i-Tree International Academy

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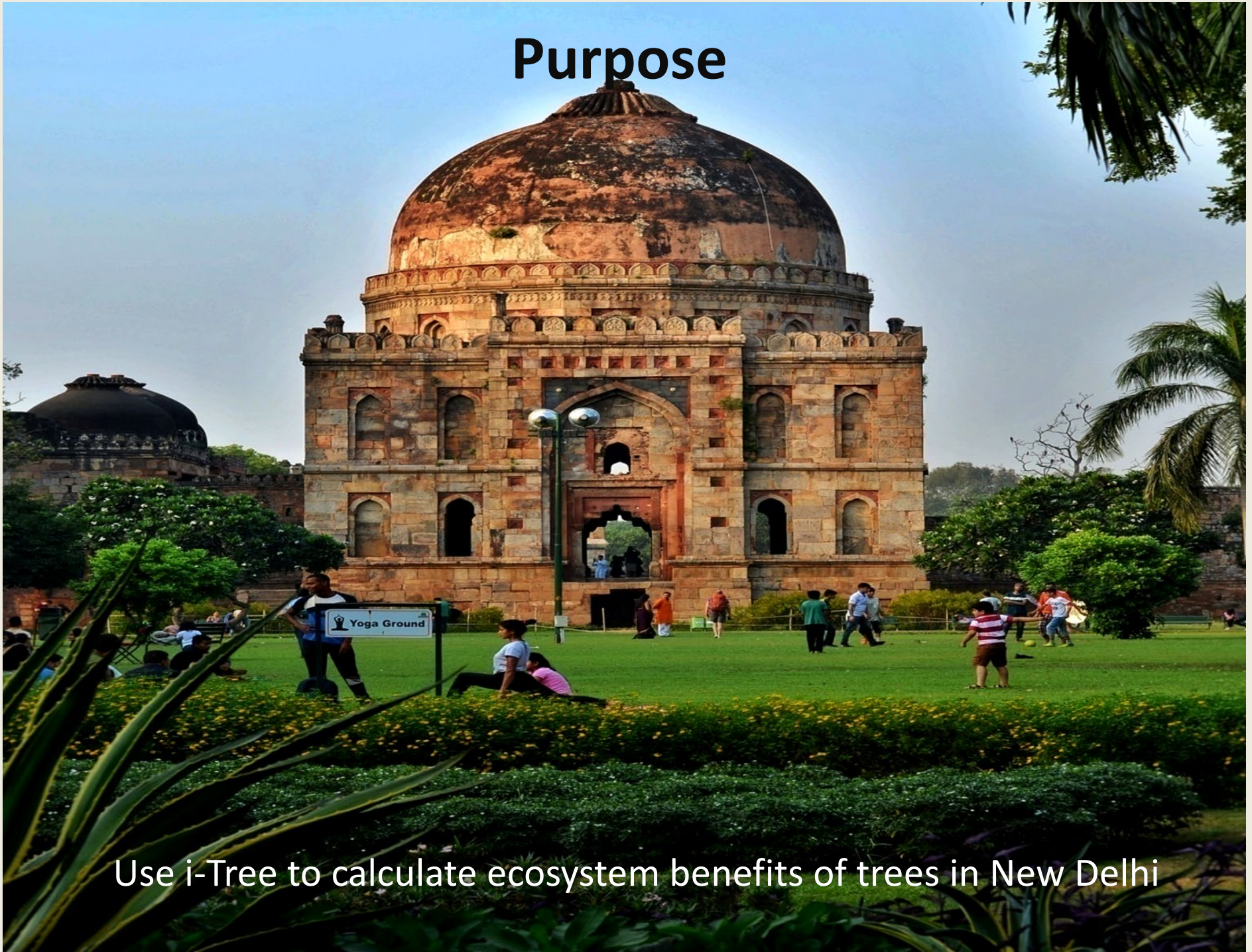
New Delhi, India
April 2020

Purpose



Use i-Tree to calculate ecosystem benefits of trees in New Delhi

Urban Profile

Population of Delhi NCR (National Capital Region): 26 million

Land mass in hectares:

348,400

Major Environmental Problems

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4 Coronavirus Could Become a Seasonal Infection

The New York Times

New Delhi, Choking on Toxic Air, Declares Health Emergency

Schools were closed after pollution in India's capital soared, reaching levels many times the global safe limit.

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News / India /

Delhi cannot breathe and it's not even Diwali yet

If you are in Delhi, try not to breathe -- that is the advice going out on Twitter as thick smog blankets the national capital

India Today Web Desk
New Delhi
November 5, 2018 UPDATED: November 5, 2018 18:19 IST

READ THIS

Covid-19 has spread to 42 new districts since April 17. What did lockdown achieve then?

Covid-19 Tracker: Maharashtra, Delhi, Gujarat account for 52% cases in India

Goodbye, Irrfan. You rare man

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Major Environmental Problems

Air Quality Index Levels of Health Concern	Numerical Value	Meaning
Good	0 to 50	Air quality is considered satisfactory, and air pollution poses little or no risk
Moderate	51 to 100	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups	101 to 150	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
Unhealthy	151 to 200	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.
Very Unhealthy	201 to 300	Health alert: everyone may experience more serious health effects
Hazardous	301 to 500	Health warnings of emergency conditions. The entire population is more likely to be affected.

The city's AQI (air quality index) is usually in the range of **200-250**
It can even cross **999** in months from October- December

Major Environmental Problems

Even though the government figures say that there is 21% green cover in Delhi, the area still suffers from pollution.

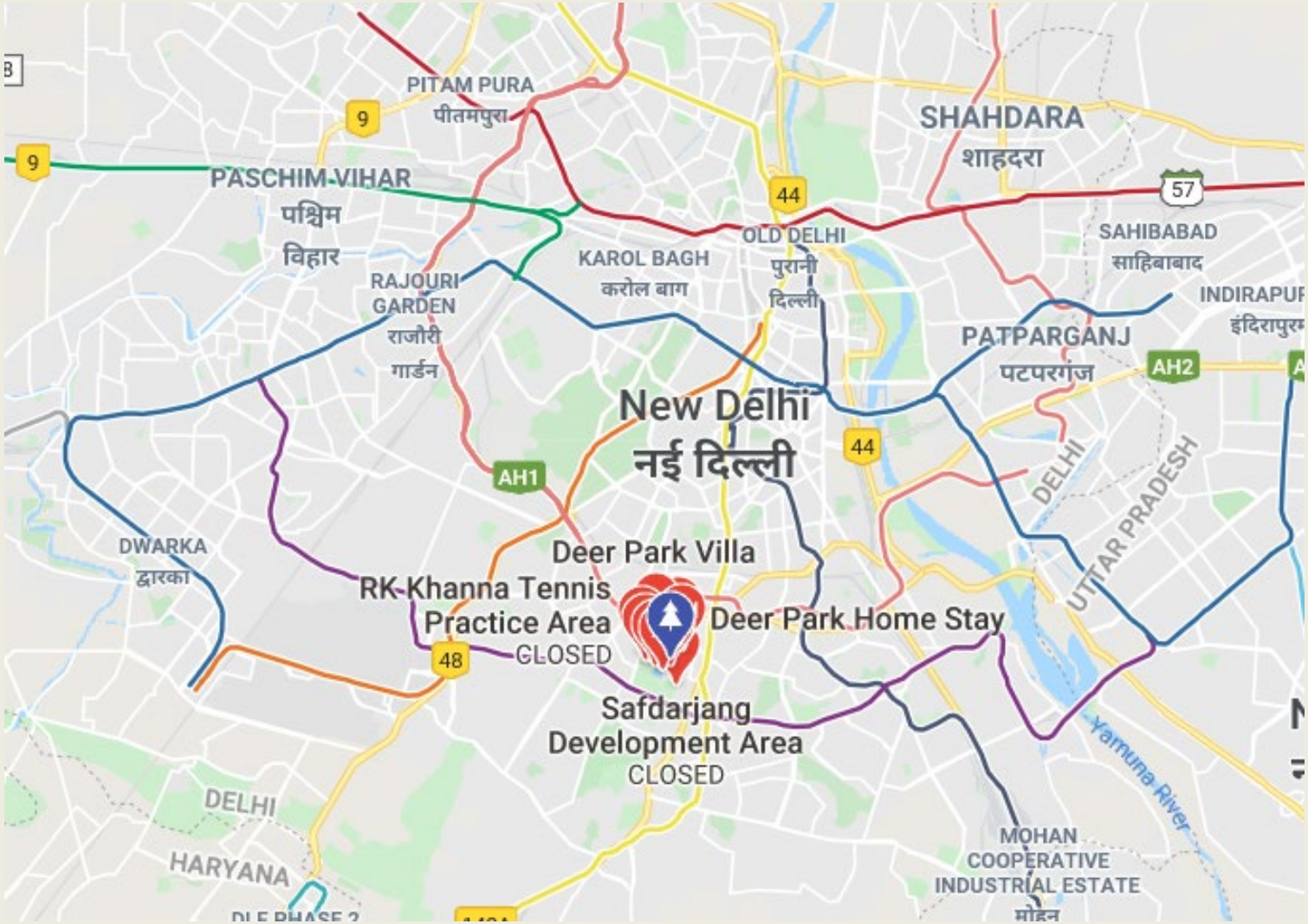
Hence, it is important to understand WHAT does the green cover in Delhi consist of? How effective are the trees and green cover in removing air pollution?

AQI : 350

AQI : 50

Study area for Project

Deer Park - (Safdarjung, South Delhi)



Study area for Project

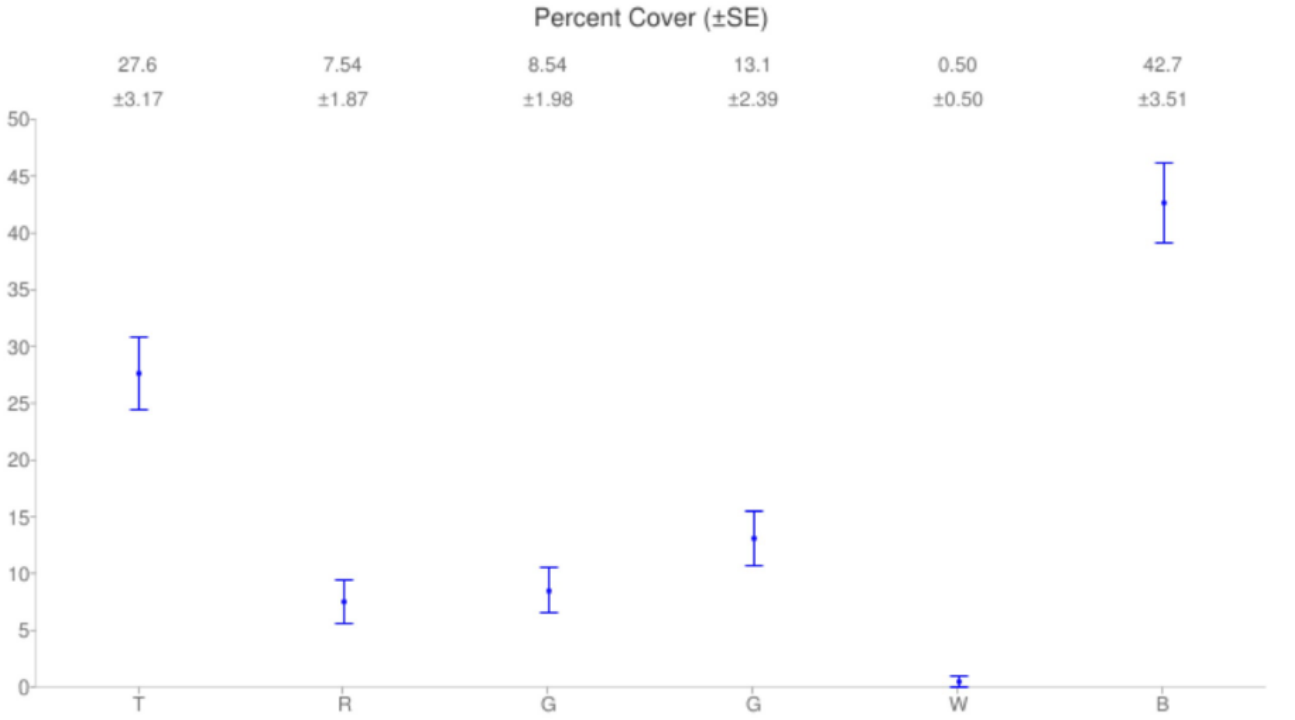
Deer Park - (Safdarjung, South Delhi)

i-Tree Canopy Survey

i-Tree Canopy v6.1

Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 3/15/20



Cover Class	Description	Abbr.	Points	% Cover
Tree	Tree, non-shrub	T	55	27.6 ±3.17
Road	Impervious Road	R	15	7.54 ±1.87
Grass	Grass	G	17	8.54 ±1.98
Bare ground	Bare ground/soil	G	26	13.1 ±2.39
Water	Water body	W	1	0.50 ±0.50
Building	Building	B	85	42.7 ±3.51

Tree data collection : Variables collected

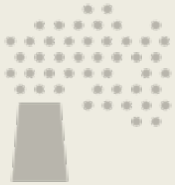
- Species
- DBH
- Crown condition
- Total height
- Crown Top Height
- Crown Base Height
- Crown % missing
- Crown Light Exposure
- Crown width

Ecosystem benefits at a glance

Carbon storage:
41.73 tons
(Rs 544,467

Avoided run-off:
307.2 cubic feet/year
(Rs 1,571 /year)

Carbon sequestration:
952.6 pounds
(Rs 6,214 /year)

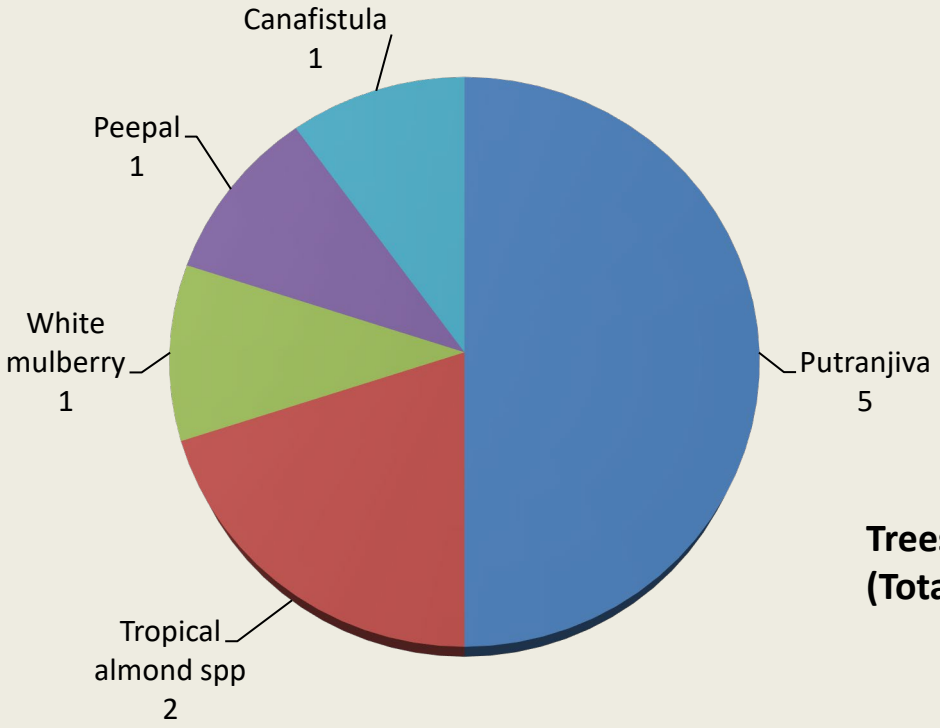


Pollution removal:
14.94 pounds/year
(Rs 4,112 /year)

Benefits	Total Rs (INR)	Rs (INR)/tree
Energy	0.00	0.00
Gross Carbon Sequestration	6,214.50	621.45
Pollution Removal	4,112.61	411.26
Avoided Runoff	1,571.16	157.12
Total Benefits	**11,898.27**	**1,189.83**

Net Annual Benefits of all trees (INR)

Trees analyzed – species composition



Trees species composition (Total number of trees: 10)

Species Name	*Percent Population*	*Percent Leaf Area*	*IV*
Putranjiva	50.0	28.7	78.7
troipical almond spp	20.0	30.5	50.5
Peepul tree	10.0	17.6	27.6
White mulberry	10.0	14.2	24.2
Canafistula	10.0	9.0	19.0

Air Pollution

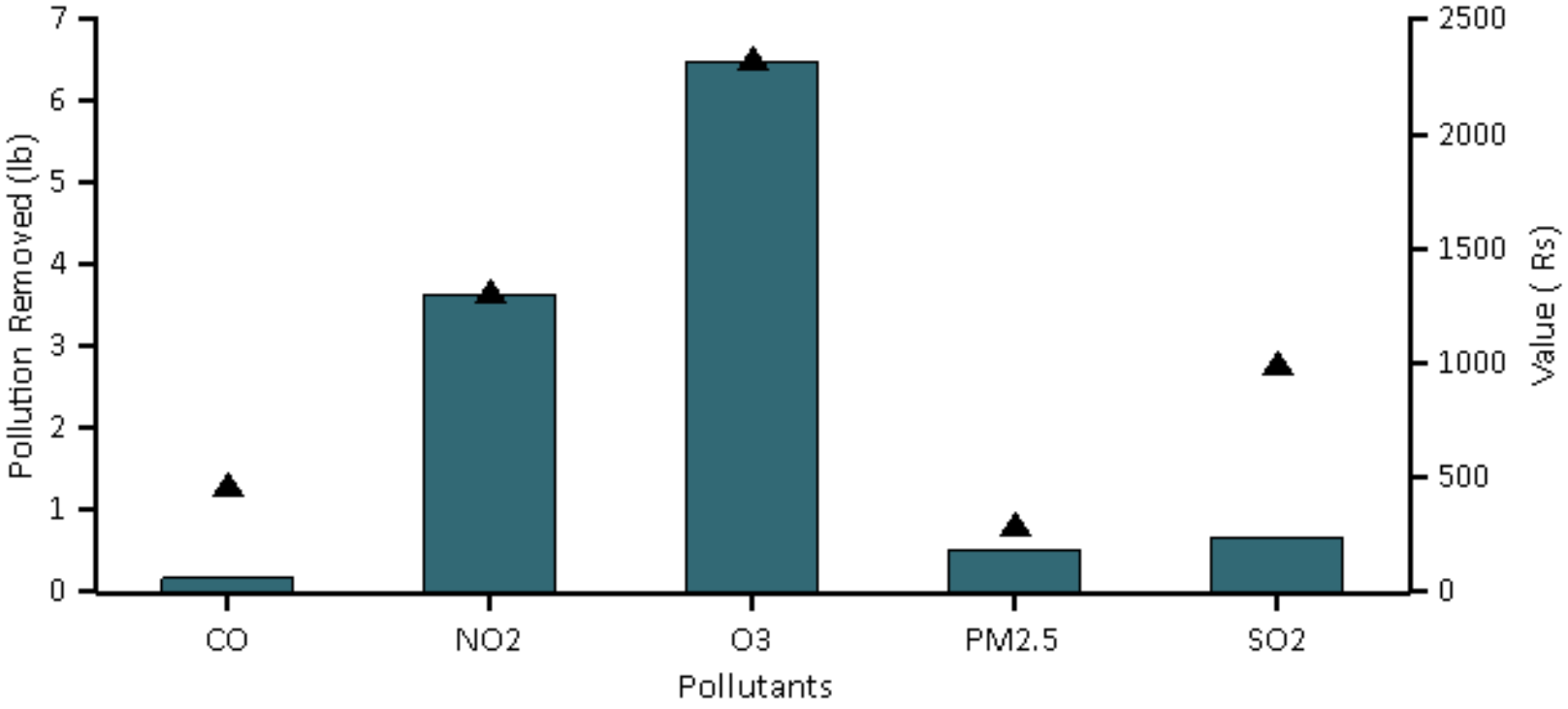


Figure 7. Annual pollution removal (points) and value (bars) by urban trees, Safdarjung New Delhi

Air Pollution – most effective species

Tree ID	Species Name	Pollution Removed (oz/yr)					Removal Value (Rs/yr)				
		CO	O3	NO2	SO2	PM2.5	CO	O3	NO2	SO2	PM2.5
2	Peepul tree	3.6	18.3	10.3	7.8	2.2	11.32	408.28	228.95	42.52	33.23
3	Putranjiva	2.9	14.6	8.2	6.2	1.8	9.06	327.04	183.39	34.06	26.62
4	troipical almond spp	3.2	16.6	9.3	7.1	2.0	10.26	370.32	207.66	38.57	30.14
5	troipical almond spp	2.9	15.0	8.4	6.4	1.8	9.31	336.04	188.43	35.00	27.35
6	Putranjiva	2.2	11.3	6.3	4.8	1.4	6.97	251.48	141.02	26.19	20.47
7	Putranjiva	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.00	0.00
8	Canafistula	1.8	9.3	5.2	4.0	1.1	5.78	208.42	116.88	21.71	16.97
9	White mulberry	2.9	14.7	8.3	6.3	1.8	9.12	329.06	184.52	34.27	26.79
10	Putranjiva	0.3	1.6	0.9	0.7	0.2	1.02	36.63	20.54	3.81	2.98
11	Putranjiva	0.4	2.3	1.3	1.0	0.3	1.41	50.97	28.58	5.31	4.15
	Total	**20.3**	**103.8**	**58.2**	**44.2**	**12.7**	**64.25**	**2,318.24**	**1,299.96**	**241.45**	**188.71**

Air Pollutants – effects on human health

Standard level of criteria air pollutants and their sources with health impact based on the United States Environmental Protection Agency

Air pollutants[©]	Major source of emission	Averaging time	Standard level	Health impact target organs
Particle pollutants				
$PM_{2.5}$	Motor engines, industrial activities, smokes	24 h	35 μg/m³	Respiratory and cardiovascular diseases, CNS and reproductive dysfunctions, cancer
PM_{10}		24 h	150 μg/m³	
Ground-level ozone	Vehicular exhaust, industrial activities	1 h	0.12 mg/m³	Respiratory and cardiovascular dysfunctions, eye irritation
Carbon monoxide	Motor engines, burning coal, oil and wood, industrial activities, smokes	1 h	35 mg/m³	CNS and cardiovascular damages
Sulfur dioxide	Fuel combustion, burning coal	1 h	75 μg/m³	Respiratory and CNS involvement, eye irritation
Nitrogen dioxide	Fuel-burning, vehicular exhaust	1 h	100 μg/m³	Damage to liver, lung, spleen, and blood
Lead	Lead smelting, industrial activities, leaded petrol	3 months average	0.15 μg/m³	CNS and hematologic dysfunctions, eye irritation
Polycyclic aromatic hydrocarbons*	Fuel combustion, wood fires, motor engines	1 year	1 ng/m³	Respiratory and CNS involvement, cancer

*Air quality standards according to the European Union; [©]$PM_{2.5}$ is stand for PM of 2.5 μ or less. PM_{10} is stand for PM of 10 μ or more. PM = Particulate matter, CNS = Central nervous system

Carbon Storage – most effective species

Tree ID	Species Name	Carbon Storage (lb)	% of Total
2	Peepul tree	13,162.5	15.8
3	Putranjiva	12,002.0	14.4
4	troipical almond spp	11,350.0	13.6
5	troipical almond spp	5,750.9	6.9
6	Putranjiva	3,757.2	4.5
7	Putranjiva	15,139.0	18.1
8	Canafistula	3,799.6	4.6
9	White mulberry	12,599.2	15.1
10	Putranjiva	500.6	0.6
11	Putranjiva	5,399.3	6.5
	Total	**83,460.3**	**100%**

Flooding during monsoon season

Avoided run-off – most effective species

Tree ID	Species Name	Leaf Area (ft^2)	Potential Evapotranspiration (ft^3/yr)	Evaporation (ft^3/yr)	Transpiration (ft^3/yr)	Water Intercepted (ft^3/yr)	Avoided Runoff (ft^3/yr)	Avoided Runoff Value (Rs/yr)
2	Peepul tree	4,559.0	2,424.2	271.3	1,265.9	271.3	54.1	276.71
3	Putranjiva	3,651.8	1,941.8	217.3	1,014.0	217.3	43.3	221.65
4	troipical almond spp	4,135.1	2,198.8	246.1	1,148.2	246.1	49.1	250.98
5	troipical almond spp	3,752.3	1,995.3	223.3	1,041.9	223.3	44.5	227.75
6	Putranjiva	2,808.1	1,493.2	167.1	779.7	167.1	33.3	170.44
7	Putranjiva	0.0	0.0	0.0	0.0	0.0	0.0	0.00
8	Canafistula	2,327.3	1,237.5	138.5	646.2	138.5	27.6	141.26
9	White mulberry	3,674.4	1,953.8	218.7	1,020.3	218.7	43.6	223.02
10	Putranjiva	409.0	217.5	24.3	113.6	24.3	4.9	24.82
11	Putranjiva	569.1	302.6	33.9	158.0	33.9	6.8	34.54
	Total	**25,886.3**	**13,764.9**	**1,540.5**	**7,188.0**	**1,540.5**	**307.2**	**1,571.16**

Data limitations

•Data could only be collected for 10 trees. This data was collected before lockdown was enforced in Delhi in March because of Covid.

•The data in this report is not representative of the tree species in either Deer Park or New Delhi.

•After lockdown is over, data will be extensively collected and analyzed.

<u>Benefits not available for i-Tree New Delhi</u>

Building energy savings

Human Health Benefits

Thank You