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Research Article

Distribution Pattern of Forest in Nadia District of West Bengal, India

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Abstract

Forests play a crucial role in maintaining ecological balance, biodiversity and livelihood security. The present study analyses the distribution pattern of forests in Nadia district of West Bengal, India, by highlighting spatial variability in forest types, forest cover status and administrative management. Although the FAO defines forest as land spanning more than 0.5 hectares with a minimum 10% canopy cover, the legal status of forest in Nadia district does not necessarily reflect actual tree presence, resulting in a discrepancy between forest area and forest cover. The findings reveal that forest distribution in Nadia district is highly uneven, with dense forests concentrated in the northern and southern parts of West Bengal, while scattered and degraded forests dominate the southwestern regions. In the Nadia–Murshidabad Forest Division (NMFD), the total forest area is 2003.49 hectares, of which Nadia district accounts for only 1233.43 hectares, representing a mere 0.33% of its total geographical area, far below the national forest policy target of 33%.

The study identifies multiple vegetation types, such as moist deciduous, dry deciduous, riverine and littoral forests, distributed differently across the district. Administrative distribution includes three range offices and ten beat offices, though only six beats contain forest land. Long-term assessment from 1999 to 2019 shows that forest cover in Nadia has gradually increased due to plantation and conservation initiatives, especially under programmes like CAMPA, Namami Gange, QGS, Strip Plantation and Social Forestry. Government-led and private plantations significantly contribute to the growing proportion of Moderately Dense Forest (MDF) and Open Forest (OF). However, issues such as illegal logging, infrastructure development, and high human pressure continue to threaten forest sustainability.

The study concludes that strengthening grassroots forest governance, enhancing community participation, promoting plantation drives, increasing outposts and reducing dependence on protected forests for livelihood are essential to restore ecological stability in the district. Ensuring planned afforestation and preservation of existing forest patches can contribute meaningfully toward enhancing forest cover and sustaining biodiversity in Nadia district.

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KEYWORDS: Reserve forest, Protected Forest, Livelihood, Scattered Forest, Moist and dry deciduous forest, Forest category

1. INTRODUCTION

A forest is an ecosystem with a dense community of trees. Tree density, tree height, legal status, ecological function, land use, etc, are the key factors to incorporate the concept of forest. The United Nations' Food and Agriculture Organisation (FAO) define forest as 'Land spanning more than 0.5 hectares with trees higher than 05 meters and a canopy cover of more than 10 per cent. It does not include land that is predominantly under agricultural use. An area can be legally designated as 'forest' even if no trees grow on it.

The allocation of forest patterns in Nadia District is purely uneven. The forest pattern of West Bengal varies from one place to another. In the northern and southern parts of Bengal, the forest is dense, and south south-southwestern part is covered with scattered types of forest. As a result, reserve forests or wildlife sanctuaries are found both extreme north and the extreme south of Bengal. Generally, the activities of people for daily livelihoods in reserve forests or in wildlife sanctuaries are less than protected forests. So, disturbance is higher in a protected forest than reserve forest or a wild wildlife sanctuary. This is why protected forests in Bengal, including Nadia District, are degrading gradually. In a classed state forest, there is no restriction or hindrance as there is in a reserve or in a protected forest.

History of Nadia Murshidabad Forest Division

Nadia Murshidabad Division came into being on 7th of June in l946, with the forest area of the District of Nadia, Murshidabad and the Bongaon subdivision of District 24 Parganas. It was known as the Central Division till the mid-eighties of 1985 and was placed under the Central Circle. Since then, the Divisional Headquarters has been in Krishnagar. At the time of the reorganisation of Nadia Murshidabad Forest Division in 1996, the forest area of Bongaon subdivision was handed over to the newly created 24 Parganas (North) Division 1996.

Types of vegetation available in the Nadia district

Moist Deciduous Forest: Rainfall 100 cm - 200 cm, mean annual temperature above 25°C with moist summer and cool winter, also called broad leaf forest, sheds leaves every year during the spring and early summer and provides organic content in soil, occupies a larger area than evergreen forest. For example, Neem, Shisu (Indian Resewood) Kul, Jhika /Indian Ash Tree (Lannea Coromandelica, Kocha Gach), Jarul, Palash, etc.

Dry Deciduous Forest: Rainfall 70 cm - 100 cm, mean annual temperature 19°C to 24°C. These types of trees lose their leaves at the beginning of the dry (winter) season. For example, teak, sal, Mahua, Palas, Beal, Amra, Ata (Ram Phal),

Riverine Forest: Trees available on both sides of the river where moisture is high due to the situation of the river, and can tolerate flooding. For example, Banyan tree, Coconut, Banana, Sishu, Arjun, Bamboo, Mango, Akashmoni, Pituli.

Littoral Forest: Along the clayey river bank up to Nabadwip. For example, Nalkhagra, hogla, bet, coconut, and dhol kolmi.

Fig. 1: Location map of the study area with respect to India and West Bengal

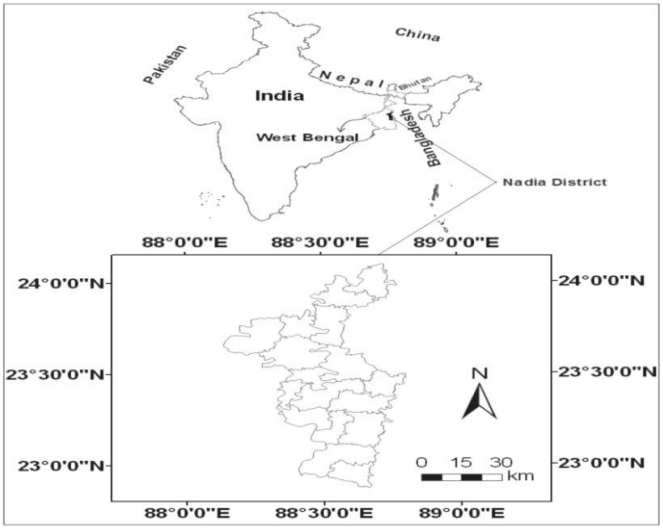
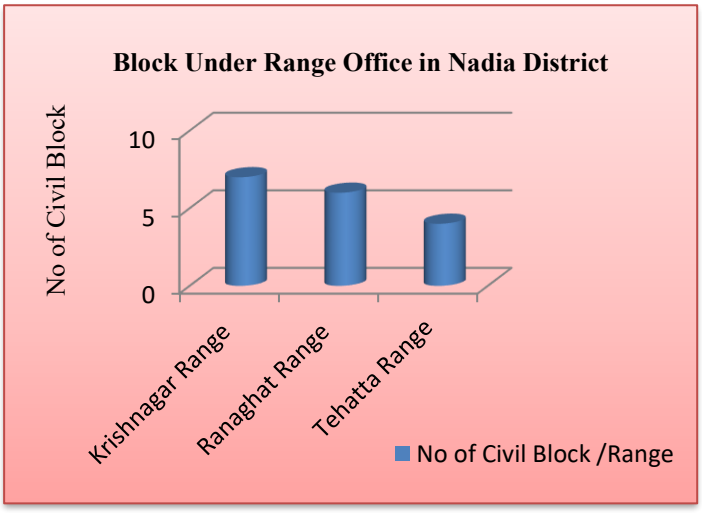


Fig. 2: No of civil blocks occupied by the Range Office in Nadia District



Category-wise Forest distribution in Nadia district

As Nadia district is under Nadia Murshidabad Forest Division (NMFD), hence at the time of forest distribution and discussion both of the district is important to discuss. The total forest area in the NMFD is 2003.490 hectares, where Nadia has 1233.430 hectares, and the rest are in Murshudabad district.

Table 1: Forest details in Nadia-Murshidabad Forest division

Category	Total Area	Nadia	Murshidabad
Reserved Forest	600.480 ha	510.37 ha	90.110 ha
Protected Forest	878.440 ha	317.29 ha	561.150 ha
U.C.S. Forest	524.570 ha	405.77 ha	118.800 ha
Total	2003.490 ha	1233.430 ha	770.060 ha

Sources: Divisional Forest Office, Nadia Murshidabad Forest Division, (2022) Krishnagar, Nadia, West Bengal.

Fig. 3: Types of forest (hec.) in Nadia – Murshidabad district: 2021

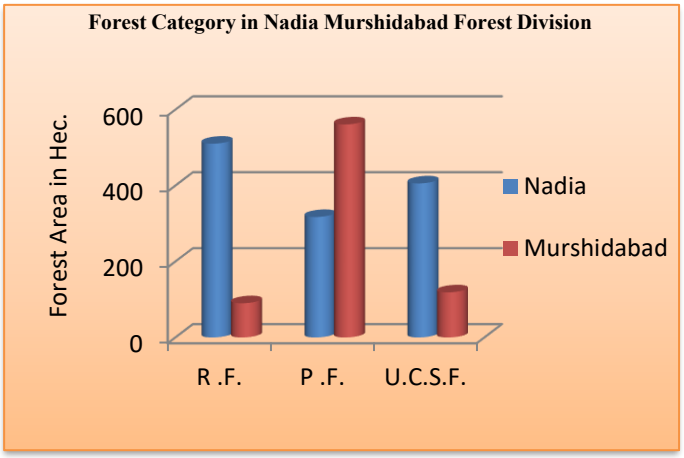
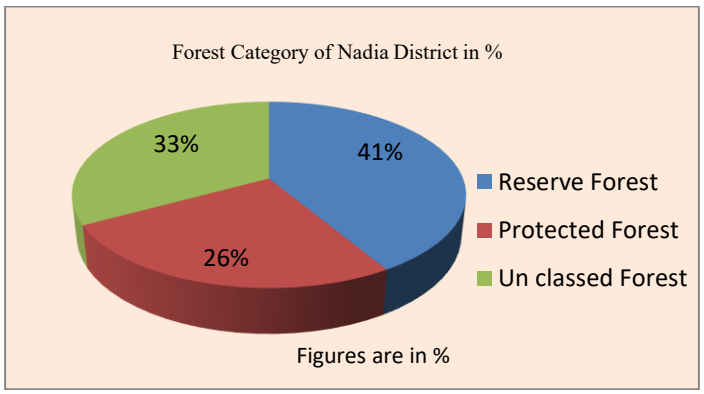


Fig. 4: Percentage (%) of RF, PF and UCSF of Nadia District – 2023



Sources: DFO, Nadia Murshidabad Forest Division, Krishnagar, Nadia.

Range and Beat-wise Forest distribution in Nadia district: In Nadia district, there are three (03) ranges and ten (10) beat office that covers the entire district. Ranaghat range (hq-Hijuli) and beat has the highest forest area of 301.23 hac. Krishnagar range and beat office has second second-highest forest area of 271.16 hectares, and Bethuadahari Wild Life Sanctuary (WLS) has the lowest forest area of 67.64 hectares. Bethuadahari beat has 245.61 ha area (3rd position), Mahatpur beat is in 4th position (214.37 ha). Among the ten (10) beats of the district, six (06) no of beats have forest area, and four (04) no of Beat have no forest area that is-

Karimpur beat - (covered Karimpur-I and Karimpur-II block). Tehatta Beat - (covered Tehatta –I and Tehatta - II block). Hanskhali Beat - (covered Hanskhali and Krishnaganj Block). Kalyani Beat - (covered Chakdaha, Kalyani and Haringhata Block). Among these four beats, the Karimpur and Tehatta Beat are from the Tehatta Range office and the Hanskhali and Kalyani Beat offices are from the Ranaghat Range office. Besides the Range and Beat office, there is another smallest administrative unit of 'Out Post 'which minutely observes the activities among villagers and the forest. Outpost plays a very crucial role in maintaining the forest health and communicating with the village people and the forest at the grassroots level. So every Range and Beat office should have sufficient 'Out Post' to maintain forest-related everything from the grassroots level.

Photograph 1: Debagram outpost from Ranaghat Range and Beat, engaged to protect Debagram reserve forest from illegal activities (29.12.2022)

Forest cover of Nadia district: Forest cover is the amount of forest that covers a particular area of land. It may be measured as relative (in percentage) or absolute (in sq km / sq. miles). Most of the world's forest cover (45%) is found in the tropics and the Nadia district is also in this zone. Assessing forest cover by using satellite data is the main activity of FSI since 1985 for every two years. In the definition of forest cover, the minimum area is one (01) hectare because this area is suitable to delineate on a map at 1: 50000 scale. The term 'forest cover' indicates the presence of trees over any land where the land criteria must be one or more hectares.

Photograph 2: Types of forest in Nadia District

Deciduous Jarul in Debagram - Pondepara Forest under Ranaghat Range, taken on 28.12.2022.

Evergreen Mixed Trees in Billwogram Forest under Krishnanagar Range near B.W.L.S. taken on 20.06.2023.

According to the National Forest Policy (NFP) of -1952 and 1988, the total forest land of the country should be 33 % of the total geographical area. In India. West Bengal and in Nadia district, that is 21.71 %, 13.28 % and 0.33 % respectively, which is very poor according to the forest policy of 1952 and 1988. In Nadia District Forest area is only 0.33 % of the total geographical area; this is too negligible and not expected from any geographical area. India and West Bengal are also not in good condition and require improvement.

As forest area and forest cover are separate concepts, though there a similarities and connections between forest cover with Very Dense Forest (V.D.F), Moderately Dense Forest (M.D.F) and Open Forest (O.F).

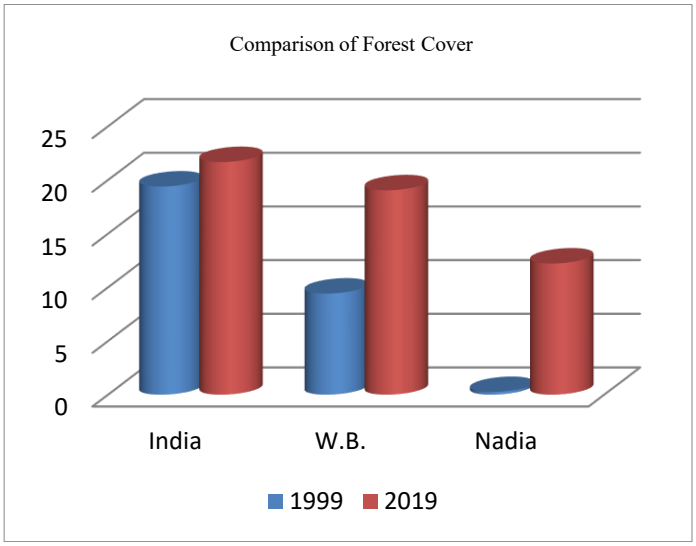


Fig. 5: Showing a clear comparison of forest cover in percentages (%) among India, West Bengal and the study area of Nadia district for the years 1999 and 2019.

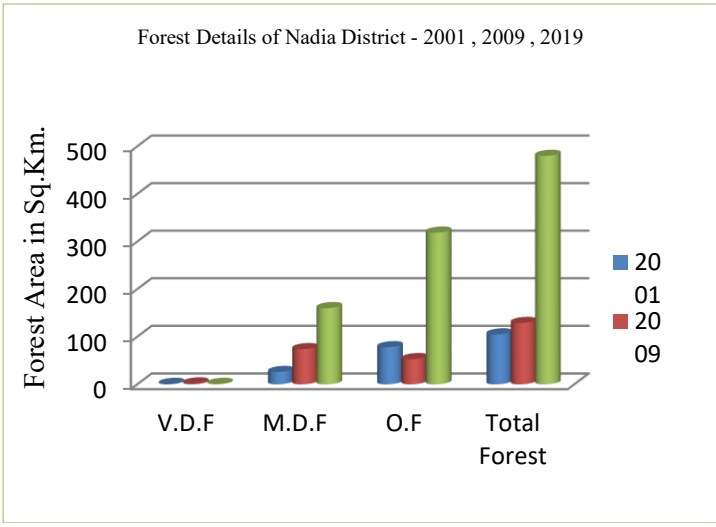
Table 2: Forest Cover of India, West Bengal and Nadia District (in %) from 1999 to 2019

Assessment Year	Forest Cover of India (%)	Forest Cover of W.B. (%)	Forest Cover of Nadia (%)
1999	19.39	9.42	0.25
2001	20.55	12.04	2.67
2003	20.63	13.9	2.42
2005	20.6	13.99	3.28
2007	21.02	14.64	3.28
2009	21.06	14.64	3.28
2011	21.05	14.64	12.2
2013	21.23	18.93	12.2
2015	21.33	18.95	12.2
2017	21.54	18.98	12.22
2019	21.67	19.04	12.22

Sources: Indian State of Forest Report -1999, 2005, 2009, 2011, 2013, 2017, 2019.

A Dense Forest is a forest where trees grow very closely to each other. Dense Forest is the Abode of a wide range of animals, plants and microorganisms; hence, it has rich biodiversity. Dense forests regulate the temperature and weather patterns locally or globally and can produce natural medicines. Dense Forest has a canopy density of 70% and above, Mod Dense Forest has a canopy density of 40 % - 70% and the canopy density of open forest is 10% to 40%. From 1987, the Forest Survey of India (Ministry of Environment and Forests), Dehradun, began to publish the 'State of Forest Report' biannually by using remote sensing techniques. Forest-related information for each state is available here.

Fig. 6: Forest Details of Nadia District - 2001, 2009, 2019

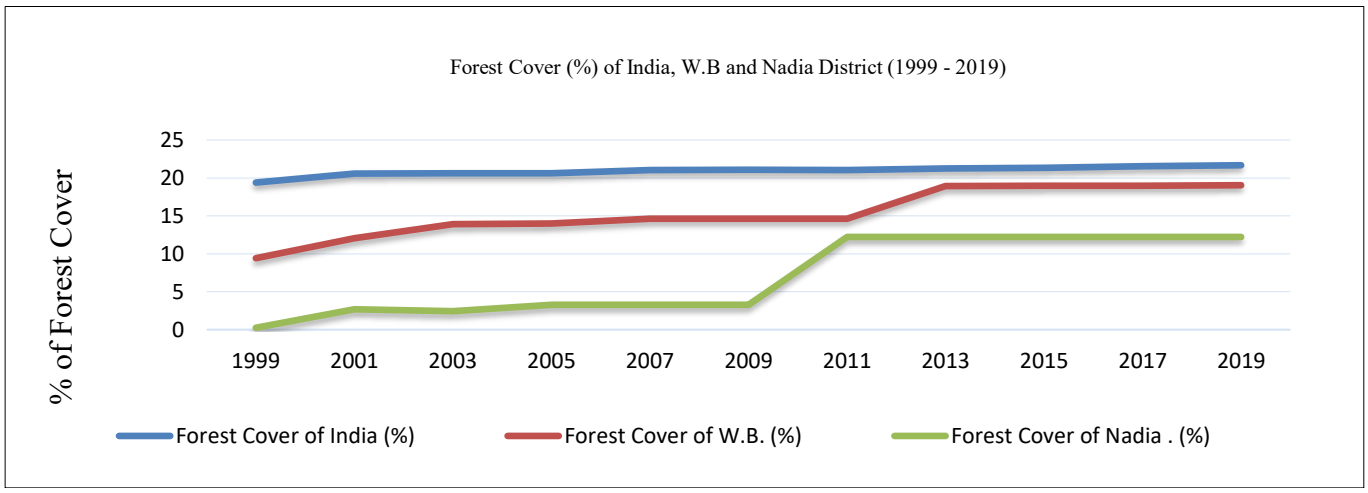


Moderately Dense Forest (M.D.F) in sq.km is increasing year to year than that of V.D.F in the table no -5.8, and said forest is totally zero (0) in the assessment year of 1999. Assessment year 2003 indicates the lowest Moderately Dense Forest (M.D.F), twenty-four (24) sq.km. The amount of 160.16 sq.km said forest is available in the years 2017 and 2019, and these two consecutive years have gained the highest M.D.F in that table from the period of 1999 to 2019. Assessment years 2011 and

2013 have a notable amount of forest, which is 159 sq km for both years.

Open Forest (O.F) in the same table (no. 5.8) is overall more than the previous two categories (VDF and MDF). In the year 1999, there was no open forest in Nadia District, and in 2005, 2007 and 2009, it had the lowest open forest that was 53 sq km. In 2017 and 2019, it had the highest amount of open forest area in the district. Assessment year 2015 has the second-highest amount of open forest. Years 2011 and 2013 have third third-highest amount of open forest area in the district between the time of 1999 to 2019 assessment year.

Fig. 7: Forest Cover of India, West Bengal and Nadia District from 1999 to 2019.



Photograph 3: Manmade destruction of the Forest to make life more comfortable for modern Society

A

B

A: Trees are being cut down along NH-34(Presently-12), Nadia Murshudabad Division, Takipur Mauza in the district of Murshidabad on 11.09.2023

B: Trees have been cut down to construct bridges on the Jalangi River to fulfil man's desire. Photo captured on 09.03.2024.

Photograph 4: Different parts of the central nursery of the Nadia Murshudabad Forest Division, Krishnanagar, Nadia.

A

B

C.

D.

A Mother Bed to plant /create a sapling. | **B.** Glass shape pot to hold sapling from Mother Bed.
C. Researcher with Forest Gourd in the central Nursery at DFO, Krishnagar, Nadia. | **D.** Identification of various saplings by the Research.

Different Types of Trees

Shed Giving Trees: Among shed giving trees, Bakul (*Mimusops Elengi*), Bat/Bot Tree (*Ficus Bengalenis*), Ashothyo/Bodhi Tree (*Ficus religiosa*), Gab (Diospyros Malabarica), Kadom/Cadamba (*Neolamarckia Cadamba*), Siris/ Chotka (Albizzia Lebbeck) etc, are important. In the summer season, sitting under the trees is very pleasant, especially under the above-mentioned trees (Table 5.12). So, shade-giving trees have a valuable importance in our society, and hence these trees should be preserved with all respect for the benefit of human beings.

Flowering Trees: Among flowering trees in the district Krishnachura (*Delonix Regia*), Radhachura (*Caesalpinia Pulcharrima*), Simul Tulo/Cotton (*Bombax Ceiba*), Shiuli/Parijat (*Nyctanthes Arbour – Tristis*), Kanchan (Bauhinia Variegata), Bakul (*Mimusops Elengi*), etc, are very common from season to season. The others are not popular or common.

Fruits giving Trees: Mango (Mangifera Indica), Jam/Berry (Cyzygium Cumini), Banana (Musa Acuminata), Litchi (Litchi Chinensis), Jackfruit (Artocarpus Heterophyllus), Coconut (*Cocos Nucifera*), Beal/Sri Fal (*Aegle Marmelos*), Kul/Baroi (Ziziphus Mauritiana), Peyara/Gaya/Amrut (Psidium Guajava), taal (Borassus Flabellifer), etc, are more available in the district throughout the year. The other fruit-giving trees (Table No. 5.14) were also found but not available, like the above-mentioned fruit-giving trees.

Photograph 5: Phantom's trees in the rural area of Nadia district.

Gab Tree (*Diospyros Malabarica*) captured by a researcher on 20.03.2024 from Badkulla Bapuji Nagar.

Shaorah Tree/Sand Paper Tree (*Streblus Asper*) captured by the researcher on 23.03.2024 from Palpara

Sources: Field Survey by the researcher (Biswas, M) and Internet Access

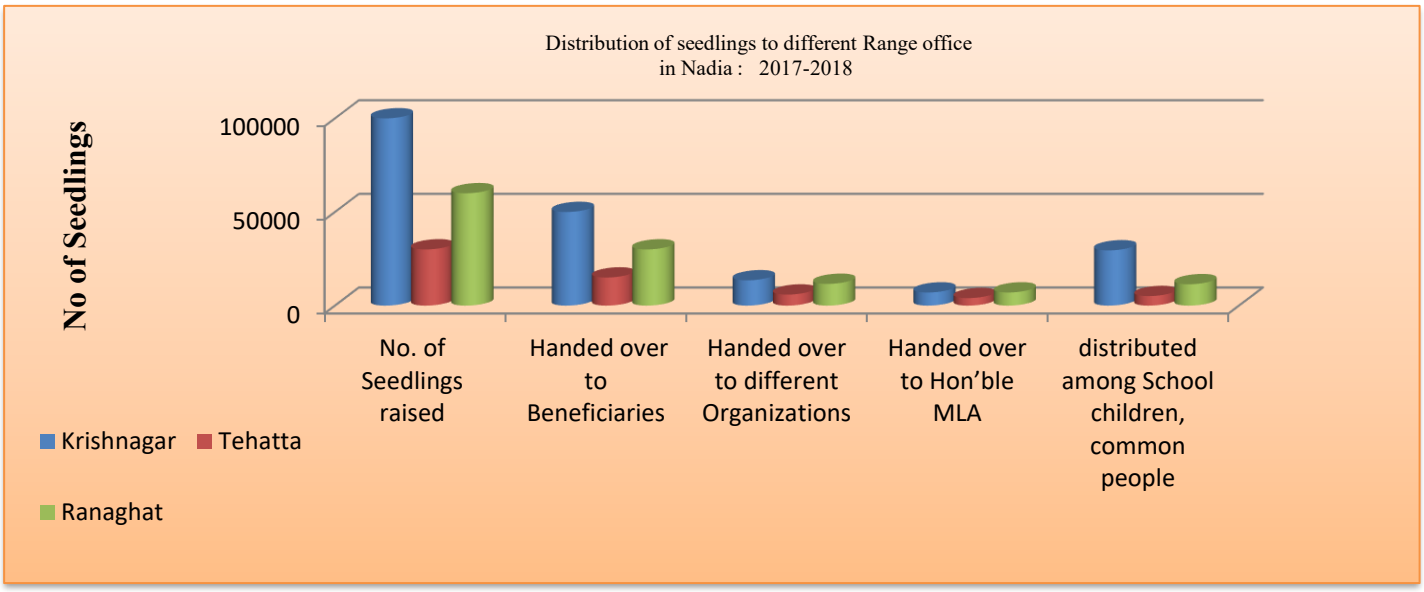
Phantom's Listeners Trees

In the rural areas of Bengal, as well as in Nadia District, there is a running proverb that there is a phantom tree in the rural area in which phantom and Ghost listeners lived in the trees. For example, Gab Tree (*Diospyros Malabarica*), Tamarind (*Tamarindus Indica*), Chatim /Devil's Tree (*Alstonia Scholaris*), Hijol Tree (*Baringtonia Acutangula*), Cane fruit/Rattan fruit/Bet (*Calamus Tenuis*), Shaorah Tree/Sand Paper Tree (*Streblus Asper*), etc, are the very common names in the rural areas of Nadia in where ghosts live. Village people don't dare to go within this tree area even during the daytime.

Distribution of Seedlings to increase the Greenery in Nadia District

In the Nadia district, from the DFO's office, a lot of seedlings have been distributed to each and every BDO of the district in the year 2017-2018. The maximum no of seedlings was distributed to the block of Chakdaha, and the amount is 6961 and Krishnagar -I gained 5670 seedlings, and the third highest no of seedlings was under the Santipur block, that is 4939 and Krishnagar –II is the lowest receiver of seedlings is with 1410. The total no of seedlings that were distributed in the year 2017-2018 was 59447 nos of seedlings (Table No. 5.17 and Figure no-5.

Fig. 8: Seedling distribution to different Range offices in Nadia district



To increase the forest area or forest cover, plantations by the initiative of the government or private/individual are much more important. Anyhow, the area of legal forest status must be increased in any form. In this regard, the range-wise distribution of seedlings has a deep effect on society. School, College, Club, NGO, Common people, MLA, Farmers for agro forestry and social forestry, Panchayet, Zilaparishod, Superintendent of Hospital, Head of varieties offices, BMOH, CMOH, etc can get seedlings from the Forest. Department and DFO. Krishnagar range has distributed the highest no of seedlings (50000) to beneficiaries, Tehatta range 15000 seedlings, and Ranaghat range 30000 seedlings have been distributed to the different beneficiaries, and this is the highest among all.

Table 3: Creation of Plantation under Namami Gange Programme: 2017-2018

Work Item	Location	Target	Achievement
Creation of Institutional Plantation	Range-Ranaghat & Beat- Ranaghat	2 ha.	2 ha.
Creation of the Riverbank Plantation	Range-Krishnagar & Beat- Krishnagar	10 ha.	10 ha.

Sources: Annual Report -2017-2018, Nadia Murshidabad Forest Division.

Governmental Scheme to increase the Plantation and Forest Area

Qgs, Strip plantation, Namami Gange, Green Evenue, CAMPA (Compensatory Afforestation Fund Management and Planning Authority CAMPA,2004, is a tool to promote afforestation in various ways (agroforestry, social forestry, silviculture, etc) and regeneration activities of forest as a way of compensating for destroyed forest land that has been diverted into non-forest activities. Forest management, conservation, Fencing, wildlife conservation, etc, are done through CAMPA.) MGNREGA, etc, are the different types of plantation programs in Nadia District.

Social Forestry: The National Commission on Forests used the term Social Forestry in 1976. To use unused and fallow land in rural areas and around the urban settlement by using fast-growing trees to meet the needs of fodder and fuel wood. Types of social forestry are Scientific Forestry or Silviculture, Farm Forestry, Community Forestry, Agro-Forestry, and Extension Forestry.

Rural Fuelwood Plantation (RFP) and Canal Embankment Plantation (CEP): Both of these are very useful tools for increasing plantation cover in rural areas, which is a safeguard of the forest.

Van Mahotsav: Every 1st to 7th July is celebrated as a tree-planting festival to increase the plantation. It was first introduced by K.M. Munshi in 1950, the then Union Minister of Agriculture. To create enthusiasm for forest conservation and the planting of trees.

Table 4: Different types of plantations from 2020 -2024 in Nadia.

	Plantation Types	Area in Hectare in Nadia
2020-2021	QGS	4.79
	Strip	Nill
2021-2022	QGS	5
	Strip	10
	NGT	15.76
	Namami Gange	12
	Green Evenue	10
2022 -2023	QGS	5
	Namami Gange	21
2023 -2024	Strip	5
	Namami Gange	0.5

Sources: Annual Report -2017-2018, Nadia Murshidabad Forest Division.

Manmade Plantation in Nadia District: Manmade plantation is very important to increase Forest Cover (F.C.), which is the amount of forest that covers a particular area of land, which may be measured as relative (%) or absolute (square kilometres). In other words, Forest Cover may be defined as 'all land more than one hectare in area with a tree canopy density of more than 10 % irrespective of ownership and legal status. Such land may not necessarily be a recorded forest. It also may include Orchards, Bamboo, Palm and manmade plantations.

Photograph 6: Example of Manmade Plantation in Nadia District

Sources: Field survey by the researcher.

(A) Segun tree (*Tectona Grandis*) at Palpara Enayetpur
(B) Lambu (*Khaya Anthotheca*) Plantation at Billwagram
(C) Akashmoni (*Acacia Auriculiformis*) Plantation at Simurali, Natun Pally
(D) Mixed Plantation at Simurali, Natun Pally.

Forest resources under private/individuals in Nadia District

During the period of Panini (Panini, the father of Sanskrit, was an ancient Indian grammarian who lived in the 4th century BCE. His work on the Sanskrit language and grammar is still considered one of the greatest achievements in linguistic history. Mentioned that there were artificial forests too. The artificial forest gardens in his period were called **'Amrabana'.** The names of trees that were listed in the period of Panini are as below –

(1) Ashbatha (Ficus Religiosa).
(2). Bot Tree (*Ficus Bengalensis*).
(3) Aam (*Mangifera Indica*).
(4). Jutikodom/ Subabul (*Acacia Catechu*).
(5). Saal (*Shorea Robusta*).
(6). Taal (*Borassus Flabellifer*).
(7). Kul/Baroi (*Ziziphus Mauritiana*).
(8). Dumur (*Ficus Glomererata*).
(9) Sirish (*Albizza Lebbek*), etc, were mentioned at the time of Panini.

Table 5: Private/Individual Forest in Nadia District (1997-1998 to 2003-2004)

Survey Year	Private /Individual Forest (ha.)
1997-1998	2301.5
1998-1999	2395.5
1999-2000	2395.5
2000-2001	2399.6
2001-2002	2399.6
2002-2003	2399.6
2003-2004	2399.6

Sources: District Statistical Handbook, Nadia District,1999, 2004.

In the year 1997-1998, the private forest was 2301.50 hectares and increased to 2395.50 hectares year 1998 and 1999, and again increased to 2399.60 in the year 2000-2001, and it was the same till 2003-2004. So, the graph is suddenly increasing in the year 1998-1999, and after that it is more or less parallelly going to the end (2003-2004).

RESULT AND DISCUSSION

The distribution of forests in Nadia district is very uneven. The northern part of the district is nearly forest-free, while the middle and southern part has some forest areas. The Tehatta range, from the northern part, has no legal forest area, whereas the Krishnagar and Ranaghat range have 1233.430 hectares of forest area. Forest cover in Nadia is gradually increasing from 1999 (0.25%) to 2019(12.22%), from Table 02. By the forest department, different types of plantations are also available in the district from 2020 -2024. Such as QGS, Namami Ganges, Strip, NGT, etc (table no 4). Forest under private also in a good position, like 2399.6 hectares in 2003-2004. Manmade plantation and manmade destruction also affect the distribution and pattern of the forest of Nadia (Photographs nos. -2,3, 5 and 6).

CONCLUSION

Once, the forests were large and people less in number. Sages lived in these jungles and imparted training and spiritual enlightenment. The pressure on forests increased considerably later. The increasing population with changing morals led to the destruction of the forest. Around 1960, the Government of India invited Dr J.von Monroy, a FAO expert in forest industries, to study the country's raw material resources for industries. He recommended raising a plantation of quick-growing species such as Eucalyptus. Today, with an increasing human population, growing industrialisation and waste generation, the challenge is to determine ways and means of ensuring that biodiversity conservation is an integral part of forest management.

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