BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL

PRINCIPAL BENCH, NEW DELHI

ORIGINAL APPLICATION NO. 739/2023

IN THE MATTER OF:

ENVIRONMENT PROTECTION SOCIETY (REGD.)

S.A.S. NAGAR & ANR. ...APPLICANT

VERSUS

MINISTRY OF ENVIRONMENT, FOREST AND

CLIMATE CHANGE & ORS. ...RESPONDENTS

INDEX **NDOH : 17.09.24**

Respondent No. 3

Through

(SANJAY KATYAL)
Advocate
170, Block-II,
Lawyers' Chambers,
Delhi High Court,New Delhi
Mob : 9350023553
Email:sanjayklaw@yahoo.com

New Delhi
Dated:13.09.2024

BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL
PRINCIPAL BENCH, NEW DELHI
ORIGINAL APPLICATION NO. 739/2023

IN THE MATTER OF:

ENVIRONMENT PROTECTION SOCIETY (REGD.)

S.A.S. NAGAR & ANR. ...APPLICANT

VERSUS

MINISTRY OF ENVIRONMENT, FOREST AND

CLIMATE CHANGE & ORS. ...RESPONDENTS

REPLY AFFIDAVIT ON BEHALF OF RESPONDENT NO. 3

I, Dr. Sarita Mutha Jain W/o Sh. Jayant Jain, aged about 56 years, presently working as Resident Director, ICFRE, Van Vigyan Bhawan, R.K. Puram, New Delhi, do hereby solemnly affirm and state as under.

1. That being the Resident Director, ICFRE I am fully conversant with the facts and circumstances of the present case and am competent to swear this affidavit in reply to the Original Application on the basis of official records maintained by the ICFRE. I seek leave of the Hon'ble Tribunal to file a detailed reply at a later stage, if necessary or if so directed by the Hon'ble Tribunal.

NOTARY
RAM PAL SINGH
DELHI
Regd. No. 16973
Valid upto 02-02-2025
GOVT. OF INDIA

Conceptual Building Blocks: Ecosystem Services from Forests

2. That the Ecosystem services (ESs) are outputs, conditions, or processes of natural systems that directly or indirectly benefit humans and are categorised into Provisioning, Regulating, Cultural and Supporting services. Valuation of ESs require to understand the generation of the service of ecological systems i.e. interactions of biotic and abiotic components with society. The global literature is still inconclusive to ascertain that how ecosystem functioning translates into the delivery of benefits as ES.

3. That the respondent ICFRE has estimated value of some intangible services and tangible services of the forest ecosystems for different Forest Types (India has 16 forest types, which are defined by species composition defined by climate). Estimation of some services (ecotourism; water yield) is undergoing and could not be accounted for present valuation.

Ecosystem Services from Trees

4. That with the above analogy, a single grown tree provides benefits, such as regulating (e.g., climate regulation, air pollution abatement, water conservation), provisioning (e.g., food, fiber, water), cultural (e.g., spiritual, recreational), and supporting (e.g., pollination, soil formation).

5. That the ICFRE has not conducted specially the value of fully grown green trees, rather estimated the value of some intangible

NOTARY RAM PAL SINGH DELHI Regd. No. 16973 Verified upto 02-02-2026 GOVT. OF INDIA

and tangible services across the forest types of the country leading to provide per unit area value of various tangible and intangible services for respective forest types. It is submitted that the Trees in urban areas have interlinked network with various ecosystems and varies depending upon the tree species, tree growth, leaf habits, location (biotic and abiotic components) and adjoining population. Therefore, ESs estimation and valuation for tree can be made on the basis of evaluations of ecosystems of the region/location to ascertain the precise value.

6. That the respondent ICFRE has tried to estimate the value based on information from various secondary sources pertaining to forests ecosystems, agro forestry and other associated ecosystems using defaults and with some assumptions due to lack of information for urban trees. The respondent has estimated a conservative tentative value of some services (not a comprehensive) for full life span of a tree as follows:

Table: Valuation of Fuelwood, Fodder, Timber, Carbon and Oxygen for per tree

Service	Biomass (in Mg/tree)	Biomass (in kg/tree)	Biomass (in kg/tree life)	Price /unit	Total Value (in Rs)
Timber	0.00752366	7.52	491.90	10.00	4918.97
Fodder	0.00056427	5.64	368.92	4.75	1752.38
Fuelwood	0.01072121	10.72	700.95	5.00	3504.76
Carbon	0.00846411	8.46	553.38	6.88	3807.28
Oxygen	0.02257097	22.57	1475.69	17.98	26531.43

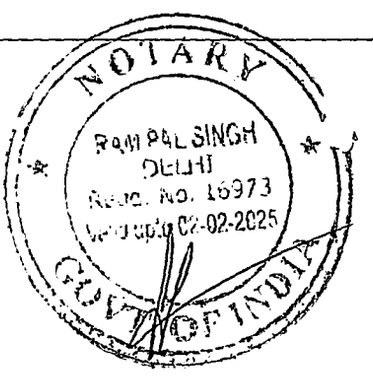


Table: Valuation of intangible services for per tree

Service	Total Value (in Rs)
Habitat services	49244.50
Biodiversity services	60764.85
PM2.5 removal	13.672
PM10 removal	1708.35
Soil Conservation	68.502
Total value of Intangible services (in INR Rs)	**111799.87 ≈ 111800**

Value of a tree =

Value of Timber + Fuelwood + Fodder + Carbon + Oxygen + Habitat Service + Biodiversity Service + PM 2.5 Removal + PM 10 Removal + Soil Conservation

= Rs 111800 + Rs 40514.83 = Rs 1,52,314.83 ≈ Rs 1,52,315

7. That many ecosystem services of trees could not be accounted due to lack of data, information and approaches for valuation as Water yield service; Medicinal service of a tree; Water quality service; Ecotourism service; Nutrient cycling service; Pollination service; Climate regulation service; Pollution i.e. SO_2 removal service; Green manure service.

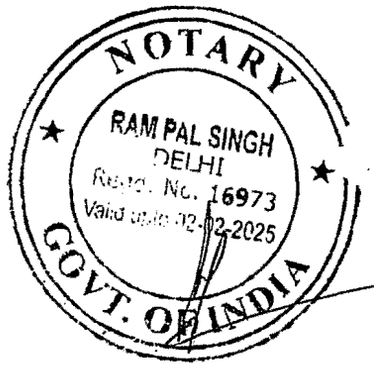
8. That the answering respondent is relying upon the Data for forest type wise Area and estimated rotation age, State/UT wise urban area and Volume of growing stock, Quantification of different

NOTARY
RAM PAL SINGH
DELHI
Regd. No. 16973
Valid upto 02-02-2025
GOVT. OF INDIA

components of biomass per tree, valuation of fuel wood, fodder, Timber, carbon and Oxygen per tree, forest type wise quantification of annual soil loss etc., forest type wise annual quantification of removal of PM2.5/PM10, forest type wise valuation on per hectare basis of ecosystem and valuation of intangible services per tree which are annexed herewith as **ANNEXURE R-3/1**.

It is submitted that the estimated value should be treated as a 'tentative estimate' and not a comprehensive one and may vary with the use of different data, assumptions, defaults and approaches (due to lack of uniform approach for many services) and even inclusion of services being provided by the trees. Without conducting an actual analysis for a tree (may be approximated at urban region), the precise value can not be estimated. ICFRE can attempt to make a precise valuation of a fully grown tree (based on sample basis with considering a few urban regions) on project mode and would be requiring at least 1.5 years and funds for the research.

In view of the submissions made herein above, it is prayed that the Hon'ble Tribunal may be pleased to pass such orders as the Tribunal deems appropriate in the facts and circumstances of the case.



DEPONENT
Resident Director
Van Vigyan Bhawan (ICFRE)
Sector-V, R. K. Puram
New Delhi-110022

VERIFICATION

13 SEP 2024

Verified at New Delhi on this 13th day of September 2024 that the contents of this affidavit are true and correct as per my knowledge, no part thereof is false and nothing material has been concealed there from.

DEPONENT

I identify the Deponent who has signed in my presence

NOTARY
RAM PAL SINGH
DELHI
Regd. No. 16973
Valid upto 02-02-2025
GOVT. OF INDIA

CERTIFIED THAT THE DEPONENT
Shri/Smt./Km. Dr. Sangita Mutha Jain
S/o, W/o, D/o Jayant Jain
R/o...
Identified by Sanjay Katyal, Adv.
has ...
on... 13
that ... which
have ... to him are
true and Correct to his knowledge.

Notary Public Delhi (INDIA)

13 SEP 2024

Detailed Analysis of Value of a Fully Grown Tree

Table 1: Forest type wise Area and estimated rotation age

Forest Type	Area of FTs (in ha)	Estimated Rotation Age
FT1 Tropical Wet Evergreen	2005400	40
FT2 Tropical Semi Evergreen	7117100	55.22
FT3 Tropical Moist Deciduous	13549200	70
FT4 Littoral & Swamp Forest	559600	50.56
FT5 Tropical Dry Deciduous	31361700	76
FT6 Tropical Thorn Forests	2087700	79.11
FT7 Tropical Dry Evergreen	93700	51.5
FT8 Subtropical Broadleaved	3270600	29.13
FT9 Subtropical Pine	1810200	62.22
FT10 Subtropical Dry Evergreen	18000	27.5
FT11 Montane Wet Temperate	2043500	56.22
FT12 Himalayan Moist Temperate	2574300	92
FT13 Himalayan Dry Temperate	562700	92.5
FT14 Sub Alpine Forests	1499500	83.5
FT15 Moist Alpine Scrub	95900	-
F16 Dry Alpine Scrub	292200	-

Source: FSI, 20111; 2013; Pandey et al.,2024

Table 2: State/UT wise Urban Area and Volume of growing stock along with stem density in India

States/UTs	Geographical Area(km^2)	Urban Area (ha)	Urban GS (M^3)	GS volume density M^3/ ha	Stems Number	Stems per ha
Andhra Pradesh	275,069	474,700	6,559,000	13.82	20007374	42
Arunachal Pradesh	83,743	10500	368,000	35.05	2100378	200
Assam	78,438	96200	1,156,000	12.02	4651696	48
Bihar	94,163	180,500	2,496,000	13.83	9233578	51
Chhattisgarh	135,191	186,600	3,186,000	17.07	4499846	24
Delhi	1,483	79700	801,000	10.05	2078498	26
Goa	3,702	51200	1,115,000	21.78	4629459	90
Gujarat	196,022	522,800	6,591,000	12.61	26888272	51
Haryana	44,212	128,000	1,287,000	10.05	3338374	26
Himachal Pradesh	55,673	24200	147,000	6.07	455524	19
Jammu & Kashmir	222,236	95000	579,000	6.09	1790550	19
Jharkhand	79,714	179,200	3,061,000	17.08	4323012	24
Karnataka	191,791	516,700	9,741,000	18.85	30137189	58
Kerala	38,863	325,200	6,706,000	20.62	28224774	87

8

Madhya Pradesh	308,245	696,200	8,995,000	12.92	19077329	27
Maharashtra	307,713	731,300	9,649,000	13.19	31608286	43
Manipur	22,327	14400	82,000	5.69	489820	34
Meghalaya	22,429	23000	128,000	5.57	765031	33
Mizoram	21,081	58700	336,000	5.72	2011005	34
Nagaland	16,579	14700	82,000	5.58	492443	33
Odisha	155,707	279,400	3,606,000	12.91	7700788	28
Punjab	50,362	207,900	2,042,000	9.82	5335348	26
Rajasthan	342,239	543,100	5,561,000	10.24	13891888	26
Sikkim	7,096	354	2,000	5.65	8369	24
Tamil Nadu	130,058	1,249,200	11,447,000	9.16	42441373	34
Tripura	10,486	13900	79,000	5.68	471388	34
Uttar Pradesh	240,928	655,800	6,812,000	10.39	17219536	26
Uttarakhand	53,483	79700	555,000	6.96	1628633	20
West Bengal	88,752	332,500	4,543,000	13.66	17021223	51
Andaman & Nicobar Islands	8,549	2600	23,000	8.85	87965	34
Chandigarh	114	7900	80,000	10.13	206812	26
Dadra & Nagar Haveli	491	1700	21,000	12.35	103540	61
Daman & Diu	112	2400	24,000	10.00	96149	40
Lakshadweep	32	1100	23,000	20.91	95816	87
Puducherry	480	13300	127,000	9.55	496907	37
TOTAL	3,287,263	7,799,700	98,008,000		303,608,262	39

Source: FSI, 2013; GS: Growing Stocks

Annual productivity

Potential Annual yield is estimated through *Von-Montel formula* as

$$Annual\ gain\ in\ growing\ stock = \frac{2 * Growing\ Stock}{Rotation\ age}$$

Annual gain Biomass is estimated as per(Sharma et al., 2011). AGB is multiple of annual GS with 1.65 (BEF). BGB is multiple of AGB with 0.20. (A conservative ratios).

GS (bole + twigs) means growing stocks of forests containing tree upto 10 cm diameter and twigs upto 5 cm. GS per tree means GS per ha divided by 450 number of stems (Say, 450 stems in a ha). Total above ground biomass means GS (bole + twigs) multiplied with 1.65 (Biomass expansion Factor). The Below Ground Biomass equals to AGB multiplied with 0.20. Total Tree Biomass is sum of AGB and BGB.

It was considered (based on peer discussion and field data) that a tree contains around 40% bole to be used for timber and remaining is for fuelwood with very low percent of fodder. We considered 5% of total remaining wood (fuelwood) as fodder as many urban species does not have fodder value.

9

Table 3: State/UTs wise estimated annual productivity of forest in India

States/UTs	GS (Bole + Twigs upto 5 cm) CUM/ha	GS (Bole + Twigs upto 5 cm) CUM/Tree	AGB per tree (in Mg)	BGB/ tree (in Mg)	TB per tree (in Mg)
Andhra Pradesh	0.4227	0.01	0.0165	0.0033	0.0198
Arunachal Pradesh	1.0721	0.0054	0.0088	0.00176	0.01056
Assam	0.3676	0.0076	0.0125	0.0025	0.015
Bihar	0.423	0.0083	0.0136	0.00272	0.01632
Chhattisgarh	0.5223	0.0217	0.0357	0.00714	0.04284
Delhi	0.3074	0.0118	0.0195	0.0039	0.0234
Goa	0.6662	0.0074	0.0122	0.00244	0.01464
Gujarat	0.3857	0.0075	0.0124	0.00248	0.01488
Haryana	0.3076	0.0118	0.0195	0.0039	0.0234
Himachal Pradesh	0.1858	0.0099	0.0163	0.00326	0.01956
Jammu & Kashmir	0.1864	0.0099	0.0163	0.00326	0.01956
Jharkhand	0.5225	0.0217	0.0357	0.00714	0.04284
Karnataka	0.5767	0.0099	0.0163	0.00326	0.01956
Kerala	0.6308	0.0073	0.012	0.0024	0.0144
Madhya Pradesh	0.3952	0.0144	0.0238	0.00476	0.02856
Maharashtra	0.4036	0.0093	0.0154	0.00308	0.01848
Manipur	0.1742	0.0051	0.0084	0.00168	0.01008
Meghalaya	0.1702	0.0051	0.0084	0.00168	0.01008
Mizoram	0.1751	0.0051	0.0084	0.00168	0.01008
Nagaland	0.1706	0.0051	0.0084	0.00168	0.01008
Odisha	0.3948	0.0143	0.0236	0.00472	0.02832
Punjab	0.3005	0.0117	0.0193	0.00386	0.02316
Rajasthan	0.3132	0.0122	0.0202	0.00404	0.02424
Sikkim	0.1728	0.0073	0.0121	0.00242	0.01452
Tamil Nadu	0.2803	0.0083	0.0136	0.00272	0.01632
Tripura	0.1739	0.0051	0.0085	0.0017	0.0102
Uttar Pradesh	0.3178	0.0121	0.02	0.004	0.024
Uttarakhand	0.213	0.0104	0.0172	0.00344	0.02064
West Bengal	0.418	0.0082	0.0135	0.0027	0.0162
Andaman & Nicobar Islands	0.2706	0.008	0.0132	0.00264	0.01584
Chandigarh	0.3098	0.0118	0.0195	0.0039	0.0234
Dadra & Nagar Haveli	0.3779	0.0062	0.0102	0.00204	0.01224
Daman & Diu	0.3059	0.0076	0.0126	0.00252	0.01512
Lakshadweep	0.6396	0.0073	0.0121	0.00242	0.01452
Puducherry	0.2921	0.0078	0.0129	0.00258	0.01548

Note: Number of trees 450 (based on filed survey for some FTs); Biomass expansion factor for AGB is 1.65; Root Shoot Ratio is 0.20; Rotation age is taken to **65.38 year;** AGB: Above ground Biomass; BGB: below Ground Biomass; TB: total tree Biomass in MG (or Tons).

10

Table 4: Quantification of different components of biomass for per tree

Service	Biomass (in Mg/tree)	Biomass (in kg/tree)	Biomass (in kg/tree life)
Bole and Branch	0.0095	9.50	621.30
Other Twigs	0.0062	6.17	403.49
Root	0.0031	3.13	204.96
Biomass	0.0188	18.81	1229.74
Fuelwood+Fodder	0.0113	11.29	737.85

Net carbon sequestration and net oxygen production is estimated as (Negi et al., 2003 and)

$$Carbon(tonnes) = Biomass(CUM) * Carbon\,\%$$

$$Net\ Oxygen\ production = Net\ carbon\ sequestration * 32/12$$

Carbon proportion was considered 45% of total tree biomass. All ratios were considered to obtain conservative estimates.

11

Table 5: Valuation of Fuelwood, Fodder, Timber, Carbon and Oxygen for per tree

Service	Biomass (in Mg/tree)	Biomass (in kg/tree)	Biomass (in kg/tree life)	Price /unit	Total Value (in Rs)
Timber	0.00752366	7.52	491.90	10.00	4918.97
Fodder	0.00056427	5.64	368.92	4.75	1752.38
Fuelwood	0.01072121	10.72	700.95	5.00	3504.76
Carbon	0.00846411	8.46	553.38	6.88	3807.28
Oxygen	0.02257097	22.57	1475.69	17.98	26531.43
Total value of Fuelwood, fodder, timber, carbon and Oxygen (in INR Rs)					40514.83

Tree life means 65.38 years estimated based on some trees age as per literature available for each forest types. Carbon proportion is 0.45%; Oxgen is a proportion 32/12 of carbon. A tree contains only 40% as timber and remaining is for fuelwood.The price of fuelwood and fodder is based on primary survey as per discussion with villagers, and sellers of fuelwood and fodder. The average price of timber was estimated based on the value of hard wood and soft wood and consider Rs 10 as a conservative value. I USD is considered as Rs 80 (to be conservative).

Cost of per ton Oxygen: In India, during the pandemic, National Pharmaceutical Pricing Authority (NPPA) had fixed the price rates of liquid medical oxygen and oxygen inhalation (medicinal cylinder gas) at INR 15.22 per cubic meter and INR 25.71 per cubic meter, respectively (NPPA, 2020).

Converting the values to kgs to tons, we follow the following steps:

1 *cubic meter oxygen weighs* 1.429 (~1.43) *kg*

(https://www.uigi.com/calculators/oxygen-quantity-conversions-calculator/);

(https://www.aqua-calc.com/calculate/volume-to-weight/substance/oxygen-coma-and-blank-solid)

If 1 m^3 *or* 1.43 *kg of Oxygen costs INR* 15.22, 1 *kg will cost INR* 15.22/1.42

$\approx$ 10.6508 $\approx$ *INR* 10.651.

Hence, 1000 *kg or* 1 *ton of liquid medical oxygen will cost INR* 10,651 *or USD* 126.95.

Similarly, the cost of oxygen inhalation gas will cost INR 17.979 per kg or INR 17,979 per ton amounting to USD 154.85 per ton. Thus, the range is USD 126.95 – 154.85 per ton for oxygen[1].

Cost of per ton Carbon: The social cost of carbon for India is estimated as USD 86 per ton (Ricke et al., 2018).

[1]INR to USD conversion - https://www.google.com/finance/quote/INR-USD?sa=X&ved=2ahUKEwjxkveFuI-IAxVNV2wGHViYEJEQmY0JegQICRAw

12

Intangible Services

Soil Conservation

Table 6: Forest type wise quantification of annual Soil loss, SOC, Soil conservation and valuation in India

Forest Type	Soil loss (t/ha) in forest	Soil loss (t/ha) without forest	Value per ha (US$)	Value per tree (US$)
FT1 Tropical Wet Evergreen	0.057	0.788	7.750	0.017
FT2 Tropical Semi Evergreen	0.016	0.352	9.790	0.022
FT3 Tropical Moist Deciduous	0.014	0.508	7.020	0.016
FT4 Littoral & Swamp Forest	0.024	0.979	28.920	0.064
FT5 Tropical Dry Deciduous	0.020	0.616	10.050	0.022
FT6 Tropical Thorn Forests	0.061	1.633	13.550	0.030
FT7 Tropical Dry Evergreen	0.002	0.147	1.180	0.003
FT8 Subtropical Broadleaved	0.004	0.104	2.120	0.005
FT9 Subtropical Pine	0.003	0.089	0.460	0.001
FT12 Himalayan Moist Temperate	0.003	0.094	0.480	0.001
FT13 Himalayan Dry Temperate	0.000	0.088	1.080	0.002
FT14 Sub Alpine Forests	0.000	0.019	0.110	0.000
FT15 Moist Alpine Scrub	0.000	0.009	0.050	0.000
F16 Dry Alpine Scrub	0.000	0.000	0.000	0.000
Average			**6.876**	**0.013**
Soil Conservation for full life of a Tree (i.e. 65.38 years age)			449.542	0.856
Value of Soil Conservation for full life of a Tree (i.e. 65.38 years age) in Rs			35963.359	68.502

Source: Pandey et al.,2024a; 1 USD = Rs 80; Tree age = 65.38 years

13

Pollution Abatement Services for PM 2.5 and PM 10

Table 7: Forest type wise annual quantification of removal of PM2.5 along with valuation for removals of PM 2.5 in India

Forest Type	Total removal PM2.5 tonnes	PM2.5 removal kg per ha	PM2.5 removal kg per tree	Value PM2.5 (US$/ha)	Value PM2.5 (US$/tree)
FT1 Tropical Wet Evergreen	34.180	0.017	0.000	1.530	0.003
FT2 Tropical Semi Evergreen	235.770	0.033	0.000	1.700	0.004
FT3 Tropical Moist Deciduous	338.900	0.025	0.000	1.570	0.003
FT4 Littoral & Swamp Forest	30.620	0.055	0.000	3.730	0.008
FT5 Tropical Dry Deciduous	534.130	0.017	0.000	1.110	0.002
FT6 Tropical Thorn Forests	17.580	0.008	0.000	0.660	0.001
FT7 Tropical Dry Evergreen	2.500	0.027	0.000	0.690	0.002
FT8 Subtropical Broadleaved	29.240	0.009	0.000	1.120	0.002
FT9 Subtropical Pine	28.880	0.016	0.000	1.460	0.003
FT10 Subtropical Dry Evergreen	0.007	0.000	0.000	0.950	0.002
FT11 Montane Wet Temperate	14.060	0.007	0.000	1.460	0.003
FT12 Himalayan Moist Temperate	79.130	0.031	0.000	1.400	0.003
FT13 Himalayan Dry Temperate	2.470	0.004	0.000	0.320	0.001
FT14 Sub Alpine Forests	11.840	0.008	0.000	0.460	0.001
FT15 Moist Alpine Scrub	1.380	0.014	0.000	0.480	0.001
F16 Dry Alpine Scrub	0.530	0.002	0.000	0.180	0.000
Average	**85.076**	**0.017**	**0.000**	**1.176**	**0.003**
PM 2.5 Removals for full life of a Tree (i.e. 65.38 years age)			**0.003**	**76.903**	**0.171**
Value of PM 2.5 Removals for full life of a Tree (i.e. 65.38 years age) in Rs				**6152.258**	**13.672**

Source: Bagaria et al.,2023; 1 USD = Rs 80; Tree age = 65.38 years

14

Table 8: Forest type wise annual quantification of removal of PM10 along with valuation for removals of PM 10 in India

Forest Type	Total removal PM10 tonnes	PM10 removal kg per ha	PM10 removal kg per tree	Value PM10 (US$/ha)	Value PM10 (US$/tree)
FT1 Tropical Wet Evergreen	9661.66	4.82	0.0107	233.21	0.518
FT2 Tropical Semi Evergreen	55023.33	7.73	0.0172	214.7	0.477
FT3 Tropical Moist Deciduous	71639.75	5.29	0.0117	179.26	0.398
FT4 Littoral & Swamp Forest	6330.55	11.31	0.0251	416.78	0.926
FT5 Tropical Dry Deciduous	117558.85	3.75	0.0083	132.3	0.294
FT6 Tropical Thorn Forests	4305.46	2.06	0.0046	87.1	0.194
FT7 Tropical Dry Evergreen	637.67	6.81	0.0151	94.55	0.210
FT8 Subtropical Broadleaved	6239.38	1.91	0.0042	129.51	0.288
FT9 Subtropical Pine	7192.83	3.97	0.0088	196.55	0.437
FT10 Subtropical Dry Evergreen	22.75	1.26	0.0028	166.97	0.371
FT11 Montane Wet Temperate	2765.8	1.35	0.003	154.97	0.344
FT12 Himalayan Moist Temperate	18831.74	7.32	0.0163	179.91	0.400
FT13 Himalayan Dry Temperate	590.62	1.05	0.0023	41.1	0.091
FT14 Sub Alpine Forests	2642.34	1.76	0.0039	54.98	0.122
FT15 Moist Alpine Scrub	215.58	2.25	0.005	40.18	0.089
F16 Dry Alpine Scrub	165.77	0.57	0.0013	29.59	0.066
Average	18989.005	3.951	0.009	146.979	0.327
PM 10 Removals for full life of a Tree (i.e. 65.38 years age)			0.573	9609.471	21.354
Value of PM 10 Removals for full life of a Tree (i.e. 65.38 years age) in Rs				768757.654	1708.350

Source: Bagaria et al.,2023; 1 USD = Rs 80; Tree age = 65.38 years

15

Valuation of Habitat and Biodiversity Services

Table 9: Forest type wise valuation on per hectare basis of ecosystem services in India

Forest Type	Value Habitat (US$/ha)	Value Biodiversity (US$/ha)	Value Habitat (US$/tree)	Value Biodiversity (US$/tree)
FT1 Tropical Wet Evergreen	5108.1	6964.75	11.35	15.48
FT2 Tropical Semi Evergreen	4081.39	7398.3	9.07	16.44
FT3 Tropical Moist Deciduous	4505.65	6321.42	10.01	14.05
FT4 Littoral & Swamp Forest	5286.29	3440.42	11.75	7.65
FT5 Tropical Dry Deciduous	4361.4	5859.9	9.69	13.02
FT6 Tropical Thorn Forests	4683.84	5048.75	10.41	11.22
FT7 Tropical Dry Evergreen	4598.99	5706.06	10.22	12.68
FT8 Subtropical Broadleaved	4166.24	6349.39	9.26	14.11
FT9 Subtropical Pine	3971.08	4936.86	8.82	10.97
FT10 Subtropical Dry Evergreen	3478.94	4069.76	7.73	9.04
FT11 Montane Wet Temperate	4174.73	4894.91	9.28	10.88
FT12 Himalayan Moist Temperate	3826.83	6125.62	8.50	13.61
FT13 Himalayan Dry Temperate	3665.61	4880.92	8.15	10.85
FT14 Sub Alpine Forests	4157.76	4922.88	9.24	10.94
FT15 Moist Alpine Scrub	3911.68	3580.27	8.69	7.96
F16 Dry Alpine Scrub	3809.86	3146.72	8.47	6.99
Average	**4236.77**	**5227.93**	**9.42**	**11.62**
Value for full life of a Tree (i.e. 65.38 years age)			**615.56**	**759.56**
Value for full life of a Tree (i.e. 65.38 years age) in Rs			**49244.50**	**60764.85**

Source: Pandey et al., 2024b; 1 USD = Rs 80; Tree age = 65.38 years

16

Table 10: Valuation of intangible services for per tree

Service	Total Value (in Rs)
Habitat services	49244.50
Biodiversity services	60764.85
PM2.5 removal	13.672
PM10 removal	1708.35
Soil Conservation	68.502
Total value of Intangible services (in INR Rs)	111799.87 ≈ 111800

17

DOC-20240913-WA0047.

1 message

Jitendra Kamal <jitendrakamal4@gmail.com> Fri, 13 Sep, 2024 at 2:36 pm
To: rahulpratap.adv@yahoo.com, advskrattan@yahoo.com, Prashant Manchanda <prashant.manchanda05@gmail.com>, cs@punjab.gov.in

Sir/Madam,

Enclosed herewith is the copy of reply affidavit being filed on behalf of Respondent 3 in the matter of OA 739 of 2023 Environment protection society SAS Nagar VS Ministry of environment and climate change

Jitender Singh Kamal
Office of
Sanjay Katyal adv
Adv for R 3