

SBI RESEARCH

Renewed thrust to Urbanisation can be elixir for Net Zero commitment & Sustainable Development Goals / SDGs

The relationship between urbanisation and forest cover is U shaped....early-stage urbanization leads to deforestation, but as urbanization progresses, there is an increase in policies such as urban greening, forest conservation programs and sustainable land-use planning which results in an eventual recovery of forest cover.. Beyond 40% urbanization rate the effect on forest cover becomes positive.... Thus, more and more programmes like Smart Cities Mission and AMRUT are essential to integrate green infrastructure and enhance urban ecological resilience

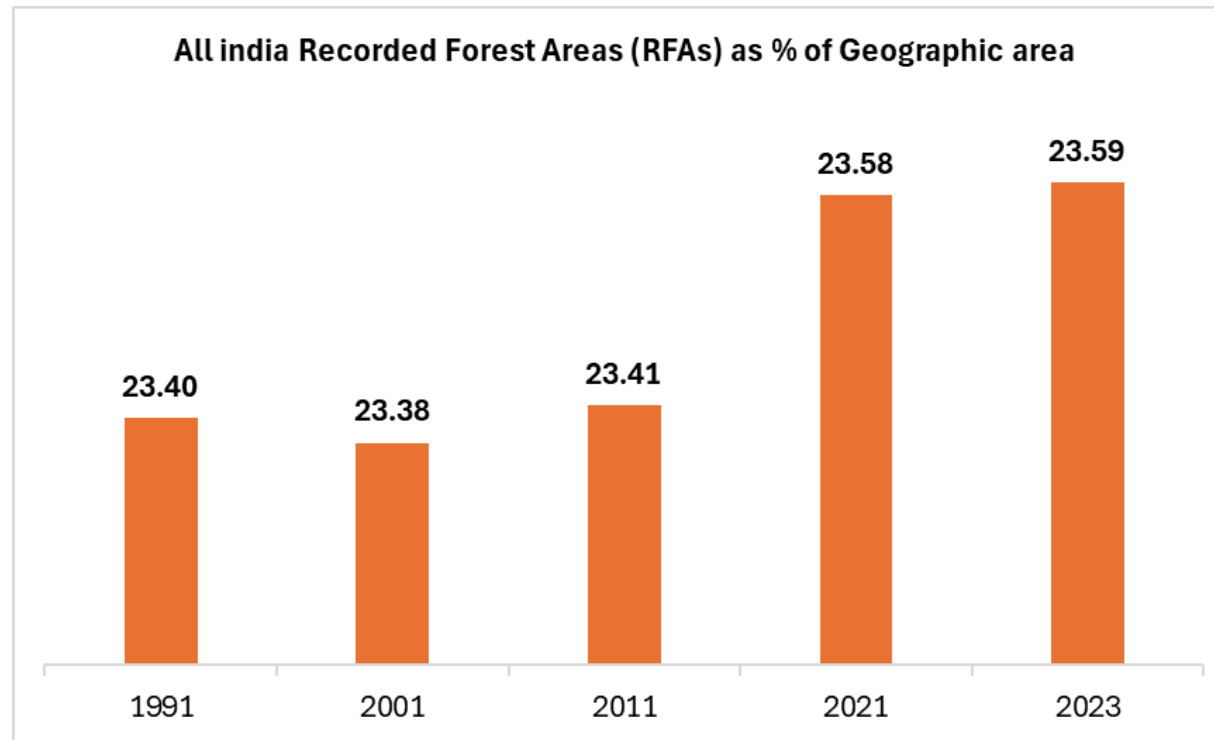
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- India is a land with asymmetric forest cover and increasing in states like Odisha, Mizoram and Jharkhand ...North-East and Hilly states (like Uttarakhand, Himachal Pradesh) have more geographical area under forest cover...**States like UP, Bihar, Rajasthan, Haryana, Punjab, etc. have less than 10% of geographical area under forest cover**
 - Maximum gain in forest cover (2023 over 2021) is seen in Ahmedabad followed by Bengaluru, while maximum loss in forest cover is seen in Chennai and Hyderabad
 - The forestry sector contributes around 1.3-1.6% to India's GVA, supporting industries like furniture, construction, and paper manufacturing
 - **India is estimated to have 35 billion trees; this translates into only Rs 100 GVA per tree**
 - Expanding biodiversity hotspots, incentivizing private sector participation can enhance forest sustainability and intend to invest in afforestation projects through Corporate Social Responsibility (CSR) and carbon offset markets can enhance conservation funding
 - Strengthening enforcement against encroachment through satellite monitoring and digital databases can protect critical forest areas
- **India is urbanising rapidly. According to Census 2011, India's urban population was 31.1% of the total population which is expected to increase to 35-37% in census 2024**
 - The relationship between urbanisation and forest cover is U shaped....early-stage urbanization leads to deforestation, but as urbanization progresses, there is an increase in policies such as urban greening, forest conservation programs, and sustainable land-use planning, which results in an eventual recovery of forest cover
 - In the earlier and medium stages of urbanisation as green cover declines, there is a potential tool of green finance to mitigate the environmental pressures on forests. **Thus the launch of green bonds** assumes crucial importance and long-term investments in green initiatives yields more substantial results over time, particularly if green bonds continue to scale up and are strategically aligned with conservation goals
 - **Finally, the turning point at 40% urbanization rate suggests a threshold beyond which effect on forest cover becomes positive....**
 - **The government has undertaken various initiatives such as Smart Cities Mission and AMRUT to integrate green infrastructure and enhance urban ecological resilience in line with the postulated U- shaped hypothesis.** This will give rise to better institutional capacity that supports both urban growth and environmental conservation

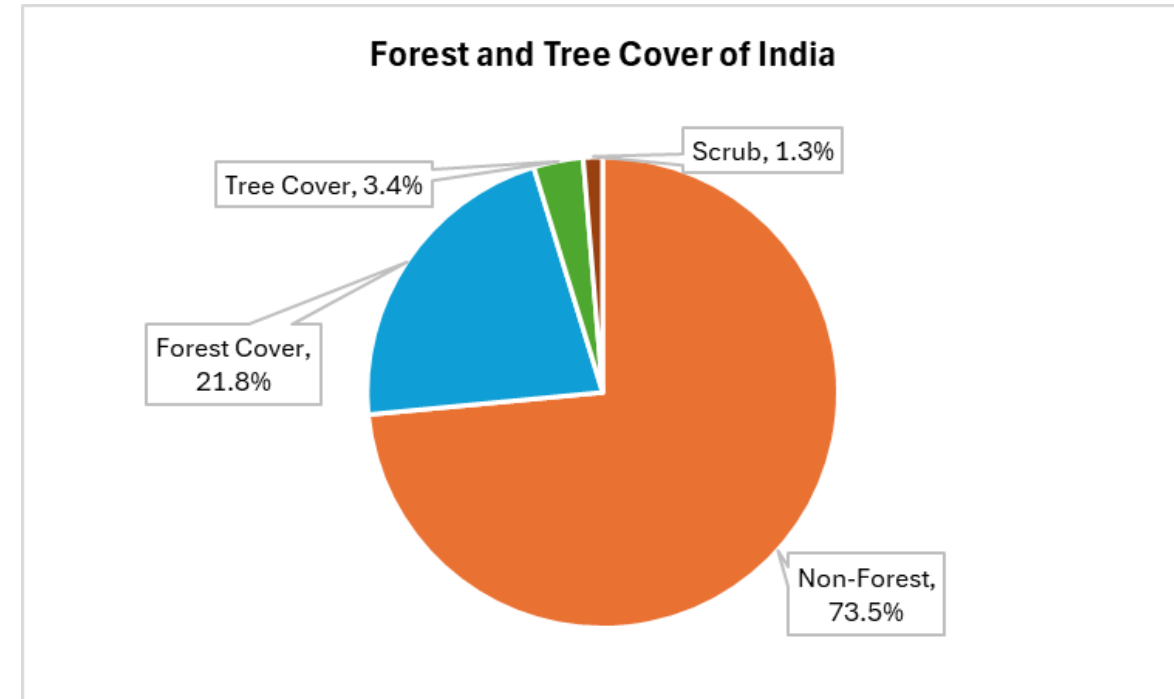
- ❑ ‘Forest cover’ refers to all lands, more than or equal to one hectare in area, with a tree canopy of more than or equal to 10%, irrespective of ownership and legal status; and includes orchards, bamboo, and palm
- ❑ The ‘recorded forest area’ (RFA) (or forest area) refers to all the geographic area recorded as ‘forest’ in government records. The ‘recorded forest area’ largely consists of the ‘Reserved Forests’ (RF) and the ‘Protected Forests’ (PF)
- ❑ Top 10 countries of the world accounted for 66% of total forest area of the world, with India standing at 10th place

Top Ten Countries for Forest Area, 2020				
Rank	Country	Forest area		
		1000 ha	% of world forest area	Cumulative %
1	Russia	815312	20	20
2	Brazil	496620	12	32
3	Canada	346928	9	41
4	US	309795	8	49
5	China	219978	5	54
6	Australia	134005	3	57
7	Congo	126155	3	60
8	Indonesia	92133	2	63
9	Peru	72330	2	64
10	India	72160	2	66
Source: Global Forest resource assessment, 2020, FAO				

- India is one of the few countries where forest cover has increased over the years
- While the forest cover (as % of GA) remains constant from 1991-2011, it increased after that



- ❑ The Forest Cover of the country has been classified and mapped into three canopy density classes, viz., Very Dense Forest (VDF), Moderately Dense Forest (MDF) and Open Forest (OF). In addition to these three density classes, scrub areas, which are not included in the Forest Cover, have also been classified and mapped
- ❑ Tree cover, on the other hand, comprises all tree patches outside the forest area, which are less than one hectare in extent including all the scattered trees found in the rural and urban settings, and not captured under the forest cover assessment



- ❑ There is wide variation regarding state-wise forest cover
 - While the North-East and Hilly states (like Uttarakhand, Himachal Pradesh) have predominantly more geographical area under forest cover, the situation in some of the states is precarious
- ❑ States like UP, Bihar, Rajasthan, Haryana, Punjab, etc. has less than 10% of geographical area under recorded forest cover
- ❑ While in most of the states, forest cover almost remains intact since 2015, it has shown considerable increase in Odisha, Mizoram and Jharkhand

Recorded Forest Areas (RFAs) in States				
State	GA (Km ²)	Recorded Forest Areas (RFAs)		
		in Km ²	% of GA	Change from 2015 in Km ²
Andhra Pradesh	1,62,923	37,258	22.9	0
Arunachal Pradesh	83,743	51,540	61.6	133
Assam	78,438	26,836	34.2	4
Bihar	94,163	7,442	7.9	949
Chhattisgarh	1,35,192	59,816	44.3	44
Delhi	1,483	104	7.0	2
Goa	3,702	1,271	34.3	46
Gujarat	1,96,244	21,870	11.1	223
Haryana	44,212	1,559	3.5	0
Himachal Pradesh	55,673	37,948	68.2	915
Jharkhand	79,716	25,118	31.5	1,513
Karnataka	1,91,791	38,284	20.0	0
Kerala	38,852	11,522	29.7	213
Madhya Pradesh	3,08,252	94,689	30.7	0
Maharashtra	3,07,713	61,952	20.1	373
Manipur	22,327	17,418	78.0	0
Meghalaya	22,429	9,508	42.4	12
Mizoram	21,081	7,479	35.5	1,838
Nagaland	16,579	8,632	52.1	-590
Odisha	1,55,707	61,204	39.3	3,068
Punjab	50,362	3,084	6.1	0
Rajasthan	3,42,239	32,869	9.6	132
Sikkim	7,096	5,841	82.3	0
Tamil Nadu	1,30,060	23,188	17.8	311
Telangana	1,12,122	27,688	24.7	784
Tripura	10,486	6,295	60.0	1
Uttar Pradesh	2,40,928	17,435	7.2	853
Uttarakhand	53,483	38,000	71.1	0
West Bengal	88,752	11,885	13.4	6
Jammu & Kashmir	2,22,236	20,206	9.1	-24
Total	32,87,469	7,75,377	23.6	10,811

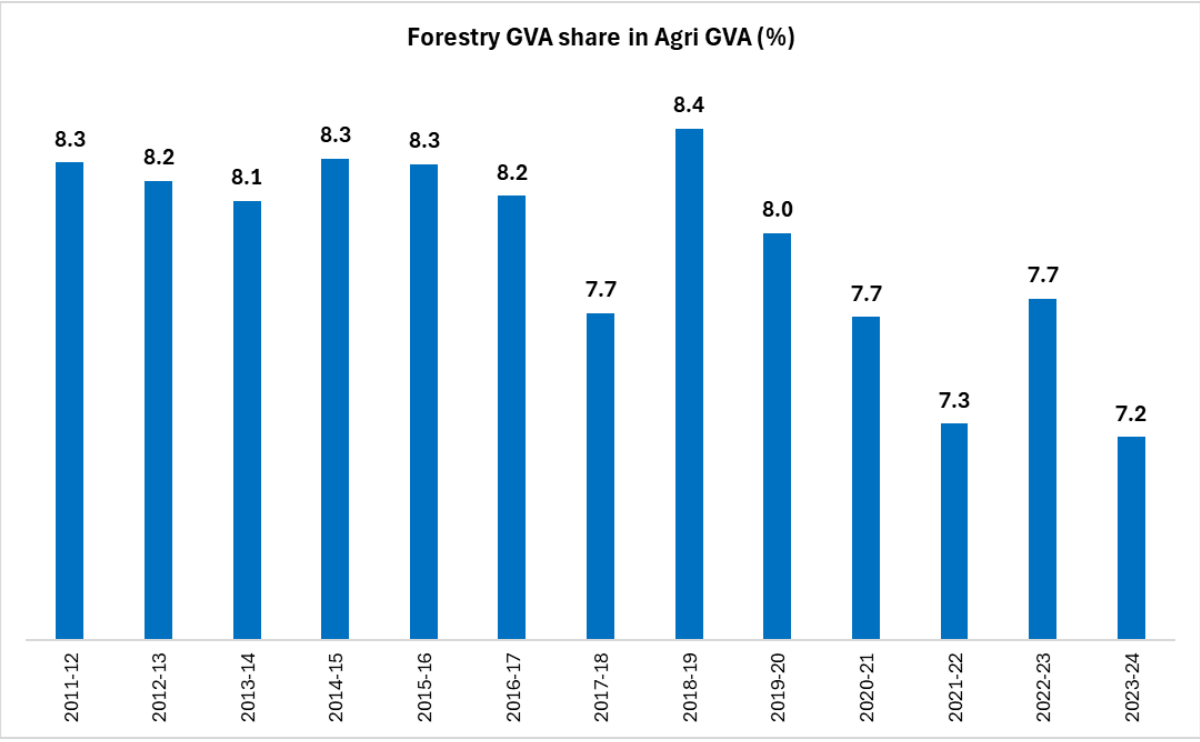
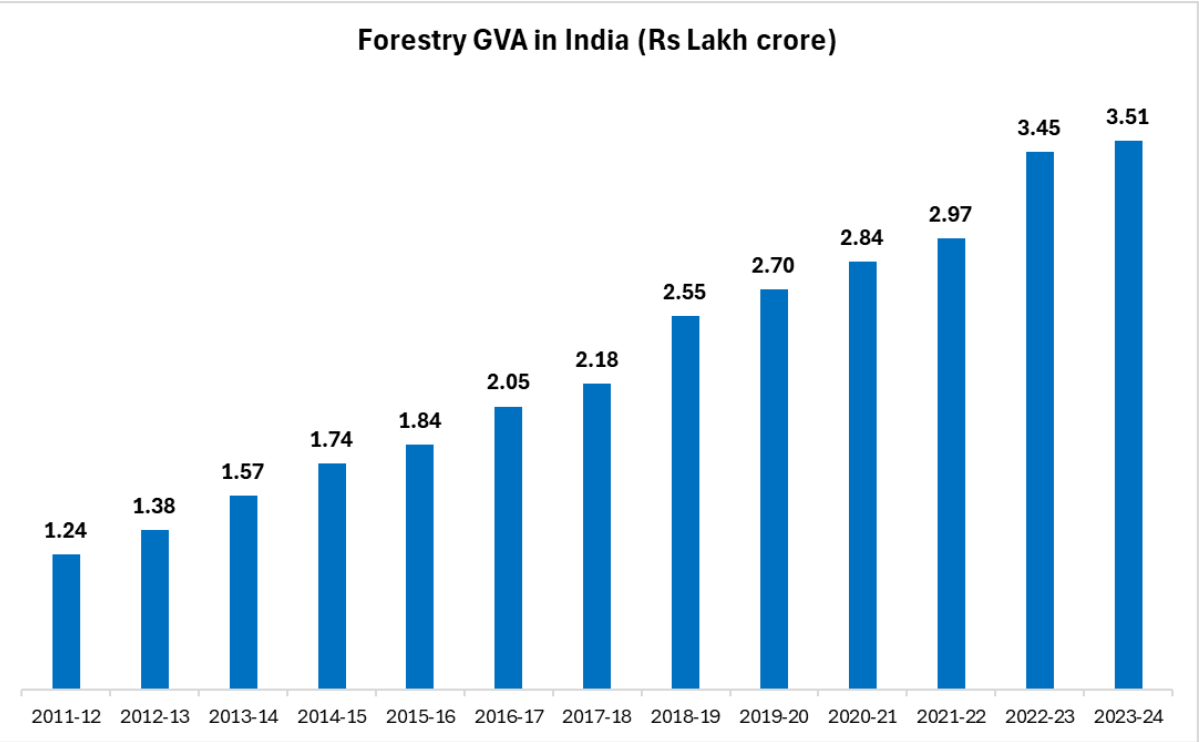
Source: India State of Forest Report 2023; SBI Research

- India has six major mega cities (population of 10 million or more) as of Sep-23. The major mega cities are Bengaluru, Chennai, Delhi, Kolkata, Hyderabad, and Mumbai. Ahmedabad is also a rapidly growing city, on the verge of becoming a major mega city
- The forest cover in major mega cities can vary widely depending on the city's location, policies, and environmental priorities. Some cities have significant green spaces and forested areas, while others have limited greenery due to urbanization
- According to the current assessment, the total forest cover in these cities is 511.81 km², which is 10.26% of the total geographical area of the cities
- From the current assessment, it can be seen that Delhi has the largest forest cover followed by Mumbai and Bengaluru
- Maximum gain in forest cover (2023 over 2021) is seen in Ahmedabad followed by Bengaluru, while maximum loss in forest cover is seen in Chennai and Hyderabad

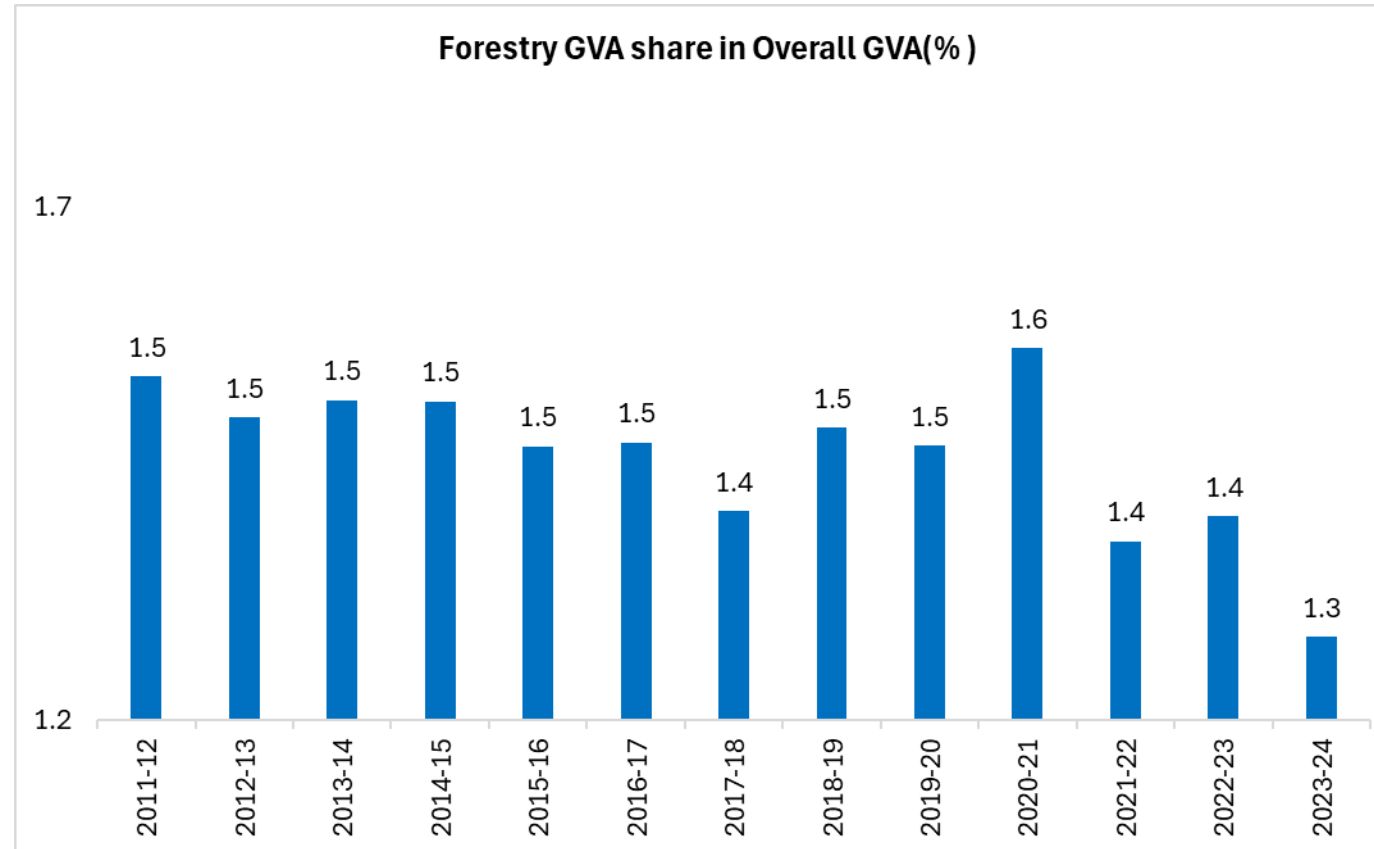
Forest Cover in major Mega Cities					
City	State	Total Area	Forest Cover (km ²)		
			2021	2023	% of total area
Ahmedabad	Gujarat	455.3	9.4	14.9	3.3
Bengaluru	Karnataka	1307.4	89.0	89.6	6.9
Chennai	Tamil Nadu	430.1	22.7	20.1	4.7
Delhi	Delhi	1540.6	194.2	194.2	12.6
Hyderabad	Telangana	634.2	81.8	80.2	12.7
Kolkata	West Bengal	186.6	1.8	2.1	1.1
Mumbai	Maharashtra	435.9	110.8	110.8	25.4
Total		4990.0	509.7	511.8	10.3
Source: India State of Forest Report 2023; SBI Research					

Share of Forestry GVA is low and falling

- ❑ As the area under forest cover is increasing since 2011, the forestry GVA is also increasing from Rs 1.24 lakh crore in FY12 to Rs 3.51 lakh crore in FY24
- ❑ While the overall level of forestry GVA is increasing, its share in overall Agriculture GVA is falling
- ❑ Given the number of trees (forest cover) in India, the GVA amount is very low. **India is estimated to have 35 billion trees; this translate into only Rs 100 GVA per tree**

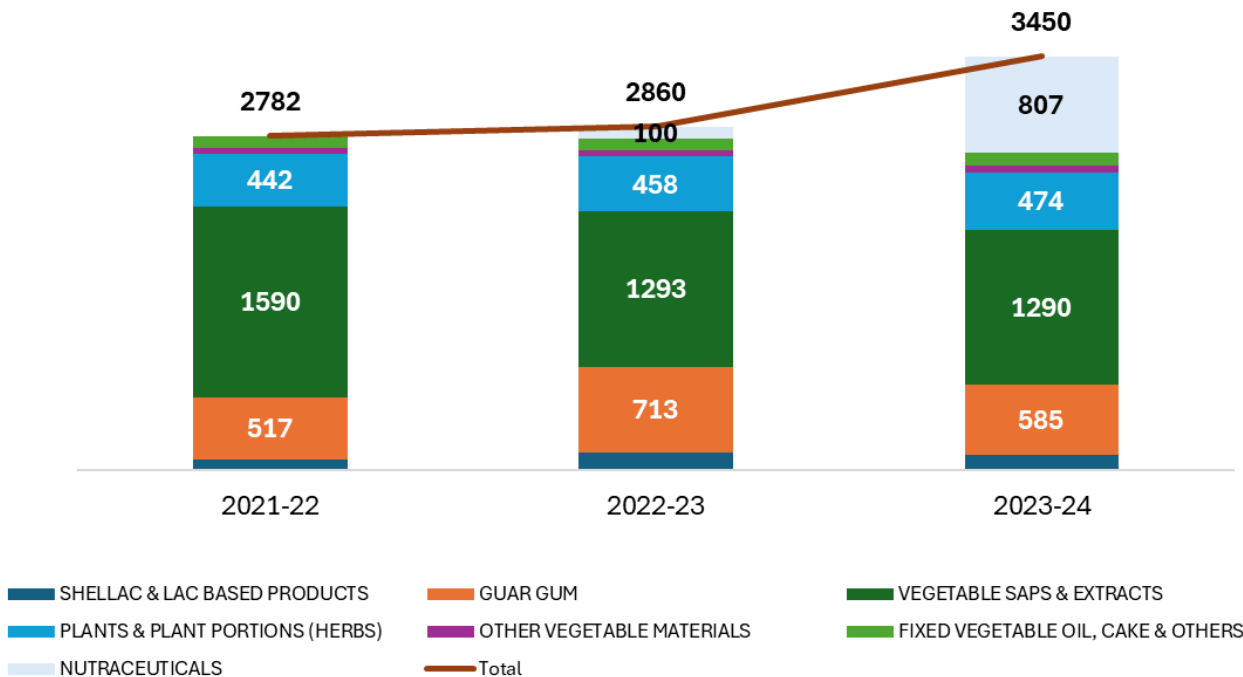


- The forestry sector contributes around 1.3-1.6% to India's GVA, supporting industries like furniture, construction, and paper manufacturing

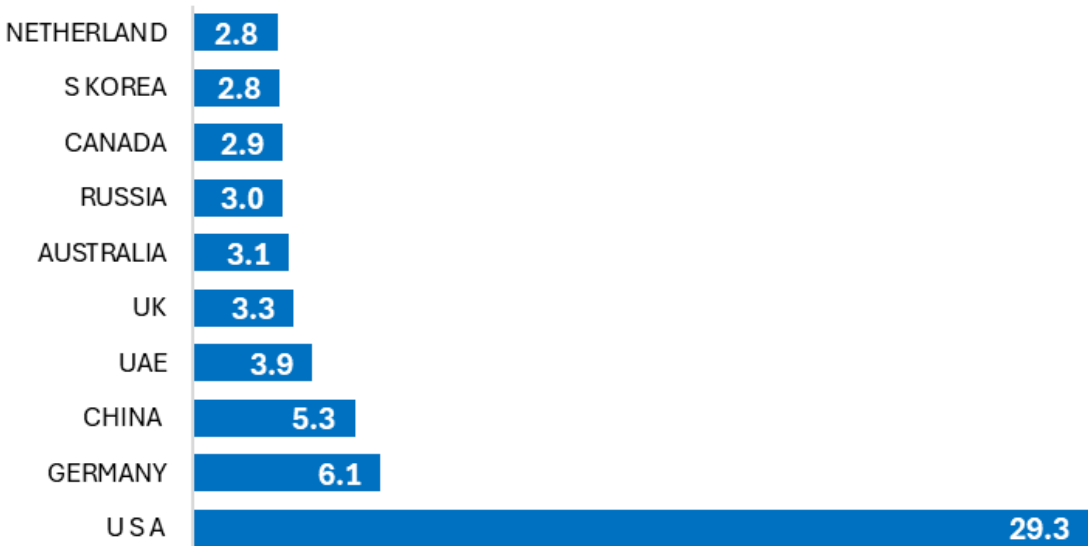


- As per the data from Shellac & Forest Products Export Promotion Council (SHEFEXIL), India's exports of forest products has increased from \$2.8 billion in FY22 to \$3.5 billion in FY24
- Of the total exports, US has almost 30% share, followed by Germany and China

Export of forest products in \$ mn

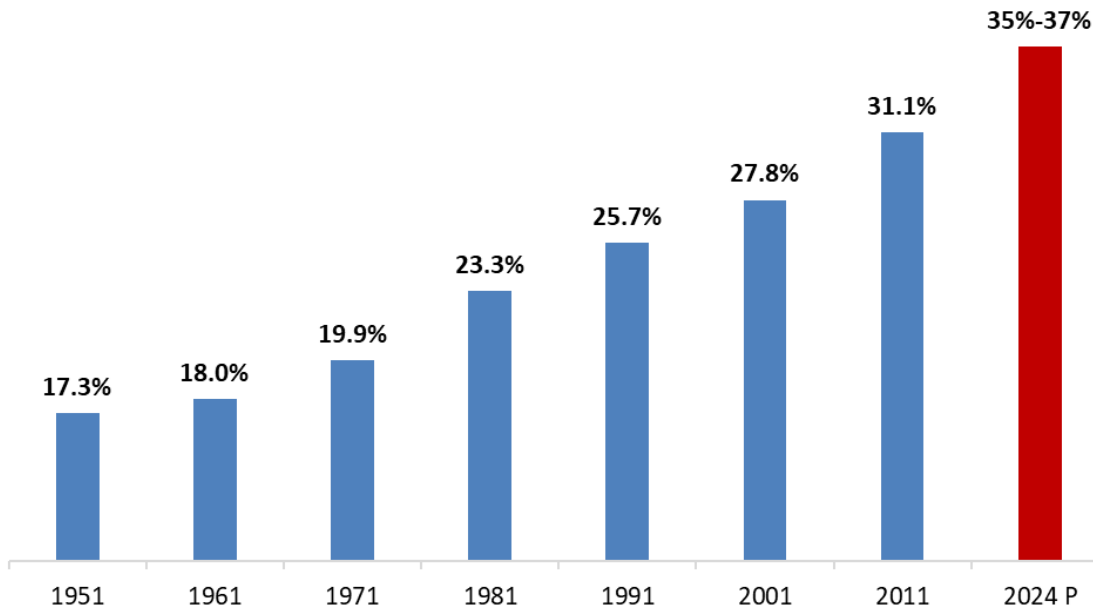


Top 10 Exports Destination in FY24 (% Share)

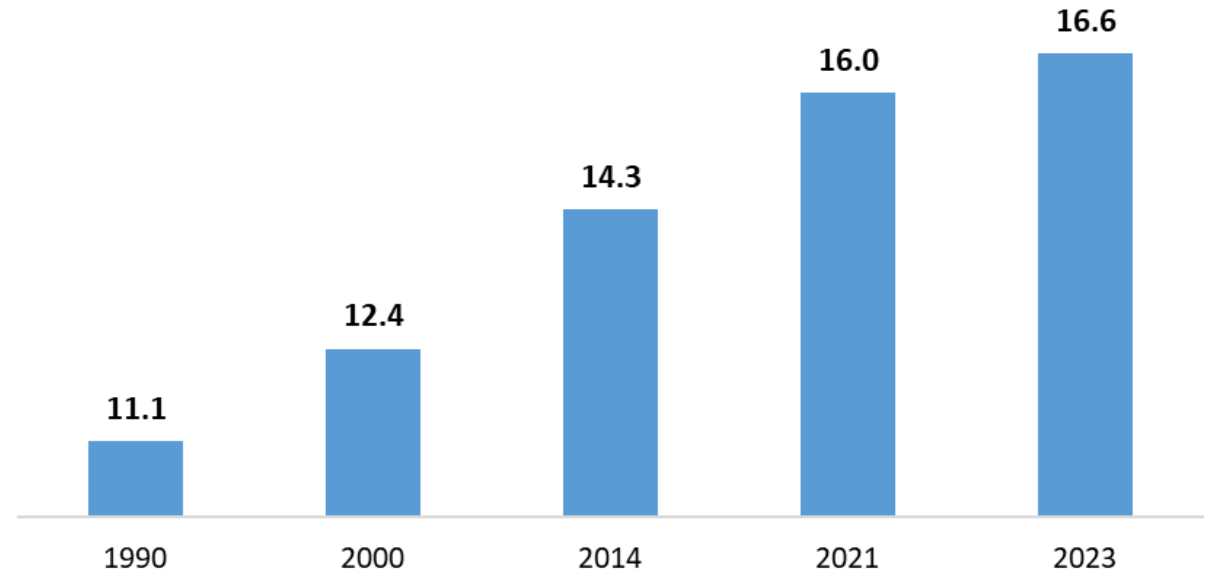


- India is urbanising rapidly. According to Census 2011, India's urban population was 31.1% of the total population which is expected to increase to 35-37% in census 2024
- Further, the share of Indian population in urban agglomerations of more than 1 million has increased from 14.3% in 2014 to 16.6% in 2023

Level of Urbanization (%)



Indian Population in urban agglomerations of more than 1 million (% of total population)



- ❑ **Objective:** We empirically examine the nonlinear relationship between urbanization and forest cover across Indian states by testing for a U-shaped association
- ❑ **Rationale:** The analysis is rooted in the theory of Environmental Kuznets Curve (EKC), which postulates that as a country or region develops economically, environmental degradation first increases and then declines after reaching a certain level of income per capita or urbanization. The hypothesis in this context is that urbanization follows a similar pattern: early-stage urbanization leads to deforestation, but at higher levels of urbanization, environmental policies and urban greening initiatives may foster an increase in forest cover. However, as urbanization progresses, there may be an increase in policies such as urban greening, forest conservation programs, and sustainable land-use planning, which could result in an eventual recovery of forest cover
- ❑ **Methodology:** To test this hypothesis, we employed a quadratic regression model to analyze the relationship between urban population percentage and forest cover across Indian states. The model is specified as follows:

$$y_i = \alpha + \beta_1 x_i + \beta_2 x_i^2 + \varepsilon_i$$

Where Y_i represents forest cover of i th state

X_i represents percentage of urban population

- ❑ **Interpretation:** From the regression results, the coefficient for urban population (β_1) is found to be negative, suggesting that at lower levels of urbanization, forest cover tends to decrease, which aligns with the hypothesis that urban expansion leads to deforestation due to land conversion for development
- ❑ The positive coefficient for the squared urban population term (β_2) implies that as urbanization reaches a certain threshold, the effect on forest cover becomes positive, indicating a reversal in the trend—forest cover begins to rise. The relatively small size of the positive coefficient on the squared term suggests that ecological recovery in response to urbanization is a gradual process

Estimation of U-shaped relationship		
Variable	Coefficient	p-value
X	-0.0845	0.103
X ²	0.0019	0.085
* : Significant at 10%		

- ❑ The study emphasizes the temporal lag between urban growth and forest recovery, underscoring the importance of proactive environmental governance.
- ❑ **The turning point at 40% urbanization rate suggests a threshold beyond which effect on forest cover becomes positive however the rate is slow as compared to decline at lower urbanization levels due to lower regenerative capacity of natural capital.** This is indicative of the fact that as urbanization progresses, the focus shifts on integrating sustainable urban planning and green infrastructure
- ❑ **Conclusion:** The government has undertaken various initiatives such as Smart Cities Mission and AMRUT to integrate green infrastructure and enhance urban ecological resilience in line with the postulated U- shaped hypothesis. This will give rise to better institutional capacity that supports both urban growth and environmental conservation
- ❑ To accelerate India's green energy transition, support must be given to green hydrogen production, biofuels, renewable infrastructure, solar parks, wind farms, and biogas plants. These will accelerate significant private investments in renewable energy initiatives fostering climate resilient cities and at the same time position India as a global leader in low-carbon development
- ❑ **India must therefore accelerate urbanization while embedding sustainability at its core, ensuring that rapid growth is harmonized with ecological resilience to achieve long term socio-economic stability**

- ❑ We investigate the relationship between green bond issuance and forest cover loss across 10 countries over multiple years, employing Karl Pearson's correlation coefficient to quantify the strength and direction of the linear relationship between these two variables.
- ❑ The **negative correlation coefficient of -0.07 suggests that an increase in green bond issuance is associated with a modest reduction in forest cover loss across countries albeit at a modest rate**
- ❑ The negative correlation underscores the potential of green finance as a tool to mitigate the environmental pressures on forests. Additionally, the gradual nature of the relationship between green bonds and forest cover loss indicates that long-term investments in green initiatives could yield more substantial results over time, particularly if green bonds continue to scale and are strategically aligned with conservation goals
- ❑ Thus, green bonds can play a crucial role when combined with other sustainability measures, such as stronger environmental regulations, stricter enforcement of anti-deforestation laws, and greater public awareness.

- ❑ Around 26% of the total 650,000 villages can be classified as forest fringe villages, where forests fulfill significant socio-cultural, and livelihood needs. For example: forest-based industries such as paper, pharmaceuticals, and handicrafts significantly contribute to employment
- ❑ As per Forest Survey Report 2019, approximately 30 crore people are dependent on forests in India
- ❑ The National Agroforestry Policy (2014) has facilitated the planting of fast-growing species like eucalyptus, benefiting industries and enhancing rural incomes
- ❑ This is also aimed at improving livelihoods and enhancing agricultural productivity through integrated tree farming. It recognizes that agroforestry, which combines trees with crops and/or livestock, offers a sustainable way to address various challenges, including food security, climate change, and rural employment
- ❑ Initiatives like Van Dhan Vikas Yojana have shown success by training tribal communities to process and market non-timber forest products (NTFPs). Expanding such programs to include agroforestry and ecotourism can reduce dependency on deforestation

- ❑ Forests harbor the majority of India's terrestrial biodiversity, supporting ecotourism and conservation-linked livelihoods. For example, tiger reserves like Ranthambore and Corbett attract millions of tourists annually
- ❑ Forests provide biomass energy, supporting India's renewable energy transition. The National Bio-Energy Mission promotes the sustainable use of forest residues, helping achieve the 500 GW renewable energy target by 2030
- ❑ Forests help control the water cycle by regulating precipitation, evaporation, flows and prevent soil erosion, ensuring agricultural productivity. Forested watersheds contribute to critical river systems like the Indus, Ganga and Brahmaputra, supporting 700 million people
- ❑ Forests act as natural barriers against disasters like cyclones, floods, and landslides, saving billions in economic losses annually. For Example: Mangroves in Bhitarkanika, Odisha, shielded against Cyclone Dana's impact, demonstrating their crucial role in storm surge protection

India's Forest Policy goal is of one-third area under forests

- Reforestation efforts contribute towards this goal, but of greater importance is the prevention of deforestation
- Some of the States are faring better at this. The India State of Forest Report (ISFR) 2023 states that the three States with the best improvement (since 2021) in forest cover are Chhattisgarh, Uttar Pradesh, Odisha
- Promoting sustainable eco-tourism can generate revenue for conservation while creating awareness about biodiversity. States like Kerala and Uttarakhand have pioneered eco-tourism projects that balance economic benefits with forest preservation. For example, Kerala's Thenmala Eco-Tourism Project supports local livelihoods. Expanding such models across biodiversity hotspots can enhance forest sustainability
- Incentivizing Private Sector Participation: Encouraging private players to invest in afforestation projects through Corporate Social Responsibility (CSR) and carbon offset markets can enhance conservation funding
- Strengthening enforcement against encroachment through satellite monitoring and digital databases can protect critical forest areas

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