

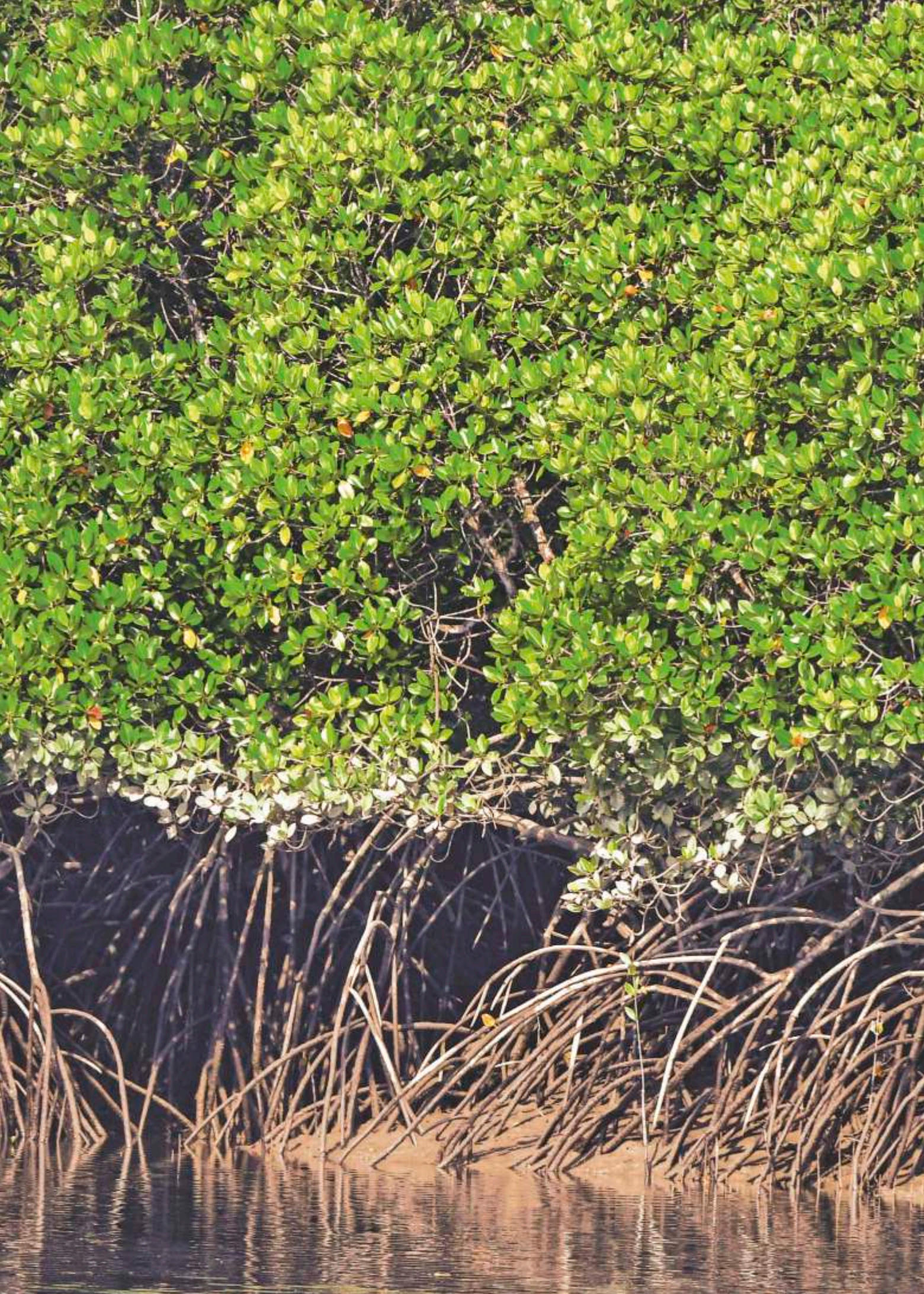




03



MANGROVE COVER



Introduction

3.1

Mangroves are salt tolerant plant communities found in tropical and sub-tropical intertidal regions of the world. Such areas are characterized by high rainfall (between 1,000 to 3,000 mm) and temperature (ranging between 26°C-35°C). Mangrove species exhibit a variety of adaptations in morphology, anatomy and physiology to survive in water logged soils, high salinity and frequent cyclonic storms and tidal surges. Mangroves are important refuges of coastal bio-diversity and also act as bio-shields against extreme climatic events. Large populations, primarily rural, depend on Mangrove ecosystems for a wide variety of biomass dependent livelihoods.

Biotic pressure and natural calamities play a major role in negatively impacting Mangrove ecosystems. Growing land reclamation for agriculture and industrialization along the coastlines and discharge of untreated domestic sewage and industrial effluents are damaging to these forests. Upstream activities related to river training and natural erosion and accretion also have an affect on the health of Mangroves since an adequate ecological flow in the rivers is essential for flushing of the Mangroves of silt and other wastes. Many studies have highlighted these problems and intensive conservation efforts are needed to ensure the survival of these sensitive ecosystems.

The Forest Survey of India has been assessing the Mangrove cover using remote sensing since 1987. In the first assessment, carried out at 1:1 million scale, the estimated extent of the Mangrove cover was 4,046 sq km. Subsequently, from 1989 to 1999 the Mangrove cover was assessed regularly on a two-year cycle at 1:250,000 scale. Assessment from 2001 onwards has been carried out at 1:50,000 scale.

3.2 Status of Mangrove Cover Worldwide

As per Global Forest Resource Assessment, 2020 (FRA 2020), world over, 113 countries have Mangrove forests covering an estimated 14.79 million hectares. The largest Mangrove area is reported in Asia (5.55 million hectares), followed by Africa (3.24 million hectares), North and Central America (2.57 million hectares) and South America (2.13 million hectares). Oceania has reported the smallest area of Mangroves (1.30 million hectares). More than 40 percent of the total area of Mangroves was reported to be in just four countries: Indonesia (19 percent of the total), Brazil (9 percent), Nigeria (7 percent) and Mexico (6 percent).¹

3.3 Conservation of Mangroves

In most countries, Mangrove ecosystems face constant pressure due to increasing human population in coastal areas and the rising demand for land, timber, fodder, fuel-wood and other non-wood forest products. Appropriate management regimes are germane to effective conservation of Mangroves.

Mangroves are repositories of rich biodiversity. According to Champion & Seth Classification (1968)², Mangroves are included in Type Group- 4 Littoral & Swamp Forests and are covered under 4A/L1 Littoral forest, 4B/TS1 Mangrove scrub, 4B/TS2 Mangrove forest, 4B/TS3 Saltwater mixed forest (*Heritiera*) and 4B/TS4 Brackish water mixed forest (*Heritiera*) types.

Important species of Mangrove ecosystems in India include *Avicennia officinalis*, *Rhizophora mucronata*, *Sonneratia alba*, *Avicennia alba*, *Bruguiera cylindrica*, *Heritiera littoralis*, *Phoenix paludosa*, *Morinda citrifolia* & *Ceriops tagal*.

Sunderban, located in the northern Bay of Bengal is the world's largest single patch of Mangrove Forests. Spread over approximately 10,000 sq km, in Bangladesh and India, Sundarban is the first Mangrove forest in the world, which was brought under scientific management, as early as in 1892. Appreciating the importance of Mangroves, the Government of India set up a National Mangroves Committee in 1976 to advise the Government on issues related to conservation and development of Mangroves in the country. The Committee emphasized the need to conduct a survey of the extent of existing Mangrove areas within the country. Subsequently, the government formulated a scheme for Mangrove conservation and protection.



¹ Source: Food and Agriculture Organisation, 2020.

² Champion H.G. and Seth S.K. (1968). A revised survey of: *The Forest Types of India*. Forest Research Institute, Dehradun.



This scheme had the areas of focus:

- Identification of selected Mangrove areas for conservation;
- Preparation of a management plan;
- Promotion of research;
- Adoption of a multidisciplinary approach involving state governments, universities, research institutions and local organizations.

Due to the rich biodiversity and ecological and environmental significance of Mangrove ecosystems, the conservation of Mangroves is a focus area in India.

Status of Mangrove Cover in India

3.4

Mangroves show conspicuous tone and texture on the satellite images. The Mangrove cover in this assessment has been categorized into Very Dense (canopy density of 70% and above), Moderately Dense (canopy density of 40% and more but less than 70%) and Open categories (canopy density of 10% and more but less than 40%). Table 3.1 presents status of Mangrove cover since 1987 onwards.

Table 3.1
Mangrove
Cover
Assessment
in States/UTs
from 1987 -
2019

| State/UT | 1987 | 1989 | 1991 | 1993 | 1995 | 1997 | 1999 |
|----------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Andhra Pradesh | 495 | 405 | 399 | 378 | 383 | 383 | 397 |
| Goa | 0 | 3 | 3 | 3 | 3 | 5 | 5 |
| Gujarat | 427 | 412 | 397 | 419 | 689 | 901 | 1,031 |
| Karnataka | 0 | 0 | 0 | 0 | 2 | 3 | 3 |
| Kerala | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Maharashtra | 140 | 114 | 113 | 155 | 155 | 124 | 108 |
| Odisha | 199 | 192 | 195 | 195 | 195 | 211 | 215 |
| Tamil Nadu | 23 | 47 | 47 | 21 | 21 | 21 | 21 |
| West Bengal | 2,076 | 2,109 | 2,119 | 2,119 | 2,119 | 2,123 | 2,125 |
| A&N Islands | 686 | 973 | 971 | 966 | 966 | 966 | 966 |
| Daman& Diu | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Puducherry | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 4,046 | 4,255 | 4,244 | 4,256 | 4,533 | 4,737 | 4,871 |

3.5 Mangrove Cover (2021 Assessment)

The current assessment shows that Mangrove cover in the country is 4,992 sq km, which is 0.15 % of the country's total geographical area. Very Dense Mangrove comprises 1,475 sq km (29.55 %) of the Mangrove cover; Moderately Dense Mangrove is 1,481 sq km (29.67 %) while Open Mangroves constitute an area of 2,036 sq km (40.78 %). There has been a net increase of 17 sq km in the Mangrove cover of the country as compared to 2019 assessment. The States that show significant gain in Mangrove cover are Odisha (8 sq km) and Maharashtra (4 sq km). The reason for the increase in Mangrove cover in Odisha, is mainly due to the natural regeneration, plantation activities in suitable land like on the banks of the rivers near the estuary and on intertidal mud-flats associated with the areas that are inundated by sea water on a daily cycle. The increase in Mangrove cover has been observed in the districts of Kendrapara, Jagatsinghpur and Balasore in Odisha. In Maharashtra, the increase in Mangrove cover is mainly due to natural regeneration. The increase has also been observed in the South 24 Parganas district of West Bengal. The State/ UT wise extent of Mangrove cover in the three canopy density classes along with the change in comparison to 2019 assessment is presented in the Table 3.2.



| State of Forest Report | | | | | | | | | (in sq km) |
|------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|------------|
| 2001 | 2003 | 2005 | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 | |
| 333 | 329 | 354 | 353 | 352 | 352 | 367 | 404 | 404 | |
| 5 | 16 | 16 | 17 | 22 | 22 | 26 | 26 | 26 | |
| 911 | 916 | 991 | 1,046 | 1,058 | 1,103 | 1,107 | 1,140 | 1,177 | |
| 2 | 3 | 3 | 3 | 3 | 3 | 3 | 10 | 10 | |
| 0 | 8 | 5 | 5 | 6 | 6 | 9 | 9 | 9 | |
| 118 | 158 | 186 | 186 | 186 | 186 | 222 | 304 | 320 | |
| 219 | 203 | 217 | 221 | 222 | 213 | 231 | 243 | 251 | |
| 23 | 35 | 36 | 39 | 39 | 39 | 47 | 49 | 45 | |
| 2,081 | 2,120 | 2,136 | 2,152 | 2,155 | 2,097 | 2,106 | 2,114 | 2,112 | |
| 789 | 658 | 635 | 615 | 617 | 604 | 617 | 617 | 616 | |
| 0 | 1 | 1 | 1 | 2 | 1.63 | 3 | 3 | 3 | |
| 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | |
| 4,482 | 4,448 | 4,581 | 4,639 | 4,663 | 4,628 | 4,740 | 4,921 | 4,975 | |

Mangrove Cover 2021

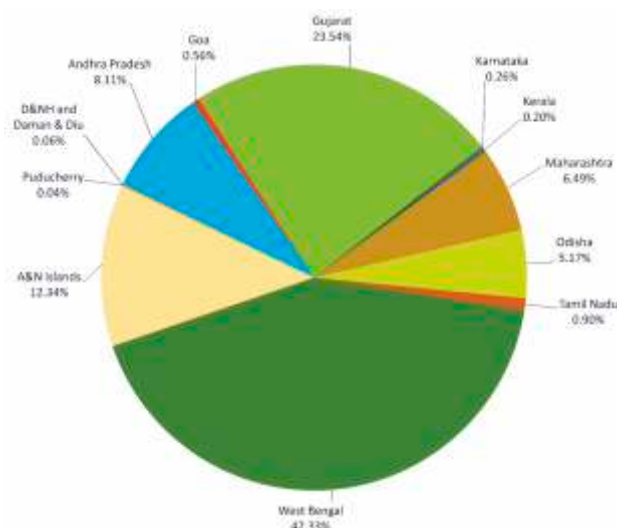


Figure 3.1
Pie chart
showing
Mangrove
Cover in
different State
& UTs

Table 3.2 Mangrove Cover Assessment 2021

(in sq km)

| Sl. No. | State/UT | Very Dense Mangrove | Moderately Dense Mangrove | Open Mangrove | Total | Change with respect to ISFR 2019 |
|--------------|----------------------|---------------------|---------------------------|---------------|--------------|----------------------------------|
| 1. | Andhra Pradesh | 0 | 213 | 192 | 405 | 1 |
| 2. | Goa | 0 | 21 | 6 | 27 | 1 |
| 3. | Gujarat | 0 | 169 | 1,006 | 1,175 | -2 |
| 4. | Karnataka | 0 | 2 | 11 | 13 | 3 |
| 5. | Kerala | 0 | 5 | 4 | 9 | 0 |
| 6. | Maharashtra | 0 | 90 | 234 | 324 | 4 |
| 7. | Odisha | 81 | 94 | 84 | 259 | 8 |
| 8. | Tamil Nadu | 1 | 27 | 17 | 45 | 0 |
| 9. | West Bengal | 994 | 692 | 428 | 2,114 | 2 |
| 10. | A&N Islands | 399 | 168 | 49 | 616 | 0 |
| 11. | D&NH and Daman & Diu | 0 | 0 | 3 | 3 | 0 |
| 12. | Puducherry | 0 | 0 | 2 | 2 | 0 |
| Total | | 1,475 | 1,481 | 2,036 | 4,992 | 17 |

(in sq km)

Table 3.3
District
wise
Mangrove
Cover

| State/UTs and District | Very Dense Mangrove | Moderately Dense Mangrove | Open Mangrove | Total | Change w.r.t. 2019 Assessment |
|-----------------------------|---------------------|---------------------------|-----------------|-----------------|-------------------------------|
| Andhra Pradesh | | | | | |
| East Godavari | 0.00 | 125.91 | 61.90 | 187.81 | -0.25 |
| Guntur | 0.00 | 35.00 | 32.97 | 67.97 | -0.03 |
| Krishna | 0.00 | 50.18 | 87.58 | 137.76 | 0.68 |
| Sri Potti Sriramalu Nellore | 0.00 | 2.00 | 8.24 | 10.24 | 0.24 |
| Prakasham | 0.00 | 0.00 | 1.00 | 1.00 | 0.00 |
| West Godavari | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 0.00 | 213.09 | 191.69 | 404.78 | 0.64 |
| Goa | | | | | |
| North Goa | 0.00 | 17.14 | 3.04 | 20.18 | 0.18 |
| South Goa | 0.00 | 3.58 | 3.58 | 7.16 | 1.16 |
| Total | 0.00 | 20.72 | 6.62 | 27.34 | 1.34 |
| Gujarat | | | | | |
| Ahmedabad | 0.00 | 0.71 | 25.67 | 26.38 | -4.67 |
| Amreli | 0.00 | 0.00 | 2.61 | 2.61 | 0.24 |
| Anand | 0.00 | 0.00 | 5.72 | 5.72 | -1.53 |
| Bharuch | 0.00 | 13.33 | 32.05 | 45.38 | 0.94 |
| Bhavnagar | 0.00 | 5.84 | 15.23 | 21.07 | -0.56 |
| Jamnagar | 0.00 | 28.06 | 203.20 | 231.26 | 1.76 |
| Junagarh | 0.00 | 0.00 | 3.91 | 3.91 | 0.58 |
| Kuchchh | 0.00 | 116.14 | 682.60 | 798.74 | 3.97 |
| Navsari | 0.00 | 0.00 | 11.15 | 11.15 | -1.82 |
| Porbandar | 0.00 | 0.00 | 1.00 | 1.00 | 0.00 |
| Rajkot | 0.00 | 0.90 | 2.63 | 3.53 | 0.00 |
| Surat | 0.00 | 3.87 | 15.45 | 19.32 | -0.95 |
| Vadodara | 0.00 | 0.00 | 2.98 | 2.98 | -0.02 |
| Valsad | 0.00 | 0.00 | 2.02 | 2.02 | -0.14 |
| Total | 0.00 | 168.85 | 1,006.22 | 1,175.07 | -2.20 |
| Karnataka | | | | | |
| Dakshin Kannada | 0.09 | 0.11 | 0.25 | 0.45 | 0.45 |
| Uttar Kannada | 0.00 | 0.28 | 10.19 | 10.47 | 1.97 |
| Udupi | 0.00 | 1.54 | 0.15 | 1.69 | 0.15 |
| Total | 0.09 | 1.93 | 10.59 | 12.61 | 2.57 |
| Kerala | | | | | |
| Ernakulum | 0.00 | 0.79 | 1.27 | 2.06 | 0.24 |
| Kannur | 0.00 | 3.89 | 2.50 | 6.39 | 0.15 |
| Kasaragod | 0.00 | 0.05 | 0.86 | 0.91 | 0.07 |
| Total | 0.00 | 4.73 | 4.63 | 9.36 | 0.46 |
| Maharashtra | | | | | |
| Mumbai City | 0.00 | 0.00 | 2.00 | 2.00 | 0.00 |
| Mumbai Sub-urban | 0.00 | 26.97 | 36.25 | 63.22 | -1.08 |
| Raigarh | 0.00 | 15.30 | 111.69 | 126.99 | 6.02 |
| Ratnagiri | 0.00 | 14.96 | 15.37 | 30.33 | 0.18 |
| Sindhudurg | 0.00 | 5.00 | 7.07 | 12.07 | -0.12 |
| Thane | 0.00 | 27.75 | 61.93 | 89.68 | -0.98 |
| Total | 0.00 | 89.98 | 234.31 | 324.29 | 4.02 |

(in sq km)

| State/UTs and District | Very Dense Mangrove | Moderately Dense Mangrove | Open Mangrove | Total | Change w.r.t. 2019 Assessment |
|--------------------------------------|---------------------|---------------------------|-----------------|-----------------|-------------------------------|
| Odisha | | | | | |
| Baleshwar | 0.00 | 1.00 | 4.40 | 5.40 | 0.33 |
| Bhadrak | 0.00 | 8.76 | 26.11 | 34.87 | 0.00 |
| Jagatsinghpur | 0.00 | 1.01 | 7.32 | 8.33 | 0.27 |
| Kendrapara | 80.43 | 83.54 | 45.28 | 209.25 | 7.76 |
| Puri | 0.00 | 0.00 | 1.13 | 1.13 | -0.02 |
| Total | 80.43 | 94.31 | 84.24 | 258.98 | 8.34 |
| Tamilnadu | | | | | |
| Cuddalore | 0.00 | 7.05 | 0.68 | 7.73 | 0.00 |
| Nagapattinam | 0.00 | 1.10 | 1.87 | 2.97 | -0.08 |
| Pudukkottai | 0.67 | 0.46 | 0.80 | 1.93 | 0.03 |
| Ramanathapuram | 0.44 | 0.71 | 1.37 | 2.52 | 0.18 |
| Thanjavur | 0.00 | 8.96 | 3.34 | 12.30 | 0.05 |
| Thiruvallur | 0.00 | 0.00 | 0.93 | 0.93 | 0.02 |
| Thiruvarur | 0.00 | 7.82 | 4.94 | 12.76 | -0.09 |
| Thoothukkudi | 0.00 | 0.85 | 2.95 | 3.80 | 0.00 |
| Total | 1.11 | 26.95 | 16.88 | 44.94 | 0.11 |
| West Bengal | | | | | |
| Purba Medinipur | 0.00 | 1.01 | 3.00 | 4.01 | 0.01 |
| North 24 Parganas | 12.97 | 10.98 | 1.99 | 25.94 | 0.00 |
| South 24 Parganas | 981.34 | 680.03 | 422.45 | 2,083.82 | 1.65 |
| Total | 994.31 | 692.02 | 427.44 | 2,113.77 | 1.66 |
| Andaman & Nicobar Islands | | | | | |
| North Andaman | 285.08 | 111.43 | 28.15 | 424.66 | 0.14 |
| South Andaman | 113.65 | 54.91 | 21.20 | 189.76 | 0.03 |
| Nicobar | 0.00 | 2.00 | 0.03 | 2.03 | 0.00 |
| Total | 398.73 | 168.34 | 49.38 | 616.45 | 0.17 |
| D&NH and Daman & Diu | | | | | |
| Daman | 0.00 | 0.00 | 1.01 | 1.01 | -0.01 |
| Diu | 0.00 | 0.00 | 2.08 | 2.08 | 0.00 |
| Total | 0.00 | 0.00 | 3.09 | 3.09 | -0.01 |
| Puducherry | | | | | |
| Yanam | 0.00 | 0.00 | 1.64 | 1.64 | 0.00 |
| Total | 0.00 | 0.00 | 1.64 | 1.64 | 0.00 |
| Grand Total | 1,474.67 | 1,480.92 | 2,036.73 | 4,992.32 | 17.10 |

The above table shows that South 24 Parganas district of West Bengal alone accounts for 41.74 % Mangrove cover of the country.

Figure 3.2
Photo showing
Mangrove
Forest
Ecosystem



