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Tree Insurance in India: Status, Challenges, and Policy Options for Agricultural Coverage

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ABSTRACT

The tree that acts as insurance against major agricultural crop losses is vulnerable to climate extreme events. The increase in climate extremes in various states in India necessitates risk reduction through tree insurance. This article fathoms multiple aspects of tree insurance at the international and national level through a literature review. A heterogeneity in the degree of risk covered, sum insured, premium, indemnity, and valuation methods at global and country levels was observed. Challenges like high premiums, claim settlement procedures, and lack of awareness hinder insurance penetration. Developing customized insurance products, leveraging technology, implementing revenue insurance, and adopting a multifaceted research approach suggested to overcome the challenges and for the growth of tree insurance.

Keywords: Climate extremes, premium, risk, agroforestry

JEL codes: D18, Q15, Q54, Q57

I

INTRODUCTION

The agriculture sector and its associated industries frequently encounter challenges from extreme weather conditions like droughts, floods, and cyclones, leading to disruptions that impede their capacity for sustainable production. The frequency of such severe weather events has escalated recently, particularly affecting South Asia and South Africa more than Europe or North America (Ranganathan et al., 2018). The repercussions of climate change have intensified. Roughly 7,000 natural disasters have occurred globally in the last twenty years, with 40 per cent occurring in Asia, affecting 4.2 billion people and causing estimated damages worth US$ 2.2 trillion (Hess and Hazel, 2016). In India alone, unseasonal rainfall and hailstorms destroyed 24 million hectares of crops from 2013 to 2015, leading to a loss of INR 260 billion (Bhushan et al., 2015). Heavy dependence on monsoons and dominance of small and marginal holdings further exasperate the problems and make the country more vulnerable to climate change effects (Gulati et al., 2018).

Farmers employ a range of risk management strategies, including risk mitigation, risk transfer, and risk adaptation. While combining these strategies is often

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seen as more effective in enhancing farm income and mitigating risks (Birthal et al., 2021), smallholders in developing countries, constrained by limited resources, may not always be able to adopt multiple approaches simultaneously. In such circumstances, prioritizing risk transfer becomes crucial, especially in countries like India, where most farmers are risk-averse (Senapati, 2020). Risk transfer has also been recommended as a preferred climate change adaptation strategy by intergovernmental organizations such as the African Risk Capacity Strategic Framework, the Intergovernmental Panel on Climate Change, and the World Bank (Madaki et al., 2023). Mechanisms like contract farming and futures trading have been implemented recently to provide safeguards against price fluctuations, directly or indirectly.

Crop insurance is one of the formal instruments used to transfer risks, wherein farmers pay a premium to an insurance provider in exchange for protecting their crops against multiple risks. Crop insurance emerges as an effective risk management strategy (Bahinipati et al., 2021; Cole and Xiong, 2017). It provides a safety net for farmers, incentivising risk-averse farmers to consider cultivating high-yielding yet riskier crops. Additionally, it catalyses innovation and agricultural development (Hansen et al., 2019). Despite numerous policy measures to enhance farmers' access to insurance, widespread access remains a persistent challenge for Indian policymakers (Singh and Agrawal, 2020). Though improved in recent years, out of 145 million farmers, only 22.45 million farmers in *kharif* and 11.68 million farmers have adopted crop insurance.[1]

The need to shift from traditional crop farming towards more diversified farming systems, particularly tree-based, has been highlighted by scientists, development experts and environmentalists due to the multiple benefits the system delivers acting insurance against major agricultural crop losses (Datta and Behera, 2024). Diversification has been recognised as a climate-smart agriculture solution to address the multiple challenges of climate change, land degradation, food security, and sustainable agriculture (Reppin et al., 2020; Chand et al., 2024). Various studies, including in India, have acknowledged the contribution of agroforestry to multiple ecosystem services, biodiversity enhancement, conservation of natural resources, microclimate regulation, and pollution control, along with financial gain to farmers (Chavan et al., 2015; Dinesh et al., 2017; Ranjan 2021; Kumara et al., 2023). Trees like Acacia, Ailanthus, Bamboo, Casuarina, Poplar, Eucalyptus, Melia, etc. have been extensively planted for commercial agroforestry.

Agroforestry systems are increasingly vulnerable to the impacts of climate extremes, underscoring the need for robust insurance frameworks. While less frequent, adverse weather events such as storms, droughts, flooding, and outbreaks of pests and diseases pose significant threats to tree-based agricultural practices, leading to substantial economic losses. For instance, in June 2021, cyclone Tauktae wreaked havoc on timber and fruit trees, notably devastating the mango crop. Reports indicate that in Gujarat alone, the cyclone damaged an estimated 30-40 lakh trees, resulting in substantial financial losses for farmers and biodiversity, with approximately 70 per cent of the mango crop lost. Similarly, the valuable Alphanso mango crop suffered severe damage in the Konkan region, amounting to losses of around Rs 5000 million. Despite these staggering losses, the uptake of agroforestry insurance remains remarkably low, with only a marginal adoption observed in certain plantation crops. This contrasts with global trends, where a significant portion of private forests are insured against multiple risks. For instance, 95 per cent of private forests in Sweden are insured, followed by 75 per cent in Japan, 50 per cent in China, 40 per cent in Finland, and 36 per cent in New Zealand (Hohl, 2019).

This study endeavours to explore the extent of tree losses in India due to various extreme climatic risks, the spectrum of risks covered, the formulation of suitable premium structures, the identification of significant challenges linked with tree insurance, and the way forward for increasing the adoption of tree insurance in India. The paper is structured into four sections. The second section presents an overarching view of worldwide tree insurance practices. The third section presents a history of forest management in India and its current status. The fourth section overviews insurance policies in India and their challenges. Finally, the concluding section synthesizes findings and recommends best practices that could be emulated to promote the uptake of tree insurance in the country.

II

GLOBAL TREE INSURANCE SCENARIO

2.1 Area Coverage and Market Size

Trees face a broad spectrum of production risks, encompassing (i) natural hazards like wildfires caused by lightning or earthquakes, tropical and extratropical cyclones (thunderstorms and winter storms), hail, snow, frost, and volcanic eruptions, (ii) biotic threats like infestation of pests and diseases, which tend to become more pronounced after natural disasters, and (iii) human-induced risks such as arson, pollution, and contamination (Patacca et al., 2023). With the increasing risks arising from natural disasters during the last few decades, globally, insurance is emerging as one of the most effective means of safeguarding against production-related uncertainties. Fires and storms are the most severe risks to the trees, resulting in significant losses. For example, in 1939, the Black Friday Fire burned 575,000 hectares of reserved forest and 780,000 hectares of Crown land in Australia (Government of Australia, 2021). Similarly, in 1987, the Black Dragon Fire in Northeast China destroyed more than 3 million acres of forests in the Heilongjiang Province (Liu et al., 2022). In 2003, the Siberian Taiga Fires damaged 55 million Acres of trees in Russia. In China, snow storms in 2008 damaged trees of 20.86 million hectares, causing loss to one-tenth of China's forests (Stone, 2008). The number and intensity of these incidences have increased over the years.

In response to such incidents, the interest in tree insurance has recently grown in some countries (Schelhaas 2008; Sacchelli et al. 2018). The global forest insurance premium reached an estimated US$557 million in 2017, constituting 1.8 per cent of the total agricultural premium of US$30.7 billion (Hohl, 2019). Still, insurance penetration is concentrated only in a few countries, mainly in northern European countries, while other countries seem to encounter challenges in adopting forest insurance. In China, including natural woodlands and timber plantations in the National Agricultural Insurance Programme led to a notable increase in premium volume. Moreover, various governments provide premium subsidies ranging from 30 per cent to 50 per cent to address reforestation expenses (Zhang and Stenger, 2014).

The highest insurance penetration levels in forest insurance are found in Scandinavian countries (Table 1). This is attributed mainly to specialized mutual insurers like Skogbrand Forest Insurance, achieving penetration ratios of 35 per cent across all forest areas (Hohl, 2019). Funded by forest owners, Skogbrand also focuses on prevention, preparedness, and awareness, helping them minimize losses. Being owned by foresters, it also ensures participatory insurance product development. In Sweden, landowner associations play a significant role in this framework. In Japan, forest insurance, introduced by the government in 1937, was later amalgamated with an insurance scheme overseen by the National Federation of Forest Owners' Cooperative Association (Zenmoriren). This joint initiative leads to 70 per cent insurance penetration in the privately owned forest land. This underscores the need for group insurance models under the out-growers schemes. India needs to learn such association between government and private entities for increasing tree insurance. Though there are a few examples where timber-based industries like Tamil Nadu Newsprint and Papers Limited under contract agreement have insured agroforestry of farmers, these models need to be studied and out-scaled.

TABLE 1. PRIVATELY OWNED FORESTS INSURANCE COVERAGE IN SELECTED COUNTRIES

Country (1)	Premium Volume (million USD) (2)	Percentage of area covered for privately owned forests (3)
USA	8.00	3.00
Spain	7.50	1.25
France	4.50	4.00
Denmark	-	50.00
Norway	-	35.00
Germany	1.17	2.00
Sweden	35.00	95.00
Finland	6.00	40.00
Japan	20.00	70.00
China	375.00	50.00
New Zealand	34.06	36.00 (Windstorm) & 19.00 (Fire)

Source: Hohl, 2019; Sacchelli et al. 2018

2.2 Risk Covered

Every geographical area presents distinct risks depending on environmental challenges and dangers that insurance endeavours to safeguard. Countries such as China, New Zealand, the United States, and Finland focus on mitigating risks associated with fire and storms as the tree cover loss due to fire incidences accounts for 8.2 per cent, 5 per cent, 27 per cent, and 21 per cent, respectively (Global Forest Watch Report, 2023). Storms also cause substantial damage in these countries. On the other hand, Japan extends coverage to include geothermal activities due to frequent earthquakes. In Europe, wind storms are the major risk to trees, accounting for 46 per cent of the total damage, followed by fire at 24 per cent, bark beetles at 17 per cent, and other factors at 13 per cent (Patacca et al., 2023). Severe weather occurrences like wind storms can result in significant physical harm (Brazell, 2021), mainly through phenomena such as wind throws, hail, or heavy snowfall. France provides insurance protection against hail, wind, and frost. Sweden and Germany specifically provide hail coverage. Some countries like Italy and Spain offer comprehensive insurance against a broad spectrum of risks, including hail, wind, frost, excess rain, drought, and plant diseases. Therefore, there is a need to design customised tree insurance to meet farmers' needs rather than adopting a complex approach that includes multiple peril coverages and specific tree species.

2.3 Determining Insurance Premium and Sum Assured

(a) *Tree Valuation*

The valuation of trees is a foundation for designing and establishing the insured product, which includes determining the sum assured and the premium amount. Depending on specific characteristics and stages of the trees, various methods are available for the valuation of planted areas. For newly established plantations, typically ranging from 4 to 5 years, the historical cost method is applied. In this method, costs associated with input supply and management during the initial phases of plantation development are accounted for. For plantations with short rotation cycles spanning 5 to 20 years, the market value method is used. In the case of slow-growing tree species, the net present value method is adopted. This approach considers the present value of anticipated future cash flows and costs and hence offers a comprehensive evaluation of the trees' long-term financial viability. The plantation yield tables are crucial in the valuation process, determining the expected timber harvest volume based on tree species, age profile, stand density, management practices, and site index (Matthews et al., 2016). Collectively, these valuation methods provide a nuanced understanding of the economic value of plantation areas across different growth stages and management practices.

The trees planted are heterogeneous and have different purposes. Plantation value is determined by assessing the age, size, health, market value, and potential yield of each tree species. Risk evaluation identifies the risks associated with each species and the plantation. Insurance coverage options include specific risks, loss of income, or comprehensive coverage that includes multiple risks. Premiums are calculated based on the assessed value of the plantation, the level of coverage chosen, and identified risks. Benefits are calculated based on actual losses incurred, including damage to each species, replacement or rehabilitation costs, and lost income or value.

In India, tree valuation faces several challenges that impede its effectiveness in calculating various costs. The lack of uniformity in cost comparison for agroforestry systems in different climatic conditions complicates matters, with uncertainties surrounding the determination of costs based on discounted or current-year prices. Insurance companies require reliable and timely data on crop area, production, and yield to insure farm operations, customize insurance products for different crops and regions, and validate claims. The Crop Cutting Experiment (CCE) is a method that provides a reliable and cost-effective estimation of yields of crops and related information by sampling small subplots within cultivated fields. It is impractical to conduct crop-cutting experiments without historical data, especially for trees (DAF, 2022). Reliance on authorities for data poses another obstacle, especially when assessing risks in complex systems involving various tree species. Obtaining reliable historical data on losses and damages is crucial for accurate insurance premium calculations, but the scarcity of such data hampers the process (Skees et al., 2006). There is a huge scope for applying advanced technologies, digital platforms, and data-driven solutions, particularly for loss assessment and risk characterization (Rumson and Hallett, 2019). The Government of India has made it mandatory to assess the crop loss through remote sensing at least 30 per cent of crops covered. Such policy decisions will be especially relevant in assessing the losses of trees.

(b) *Sum Insured*

The amount of sum insured depends on several factors, including tree species, age, location, and management standards (Brunette et al., 2015), and accordingly, globally, three different methods are used to determine the sum assured. The *full value approach*, practised in several countries, including France, Germany, Italy, Japan, New Zealand, Sweden, and the United States, is based on the value of plantation estimated based on prevailing market rates, providing a comprehensive reflection of its value (Table 2). The *net of salvage value method*, used in Finland and Denmark, factors in the potential value of salvaged timber from the overall valuation, thereby accounting for possible recoveries after an insured loss. This method is particularly suitable for high-value timber species where the damaged tree species have a significantly high value. In the third method, the *re-planting costs method*, the sum insured is determined as a proportion of the initial expenses incurred in establishing the plantation. China adopts this approach for sum-insured calculations (Zhang and Stenger, 2014). In India, the determination of per hectare sum insured relies on the Scale of Finance (SOF), which is the financial need for cultivating a specific crop. The crop-specific SOF is decided by the District Level Technical Committees/State Level Technical Committees and notified by the State Level Coordination Committee on Crop Insurance. However, it is important to note that only selected states work out the SOF for a few perennial crops, particularly fruit crops.

TABLE 2. STATUS OF TREE INSURANCE IN DIFFERENT COUNTRIES

Country (1)	Sum Insured (2)	Deductibles (3)	Premium (%) (4)
USA	Full Value	-	0.5-1.0
Spain	Full Value	10-30	-
Italy	Full Value	20-30	Single risk 7.7, Combined risk 6.1
France	Full Value	15	7.6
Germany	Full Value	Standard 10% Optional: 0-25% (depending on loss ratio)	-
Sweden	Full Value	-	19 SEK (or US$2.9) ha-1 (Fire only 2-5 SEK or US$0.30 - 0.80 ha^{-1}; Storm, including fire 12-58 SEK or US $1.8 - 8.8 ha^{-1}
Finland	Net of salvage value	-	-
Denmark	Net of salvage value	-	0.2-1
Japan	Full Value	-	1-2
China	Replanting costs	-	1
New Zealand	Full Value	-	0.345

Source: Bielza et al., 2007

(c) Indemnity

Indemnity involves evaluating the extent of damaged timber with the insured volume. Compensation is determined by considering the actual incurred costs, such as those associated with claims preparation and loss mitigation, and estimated costs, such as re-establishment expenses, net of deductibles, and within pre-agreed limits (Carbone, 2012). Deductibles are commonly implemented for each loss, calculated as a percentage of the insured amount or a specified monetary value (Brèteau-Amores et al., 2023). For example, in the case of larger plantation risks spanning multiple geographical locations, there is often an annual aggregate deductible. It varies in different countries such as Spain (10-30%), France (15%), Germany (0-25%) and Italy (20-30%) (Hohl, 2019). In India, under Pradhan Mantri Fasl Bima Yojana (PMFBY), the indemnity is calculated as the ratio of shortfall in yield to the threshold yield multiplied by the sum insured amount. However, in the case of perennial crops, exactly calculating threshold yield is challenging as it varies regionally. Currently, only nine states in India have officially designated perennial crops, particularly fruit crops, for tree insurance (NABARD, 2022). Therefore, other states also need to include perennial crops under tree insurance.

(d)Premium

Premium rates are calculated as a percentage of the sum insured. In Sweden, where the highest percentage of area under forest is insured, the tree insurance premium is relatively low, ranging from 0.2 per cent for fire-only coverage to 3 per cent for protection against all disaster damage. In New Zealand and the United States, the premiums are even lower: 0.345 per cent and 0.5-1 per cent of the sum insured, respectively. In China and Japan, where the tree insurance market size is large, the premium rate is less than 2 per cent. Conversely, the premium rates are higher in countries where the area under tree insurance is relatively low. For example, in France and Italy, the rates are 7.6 per cent and 6-7.7 per cent, respectively (Zhang and Stenger, 2014). In several countries, farmers receive subsidies to encourage insurance adoption (Bielza et al., 2007). In India, though subsidized, the premium rates for perennial crops are relatively higher (5 per cent of the sum insured) than in countries where tree insurance adoption is high. This indicates the need to increase the tree insurance market size by offering affordable premium rates for expanding the adoption of tree insurance. Coupled with low premiums, the governments can aid tree investors by requiring private landowners to acquire suitable insurance as a prerequisite for receiving additional government assistance. Price uncertainty is a major risk in perennial crops, particularly woody ones. In such a case, the feasibility of revenue insurance could be studied. In 2017, the Government of India initiated a pilot Revenue Insurance Scheme for plantation crops to protect the growers from risks such as yield loss, pest attacks and price fluctuations. However, these attempts need to be evaluated and modified if required.

III

FOREST MANAGEMENT IN INDIA

3.1 Evolution of Forest Governance in India

The historical evolution of forest governance in India reflects a complex trajectory shaped by colonial legacies, environmental conservation efforts, and ongoing struggles for the rights of forest-dwelling communities, particularly tribals (Figure 1). During the pre-colonial era, forests in India were managed as communal property, essential for the economic subsistence of individuals, families, and communities. Significant changes began with the British colonial period in 1793 when the Permanent Settlement introduced the Zamindari system, granting control over territories, including Adivasi lands, to feudal lords for revenue collection. The formation of the Imperial Forest Department in 1864 and the first Indian Forest Act in 1865 allowed the government to declare any forest land as government property for revenue from timber and forest produce. The Indian Forest Act of 1927 further empowered the government to designate forest lands as reserved, protected, or village forests, often disregarding the rights of tribals and other forest dwellers. Post-colonial developments included the Wildlife (Protection) Act of 1972, which established protected areas like national parks and wildlife sanctuaries, restricting residents' use. In the 1980s, the government initiated converting forest villages into revenue villages, although only partially implemented, sparking ongoing agitation for complete conversion. The 1988 National Forest Policy recognized the symbiotic relationship between tribal people and forests, advocating their involvement in forest management. In 1990, the Ministry of Environment and Forests issued guidelines for Joint Forest Management (JFM), promoting participatory forest management involving local communities and the Forest Department. Internationally, India committed to sustainable forest management at the United Nations Conference on Environment and Development (UNCED), outlined in Agenda 21 in 1992. Today, over 17 million hectares of forest are managed by nearly 10,000 Joint Forest Management Committees, and the Government of India is working on legislation to settle the tenurial rights of forest-dwelling communities, primarily tribals.

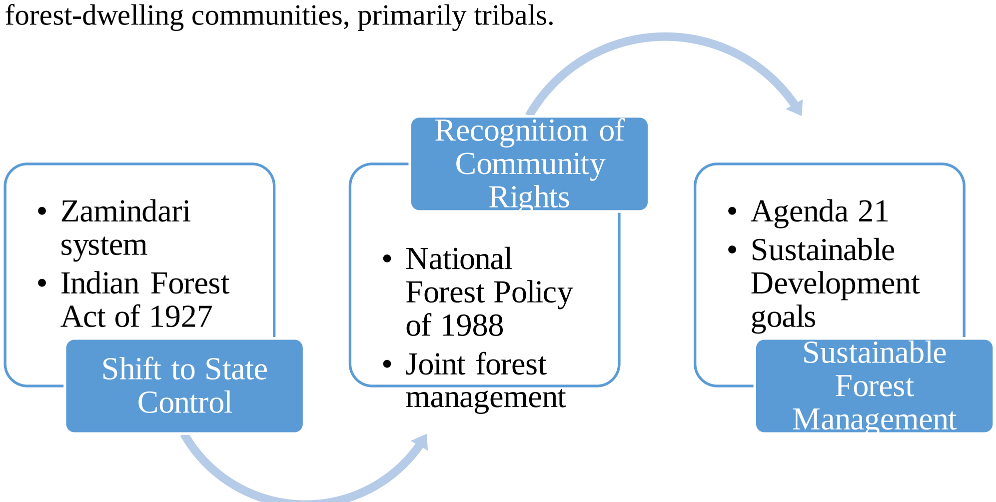


Figure 1. Shifts in Forest Management in India

3.2 Social Movements in India Related to Trees

Tree insurance in India is closely linked to the country's history of environmental movements, particularly those centred around forest conservation. Movements like the Chipko Movement (1973) and the Appiko Movement (1983) highlighted the critical role of forests in maintaining ecological balance. The Narmada Bachao Andolan (1985) and similar movements often focus on the displacement of communities dependent on forests for their livelihoods. Tree insurance can provide a safety net for these communities, helping them recover from losses and maintain their traditional livelihoods. Initiatives like the Silent Valley Movement (1978) emphasize the importance of reforestation and afforestation. Tree insurance can incentivize landowners and communities to plant more trees by offering financial protection against potential losses. Environmental movements often lead to legal and policy changes aimed at protecting forests. Tree insurance can complement these efforts by providing a practical tool for implementing conservation policies and supporting regulatory frameworks by ensuring compliance and promoting responsible stewardship of forest resources.

3.3 Current Status of Tree Plantation in India

The forest area has shrunk worldwide, but planted forests have increased significantly. Worldwide, 73 per cent of forests are owned by the public, 22 per cent are owned by private, and five per cent are unknown (FAO, 2020). The increase in planted forests results from increased demand for timber due to the high market potential of these trees. In India, 86 per cent of forests were owned by the public, while 14 per cent were privately owned forests (Forest Survey of India, 2019). Trees provide benefits such as an additional source of income, resisting climate shocks, lowering chemical costs, etc. Trees outside forests (TOF) have emerged as a primary alternative to traditional forests, effectively alleviating pressure from natural forest ecosystems. Trees outside forests in India meet 70-80 per cent of plywood demand, 60 per cent of pulp wood demand, and half of the pulp wood demand (Rao et al., 2018). Figure 2 illustrates the absolute TOF area for the year 2021. The TOF area was observed to be highest for states like Maharashtra, followed by Karnataka and Orissa. However, these systems are vulnerable to extreme climate events. It created a need for production risk transfer, including compensation for physical harm caused by natural hazards.

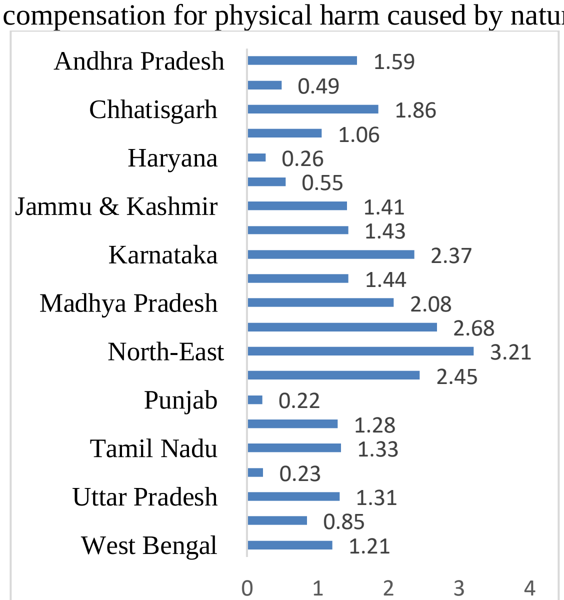


Figure 2. Area under Trees Outside Forest (million ha), 2021

IV

OVERVIEW OF TREE INSURANCE IN INDIA

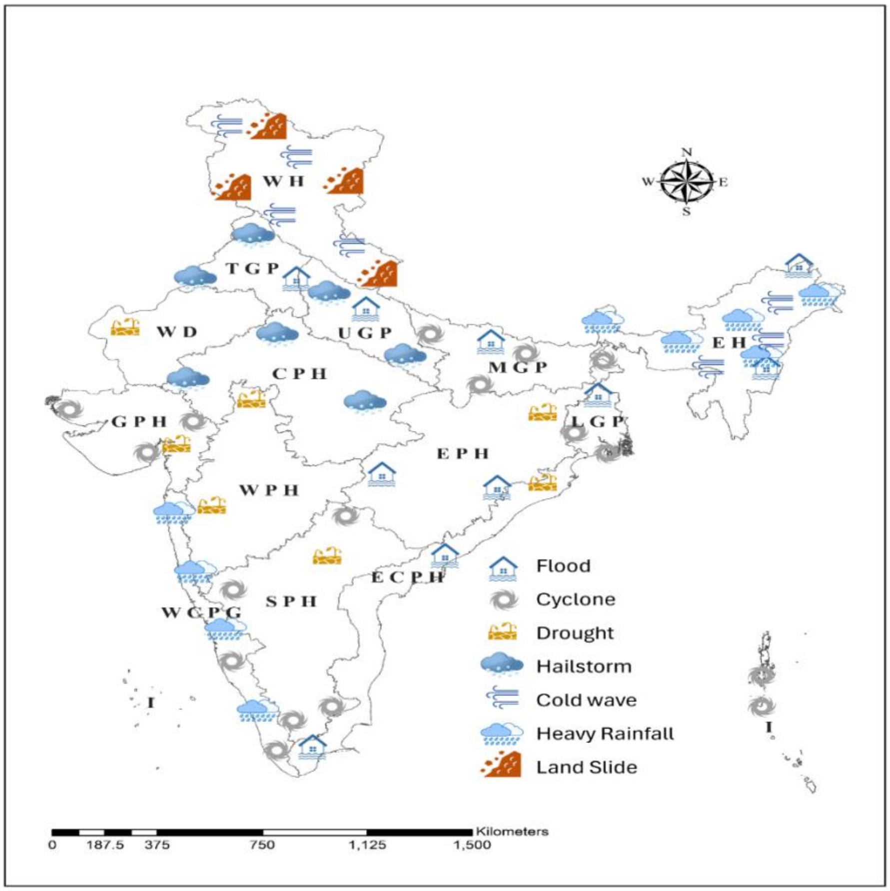
4.1. Key Perils Associated with Trees

India's large geography exposes diverse regions to various risks (Figure 3). The coastal area is vulnerable to cyclones, while in the Himalayas and northeastern regions, the major risks are landslides, hailstorms, and heavy snowfall. The Indo-Gangetic plains are susceptible to hailstorms, and in the Arid Western region, wind storms cause major damage to trees. Central India, parts of Uttarakhand and the North-Eastern Region are prone to fires ignited by natural and human-made causes. Here, we collected information from different government reports and information available in newspapers. Wherever the monetary value of losses was not available, these were estimated by multiplying the number of trees damaged by the unit value of trees collected from different sources. Though comprehensive studies on the economic impact of various hazards on tree loss are lacking, few regional rough estimates underscore substantial losses of trees in various parts of the country. For instance, the Cyclone *Titli* in 2018 damaged the coconut and cashew trees worth Rs. 19,480 million in Andhra Pradesh alone. In 2019, Cyclone *Fani* damaged over 1.6 million trees in Odisha, resulting in an estimated monetary loss exceeding Rs. 3,000 million (Table 3). Similarly, another Cyclone *Tauktae* in 2021 wreaked havoc on trees worth Rs. 10,506 million in Gujarat. Besides, regulatory and political uncertainties can potentially bring about substantial socio-economic shifts in the management of trees. These risks represent a significant menace to India's greenery, discouraging tree plantation by the farmers and underscoring the urgency for robust insurance policies to mitigate such risks effectively.

TABLE 3. TREE LOSS DUE TO CYCLONIC EVENTS IN DIFFERENT STATES

State (1)	Disaster (2)	Year (3)	No. of trees lost/uprooted (lakh) (4)	Loss (Million Rs.) (5)
Odisha	*Phailin*	2013	0.15	70
	Fani	2019	9.00	2700
	Fani		7.90	395
	Amphan	2020	0.040	2.5
AP	*Titli*	2018	Coconut: 12.56; Cashew: 22000 ha	19480
	Fani	2019	Coconut: 0.10	581
TN	*Nivar*	2020	0.01	3.0
	Mandous	2022	0.000350	1.05
Gujarat	*Tauktae*	2021	35.00 in Gir National Park; 0.02 mango on farmers' field	10506

Source: Estimated based on assessment reports by different agencies and reported in newspapers



Note: WH-Western Himalayan, TGP-Trans-Gangetic Plain, UGP-Upper-Gangetic Plain, MGP-Middle-Gangetic Plain, LGP-Lower-Gangetic Plain, EH- Eastern Himalayan, WDR-Western Dry Region, CPH-Central Plateau and Hill, EPH-Eastern Plateau and Hill, WPH-Western Plateau and Hill, ECPH-East Coast Plain and Hill, WCPG-West Coast Plain and Ghat, SPH-Southern Plateau and Hill, I-Island

Figure 3. Agroclimatic Zone-Wise Risks in India

4.2. Status of Tree Insurance

In India, there is an ongoing implementation of a multi-peril tree insurance program, recognizing the significant influence of natural factors on agricultural yields and the potentially devastating consequences for society (Table 4). Some fruit crops are covered under Pradhan Mantri Fasal Bima Yojana, whose subsidy premium is 5 per cent of the sum insured. Besides, there are a few dedicated insurance schemes for plantation and wood-based tree species, like Agroforestry Plantation Insurance,

TABLE 4. VARIOUS TREE INSURANCE SCHEMES IN INDIA

Policy Name	Trees covered	Risk covered	Premium	Sum assured	Period of insurance
Agroforestry Plantation Insurance	Ailanthus, Casuarina, Dalbergia sissoo, Eucalyptus, Gmelina, Leucaena, Melia dubia	Fire, Lightening, Riot, strikes, acts of terrorism, storms, hailstorms, cyclones, flood	1.25 per cent of the input cost (Varies with stage of plantation)	Input cost	Annual
Pulpwood Tree Insurance	Casuarina, Eucalyptus, Poplar, Subabul	+Pest & diseases	1.5%-2.5% Depends on species, risks, geographical location, etc.	Input cost and extended up to 125-150% of input cost	Annual with provision to go for a 5-year duration
Bio-Fuel Tree /Plant Insurance	Callophyllum, Jatropha, Karanja, Mahua, Neem, Simarouba	+Pest & diseases either in isolation or concurrently	Depends on 1%-2% of basic risks (Fire, Pest & Disease), 0.5%-1% drought/ Prolonged dry spell	Input cost and extended up to 125-150% of input cost	Annual with provision to go for a policy of 3 to 5 years duration
Plantation / Horticulture Insurance	Arecanut, Chickoo, Citrus, Cocoa, Eucalyptus, Pomegranate, Poplar, Rubber, Teak Wood	Fire, Lightening, Riot, strikes, acts of terrorism, storms, hailstorms, cyclones, flood	1.25% of the Sum Insured	Input cost or cost of raising	Annual
Rubber plantation insurance	Rubber	+Earthquake+ landslide and rockslide+ damage caused by road or rail vehicles+Drought+Damages caused by wild animals	Depends on input cost and the stage of the crop	Based on input cost and yield deduction	Immature: 7 years Mature:8 to 38 years
Coconut Palm Insurance Schemes	Coconut	+Pest (birds not covered as a pest)+diseases of widespread nature causing irreparable damage to plant+ Earthquakes, landslides+ tsunamis, Severe drought	Palm age (4th-15th)- 9 Rs. /plant/year Palm age (16-60th)- 14Rs./plant/year Rebate in premium @7.5% for two-year policy and 12.5% for three-year policy	Palm age (4th-15th)- 900 /palm Palm age (16-60th) 1750Rs. /palm	Annual with provision to go for a 3-year duration

Note: Fire, Lightening, Riot, strikes, acts of terrorism, storms, hailstorms, cyclones, flood is included before + in risk covered

Pulpwood Tree Insurance, Bio-Fuel Tree /Plant Insurance, Rubber Plantation Insurance, and Coconut Palm Insurance Schemes. The premium rates of these insurance schemes vary from 1-2.5 per cent depending on the plantation stages, species, risks, and geographical location. The sum insured for the insurance is generally based on the input cost and may extended up to 125- 150 per cent of the input cost. The period of insurance varies from annual to more years, as in the case of rubber and coconut insurance.

In addition to this, Karnataka offers insurance coverage for income loss resulting from crop damage in annual horticulture crops like pomegranate, papaya, mango, and commercial species such as areca nut (Duraisami et al., 2022). Traditional tree insurance has historically focused on mitigating losses related to crop yields and damages. However, with technological advancements and increased commercialization in tree-related industries, there's a growing need to protect against revenue losses. Therefore, other states might think to include revenue insurance for tree species. Even with several tree insurance schemes, insurance penetration is notably low. For instance, in the coconut palm insurance scheme, less than 1 per cent of farmers benefited, while the claim-to-premium ratio remains high, reflecting similar trends in other schemes.

4.3 Tree Insurance Aspects

a. Land Use/Tenure, Market, and Institutions in Tree Insurance

Tree insurance policies in India are influenced by land use, market dynamics, and institutional frameworks. Land tenure systems in India have evolved, leading to fragmented land holdings. Secure land tenure is essential for farmers to invest in long-term tree crops, while insecure tenure can discourage farmers from investing in tree crops and reduce the demand for insurance. The risk profile of tree crops also affects the type of land use, with India's diverse climatic and geographical zones resulting in varied land use patterns. Monoculture plantations may be more susceptible to pests and diseases than to diversified cropping systems, which can influence insurance premiums and coverage options.

Market dynamics play a significant role in tree insurance, with traditional fragmented agricultural markets providing limited access to formal insurance products. Stable and predictable pricing mechanisms enhance the attractiveness of tree insurance, and a well-developed value chain ensures that farmers can consistently profit from tree crops, justifying the cost of insurance as a necessary investment. Historical evidence and case studies demonstrate the importance of tree insurance in mitigating risks. Cyclone Hudhud in 2014 highlighted the vulnerability of tree crops, leading to increased adoption of tree insurance in affected regions. Rubber and coffee plantations in Kerala and Karnataka have benefited from specialized insurance schemes that protect against market fluctuations and climatic events. Under the PMFBY, insurance of mango plantations in Uttar Pradesh has ensured income stability for farmers in years of unexpected weather patterns.

b. Indigenous Fruit/Fodder Trees in Dryland India

Indigenous fruit and fodder trees are integral to the sustainability and resilience of dryland ecosystems in India. These trees provide multiple benefits that support ecological balance, economic stability, and social well-being (Shiran et al., 2020). Their role in traditional agricultural systems highlights the importance of conserving and promoting these species to ensure the sustainability of dryland regions. For instance, the *Azadirachta indica* is known for its medicinal properties and use as a natural pesticide, making it a vital component in both healthcare and agriculture. Similarly, *Phyllanthus emblica*, valued for its high vitamin C content and other health benefits, contributes significantly to nutritional needs. The *Ziziphus mauritiana*, a hardy tree, produces nutrient-rich fruits that are important for food security in the dryland area. *Vachellia nilotica* provides multiple resources, such as fodder, wood, and gum, which are crucial for local economies. Likewise, *Prosopis cineraria* is integral to agroforestry systems, providing fodder and enhancing soil fertility, thereby supporting sustainable agricultural practices. Recognizing and ensuring these trees can play a crucial role in safeguarding the livelihoods of communities that depend on them and maintaining the health of dryland ecosystems in India.

c. Home-Garden-Based Fruit Tree Production

Home gardens in agro-forestry systems improve food and nutrition security. However, as markets and policies encourage commercialization, smallholder farmers struggle to maintain their plots. Instead, they turn their land into income-generating areas by planting commercial crops for urban and processing markets (Abdoellah et al., 2020). It is crucial to provide insurance to small-scale, home-garden-based agroforestry through individual and group insurance approaches to protect these vulnerable areas.

d. Germplasm Supply for Nursery Management of High-Value Tree Species

The germplasm supply for managing high-value tree species faces issues affecting the availability and quality of planting material. These issues significantly impact tree insurance, influencing the success and sustainability of tree cultivation. Insurance companies may offer better rates for nurseries and farmers who use certified, high-quality germplasm. This insurance can cover losses related to germplasm issues, such as poor genetic quality, disease susceptibility, and environmental stress tolerance, providing a safety net for investments in high-value tree species. By encouraging the use of high-quality, diverse germplasm, insurance supports sustainable forestry practices and aligns with the long-term viability goals of insurance providers. Coverage for high-value trees can offer economic stability to nursery managers and farmers, ensuring they can recover from losses and sustain their operations.

4.4 Challenges in Tree Insurance

In India, agricultural insurance, in general, and tree insurance, in particular, face several challenges, including a lack of precise loss estimates, a lack of awareness, and high premiums for perennial crops. The 5 per cent premiums under the Pradhan Mantri Fasal Bima Yojana for horticultural crops are higher than in many other countries. Evidence identified a premium rate that is too high as a major hurdle in adopting tree insurance (Ghosh et al., 2019). Claim settlements are also an issue, as delayed or insuring the wrong crop can leave farmers vulnerable (Ghosh et al., 2019). Presently, in this program, farmers are obligated to make an annual premium payment, which has the potential to be transformed into a single lump-sum payment. Additionally, a lack of awareness and understanding among tree-growing farmers regarding insurance terms, conditions, and coverage further hinders their participation in insurance schemes (Singh and Agrawal, 2020). A comprehensive and sustained awareness campaign can be developed to increase understanding and participation in tree insurance programs. It's essential to tailor the approach to the specific needs and characteristics of the target audience while maintaining a focus on the benefits of tree insurance for sustainable agriculture and forestry practices. The foundation of agricultural credit, known as the scale of finance, is well-established for field crops but remains limited to horticultural trees and fruits. However, there is a need to expand this coverage to include a broader range of perennial crops, especially those with woody characteristics. Additionally, it is recommended that more states and union territories prioritise tree insurance alongside their focus on food crops. In essence, the multifaceted challenges faced by tree insurance underscore the need for comprehensive solutions to promote its viability and accessibility in safeguarding the interests of tree-growing farmers.

Role of Tree Insurance in Livelihood Enhancement

Insurance ensures a predictable income stream, allowing farmers to plan and invest more confidently in their agricultural activities. It encourages diversification of crops, such as high-value perennial trees like fruits and nuts, which provide higher returns. It also incentivizes adopting modern agricultural practices and technologies, increasing productivity and sustainability. Insuring trees in Indian agriculture can improve livelihood by providing financial stability, reducing risk, and promoting sustainable farming practices. Insurance can protect farmers against losses from natural disasters, pests, diseases, and other unforeseen events, ensuring a steady income. It can also help maintain income even in adverse conditions, reducing poverty and financial stress. Insurance can also encourage investment by providing improved confidence and credit access for further farm investment. It can also incentivize sustainable practices by offering lower premiums or better terms for sustainable practices. Farmers can diversify their crops and plant trees, improving biodiversity and ecosystem health. This increased agricultural productivity can lead to social and economic development, job creation, and community resilience. To implement comprehensive insurance programs, it is essential to develop and implement schemes that cover a wide range of risks, foster partnerships between the government, insurance companies, and agricultural organizations, conduct awareness and education campaigns, offer incentives for sustainable practices, ensure affordable insurance, provide policy support and subsidies, and continuously monitor and evaluate the effectiveness of insurance programs.

V

CONCLUSIONS AND POLICY IMPLICATIONS

A significant increase in tree insurance in recent years is driven by the shift toward addressing financial risk from catastrophic events. The coverage of tree species and perils varies across countries, with primary obstacles being the exact valuation of tree species. India faces significant challenges with tree insurance, such as high premiums for perennial crops and low awareness among farmers. The Pradhan Mantri Fasal Bima Yojana, which requires annual premium payments, has a high premium rate for horticultural crops, limiting its adoption. Problems with claim settlements, including delays and inaccuracies, leave farmers vulnerable. To adequately address the needs of farmers and alleviate financial burdens, it is necessary to do effective collaboration between government and private entities as evident in countries like China, Japan, and Scandinavian countries.

India is implementing a multi-peril tree insurance program. However, there is a requirement for customized tree insurance tailored to farmers' needs, as insurance for a specific peril is more, also varies state-wise. Currently, only nine states in India officially designate perennial crops, mainly fruit crops, for tree insurance, and other states need to include these crops in their insurance schemes. At the same time, the scale of finance should be determined more comprehensively. Price uncertainty poses a significant risk for perennial crops, especially woody perennials, indicating the need to explore revenue insurance. Provisions of cooperative insurance for participatory insurance product development can be explored. Lowering the insurance premium would help provide wider coverage, as evidenced by international experiences. Providing basic cover at a minimum premium add-on for farmers to choose as per requirement would also help increase tree insurance. Steps are needed to create awareness among farmers about the benefits and provisions of tree insurance to create a robust database of economic indicators, including input costs and historical losses. Insurance premiums may be an integral part of the benefits of government assistance for plantations. Additionally, India can leverage technological advancement to tailor insurance units to individual farmers' fields and adopt a multifaceted research approach to address various challenges. Tree insurance can be used as an economic instrument to guide tree plantation policy in India, as it reduces risks and ensures a continuous inflow of income. It can also guide the selection and popularization of plant species.

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NOTE

1. https://pmfby.gov.in/adminStatistics/dashboard

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