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**Corresponding Author**

Rohith Ravula

e-mail: ravularohith2021@gmail.com

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## Author's Address

<sup>1</sup>Forest College and Research Institute, Mulugu, Siddipet, Telangana (502 279), India

<sup>2</sup>Professor Jayashankar Telangana Agricultural University, Rajendranagar, Hyderabad, Telangana (500 030), India

<sup>3</sup>ICAR-National Academy of Agricultural Research Management, Hyderabad, Telangana (500 030), India

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# Trees Outside Forests: Ecological Contributions, Socio-economic Impacts and Policy Imperatives for Sustainable Development

Akkenapally Snehanjali<sup>1</sup>, Rohith Ravula<sup>1\*</sup>, A. V. Ramanjaneyulu<sup>2</sup>, M. Ramesh Naik<sup>3</sup>, T. Chaitanya<sup>2</sup>, U. Madhurima<sup>3</sup> and B. Joseph<sup>2</sup>

## Abstract

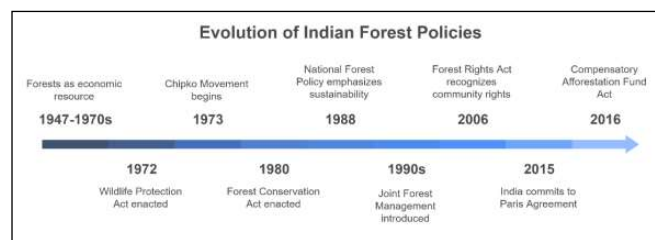
Trees Outside Forests (TOF), including trees on farmlands, urban areas and roadsides, play a crucial role in India's ecological and socio-economic landscape. With 1,12,014 sq. km of tree cover and a growing stock of 1,951 million m<sup>3</sup>, TOFs support carbon sequestration, timber supply and rural livelihoods. Despite their potential, TOFs face challenges such as long gestation periods, market risks and weak policy support. Their integration into national goals like the SDGs and NDCs remains incomplete without comprehensive reforms. This paper examines the ecological significance, policy gaps and regional examples of TOF practices. It highlights the need for participatory planning, community involvement and targeted financial incentives to scale up TOF systems. Strengthening TOF governance can substantially contribute to India's forest targets and climate commitments. However, realizing this potential requires comprehensive policy reforms, evidence-based management practices and targeted financial incentives to encourage widespread adoption among landowners and farmers.

## 1. Introduction

India after gaining independence in 1947, has undergone significant transformations in its forest management policies, conservation efforts and legal frameworks to combat deforestation, biodiversity loss and sustainable development (Figure 1) (FSI, 2023). In this context, Trees Outside Forests (TOF) have emerged as a crucial complement to traditional forest cover, especially in addressing the rising demand for timber and ecosystem services which they provide. Trees outside the forest are defined as all trees excluded from the definition of forest and other wooded lands. Trees outside the forest are located on other lands mostly on farmlands and built-up areas, both in rural and urban areas. A large number of TOF consist of planted or domesticated trees. Trees Outside Forests (TOF) refer to tree resources that are not part of designated forest areas. In

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India, TOF includes trees found on agricultural land, in urban areas, along roads, in home gardens and other non-forest areas.



**Figure 1: Evolution of Indian forest policies**

## 2. Concept and Classification of TOF

Trees Outside Forests (TOF) refer to trees and woody vegetation growing outside designated forest areas, such as in agricultural landscapes, urban areas, rural settlements, along roads, or in other non-forest land uses. (de Foresta et al., 2013). They are integral to agroforestry systems, urban green spaces and scattered landscapes,

contributing to ecological, economic and social benefits. FAO defines TOF as trees and shrubs found on land that is not categorized as forest or other wooded land. This includes trees in:

- Agricultural lands (*e.g.*, agroforestry, home gardens, orchards).
- Urban and peri-urban areas (*e.g.*, parks, street trees, gardens).
- Linear features (*e.g.*, along roads, canals, or field boundaries).
- Scattered trees in pastures, farmlands, or degraded lands.

TOF excludes trees in areas meeting the forest definition (*e.g.*, minimum area of 0.5 ha, tree height >5m and canopy cover >10%).

### 2.1. Concept

There are four models under TOF as furnished in the Table 1.

**Table 1: Four models under TOF**

Type	Approach	Driver	Type of forests/Trees outside forests	Applicable standard
Model I	Landscape	Forest management entity	Natural forest/Reserve forests/ Protected area/Conservation zones Example - Uttar Pradesh Forest Corporation	Country Specific Sustainable Forest Management (SFM) Standard
Model II	Landscape	Forest management entity	Commercial Plantations Example – Plantations by pulp and paper, Plywood etc.	SFM Standard (+) additional indicators and safeguards
Model III	Landscape	Forest management entity or Service-provider	Block plantations less than 25 acres Example – PACL, SARA	SFM Standard (-) less some indicators to give a relaxation against SFM standards
Model IV	Standalone	Supplier, buyer or service-provider	Scattered and Linear stratum of trees with economic utility (commercial trees)/Agroforestry practices/Urban trees/stand-alone trees at homestead/home gardens/multipurpose tree lots like shelter belts/windbreaks etc.	Standalone standard containing non-negotiable attributes of SFM standard (+) environmental and social safeguards which are reduced from model III but intense and robust than required in DDS (Due Diligence System) of PEFC and/or Controlled wood of FSC.

### 2.2. Classification

The classification of TOF's are as follows (Bolyn et al., 2019) (Table 2)

### 2.3. Significance

Trees Outside Forests (TOF) are vital for ecological, economic, social and cultural benefits, bridging the gap

between forested and non-forested landscapes. Their significance includes (Figure 2 and 3).

### 2.4. Scope

Trees Outside Forests (TOF) can be strategically planned in a wide variety of lands outside government-notified forest lands (Figure 4).



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Table 2: Classification of TOFs

As per land use	As per geometrical formation
Trees with settlements:	Isolated and scattered trees
✓ Urban	✓ Trees exist in scattered form
✓ Rural	Zonal Trees:
Trees with Agricultural lands:	✓ Trees in lines
✓ Agroforestry	✓ Trees in blocks
Trees along manmade or natural features:	
✓ Beside railways	
✓ Beside roads	
✓ Beside canals/rivers	

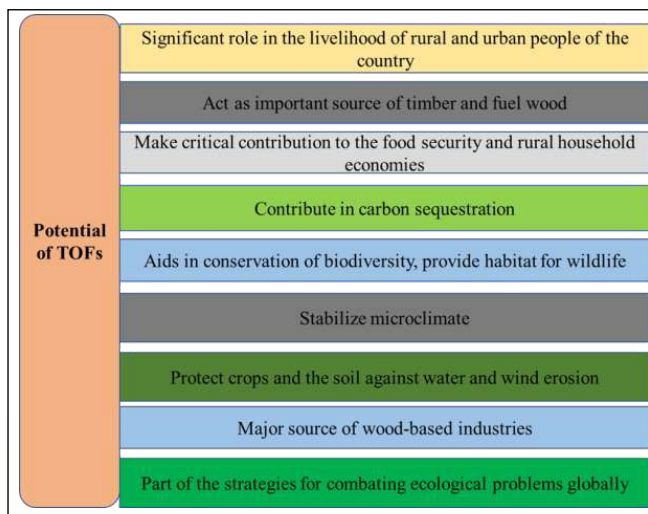


Figure 2: Ecological economic and social benefits of TOFs

- Agricultural and rural landscapes – field boundaries and bunds, fallow lands, homesteads and farmyards.
- Degraded wastelands – community lands, grazing lands, government lands, panchayat lands and non-arable lands.
- Urban and peri-urban areas – urban avenue plantations, green corridors, industrial zones, colony parks and other institutional premises.
- Infrastructure corridors: railway lines, canal bunds, highways.

While growing, the factors like species suitability (native, multi-purpose, drought/flood tolerant), community participation and ownership, legal and tenure clarity, access to markets for tree-based products and integration with existing land use should be considered.



Figure 3: Various forms of TOF; A. Mahogany based Silviculture, B. Maize with teak as border plantation, C. Tobacco with teak as bund plantation, D. Eucalyptus on paddy bunds, E. Sandalwood+casuarina+small ruminants, F. Red Sanders based horti (Coconut) silviculture, G. Institutional plantation @ FCRI Mulugu (Kadamba+Fishtail palm). H. Central median (*Ficus panda*+*Bougainvillea*)



Figure 4: Scope of TOF

### 3. Policy Overview for TOF in India

India has developed a robust policy framework to promote Trees Outside Forests (TOF), recognizing their role in enhancing biodiversity, carbon sequestration and rural livelihoods. National Agroforestry Policy (2014), the world's first dedicated agroforestry policy, aimed at increasing tree cover on non-forest lands, simplifying regulations and boosting farmer incomes through agroforestry systems. Other key policies include Sub-Mission on Agroforestry (SMAF) and Green India Mission (Ghosh and Sinha, 2018).

Tree Outside Forests in India (TOFI) program launched in 2022 in partnership with USAID and MOEFCC.

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A five-year (2021–2026) joint initiative by the United States Agency for International Development (USAID) and India's Ministry of Environment, Forest and Climate Change (MoEFCC), aimed at expanding tree cover outside forests by 2.8 million hectares across seven states: Andhra Pradesh, Assam, Haryana, Odisha, Rajasthan, Tamil Nadu and Uttar Pradesh. Different states have formulated their own policies for promotion of TOF in respective states (Figure 5). TOF are integrated into India's Nationally Determined Contributions (NDCs) under the Paris Agreement, aiming to create an additional carbon sink of 2.5–3 billion tonnes of CO<sub>2</sub> e by 2030, with programs like the Trees Outside Forests in India (TOFI) targeting 210 million metric tons of CO<sub>2</sub> e



Figure 5: TOF policies of various states of India

## 4. Constraints and Solutions for Growing TOFs

### 4.1. Constraints

The growth and development of Trees Outside Forests (TOFs), particularly in farm and agroforestry systems, face several constraints that hinder their full potential. One major challenge is the long gestation period and market uncertainties, which discourage farmers from investing in TOFs. The lack of support from financial institutions and extension services, coupled with the absence of regulated markets and price mechanisms, further adds to the difficulties. Additionally, the unavailability of improved planting material and limited

profitable planting models restrict farmers choice. TOFs are also governed by the Forest Act instead of separate laws and regulations, making management more complicated (Chavan et al., 2015)

Unfavorable export and import policies limit opportunities for trade, while the competition between trees and food crops for space, sunlight, moisture and nutrients can reduce crop yields and even cause damage during harvesting. Certain tree species act as hosts to insects and birds, leading to pest problems, while allelopathic effects, such as those from eucalyptus, negatively impact crop growth. Invasive species like wild sage (*Lantana camara*) and Subabul (*Leucaena leucocephala*) can rapidly spread and dominate farmland. Furthermore, TOFs are labor-intensive, sometimes leading to labor shortages for other farm activities. The longer gestation period required to generate income and the competition with crops, especially in land-scarce areas, make TOFs a less attractive option for many farmers.

### 4.2. Solutions

- Develop clear, farmer-friendly guidelines and single-window clearance systems to encourage TOF planting, as recommended by initiatives like the Trees Outside Forests in India (TOFI) program.
- Integrate TOF into existing agricultural and rural development schemes (e.g., MGNREGA, PM Kisan) to provide financial support and incentivize tree planting.
- Establish market information systems and cooperatives to ensure fair prices and reduce dependence on middlemen.
- Develop carbon credit mechanisms for TOF and integrate them into urban planning and rural restoration programs to align with India's 2070 net-zero goal.
- Mandate urban tree cover targets and incentivize private-sector involvement (e.g., CSR funding).

## 5. Conclusion

Trees Outside Forests (TOF) are vital for India's ecological sustainability, rural livelihoods, and global environmental commitments. Integrated into agricultural, urban, and infrastructure landscapes, TOFs offer carbon sequestration, biodiversity conservation, soil health improvement, and income diversification. Despite regulatory, market, and ecological hurdles, supportive policies, technology, and community-driven approaches can scale TOF initiatives. A cohesive environment with policy alignment, financial and technical support, and



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strong market linkages is essential for TOFs to boost forest cover, rural development, and climate resilience.

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