1983	Jaswinder Singh	30600 wild animal skins	Then biggest ever

25.03.1988	Sansar Chand & others	29162 wild animal skins	Then biggest ever
30.03.1988	Jaipur Golden Transport Co.	5266 wild animal skins	Then biggest ever
05.09.1990	Sh. Satpal (seizure from IGI Airport)	2850 prohibited birds	Then biggest ever
27.10.1992	Sansar Chand & others	81 Tiger, Leopard & other skins	Then biggest ever
06.04.2003	Inder Singh & others	11 big bundles containing Shatoosh wool	Then biggest ever
24.11.2007	Manoj Kumar Pandey	293 marine animal articles	Then biggest ever

The impact of the relentless crusade conducted by the Wildlife Enforcement Wing is that the poachers and traders have by and large shifted their infamous activities to areas outside the NCT of Delhi. As regards the number of wildlife offence cases filed by the Department in the Court of law, the details are as follows:

Year	Total no. of cases filed in court	Convicted	Acquitted	Closed due to accused being declared proclaimed offender or dead	Pending
1980	27	18	3	6	0
1981	38	21	2	15	0
1982	14	10	1	3	0
1983	11	10	0	1	0
1984	6	4	2	0	0
1985	4	3	1	0	0
1986	0	0	0	0	0
1987	3	1	1	1	0
1988	24	19	2	3	0
1989	22	17	2	3	0
1990	63	49	6	8	0
1991	26	21	1	4	0
1992	59	34	13	11	1
1993	42	24	6	11	1

1994	9	5	1	3	0
1995	32	14	7	11	0
1996	37	18	7	12	0
1997	22	10	6	5	1
1998	14	6	0	6	2
1999	16	10	1	3	2
2000	24	8	9	3	4
2001	16	5	4	6	1
2002	18	7	2	4	5
2003	6	2	2	1	1
2004	11	7	3	0	0
2005	7	4	0	2	1
2006	35	22	4	5	4
2007	11	6	2	0	3
2008	43	32	6	0	5
2009	20	11	3	3	3
2010	23	14	0	4	5
2011	12	7	0	1	4
2012	6	3	0	0	3
2013	29	12	0	0	17
Total	**730**	**434**	**97**	**135**	**63**
Total Cases Decided			531		
Total Cases Convicted			434		81.73%
Total Cases Acquitted			97		18.27%

The Wildlife Enforcement Wing of the Department has till date filed 730 cases in the Court of law, and a conviction rate of 81.73% of the decided cases is certainly encouraging. A total of 63 cases are pending in the courts.

Significant reduction in wildlife crimes is a result of effective enforcement of the provisions of the law. Raids and seizures are planned and co-ordinated among the Wildlife Enforcement Wing of the department and Police Officials. A host of NGOs also work in tandem in intelligence gathering and play a key role in helping the department to keep a check on illegal trade of wildlife and its products. In addition, various activities are also undertaken on occasions like Wildlife Week, World Forestry Day etc. to spread the awareness amongst the citizens of Delhi, to discourage trade

and consumption of wildlife and its products, thereby extending the due protection for wild flora and fauna.

4.10 CONSERVATION AWARENESS

The Department of Forests & Wildlife has been successful to a great extent in enlisting the support of the masses through Bhagidari, Eco-clubs, Health Melas, Awareness camps, rallies etc. in creating awareness about the importance of trees, forests and wildlife, as also the role played by them in improving the environment. Every year a large number of students from government and private schools voluntarily participate in the massive afforestation and awareness programmes undertaken by the department. Besides, the department, through banners, hoardings, electronic and print media, has enlisted the willing support of citizens of Delhi for conserving the green cover, wildlife and ecology of Delhi as a whole.

The Forest Department undertakes awareness activities targeting a wide section of the society including school and college students, their parents, market associations, resident welfare associations, etc. The publicity efforts are carried via radio, newspapers, posters, kiosks, panels on bus shelters and animated display systems. Every month public notice is advertised in the leading dailies of Delhi, advising the citizens to stop feeding monkeys at public places to keep a check on their uncontrolled population expansion.

Various other activities are also undertaken on occasions like World Forestry Day, World Environment Day, Van Mahotsav, Wildlife Week, etc., aimed at spreading conservation awareness amongst the masses. The activities include organization of rallies, planting and distribution of saplings, poster painting, photography competition, birding, etc.

As discussed earlier in this book, the Department of Forests & Wildlife has also established a Conservation Education Centre at Asola-Bhatti Wildlife Sanctuary in collaboration with the Bombay Natural History Society for imparting education in nature and wildlife conservation to students, teachers and citizens of Delhi. It also organizes nature trails and workshops exposing the participants to the wilderness and providing them with first-hand experience of the dynamics of nature. Audio-visuals and film shows on conservation of wildlife and protection of their habitats including climate

change are also being regularly arranged in a makeshift auditorium in the office complex of the DCF (South) at Tughlaqabad for students and other stakeholders.

From 2004 to 2013, around 48,390 people visited the Centre and benefited from the environmental education programme. Besides, with the support of the Department of Forests and Wildlife, the Centre also organizes quiz, painting, clay modelling and face painting competitions for a large number of school children.

Figure 9: Activities organized during Wildlife Week.

4.11 ECO-SENSITIVE ZONE AROUND ASOLA BHATTI WILDLIFE SANCTUARY

In the XXI meeting of the Indian Board for Wildlife held on 21st January 2002, a 'Wildlife Conservation Strategy-2002' was adopted wherein point no. 9 envisaged that land falling within 10 km of boundaries of National Parks and Wildlife Sanctuaries should be notified as Eco-Fragile Zones under section 3(v) of the Environment (Protection) Act, 1986 and rule 5 subrule (viii) & (x) of the Environment (Protection) Rules, 1986.

The purpose for declaration of Eco Fragile Zone or Eco-sensitive Zones (ESZ) around National Parks and Sanctuaries was to create some sort of 'Shock Absorber' for Protected Areas, and would also act as a transition zone from areas of high protection to areas receiving a lower level of protection.

According to the National Wildlife Action Plan (NWAP) 2002-2016, "*Areas outside the protected area network are often vital ecological corridor links and must be protected*

to prevent isolation of fragments of biodiversity which will not survive in the long run. Land and water use policies will need to accept the imperative of strictly protecting ecologically fragile habitats and regulating use elsewhere.''

The Additional Director General of Forests (WL), had requested all the Chief Wildlife Wardens to list out such areas within 10 km of the boundaries of National Parks and Wildlife Sanctuaries and furnish detailed proposals for their notification as eco-sensitive areas under the Environment (Protection) Act, 1986.

But considering the constraints communicated by the States, the proposal was re-examined by the National Board for Wildlife (NBWL) wherein it was decided and communicated that the delineation of ESZ would have to be site specific and relate to regulation, rather than prohibition, of specific activities.

The Hon'ble Supreme Court in Writ Petition 460/2004 vide its order dated 04.12.2006 had directed the Ministry of Environment & Forests (MoEF) to give a final opportunity to all States/UTs to respond to the Ministry's directions, and that the State Governments shall send their proposals within four weeks to the Ministry. It was also directed that all cases where environmental clearances were granted where activities are within 10 km zone, be referred to the Standing Committee of NBWL.

The MoEF was of the view that the State/UT Governments be given one last opportunity to submit site specific proposal for declaration of ESZ around National Parks and Wildlife Sanctuaries within an extended time till 15th July 2013.

As per the 'Guidelines for declaration of Eco Sensitive Zone' issued by the MoEF, a committee comprising of Mr. Nisheeth Saxena, IFS, DCF (South), Dr. Prodyut Bhattacharya, Dean Department of Environmental Management, IP University, Delhi, Mr. Mohd. Arif, SEE (CMC-III) DPCC and Mr. K.P. Suhag, SDM Saket was formed which studied the ecology, land use pattern and activities of the areas surrounding the Asola Bhatti Wildlife Sanctuary. The committee suggested regulation of various activities in the surrounding areas within 1 (one) km around the Asola Bhatti Wildlife Sanctuary, Delhi.

It was further acknowledged that the southern and western sides of the Sanctuary are along the interstate border with Haryana. This matter was brought to the notice of the MoEF. In response, the MoEF stated that in cases where the boundary of a Protected Area abuts the boundary of another State/UT it shall be the endeavour of both the State/UT Governments to have a mutual consultation and decide upon the width of the eco-sensitive zone around the Protected Area in question.

In the last meeting held at MoEF, the matter was discussed with the officials of Forest Department of Haryana who had a positive approach towards considering Eco-sensitive Zone for Asola Bhatti Wildlife Sanctuary towards the boundary of the sanctuary abutting the inter-state border of Delhi with Haryana. Presently, the Department of Forests & Wildlife, Government of NCT of Delhi is also considering some permanent features for easy demarcation of the zone,to facilitate proper identification by the people residing in this area. The matter is also being taken up with the Haryana Forest Department to facilitate complete demarcation of the Eco-sensitive Zone of Asola Bhatti Wildlife Sanctuary.

4.12 CONCLUDING REMARKS

The aesthetic, ecological and societal significance of the lone Wildlife Sanctuary of Delhi is beyond imagination. The Forest Department, Government of NCT of Delhi is dedicated to take every possible measure to conserve and improve the habitat of Asola Bhatti Wildlife Sanctuary. Conservation efforts aimed for a better tomorrow is not one man's job. The realization and responsibility should be imbibed in the Society as a whole. Keeping this in mind, the Forest Department tries to involve the citizens of Delhi in every possible way towards conservation and awareness activities. Various activities are also undertaken to discourage the citizens from using wildlife products thereby aiming at conservation in a holistic way with a national or global approach.

Chapter-5

Flora and Fauna of Delhi Ridge

The Aravallis and river Yamuna, prominent physical features, play a dominant role in shaping an array of ecological variations in Delhi. The National Capital Territory of Delhi acts as a transition zone between two contrasting ecosystems. It is influenced by the semi-arid and arid desert of the west, and the fertile Gangetic Plains of the east. Thus, it harbors features of both these biogeographic zones.

The northernmost spur of the Aravallis, the Delhi Ridge provides a natural treasure for millions of people in Delhi, and harbors a bountiful variety of flora and fauna.

5.1 FLORA

The Ridge of Delhi represents a tropical dry thorn forest characterized by the presence of scattered trees and thorny shrubs. The native plants exhibit xerophytic adaptations such as stunted growth, thorny appendages, wax coated, succulent and tomentose leaves. Where the soil profile is good, accompanied by an adequate soil moisture regime and sufficient humus content, broad-leaved tree species like Dhak (*Butea monosperma*), Kaniar (*Bauhinia purpurea*), Pilu (*Salvadora persica*), etc. also thrive well. The native Dhak or Palas, commonly known as the 'flame of the forest', acts as an indicator of the clayey nature of the soil (Foundation for Ecological Security 2008). It also plays a major role in changing the look of the Ridge from season to season. When in bloom it gives an elegant look to its surrounding – patches of the Ridge are covered with a red hue in the flowering season and actually appear to be aflame. On the other hand, in the monsoon months of July-September, the broad, deep-green leaves of the species display a lush green cover. The plant remains in foliage for a major part of the year, thereby indicating exuberant growth due to availability of soil moisture.

The vegetation presents two distinct, seasonal aspects on the Ridge:

a. In summer and winter, most of the trees and some of the shrubs bloom,while the ground layer is devoid of vegetation.
b. The vegetation cover during the rainy season is at its best. The first rains, absorbed by the dry soil, bring the return of green to the landscape. The soil gets covered with vivid green carpet of vegetation, which was dormant in the hot summer season, but is re-invigorated by the favorable rain. Flowering and fruiting sets in, and continues until the surface layer of soil dries up and winter sets in.

The vegetation of the Ridge can be generalized into native and exotic trees with beneficial and vividly colored herbs, shrubs and grasses. Amongst the most common native trees is the Babul (*Acacia nilotica*) with its delicately-leafed branches containing deadly long thorns. Three other species of this genus native to the Ridge are Phulahi (*Acacia modesta*), Katha (*Acacia catechu*) and *Acacia senegal*. Another native species is Ronjh (*Acacia leucophloea*), characteristic of the hilly tracts in and around Delhi. The leaves of this tree are eaten by goats, and its pale yellow flowers emanate a fragrance at dusk.

Pilu (*Salvadora persica*) has glossy oval leaves and greenish-yellow flowers. The leaves, when crushed, give out a sweet smell. Another commonly sighted native species is *Wrightia tinctoria*,which one normally recognizes by its large, shrub-like appearance, greenish-yellow leaves, white flowers and long, joint pods. Ber (*Ziziphus mauritiana*), indigenous to the Ridge, is a small thorny tree with greenish-yellow flowers. It bears yellowish-red fruits, a very popular edible item. Another native tree with commercially viable fruit is Hingot (*Balanites aegyptiaca*). A number of other colorful and useful trees are found on the Ridge, such as Amaltash (*Cassia fistula*), Siris (*Albizia lebbeck*), Coral tree (*Erythrina indica*), Pongam (*Derris indica*) etc.

One of the noteworthy examples of introduced tree species is *Prosopis juliflora* (Vilayati Babul) which is a native of Mexico and was introduced to the Ridge in the early 20th century. It is a small, evergreen, spiny tree, which has the capacity to survive in harsh environments, but is a colonizer by nature. Presently it appears to have established on barren, devegetated areas. Today large parts of the Ridge are covered by this species. Other exotics include Neem (*Azadirachta indica*), Kadam (*Neolamarckia cadamba*), Churel Papri (*Holoptelea*

integrifolia), etc. All these species are very common on the Ridge and have established as native flora.

Trees like *Diospyros cordifolia* (Bistendu), a drought resistant and frost resistant species, which forms single-storeyed thorn forests and Dhau (*Anogeissus pendula*), which is able to thrive on hot dry slopes and rocky soil, form an integral part of Ridge.

Some other tree species found in the Ridge area worth mentioning are *Morus alba, Acacia tortilis, Alstonia scholaris, Balanites roxburghii, Acacia auriculiformis, Erythrina variegata, Euphorbia neriifolia, Jacaranda mimosifolia, Maytenus senegalensis, Delonix regia, Fernando aadenophyllun, Capparis decidua, Ficus virens, Pongamia pinnata, Syzygium cumini*,etc.

Apart from the trees, shrubs also play a major role in shaping the forest ecosystem. The common shrubs are Bansa (*Adhatoda vasica*) and Heens (*Capparis sepiaria*). It bears white flowers, and berries which are sweet when ripe. *Grewia tenax*, a native shrub, is highly branched, with irregularly-shaped leaves, which are rough to touch, with edible fruits. Jangli karaunda (*Carissa spinarum*) is often seen on the Ridge, and is a bushy evergreen shrub, with white, scented flowers and dark purple berries. A very common and gregarious undershrub *Adhatoda zeylanica*, grows as a co-dominant species with *Capparis sepiaria*. It flowers from December to March and adds to the winter aspect of the Ridge. A thorny shrub *Dichrostachys cinerea* bursts into refreshing blooms of pink and yellow adding to the magic of monsoon. Among the shrubs, *Jatropha gossypifolia*, native of Brazil, and *Opuntia dillenii*, native of South America, have become naturalized on the Ridge.

Some other species of shrubs found in the Ridge forest are *Abrus precatorius, Asparagus racemosus, Datura netel, Ipomea carnea, Lantana camara, Oxystelama esculentum, Plumbago zeylanica, Solanum xanthocarpum, Tabernaemontana divaricata, Withania somnifera*, etc.

As the monsoon arrives, a large number of annuals sprout up, carpeting the Ridge forest floor. The whole ground is carpeted with a variety of herbs, with a vivid green color. These plants complete their life cycle in three to four months after the rains i.e., by January. The commonest and most

successful annuals are: Chiriyari (*Triumfetta rhomboidea*) with yellow flowers and round, spiny fruits, Missi (*Peristrophe bicalyculata*), which has pink flowers and capsular fruits narrowed into a stalk, *Portulaca grandiflora, Glinus lotoides, Boerhavia diffusa, Calotropis procera, Whitania somnifera, Achyranthes aspera, Aerva scandens, Tridax procumbens, Euphorbia hirta, Solanum suratens, Xanthium strumarium*, and others constitute the common herbaceous flora of the region. Besides, a number of annual and perennial twiners and climbers, including *Ipomoea pilosa, Rivea hyprocrateriformis, Coccinia cordifolia, Mukia maderaspatana and Telosma pallida* add to the monsoon aspect of the Ridge.

The soil supports a number of grass species like *Cynodon dactylon, Dicanthium annulatum, Eragrostis poaeoides, Saccharum spontaneum, Sporobolus diander, Setaria verticella, Paspalum distichum, Melanocenchrus ciliaris, Desmostachys bipinnata*,etc.

When studied with a critical mind frame, various micro habitats are found to thrive along the Ridge forest land of Delhi. This has led to diversity in the floristic composition of the Ridge. These attributes are mainly due to following reasons:

1. Proximity to river Yamuna

The Northern and Central Ridge are much closer to the Yamuna flood plains, giving them a somewhat thick soil structure with adequate humus content, whereas the Southern Ridge is comparatively less fertile with poor soil structure and high porosity. From north to south the texture of the soil varies from clayey to coarse sandy, affecting the vegetation accordingly. The Southern Ridge predominantly consists of a thinner soil layer with exposed quartzites, grits and schistose rocks. Thus, trees with greater water demand survive better on the Northern and Central Ridges,whereas drought resistant trees seem to survive better on the Southern Ridge.

2. Impact of urbanization

With the sprawling urban conglomeration in the vicinity, the ecology of the Northern and Central Ridges is bound to be different from the comparatively less disturbed patches of Southern Ridge. The Northern parts of the Ridge are more prone to human induced effects like pollution, malba dumping, dumping of household/kitchen wastes, feeding of monkeys, etc. Even plantations carried out around the Ridge vary. Plantation of ornamental

tree species is encouraged around the Northern Ridge, whereas plantation activities on the Southern Ridge are focused more on ecological aspects.

A gradual rise in elevation is also found from north to south, resulting in the rocky, undulating terrain of the Southern Ridge.

Due to the aforesaid reasons, trees with a greater soil moisture demand, thick soil profile and suited to plain areas have established themselves on the Northern Ridge, as evident in the presence of trees like *Ehretia laevis* (Desi Papdi), *Acacia leucophloea, Azadirachta indica, Diospyros montana, Ficus religiosa, Holoptelea integrifolia, Millettia peguensis, Murraya paniculata, Pongamia pinnata*,etc. Subabool (*Leucaena leucocephala*), a thornless tree species with high water demand, having tiny white or cream-colored flowers in clusters is also seen in abundance. Other species like *Crateva adansonii* subsp. *odora*, which prefers deep alluvial soil with undulating terrain, is strikingly beautiful in full bloom in late April. *Melia azedarach* (Bakain), a long limbed quick-growing but short lived tree with a dense, spreading crown, and *Bombax ceiba* (Semal) are abundantly found on the Northern Ridge.

Trees which require well-drained, deep, sandy soils and sufficient annual rainfall grow well on the Northern Ridge as well as on the Central Ridge. *Azadirachta indica* (Neem), *Acacia leucophloea* (Ronjh), *Diospyros montana*, *Ficus religiosa*, *Millettia peguensis*, *Murraya paniculata*,*Pongamia pinnata*,etc. are found on the Northern Ridge. A tree species comparatively exclusive to the Northern Ridge and not found on the South and Central Ridgesis *Schleichera oleosa* (Kosam) which prefers light, well-drained soils; its young leaves emerge a startling shade of red.

The southern part of the Central Ridge, however, forms a transition zone, harboring species being both drought-resistant and suited to the plains,e.g., *Dichrostachys cinerea*, which is a small multi-stemmed tree with striking pink and yellow flower and is exclusive to the Central Ridge. Other species include *Coccinia grandis, Opuntia elatior, Lactuca dissecta, Albizia lebbeck*,etc.

Thus, the Ridge harbors bountiful beauty in itself. Every season brings a new combination of colors, scents and foliage on the Ridge.

5.2 FAUNA

In the beginning of the 20th century, the Ridge forests of Delhi had reported sightings of Wolf, Hyena, Leopard, Blackbuck and Chinkara. By 1908, Blackbuck had become rare and Wolf, Leopard and Chinkara were not seen in the wild after 1940[1].

Rapid urbanization and pressure on land due to human population expansion has isolated the Ridge forests from the forested areas of the neighbouring States. Even the Delhi Ridge is not a contiguous stretch in itself, but exists as disjointed fragments. This has led to fragmentation of the wild animal populations along the Ridge.

Located in a human dominated matrix, the Northern, Central and Western Ridges are characterized by the presence of small mammals like Common Mongoose, Small Indian Mongoose, Palm Squirrel, Rufous Tailed Hare, Rhesus Monkey, etc. Occasional sightings of Small Indian Civet or that of a Jackal in these parts may also occur. Isolation from other parts of the Ridge prevents the free movement of these animals, thereby confining them to these microhabitats.

Historically these areas used to harbor agricultural fields due to its fertility rendered by the Yamuna belt. This has helped the peafowl establish itself as a major ground bird of the region. Though these areas harbor a few species of amphibians, birds and reptiles, they have not yet made a noteworthy impression on the citizens of Delhi.

The Southern Ridge portrays a better scenario as far as the faunal composition of the Ridge is concerned. Being comparatively isolated, it bears a greater sanctity in terms of the forest ecosystem. It also holds the capability to sustain mammals of greater body weight like the Nilgai. The Asola Bhatti Wildlife Sanctuary, being a major part of the Southern Ridge, has played a major role in bestowing adequate management and conservation practices over the entire Southern Ridge.

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1 *A Gazetteer of Delhi* (1912). Aryan Publishing House.

Adequate conservation and protection activities undertaken by the Forest Department have given a boost to the wildlife of the region, which is reflected by the sighting of five species of vultures, including red-headed vultures after 27 years in Delhi. A pack of Striped Hyenas is also spotted occasionally in the Bhatti area. The number of individuals of all other species has increased in the last decade.

Some other mammals found in the area include Jungle Cat, Palm civet, Flying Fox, Porcupine, Indian Pipistrelle, Fulvous Fruitbat, Bush Rat, Ship Rat, Grey Musk Shrew, Lesser Bandicoot Rat, Little Indian Mouse, etc.

The area also harbours a variety of reptiles like Common Skink, Monitor Lizard, Garden Lizard, Fan-throated Lizard, Yellow bellied House Gecko, Spectacled Cobra, Common Krait, Wolf Snake, Rat Snake, Common Sandboa, Saw-scaled Viper, etc.

Amphibians like the Common Toad, Bullfrog, Indian Skipper Frog, Marbled Toad, Micro hyalid, etc. are also reported on the Delhi Ridge. The area also harbors a large number of butterflies such as Common Banded Awl, Small Grass Yellow, Salmon Arab, Tailless Lime Blue, Plain Tiger, Blue Pansy, etc. and dragonflies like Common Clubtail, Pied Paddy Skimmer, Crimson Marsh Glider, Ground Skimmer, etc.

Records indicate that around 110 species of resident birds and 200 species of migratory birds can be seen on the Delhi Ridge. These include Little Grebe, Little Cormorant, Cattle Egret, Peregrine Falcon, Grey Fancolin, Brown-headed Barbet, Coppersmith Barbet, Alexandrine Parakeet, Spotted Owlet, Spotted Dove, Jungle Prinia, Red Whiskered Bulbul, Oriental Magpie Robin, Pied Bushchat, Orange-headed Thrush, among others.

The presence of wetlands, artificial water bodies and seasonal ponds on the Southern Ridge has resulted in its preferential selection by the migratory waterbirds over the Northern parts of the Ridge. Other than the regular migratory visitors arriving in Delhi, there have been some eye-catching sightings of migratory birds in Delhi. The Indian Pitta, mostly found in the Himalayan foothills and Western Ghats, has been spotted in Delhi in recent

times after 60 years. Other such rare sightings in the year 2013 include White-capped Buntings, Marbled Teal and Black Stork.

Some other noteworthy sightings of the year 2013 include that of Verditer Flycatcher, Greater Adjutant Stork, Brahminy Kite, Upland Buzzard, Imperial Eagle, Green Sandpiper, Red Shank, Scops Owl, Red-breasted Flycatcher, Orphean Warbler, Common Chiffchaff, Yellow-browed Warbler, Brook's Leaf Warbler, Greenish Warbler, Western Crowned Leaf Warbler, Bluethroat, Black Redstart, Blue-capped Rock Thrush, Dark-throated Thrush and Grey-necked Bunting.

Chapter-6

Technological Intervention for Protection of Delhi Ridge

"अयं बन्धुरयं नेति गणना लघुचेतसाम् | उदारचरितानां तु वसुधैव कुटुम्बकम् ||"

This one is a relative; other one is a stranger" for the mean minded. For those who are known as magnanimous, the entire world constitute as a family.

– V.3. 37 of Panchatantra in Hitopadesha

The above statement is not just about peace and harmony among the societies in the world, but also about a truth that somehow the whole world has to live together. A feeling of seeing the entire world with one's own eyes is possible through space-based technology known as Geospatial technology. With its unique ability for acquisition, integration and analysis of geographically referenced information, this technology is being recognized as an effective tool for planning, management and decision making locally and globally.

In the present-day scenario, Geospatial technology has evolved and generated new tools for managing spatial data. In particular, the evolution of Geographic Information Systems (GIS), the Global Positioning System (GPS), and Remote Sensing (RS) technologies has enabled the collection and analysis of field data in ways that were not possible before the advent of the computer. With Google Earth, observation of earth surface from aerospace media has been made available at the click of a button. It has gained significant importance due to the ever increasing demand for most authentic, timely and uniform information of the earth's surface features and simple processes involved. In this technology, large numbers of sensors are used to get information from broad satellite spectrum revolving around the earth and providing precise geographical information of a required point. With the broad application of remote sensing for natural resource management, the definition used by the Indian Institute of Remote Sensing, Dehradun seems to be more appropriate.

"Remote sensing is the science of acquiring information about the Earth's surface without actually being in contact with it. This is done by sensing and recording reflected or emitted energy and processing, analyzing, and applying that information".[1]

The Remote Sensing technology is used to gather information about objects or area on the earth's surface, by making use of the properties of electromagnetic radiation without coming in physical contact with the object or area under investigation. The basic components of an ideal remote sensing system are shown in Figure 10, and include the following components:

1. Emission of Electromagnetic radiation (EMR)
2. Transmission of energy from the source to the surface of the earth, as well as absorption and scattering.
3. Interaction of EMR with the earth's surface: reflection and emission
4. Transfer of energy from the surface to the remote sensor
5. Sensor data acquisition
6. Data transmission, processing and analysis

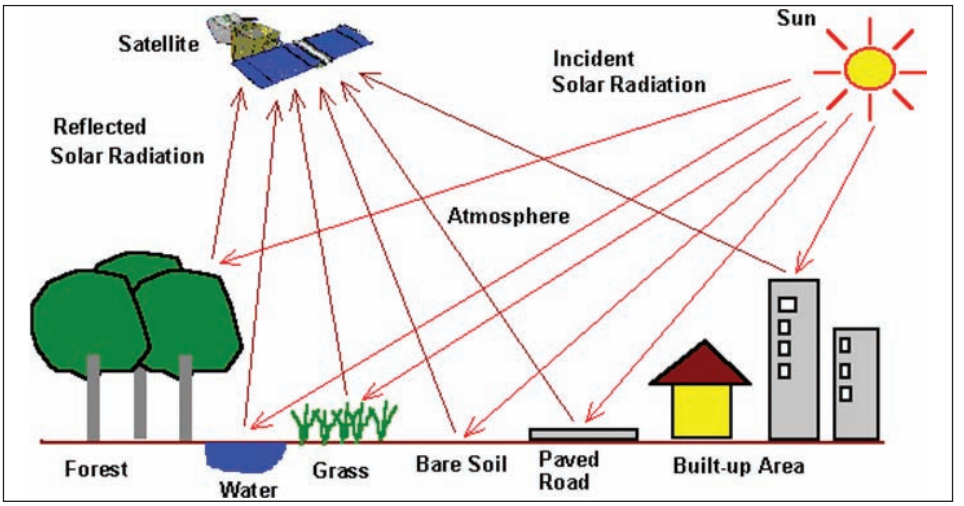

Figure 10: Stages in remote Sensing.

Source: Google Image

[1] Indian Institute of Remote Sensing (2012) *Applications of Remote Sensing and GIS in Forestry*, Ministry of Environment & Forests, Govt. of India, New Delhi, p. 1.

Nowadays a large number of earth observation satellites provide imagery that can be used to derive thematic information on various natural resources and environment. The type and level of information extracted depends on the expertise of the analyst and what he is 'looking for' in the data. For example, the remote sensing image of land can be used to derive information on vegetation cover, water bodies, land use pattern, geological features, etc. In developed Countries, it is used in all the sectors of society providing data of environment, education, housing, civic utilities, traffic, municipalities, policing and vigilance, security, nuclear securities, etc.

Satellite remote sensing has emerged as an effective option for spatial analysis of changes in the environment; its capability to provide real time data with synoptic and repetitive coverage is a significant advantage over traditional methods. Through ground surveys, the whole area can't be traversed in one instance and information collected may not be adequate and accurate. Remote Sensing is an effective tool to supplement or reduce tedious ground survey methods. It offers benefits in the field of land use/land cover mapping and change detection. The temporal images captured by satellite help in monitoring all back processes of a landscape in given time. Remote Sensing data coupled with GIS and GPS together provides the capabilities to acquire, analyze and interpret wildlife habitat information on various-time scales with cost effectiveness. Both visual and digital interpretation is used for interpretations in forestry and wildlife surveys. The broad areas in forestry for which remote sensing techniques can be used are shown systematically in Figure 11.

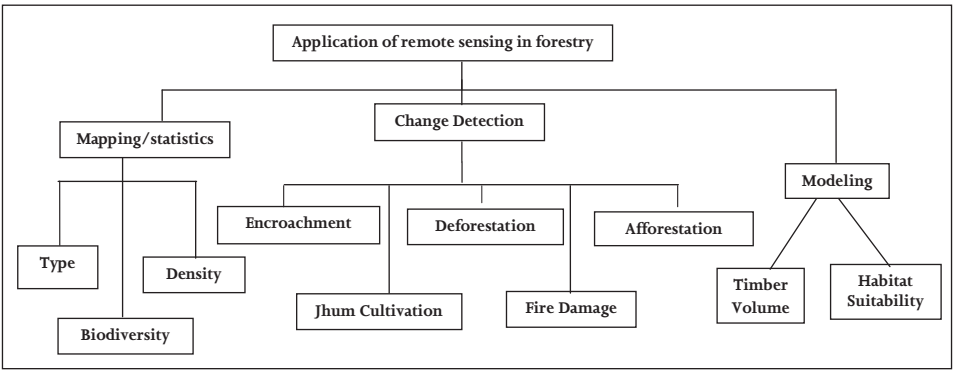

Figure 11: The indicative diagram represents the possible application of remote sensing in the forestry sector.

Source: Joseph (2009)

With the advent of space-based remote sensing, traditional aerial photographs are being replaced by satellite imagery. For example several satellites launched by India including earlier generation IRS 1A, IRS 1B, IRS 1C, IRS 1D IRS P2, IRS P3, IRS P4, IRS P6 and Cartosat series, and the latest Resourcesat 2, while other global satellites include LANDSAT, SPOT, ASTER, MODIS, IKONOS, QUICK BIRD for different applications.

6.1 GEOGRAPHIC INFORMATION SYSTEM

One of the common forms of representing remote sensing data in the form of information is thematic maps. Organizing the remote sensing data in the environment of Geographic Information System makes data integration and manipulation very convenient. *GIS can be thought of as a system of hardware and software wherein geographically referenced spatial data and non-spatial data (attributes) can be captured for manipulation, analysis and modeling to solve management of decision making tasks.*[2] Geographic Information System comprises of two types of data i.e. Spatial Data and Non-spatial data. Spatial Data describes the location: *where is it?* i.e., specifies location; generally in terms of latitude and longitude, while attribute data or non-spatial data specifies the characteristics at that location: *what (how much) is it?* i.e., characteristic at that location, natural and man-made.

GIS plays an important role in creation of geospatial information from vast sources such as analog and digital domains, and aids the decision maker at various junctures of resource identification, assessment and management. It acts as an important tool for viewing broad scale patterns of spatial data and organizing and integrating information about an area. It provides the users with the ability to store, manipulate and display information about a region. A few internet sites for viewing all forms of geographical information in the form of satellite pictures/maps in 2D/3D, have made Geographic Information Systems quite popular in the recent past: Bhuvan (http://bhuvan.nrsc.gov.in), Google Earth (http://earth.google.com), Microsoft's Virtual Earth (http://www.microsoft.com/virtualearth/) and NASA's Worldwind (http://Worldwind.arc.nasa.gov). Several tools used to carry out these tasks are part of GIS with the background of satellite images.

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[2] Joseph, G. (2009) *Fundamentals of Remote Sensing*. University Press, India, p.390.

By using GIS, people can find their location, assess the present situation, find the route to reach a destination, overlay a new surveyed routes and other information. The use of GIS is rapidly increasing, as city, regional and environmental planners, resource managers and the scientific communities become aware of the capabilities that these systems have to offer.

6.2 GIS SOFTWARE

All the above mentioned information can be accessed through the use of GIS software. There are many new and open/free software available in the market. Table below provides the list of some of commercial, open and free GIS software.

List of GIS software available commercially/ open source/freely to the user.

S. No.	Software
	Commercial Software
1.	*ArcGIS*
2.	*Geomedia*
3.	*MapInfo*
4.	*AutoCAD Map*
5.	*JTMaps (India)*
	Open Source
5.	*GRASS GIS*
6.	*Quantum GIS*
7.	*JUMP*
8.	*ILWIS*
9.	*POSTGIS*
10.	*Mapserver*
	Free Software
11.	*ArcView*
12.	*TNTMIPS*

Source: Indian Institute of Remote Sensing Faculty/Application of RS and GIS in Forestry

6.3 NEED FOR SURVEY

The method used for surveying and navigation purposes in earlier times was tedious for deriving positional and directional information. Diverse field conditions, seasonal variation and many unavoidable circumstances always bias the traditional field approach. With the advent of Industrial Revolution

(around 1800 BC), the importance of "exact boundaries" and the need for public improvements (i.e. railroad, canals, and roads) led surveying into a prominent position. Highly accurate equipment was developed. Surveying is now being used to prepare navigational maps (land, air and sea), to determine the boundaries of public and private lands, to create databases for natural resource management, bridge construction, roads, buildings and land developments, etc.

Due to rapid advancement in electronics, field surveying and navigation has benefited. Many of the critical situations in surveying/navigation are now easily and precisely solved in short periods of time with the advent of new instruments which being used for surveying the land i.e. GPS, Total Station, Laser Beam Range finder, etc. ***The NAVSTAR GPS (Navigation System with Time and Ranging Global Positioning System)*** is a satellite - and ground-based radio navigation system that enables the user to determine their three-dimensional position, course and time information on the surface of the Earth. GPS system measurements are taken by receiving signals from satellites. **Total Station Method (TSM)**has gained significant attention in modern surveying techniques because the data generated by this instrument is highly accurate. Using this electronic system, multiple surveys can be performed at one set-up location and daily survey information can be quickly downloaded using software.

A total station is an electro-optical instrument used in modern surveying. It is a combination of an electronic theodolite (transit), an electronic distance measuring device (EDM) and software running on an external computer.[3]

The primary function of Total Station Method is to measure distance, angle and height from the instrument to points to be surveyed. With the assistance of trigonometry, the angles and distances may be used to calculate the coordinates of actual positions (X, Y, and Z or northing, easting and elevation) of surveyed points, or the position of the instrument from known points, in absolute terms. The data may be downloaded from the theodolite to a computer and application software will generate a map of the surveyed

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[3] See generally, JNNURM Rapid Training Programme. *Survey and Investigation*. CEPT, Ahmedabad, p. 13.

area. It is used to carry out detailed survey (data collection), contour survey, height measurement, fixing of missing pillars, resection, area calculation, Remote Distance Measurement (RDM) or Missing Line Measurement (MLM).

The Department of Forests & Wildlife, Government of NCT of Delhi, used Total Station Method for identification and demarcation of notified forest lands in the Southern Ridge, by taking reference points in the process of geo-referencing. **Special Task Force (STF)** was engaged for carrying out demarcation of notified forest lands jointly with the revenue authorities for the purpose of delineation, demarcation and identification of forest boundaries of notified forests and handing over the land to the Forest Department.

6.4 SPECIAL TASK FORCE

A great effort has been made by the Department of Forests & Wildlife, GNCTD; by constituting a Special Task Force vide order no. F.8 (118)/PA/CF/RUC/Pt.IV/7709-7723 dated 28.02.2012. The Special Task Force was constituted for the purpose of identification & TSM Survey and demarcation of notified forest lands in the Southern Ridge which include Wildlife Sanctuary, Reserved Forest, Protected Forest, land allotted to the Forests Department by various authorities for the purpose of plantation and creation of Reserved Forests (1994 & 1996 notifications), Morphological Ridge, and the land under non-forestry use within the confines of the above categories of lands in South and South West Revenue Districts in NCT of Delhi, based on relevant official records, notifications and administrative orders, etc.

Duties and responsibilities of the STF were outlined in the above order dated 28th February 2012. The team of STF comprises one Kanoongo, two Patwaris, TSM survey team and a representative from Forest Department, Survey of India (DSSDI), for survey and demarcation of notified forests land in the Southern Ridge through TSM and delineation of its boundary on the map including validation of the information available with the Survey of India (DSSDI) in digitized form. The Conservator of Forest is the Nodal Officer for STF (Special Task Force), and the Deputy Commissioner along with DCF (South) and DCF (West) are Reviewing Officers. In Hauzrani City Forests, Saket, a hub has been created from where STF is operating. 60-70%

of the related revenue records required for survey and demarcation has been obtained by STF.

After basic examination of the records of Forest Department and Revenue Department by the STF, they planned to carry out survey and demarcation using Total Station Method in villages of South District and South West District as per the 1994 & 1996 notification of Reserve Forest. The villages are as follows: Nebsarai, Chattarpur, Dera Mandi, Rajokri, Ghitorni, Mahipalpur, Rangpuri, Pulpehladpur, Devli, Aayanagar, Jaunapur, Ladhosarai, Rajpurkhurd, Satbari, Asola, Bhatti, Siadulajab, Maidangarhi, Tughlaqabad, Sahurpur and FatehpurBeri.

6.4.1 Methodology adopted

i. In the first phase, a copy of Masavi of each village of South and South West District has been collected by STF from Revenue Department at Tis Hazari.

ii. Field book, Khasra/Khatauni, Jamabandi and other relevant records of the Revenue Department for each village of South and South West district has been collected by STF.

iii. Information relating to Forests Land as per the Notifications for Protected Forests, Reserve Forests and other relating orders and Notification from the revenue records for each village were segregated at one place by the revenue officials of STF.

iv. With the help of TSM survey team, the Masavi was digitized by revenue officials of the STF.

v. After digitization of the Masavis for all the concerned villages, Geo-referencing and Field verification was done by TSM team with the help of Revenue officials. For the same purpose the Kanoongo and Patwaris of STF visited the field along with TSM survey team and Forest officials. They identified the physical locations of reference points with their boundaries of khasras on the field. TSM team then picked up those reference points through differential DGPS and TSM instruments.

vi. The STF after picking up of reference point of all the 21 villages and their verification on the basis of field book of Revenue Department confirmed the location with permanent features by taking their GPS

readings, latitude and longitude, for fixing pillars on the ground with proper marking in future course of action.

vii. These identified points have been marked on the Revenue map showing their latitude, longitude and GPS reading through survey by Total Station Method. The TSM team prepared the map of the survey undertaken by them of the area and submitted the same duly verified by concerned authorities of the task force.

viii. The detailed report of the survey demarcation work of all the 21 villages has been completed by STF. The digitized map of all the villages of Southern Ridge with forest area is finalized and authenticated by District Revenue Officials and concerned DCF.

ix. The Department of I & FCD (Irrigation and Flood Control Department), Government of NCT of Delhi, which is also the part of the STF, was appointed for the purpose of all civil work in the Forest Department including fixing of boundary pillars, and construction of boundary walls around the notified forests area.

x. The process of ground-truthing and fixing of forest boundaries by DGPS and TSM method has been assigned to I & FCD, Government of NCT of Delhi, and is under process.

xi. In order to consolidate and protect the demarcated forests lands, proposed "Munara"/ boundary pillar (trapezoid structure as shown in Figure 12) at intervals of 50 meters is in the process of implementation with ground-truthing in consultation with I&FCD. On the dorsal surface of this boundary pillar, GPS coordinates will be embossed in red color. This process will strengthen the boundary demarcation of forest areas in particular villages and Reserved Forest as whole.

In summary, it is stated that the Forest Department has done substantial work through STF. Till date the Department of Forests & Wildlife, through its STF has digitized and geo-referenced 21 villages in Southern Ridge as per the 1994 & 1996 notification, with the application of GIS technology to consolidate the forest areas in Delhi. Out of 21 villages, maps of 14 villages in the Southern Ridge are uploaded on the website of the Department of Forests & Wildlife, GNCTD, which is now in public domain. (www.forest.delhigovt.nic.in).

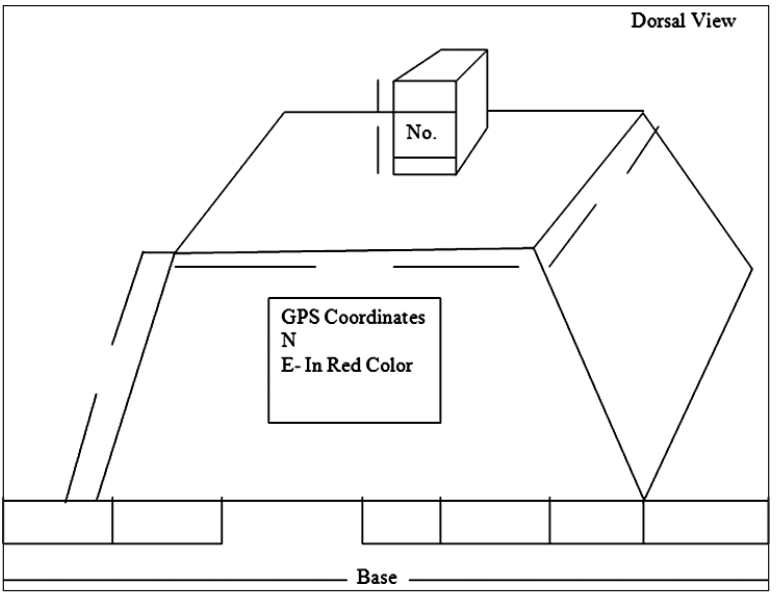

Figure 12: Munara/boundary pillar

List of maps in public domain

S. No.	Name of villages	S. No.	Name of villages
1.	Aayanagar	8.	Nebsarai
2.	Chhatarpur	9.	Ghitorni
3.	Deramandi	10.	Rajokri
4.	Devli	11.	Rangpuri
5.	Jaunapur	12.	Mahipalpur
6.	Satbari	13.	Rajpurkhurd
7.	Pulpehladpur	14.	Sahoorpur

After this exercise, the Department of Forests & Wildlife, GNCTD, will be able to delineate the boundary of Reserved Forests as per Notification No. F.10 (42)-I/PA/DCF/93/2012-17(1), dated 24th May 1994 and No. F1 (29)/PA/DC/95, dated 2nd April 1996. The data of forest land consolidation will subsequently be uploaded on the departmental website. It will be a very effective tool in terms of protection and monitoring of the Ridge in compliance to the order of NGT & the Hon'ble Supreme Court. The Supreme Court in its case M.C. Mehta Vs. Union of India & others, states that there are two natural features in the Delhi i.e. Delhi Ridge and River Yamuna. These should be protected in their pristine glory.

6.5 INTERFACE WITH GSDL

The Special Task Force has submitted their detailed report in regards to survey and demarcation of 21 villages of the Southern Ridge to the Department of Forests & Wildlife, GNCTD. In the first phase of this exercise, data of STF was sent to GSDL (Geospatial Delhi Limited) for validation purpose. A representative from the Forest Department (i.e. Kanoongo), went to GSDL and on the basis of STF report and 1996 notification, GSDL has completed validation process, and maps were generated for each village. After providing data for all the 21 villages to GSDL, the Forest Department requested GSDL to mosaic all the villages of the Southern Ridge, so that it will be of help to the department to take decisions for construction of "Munara"/boundary wall around the forests area.

The Forest Department has already taken the initiative to tap the facility by taking connection from GSDL to access their database, and efforts were made to operationalize the mini GIS lab. To understand the economic and technical feasibility for setting up this lab, the Forest Department has requested GSDL for their valuable guidance. Technical experts from GSDL have prepared hardware and software requirement along with financial quotation on each component for setting up of GIS lab.

6.6 ESTABLISHMENT OF GIS CELL

Establishment of GIS cell is under process to create a database of all the forest areas falling under the Ridge for regular monitoring. Updating data in a GIS is much more cost effective and less time consuming than having to manually redraw maps. This would give "up to date" information, which can be used by environmental planners during planning and policy formulation. The Department of Forests & Wildlife, GNCTD, is in the process of making online monitoring system for protection and management of Ridge Reserved Forest as per the notification of 24th May 1994 vide notification no. F10 (42)-I/PA/DCF/93/2012-17. Ridge Protection Management System may be the most ambitious technological application which is based on GIS applications to keep vigil and online monitoring of Ridge Reserved Forest, its protection, management and planning with high degree of accuracy.

6.7 RIDGE PROTECTION MANAGEMENT SYSTEM

This application combines Personal Digitized Application (PDA)/mobile with camera, date and GPS can be used at the location of forest offence in case of encroachment /offence under Indian Forest Act, 1927 or the DPTA, 1994. PDA facilitates the collection of continuous GPS data for charting out areas. On activating the charting service within PDA, the device begins to continuously gather and upload GPS data to the server. In the presence of data connectivity such as GPRS or 3G on the device, the GPS uploads data almost in real-time. The data collected from all the mobile devices PDA will be available to the Department of Forests & Wildlife, GNCTD through a data portal. The data portal enables the Department to view the data being uploaded in real time.

PDA records and provides the following information to the organization:

a) Time of data input
b) Location (Geo-tagging) of data input
c) User information
d) Type of data inputs
e) The time spent filling in the form

In the PDAs given to the field surveyor, the digitized map of the Ridge under respective Forest Division will be uploaded. The field surveyor, with the help of PDA, will capture the forest offences by camera. The data of offence will be recorded with PDA and transferred to the main server at GIS cell in the Headquarters through GPRS (General Packet Radio Service) connectivity. It is a packet-switching technology that enables data transfers through cellular networks. In this process, the photograph of encroachment along with its geo-coordinates, date and place will reach the main server at Headquarters, and also the concerned DCF office computer. The information received in the GIS cell at Headquarters, will be processed by Google Earth Pro software and will be further confirmed by Quick Bird satellite imagery in GSDL about fresh encroachment in the Ridge Reserved Forest.

Fire Information Resource Management System (FIRMS) was developed and maintained by University of Maryland. It provides fire location information

to resource managers. The Fire Alert Managing System (FAMS) developed by MPFD (Madhya Pradesh Forest Department) uses this information and identifies the concerned active fire locations which are within administrative units of Forest Department. Then it automatically sends SMS to concerned field staff and monitoring officers. The field officers can see these fire locations on Google maps on their computers. After adequate planning to take control measures, the field staff gives feedback online about the location and action taken and the area burnt and monetary loss if any. Almost all the states of India are following FAMS.

In a same way, **Forest Offence Alert Messaging System** technology will be incorporated in Department of Forests and Wildlife, Government of NCT of Delhi, which provides SMS and e-mail in case of any fresh encroachment detected in the Ridge in real time. Periodic report from field staff based on ground-truthing will be taken up through PDA in the form of digital signature which gives geo-coordinates of the already existing/detected encroachment, and any change noticed in the form of geo-coordinates will provide information of fresh encroachment. The applications in this system would be interphase and integrated by GSDL to meet the needs of Department for protection and management of the Ridge Reserved Forest. It has mainly three technological interventions.

1. GIS application interphase which includes uploading of geo-referenced maps of all Ridges in PDA. It also includes the current status of encroachment, which will be uploaded on the departmental web portal for public domain.
2. Location based tracking and monitoring by using GPS technology.
3. Mobile application interphase to capture data at source.

Most of these applications are in the primary stages of development. The Department of Forests and Wildlife, GNCTD, will adopt client server architecture to operate the above said web based applications which will be connected to Headquarters with remote users, i.e. Divisional Offices, for critical monitoring of various functions accessed anytime, anywhere on this multiple device. This technology will be useful to manage the Ridge Reserved Forest with the minimum scaling of the present man power and the skill set available in the Department.

6.8 CONCLUSION

GIS can be used in various applications by empowering field personnel with the responsibility of data acquisition, editing and verification. GIS has the capability of bringing field and office activities into a collaborative environment that can further improve productivity, reduce costs and minimize project completion time frames. The use of modern electronic instrument in forestry has tremendous potential advantages over traditional methods of data collection, including the speed at which measurements, particularly over long distances, can be taken. In addition, the accuracy and precision of measurements taken by digital instruments can be superior to those captured by manual tools. With digital data collection, databases can be created rapidly and can be transferred to a GIS for inspection, analysis, and mapping.[4] In a similar way, these GIS tools and techniques will help the Department of Forests & Wildlife, GNCTD, to take quick decisions on various matters related to forestry. It will also help the Department in assessment of the status of unauthorized colonies on forest land, identification of the level of encroachment on forest land, assessment of existing built up area on notified forest land, protection against encroachment of forest land, forest land consolidation as per the notifications and orders, maintenance of consolidated report and easy retrieval of data on maps.

[4] Wing, M. and Kellogg, L. (2004) *Digital Data Collection and Analysis Techniques for Forestry Applications*. Geospatial Information Research,University of Gavle, Sweden, p. 82.

Epilogue

The Aravalli mountain range of India is the site of the oldest geological formations in the world. The Aravalli range is a worn away stub of stretch of historical folded mountains. In ancient times they were extremely high but over a period of time, they have worn down almost completely by millions of years of weathering.

The Aravallis are rich in variety of minerals, including large amounts of quartzite. A few decades back, the Aravalli hills were densely forested and rich in wildlife. However, due to excessive felling of trees to meet the increasing demand for fuel, fodder and sporadic growth of industry to meet the construction needs and industrial demand for minerals, the ecosystem of the region has come under severe stress. The unprecedented deforestation has reportedly resulted into degradation/ decline in the forest cover. It has also affected monsoon rains alarmingly. The entire Aravalli range has become ecologically sensitive and critically fragile, at present.

An extension of the Aravalli hills enters Delhi from Gurgaon on the southern border and immediately spreads in a north-eastern direction nearly crossing the district. Around 16-17 km towards the south, the range divides into two halves, one of these branching halves turns sharply to the south-west and re-enters the borders of Gurgaon. The other fork continues its northerly course as a low narrow range of sandstones passing west of New Delhi city where it forms the historic 'Ridge' and finally terminates through the modified area on the right bank of Yamuna river at Wazirabad. The Ridge area in South Delhi includes Mehrauli, Tughlakabad, Fatehpur Beri, Dera Mandi and other neighbouring urbans, which is rocky and undulating. This low plateau, known as Kohi, consists mainly of bare, unconsolidated rocks. The area attains a height of 305-335 m above mean sea level, which is 90 m above the alluvial plains of the river Yamuna. Northwards, its height gradually falls to only 2.5 m above the plains.

The Delhi Ridge was once a continuous stretch but due to the increasing population, and demand of housing as well as other developmental projects, the Ridge got fragmented into patches. Presently, the Delhi Ridge is divided

into four parts, namely Northern Ridge (87 ha), Central Ridge (864 ha), South-Central Ridge (633 ha, including the Nanakpura area of 7 ha), and Southern Ridge (6200 ha).

The Delhi Ridge is an integral and one of the most important parts of NCT of Delhi. With the shifting of capital from Calcutta (now Kolkata) to Delhi, the British rulers decided to preserve this natural wealth by protecting it as per the Indian Forest Act, 1878. They declared parts of these Ridges as Reserved Forests in 1913 & 1915 and placed them under the charge of CPWD 'Notified Area Committee' (NAC) and declared them Reserved Forests again in the year 1942 as per Indian Forest Act, 1927. With the birth of the Forest wing in 1950, the Delhi Administration had taken up the planned work of managing the Ridges through norms of forestry. A great chunk of the Ridge area was cleared during 1947 for the resettlement of refugees; this caused severe damage to the natural flora and fauna, and consequent ecological disruption through erosion was caused due to indiscriminate, unscientific denudation of forests. The charge of Delhi Ridge was subsequently transferred to Delhi administration because the CPWD/NAC failed to maintain the Ridge in its natural status and keep encroachers at bay.

Later on, maybe due to a lack of proper management support, the Southern Ridge was handed over to CPWD for its maintenance and for its beautification as parks and gardens, in 1963. Further, the Hon'ble Lt. Governor, Delhi ordered the transfer of the Northern Ridge to DDA in the year 1968 for maintenance and beautification. However, with the efforts of the Development Commissioner, two nurseries, namely Birla Temple and Kamla Nehru Ridge remained with the Forest Department, Delhi Administration. This decision of transfer of Delhi Ridge to different departments with little or no knowledge of the forest management principles was taken, most probably, arbitrarily, without indulging in a proper thrashing out of the pros & cons, and unfortunately, without understanding the gravity of the status of Reserve Forests. Irreversible damages were incurred on the natural state of the Delhi Ridge because of the multiplicity of organisations controlling the Ridge. The consequences were dramatic in the form of encroachments, shrinkage of effective green area, illegal allowance of diversion of forest land for absolutely non-forestry purposes.

Indiscriminate violations further contracted the Ridge land due to allowing construction of schools and offices, making amusement parks with its consequent damaging activities, and in general, grossly mismanaging the areas so sensitive, even though the Delhi Urban Arts Commission had emphasised very strongly in its report in 1987-88, that the Ridge should be preserved at all costs. This utter disregard for the norms of scientific management of natural resources, and the perpetual need to protect it, by arbitrary destruction for short sighted urban needs has resulted in the drastically shrunk forest area of the Ridge. The gloomy picture presented by these sensitive green areas very clearly depicts the inefficiency of managing such areas by horticultural agencies with very little or no knowledge of the forest management practices and wisely enacted laws for their protection.

The very fact that the Government had decided to declare these areas as Reserved Forests implicates the understanding of its ecology and the contingent requirement for preservation of its natural beauty and extent through scientific and appropriate norms of forest management principles. The pressure on the use of the Ridge for developmental purposes is contradictory to conservancy principles of forestry; but it is so large and also increasing continuously that no agency of the Government can by itself ensure success in conservation. It is therefore essential to enlist the active cooperation of all sections of society in such a manner that the effects of the Government and citizens groups are mutually reinforcing.

The people's movement to save the Ridge appeared in the early 90s when it was decided by the Administration to transfer the management of the Ridge area held by different agencies to Delhi Development Authority. Various environmental groups like Srishti, Kalpvriksh, WWF-India as well as motivated school children were responsible for review of the decision and constitution of Lovraj Committee under the chairmanship of Mr. Lovraj Kumar. This committee was also of the view to protect the Ridge on conservancy principles as forests. The citizens of Delhi are ecologically conscious and express their concern from time to time on diversion of forest land for non-forest purposes and their long term ecological viability. Their interests are expressed through press clippings, media reports, etc. Fortunately, the list of such groups fighting for the protection of the Ridge is rapidly growing in NCT of Delhi.

The most important administrative work that would significantly contribute to the preservation of the Ridge would be to hand over control of the entire Ridge Reserved Forest area to the Forest Department, Government of NCT of Delhi. Today, the DDA, NDMC, CPWD, Sports Authority of India (SAI) and Ministry of Defence also control different parts of the Ridge to perform different functions on the Ridge. Different agencies, incharge of various parts of the Ridge, have, bit by bit, allocated large parts of the forest for some kind of non-forest activity. The multiplicity of organisations controlling the Ridge has led to a number of problems. Each organisation has its own plans and norms for the Ridge, and there is no final authority to take and approve decisions concerning regular management practices followed on the Ridge forest land in their possession. No plan for integrated development of the Ridge, with conservation as the focus, has ever evolved due to this confusing situation.

The Hon'ble Supreme Court of India, in its order dated 09.05.1996 in the matter of M.C. Mehta Vs. UOI & Ors. in WP (C) 4677/85, had directed that the Ridge should be maintained in its pristine glory and no further infringement of the Ridge is to be permitted. Following the directions of the Hon'ble Supreme Court, the Ridge Management Board (RMB) was constituted in the year 1995, for effective conservation and management of the Ridge. Therefore, now for undertaking any developmental activities in the Ridge area, clearance of the Ridge Management Board (RMB) is required. Its domain also extends to the morphological Ridge, which shows Ridge like features. However, it is not part of the notified forest land. In the last two years, RMB has given due attention to restoration of territorial sanctity of the Ridge forest land. The Forest Department, GNCTD has initiated due efforts for regeneration of indigenous vegetation supported with artificial plantation of indigenous saplings in the Ridge forest land.

The rocky area surrounding the Ridge Reserved Forests, which is geo-morphologically similar to the rocky outcrops of the Aravalli range, has been identified as 'morphological Ridge' by the State Government. Morphological Ridge is defined on the basis of the Geological Survey of India map (2011), which was developed for the second stage seismic microzonation of NCT of Delhi. Considering the importance of the morphological Ridge in protection of the Ridge Reserved Forests, its management is as important as that of

the notified Ridge forest land. Knowing which part of the morphological Ridge has vegetation cover, which part is barren and which part has urban structures will be really helpful in developing strategies for its management. Conservancy principles of forestry demands that areas having Ridge like vegetation cover falling under the morphological Ridge area, should also be preserved in its original state.

Delhi Ridge – declared via 1994 and 1996 notifications

Due to the continuously increasing population of the metro city of Delhi, it became more crucial to preserve the forests of Delhi than ever before. The Government of NCT of Delhi, vide notification dated 24th May 1994 had declared "*All forest lands and waste lands which is the property of the government or over which government has proprietary rights*" as Reserved Forests under section 4 of the Indian Forest Act (IFA) 1927. Later on, notification issued in 1996 directed that uncultivated surplus land of Gaon Sabha falling in the Ridge area may be excluded from vesting the Gaon Sabha under section 154 of Delhi Land Reforms Act, 1954 and made available for the purpose of creation of Ridge forests.

However, a few limitations of the 1994 & 1996 notifications came to notice afterwards. First of all, for the gazette notification during 1994, map and field book with area statement were not available to ascertain actual area of notified Reserved Forests under IFA, 1927. Secondly, the boundaries in the 1994 notification were not precise and surveyed; apart from the government and waste land, it had other areas also. Thirdly, the area of 7777 ha (approx.) in the original notification is exactly the same as the area of the Regional Park provided in DDA's Master Plan 2001. It seems that the area given under four Ridges was not actually surveyed or estimated. Lastly, doubling errors exist in a few khasras of the notification of 1996 due to notification of those khasras as Asola-Bhatti Wildlife Sanctuary in 1986 & 1991 under section 18 of the Wildlife (Protection) Act, 1972.

Since the exact area and boundary of the notified Ridge land was not clear in the notification, the Department of Forests and Wildlife, GNCTD undertook the task of demarcation of Ridge forest land by constituting the Special Task Force (STF). STF was constituted vide order dated 28th February 2012 for survey and demarcation of notified forest land in the Southern Ridge

through 'Total Station Method' (TSM) and delineation of its boundary on the map including validation of the information available with Survey of India (DSSDI) in digitized form. After the STF work, it appears that the boundaries of Regional Park and Notified Ridge are not coterminous.

Establishment of GIS cell

GSDL (Geospatial Delhi Limited), an undertaking of the Delhi Government, has been assisting the Forest Department in validation of the data collected by STF and other GIS related works. However, an independent GIS cell is an essentiality in the Department of Forests and Wildlife, GNCTD. GSDL is providing assistance in setting up a GIS lab to create an in-house database of all the forest areas falling under the Ridge for regular monitoring. It would provide more "up to date" information, will be more cost effective and less time consuming than current strategies followed. The efficient use of this lab will facilitate the quick decision making in important works like survey and demarcation of forests land, assessing the status of unauthorized colonies on forest land and also assessing the level of encroachment on forest land. The Department is also establishing an online monitoring system, called the 'Ridge Protection Management System', which is based on GIS applications to keep vigil through online monitoring of the Ridge Reserved Forests, its protection, management and planning with high degree of accuracy.

In order to consolidate and protect the demarcated forest lands, proposed "Munara"/boundary pillars (marked with GPS coordinates) at intervals of 50 m is in the process with ground-truthing in consultation with I&FCD. This process will restore/strengthen the boundary demarcation of forest areas in Reserved Forests.

The Asola Bhatti Wildlife Sanctuary

The active mining of quartzite, commonly known as 'Badarpur' had heavily seared and severely degraded the Southern Ridge. Considering the ecological, faunal, floral and geomorphological significance of this land, and with the aim of protecting it from further degradation, Asola and Bhatti areas were notified as Wildlife Sanctuary. In 1986, a total of 12860 Bigha and 12 biswa (2679.29 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 section 18 of the Wildlife (Protection)

Act, 1972. Later on, imposing a ban on the mining of Badarpur and in the larger interest to protect the ecology of the area, 2166.28 acres of village Bhatti was notified in 1991 to complete the process of establishing Asola Bhatti Wildlife Sanctuary (4845.57 acres), the only sanctuary in NCT of Delhi to preserve the flora and fauna in its natural ecosystem.

Extensive mining of Badarpur had left the Bhatti mines devoid of natural vegetation with heavily leached and eroded top soil and relegated moisture regime. Finally, the Forest Department, GNCTD undertook a project on eco-rehabilitation of about 2100 acres of Bhatti Mines area since 2004-05, about 1400 acres of Dera Mandi area since 2006 and about 1500 acres of Asola area since 2011 through 132 Infantry Battalion (TA) ECO Rajput (Eco- Task Force – ETF). The major aim of the project was to restore the ecological balance by harnessing, conserving and developing natural resources i.e. land, water and vegetative cover. Afforestation activities like block plantations are complemented with drainage line treatment and a combination of vegetative and engineering structures for improvement in water regime. ETF along with the Forest Department encourages growth of indigenous species to restore and conserve the ecology of the region and also undertakes plantation of fruit bearing trees to support the population of translocated monkeys.

The Delhi Ridge, in general, has fresh ground water at all explored depths. The adjacent areas receive continuous recharge from the Delhi Ridge, and have high lateral permeability on account of faults and the coarser nature of sediment (weathered quartzite). A number of micro watersheds originate from the Southern Ridge. The drainage on the east of the Ridge enters river Yamuna, whereas on the west, it enters natural depressions located in Najafgarh Tehsil of South-West district. The depth of ground water in NCT of Delhi varies greatly from 1.2 m (in the Yamuna flood plains) to more than 64 m (in the southern part of the Delhi Ridge) below ground level. The average depth of water level in the Bhatti mines area is 40-45 m.

Due to extensive mining, the water levels of Bhatti mines area have been seriously affected. Deep digging for minerals in the quartzite ridge has ruptured many aquifers in this region. While mining, the water is pumped out of these pits to dig as deep as possible (sometimes deeper down to the

water table). This may be the reason why some of these deep depressions retain water throughout the year. Beneath the rocks lies red Badarpur sand, which has a tendency to retain water. Removal of this layer of sand exposes the groundwater. Due to this, a fall of 10-20 m in the ground water level was observed in the Bhatti mines area of the Southern Ridge, from 1999 to 2009. However from the year 2010, a rise in water level of 2-4 m, even more than 4 m in some parts of the Bhatti mines has been observed.

The normal annual rainfall of NCT Delhi is 611.8 mm, and the Ridge recharges 60% of this from the rain falling on it. All rain fed aquifers surrounding the Ridge are an incredible resource for pure water and must be preserved by protecting their recharge zones. There are around 300 abandoned mine pits in Bhatti area, of which 4 pits are sizable. If proper steps are taken for rainwater harvesting in these abandoned mine pits, an amount of 2.3 MCM of rainfall will be recharged in the adjoining areas.

The abandoned Bhatti mines resemble a barren land with open pits but were seen to hold good potential as an aquifer due to the presence of loose and porous Schistose/quartzite rocks. The Forest Department has undertaken various soil and moisture conservation works under watershed management principles of ridge to valley approach to improve the groundwater regime of the area. Today, the Asola Bhatti Wildlife Sanctuary as a whole along with its surrounding areas act as a major groundwater recharge zone for the surroundings, which may have an impact up to North Delhi through aquifer linkages. Contour bunds, bench terracing, dry stone check dams, gabion structures in large channels carrying rainwater and other such structures are being constructed on a requirement basis to prevent soil erosion and conserve the soil moisture regime. Watershed structures along with catchment area plantations of indigenous species will restore the pristine glory of the Ridge land, once known for its wildlife habitat. The principles of watershed management in drought prone areas like Bhatti mines (rain-shadow area) must be framed with an approach to harvest each drop of rainwater to the fullest of its potential.

Apart from the Eco Task Force, the Bombay Natural History Society (BNHS) is also working in collaboration with the Forest Department to aid in better management of Asola Bhatti Wildlife Sanctuary. BNHS set up a Conservation

Education Centre (CEC) in Delhi in 2004 to create environmental awareness amongst the citizens of Delhi, particularly through Eco-clubs of school children, teachers, teacher trainers, etc. The project aimed at developing and delivering environment education programs to raise visitors' awareness about nature conservation. Currently, CEC is functioning in project mode, a joint venture of the Government of NCT of Delhi and BNHS, and serving as an important link between the Government and students/public for disseminating information/education on wildlife, environment and forestry ecosystem.

Enrichment of Ridge and its management on conservancy principles

A forest may be viewed as an assemblage of ecosystems dominated by trees and other woody vegetation. It is a dynamic complex web of plant, animal and micro-organism communities and their abiotic environment interacting with each other as a functional unit on its own. Humans, with their cultural, economic and environmental needs form an integral part of various forest ecosystems. Starting from the micro-organisms to the tallest of trees, from the minute termites to the large mammals, from the living component to the abiotic environment, all complement each other making the forest ecosystem a self-sufficient entity. The flow of energy and nutrients from one tier of the ecosystem to another and finally back to the source (autotrophs) through the detritivores, forms a complete energy and geo-chemical cycle.

Through evolution, floral and faunal species have inherited characteristic modifications to establish themselves in their respective forest types/ ecosystems. The characteristic traits of these species are habitat specific and act as an integral part for the survival of other species of that region. Thus, to ensure continued sustenance of a forest ecosystem, the growth of its indigenous species should always be encouraged. This will in turn help complete the energy and chemical cycle of the habitat, making it a self-sustaining and self-regenerating one.

Considering the sanctity of the Ridge ecosystem, the entire Ridge area should be managed by all the agencies with a common goal under a common management strategy. Most of the areas of the Ridge have to be maintained as 'sanctum sanctorum' and usage of Ridge land as parks and gardens should be discouraged. This will help encourage the growth of indigenous species

of the Aravalli ecosystem. Several activities, individually small, like malba dumping, but cumulatively adding to the damage, have plagued the Ridge. Developmental and construction activities in areas adjacent to the Delhi Ridge sometimes result in the problem of malba dumping in drainage lines in the Ridge areas.

Although different agencies are in possession of different Ridge land, these agencies may take a lesson from forest land and watershed management practices undertaken in the US. United States of America initiated upgradation of its infrastructure a long time ago, but also incorporated ecological and environmental principles in civic planning. Along with the creation of massive infrastructure, the United States also established and promoted forests and nature preserves catering to various ecological and human needs. Two specific instances may be highlighted displaying American wisdom in protecting natural resources on a long term basis for sustaining future needs of the cities on a sustainable basis.

Belt woods, in Prince George's County, Maryland, is a nature reserve (containing South Woods) which spreads along 43-acre (1,74,015 m^2) and constitutes one of the last stands of virgin hardwood forest on the Atlantic coastal plain. It is a mere 8 miles (13 km) east of Washington, D.C. In 1984, the state of Maryland, with partners, purchased this area and designated them as Belt Woods Natural Environment Area and these are under the protection of the Maryland Department of Natural Resources.

The Catskill/Delaware watershed system is one of the two watershed systems (second is Croton watershed) in New York which is responsible for providing 90% water supply and cover 1,600 square miles. The two New York City watersheds cover some 1,900 square miles in the Catskill Mountains and the Hudson River Valley. These two systems deliver approximately 1.4 billion gallons of water each day to nearly 9 million people.

Besides the Delhi Ridge, woodlots and other such green spaces may be developed on other areas of the city, by undertaking plantation activities. In 1878-79, the British undertook an ambitious afforestation program on Delhi Ridge. Afforestation began in 1913 on the Northern Ridge, and later commenced on the Central Ridge. Initially, the plantation was confined

to indigenous species like *Prosopis cineraria*, *Acacia noilotica*, *Salvadora oleoides* and *Salvadora persica* but most of the species could not survive Delhi's harsh and dry climate. Later, *Prosopis juliflora*, a Mexican mesquite tree now known in India as *vilayati* (foreign) *kikar*, with drought resistant characteristics, was introduced. The *vilayati kikar* thrived in Delhi, and gradually the Ridge was covered with this species. While this increased Delhi's green cover, it was not an entirely positive development. Apart from being an invasive species, its leaves do not decompose and discourage all of the undergrowth below it. However, the Forest Department is taking all measures to prevent the invasion of *P. juliflora* on the Delhi Ridge and encourage the growth of indigenous species.

With globalization and increase in human population, urbanization and developmental activities become inevitable. However, development in Delhi has always been aimed in consonance with ecology. Apart from the provisions of compensatory afforestation under Delhi CAMPA, the Delhi Preservation of Trees Act, 1996 also has the provision for plantation of 10 saplings in lieu of felling of 1 tree for developmental activities. With the highest population density in the country, availability and identification of land for compensatory afforestation and/or plantation activities becomes a major challenge. Often it poses a major threat to the sanction of developmental projects for public utility. To overcome this problem a mechanism of 'land bank' needs to be developed. Proper and updated records of available and uncultivated land should be maintained and made available. It should include:

- Uncultivated Gaon Sabha land.
- Vacant land adjoining industrial pockets: Plantation activities on these lands will also help in abating the industrial pollution.
- Pockets near high rises and residential complexes: Like some other cities, Delhi has also seen the establishment of some 'zero waste generating' residential complexes. Attempts may be taken to carry out plantation activities in pockets in close proximity to official/residential complexes, and the solid waste generated from them may be used as humus to improve the soil fertility of these plantation areas. They should be maintained as woodlots. This can turn out to be a revolutionary concept where even the refused waste can be used for environmental protection.

- Vacant patches/ barren land coming under the morphological Ridge land (if any).

The Forest Department will resort to undertake plantation activities on these lands in lieu of developmental projects for public utility. These areas will be maintained as woodlots. A mechanism of this sort will obviously be helpful in the developmental scenario of Delhi, and prevent our long search for vacant land. For an endeavour like this, the Forest Department and other land owning agencies must work in consonance with each other in a holistic manner to conserve the Ridge ecosystem and help it serve its ecological services to the fullest of its potential.

A.K. Shukla
CCF and CWLW

No. 8734h-R. & A. dated 6th December, 1913. Under Section 4 of Act VII of 1878 (the Indian Forest Act. 1878), the Chief Commissioner, Delhi, is pleased to declare that it is proposed to constitute the land described in the following schedule to be a reserved forest.

District	Tehsil	Name of Village	Approximate Area in Acres	Boundaries				Remarks
				North	South	East	West	
Delhi.	Delhi	Dasghara	1948 Acre	Delhi	Narhaula	Delhi	Shadipur	The plan may be inspected in the office of the Chief Commissioner, Delhi.
		Khanpur Shadipur		Chauki Mubarakbad Banskauli	Malcha, Shadipur Naraiana	Panskauli Malcha	Khanpur Raya Basai Darapur Todapur	
		Dasghara		Sadhora Khurd Sherpur Kalan	Dasghara	Arakpur Bagh Mochi	Naraiana	
		Band Shikar Khatun		Shadipur	Band Shikar Khatun	Jor Bagh	Band Shikar Khatun	
		Alipur Pilanji		Dasghara Malcha	Jawahirpur	Bibipur Raisina	Dasghara	
		Malcha		Naraiana Narhaula	Arakpur Khusak Mochi	Khanpur Pagh	Raisina	
		Narhaula		Khandrat Kalan Kangam Serai Alipur Pilanji Baburpur Bazidpur	Majahadpur	Indrapat	Malcha	

Under Section 4 of Act VII of 1878 (the Indian Forest Act), the Chief Commissioner is pleased to appoint Mr. Vincent Connolly, I.C.S, Additional District Magistrate, Delhi, to be a forest Settlement Officer to enquire into and determine the existence, nature and extent of any rights alleged to exist in favour of any person in provided in chapter Ii of Act VII of 1878 (The Indian Forest Act 1878).

ANNEXURE - 2

No.: 5911-R & A. dated 7th September, 1915.

With reference to notification No:6143 R & A. dated the 13st August 1914, the Chief Commissioner of Delhi is hereby pleased to declare, under the Provision of section 19 of the Indian Forest Act VII of 1878, that the area specified below shall be deemed to be a reserved forest from the 1st October 1915.

Specification of Land

Delhi.	District.
Delhi.	Tehsil
Patti Chandrawal Mahal Delhi.	Name of Village.
395	Approximate area in acres.

Boundaries	
Alipur Road.	North
Boulevard Road and boundaries of Patti Chandrawal and Jahan Numa.	South
Alipur Road, Rajpur Road, Chord Road, Fields Nos. 173 min, 174 min, East 175 min, 176 min, 177, 179, 153 min, 184 min, 185 min and 151 min of Chandrawal.	East
Circuit House Road from Khyber Pass to its junction with Roshanara Road fields Nos. 96 min, 127 min, 126 min, 125 min, 134-136, 145, 146, 148 min, 119, 118, 117 of Chandrawal & malkagang Road.	West

REMARKS

The plan may be inspected in the office of the Chief Commissioner, Delhi.

S.N.T. 12/8 I C.

No. 5913-R & A dated 7th September, 1915

Under the provisions of Section 2 of Act VII of 1873, the Indian Forest Act, the Chief Commissioner is pleased to appoint the Secretary, Notified Area Committee, Delhi, as Forest Officer for all purposes of the Act, for the Area specified in Notification No. 5911-R & A., dated the 7th September, 1915.

ANNEXURE- 3

OFFICE OF THE CHIEF COMMISSIONER, DELHI

NOTIFICATION

Dated Delhi the 16th September, 1942.

No.F.F. 14(122)/41-LSB-In exercise of the powers conferred by Section 4 of the Indian Forest Act 1927, the Chief Commissioner is pleased to declare the area specified in the annexed schedule to be a reserved forest.

This notification supersedes and replaces the Chief Commissioner notification **No. 5911-R & A dated the 7th September, 1915.**

SCHEDULE

Distt:	Tehsil	Village	Approximate area in acre.	Boundaries	Remarks
Delhi	Delhi	Patti Chaudrawal Mahel Delhi.	372.7	North: Alipur Rd. South: Bouleward Road & Boundaries Of Patti Chaudrawal & Jabau Nurua. East: Alipur Rd. Rajpur Road Chord Road Fields Nos. 173-77 Min, 179 Min 153 Min, 184-185 Min, and 151 Min of Chaudrawal West: Cercuit House Road from Khyber Pass to its junction with Roshanara Road. Fields Nos. 96 Min, 125-27 Min, 134-36 Min, 145-46 Min of Chaudrawal & Malkaganj Road. Sd/- A.V. Askaith, Chief Commissioner, Delhi	A plan may be inspired in the Chief Commissioner office, Delhi

ANNEXURE - 4

NOTIFICATION

Dated Delhi, the 10th April, 1944.

No.F.14(80)/44-L.S.G. : In exercise of the powers conferred by sub-section (2) of section 2 of the Indian Forest Act 1927, the Chief Commissioner is pleased to appoint the Secretary, Civil Station Notified Area committee, Delhi, to be a forest officer for all the purposes of the said Act, for the area specified in his notification No. F.14(122)/41-LSG, dated the 16th September, 1942.

This notification supersedes and replaces the Chief Commissioner's notification No. 5913-R&A dated the 7th September, 1915.

A.V. Askwith,
Chief Commissioner, Delhi

No.F.14(80)/44-L. S. G
Copy forwarded to the Deputy Commissioner, Delhi, for information.

By order,
Sd/- J.V. David
Registrar to the Chief
Commissioner, Delhi.

No.F.14(80)/44-L.S.G.
Copy with a copy of notification No.F.14(122)/41-L.S.G. dated the 18th September, 1942, forwarded for information to the Secretary, Civil Station Notified Area Committee, Delhi

Under section 24 of the General Clause Act 1897 the Secretary continues as Forest Officer until reappointed as such under the Indian Forest Act 1927.

By order
(SD) J.A. David,
Registrar to the Chief
Commissioner, Delhi.

NOTIFICATION

Dated Delhi, the 10th April, 1944.

No.F.24(80)/44-L.S.G.: In exercise of the powers conforred by subsection (2) of section 2 of the Indian Forest Act, 1927, the Chief Commissioner is pleased to appoint the Secretary of the Civil Station Notified Area Committee, Delhi, to be a Forest Officer to all the purposes of the said Act, for the area specified in his Notification No. F.24(122)/41-L.S.G., dated the 18th September, 1943.

This Notification supersedes and replaces the Chief Commissioner's Notification No. 5913-R&A, dated the 7th September, 1915.

Sd/- A.V. Ask with,
Chief Commissioner, Delhi.

Copy of an endorsement No. 5912 R&A, dated 7th September, 1915 by the Personal Assistant to the Chief Commissioner, Delhi.

Copy forwarded to the Deputy Commissioner, Delhi, for information, with reference to his letter No. 1668, dated the 15th June, 1915.

Attention is invited to the procedure for the completion of the final record and its deposit in the record room enjoined in Appendix II to the Punjab Land Administration Manual.

The area referred to is included in the Notified Area, Delhi and for practical purposes is in charge of the Secretary, Notified Area Committee, and the Chief Commissioner has accordingly decided to appoint him as forest Officer of the area. He is being address separately about Forest Officer's duties.

The Forest Settlement Officer should be directed to supply the Forest Officer with a map of the area in question.

No. 2447

Deputy Commissioner's Office, Delhi
Dated, Delhi the 10th Sept., 1915

Copy of the above forwarded to the Secretary, Notified Area Committee, Delhi, for information.

Sd/- Head Clerk
For Deputy Commissioner, Delhi.

ANNEXURE - 5

(To be published in Part I of the Delhi Gazette)
DELHI ADMINISTRATION: DELHI.

NOTIFICATION

Dated the 19th November, 1958

No. F.8(1)/58-Dev:-In exercise of the powers conferred by Sub-Section (2) of section 2 of the Indian Forest Act, 1927, the Chief Commissioner, Delhi is pleased to appoint the Soil Conservation Officer, Delhi to be a Forest Officer to carry out all the purposes of the said Act for the areas specified in his notification No. F.14(122)/41-LSG, dated the 16th September, 1942 and No. 873A-R&A dated the 24th November 1913 under the Indian Forest Act, 1878 (VII of 1878).

This notification shall be deemed to have come into force on the 12th July, 1957, from which date the Chief Commissioner's Notification No. F.14 (80) 44-LSG, dated the 10th April, 1944, shall be deemed to have been cancelled.

By order,

Sd/-(NAR NARAIN SINGH)
UNDER SECRETARY (DEVELOPMENT) DELHI ADMN: DELHI

NO. F.8(1)/58-Dev. Dated the November, 1958

Copy forwarded for information to:-

1. The Development Commissioner, Delhi with reference to his letter No. SPD. 111(4) /69/56, dated the 17th January, 1958
2. The Soil Conservation Officer, Delhi with reference to his letter No. SCO-58/1459 the 7th July, 1958
3. Recruitment and Services Deptt: Delhi Administration, Delhi (in duplicate) for publication in the Gazette.

Sd/-(NAR NARAIN SINGH)
UNDER SECRETARY (DEVELOPMENT) DELHI ADMN: DELHI.

ANNEXURE - 6

DELHI ADMINISTRATION, DELHI.
(DEVELOPMENT DEPARTMENT)

Dated the 15.03.1965

NOTIFICATION

N.F.1(1)/64-65/SCO- In exercise of the powers conferred by clause (2) of section 2 of the Indian Forest Act, 1927 and in partial modification of his notification No.F.8(1)/58-Dev. Dated 19.11.1958 the Chief Commissioner, Delhi, is pleased to appoint the Assistant Director Incharge of Southern Ridge, CPWD, Horticultural Directorate, New Delhi to be a forest officer to carry out all the purpose of the said Act for the area bounded as below :

OLD BOUNDARY

North.	Banskauli.
South.	Band Shikar Khatun, Alipur, Pilanji.
East.	Banskauli, Narbaula, Maloha, Alipur, Pilanji.
West.	Banskauli, Khanpur, Shadipur, Dasghara & Band Shikar-Khatun.

NEW BOUNDARY

North	**South**	**East**	**West**
Storm water Drain.	Marked with Fencing	Forest area President Estate	Purvi Marg Road. New Rajinder Nagar
Reservoir Road	Domestic Water Reservoir	Talkatora Garden	Wireless Station
D.A.V. School. Bal Bharti School etc.		Storm water drain	

By order,
SD/- (L.S. TITUS)
DEVELOPMENT COMMISSIONER, DELHI.

No. F.8(1)/58-Dev. Dated the 15th March, 1965

Copy forwarded to:-

1. The Project Officer (I.A.D.P), Delhi.
2. The Soil Conservation Officer, Delhi
3. The Appointment (A) Department, Delhi Administration, Delhi(in duplicate) for publication in the Gazette.
4. The Asstt. Development Commissioner (PL), Delhi.
5. Unit-IV, Dev. Deptt. Delhi.
6. Guard-file (Notifications).

(L.S. TITUS)
DEVELOPMENT COMMISSIONER, DELHI.

ANNEXURE - 7

NOTIFICATION

Delhi, the 10th April, 1980.

No.F. SCO 32(c) Noti – 80-81.- In exercise of the powers conferred by Section 29 the Indian Forest Act, 1927, read with the Government of India, Ministry of Home, notification No. 104 J and No. 146-J dated 24.8.50 and 6.12.50, the Lt. Governor of Delhi is pleased to declare as protected forest the areas specified in the schedule hereto annexed.

By order,
M.W.K. YUSUFZAI, Secretary

SCHEDULE
Protected Forest Area, 1980

S. No.	Name of work	Zone ownership	Distt.	Tehsil	Village	Area
1.	Distt. Park i/c Hauz Khas picnic hut, Lake, Rose Garden etc.	F.-4 DDA	Delhi	Mehrauli	Hauz Khas Humayonpur Jeya Sarai	400 Acres
2.	Jahan Panah City Forest	F.-9, 17 DDA	Delhi	Mehrauli	Tughlakabad, Khirki, Chirag Delhi, Madan Gir.	800 Acres
3.	Basant Nagar Moradabad Pahari area	F-12- DDA Land except Monument	Delhi	Mehrauli	Besant Ngr. Kasumpur Moradabad Pahari area	200 Acres
4.	Vasant Vihar Distt. Park	F-12 DDA L & DO except Monument	Delhi	Mehrauli	Mohd. Pur Munirka	20 Acres
5.	Dhaula Kuan Complex	F-6 Defence Land	Delhi	Mehrauli	Cantt. Area	200 Acres
6.	Southern Ridge Area	G-5. D-10 L & DO Land	Delhi	Mehrauli	Nazul Estate	2022 Acres
7.	Nehru University Afforestation	F-12 D.D.A. Land	Delhi	Mehrauli	Katwaria Sarai Ber Sarai Masood Pur	200 Acres
8.	V.R. Block Rajender Nagar	B-7 D.D.A. Land	Delhi	Delhi	Nazul Estate	205 Acres
9.	Bhuli Bhatyari area	B-3 DDA Land	Delhi	Delhi	Nazul Estate	40 Acres
10.	Distt. Park Gokul Puri	E-14, E-15, E-16, DDA Land	Delhi	Delhi	Gokul Puri and Mehrauli	7.5 Acres
11.	Distt Park Jhilmil Taharpur	F-6, DDA Land	Delhi	Delhi	Jhilmil, Taharpur,	20 Acres
12.	Zonal green area Kalyan Puri, Trilokpuri, Khicharipur, Ghaziabad etc. Rd. No. 56, Dilshad Garden	E-16 DDA Land	Delhi	Delhi	Kotla Patpar Ganj Khichripur Gazipuri Mandoli, Fazalpur,	373 Acres

13.	Northern Ridge Area	C-11 DDA Land	Delhi	Delhi	Civil Station	400 Acrea App
14.	Archara between Sadhora Kalan, Nemri, Gulabi Bagh & Darbar Khan Nursery and other areas.	H-3 DDA Land	Delhi	Delhi	Sadhora Kalan, Neemri, Sadhora Kkhurd	100 Acres
15.	Area between hill Road & Ludlo Castle Road.	C-11 L & D.O. Land	Delhi	Delhi	Civil Station	17 Acres
16.	Orchard in Wazirpur near Bharat Nagar & Neemri Colony,	H-3 DDA Land	Delhi	Delhi	Sadhora Kalan, Wazirpur	120 Acres
17.	Maya Puri green belt	G-8 DDA Land	Delhi	Mehrauli	Naraina Tehar	5 Acres
18.	Hastsal Afforestation	G-16 DDA Land	Delhi	Mehrauli	Poshangirpur Hastsal Pudhela	40 Acres appx.
19.	Area between Inder Puri, Naraina, J.J. Colony	G-5 DDA Land	Delhi	Mehrauli	Naraina	32 Acres
20.	Afforestation Maya Puri Green area Tagore	G-9	Delhi	Mehrauli	Talarpur	55.26 Acres
	Garden	DDA Land				
21.	Orchard Nangloi Sayed	G-17 DDA Land	Delhi	Mehrauli	Nangloi Sayed	257.56 Acres
22.	District Park, Rohtak Road, Cooperative Society	G-17 DDA Land	Delhi	Mehrauli	Jawala Heri	35 Acres
23.	Afforestation Maya Puri Green G-8	G-18 DDA Land	Delhi	Mehrauli	Tihar	65 Acres
24.	Afforestation Maya Puri Green area Najafgarh Drain	G-17 DDA Land except Village Khyala.	Delhi	Mahrauli	Basai Darapur Khiala Keshopuri Chowkhandi Buddela Nangloi Sayed Jawala Heri	54.58 Acres
25.	District Park in between Pitam Pura Co-operative Housing Society.	H-4 DDA Land	Delhi	Mehrauli	Sultan Pur Nazea Madipur Shakurpur, Peer Garhi	185 Acres.

ANNEXURE - 8

DELHI ADMINISTRATION : DELHI

No. F.3(116)/CWLW/84/897/ to 906

Dated : 9.10.1986

NOTIFICATION

In exercise of the powers conferred by section 18 of the Wildlife (Protection) Act, 1972, the Administrator Delhi, is pleased to declare the Wildlife Sanctuary in 7827 Bighas 17 Biswas of Gaon Sabha land of village Asola, 2845 Bighas 17 Biswas of Gaon Sabha land of village Sahurpur and 2186 Bighas 18 Biswas of Gaon Sabha Land of village Maidan Garhi considering that the said are is of adequate ecological, faunal, floral, geomorphological, natural or zoological significance, for the purpose of protecting, propagating or developing of Wildlife or its environment. For the purpose of situation and limits of the area of the village wise Khasra numbers are as under:

VILLAGE ASOLA
1667, 1668, 1673, 1728, 1738, 1744 TO 1746, 1750, 1752, 1754 to 1787.

VILLAGE SARURPUR
488, 490 TO 493, 510 to 515, 516/1, 516/2, 517 to 542,

VILLAGE MAIDAN GARHI
658, 659, 661, 663, 665 to 668, 670 to 672.

By order,
Sd/- S.S. HARIT
DEPUTY SECRETARY (DEVELOPMENT)
DELHI ADMINISTRATION, DELHI

ANNEXURE - 9

No.F2(19)/DCF/90-91/1302-91

Dated : 15.04.91

NOTIFICATION

(To be published in Gazette of Delhi)

In continuation of Notification No.3(116)/CWLW/84/89/906 dated 9.10.86. In exercise of the powers conferred by Section 18 of the Wildlife (Protection) Act, 1972. The Lt. Governor, (Administrator), Delhi is pleased to declare the areas in the schedule below as Wildlife Sanctuary in Bhatti Village. Total Areas 2166.28 acres; considering that the said area is of adequate ecological, geological, faunal, floral, geomorphological and natural significance for the purpose of propagating and or developing of Wildlife and / or its environment.

SCHEDULE

Village	(Khasra Nos.)	Area
Bhatti	708, 712, 713, 715 1895 to 1900, 1903 to 1938, 1940 to 1942	2166.28 Acres.

By Order
DY. SECRETARY (FORESTS)
DELHI ADMINISTRATION: DELHI

Copy to:
1. A.D.M(R), for physical demarcation.
2. Development commissioner, Delhi
3. CWLW, Delhi
4. Dy. Conservator of Forests, Delhi
5. Director, Wildlife, Preservation, GOI, Bikaner House.
6. Law & Jud. Deptt., Delhi Admn.
7. Director, A.R. Deptt., Delhi Admn.
8. Members, Delhi W.L. Adv. Board.
9. Director, Delhi Gazetteer with request to publish in Delhi Gazette.

DY. SECRETARY (FORESTS)
DELHI ADMINISTRATION: DELHI

ANNEXURE - 10

NOTIFICATION DECLARING RESERVED FORESTS

DEVELOPMENT DEPARTMENT

NOTIFICATION
Delhi, the 24th May, 1994

No.F.10(42)-1/PA/DCF/93/2012-17(1) – In pursuance of the provisions of Section -4 of the Indian Forest Act, 1927 (Act No. 16 of 1927) the Lt. Governor, of National Capital Territory of Delhi hereby declares the lands mentioned in Schedule 'A' below as reserved forest.

SCHEDULE 'A'

All forest lands and wastelands which is the property of the government, or over which government has proprietary rights in:

1. Northern Ridge in National Capital Territory of Delhi, surrounded on	North by Jubilee Hall, Government Petro Pump, Masjid Mall Road. South by Crossing of Old G.T. Road and Rani Jhansi marg, Old Subzi Mandi. East by Mall Road, Rajpur Road, Behind MCD Office West by Ice Factory, Malka Ganj, Dhobighat, And University Road **(Approximate area 87 ha.)**
II. Central Ridge in NCT of Delhi, Surrounded on	North by Link Road along Institutional area. South by Dhaula Kuan, Military Farm, Sardar Patel Marg East by Mandir Marg, Institutional area and Willingdon Crecent. West by Inderpuri Road and Naraina Industrial area **(Approximate area 864 ha.)**
III. South Central Ridge in NCT of Delhi, Surrounded on	North by Qutab Institutional area. South by Vasant Kunk, Kishan Ganj,

	East by Aurobindo Marg, Nazarika Bagh. West by Jawahar Lal University Road, Vasant Kunj, Mehrauli **(Approximate area 626 ha.)**
IV. Southern Ridge in NCT of Delhi Surrounded on	North by Power line from Mahipalpur to Sultan Gauri Tomb, Telephone Line from Sultan Pur Gauri Tomb to crossing o Main Power Line & Road, Western Boundary of Ghatorni, Western boundary of Aya Nagar, Southern Boundary of Jaunapur, Southern boundary of Fatehpur Beri, Eastern Boundary of Asola Village, Eastern Boundary of Shahpur, Eastern Boundary of Chandanhola, Eartern boundary of Satbari, Eastern Boundary of Maidan Garhi, Southern Boundary of Naib Sarai, South Eastern Boundary of Deoli and Adilabad ruins. South by State of Haryana. East by Surajkund Road and State of Haryana. West by State of Haryana, Eastern Boundary of Rajokari, Eastern Boundary of Malikpur, Kohi & Rangpuri. **(Approximate area 6200 ha.)**

No.F.10(42)-I/PA/DCF/93/2018-23 (ii).- In pursuance of the provision of clause (c) of sub-section (1) of section 4 of the Indian Forest Act, 1927 (Act No. 16 of 1927), the Lt. Governor of National Capital Territory of Delhi is pleased to appoint A.D.M. (revenue) to be the Forest Settlement Officer to enquire into and determine the existence, nature and extent of any rights alleged to exist in favour of any person in or over any land comprised within such limits, as notified vide Notification No. 10(42)-IPA/DCF/93(I) dated 24th May, 1994 or in or over any forest produce and to deal with the same as provided in Chapter II of the Indian Forest Act, 1927.

By order and in the name of the
Lt. Governor of National
Capital Territory of Delhi,
G.C. Joshi, Dy. Secy.

ANNEXURE - 11

NOTIFICATION DECLARING RESERVED FORESTS

REVENUE DEPARTMENT

NOTIFICATION

Delhi, the 2nd April, 1996

No.F.1(29)/PA/DC/95.-Whereas the Supreme Court of India in I.A. No. 18 and 22 in Writ Petition (Civil) No. 4677/85 M.C. Mehta V/s Union of India & Others in their orders dated 25-1-96 and 13-3-96 have directed that uncultivated surplus land of Gaon Sabha falling in "Ridge" may be excluded from vesting in Gaon Sabha u/s 154 of the Delhi Land Reforms Act, 1954 and made available for the purpose of creation of Reserved Forest.

Now, therefore, in exercise of powers conferred u/s 154 of the Delhi Land Reforms Act, 1954 (8 of 1954), the Lt. Governor of National Capital Territory of Delhi, hereby declares the uncultivated land of Gaon Sabha specified in Column 'III' and Annexure 'A' to 'N', situated in Southern Ridge in respect of Villages mentioned in Column 'II' of table given below as surplus land and lands at the disposal of Forest Department of Government of National Capital Territory of Delhi.

S. No.	Name of Village	Quantum of Gaon Sabha land Covered in ridge as declared under notified Ridge and proposed by Forest Deptt. for afforestation.
I	**II**	**III (Bigha-Biswa)**
1.	Nebsarai	466-10
2.	Chatterpur	225-10
3.	Maidangarhi	4263-02
4.	Dera Mandi	9412-05
5.	Asola	8387-06
6.	Pulpehlad	99-04
7.	Devli	5175-06
8.	Rangpuri	1365-05
9.	Ayanagar	4121-02
10.	Rajokri	3106-01
11.	Bhatti	11101-19

12.	Ghitorni	732-14
13.	Saidulazab	65-19
14.	Jonapur	1979-13
	Total in Bighas	**50,480-16**
	Or	
	Total in Acres	**10517.10**

By order and in the name of
The Lt. Governor of the
National Capital Territory of Delhi.

G.S. PATNAIK, Secy.

ANNEXURE - 12

DEPARTMENT OF ENVIRONMENT, FORESTS AND WILDLIFE

NOTIFICATION

Delhi, the 10th May, 2006

No.F.10(42)-1/PA/DCF/93/II/181-198. – In supersession of all the previous notifications on the subject (except in respect of things done or omitted to be done before such supersession) and in exercise of the powers conferred by clause (c) of sub-section (1) and sub-section (3) of Section 4 of the Indian Forest Act, 1927 (16 of 1927) read with State Ministry's notification No. 104-J dated 24th August, 1950 as amended by their notification No. 146-J dated the 6th December, 1950, the Lt. Governor of the National Capital Territory of Delhi is pleases to appoint Additional District Magistrate (HQ), Additional District Magistrate (South District) and Additional District Magistrate (South-West District) to be the Forest Settlement Officer to enquire into and determine the existence, nature and extent of any right alleged to exist in favour of any person in or over any land comprised within such limits, as notified vide notification No. F.10(42)-1/PA/DCF/93/2012-17 dated the 24th May, 1994 and notification No. F.11(40)/PA/DCF/96(I) dated the 19th March, 1996, or in or over any forest produce and to deal with the same as provided in Chapter-II of the said Act.

By Order and in the Name of the
Lt. Governor of the National Capital
Territory of Delhi,

NAINI JAYASEELAN, Secy.

ANNEXURE - 13

List of Indigenous Species:

1. Shisham (*Dalbergia sissoo*)
2. Bakayan (*Melia azaderach*)
3. Neem (*Azadirachta indica*)
4. Kikar (*Acacia nilotica*)
5. Kachnar (*Bauhinia variegata*)
6. Imli (*Tamarindus indica*)
7. Pilkhan (*Ficus infectoria*)
8. Gular (*Ficus glomerata*)
9. Pahadi Papri (*Holoptelia integrefolia*)
10. Amaltas (*Cassia fistula*)
11. Balam Kheera (*Kigelia pinnata*)
12. Peepal (*Ficus religiosa*)
13. Kadam (*Anthocephalus chinensis*)
14. Semal (*Bombax ceiba*)
15. *Lagestromia speciosa*
16. Bael Patra (*Aegle marmelos*)
17. Mulbery (*Morus alba*)
18. Ber (*Zizyphus jujube*)
19. Khairi (*Acacia senegal*)
20. Dhuak (*Annogeissus pendula*)
21. Sharifa (*Annona squomosa*)
22. Jamun (*Syzygium cumini*)
23. Guava (*Psidium guajava*)
24. Maulsari (*Mimosops elengi*)
25. Harsringar (*Nyctanthes arbor-tristis*)
26. Bahera (*Terminalia bellerica*)
27. Lesu (*Cordia dichotoma*)
28. Mango (*Mangifera indica*)
29. Siris (*Albizia lebbeck*) & *A. procera*
30. Bargad (*Ficus benghalensis*)
31. Dhak (*Butea monosperma*)
32. Ronj (*Acacia leucophloea*)
33. Amla (*Embilica officinalis*)
34. Khezari (*Prosopis cineraria*)
35. Katahai (*Artocarpus integrifolia*)
36. Rohida (*Tecomela undulate*)
37. Gundani (*Cordia gharaf*)
38. Karonda (*Carissa karonda*)
39. Pasendu (*Diospyros montana*)
40. Mahua (*Meduca indica*)
41. Phalsa (*Grewia asiatica*)
42. *Hardwickia binnata*
43. Khair (*Acacia catechu*)
44. Arjun (*Termnalia arjuna*)
45. Harad (*Terminalia chebula*)
46. Khirni (*Manilkara hexandra*)

ANNEXURE - 14

Targets and achievements of plantation under Greening Delhi Action Plan 2012-13

Sl. No.	Greening agency	Target for 2012-13	Achievement upto January, 2013
1	BSES	2000	Nil
2	C.P.W.D.	25000	27556
3	DDA	150000	139282
4	Delhi Cantonment Board	10600	Nil
5	Delhi Jal Board	15000	7750
6	Delhi Metro Rail Corporation	5000	4697
7	Dev .Deptt.&IFCD/DPGS	100000	10270
8	DSIIDC	50000	Nil
9	DTC	500	275
10	Education Department	20000	25000
11	Health Department	4000	976
12	IPGCL	500	Nil
13	MCD	150000	133554
14	N.D.M.C.	5100	5849
15	NDPL	5000	Nil
18	Northern Railways	20000	Nil
19	P.W.D. (Hort.)	8000	Nil
	Sub-total	**570700**	**355209**
20	Forest Department	250000	412180
	Total	**820700**	**767389**
	Free Distribution of seedlings	600000	783745
	Grand Total	**1420700**	**1551134**

ANNEXURE - 15

Targets and achievements of plantation under Greening Delhi Action Plan 2013-14

GREENING DELHI ACTION PLAN 2013-14 FOR THE MONTH OF FEBRUARY, 2014					
Sl. No.	**Greening Agency**	**Target for Plantation in 2013-14**	**Total achievement upto January, 2014**	**Total achievement during February, 2014**	**Total achievement upto February, 2014**
1	Airport Authority of India	1000	Nil	Nil	Nil
2	BSES	2000	Nil	Nil	Nil
3	C.P.W.D.	25000	7668	12314	19982
4	DDA	150000	115980	Nil	115980
5	Delhi Cantonment Board	10600	Nil	Nil	Nil
6	Delhi Jal Board	15000	7300	Nil	7300
7	Delhi Metro Rail Corporation	2500	1893	Nil	1893
8	Dev. Deptt. & IFCD/ DPGS	100000	10176	Nil	10176
9	DSIIDC	50000	12900	Nil	12900
10	DTC	500	Nil	Nil	Nil
11	Education Department	20000	19000	6000	25000
12	Health Department	4000	2726	240	2966
13	IPGCL	500	Nil	Nil	Nil
14	MCD	150000	147369	Nil	147369
15	N.D.M.C.	2719	3257	Nil	3257
16	NDPL	5000	Nil	Nil	Nil
17	Northern Railways	20000	26000	Nil	26000
18	P.W.D. (Hort.)	800	5843	Nil	5843
	Sub-total	559619	360112	18554	378666
19	Forest Department*	250000	117822	5200	123022
	Total	809619	477934	23754	501688
	Free Distribution of seedlings	600000	427309	13274	440583
	Grand Total	1409619	905243	37028	942271

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KEY CONTACTS

S. No.	Name	Designation	Contact no.	E-mail address
1.	Sanjiv Kumar, IAS	Secretary (E & F)	23392108	senv@nic.in
2.	G.N. Sinha, IFS	APCCF & Head, Forests and Wildlife Department	23378513	apccfgnctd@gmail.com
3.	A.K. Shukla, IFS	CCF & CWLW	23379629	ak.shukla@nic.in
4.	Dr. Suneesh Buxy	CF	23370506	cfgnctd@gmail.com
5.	Tarun Johri, IFS	DCF (Headquarters)	23361879	dcfhqgnctd@gmail.com
6.	Nisheeth Saxena, IFS	DCF (South)	9968312090	dcfsouthdelhi@gmail.com
7.	Rajgopal Prashant, IFS	DCF (West)	9868948319	dcfwestgnctd@gmail.com
8.	Dr. R. Gopinath	DCF (P & M)	7838598570	dcfpmgnctd@gmail.com

About the Authors

Varsha graduated in Life Sciences from Sri Venkateswara College, Delhi University. Having developed an interest in Conservation Biology, she pursued her Master's in Biodiversity and Conservation from Guru Gobind Singh Indraprastha University, New Delhi. At present, she is working as Project Associate (Ridge) under RMB in the Department of Forests and Wildlife, GNCTD. Of late, she has developed keen interest in the history of British India's forestry and environmentalism. She intends to continue her education in the field of Conservation. She reads novels and spends time in nature photography for recreation.

Srishti Solanki has done her Master's in Biodiversity and Conservation from Guru Gobind Singh Indraprastha University. She is currently working as Project Associate (Land Management) under RMB in the Department of Forests and Wildlife, GNCTD. Not having much prior exposure to the wild makes her all the more interested in studying nature and its components. She is concerned about the effects of habitat fragmentation on biodiversity and would like to find ways to address this problem. Besides this, she also likes to spend time bird-watching, visiting and exploring new & interesting places. She recently published a book titled 'Wings of Dwarka'.

Nitisha Singh graduated with Honors in Biotechnology from the Amity University, and obtained a Master's degree in Environment Management from Guru Gobind Singh Indraprastha University, New Delhi. Presently she is working as Project Associate (Forestry) under RMB in the Department of Forests and Wildlife, GNCTD. Further during the time working in the Department of Forests and Wildlife, she was introduced to the subject of forestry in British and post-British era and management techniques accompanying various forest laws. This again has become a subject of interest for her, in addition to climate change and EIA. She intends to further her career in this field. Additionally, apart from being a numismatist, she enjoys reading books giving historical background of India.

Arnab Basu graduated with Honors in Zoology from the Calcutta University and obtained his Master's degree in Forestry from the Forest Research Institute, Dehradun. Presently he is working as Project Associate (Wildlife) under RMB in the Department of Forests and Wildlife, GNCTD. He has research interests in Conservation Biology and conflict modeling. He intends to pursue further education in these fields. Experimental dramatics, photography and composing running verses are his favorite pastimes. He enjoys spending time inside forests and intends to spend a major part of his life camping and trekking.

Bhavna Sharma completed her M.Sc. in Biodiversity and Conservation from Guru Gobind Singh Indraprastha University in the year 2013. Presently, she is working as Project Associate (Ridge) under RMB in the Department of Forests and Wildlife, GNCTD. She has a keen interest in learning Geospatial technology and wants to pursue her studies in the same field. For her Master's project, she worked on wildlife corridors in Central and North-East India using Geospatial techniques. Besides this, she likes to spend time in nature photography.