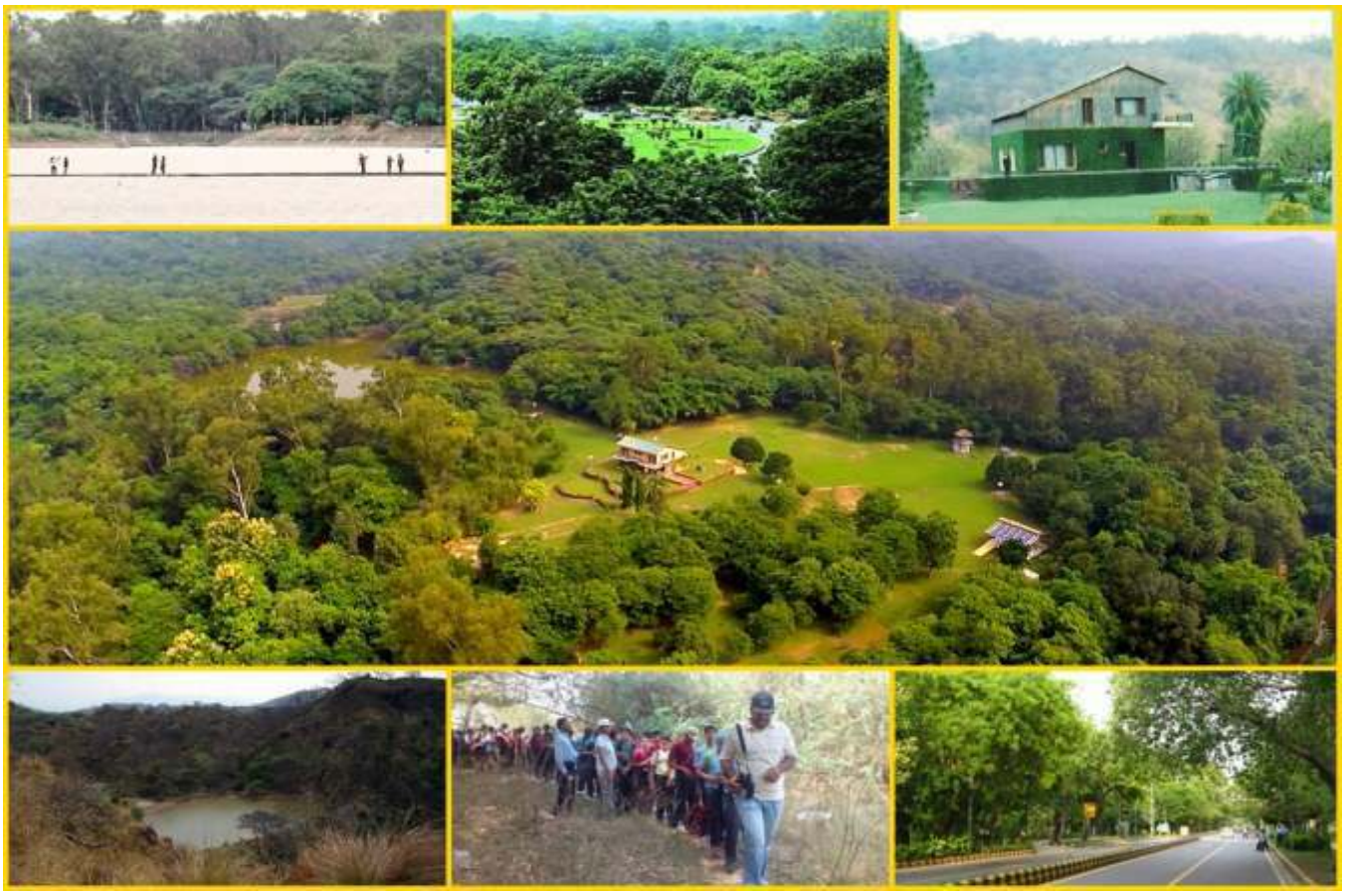


Forests & Tree Cover

Trees and Forests are mankind's lifeline and are given great importance in our culture, tradition, mythology and legends. From the oxygen that we breathe in, the food we eat, to the clothes we wear; we owe it all to the trees and forests. Forests perform variety of functions like land conservation, securing water resources, control of climate change. Forests act as the natural lungs of the earth and work continuously for the purification of air and control of temperature of troposphere. Due to increased biotic pressure, these versatile, renewable resources are under tremendous pressure all around the globe.

As per Indian State Forest Report 2015, the Forest Cover of the country is 701,673 Sq. Km, which constitutes about 21.34 % of the total geographical area of the country. Whereas, the tree cover of the country is estimated to be 92,572 Sq km, which is merely 2.82 % of the geographical area.

However, as far as the scenario of Chandigarh (ISFR 2015) is concerned the city beautiful has shown a remarkable increase in the forest and tree cover of the city. The green cover of the city has been increased from 53 Sq. km to 58.04 Sq. Km. in last two years due to sustained and sincere efforts of all the greening agencies and other stakeholders comprising a total of 40.73% of the total geographic area.

Statistical Details of Forests and Tree Cover of U.T., Chandigarh

Forest Cover

The term 'Forest Area' (or recorded forest area) generally refers to all the geographic areas recorded as forest in government records. Recorded forest areas largely comprises Reserved Forests (RF) and Protected Forests (PF), which have been constituted under the provisions of Indian Forest Act, 1927.
The term 'Forest Cover' as used in the 'SFR' refers to all lands more than one hectare in area, having a tree canopy density of

Tree Cover

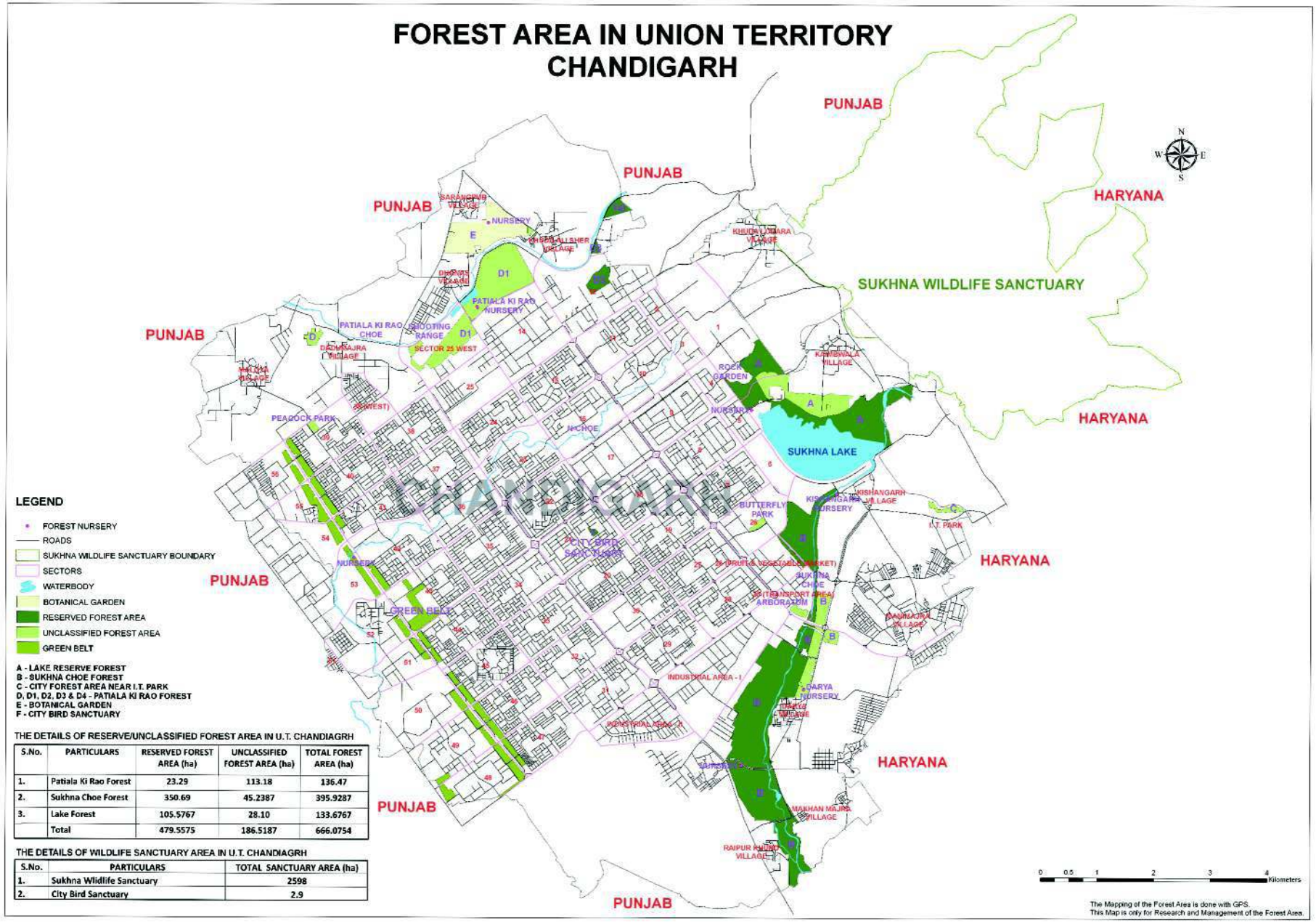
Tree Cover is defined as tree patches outside recorded forest areas exclusive of forest cover and less than the minimum map-able area of one hectare. The term refers to all plantation that is present between the residential houses, roadsides, parks, gardens and orchards.
India's National Forest Policy aims a maintaining 33 percent of country's geographical area under forest and tree cover.

SFR Report of FSI (km^2)	Forests Cover as per SFR Report (km^2)	Tree Cover as per SFR Report (km^2)	Green Cover as per Chandigarh Administration (km^2)	Green Cover % of total Geographical area (140 km) as per Chandigarh Administration
1997	07	-	7+26* = 33	23.5
1999	07	-	7+26* = 33	23.5
2001	13	02	13+2+26* = 41	26
2003	15	08	15+8+26* = 49	35
2005	15	09	15+9+26* = 50	35.7
2009	17	11	17+11+26* = 54	38.8
2011	16.78	10	16.78+10+26* = 52.78	37.7
2013	17.26	10	17.26+10+26* = 53.26	38.04
2015	22.03	09	22.03+09+26 = 57.03	40.73

* The 26 Sq. Km is of Sukhna WL Sanctuary,the area vests with the Union Territory of Chandigarh as per Section 48(5) Read with Schedule XIII of Punjab (Reorganization)Act. 1966. The area is still appearing in Punjab & Haryana as per map of FSI and need to be corrected, for which process is on.

Source: India State of Forest Reports (ISFR) 1997.1999,2001,2003,2005,2009,2011,2013,2015

FOREST AREA IN UNION TERRITORY CHANDIGARH



LEGEND

- FOREST NURSERY
- ROADS
- SUKHNA WILDLIFE SANCTUARY BOUNDARY
- SECTORS
- WATERBODY
- BOTANICAL GARDEN
- RESERVED FOREST AREA
- UNCLASSIFIED FOREST AREA
- GREEN BELT

A - LAKE RESERVE FOREST
B - SUKHNA CHOE FOREST
C - CITY FOREST AREA NEAR I.T. PARK
D, D1, D2, D3 & D4 - PATIALA KI RAO FOREST
E - BOTANICAL GARDEN
F - CITY BIRD SANCTUARY

THE DETAILS OF RESERVE/UNCLASSIFIED FOREST AREA IN U.T. CHANDIAGRH

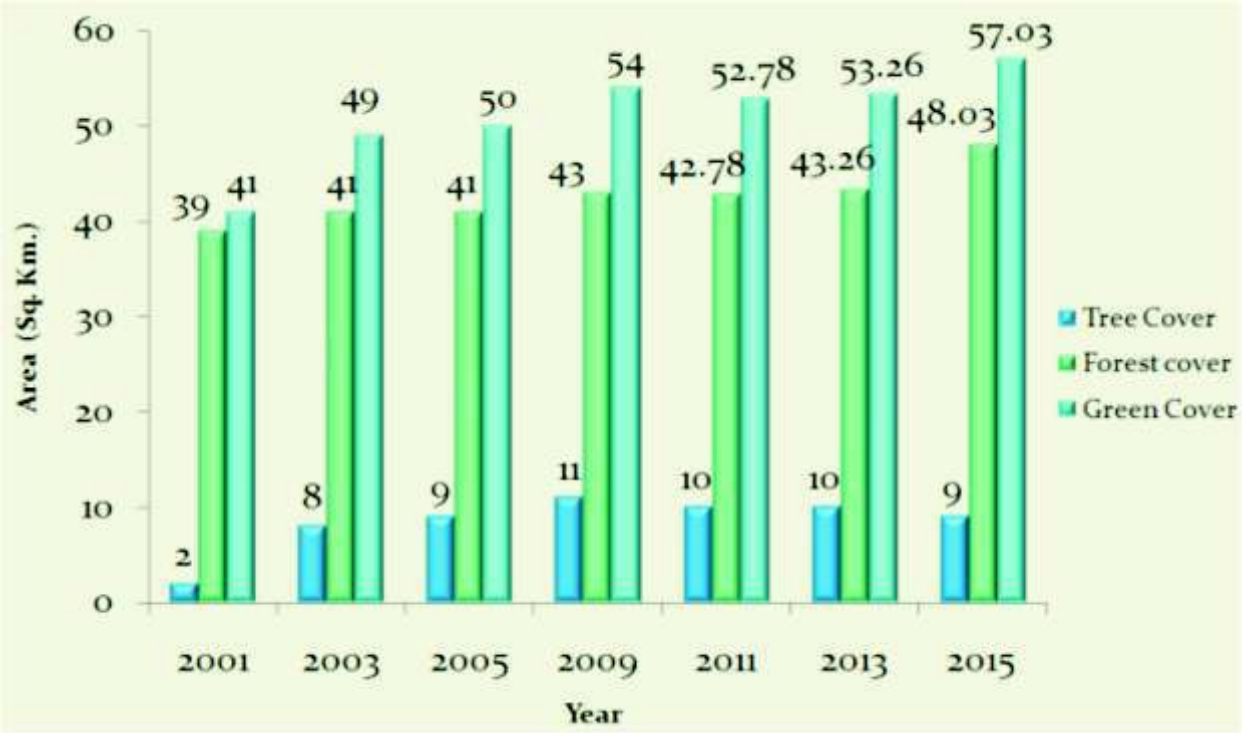
S.No.	PARTICULARS	RESERVED FOREST AREA (ha)	UNCLASSIFIED FOREST AREA (ha)	TOTAL FOREST AREA (ha)
1.	Patiala Ki Rao Forest	23.29	113.18	136.47
2.	Sukhna Choe Forest	350.69	45.2387	395.9287
3.	Lake Forest	105.5767	28.10	133.6767
	Total	479.5575	186.5187	666.0754

THE DETAILS OF WILDLIFE SANCTUARY AREA IN U.T. CHANDIAGRH

S.No.	PARTICULARS	TOTAL SANCTUARY AREA (ha)
1.	Sukhna Wildlife Sanctuary	2598
2.	City Bird Sanctuary	2.9

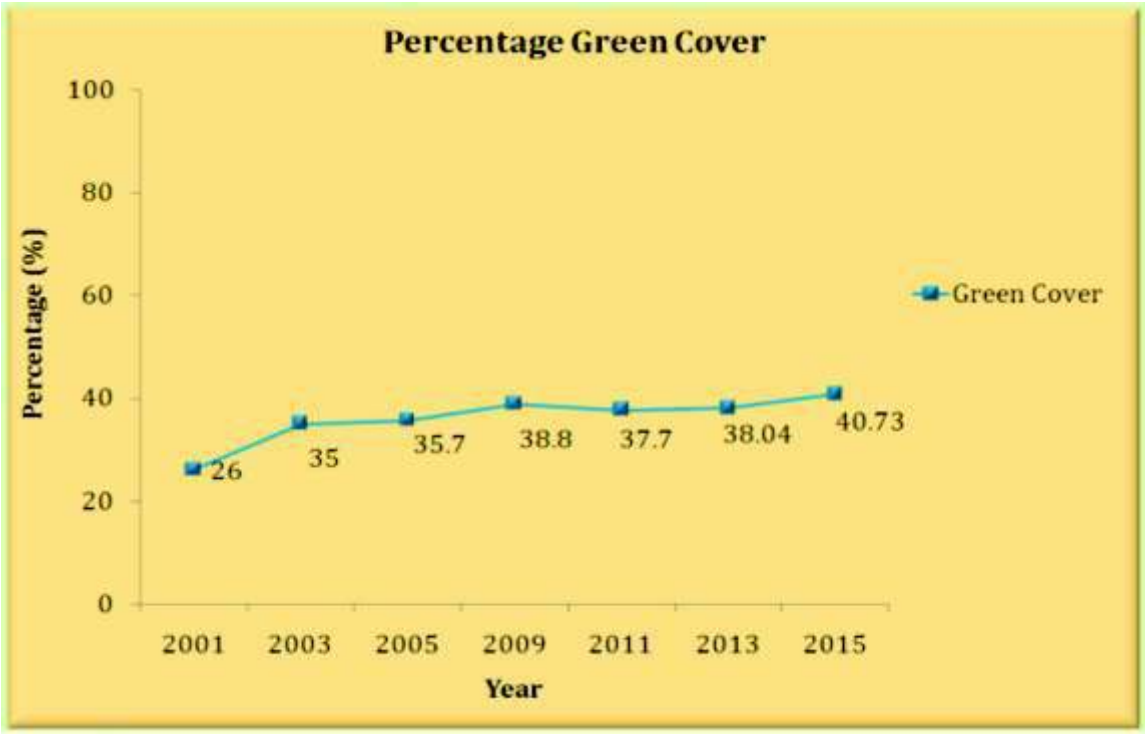
The Mapping of the Forest Area is done with GPS.
This Map is only for Research and Management of the Forest Area.

Year-wise Progress in the Green Cover (Forests & Tree Cover) of U.T. Chandigarh



Source: India State of Forest Reports (ISFR)2001,2003,2005,2009,2011,2013,2015

Trend of Increase in Green Cover of UT Chandigarh (% of Total geographical area)



Source: India State of Forest Reports (ISFR)2001,2003,2005,2009,2011,2013,2015

Classification of Forest Area

Total forest area in U.T. Chandigarh is 3295.77 hectares as shown in the following table:-

Achievements and Awards earned for Greening Chandigarh

✍For outstanding work in increasing forest & tree cover in the city, Union Territory of Chandigarh was presented the prestigious "Indira Priyadarshini Vriksha Mitra (IPVM) Award" for the year 2010 by Director General (Forests) & Special Secretary, Ministry of Environment & Forests, Govt. of India and Award money of Rupees Five lakh.

✍

✍As per Planning Commissions Environmental performance index (PC-EPI) 2012, the Forest of UT Chandigarh has been ranked No. 1. The cumulative Environmental Performance Index (EPI) is a measure of the environmental well being of the States, i.e., the States with a score of 1are characterized by cleaner environment, adherence to environmental standards including implementation of legislation and institutional mechanisms and efforts towards Natural resource conservation. With a EPI score of 0.8123, 0.7316, 0.7270, 0.7149 and 0.7147 Uttarakhand, Himachal Pradesh, Chandigarh, Sikkim and Andhra Pradesh in that order have been ranked as the best performing States respectively.

✍

✍As per State Forest Report 2015 published by Forest Survey of India (FSI), there is an increase of Forest cover by 13.8%.

Greening Chandigarh Action Plan 2015-16

S.N	Name of Activities	Targets (in Numbers)	Achievement	Remarks
1	Plantation	205000	248338	More than 100%
2	Free Distribution of Seedlings	40000	67137	
3	Distribution of Fruit and Ornamental Tree species	40000	48793	

Source: Greening Chandigarh Action Plan 2016-17

Plantation Target For 2016-17

S.No	Department/ Organization	No. of saplings		No. of stem cuttings of Arundo-donax & Ipomea		No. of patch-sowing (seed sowing)	
		Target	Achievement	Target	Achievement	Target	Achievement
A) 1	Forest Department	50000	75000	100000	100000	300000	300000
2	Municipal Corporation	40000	40964	-	-	-	-
3	Horticulture Division, Engineering Department	20000	27980	-	-	-	-
B) i)	Free distribution of saplings by Forest Department to Educational & Religious Institutions, NGO's etc	50000	50000	-	-	-	-
ii)	Distribution/selling of saplings by Hort.Wing of MC	25000	30305	-	-	-	-
iii)	Distribution/ selling of saplings by Engg. Department.	35000	30477	-	-	-	-
	Total:	**220000**	**254726**	**100000**	**100000**	**300000**	**300000**

Source: Greening Chandigarh Action Plan 2016-17

Wildlife Sanctuaries in Chandigarh

The City beautiful Chandigarh is blessed with two wildlife sanctuaries covering total area of 2601.38 Ha which includes Sukhna Wildlife Sanctuary with total area of 2598.48 Ha and City Bird Sanctuary, Sector 21 with total area of 2.90 Ha. Due to ecological, faunal, floral, geomorphological, natural and geological significance for the purpose of protecting, propagating and developing wildlife and its environment, Sukhna Wild Life Sanctuary was declared as Wildlife Sanctuaries vide Chandigarh Administration notification No. 694-HII(4)-98/4519, dated the 6th March, 1998 and City Bird Sanctuary was was declared as Wildlife Sanctuary vide Chandigarh Administration notification No. 18/1/48-HII(4)-98 dated 3rd September, 1998.

Sukhna wildlife Sanctuary -

Sukhna Wildlife Sanctuary spreading over an area of 2600 hect. is situated at 1 Km. in the North-East of Sukhna Lake. It forms the part of Sukhna Lake catchment area falling in Shivalik hills. The Sukhna Wildlife Sanctuary in the Union territory of Chandigarh shares the boundary with two other States viz Punjab and Haryana and falls in the Shivalik Hills which are ecologically sensitive and geologically unstable and thus are highly prone to soil erosion during rains. Prominent species present in the Sukhna Wildlife Sanctuary are-Leopar (Panthera sp.), Sambar (Rusa sp.), Indian Pangolin (Manis sp.), Golden Jackal (Canis), Grey Langur (Semnopithecus sp.), Wild Boar (Sus sp.), Red Jungle Fowl (Gallus sp.), Indian Peafowl (Pavo sp.), Chital (Axis sp.), Golden Oriole (Oriolus sp.), Cobra (Ophiophagus sp.), Russell's Viper (Daboia sp.), Indian Python (Python sp.), etc. Apart from this a wide variety of butterflies (more than 70 species) and other insects are found in abundance. Due to presence of rich flora and fauna in this area it is necessary to conserve and protect the area, the extent and boundaries, around the protected area of the Sukhna Wildlife Sanctuary declared as Eco-sensitive Zone dated 18th Jan, 2017 vide notification of the Government of the India in the Ministry of Environment, Forest and Climate Change number S.O. 185(E).

City Bird Sanctuary, Sector 21

City Bird Sanctuary Chandigarh is situated in sector 21 of the city with a total area of 2.90 Ha. It is primarily habitat of parrots. Hundreds of parrots live here. They fly in flocks in the morning and evening from here. There are two parks adjoining to this sanctuary. Flocks of parrots sit on the trees of these parks also. It is the second wildlife sanctuary of Chandigarh. It is notified under Section 18 of the Wildlife (Protection) Act, 1972.a variety of Wildlife such as Rose ringed Parakeet (Psittacula krameri), Grey Hornbill (Ocyceros birostris), House sparrow (Passer domesticus), Common Myna (Acridotheres tristis), Indian Koel (Eudynamys scolopaceus), Red vented Bulbul (Pycnonotus cafer), Blue Rock Pigeon (Columba livia), Starling Hoopoe (Fregilupus varius), Ring Dove (Streptopelia capicola), Green bee eater (Merops orientalis), Spotted Owlet (Athene brama) Purple Sunbird (Cinnyris asiaticus), Indian Grey Mongoose (Herpestes edwardsii) and Various reptiles are found here in Sanctuary. For conservation of this area and to restrict industrialization near the area the City Bird Sanctuary is declared as Eco-Senstive Zone on 4th Jan 2017 vide notification of the Ministry of Environment, Forest and Climate Change, Government of the India, vide number S.O. 2045(E), dated 27 July 2015.

Flora and Fauna at Forests of Chandigarh:

Large number of water holes, grazing grounds and good plantations including natural regeneration of indigenous species provide an ideal habitat for the wildlife in the Sanctuary. The flora & fauna found in forests of Chandigarh are :

Flora: There are wide variety of trees, shrubs, herbs, grasses and climbers. The prominent among them are : Acacia catechu (Khair), Acacia modesta (Phulai), Acacia Arabica (Kikar), Acacia leucophloea (Raeru), Dalbergia sisoo (Shisham), Anogeissus latifolia (Chhal), Azadirachta indica (Neem), Bombax ceiba (Semal), Butea frondosa (Dhak), Bauhinia racemosa (Kachnar), Emblica officinalis (Amla), Morus alba (Tut), Lannea grandis (Jhingan), Diospyros montana (Kendu), Murraya koenigii (Kari patta), Prosopis juliflora (Musket), Cassia fistula (Amaltas), Zizyphus jujoba (Ber), Vitex negundo (Bana or nirgundi), Carissa spinarum (Karaunda), Adhatoda vasica (Vasaka), Saccharum sararoxb (Moonj), Tinospora cordifolia (Giloe), Abrus precatorious (Rati) etc.

Digitization of flora

The Department of Forest & Wildlife, UT, Chandigarh has launched a website for identification of various trees present in Chandigarh for benefits of residents with url www.chandigarhforestflora.in. The website was inaugurated at a Conference on "Environmental Education through Eco Clubs - let us think globally and act locally" on the occasion of 'World Earth Day was inaugurated today by Sh. Parimal Rai, IAS, Adviser to the Administrator, UT Chandigarh.

Salient Features

- This website list out more than 300 tree species of UT Chandigarh along with morphological characters like Leaf, Flower, Fruit, Bark and Habit alongwith photographs
- It is an online plant identification system. Taxonomic research can also be done with the help of Family, Genus Species, Vernacular name and English name of the tree species

Significance/Importance

With the help of this website one can know about the different tree species found in UT Chandigarh. Through this website one can easily identify tree species with the help of morphological characters like Leaf, Flower, Fruit, Bark and Habit and this website will definitely help Students, Researchers and other people of UT Chandigarh to know about floral diversity of the city beautiful in detail.

Fauna

Forest of Chandigarh has wide variety of Mammals, birds, reptiles, butterflies and micro-organisms as follows

Mammals :

The following animals are found here:
Sambar, Spotted Deer (Chittal), Pangolin (ant eater), Wild boar, Jackal, Small Indian Civet, Jungle Cat, Porcupine, Hanuman Langur, Rhesus Monkey, Indian Hare, Common-Mongoose, Common rat, Squirrel etc.

Birds :

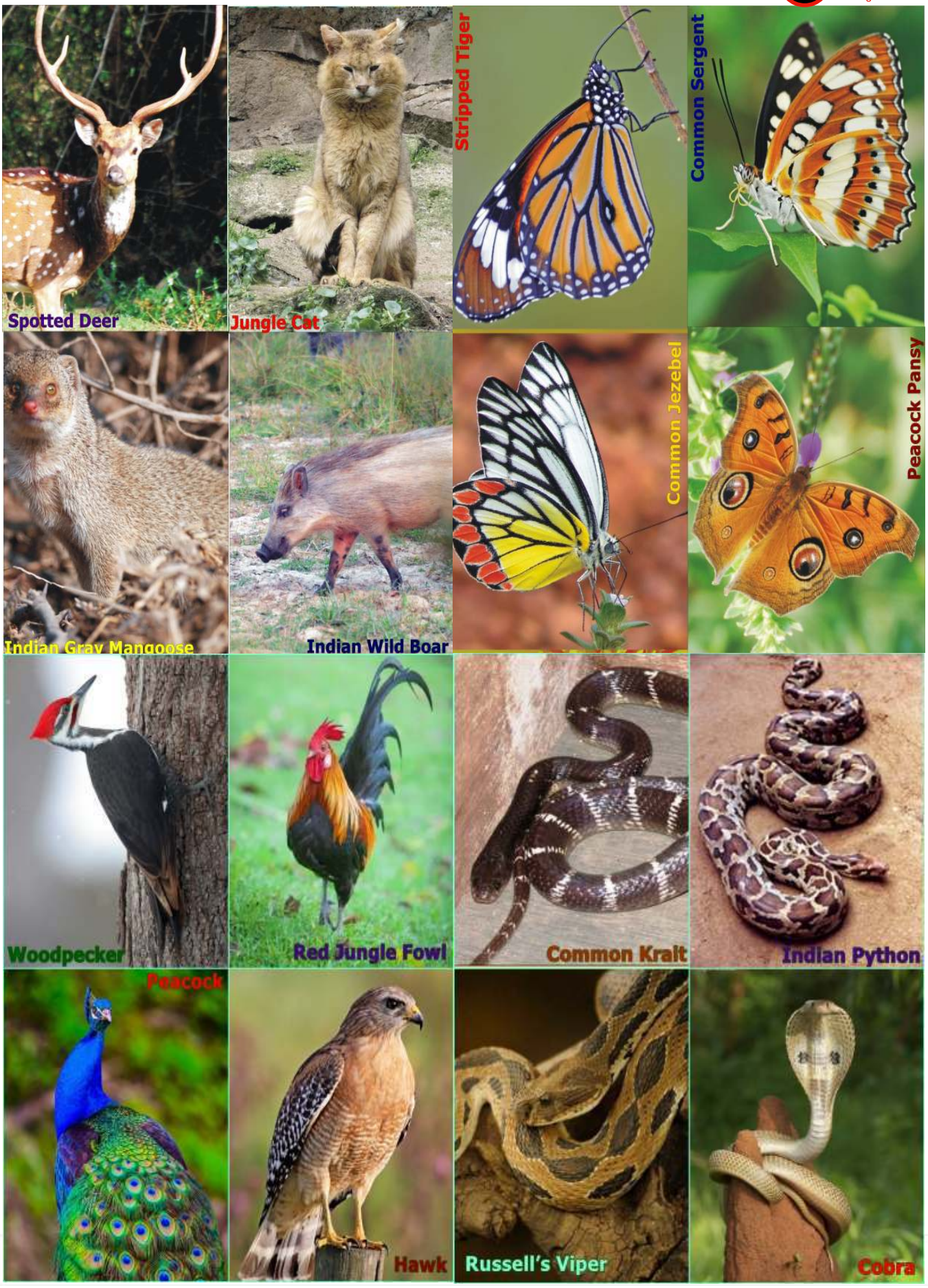
There are more than 150 varieties of birds including aquatic birds. Prominent among them are Peacock, Red jungle fowl, Grey partridge, Cuckoos, Night jars, Golden Oriole, Kingfisher, Swifts, Hoopoes, Hornbills, Barbets, Woodpeckers, Rollers, Barn owls, Parrots, Doves, Jacanas, Plovers, Coots, Hawks, Geese, Swan, Ducks, Grebes, Black drongo, Tree pie, Jungle crow, Bulbul, Hill myna, Koel, Bee-eater, Common Myna etc.

Reptiles :

There are varieties of reptiles including snakes like Cobra, Rat snake, Common Krait, Russell's viper, Indian Python and common Monitor (Gho), Turtle etc

Insects :

Wide variety of Butterflies, Moth, Honey-bee and other micro-organisms are in abundance.


Spotted Deer
Jungle Cat
Stripped Tiger
Common Sergent
Indian Gray Mangoose
Indian Wild Boar
Common Jezebel
Peacock Pansy
Woodpecker
Red Jungle Fowl
Common Krait
Indian Python
Peacock
Hawk
Russell's Viper
Cobra

What Makes Chandigarh Green:

Greening Chandigarh Action Plan

Every year, U.T. Administration comes out with a Greening Chandigarh Action Plan wherein efforts of all stake holders like Forest department, Horticulture wing of MC and Engineering Department, Ngo's, RWA's etc are synergised. All stake hoders are given area wise target to plant saplings.These agencies play a crucial role to become a city more beautiful by implementing new ideas & execute them time to time. To fulfill its commitment to maintain and improve the greenery of the city and to have a better co-ordination among these different stakeholders & to chalk out the planning of plantation works, its implementation & to look into all aspects of Silvicultural/Horticultural operations, Chandigarh Administration formed a Greening Chandigarh Task Group in the year 2001.

NGC-Eco-Clubs

The programme has a cascading effect, seeks to redirect the consciousness of students towards environment friendly attitudes and actions and goes beyond schools, promoting school-society interactions to sensitize the society.Administration of UT has set-up 137 Eco-Clubs in various Govt./Recognized Schools of Union Territory, Chandigarh under National Green Corps Programme of the Ministry of Environment & Forests& Climate Change New Delhi, to spread environmental awareness and carry out action based programmes for protection and improvement of environment through the

Residents of City Beautiful

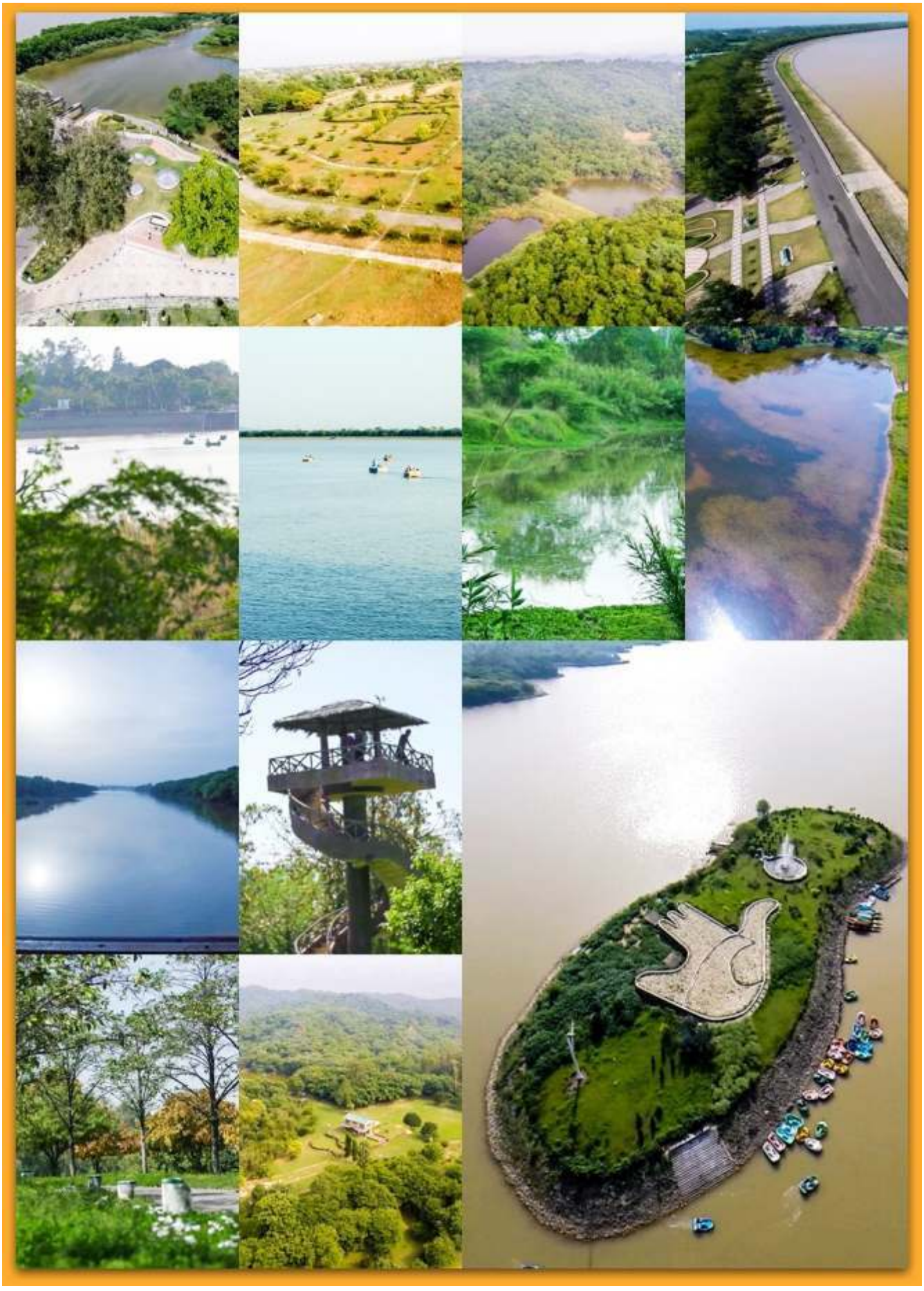
The People of City Beautiful play a vital role in conservation and incease of green cover. The are quite aware and sensitizes towards healthy and green environment. They also conduct and take part in awareness activists conducted by Administration for better and green environment.

Shri Parimal Rai, IAS, Adviser to the Administrator, UT, Chandigarh, planting sapling of ***'Plumeria'*** *during Paudha Mela on 08th July, 2016*

Shri Santosh Kumar, IFS, Chief Conservator of Forests, UT, Chandigarh, planting sapling of ***"Nili Gulmohar"*** *during Paudha Mela on 08th July, 2016*

Shri Ajit Balaji Joshi, IAS, Deputy Commissioner, UT Chandigarh distributed saplings during 'Eco Club Day' on 20th July, 2016

Distribution of plants by Chief Guest to various members of Lion Club at Govt.Model, Sr.Sec.School, Sec.37-B, Chandigarh during 'Eco Club Day' on 11th July, 2016



AIR

Importance of air in our life is uncomparable as it is the prime cause of life on Earth. Without air life would not be possible as seen on other planets in our Solar system. Hence, air is a natural virtue on earth which sustains life. Air is a non-visible form of matter which is free flowing and in gaseous state. With the increase in population and the industrialization of the city, the problem of air pollution has also been arising. Due to high per capita income, the city beautiful is among the highest vehicular density areas of the country. Due to daily inflow of commuters from the three adjoining states (Haryana, Punjab & Himachal Pradesh), and the visitors load for centrally located PGIMER (Post Graduate Institute of Medical Education & Research); Chandigarh experiences very heavy traffic load daily. Also as the name indicates, city beautiful is densely occupied with a variety of seasonal, flowering, ornamental and fruit yielding trees. All these factors contribute through their own way towards the gaseous pollutants and suspended particulate loads in the air by means of releasing SO_2, NO_2, smoke, carbon particles and pollens.

Due to the well managed traffic system, strictly followed speed limits, dense tree cover around all roads, high green area, and regular industrial check-ups; the air quality of Chandigarh is much healthier than most of the growing cities of India. The SO_2 & NO_2 levels of the city always lie below the permissible limits given by the "National Ambient Air Quality Standards 2009" of India (MPL SO_2-50 $\mu g/m^3$ & NO_2 - 50 $\mu g/m^3$). However, the RSPM (PM_{10}) level has been observed above permissible limits in the city. The average RSPM level observed for the last year i.e. 2016 was 104 $\mu g/m^3$, which is quite higher than the desired limit of 60 $\mu g/m^3$. Therefore, there is a need to find out the culprit facts and to plan out strategy for their effective eradication.

National Ambient Air Quality Standards

Pollutant	Time Weighted average	Concentration in ambient air		Method of measurement
		Industrial Area	Sensitive Area	
Sulphur Dioxide (SO_2)	Annual Average*	50 µg/m³	20 µg/m³	Improved West and Gacke method Ultraviolet fluorescence
	24 hours **	80 µg/m³	80µg/m³	
Oxides of Nitrogen as NO_2	Annual Average*	40 µg/m³	30 µg/m³	Modified Jacob & Hochheiser modified (Na-Arsenite) Chemiluminescence
	24 hours **	80 µg/m³	80 µg/m³	
Particulate Matter (size less than 10 µg/m)	Annual Average*	60 µg/m³	60 µg/m³	Gravimetric TOEM Beta Attenuation
	24 hours **	100 µg/m³	100 µg/m³	
Particulate Matter (size less than 2.5 µg/m)	Annual Average*	40 µg/m³	40 µg/m³	Gravimetric TOEM Beta Attenuation
	24 hours **	60 µg/m ³	60 µg/m³	
Lead (Pb)	Annual Average*	0.50 µg/m ³	0.50 µg/m³	AAS Method after Sampling using EPM 2000 or equivalent filter paper
	24 hours **	1.0 µg/m ³	1.0 µg/m³	
Carbon Monoxide (CO)	8 hours	02 µg/m ³	02 µg/m³	Non dispersive infrared spectroscopy
	I hour	04 µg/m ³	04 µg/m³	

***Annual Arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval**

****24 boudy/8 hourly or 01 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.**

NOTE:

Whenever and wherever two consecutive values exceeds the limit specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigations.

Major Institutions, working towards air quality monitoring and preservation in Chandigarh are:-

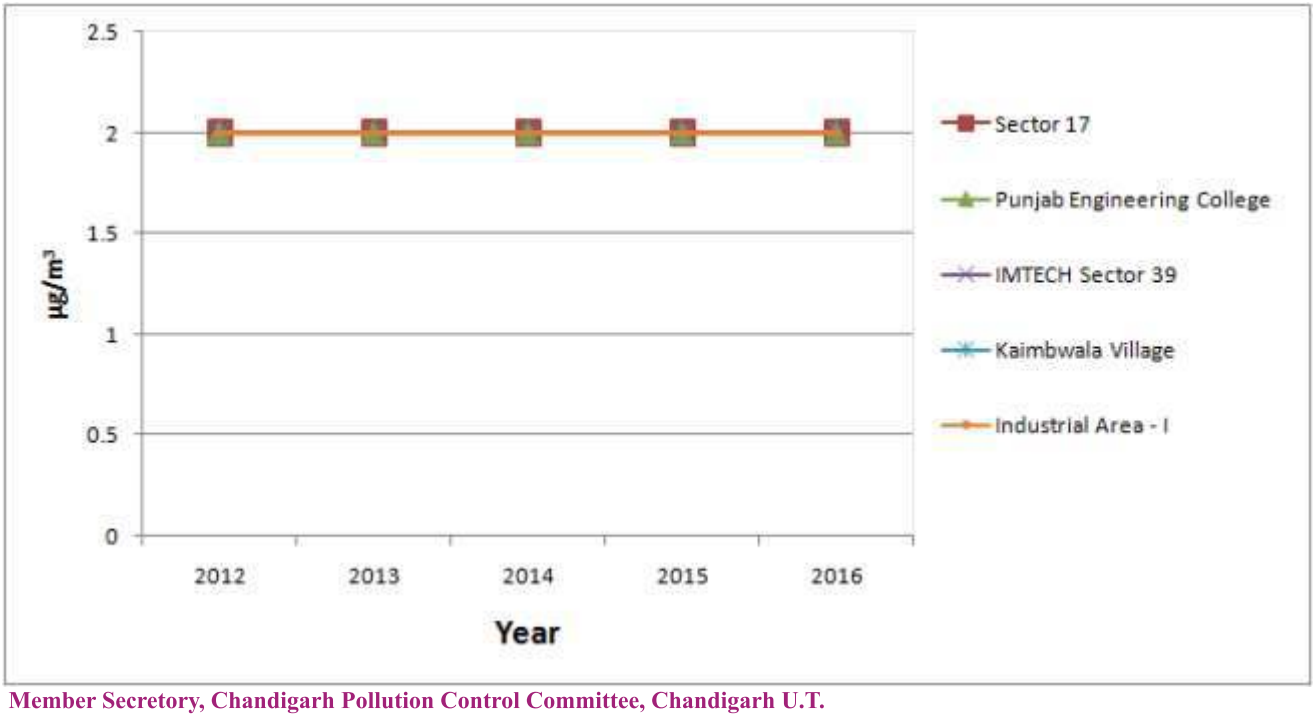
- Policy and regular Monitoring
- Chandigarh Pollution Control Committee (CPCC)
- Department of Environment
- State Transport Authority
- Research and Development
- Central Scientific Instruments Organization
- Punjab Engineering College

In addition to the above, the State Transport Authority and Chandigarh Police are responsible for taking action for the control of vehicular pollution whereas the Municipal Corporation is responsible for the control of pollution from municipal waste.

What is ambient air quality:

Ambient air quality reefers to quality of outdoor air in our surrounding environment. Air quality can be quantified by concentrations of substances identified through monitoring.(it is typically measured near groundlevel, away from direct sources of pollution)

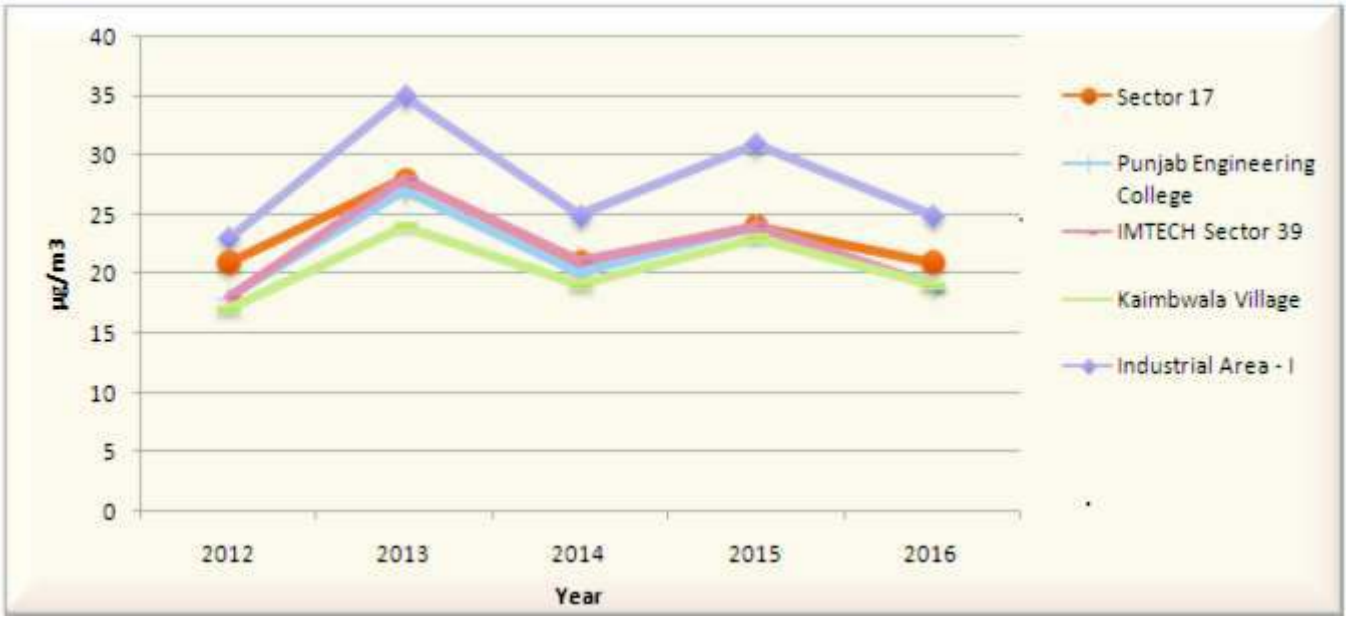
Trends of SO_2 in Chandigarh



Member Secretory, Chandigarh Pollution Control Committee, Chandigarh U.T.

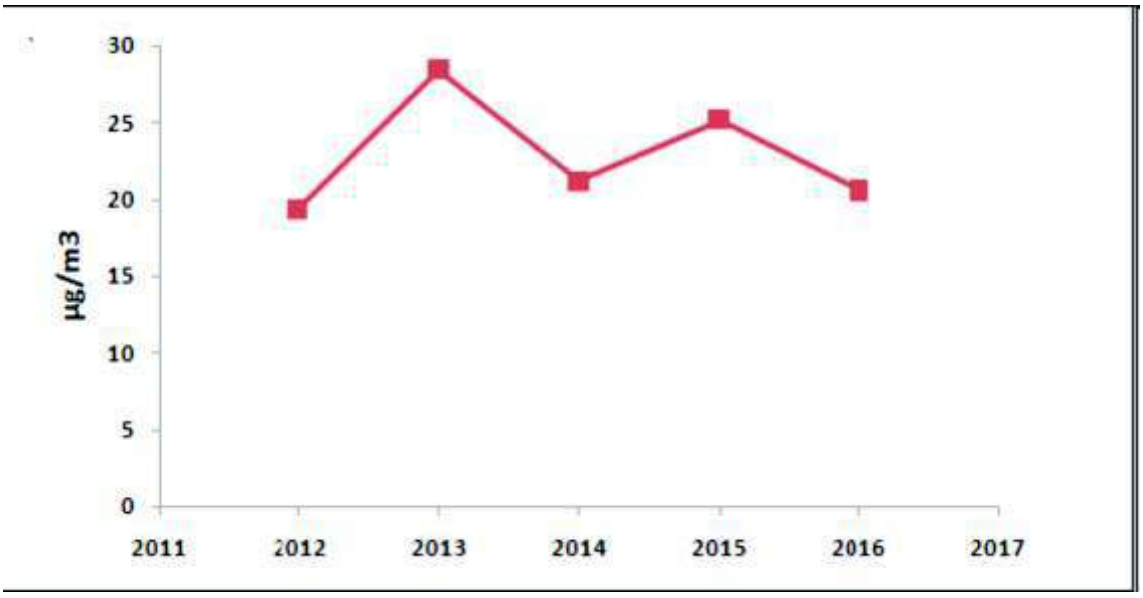
The atmosphere of city beautiful is very clear as far as the concentration of SO_2 is concerned. The SO_2 levels in the air of Chandigarh are observed to lie below the detectable limits (BDL) therefore assigned a constant value "2" for the ease of data management. The above graph shows the controlled level So_2 in the city since year 2012.

Yearly Trends of No_2 in Chandigarh



Member Secretory, Chandigarh Pollution Control Committee, Chandigarh U.T.

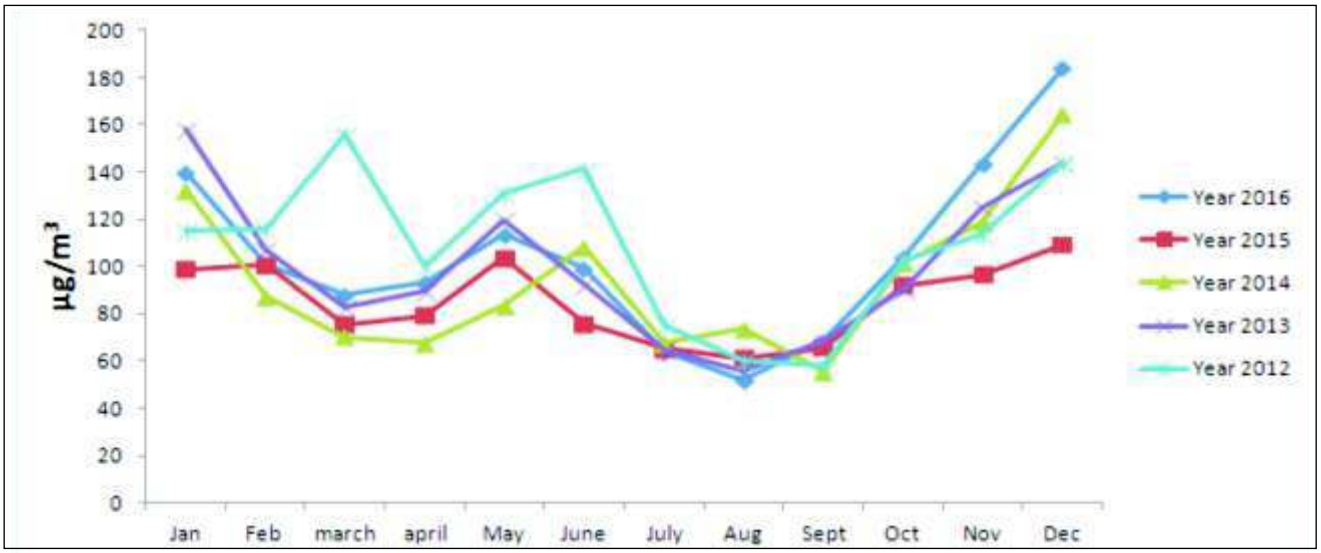
Yearly Average of NO_2 concentration throughout the city



Member Secretory, Chandigarh Pollution Control Committee, Chandigarh U.T.

The graphs above, shows the trends of NO_2 in Chandigarh varying with the point of monitoring and their average values per year since 2012. The NO_2 level is also very much controlled in the city as lies much below the permissible limits (MPL for NO_2 40 µg/m3) decided under national ambient air quality standards of India 2009. The average value of NO_2 in the city is recorded to be 17.38 $\mu g/m^{3;}$ however, due to increasing vehicular density in the city the levels of NO_2 are increasing year by year. Comparatively higher concentrations were observed at Industrial area and the monitoring point located at Sec 17, due to frequent movement of heavy vehicles.

Year-wise variation in RSPM concentration in Chandigarh

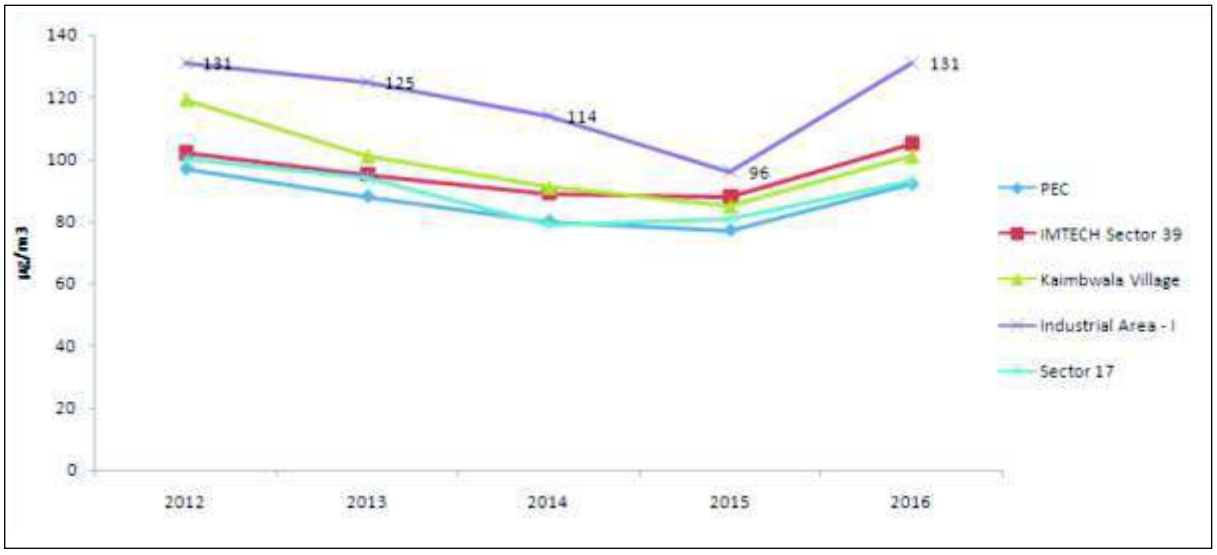


Member Secretory, Chandigarh Pollution Control Committee, Chandigarh U.T.

The above graphs clearly show the variations in the trend of RSPM levels in the city, changing with the seasons throughout a year. The level of RSPM was observed to follow the same trend every year, in last decade.

- The levels of RSPM in the air of Chandigarh were observed to increase with the decrease in temperature, from October to January (winter season).
- Further the RSPM count start decreasing with the temperature rise from February to April.
- Again the high RSPM count was observed in the months of May June (crop harvesting season)
- During the Monsoonal months, July to September, the RSPM level remains to the lower limits due to the rainfall activities.

Yearly average of RSPM at Chandigarh (Monitoring point wise)



Member Secretory, Chandigarh Pollution Control Committee, Chandigarh U.T.

RSPM monitoring in Chandigarh has been performed at five different locations i.e. Industrial area Phase 1, Punjab Engineering College (University of Technology) Sector 11, Commercial Complex Sector 17, Educational area IMTECH at Sector 39 and a village named Kaimbwala.

Due to high industrial and heavy vehicular activities, highest RSPM levels were observed at the monitoring point located at Industrial Area Phase 1 (119.4 avg. / 5yr) followed by IMTECH Sec 39 (95.8 avg. /5 yr), Chandigarh.

The lowest RSPM level in the city was observed for the Punjab Engineering College (University of Technology), Sector 12(86.8 avg. /5 yr).

Air quality of the City Beautiful during Diwali

Trends of SO_2 During Diwali

The SO_2 level of Chandigarh is under control. As it observed from previews four year's data sulfur dioxide level of Chandigarh before and during Diwali is lie below the detectable limits (BDL) therefore assigned a constant value "2" for the ease of data management.

Trends of NO_2 During Diwali

Year	Before Diwali	Diwali Day
2012	28	36
2013	19	33
2014	30	27
2015	24	35
2016	19	42

NO_2 Level of Sec 29 (Values in PPM)

Year	Before Diwali	Diwali Day
2012	28	32
2013	20	32
2014	29	20
2015	31	34
2016	16	38

Level of No_2 Sec 22 (Values in PPM)

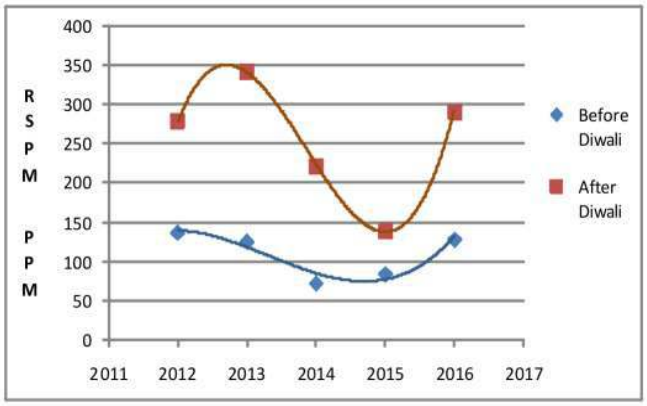
Year	Before Diwali	Diwali Day
2012	29	35
2013	17	27
2014	19	31
2015	23	24
2016	21	30

No_2 Level of Sec 29 (Values in PPM)

NO_2 is well within permissible limits in Chandigarh. Though the level of pollutants rises during Diwali festival but still it is well below permissible limits. The applicable permissible limit, for 24 hours' average, is 80 $\mu g/m^3$ for NO_2

Trends of RSPM During Diwali

The above graph shows the notable increase in the RSPM levels of the city before Diwali day and on Diwali. Due to the excessive use of fire crackers by the city residents and the adjoining states of Haryana, Punjab and Himachal Pradesh, the RSPM level of the city reaches to the dangerous level every year. The maximum increase in RSPM till date was observed for the year of 2013, however due to increasing awareness among the people through FM radio, newspaper advertisements, newsletters, campaigns by eco clubs and schools oragnized by Environment Department, Chandigarh, the difference has been notably decreased in the year 2014.



The Average RSPM Level of Chandigarh is 105 ppm on normal days that is above permissible limit as per the ambient air quality standards of India. The RSPM level rises during diwali period because of smoke and other pollutants by released from burning crackers .

Factors Effecting Air Quality

Crop Harvesting Seasons: Located nearby the agricultural hubs (Punjab/Haryana), city received a lot RSPM from the wheat harvesting, stubble burning and field ploughing/preparation for the next crop during summers (April - June); whereas the repetition same activities for rice cultivation takes place during winters (Oct-Nov).

Effect of Pollens: Plants and Trees used to propagate their seeds through air by the process of Pollination. Almost all the flowering plants distribute their seeds through air to the nearby area. In the process, as the size of these pollens lie within the limits of RSPM (less than 10 µm) therefore pollens counts for the major part in the RSPM level of any city. Chandigarh, a green city, also has very high density planted series of different trees, which consists of a major fraction of flowering trees.

List of flowering (pollinating) trees in Chandigarh is given below:

Name of the Plant	No. of Plants	Name of the Plant	No. of Plants
Eucalyptus Hybrid	14912	Lagers Troemia Throelli	3075
Alstonia Scholaris	13639	Bauhina V Ariegata	2989
Mangifera Indica	9924	Kikar	2688
Morus	8402	Jacaranda Mimosifolia	1891
Terminalia Arjuna	8170	Melaleuca Alternifolia	1585
Toona Ciliata	7198	Barringtonia Acutangula	1371
Swietenia Mahagoni	6012	Delonix Regia	1279
Ficus Infectoria	5653	Pterospermum Acerifolium	1198
Schileichera Oleosa	5164	Zizyphus	1151
Callistemon Viminalis	3537	Heterophragma Roxburght	1113
Cassia Fistula	3495	Acacia Auriculiformis	917
Albizzia Procera	3479	Bombax Ceiba	894
Acacia	3478	Cassia Siamea	780

Source: An Inventory of Multipurpose Avenue Trees of Urban Chandigarh, India

Temperature Effect:

- The rising RSPM levels during the low temperature seasons are because when temperature declines, the air masses gets denser and settle down causing the phenomenon of "Inversions".
- The cold and humid air traps the pollutants to the lower heights and prevent their dilution in environment thus one of the main reason behind the high RSPM.
- In hot days the vehicular emission also increases due to the air conditioner load.

During the winter season, average mixing height is lower as compared to other seasons and atmospheric dispersion is typically at a minimum and therefore the pollutants will not be as widely dispersed. Lower average mixing height in winter season results in less volume of troposphere available for mixing and hence higher concentrations. Calm conditions in winter season result in less dispersion of pollutants resulting in building up their levels. The monsoons results in large amount of precipitation, high wind velocities and changes in general wind direction. The large amounts of precipitation reduce atmospheric pollution via associated wet deposition processes. Further wind velocities will allow for pollutant transport away from sources and increase mixing processes, thereby resulting in lower levels.

However in the rest of the period the low RSPM is controlled by the rainfall (monsoon/western disturbances) and spreading due to heated air masses & wind speed.

Location of the city & Industrial surroundings:

- Chandigarh is surrounded by the Industrial hubs such as Baddi, Mohali, Zirakpur, Derabassi and Panchkula. Chandigarh too has a vast number of Industrial setups. As observed, the RSPM level of these cities is usually remains higher than that of the Chandigarh; therefore it can contribute to the RSPM of the city.

- RSPM levels in air also increases due to the operation season of brick kilns (Oct May) and sugar mills (Oct - March) located at the surroundings of Chandigarh. Their continuous exhaust releases enormous amounts of SPM/RSPM, which can travel tens of kilometers to the nearby areas.

Human Activities:

- High RSPM levels in the months of winter may also be attributed to the shooting of fire crackers due to number of festivals like Diwali (Nearly Rs. 10 Crores), Guruparav and New Year eves; moreover it's the season when most of the marriages happen in the north region.

- Falling of leaves and their illegal burning in autumn season i.e November to January (winters) is also one of the main reason behind high RSPM in winters as green leaves exhibits a ultimate property of adsorbing the suspended particulates and purifying air.

Population & Vehicle density:

As per the census 2011, the population of city has crossed the mark of 10.5 Lakh. The population density during the last 5 decades (1961-2011) has increased 9 fold, from 1051 to 9252 persons per sq. Km. Due to the high economic status; the city has the largest density of vehicles (878 vehicles/1000 people) also, which is one of the main contributors to the RSPM level. Frequent braking and idling at light points; resulting in higher emission of pollutants. Moreover un-managed diesel auto rickshaw and buses also adding up to the problem.

Transportation Load in the city:

With the increase in population the need of travel facilities has also been increasing. People used to travel daily to the city from adjoining Haryana, Himachal and Punjab and enter Chandigarh from Zirakpur, Panchkula, Mullanpur, and Mohali.

As per the information obtained from the RLA department, Chandigarh; more than 358432 four wheelers, 4494 buses, 10937 goods vehicle and more than 668160 two wheelers were registered with the city till year 2015

As per the national summary report 2010 (CPCB) the total contribution of vehicular exhaust of any city adds up 15 to 70% of the total PM10 level, depending upon the density of vehicles and weather conditions, out of which the main contributors (56%) are diesel vehicles including buses, trucks and auto-rickshaws. (Bangalore is the only city with highest PM contribution coming from vehicular sector with 41%. Pune with 61 % and Chennai with 72 % show the highest percent contribution from road dust. Pune has the lowest industrial contribution (1-3%) as it has mainly engineering industries and also most of them are outside the city boundary).

The proposed action plan to control particulate pollution (high RSPM10):

1. Control over Diesel locomotives:

- Chandigarh Administration has made a complete ban on diesel based auto-rikshaws. Moreover, suitable action should also be taken against the highly polluting/unmaintained vehicles.
- Overloading of the public transport mainly auto rickshaw, should also be checked strictly.
- New projects (under/over pass bridge) for the traffic bypass should be initiated for the hustle free and smooth travel in the city and to avoid excessive fuel burning by the traffic jams occurred due to traffic lights and roundabouts.

2. Control over Pollinating Vegetation:

- Department of Environment gave a study to Department of health for the quantitative and qualitative analysis of the pollinating trees available in the city and their capacity of pollination.
- Quantification of the extent of RSPM addition by the pollinating trees should also be done.
- Further, the plantation of identified species of plants should be avoided and suitable measures should be taken for their possible replacement.

3. Control over highly Polluting Industries:

- Quantification of the emissions of each industry can help to locate the highly polluting units and control the pollution caused by them.
- Industries should also submit data on the source of emission (whether boiler or furnace or cupola etc) boiler capacity, type of fuel used, fuel consumed per day, number of working hours per day, and quantity of emissions of all pollutants (SOx, NOx, RSPM).

4. Sensitisation of the nearby Industrial States:

- Chandigarh, being a small city surrounded by the big industrial hubs, is very much affected by the high RSPM levels of the nearby cities. Therefore, they should be sensitized against the issue and coordinated to initiate necessary steps to control the situation.

- Uncontrolled stubble burning in the nearby agriculture area should also be checked properly.
- Brick kilns are among the main pollutant emitting production units and are present in a high number across the city in the territory of Haryana, Punjab and Himachal. Particularly in winters, the coal consumption in these units increases gradually to maintain the temperature of boiler in cold climate; thus releasing excessive emissions of particulates in winters. Therefore, required steps should be taken to control such activities.

5. Awareness:

Time to time initiation of effective awareness programmes for the city residents, school children, colleges/university students, industrialists, and farmers should be done, to aware them against the detrimental consequences of burning fire crackers, waste leaves, waste paper & plastics, and stubble burning etc. by using different means such as:

- Printed materials such as newsletters, magazines, pamphlets etc
- Organising Mob shows, theatre plays
- Seminars and workshops
- Industrialists should also make aware about the health implications and environmental losses caused by the polluted emissions of their units.

Administrative Initiatives

Chandigarh Administration has taken requisite steps to control the air pollution generation and to enhance the air quality of Chandigarh.

- As an initiative for clean air and respiratory health, Chandigarh is declared as smoke free zone. Nobody is allowed to smoke in public areas. Due to strict drive for challaning smokers, the number of challans in the year 2016 has decreased to 477 from 1147 in the preceding year.
- Complete ban on diesel operated auto-rickshaws.
- Chandigarh is all set to become a solar city with installation of solar lights and state level energy park.
- Electricity generation from renewable resources, primarily from Sunlight has achieved high success and till March 2016, the administration has successfully installed more than 10 MW of roof top Solar Photovoltaic system throughout the city.
- Subsidies are granted to battery operated vehicles and alternate sources of energy such as LPG & CNG.
- City has strict regulation over the vehicular movement and the traffic rules.
- All routes of the city are occupied with the active & attentive traffic police officers who keeps a sharp eye on the traffic violators. In total 1725 challans were issued in 2016 for pollution violation in Chandigarh.
- Due to strict norms, the commuters used to follow all rules and keeps their vehicles up to date.

RESPONSES

A. Legislative & Policy Responses:

1. The entire Union Territory has been declared as 'air pollution control area' vide notification no. G.S.R. 71(E) [NO.Q-14012/87-CPA] dated 1st February, 1988 with the aim of exercising the powers conferred by sub-section(1) of section 19 of the Air (Prevention and Control of Pollution) Act, 1981, to reduce air pollution.
2. The Central Pollution Control Board (CPCB) was monitoring the Air Quality in Chandigarh from 1989 to 1992 and Chandigarh Pollution Control Committee (CPCC) was set up thereafter. The ambient air quality is currently being monitored by CPCC at five points.
3. The Environment (Protection) Act, 1986 & The Motor Vehicles Act, 1988 and rules notified there under and all other legislation of the central government are being implemented in the UT.
4. Directions have been issued u/s 5 of The Environment (Protection) Act, 1986 to the Municipal Corporation, as well as, other concerned institutions for doing organic composting to prevent burning of leaves and to prevent air pollution.

5. Mass emission standards for new vehicles were notified in the country in 1991. In Chandigarh Bharat Stage II norms are applicable.

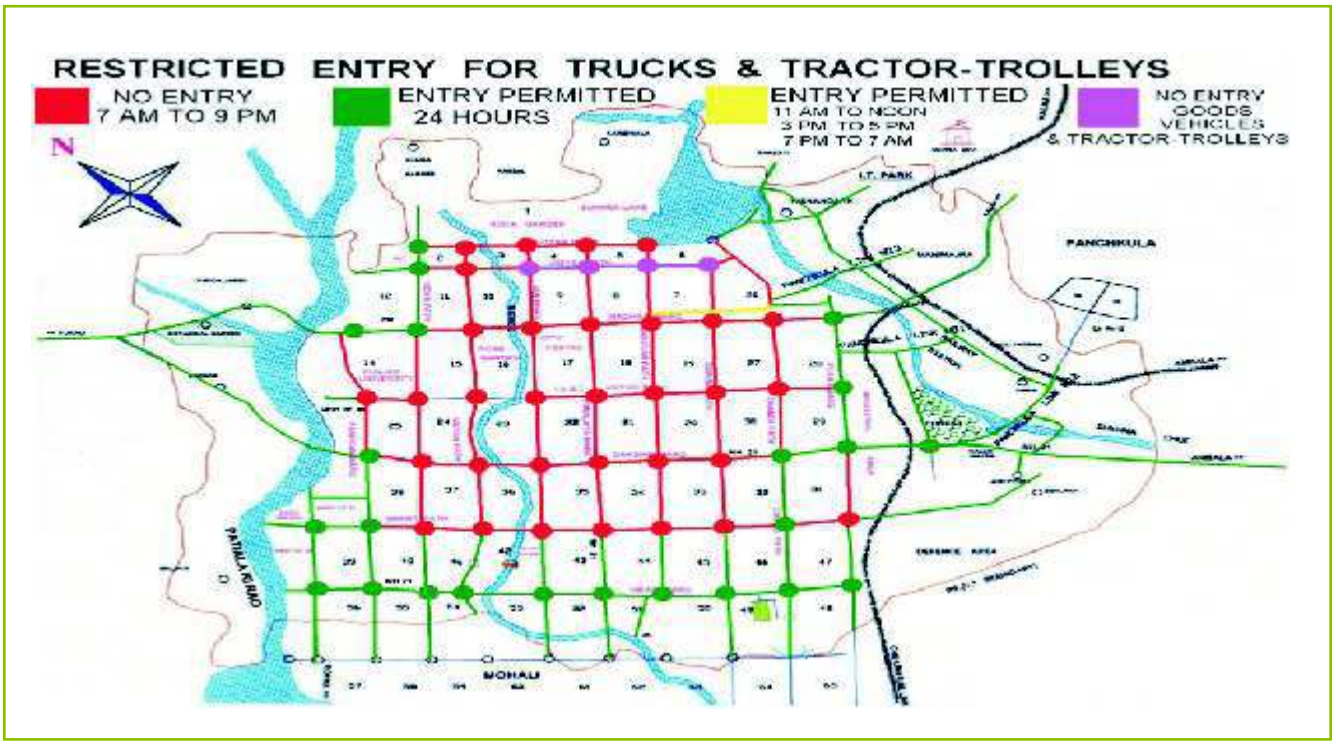
B Infrastructural Responses

a. Industrial Pollution Control:

1. The industrial zone is situated towards Southeast of the city in the leeward direction. Green rows and columns of mango trees separate it from the rest of the city. It is located ideally near the railway station for easy transportation of raw materials and goods. The IT Park of the city is located in a pollution free environment near the foothills of the mountains. Recently the Administration has acquired another 152 acres of land in revenue estate of Village Mauli Jagran for developing Phase-III of the Industrial area.
2. All the air polluting industries under Red Category in the Union Territory have installed air pollution control equipments.
3. No air polluting industry is allowed to operate in non confirming areas (outside Industrial area).

B. Vehicular Pollution Control:

1. Compulsory 'Pollution Under Control' (PUC) certificates for vehicles has been introduced by Chandigarh Traffic Police. Pollution monitoring facilities are available at most of the Petrol Pumps & Vehicle Repair Maintenance units in the city. As per data provided by the State Transport Authority, Chandigarh, 30 authorized stations are operative for issuing 'Pollution Under Control' certificates (PUC).
2. Lead free petrol was introduced in Chandigarh in early 2000. This is expected to reduce lead pollution in air. Other clean fuels like LPG are also introduced in city. Chandigarh Administration has taken steps to promote battery operated vehicles which do not pollute while running on roads.
3. Many roundabouts which were facing traffic congestion problems especially during peak hours have been converted into traffic light points with timers and slip roads to ensure easy flow of vehicles. Moving one step further to grid based movements of traffic, Administration has closed rotaries



4. Cycle tracks have been developed along all major Margs and important Paths in Chandigarh. The Chandigarh Traffic Police has also started compulsory segregation of slow moving vehicles in separate lanes especially during peak hours.
5. Routes of HTV and interstate buses in the city are specified.
6. Chandigarh Traffic Police has also taken measures to ensure smooth moving of the traffic, reducing jams, and hence, minimizing wastage of fuel. Chandigarh wins the first place in India when it comes to roads' width. It is estimated that Chandigarh has zero congestion level.
7. To reduce incoming inter state buses within the city center, a new ISBT was set up in Sector 43 in 2002 which has started functioning to its capacity in year 2008. Thus, buses coming from other states do not interfere the local traffic.
8. The scooter repair market was shifted from sector 21 in the city center to sector 43 & 48 at the outskirts.
9. Metro DPR is approved and project is moving on.

c) Air Pollution control from Municipal & Commercial Sources:

1. To assess the pollution caused by gensets in Chandigarh, a survey was conducted by CPCC. Notices were issued and remedial actions taken.
2. Burning of leaves has been banned by the Municipal Corporation. Composting is being promoted instead.
3. Burning has also been banned at the Chandigarh land fill site and regular compaction is carried out.
4. CPCC has closed down small kilns being operated at 8 Dhobhi Ghats and at Kumhar Colony (for baking clay pottery) and initiated disciplinary action against Junk Dealers burning plastic wastes. The Administration has modernized the Dhobi Ghats to control pollution.
5. Smoking has also been banned in Chandigarh