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RESILIENCE BY DESIGN

A climate risk lens on Fiscal Devolution

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Message

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Nations rise not only on the strength of their economies, but on the strength of their institutions and their ability to withstand shocks, safeguard livelihoods, and keep the engine of growth running. In today's era, when heatwaves, floods, droughts, and cyclones can strike within the same year, resilience is not just a policy theme, but it is the very test of state capacity. Finance is the first shield against climate risk. With strong, predictable flow of finance, losses can be prevented, productivity protected, and recovery costs reduced before the next disaster strikes.

At the centre of India's federal fabric lies the Finance Commission, whose decisions shape the resources available to states. Climate change has now become a systemic risk by upending agriculture, energy, and cities. Fiscal devolution, therefore, is not merely in the background; it is a frontline instrument for national resilience and competitiveness.

Resilience by Design: A Climate Risk Lens on Fiscal Devolution makes the case for action. The devolution formula, built over decades to balance equity, efficiency, and growth, must now reflect the defining reality of this decade—climate risk. The report presents a well-researched, evidence-based new devolution formula to meet this need, integrating insights from state-level Climate Risk and Vulnerability Assessments (CRVA). This approach provides a robust framework that aligns fiscal transfers with the hazards states face, the scale of their impact, and the capacity to prepare, cope, and recover.

The report offers a thorough assessment of all channels of public funding that address climate risks and disasters. Most existing mechanisms remain reactive, designed to meet immediate needs once a shock has already occurred. In contrast, the proposed devolution framework opens the possibility for long-term mitigation and adaptation by embedding climate considerations directly into fiscal transfers. The analysis also looks at global experiences from ecological fiscal transfers to climate budgeting in countries such as Brazil, South Africa, and others. In this context, India would lead by example, becoming one of the first major economies to formally integrate climate risk and vulnerability into its system of fiscal devolution. This aspect of the design is not only innovative but also commendable in setting a global benchmark.

Resilience is development. Embedding climate risk into devolution will equalise opportunity across states, protect productivity and revenues, and accelerate progress toward the SDGs, the Paris commitments, and Viksit Bharat @2047. Growth must not only be faster, but safer, fairer, and built to last.

I extend my sincere appreciation to the research team at the Institute for Competitiveness whose dedication and hard work shaped this comprehensive report.

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Executive Summary

> *Finance is the linchpin that connects climate ambition to climate action.*

Climate change has emerged as a systemic risk that recasts economic systems, governance structures, and fiscal frameworks around the globe. Mounting impacts have transitioned the discussion from post-disaster assessments to the imperative of incorporating climate resilience into economic planning and fiscal arrangements.

In the global context, climate finance facilities from multilateral adaptation funds to new instruments such as green bonds, have been developed to mobilize resources for mitigation and adaptation efforts. Yet, evidence reveals a need for systematic approaches towards enhancing ex-ante adaptive capacity and resilience. In India, most of its prominent institutional setup (NDRF, SDRF, NAPCC, CAMPA) are still geared towards relief and restoration, with insufficient co-option of risk reduction and adaptation interventions within fiscal federalism.

> *Fiscal federalism in India is not static; it is an evolving instrument to meet emerging national challenges*

This report recommends a paradigm change in Indian fiscal federalism away from piecemeal expenditure to systemic, proactive readiness. The devolution formula of the Finance Commission is a tried and tested forum to make climate risk mainstream through the incorporation of a climate-related criterion within fiscal transfer. This aligns with international best practices in fiscal federalism, where intergovernmental transfers are seen to be aligned with changing risk and adaptive requirements.

The proposed climate component would allocate a percentage of devolved funds to proactive climate adaptation. This rule-based, bounded fiscal allocation creates budgetary incentives for incorporating climate assessments into planning and building institutional capacity for climate-resilient, low-carbon development. Prioritising resilience through budget transfers would address ongoing adaptive capacity gaps and align India's subnational budgets with long-term mitigation goals and international commitments.

This report is organised into four chapters.

- **Chapter 1 discusses global climate risk, the Indian climate risk context, and the development of the Finance Commission.**
- **Chapter 2 examines the climate-related funds in the country.**
- **Chapter 3 explains the rationale and the integration of the proposed climate component into the devolution formula.**
- **Chapter 4 highlights best practices worldwide for inter-governmental fiscal transfers related to climate risk.**
- **Chapter 5 concludes the report by summarising key insights from each chapter.**

By shifting climate finance from reactive support to a structural element of fiscal transfers, India could balance equity and resilience. This would ensure that resources reach states most vulnerable to climate shocks-a precondition for transformational and inclusive development in a century of climate disruption.

Chapter 1

Integrating Climate Risk into India's Current Fiscal Devolution Formula

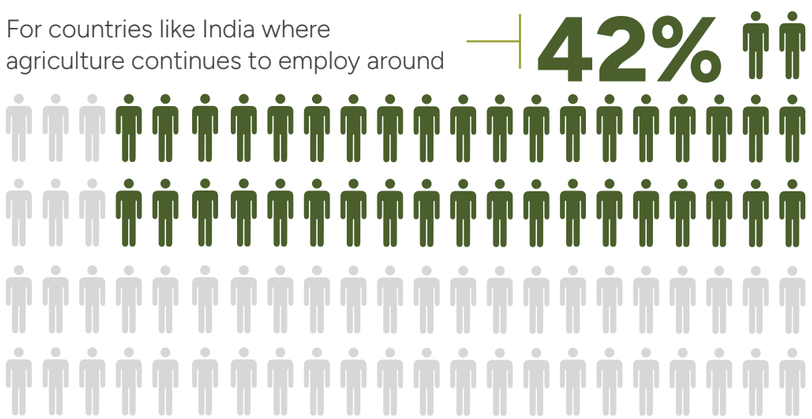
Climate-related disruptions are no longer distant threats, they are visible in the form of catastrophic floods, devastating wildfires, intensifying heatwaves, and destructive storms that cut across continents

The global development outlook as of 2025 is characterized by deepening fragility across geopolitical, social, technological and economic domains, but it is environmental risks and particularly those linked to climate change that have emerged as both the most urgent and the most consequential for long-term prosperity. Global surveys suggest that more than half expect the world to remain unsettled over the next two years, with nearly two-thirds projecting turbulence or outright storminess over the coming decade. This widespread pessimism reflects an increasingly fractured global system in which extreme weather, resource pressures, and ecological degradation are converging with social and economic instability. Climate-related disruptions are no longer distant threats; they are visible in the form of catastrophic floods, devastating wildfires, intensifying heatwaves, and destructive storms that cut across continents. Recent years have witnessed record heat across Asia, unprecedented flooding in Brazil and Indonesia, fires engulfing Canada's forests, and severe hurricanes sweeping across the United States. Globally, weather-, climate-, and water-related disasters inflicted losses of US$4.3 trillion between 1970 and 2021[i] .The costs are accelerating economic losses from natural catastrophes reached nearly US$368 billion in 2024 alone.[ii]

The manufacturing sector is similarly exposed, though in different ways. Floods, heatwaves, and hurricanes not only damage physical plants and industrial clusters but also disrupt supply chains that have grown increasingly globalized and interdependent.

The significance of climate risk lies in its potential to derail expected gains in income and productivity. Although per capita GDP is projected to grow in most economies, climate shocks threaten to erode these improvements through declining agricultural productivity, infrastructure destruction, and heightened health risks. The International Labour Organization projects that by 2030, heat stress alone could diminish global working hours by 2.2 percent which is equivalent to 80 million full-time jobs translating to productivity losses of about US $2.4 trillion[iii].

For countries like India where agriculture continues to employ around **42%**



of the workforce but contributes a far smaller share of value added, climate change is particularly destabilizing.

Crop yields fluctuate dramatically under rising temperatures and erratic rainfall, undermining food security and export revenues. FAO's latest global estimation reveals that over the past 30 years, disasters destroyed around US $3.8 trillion in crop and livestock output which roughly US $123 billion per year[iv]. At the same time, rural households already operating near subsistence face heightened vulnerability, pushing governments into cycles of emergency spending and disaster relief that crowd out long-term investment.

The manufacturing sector is similarly exposed, though in different ways. Floods, heatwaves, and hurricanes not only damage physical plants and industrial clusters but also disrupt supply chains that have grown increasingly globalized and interdependent. Rising energy volatility and climate-related shocks to critical resource supplies raise production costs and increase the vulnerability of export-oriented growth models. Moreover, evidence suggests that supply chain disruptions

Pollution and ecosystem collapse, meanwhile, undermine health and productivity, raising long-term costs for public budgets and constraining labour force participation.

are now systematically interconnected with environmental stressors, meaning that climate volatility anywhere can have cascading effects across regions. This nexus of climate and manufacturing underscores the need for resilience measures that extend beyond disaster recovery into the heart of industrial policy.

Understanding climate risk requires appreciating its multiple dimensions. Physical risks are the most visible, emerging from acute shocks such as floods or chronic shifts like sea-level rise. Transition risks stem from the policy and market adjustments associated with decarbonization, with implications for industries dependent on fossil fuels. More complex are the systemic risks that emerge when climate interacts with social and economic vulnerabilities displacing populations, exacerbating inequality, or amplifying political polarization. Migration induced by droughts or floods, for example, is not simply a humanitarian concern but also a driver of social tension and fiscal strain. Pollution and ecosystem collapse, meanwhile, undermine health and productivity, raising long-term costs for public budgets and constraining labour force participation.

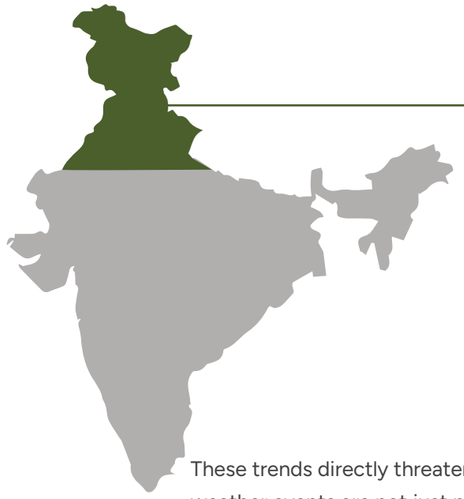
In this context, adaptation and mitigation are not optional but integral to sustaining growth. Adaptation measures such as climate-resilient agriculture, urban cooling systems, and flood management infrastructure are essential to safeguard human capital and productive assets.

At the same time, mitigation through energy diversification, green industrialization, and low-carbon transport systems reduces future exposure to transition risks and fosters innovation-led growth. Crucially, survey evidence shows that while all risks are expected to intensify over the next decade, environmental risks display the steepest deterioration, underscoring the cost of inaction. The fiscal dimension of climate risk is especially pressing. Without climate-informed allocation mechanisms, fiscal transfers often fail to reflect the uneven distribution of environmental exposure across regions. Moreover, aligning fiscal transfers with climate objectives can accelerate structural transformation.

1.1 Indian Economy from a Climate Lens

Few countries face the paradox that India does today: a rapidly expanding economy with global ambitions, built on foundations that are deeply exposed to

the shifting climate. Over the last three decades, India has moved decisively into a services- and industry-led growth model, with modern sectors propelling GDP and shaping its international profile. Services contribute roughly 55% of GVA, industry close to one-third, and agriculture, still the primary livelihood for a large share of households accounting for about 18%[v]. Yet beneath this structural transformation there are systems of agriculture, infrastructure, and energy that remain tethered to rainfall patterns, seasonal temperatures, and the growing frequency of extreme weather events. The very scaffolding of India's economic success is anchored in climate-sensitive sectors. From the heatwaves that push electricity demand to unprecedented peaks, to the floods that wash away transport corridors and disrupt urban life, climate shocks no longer arrive as rare, isolated events. They have become a recurrent feature of India's development landscape, blurring the lines between economic planning and disaster response. India ranks as the seventh most climate-vulnerable country in the world, exposed to a spectrum of risks including floods, droughts, heatwaves, sea-level rise, biodiversity loss, and water insecurity[vi]. **The Economic Survey 2024–25 underscores that adaptation has already become a fiscal priority, with national adaptation-related spending rising from 3.7% of GDP in FY16 to 5.6% in FY22.** This trajectory reflects a growing recognition that climate resilience is not merely an environmental concern but a macroeconomic necessity.



Agriculture illustrates this vulnerability most starkly. More than

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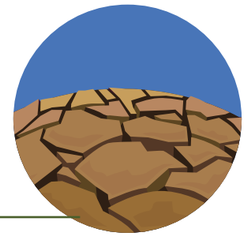


of India's agricultural land is drought-prone, with drought probability ranging from 20% in dry-humid zones to over 40% in arid zones. Heatwaves are now occurring on 18% of days annually (2022–24) compared to just 5% in 2020–21[vii].

These trends directly threaten crop productivity and agricultural incomes. Extreme weather events are not just production shocks; they ripple through the economy, as evidenced by vegetable price inflation persisting for up to three months after such events. In central India, the frequency of extreme daily rainfall events (>150 mm) has risen by around 75% from 1950 to 2015, driving up flood risk and damaging standing

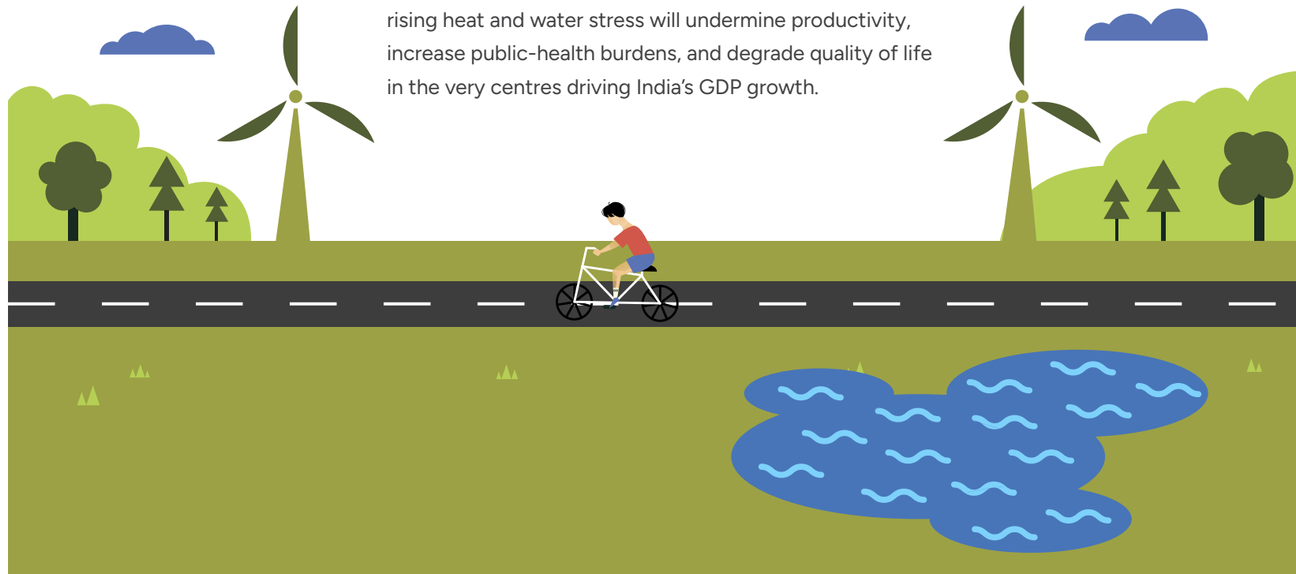
crops, rural infrastructure, and irrigation systems[viii]. These impacts compound fiscal stress by depressing state revenues, raising relief and reconstruction costs, and increasing the volatility of agricultural procurement and subsidies.

Energy systems face their own climate-induced stress points. Heatwaves push electricity demand to record highs. India met an all-time peak of ~250 GW in FY2024–25 while droughts have the potential to reduce hydropower generation and force costly shifts to alternative generation sources[ix]. The energy transition, while critical, is constrained by dependencies on critical minerals and global supply chains. Lessons from countries that prematurely phased out thermal generation show the risks of underestimating reliability needs in a warming world. Adaptation in the energy sector now includes investment in low-emission thermal technologies, accelerated battery storage R&D, and integrating water body rejuvenation into power plant cooling strategies. Without such measures, climate-induced energy instability will spill over into industrial output, export competitiveness, and household welfare.

Urban infrastructure is similarly vulnerable. Cities already face triple climate pressures: heat stress, flooding from extreme precipitation, and groundwater depletion.

The National Mission on Sustainable Habitat and AMRUT 2.0 have initiated over 3,078 water body rejuvenation projects and developed 493 km of green mobility corridors to improve resilience.

Yet the scale of urban expansion means these efforts must be matched by sustained fiscal flows to prevent maladaptation. Without climate-sensitive urban planning, rising heat and water stress will undermine productivity, increase public-health burdens, and degrade quality of life in the very centres driving India's GDP growth.



The fiscal implications of these sectoral risks are immediate and structural. Climate shocks erode tax bases especially in states reliant on agriculture, mining, or tourism while creating unplanned expenditure needs for relief, public health, and infrastructure repair. Capital losses from damaged infrastructure shorten asset lifespans, raising maintenance costs and diverting funds from long-term development projects[x].

The Reserve Bank of India's Report on Currency and Finance 2022–23 quantifies climate change as a systemic macro-financial risk, with an estimated 2.5% of GDP annually required through 2030 for climate-resilient growth.

Given India's federal fiscal structure, much of this burden will fall on states, whose adaptive capacity varies widely.

Climate vulnerability in India is spatially uneven and often regressive. DST's state-level assessments highlight Jharkhand, Mizoram, Odisha, Chhattisgarh, Assam, Bihar, Arunachal Pradesh, and West Bengal as high-risk states when hazard exposure, sectoral sensitivity, and adaptive capacity are combined. Many of these states are also among the poorest in per capita income, with heavy dependence on climate-sensitive sectors and limited institutional capacity to manage adaptation[xi]. Climate change thus functions as a structural development penalty: it imposes the heaviest burdens on those least able to bear them, widening existing economic disparities. Coastal states face chronic storm surge and erosion threats that demand expensive protective infrastructure. Rapidly urbanising states face the high upfront costs of climate-proofing cities and these costs cannot be fully recovered through narrow local tax bases.

These overlapping risks bring India's fiscal architecture and particularly its system of intergovernmental transfers into sharp focus. India's constitutional design exhibits a vertical fiscal imbalance, with the Union government collecting the majority of revenues while states shoulder the largest and most climate-sensitive expenditure responsibilities, from agriculture and irrigation to disaster response and urban infrastructure. As noted by the Finance Commission, the Union collected over 60% of total public revenues, while states accounted for over 62% of combined government expenditure. Compounding this is a horizontal fiscal imbalance, where poorer, climate-vulnerable states have significantly lower revenue capacity but far higher exposure to fiscal and climate shocks. Seventeen states were identified by the Commission as requiring post-devolution revenue deficit grants totalling ₹2.95 lakh crore for the 2021–26 period, underscoring how fiscal gaps persist even after central transfers. Without corrective fiscal mechanisms, these imbalances risk deepening inter-state inequality and eroding the fiscal foundations of cooperative federalism.

India's third national communication in 2023 documents sectoral vulnerabilities and the need to mainstream adaptation and resilience into all levels of economic planning

India's climate policy framework is anchored in its commitments under the Paris Agreement, the SDGs, and the Sendai Framework for Disaster Risk Reduction. Domestically, these commitments are operationalised through the National Action Plan on Climate Change (NAPCC) and a set of State Action Plans. India's third national communication in 2023 documents sectoral vulnerabilities and the need to mainstream adaptation and resilience into all levels of economic planning. Within India's fiscal architecture, the Finance Commission's horizontal devolution formula is one of the most important levers for aligning subnational incentives with national climate goals. In recent years, Finance Commissions have made incremental but important moves towards integrating ecological and risk-based parameters into devolution. The 14th Finance Commission introduced a forest cover criterion with a 7.5% weight, compensating states for the opportunity cost of conservation. The 15th Finance Commission expanded this to a 10% forest and ecology weight and introduced a Disaster Risk Index (DRI) to guide the allocation of disaster management funds. The DRI marked a shift from purely post-disaster relief to risk-informed pre-disaster allocations, ranking states by their hazard exposure. These critical steps set a precedent for including beyond-income parameters in the constitutional transfer framework, provided they use transparent data and serve a clear public purpose.

Yet important gaps remain. Forest and ecology weights reflect a specific form of natural capital, while the DRI is largely backward-looking, based on historical disaster events such as floods, cyclones, and earthquakes. Neither fully captures emerging climate threats such as chronic heatwaves, sea-level rise, or shifting monsoon dynamics, nor do they integrate measures of adaptive capacity. As the heatwaves of 2024–25 demonstrated, climate extremes increasingly manifest as compound, multi-sector shocks, stretching energy, health, and fiscal systems simultaneously[xii]. Without a forward-looking climate criterion, the devolution formula risks underestimating the structural fiscal needs of the most climate-exposed states.

India's future growth path and its fiscal equalization mechanisms cannot be separated from climate risk management

The case for integrating a climate risk indicator into the devolution formula now rests on four pillars.

- **First**, climate hazards are intensifying in both frequency and severity, making them a predictable driver of fiscal stress.
- **Second,** India already has the data infrastructure ranging from IMD, CWC, FSI, Census, NFHS, SECC, and DST vulnerability assessments to construct a composite climate risk metric that blends hazard exposure, sectoral sensitivity, and adaptive capacity.
- **Third,** there is precedent for introducing new criteria when they address nationally significant public goods or shared risks.
- **Fourth,** embedding climate risk into transfers is fiscally prudent, reducing reliance on unpredictable post-disaster aid and smoothing fiscal capacity over time. This integration would also advance four development objectives. It would strengthen productivity resilience by financing climate-smart agriculture, resilient infrastructure, and energy systems with higher flexibility. It would bolster human development by supporting health adaptation, heat action plans, and early-warning systems. It would promote horizontal equity by directing untied funds to states with high vulnerability and low adaptive capacity, and finally, it would create predictable domestic finance streams that could leverage private investment and international climate finance for adaptation and resilience projects.

India's future growth path and its fiscal equalization mechanisms cannot be separated from climate risk management. The interplay between economic structure, spatial inequalities, and climate vulnerability means that without explicit integration of climate risk into fiscal transfers, climate change will entrench regional disparities, undermine macroeconomic stability, and slow progress towards national development goals. By embedding a transparent, data-driven climate risk criterion into the Finance Commission's devolution formula, India can modernise its fiscal federalism for the climate realities of the 21st century ensuring resilience, equity, and sustained growth in the decades ahead.

The main objective of this report is to propose modifications to India's fiscal devolution formula so that it reflects climate risk and vulnerability as a core criterion. Over the decades, Finance Commissions have adapted their formulas to changing national priorities from population and income equalisation to efficiency, ecological considerations, and disaster management. Building on this trajectory, the report argues that climate risk and vulnerability is an emerging and persistent structural reality which must now be explicitly integrated. To make this case, it draws on India's State-Level Climate Risk and Vulnerability Assessment (CRVA), which provides robust, state-level evidence of how uneven exposure, sensitivity, and adaptive capacity shape differentiated risks across the country. By aligning fiscal transfers with these vulnerabilities, the proposed framework ensures that states facing the highest risks receive targeted support, while enhancing rather than displacing existing indicators such as population, area, and income distance. In doing so, the report calls for a forward-looking fiscal system that equalises resources and strengthens resilience, enabling India's growth and development to remain robust in the face of escalating climate challenges.

1.2 The Finance Commission and its role in fiscal federalism

India's Finance Commission, established under Article 280 of the Constitution, is a cornerstone of the country's fiscal federalism. It operates at the intersection of economic policy, constitutional design, and intergovernmental equity, with the binding authority to recommend how the net proceeds of central taxes are divided vertically between the Union and the States, how the States' collective share is distributed horizontally among them, and how grants-in-aid are allocated to address specific needs. In a context where the Union controls the most buoyant sources of revenue including corporate income tax, GST, customs and excise duties while the States bear the major share of expenditure responsibilities in development, welfare, and increasingly, climate adaptation, this role is both pivotal and politically sensitive. The architecture of vertical and horizontal devolution was originally designed around income equalisation and demographic factors, but the demands placed on it have evolved with India's economic, environmental, and social challenges. Today, the accelerating pressures of climate change, coupled with the structural asymmetry in fiscal capacity and risk exposure between Centre and States, present a compelling case for integrating climate vulnerability and resilience into the core of the Finance Commission's transfer mechanisms.

The vertical fiscal imbalance in India is not accidental; it is embedded in the constitutional assignment of functions and revenues. The Union collects roughly two-thirds of combined government revenues, owing to its jurisdiction over high-yield taxes with nationwide bases, while the States together collect the remainder from narrower, less buoyant tax sources. Yet the States incur more than half of the

This was India's first ecological fiscal transfer, reflecting an acknowledgement that States maintaining forests incur both opportunity costs.

combined revenue expenditure, with their mandates spanning agriculture, rural development, health, education, irrigation, and the delivery of essential public services. Local governments, for their part, are responsible for critical last-mile functions such as water supply, sanitation, and local roads, but depend almost entirely on transfers from the States.

This asymmetry was manageable when intergovernmental transfers were designed solely to address conventional fiscal disabilities. In the climate era, however, it leaves States, particularly those with low fiscal capacity bearing disproportionate costs for climate-related damages and adaptation measures without commensurate revenue authority.

Successive Finance Commissions have sought to bridge this gap through a combination of tax devolution and grants. Early Commissions focused heavily on income equalisation, using population and per capita income distance as the principal criteria for horizontal distribution. Over time, efficiency considerations such as tax effort and fiscal discipline were added. The 14th Finance Commission marked a turning point by raising States' vertical share of the divisible pool to 42 per cent and introducing, for the first time, an explicit ecological criterion: the proportion of State area under forest cover, weighted at 7.5 per cent. This was India's first ecological fiscal transfer, reflecting an acknowledgement that States maintaining forests incur both opportunity costs: foregoing revenue from resource exploitation and higher service delivery costs due to terrain and environmental restrictions.

The 15th Finance Commission retained a near-equivalent vertical share (adjusted to 41 per cent) and raised the Forest and Ecology weight to 10 per cent. It also pioneered performance-based grants for air quality improvement and disaster risk management, representing an explicit link between transfers and environmental outcomes.

Yet the ecological parameter remains a blunt instrument for climate-sensitive allocation. It is static, based on forest stock rather than dynamic hazard exposure or adaptive capacity. Forest-rich States benefit regardless of whether they face recurrent extreme weather events, while highly vulnerable States with less forest cover receive little recognition for the fiscal risks they face. Data from the Economic Survey and independent analyses highlight this mismatch. States such as Arunachal Pradesh and West Bengal may register similar vulnerability indices yet receive very different allocations due to their forest shares; Assam, Bihar, and Chhattisgarh, despite comparable climate vulnerability, are treated divergently in fiscal terms. Moreover, forest-rich States themselves point out that maintaining forests constrains their ability to raise revenue. For instance, Arunachal Pradesh's forest-based revenue fell from 60 per cent of its receipts to under 2 per cent following the 1996 Supreme Court restrictions on tree felling while increasing the cost of infrastructure provision due to difficult physiography and regulatory clearances.

1.3 Evolution of fiscal devolution formula

The Finance Commission's horizontal devolution formula has undergone incremental evolution over successive award periods, reflecting shifts in the policy priorities of the Union and in the perceived drivers of inter-state fiscal equity. **At its core, the formula distributes the States' collective share of the divisible pool among individual States using a set of weighted criteria.** Historically, the primary drivers were population and income distance, reflecting a strong commitment to fiscal equalisation: the principle that States with lower fiscal capacity should receive proportionally more resources to enable comparable levels of public service provision at reasonable tax effort. Over time, additional variables such as area, demographic composition, tax effort, and, more recently, environmental indicators have been incorporated to refine this allocation.

Finance Commission	Population (1971)	Population (2011)	Income Distance	Area	Forest / Ecology	Demographic Performance	Tax Effort	Fiscal Discipline
12th FC (2005–10)	25.0	-	50.0	10.0	-	-	7.5	7.5
13th FC (2010–15)	25.0	-	47.5	10.0	-	-	-	17.5
14th FC (2015–20)	17.5	10.0	50.0	15.0	7.5	-	-	-
15th FC (2020–21)	-	15.0	45.0	15.0	10.0	12.5	2.5	-
15th FC (2021–26)	-	15.0	45.0	15.0	10.0	12.5	2.5	-

The current formula, as used by the Fifteenth Finance Commission, combines five principal criteria. Population, measured from the 2011 Census, ensures that allocations reflect the scale of service delivery responsibilities, though a small weight is still assigned to the 1971 population to balance the concerns of States that have achieved demographic transition. Income distance, the single largest criterion, is calculated as the gap between a State's per capita income and that of the richest State; it serves as a proxy for fiscal capacity, allocating larger shares to poorer States that would otherwise be unable to raise equivalent resources through their own tax bases. Area accounts for the geographical expanse of a State, recognising that larger territories impose higher administrative and infrastructure costs even at similar population levels. Demographic performance has been included to reward States for successful population stabilisation, reflecting broader national policy priorities. Tax effort measures the ratio of a State's own tax revenue to its gross state domestic product, rewarding better mobilisation of available fiscal capacity. The environmental dimension is represented by the Forest and Ecology criterion, introduced by the Fourteenth Finance Commission at 7.5 per cent and raised by the Fifteenth to 10 per cent, which allocates resources in proportion to the share of a state's land area under forest.

From a climate perspective, these variables have differing degrees of relevance. Income distance has a direct climate connection because it captures fiscal capacity: a poorer State with lower per capita income will, by definition, have less ability to absorb and respond to climate shocks, making higher transfers potentially more critical for resilience. However, the measure does not differentiate between low-income States with high climate risk and those with relatively low risk. The area criterion can advantage large but sparsely populated States, many of which are also environmentally sensitive such as those in the Himalayan region or with extensive drought-prone zones, but it does not explicitly identify or weight hazard-prone territory, so its climate sensitivity is coincidental rather than intentional. The Forest and Ecology parameter was the first explicit environmental indicator in the formula, acknowledging the ecosystem services and opportunity costs associated with forest conservation. Yet it is static, measuring forest stock without accounting for a state's exposure to climate hazards or its adaptive capacity. As such, it can direct funds to forest-rich States regardless of whether they face high climate-related fiscal risks and conversely under-recognise highly exposed States with low forest cover.

The Forest and Ecology parameter was the first explicit environmental indicator in the formula, acknowledging the ecosystem services and opportunity costs associated with forest conservation.

This architecture leaves a significant gap: there is no direct measure of climate vulnerability or hazard exposure in the devolution formula. States recurrently affected by floods, droughts, cyclones, glacial melt, or heatwaves, and those facing chronic risks such as coastal erosion or Himalayan fragility, receive no systematic recognition of the fiscal pressures these hazards impose. The absence of such a criterion means that climate risk is essentially invisible in the horizontal distribution, despite its growing influence on State-level expenditure needs and fiscal stability. The only environmental factor, forest cover, captures a static land use attribute rather than the dynamic, multi-hazard risk profile that now shapes the resilience and development trajectory of each State.

The opportunity for the 16th Finance Commission is therefore both clear and pressing: to evolve the horizontal distribution formula so that it incorporates a robust, data-driven measure of climate risk alongside existing economic and demographic criteria.

1.4 Insights from stakeholder consultations

Stakeholder consultations conducted for the Fifteenth Finance Commission confirmed both the political salience and the technical limitations of the current approach. Forest-rich States pressed for retention or even enhancement of the forest weight, while several low-cover but hazard-prone States argued for criteria that reflect actual vulnerability. The study on forest conservation through fiscal federalism undertaken by TERI distilled three guiding principles: compensation for the opportunity cost of conserving forests, provision of adequate resources for

sustainable forest management, and performance-based incentives for States to contribute to national and global climate goals such as India's Nationally Determined Contributions (NDCs). The report recommended a dual mechanism, retaining forest cover in the horizontal formula while creating earmarked grants to support targeted ecological outcomes.

Parallel analysis of resource sharing by the Institute of Economic Growth for the Fifteenth Finance Commission underscores the structural roots of the problem. The Union's buoyant tax base, coupled with higher tax buoyancy compared to States, has historically justified a significant share of vertical devolution. However, horizontal distribution remains dominated by economic and demographic variables. The inclusion of "dense forest cover" by the 14th Finance Commission was a step toward integrating environmental criteria, but the report notes that the Terms of Reference for the 15th also called for attention to climate change commitments and the Sustainable Development Goals. This, it argues, warrants expanding environmental coverage beyond static forest metrics to include indicators of climate-related fiscal disability. The same study points to the feasibility of developing hazard vulnerability risk profiles for States to inform disaster-related transfers, an idea directly translatable into the use of comprehensive climate vulnerability indices in the devolution formula.

The Union's buoyant tax base, coupled with higher tax buoyancy compared to States, has historically justified a significant share of vertical devolution.

At the third tier of government, the challenges are even sharper. The study on the design of intergovernmental fiscal transfers to rural local governments highlights the mismatch between the significant functional responsibilities devolved to panchayats as many of them directly relevant to climate adaptation, such as water resource management, local infrastructure resilience, and agricultural extension and their extremely limited fiscal powers. State Finance Commissions are mandated to recommend measures to augment local bodies' resources, and the Union Finance Commission can recommend augmentation of State Consolidated Funds for this purpose. This creates a constitutional channel through which climate-sensitive transfers can reach the very localities where adaptation action is most urgent, provided that vulnerability-based criteria are embedded upstream in the Finance Commission's recommendations to the States.

Recent OECD consultations with the 16th Finance Commission have underscored the opportunity to embed climate considerations directly into India's intergovernmental fiscal framework, moving beyond parallel schemes toward mainstream fiscal devolution. International experience such as Brazil's ecological revenue-sharing and Portugal's ecosystem-based transfers demonstrates that predictable, rules-based allocations linked to ecological performance can incentivise sustained state-level action. For India, this could take the form of climate-weighted devolution criteria in the tax transfer formula, performance-based grants for measurable mitigation and adaptation outcomes, and targeted capacity-building support for state climate finance systems, including climate budget tagging and robust MRV protocols. The OECD stressed that reliable, comparable state-level data is critical to avoid tokenism and ensure accountability. It also mentions that if operationalised, India's emerging Climate Finance Taxonomy could serve as a reference point for identifying eligible projects for such transfers, improving comparability across states and aligning fiscal incentives with both national climate commitments and capital market mobilisation.

Chapter 2

Indian Scenario: Evolution of Climate Funds in India

Hyogo Framework for Action (2005-2015) placed DDR as a focal point of sustainable development discourse and established institutional, legal and financial frameworks to address disaster risk management.

2.1 Background and History of Climate funds

Natural and anthropogenic climate disasters have contributed to challenges in human societies across centuries. The frequency, intensity, and geographic spread of these disasters have, however, catastrophically increased in recent decades, requiring a paradigm shift from post-disaster relief to long-term resilience building. Multilateral frameworks at the global level during the 1990s and early 2000s laid the foundations for this shift. The first international call to integrate Disaster Risk Reduction (DRR) into developmental planning was the **United Nations' Yokohama Strategy for a Safer World of 1994**, which emphasised community involvement and vulnerability assessment. **Hyogo Framework for Action (2005-2015)** placed DDR as a focal point of sustainable development discourse and established institutional, legal and financial frameworks to address disaster risk management.

India has been a signatory to both the Yokohama Strategy and the Hyogo Framework. While multilateral frameworks were being established at the global level, India suffered devasting climate events in the 1990s and early 2000s. The country

is exposed to multiple climate risk ranging from floods, cyclones, earthquakes to droughts and heatwaves. The Orissa Super Cyclone of 1999 claimed over 10,000 lives and left millions homeless. The 2001 Gujarat Earthquake caused enormous loss of life, infrastructure and to the fiscal capacities of both the state and the centre. Over 2.7 million people were affected in the Indian Ocean Tsunami of 2004 and thus exposed glaring gaps in the early warning systems and the financial mechanisms for both immediate relief and long-term rehabilitation. These cataclysmic climate disasters led to an urgent need of a disaster management and financing architecture. They were catalysts in pushing India to build a structured and predictable system for disaster risk management.

The Disaster Management Act of 2005 laid the legal foundation for disaster risk management in India. Thus, the two key instruments National Disaster Response Fund (NDRF) and the State Disaster Response Funds (SDRF) were established.

NDRF is a dedicated central pool of funds to assist disaster affected states and regions that have exceeded their coping capacities. In parallel, the SDRFs are the state's primary source for financing response, relief and rehabilitation efforts for recognised disasters. These funds minimised delays in relief delivery and ensured availability of resources in the aftermath of disasters. Over the years, these funds have been reformed in terms of allocation formulae, eligible expenditures and utilization mechanisms to improve responsiveness to the disasters.

Significant alterations in the disaster landscape of India exposed that response funds alone cannot mitigate the growing complexities and vulnerabilities of climate-linked disasters. **The National Action Plan on Climate Change launched in 2008** was a significant policy shift which recognised climate change as a central developmental challenge. A total of eight national missions were established including the National Mission on Sustainable Agriculture, Water, Solar Energy, Energy efficiency and Strategic Knowledge. However, there was growing concern that vulnerable states needed adaptation and targetter financial support. **The National Adaptation Fund on Climate Change was established in 2015.** This forward-looking initiative supports state driven and sector specific adaptations and is managed by the Ministry of Environment, Forest and Climate Change (MoEFCC). Grassroot level climate vulnerabilities especially in agriculture and water management are under the purview of the NAFCC. **The Compensatory Afforestation Fund under the Compensatory Afforestation Fund Act of 2016** is another significant financial mechanism to offset deforestation due to developmental activities. CAMPA enhances ecological resilience to reduce disaster risks.

Apart from domestic institutions, India has been both a recipient and a participant in global climate finance mechanisms. These funds play a crucial role in augmenting India's climate resilience and transition efforts. **The Green Climate Fund (GCF),** established under the United Nations Framework Convention on Climate Change, is designed to assist developing countries in pursuing low-emission and climate-resilient development. Projects under this fund in India span across sectors including climate-resilient agriculture, renewable energy and energy efficiency in MSME. The Global Environment Facility (GEF) predates the GCF and is critical in co-financing opportunities to complement government and private sector investments. India has received multiple GEF tranches to finance projects on biodiversity, land degradation, sustainable forest managemental, electric mobility and clean technologies in urban and industrial areas. **The Adaptation Fund** established under the Kyoto Protocol has significantly supported small-scale, locally embedded adaptation projects. This is the only fund that focuses on community participation and analyses local needs. Bilateral funding arrangements from institutions like **Germany's KfW Development Bank, France's AFD (Agence Française de Développement) and Japan's JICA** have heavily invested in India's climate infrastructure. These agencies have structured instruments such as concessional loans and blended finance programs to de-risk large infrastructure investments.

India is on an ongoing journey of acknowledging climate risks and shifting its focus towards adaptation and mitigation.

India's climate disaster funding mechanisms continue to rely heavily on a response-based or a post-disaster model. Despite advancements and expansion of the climate-finance architecture a paradigm shift is urgently needed. Even as global climate funds continue to supplement national efforts of climate-resilience, the lack of improved institutional readiness and mechanisms to ensure transparency and accountability, equity and impact at last mile have hampered the full realisation of potential. Anticipatory investments or climate-resilience investments are required to mitigate climate risks, and this can only be achieved through integration of climate considerations in the core public-finance architecture including budget and fiscal transfers. The increased frequency of extreme weather events has further enhanced the need for a quantum of public finance dedicated to climate action. The heatwaves of Northern India, the floods in the Himalayas and cyclones of the eastern coast demands a predictable, adequate and transparent financial instrument to pre-empt the risks and safeguard livelihoods. National and sub-national allocations of budget for climate risks have thus become indispensable.

India is on an ongoing journey of acknowledging climate risks and shifting its focus towards adaptation and mitigation. There is still a pressing need to bridge the gap between disaster response and climate resilience. Thus, there is requirement to delve deeper into existing architecture to further build a more risk-resilient financial structure.

2.2 Overview of the current funding landscape

When redesigning the Finance Commission's fiscal devolution formula, a rigorous assessment of the current climate risk and vulnerability funding landscape is essential because India's existing mechanisms ranging from statutory disaster relief funds (SDRF/NDRF) to targeted climate adaptation schemes (NAFCC), ecological restoration pools (CAMPA), and international climate finance operate in silos, with uneven coverage, fragmented eligibility norms, and stark utilisation gaps. **Without a consolidated understanding of how these streams function, overlap, and leave gaps, particularly in underfunded areas like heatwave response, flood resilience, and long-term mitigation, a new formula risks perpetuating reactive, post-disaster expenditure rather than incentivising proactive resilience-building.** A nuanced mapping reveals not just the scale and flow of funds, but also the institutional bottlenecks, hazard blind spots, and disparities in state-level access and capacity. Embedding such analysis into the devolution architecture would allow fiscal transfers to be calibrated to forward-looking climate risk profiles, reward investments in vulnerability reduction, and ensure that high-risk yet low-capacity states are not penalised for structural limitations thereby shifting India's public finance stance from compensating loss to preventing it.

Fund / Mechanism	Administered By	Purpose	Corpus / Allocation	Funding Source	Coverage	Gaps
SDRF / NDRF (Response & Relief)	State Govts (SDRF), MHA (NDRF)	Immediate relief, early recovery for notified disasters	SDRF ₹1,28,122 Cr; NDRF ₹54,770 Cr (2021–26)	Cost-sharing (75:25 or 90:10), central budget	Cyclones, floods, droughts, earthquakes, etc. + 10% state-specific	Limited to notified disasters; heatwaves not fully covered; recovery & mitigation underfunded
SDMF / NDMF (Mitigation)	State & National DM Authorities	Disaster risk reduction projects	SDMF ₹32,031 Cr; NDMF ₹13,693 Cr (2021–26)	Budgetary allocation	Fire services, erosion resettlement, seismic & landslide risk	Small share of total corpus (<20%); limited shovel-ready projects; bureaucratic delays
NAPCC	MoEFCC	8 climate missions covering mitigation & adaptation	No dedicated corpus; sectoral budgets	Sectoral allocations	Solar, energy efficiency, water, agriculture, forestry, habitat	Weak enforcement; no dedicated finance; uneven state-level integration
NAFCC	MoEFCC / NABARD	Adaptation projects in vulnerable sectors/regions	₹847 Cr approved (2015–2023)	Central budget	Climate-resilient agriculture, water, forestry	Small scale; underutilised; lacks urban & coastal adaptation coverage
CAMPA	MoEFCC / State Forest Depts	Compensatory afforestation, ecosystem restoration	₹60,000 Cr accumulated	Charges for forest diversion	Afforestation, wildlife, soil & moisture conservation	Monoculture plantations; community exclusion; slow disbursal
Global Funds (GCF, GEF, AF, etc.)	MoEFCC / NABARD / UN agencies	Climate mitigation & adaptation across sectors	GCF >$280M; GEF >$600M; AF >$10M	International climate finance	Coastal resilience, energy efficiency, agriculture, biodiversity	Access uneven; technical capacity constraints; project-based funding
Draft Climate Finance Taxonomy	MoF / MoEFCC (Proposed)	Classify climate-aligned activities for finance	Not a fund; classification tool	NA	Mitigation, adaptation, transition sectors	Data gaps; verification challenges; phased sectoral coverage

The Fifteenth Finance Commission (FC-XV), in its award period 2021–2026, restructured these mechanisms into broader State and National Disaster Risk Management Funds (SDRMF and NDRMF)

2.3 National Disaster Response Fund (NDRF) and the State Disaster Response Fund (SDRF)

India's exposure to a diverse set of natural hazards demands a robust, rules-based disaster financing architecture. At the heart of this system lie two statutory instruments: the National NDRF and the State Disaster Response Fund SDRF. Established under the Disaster Management Act, 2005, these funds represent the country's primary mechanism for financing immediate relief and early recovery following disasters. The SDRF serves as the first line of fiscal defence for states, while the NDRF provides additional surge financing for calamities of "severe nature" that overwhelm state capacities.

The Fifteenth Finance Commission (FC-XV), in its award period 2021–2026, restructured these mechanisms into broader State and National Disaster Risk Management Funds (SDRMF and NDRMF), each with two windows: Response & Relief (where SDRF and NDRF reside) and Mitigation (State and National Disaster Mitigation Funds). This shift reflected a growing recognition that disaster risk financing must address not only post-disaster relief but also risk reduction and preparedness. For the 2021–2026 award period, FC-XV recommended a total SDRMF corpus of ₹1,60,153 crore, of which ₹1,28,122 crore is earmarked for SDRF and ₹32,031 crore for the State Disaster Mitigation Fund (SDMF). The NDRMF corpus is set at ₹68,463 crore, with ₹54,770 crore for NDRF and ₹13,693 crore for the National Disaster Mitigation Fund (NDMF). Allocations are escalated annually by 5 per cent from the 2021–22 base year. Allocations to states are determined primarily based on average past expenditure on disaster relief (2015–2016 to 2018–2019), adjusted for hazard risk profiles. Within the NDRMF, certain earmarked envelopes are reserved for historically underfunded risk areas, including ₹5,000 crore for fire services modernisation, ₹1,000 crore for resettlement of populations affected by riverbank erosion, and smaller allocations for drought mitigation, seismic and landslide risk reduction in hill states, and urban flood management in major cities.

The SDRF is financed through annual budgetary transfers to state public accounts. The NDRF, while primarily funded through budgetary allocations, can also receive voluntary contributions through designated channels such as Bharatkosh. Both funds are subject to Comptroller and Auditor General (CAG) audit and are operated under strict accounting protocols, including the crediting of accrued interest.

Relief assistance from these funds is available only for disasters on the centrally notified list, which includes cyclones, droughts, floods, landslides, avalanches, cloudbursts, pest attacks, hailstorms, tsunamis, earthquakes, frost/cold waves, and lightning. States are permitted to allocate up to 10 per cent of their SDRF annual allocation to "state-specific" disasters not on the notified list, provided they apply the same norms.

Notably, these funds are not designed to finance the full-scale reconstruction of major capital works or routine maintenance. Large-scale infrastructure projects, basin-level flood control, and other long-gestation investments fall outside the remit of SDRF and NDRF and are intended to be financed through development budgets or sectoral schemes. Similarly, while heatwaves have been recognised as a major hazard in technical guidance from the National Disaster Management Authority (NDMA), they have not been uniformly included in the notified list for relief funding, resulting in reliance on mitigation windows or state-specific allocations.

2.3.1 Effectiveness and Strengths

The most significant strength of SDRF is its role in ensuring predictable, immediately available liquidity at the state level. This allows for rapid initiation of relief operations, provisioning of camps, restoration of essential services, and distribution of livelihood support without waiting for central approvals. The fixed cost-sharing arrangements and annual transfers enable states to plan their emergency financing with certainty.

The NDRF serves as a surge mechanism that delivers scale when required, while its access rules prevent over-reliance on central aid for routine disasters. The IMCT assessment process, although occasionally criticised for duration, lends credibility and objectivity to damage assessments.

A major reform under FC-XV is the ring-fencing of 10 per cent of response funds for preparedness and capacity-building, and 30 per cent for recovery and reconstruction. This addresses a longstanding tendency for relief to consume the entirety of available funds, leaving little for recovery or institutional strengthening. Earmarked national priorities within NDRF/NDMF, such as fire service modernisation, target areas with chronic capacity deficits that have historically been underfunded through regular budget lines.

2.3.2 Gaps and Challenges

While the SDRF and NDRF have proven effective in ensuring rapid mobilisation of resources for immediate relief, the system still carries inherent limitations that constrain its ability to address the full spectrum of disaster risk management. The most significant of these limitations lies in the underdeveloped role of long-term mitigation.

The Mitigation Deficit:
The creation of the National and State Disaster Mitigation Funds under the FC-XV framework was a deliberate step towards integrating risk reduction into the fiscal architecture. Yet, in practice, mitigation financing remains a small and unevenly utilised component of overall disaster-related transfers. The ₹32,031 crore earmarked for SDMF and ₹13,693 crore for NDMF over five years represent less than one-fifth of the combined national and state disaster management corpus. More importantly, these amounts are disbursed for specific, approved projects, and utilisation has been constrained by a limited pipeline of technically sound, shovel-ready mitigation proposals from states. The result is that the bulk of available funds still flow to post-disaster relief rather than pre-disaster risk reduction.

Hazard Coverage and Norm Evolution:
The list of disasters eligible for relief from SDRF/NDRF is updated periodically, but the process has struggled to keep pace with India's evolving risk profile. Heatwaves, which now account for some of the highest weather-related death tolls in the country, are not uniformly included in the notified list for relief funding. This means that states seeking to provide ex-gratia payments or livelihood support after extreme heat events must either use their limited "local disaster" allocation capped at 10 per cent of SDRF or draw from other state resources. Similar gaps exist for hazards such as lightning, slow-onset coastal erosion, and certain public health emergencies.

Recovery Financing Constraints:
The FC-XV innovation of a dedicated Recovery and Reconstruction (R&R) window within SDRF and NDRF marks a recognition that post-disaster needs extend beyond immediate relief. However, the 30 per cent allocation to R&R must be seen against the scale of damage from major disasters. When large-scale events such as the 2018 Kerala floods or the 2023 Himalayan landslides occur, the resources available under R&R are insufficient for comprehensive recovery. Moreover, the separation between disaster funds and development budgets remains incomplete. Large capital works such as flood embankments, slope stabilisation in landslide-prone areas, or urban drainage upgrades are excluded from SDRF/NDRF financing and must be funded through sectoral schemes or special central assistance.

Administrative and Institutional Bottlenecks
Effective disaster financing requires not only adequate allocations but also robust administrative capacity to manage, disburse, and account for these funds. In several states, delays in the submission of utilisation certificates, inaccurate reporting of opening balances, and late crediting of interest have resulted in the postponement of subsequent releases. The FC-XV addressed these challenges by recommending distinct accounting heads for response and mitigation funds, but the operationalisation of this recommendation has been uneven.

2.4 The National Action Plan on Climate Change (NAPCC)

NAPCC launched in June 2008 is India's first comprehensive policy that recognised the growing threat of climate change. In the context of global climate framework, developing countries were beginning to articulate nationally appropriate actions

and thus the principle of "co-benefits" was adopted. The objective was to integrate India's developmental plans with ecological sustainability to ensure economic growth and poverty alleviation along with addressing climate change.

The NAPCC comprises of eight core missions and each targets a specific sector or area of climate concern-

National Solar Mission (NSM) –
The mission promotes solar energy to reduce dependence on fossil fuels.

National Mission for Enhanced Energy Efficiency (NMEEE) –
The mission promotes enhancement of energy efficiency across industrial sectors.

National Mission on Sustainable Habitat –
The mission encourages energy-efficient buildings, urban waste management, and eco-friendly transport systems.

National Water Mission –
The mission enhances water use efficiency by 20% through regulatory measures. It promotes rainwater harvesting, groundwater recharge, wastewater recycling and enhanced surface and groundwater storage.

National Mission for Sustaining the Himalayan Ecosystem –
The mission promotes protection of fragile mountain ecosystems.

National Mission for a Green India (GIM) –
The mission promotes afforestation and ecosystem restoration to increase forest cover.

National Mission for Sustainable Agriculture (NMSA) –
This mission promotes climate-resilient farming practices including water use efficiency, agroforestry, stress-tolerant seeds and soil health management.

National Mission on Strategic Knowledge for Climate Change –
The mission focusses on research, data sharing, and capacity building.

Climate financing focus has often been diluted as there has been no dedicated financial allocations.

The NAPCC acknowledged that climate change is a multi-sectoral challenge. The NAPCC also prompted the creation of State Action Plans on Climate Change. This was seen as a multi-level governance approach encouraging states to adopt regional action plans.

The Principles of NAPCC include-

- Protecting the poor through an inclusive and sustainable development strategy, sensitive to climate change.
- Achieving national growth and poverty alleviation objectives while ensuring ecological sustainability
- Efficient and cost-effective strategies for end-use demand-side management
- Extensive and accelerated deployment of appropriate technologies for adaptation and mitigation
- New and innovative market, regulatory, and voluntary mechanisms for sustainable development
- Effective implementation through unique linkages – with civil society, LGUs, and public-private partnerships

2.4.1 Challenges and Limitations:

The NAPCC despite being an innovative climate action policy faces significant limitations. Enforceability and institutional strength of the missions has been limited due to lack of legal backing and accountable mechanisms. **Climate financing focus has often been diluted as there has been no dedicated financial allocations. Even though missions have outlined objectives and targets, varying levels of success is observed with issues ranging from lack of implementation to funding delays.** The Missions hardly address the urgent needs of vulnerable communities and there have been concerns over whether climate action should be mitigation-centric or adaptation-focussed. The SAPCCs have been more template-based rather than addressing local needs and has failed to integrate with state budgets and development.

The policy is 15 years old and newer risks, technologies and frameworks have developed in the meanwhile. Reforms in terms of climate-finance tracking, embedding climate targets into fiscal planning and community participation is necessary for the policy to be climate-resilient.

2.5 National Adaptation Fund on Climate Change NAFCC

India launched a fund administered by the Ministry of Environment, Forest and Climate Change (MoEFCC), the National Adaptation Fund on Climate Change (NAFCC) in July 2015. The fund provides financial support to projects addressing climate vulnerability in sectors and regions to help build climate resilience.

Sectors like agriculture, water resources, forestry and climate-sensitive communities are most vulnerable. NAFCC was designed to support States to implement adaptation projects. NAFCC started with an initial corpus of ₹350 crore in the financial year 2015-16 and 2016-17 and ₹181.5 for the financial year 2017-18. NABARD (National Bank for Agriculture and Rural Development) acts as the National Implementing Entity (NIE) for the fund. Project proposals had to be aligned to the State Action Plans on Climate Change and then submitted to NABARD for appraisal and MoEFCC for approval.

The most critical gap that NAFCC aimed to address was to focus primarily on vulnerability reduction and climate adaptation. Climate-sensitive states of the North-Eastern Region, the Himalayan belt and drought-prone regions have had access to project-based climate finance under this fund. Till 2023, 30 projects in 27 states and Union Territories and an amount of ₹847 crores have been sanctioned. The projects can be categorised under various themes including climate-resilient agriculture, drought-proofing, water resource management and ecosystem restoration. The most notable multi-state project, with the highest fund allocation (₹120 crores) is the project on 'Climate Resilience Building in Rural areas through Crop Residue Management' by the states of Punjab, Haryana, Uttar Pradesh and Rajasthan. The core of these projects has been to integrate scientific practices with traditional knowledge systems.

2.5.1 Challenges and Limitations

The scale and impact of the fund has been modest despite it being extremely relevant. Uneven technical capacities, monitoring indicators and vulnerability assessments across states have resulted in uneven participation. There has been issues with underutilization of allocated funds as many projects have remained isolated experiments without long-term sustainability prospects. The funds are released in instalments based on performance of the project and NAFCC guidelines. Furthermore, NAFCC has been made a non-scheme in November 2022. NAFCC implementation has revealed that states need financial and technical 'handholding' at least until climate change issues are embedded in the policy framework completely. To handle issues of climate change, domestic climate finance sources are extremely critical and proper monitoring and evaluation is required to successfully implement schemes like NAFCC.

NAFCC highlights the lack of alignment of the projects with larger state-level missions. Climate risks have become more complex, but NAFCC showcases a limited scope and does not take into consideration newer adaptation challenges in cities, coastal zones and climate-linked disasters. Thus, the fund has remained underutilized and underfunded even with escalating climate risks.

2.6 CAMPA

The Compensatory Afforestation (CA) mechanism was introduced under the Forest (Conservation) Act of 1980 to mitigate losses. This required both public and private agencies to compensate for diverted forest lands by funding afforestation elsewhere. However, these funds have remained underutilised, underregulated and gravely lacks a transparent institutional framework.

The Compensatory Afforestation Fund Management and Planning Authority (CAMPA) was established in 2004 to address the same challenges through a Supreme Court directive. The core pillar of CAMPA was to act as an institutional body to manage and disburse funds collected from agencies for forest diversion. However, for over a decade CAMPA remained only an ad hoc body. Legal and procedural challenges resulted in the requirement of a statutory mechanism. Thus, the Compensatory Afforestation Fund Act was created in 2016 which formalised the fund and made it operational.

Net Present Value (NPV) of forest land and other charges collected as compensatory afforestation are deposited into the National Compensatory Afforestation Fund. The funds are then transferred to the State CAMPA funds where 90% is retained by the states and the rest 10% of the funds is retained in the central authority. The funds are to be used exclusively for activities listed below:

- **Compensatory afforestation on degraded or non-forest lands**
- **Assisted natural regeneration**
- **Wildlife protection and management**
- **Forest fire prevention**
- **Soil and moisture conservation**
- **Strengthening forest protection and infrastructure.**

However, the major concern of the fund is the quality and ecological appropriateness of afforestation activities. Plantations using monoculture species like eucalyptus provide quick canopy cover but have limited biodiversity

value. **Conflicts have arisen because of plantations on non-forest lands which may have been agriculturally productive or were of cultural significance for local communities.** Although allocations have happened, disbursements and implementation has been slow leading to slow utilisation of the fund. CAMPA also risks becoming a legitimate tool for deforestation.

Thus, reforms are required for CAMPA to serve as an ecological and climate action tool. Promotion of diversity in plantations, community participation along with transparency and social equity remains lacking from CAMPA.

2.7 Draft Climate Finance Taxonomy

India's move to establish a climate finance taxonomy is rooted in a dual imperative: meeting ambitious climate commitments while sustaining rapid economic growth. The country has pledged to reach net-zero by 2070 and has updated its Nationally Determined Contributions (NDCs) to include enhanced targets on renewable energy deployment and emissions intensity reduction. Achieving these goals is capital-intensive and estimates suggest that between USD 2.5 trillion and USD 3 trillion will be needed by 2030, with adaptation alone requiring over USD 600 billion. Mobilizing such resources will require both substantial public and private capital.

The taxonomy responds to a structural gap in India's financial system: the absence of a unified framework to define what constitutes a climate-aligned activity. Without such clarity, the risk of greenwashing rises, comparability across financial products suffers, and investors face uncertainty over whether their funds truly advance India's transition. Announced in the Union Budget 2024–25 and now circulating in draft form, the taxonomy also reflects India's desire to align with emerging global standards while embedding its unique development and energy security priorities. By explicitly including adaptation and transition categories alongside mitigation, it aims to direct investment not only toward emissions reduction but also toward resilience building and orderly decarbonisation in hard-to-abate sectors.

Eight guiding principles anchor the taxonomy: alignment with national climate and development goals; the "do no significant harm" safeguard; interoperability with other jurisdictions' frameworks; explicit support for transition activities; promotion of indigenous and affordable technologies; scientific transparency; proportionality for micro, small and medium enterprises (MSMEs); and evidence-based thresholds.

These principles signal both ambition and pragmatism, recognizing India's high growth and development needs while aiming for credibility in international capital markets.

The classification scheme is built around two major baskets:

Climate-supportive activities:
These are aligned with mitigation or adaptation objectives and are tiered into levels of ambition. Tier 1 covers absolute GHG emissions avoidance or major reductions; Tier 2 covers relative or incremental improvements in cases where full decarbonisation is not yet possible.

Transition activities:
These are sector-specific interventions in hard-to-abate industries such as steel and cement where low-emission substitutes are commercially unavailable at scale. The goal is to incentivize efficiency gains, intensity reductions, and technology upgrades without creating stranded assets or jeopardizing energy security.

2.7.1 Sectoral Coverage and Phased Evolution

On the mitigation side, the taxonomy targets power, mobility, and buildings, which together account for a significant share of India's emissions and present large investment opportunities. Adaptation coverage focuses on agriculture, food, and water security, reflecting both climate vulnerability and the potential for developmental co-benefits. Transition coverage begins with steel and cement but is explicitly designed for expansion to aluminium, fertilizers, and other emissions-intensive sectors as viable low-carbon pathways emerge.

The phased roadmap foresees:
Phase I: Release of guiding principles, eligibility categories, and a broad sectoral outline. This phase aims to give markets and policymakers an early reference point and to build familiarity.

Phase II: Publication of sectoral annexures with quantitative technical screening criteria—benchmarks for GHG intensity, energy efficiency, or resilience metrics—tailored to each sector. These annexures will be updated periodically as technologies and best practices evolve.

2.7.2 Strengths, Opportunities and Risks

One of the taxonomy's greatest strengths is its **alignment with national priorities.** By integrating energy security, affordability, and MSME inclusion into its design, it reduces the risk of domestic pushback and increases the likelihood of market uptake. The equal emphasis on adaptation is well-suited to India's climate risk profile, where resilience in agriculture, water systems, and infrastructure is as urgent as decarbonisation. This dual focus expands the taxonomy's relevance beyond emissions reduction to resilience-building, enabling it to channel funds toward critical but often underfinanced adaptation projects.

The taxonomy's **flexible, phased approach** is another asset. Early adoption allows India to send investment signals quickly, while the commitment to iterative updates ensures the framework can absorb technological and market changes. The recognition of transition activities, particularly in heavy industry, offers a realistic pathway for decarbonisation that does not jeopardize growth or jobs. From an investor's perspective, the planned interoperability with other jurisdictions and eventual quantitative criteria can reduce due diligence costs, improve comparability, and enhance the credibility of India-labelled green, sustainable, or transition finance instruments. Over time, this could position the taxonomy as a **pipeline identification** tool for climate projects, linking eligibility directly to investable opportunities that are critical for mobilizing private finance at scale.

However, these opportunities come with **implementation risks**. The most pressing challenge lies in **data and verification**. Implementing quantitative thresholds will require consistent, reliable, and verifiable data on emissions, energy use, and resilience performance across sectors areas where current reporting systems are uneven. Without robust monitoring, reporting, verification infrastructure, the taxonomy risks inconsistent application and possible greenwashing. **The breadth of coverage** is another limitation. While the initial sectors are high impact, several major emitting or vulnerable sectors will remain outside the taxonomy's scope until later phases, potentially limiting near-term comprehensiveness.

Regulatory coordination will also be critical. The taxonomy must align with SEBI's sustainability disclosure requirements, RBI's guidance on climate-related risks, and India's sovereign green bond framework to avoid duplication and ensure coherence. Absent such coordination, firms may face fragmented reporting regimes and higher compliance costs. Finally, the calibration of **transition thresholds** will be delicate: overly permissive criteria could entrench high-carbon activities under a "green" label, while overly stringent ones could choke finance to industries vital to growth and employment. Transparent methodologies, public consultations, and periodic tightening of criteria will be essential to maintain market confidence.

2.8 Global Funds in India

India being one of the most climate-vulnerable countries in the world is also a stakeholder in global climate negotiations. To supplement domestic efforts towards climate adaptation, India has both contributed to and accessed global climate funds such as Green Climate Fund (GCF), Adaptation Fund (AF), Global Environment Facility (GEF) and other bilateral funding agreements. They are playing a crucial role in building climate resilience and supporting initiatives ranging from renewable energy, sustainable agriculture to ecosystem protection and capacity building across states.

Fund/ Mechanism	Nature / Objective	India's Role / Allocation	Key Projects (States / Partners / Institutions)	Funding Amounts	Implementation Entities / Partners	Focus Areas / Outcomes
Green Climate Fund (GCF)	World's largest UNFCCC climate-dedicated fund; supports low-emission & climate-resilient development	India is both a contributor and recipient; > $280 million approved till 2025 (7 national + multi-country projects)	- Enhancing Climate Resilience of India's Coastal Communities (Andhra Pradesh, Maharashtra, Odisha) – mangroves, wetlands, cyclone shelters - Energy Efficient & Sustainable Transport – 10,000 e-buses + 1,000 fast chargers by 2030 - Solar Irrigation for Smallholder Farmers (Madhya Pradesh, co-financed) - Climate-resilient livelihoods in mountainous regions (Himachal Pradesh) - Avaana Sustainability Fund (climate-tech startups, 2024) - MSME concessional loans/ grants (2024) - Green Growth Equity Fund (low-carbon infra, 2021)	- $43.4m grant for coastal project - $50m for transport/e-bus project - $280m+ cumulative approval	MoEFCC, UNDP, NABARD, EESL, ADB, state governments	Adaptation (ecosystem-based), mitigation, transport decarbonisation, resilience, MSME climate finance, green infra, capacity building
Global Environment Facility (GEF)	Supports developing countries on biodiversity, climate change, land degradation	India cumulative allocation: $600m+ GEF-5/6/7: $87.88m (climate), $36.87m (biodiversity), $5.83m (land degradation)	- Energy Efficiency in MSME Clusters (25 clusters, 10 states incl. Maharashtra, Gujarat, TN, Rajasthan) - GEF Small Grants Programme – 400+ community projects (Jharkhand, Odisha, Chhattisgarh, Meghalaya)	- $87.88m climate - $36.87m biodiversity - $5.83m land degradation - 1.5m tCO_2 reduced (MSME clusters)	UNDP, national ministries, state agencies	Energy efficiency, forest conservation, RE, sustainable agriculture, community resilience

Adaptation Fund (AF)	Kyoto Protocol-based fund for adaptation in developing countries	India accessed AF since 2012; NABARD is National Implementing Entity	- Climate Adaptation in Rural Areas (Madhya Pradesh) – climate-resilient agriculture, water conservation, livelihood diversification ($2.5m) - Climate-smart agriculture & micro-irrigation (Andhra Pradesh) – $2.5m - Flood-tolerant rice, seed banks, village climate committees (ICAR support) - 4 approved projects in Rajasthan, Tamil Nadu, West Bengal (WRM, agriculture, forest livelihoods)	~$10m cumulative $2.5m per MP & AP projects	NABARD, ICAR, state departments	Agriculture resilience, water resource management, livelihood diversification, forest-based adaptation
NDC Partnership & Bilateral Funding	Global coalition supporting NDCs with TA + finance	India member; receives TA & co-finance from Germany, UK, Japan, etc.	- Indo-German Cooperation (KfW-GIZ): → Himachal Forest Climate Proofing (€30m loan + €2m grant) → Maharashtra Solar Power Extension (€92m loan) → Delhi/ Kerala/Maharashtra Low-carbon transport (€3.25m grant) → Gujarat/Kerala/Punjab Rooftop PV prototypes (€2.95m grant) - Green Growth Equity Fund (UK + NIIF India) – INR 2500cr for RE & green infra	- €150m overall Indo-German portfolio - GGEF: INR 2500cr committed	KfW, GIZ, NIIF, MoEFCC, state govts	Climate-smart cities, RE, green hydrogen, forest resilience, low-carbon transport
Global Climate Partnership Fund (GCPF)	Provides green finance access to NBFCs, MSMEs, plus TA	Signed $80m loan agreements with Indian FIs till 2023	Targets: MSMEs, EVs, solar PVs, green lending	$80m loans committed	International development finance institutions + Indian NBFCs/ FIs	Expanding credit access, catalysing climate-positive investments, MSME decarbonisation

2.9 Preparedness vs Response

India's climate-linked disaster management structure is heavily lopsided in favour of post-disaster interventions, existing largely to act in the wake of disasters. These organizations are crucial for instant relief and rehabilitation, offering lifelines during the crisis and enabling quick recovery. But this response-driven bias points to a larger, international pattern: a structural inclination to ramp up fiscal and administrative responses in the aftermath of disaster, instead of proactively investing in risk reduction and resilience building.

The institutional and fiscal preference for post-disaster response, as required, is usually at the cost of investment in preparedness. Preparedness involves a range of interventions ranging from resilient infrastructure, strong early warning systems, climate-smart agriculture to the restoration of ecosystems and the capacity of communities that systematically reduce vulnerability and decrease future losses. Global evidence has repeatedly shown that each rupee or dollar invested in prevention and risk reduction results in much higher payback in costs avoided in recovery, less human suffering, and long-term economic growth.

However, preparedness is constantly confronted with political and budgetary obstacles. Its payoffs are long-term and less directly tangible, making it more difficult to fund in yearly budgets or quantify in near-term appraisals. India's extreme vulnerability to climate hazards heightens the need for re-prioritization of fiscal allocations. Sustaining a reactive model will be a self-perpetuating cycle of large post-disaster expenditures and persistent underinvestment in resilience.

It is imperative not to underplay the vital roles of NDRF and SDRF, but rather to rebalance policy priorities. Integrating climate and disaster preparedness into the country's fiscal framework, through regular capital and maintenance spending, and through redesigned transfers and incentives. To fail to do so is to risk trapping India in cyclical fiscal shocks and wasted development benefits, making a change towards preparedness not merely desirable, but necessary for future stability and prosperity.

2.10 Climate Integration in budgets

Integrating a climate factor into India's budgets and devolution is no longer optional but a fiscal imperative. The Reserve Bank of India has warned that extreme weather events threaten macroeconomic stability, particularly in agriculture-dependent and infrastructure-deficient states. Between 1998 and 2017, India lost over USD 79.5 billion to climate-related disasters. India's fiscal architecture is skewed towards response rather than preparedness. There is a risk of perpetual underinvestment in resilience and overpay of post-disaster recovery if climate is not mainstreamed into routine fiscal flows including capital expenditure, recurring maintenance, conditional and unconditional transfers and incentive structures.

Embedding climate factors in budgets reap benefits across fiscal, economic and social dimensions. Empirical modelling and international experience show that every rupee spent on well-designed preparedness or adaptation can avert multiple rupees of post-disaster reconstruction and economic loss. In an era of mounting climate exposure, the strategic argument of mainstreaming climate into budgets and devolution is the most cost-effective way to protect growth, livelihoods and public finances is unambiguous. Vulnerabilities are converted into planned investments, it reduces the frequency and scale of fiscal shocks. It further unlocks benefits of blended finance. Put bluntly, sooner India's development trajectory realises that addressing climate vulnerabilities through climate finance is a fiscal necessity, the lower the economic and human cost. The long-run benefits of adaptation and mitigation are profound.

Climate-sensitive budgeting and fiscal transfers closes gaps in the fiscal architecture. The first being the timing gap between preventive investment and post-event spending reducing recurring repair bills and economic disruption. Second, it encourages closure of allocation gaps by making climate-relevant expenditure visible and accountable for adaptation and mitigation outcomes. Next, it closes the incentive gap as current fiscal transfers rarely reward mitigation or penalize maladaptive development. Fourth, by enabling poorer states to design bankable adaptation projects rather than simply receive ad hoc relief tackles capacity and absorption gaps. This further aims for an equity multiplier saving millions in post-disaster recovery costs and reducing income disparity.
In the context of climate change, the equity principle becomes even more critical. In India, climate impacts in are not uniformly distributed. Some states face chronic

drought, others recurrent floods, while certain coastal states experience cyclonic devastation at increasing frequency. These result in asymmetric risks widening regional economic inequalities, undermining the objective of fiscal transfers. Without proactive adaptation spending, the economy will confront higher demands for disaster relief, slower economic growth in vulnerable states, and widening interstate inequality. Current transfer systems fail to account for vulnerabilities faced by states and the disproportionality of risks. Integration climate into the fiscal architecture would empower vulnerable states for strategic risk reduction and thus reducing long-term economic losses. Climate change risks are only accelerating and there is an urgent necessity to secure a sustainable, inclusive, and resilient growth trajectory.

Ultimately, aligning the finance architecture with climate resilience goals, India can safeguard livelihoods, protect growth trajectories and demonstrate how climate finance can drive sustainable developments in a rapidly changing world

Chapter 3

Financing Climate Action Through Fiscal Devolution

In such countries, recurrent hydrometeorological events including floods, droughts, cyclones, and increasingly frequent and prolonged heatwaves already account for annual losses equivalent to 2–3% of GDP

The escalating economic consequences of climate risk and vulnerability have transformed what was once framed as an environmental or humanitarian concern into a macro-fiscal imperative, with mounting empirical evidence showing that climate shocks act as a structural drag on long-term development trajectories, eroding both GDP growth and the fiscal space of vulnerable states. The Climate Risk Index 2025 makes this reality explicit: between 2010 and 2019, eight of the ten most climate-impacted nations were low-or middle-income economies, six of them in the lower-middle income bracket, underscoring the asymmetry of climate exposure. **In such countries, recurrent hydrometeorological events including floods, droughts, cyclones, and increasingly frequent and prolonged heatwaves already account for annual losses equivalent to 2–3% of GDP**, with modelled projections under high-emissions pathways showing that these losses could exceed 10% of GDP by 2050 in the absence of adaptation.

These headline figures obscure the complex transmission channels through which climate shocks degrade macroeconomic stability. Bilal and Känzig's Econometric analysis reveals that temperature increases have a persistent and non-linear effect

The Fifteenth Finance Commission (FC-XV), in its award period 2021–2026, restructured these mechanisms into broader State and National Disaster Risk Management Funds (SDRMF and NDRMF)

on GDP per capita growth: beyond critical thermal thresholds, the economic damage accelerates, particularly in economies with limited adaptive capacity. The persistence is such that output losses do not fully reverse even after the climatic shock subsides, leaving a permanent negative gap in the growth path. The compounding nature of these impacts intensifies fiscal strain. On the revenue side, slower GDP growth and disrupted trade flows suppress tax receipts, while on the expenditure side, governments face spiraling costs for relief, reconstruction, and adaptation investments. The World Bank's macro-structural simulations for high-exposure countries such as Madagascar, Malawi, and Guinea-Bissau indicate that these channels together can reduce medium-term output growth rates by 0.2–0.5 percentage points annually which if compounded over decades, becomes a formidable constraint on poverty reduction.

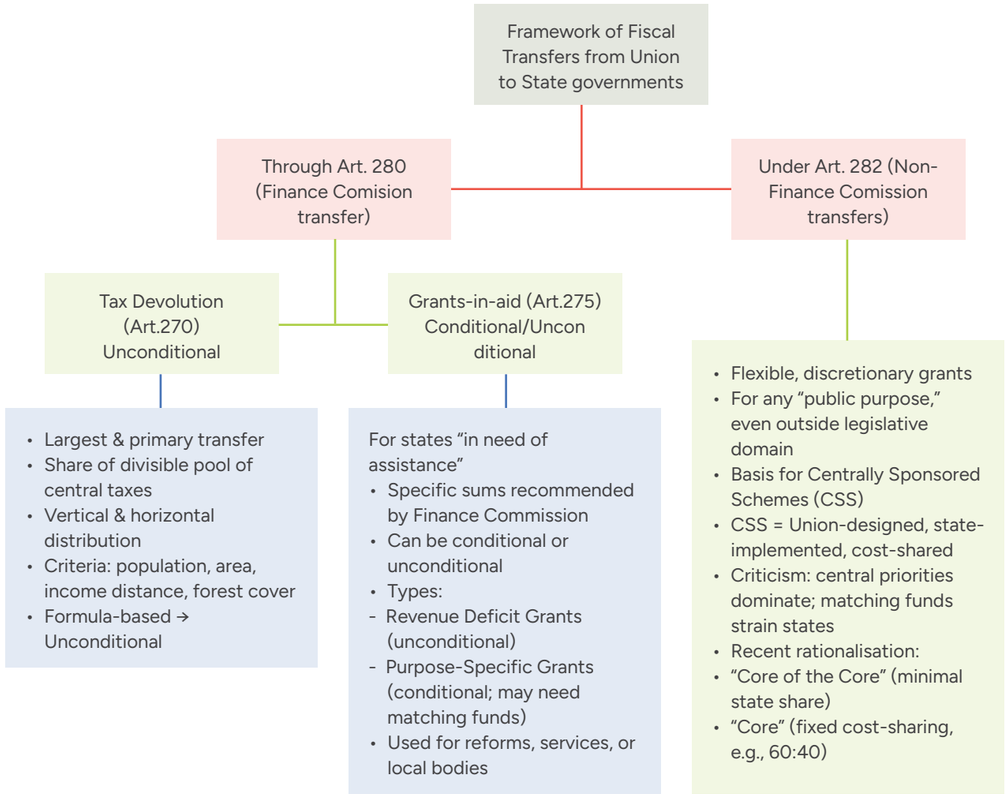
The poverty implications are equally severe. **Without decisive adaptation, over 100 million people globally could be pushed into extreme poverty by 2030, reversing decades of progress, with low-income agrarian economies particularly at risk due to rainfall variability, soil moisture stress, and heat extremes**. In such contexts, falling domestic yields force higher food imports, sometimes exceeding 20% of total import value, thereby worsening trade balances and increasing vulnerability to external price shocks. The fiscal consequences are not limited to emergency expenditure and foregone revenue; they extend to debt sustainability. Climate stress-testing of public debt frameworks reveals heightened risks of debt distress, driven by repeated climate shocks that require borrowing for reconstruction while simultaneously reducing the GDP denominator against which debt is measured. This twin dynamic of increased debt service pressure and reduced fiscal capacity already observable in multiple small islands developing states and climate-exposed low-income countries. Yet, the same modelling that quantifies these losses also demonstrates the economic efficacy of targeted adaptation. Sector-specific measures such as climate-smart irrigation, resilient road construction, and decentralized renewable energy not only reduce exposure but generate robust economic returns, with internal rates of return estimated at 15–20% in several case studies.

In the five African Country Climate and Development Reports (CCDRs) analyzed, implementing the identified adaptation portfolios could recoup between 30–60% of projected GDP losses by 2050, effectively converting climate spending from a perceived cost into an investment in economic stability. This reframing is critical for fiscal policy. Historically, climate risks have been addressed in disaster relief silos, with ex-post budget reallocations and donor appeals, rather than embedded in the ex-ante architecture of growth, equity, and fiscal transfers. Such an approach underestimates both the scale and the predictability of climate-linked macroeconomic shocks.

In India, where vertical and horizontal transfers through the Finance Commission are central to intergovernmental fiscal equity, ignoring structural climate disadvantage risks hard-wiring fiscal disparities into the transfer formula. **The Indian context amplifies the urgency. Coastal states face chronic cyclone exposure and saline intrusion into agricultural land; Himalayan states are grappling with glacial retreat, flash floods, and landslides; and rainfed agrarian states in central and peninsular India endure intensifying drought cycles**. These systemic risks depress state GDP growth potential and tax buoyancy over the medium term, creating a fiscal headwind that cannot be offset solely through state-level adaptation spending, particularly where fiscal capacity is already constrained. The Finance Commission's current devolution formula weights largely on income distance, population, area, and forest cover, with no explicit metric for climate risk exposure or resilience need. Embedding a climate risk equalisation parameter grounded in robust would enable pre-emptive fiscal compensation to structurally disadvantaged states, reducing the inter-state divergence in fiscal capacity over time. This would not only align fiscal transfers with the principles of horizontal equity but also create incentives for states to integrate resilience into their growth strategies, knowing that climate risk management is recognized and supported in the devolution architecture. Such a shift would mark a departure from reactive disaster relief toward a fiscal federalism that internalizes climate realities as a core macro-fiscal variable. In doing so, it would operationalize the growing consensus that resilience is not a competing objective to growth, but a precondition for sustaining it under the current climatic conditions.

The policy challenge is thus one of institutionalizing climate risk assessment within the fiscal decision-making frameworks ensuring that intergovernmental transfers function not just as mechanisms of income redistribution, but as instruments for climate-proofing the development pathway of the country.

India's Constitutional Framework for Fiscal Transfers



The Indian Constitution establishes a structured system of financial transfers from the Union to the states to correct inherent fiscal imbalances. Revenue-raising powers are concentrated at the Union level, while expenditure responsibilities especially in social and developmental sectors rest largely with the states. This creates a vertical imbalance between the Union and the states, and horizontal imbalances among states themselves. Intergovernmental transfers are the mechanism to address both. Article 280, central to the functioning of Finance Commission recommends principles for resource sharing, aiming to narrow vertical fiscal gaps, promote efficiency, and ensure equity across states. Though formally advisory, its recommendations are conventionally treated as binding.

Transfers occur through three main constitutional channels. **The first is tax devolution under Article 270, the largest and most predictable source of transfers.** A share of the divisible pool of central taxes excluding cesses and surcharges is mandatorily shared with the states. The Finance Commission decides both the vertical share allocated to states collectively and the horizontal distribution across individual states, using criteria such as population, area, income distance, and forest cover. These transfers are unconditional, and states are free to use them. For example, the 14th Finance Commission recommended that 42% of the divisible pool be transferred to states.

The second channel is grants-in-aid under Article 275, directed at states "in need of assistance." Unlike tax devolution, these are specific sums, designed to fill the gap between a state's assessed expenditure and its revenues. The Finance Commission exercises greater discretion here, and conditions may be attached. Grants take two principal forms: revenue deficit grants, which are unconditional transfers to cover shortfalls, and purpose-specific grants, which may require matching funds and have been used to support reforms, strengthen services, or finance local bodies.

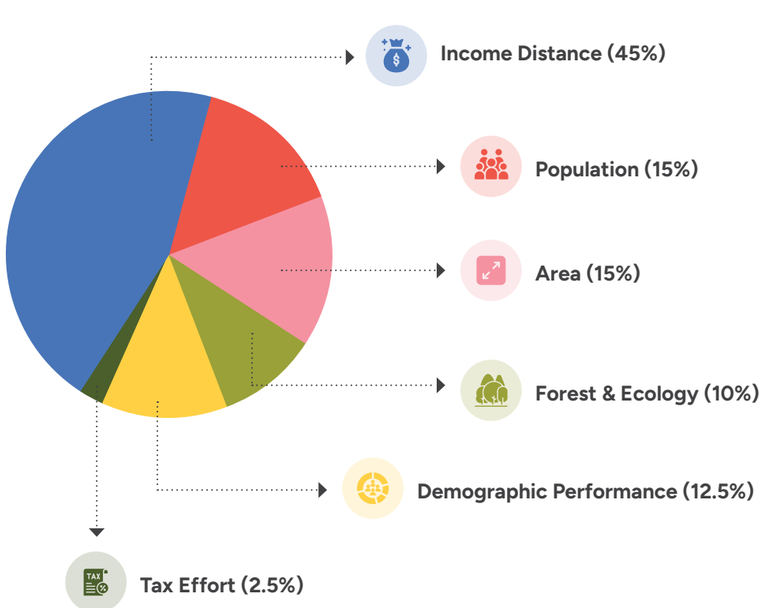
The third mechanism grants for public purpose under Article 282, a discretionary provision allowing both Union and states to make grants for any purpose, even outside their legislative jurisdiction. Historically, it underpinned discretionary transfers by ministries and the Planning Commission and continues to support Centrally Sponsored Schemes (CSS), Union-designed programmes implemented by states in areas such as health and education.

Following the 73rd and 74th Constitutional Amendments, the Finance Commission is also mandated to recommend measures to supplement the finances of Panchayats and Municipalities. These grants, generally under Article 275, increasingly include performance-based conditions, such as publishing audited accounts or improving revenue mobilisation.

The constitutional position on conditionality is clear. Tax devolution under Article 270 is strictly unconditional, forming the backbone of state finances. Articles 275 and 282, however, permit conditional transfers, giving the Union and Finance Commission the flexibility to target assistance and align spending with broader policy objectives. This layered framework underpins India's fiscal federalism, combining predictable unconditional transfers with discretionary grants to address specific needs and policy goals.

3.1 India's fiscal devolution — Overarching influence of Climate Risk

Climate risk is no longer a peripheral environmental consideration; it is a cross-cutting macro-fiscal concern that interacts directly and indirectly with each of the major weights in India's Finance Commission devolution formula, thereby influencing both vertical and horizontal transfers in ways that the current system only partially captures. The existing architecture of the XV Finance Commission weights: **Income Distance (45%), Population (15%), Area (15%), Forest & Ecology (10%), Demographic Performance (12.5%), and Tax Effort (2.5%)** is designed to balance equity, efficiency, and growth objectives in the transfer system. Yet the metrics underpinning these weights are reactive rather than anticipatory, meaning that the growing structural climate disadvantage only gets added in the formula aftershocks have eroded output, revenues, and service delivery capacity. This lag creates a built-in bias against states that face persistent climate exposure, reducing the formula's ability to pre-empt widening fiscal disparities.



Income Distance is the core equalisation lever, and it measures the gap between a state's per capita income and that of the state with the highest per capita GSDP. Climate shocks, whether rapid-onset like cyclones and floods, or slow-onset like droughts and glacial retreat adversely affects productivity by damaging infrastructure, disrupting supply chains, reducing agricultural and fisheries output, and deterring private investment. For high-exposure states, this leads to a widening income distance, but only after the economic damage has occurred. The XV Finance Commission notes that such disparities can persist over multiple award periods because low-growth trajectories become entrenched. **Without a climate risk parameter, the formula equalises ex-post, compensating after the loss, rather than ex-ante, when preventive transfers could protect productive capacity.**

Population: States with high climate exposure often have large concentrations of vulnerable populations dependent on climate-sensitive livelihoods such as agriculture, forestry, and fisheries. In its analysis of service delivery gaps, the Commission highlighted the fiscal challenge of providing comparable outcomes in health, education, and infrastructure to dispersed, rural, and marginalised populations. Climate change exacerbates this by increasing the per capita cost of achieving baseline outcomes like the need for more climate-resilient schools, health centres, irrigation, and housing in cyclone-prone or drought-prone districts. **This is not merely a developmental disadvantage; it is a compounding fiscal liability that, without adjustment, forces vulnerable states to devote a disproportionate share of their budget to maintaining, rather than improving, human development indicators.**

Area: Larger states inherently face higher logistical costs in service delivery, a rationale for the existing area weight. Climate variability intensifies these costs where states span multiple climate zones, each with distinct resilience and recovery needs drought-proofing one region, cyclone preparedness in another, and flood management elsewhere. The Commission's own cost-distance analysis for infrastructure delivery shows that remoteness and terrain multiply expenditure requirements; climate stress adds another layer of cost volatility, especially when disasters strike multiple subregions in a single fiscal year. **This argues for factoring hazard diversity and recurrence probability into the area weight.**

Forest & Ecology. The 10% weight for forest and ecology recognises the ecological services provided by states with high forest cover, an approach reinforced by the Commission's endorsement of the 2015 Forest Survey of India's data. However, **the**

formula does not account for the increasing costs of maintaining these assets under climate stress. States with high forest cover now face higher outlays for fire management, biodiversity protection, and invasive species control, as well as reduced forest productivity from shifting monsoon patterns. The Commission has noted that forest-rich states in the Northeast and central India already face fiscal constraints in financing these stewardship costs; climate change will only amplify this imbalance.

Demographic Performance. Designed to reward states that have achieved demographic transition, this weight reflects efficiency in population management. However, climate vulnerability can undermine these gains through distress migration, altered dependency ratios, and strain on urban services in receiving areas. States experiencing recurrent agricultural droughts or coastal erosion often see net out-migration of working-age populations, eroding the local tax base and increasing the proportion of dependents. Conversely, in-migration to climate-safe urban clusters can stress host state finances through increased demand for housing, health, water, and sanitation.

Tax Effort. While small in weight, this parameter rewards states with higher own-revenue mobilisation relative to GSDP. Climate shocks disrupt revenue collection both directly through destruction of economic assets and displacement of taxpayers and indirectly, by raising business costs (insurance, energy, logistics), thereby reducing economic activity. The XV Finance Commission observed that post-disaster states often face a double blow: reduced tax buoyancy and higher expenditure needs, forcing them to borrow or cut back on developmental spending.

3.2 Why climate risk belongs in the formula: The Equity–Efficiency–Growth case

Equity:
The principle of horizontal equity underpins the Finance Commission's mandate: states with lower fiscal capacity require higher transfers to deliver comparable public services. Climate-vulnerable states must spend more per capita simply to maintain baseline service levels, given repeated asset loss, reconstruction cycles, and environmental degradation. The XV Finance Commission's treatment of Northeast and hill states illustrates the logic: terrain and remoteness are structural cost drivers justifying higher transfers. Climate exposure is a similar structural disadvantage that is persistent, location-specific, and outside state control thereby warranting equalisation support.

Efficiency:
Predictable, formula-based transfers linked to climate risk would create incentives for states to invest in resilience rather than relying on uncertain, often delayed post-disaster aid. The current system's reliance on the National Disaster Response Fund (NDRF) and ad-hoc central assistance means that state adaptation investments compete with other priorities in constrained budgets. Embedding climate risk in the formula would mainstream resilience into state fiscal planning and align with the Commission's recommendation to integrate risk reduction into capital investment decisions.

Growth:
Climate shocks depress GSDP, widening income distance the central equalisation variable but the current formula captures this only after the shock. A forward-looking integration of climate risk would smooth the income path, protecting growth potential by cushioning states before downturns hit. This aligns with the Commission's own emphasis on stability and predictability in transfers as critical for state-level fiscal planning and development programming.

Incorporating climate risk into the Finance Commission formula would not require discarding existing weights but augmenting them by adding an evidence-based indicator that captures climate risk, vulnerability and adaptive capacity of states. A climate-adjusted devolution formula would pre-emptively compensate for structural disadvantage, much as area and forest weights do for physical geography, ensuring that fiscal equalisation keeps pace with the defining macro-fiscal risk arising from climate change.

3.3 How we will embed climate risk

3.3.1 Why the current formula falls short

India's fiscal devolution formula is unique. It is a concrete mechanism of dividing the **divisible pool of central taxes between the Union and the States with a 41% allocation to the states under the XV FC.** The XV Finance Commission (FC) retained the conventional components including a 45% weight on income distance, a 15% weight on population, a 15% weight on area, a 10% weight on forest and ecology, a 12.5% weight on demographic performance and 2.5% weight on tax effort. The horizontal devolution formula has delivered transparency and predictability. However, it remains poorly aligned to the realities of a warming world. The parameters of the formula although administratively traceable, do not account for price of physical climate risks or the cost of climate resilience before shocks materialise. The absence of a forward-looking compensation mechanism embedded in the devolution for states that are chronically exposed to floods, droughts, cyclones face recurrent fiscal drains.

The misalignment can be explained through three design gaps. **The forest and ecology criteria is static stock proxy.** This component rewards the conservation efforts for forest cover taking into consideration the 'dense forest' cover area. It does not account for dynamic climate stresses on the ecosystem. **It further does not reflect the avoided-loss value of a climate resilient ecosystem in a time of escalating extreme weather events.** Climate extremities vary sharply across states, geographies and over time. The escalating costs of climate risks demand forward-looking risk and performance indicators rather than static stocks alone.

Adverse conditions depress economic outcomes. Income distance is an economic indicator which equalises fiscal capacity of states. It essentially measures the disparity between the states.

Adverse conditions depress economic outcomes. Income distance is an economic indicator which equalises fiscal capacity of states. It essentially measures the disparity between the states. However, it does not reflect underinvestment or exogenous climate disadvantages including high probability of cyclones, chronic water stress, or heat-induced productivity losses. These climate disadvantages supress growth and create structural blind spots. Climate vulnerability can slow growth even before it can show up in revenue gaps. Physical risks of climate are materially macro-relevant and any fiscal design without such consideration may result in systematic under-allocation to climate exposed jurisdictions and even more so for already vulnerable states.

Further, there is a need to view devolution from an explicit lens of adaptive capacity. Preparedness includes risk assessment, early-warning-coverage, resilient public infrastructure, health systems and capacity and the ability to mobilise financial instruments. They determine the degree of fiscal losses when shocks occur. Climate resilience building relies on shifting from ex-post relief to ex-ante risk reduction and financial protection. A devolution mechanism should be able to incentivise states to strengthen their adaptation infrastructure that would reduce future liabilities for both the state and the Centre.

The opportunity cost of inaction is only increasing. World Bank diagnostics for India's urban systems estimate multitrillion-dollar needs for resilient, low-carbon infrastructure by mid-century, while flood and heat risks already impose significant annual losses. Thus, a devolution calculation that recognises climate exposure for states would be able to channel calculated, formula-based financial resources to yield marginal reduction in disaster losses and productivity drag.

3.3.2 Forest and Ecology weight limitations

The forest and ecology (10%) criterion is calculated from each state's share of dense forest in the national total. It is an unconditional transfer that internalises ecological externalities by compensating states for foregone developmental opportunity on forest land. Developed over three Finance Commissions, it signals a shift towards environmental public good stewardship. **However, as a stock-based proxy, it does not capture the dynamic climate risks of the states.** Nor does it capture the performance of the states to maintain ecosystems and risks under changing climatic baselines.

The three primary limitations of the criteria are as follows-

Invisible risk dynamics:
The forested states of the country in central and Himalayan belts or the coastal regions face physical stress and disaster interferences ranging from landslides after cloudburst to potential loss of biodiversity. Thus, a dense forest area today would hardly be able to say anything about tomorrow's resilience. The OECD Net Zero+ initiative highlights the importance of incorporating resilience into climate and economic policy and thus advocating a systemic resilience beyond stock-based indicators. **The flat stock metric would only be able to reward a state that is 'lucky' on risk realisations. It would grossly under-compensate a state heavily investing to prevent ecosystem degradation under much harsher conditions.**
Even International Agencies and their guidelines like the OECD advises on 'greening' inter-governmental transfers by embedding climate risk indicators including resilience into transfer formulas.

Cost of stewardship under climate change is unrecognised:
Higher operations and maintenance is required to maintain forest cover and health under escalating climate stress. Higher costs are also required for maintaining the economic infrastructure. International studies say, 'achieving 0.6–6.0 $GtCO_2$ per year of mitigation through avoided tropical deforestation and other forest strategies by 2055 is projected to cost between US$2 billion and US$393 billion annually'. States often struggle to maintain ecological assets under rising climate risks. **Increasing climate pressure increases the cost of preserving and managing forest cover.**
A stock-based stewardship neither reflects these cost escalators nor does it incentivise transparent stewardship outputs like healthier canopy scores. Preservation thus becomes a fiscal burden rather than a financially supported public good as it would fail to account escalating restoration costs. International experience also suggests allocations to measurable outputs and outcomes rather that stock indicators.

Avoided losses are not priced:
A forest ecosystem provides climate-risk mitigation services ranging from flood regulation, slope stabilisation to coastal protection to local cooling. Their fiscal value is very localised. Mangroves in cyclone-prone coasts provide disproportionately large avoided-loss benefits relative to inland forests and upstream catchment integrity reduces downstream flood damage. OECD–World Bank work on fiscal resilience emphasises prioritising risk reduction investments that demonstrably lower expected disaster losses and more precisely the type of signal a refined criterion could transmit if it measured ecosystem-based risk mitigation. **The criteria overlooks large economic value of avoided loss leaving critical climate resilience benefits unrecognised.**

Thus, there is a requirement for composite indicators and alignment of incentives with ex-ante risk reduction to guard against climate-induced degradation. Forests also intersect tightly with urban and coastal resilience including city-heat mitigation and coastal protection via mangroves making it an indispensable asset. But is still a limited mitigation mechanism to the vast array of climate-risks. It has the potential to act as a nature-based solution to reduce expected fiscal liabilities from extremities, but it needs a wider scope to completely mitigate climate risks. Ultimately, without the integration do dynamic climate risk metric, it would be a missed opportunity to incentivise proactive resilience-building in vulnerable states.

3.3.3 Income Distance's climate blind spot

The Income Distance criteria has been the backbone of horizontal equalisation. It offers a transparent and rule-based measure of fiscal capacity. However, in a climate-disrupted economy like India, this metric is a little limiting and has a blind spot. During the last decade (2014–2024), states have had very unequal growth trends: while Goa and Sikkim consistently have the highest per capita incomes, Karnataka, Telangana, and Mizoram have had the highest annual GDP per capita growth rates—over 6%, significantly higher than the national average. Bihar, Jharkhand, and Uttar Pradesh are in contrast firmly located at the bottom both in current income and growth rates.

This difference is even more relevant in the case of climate vulnerability. Most agrarian states whose GVA is substantially agriculture dependent often have lower per capita GDP and are more vulnerable to climate shocks. When persistent growth gaps coincided with greater climate risks, the application of income distance without climate adjustment has the potential to underestimate real fiscal requirements of these states. **There is a risk of underestimating fiscal capacity and needs of vulnerable states without a climate adjustment.**

Thus, amplifying development gaps reinforced by recurring climate shocks. As climate risks are escalating, pre-existing structural disadvantages due to the geography and climate exposure overlooks how climate risks intensify distance and economic vulnerabilities of states.

Without climate correction, income distance creates three unique problems-

Conflates vulnerability with inefficiency:
Exogenous climate risks like a drought or a cyclone may display persistent income shortfalls for a state. According to an ILO report, by 2030 India could lose the equivalent of tens of millions of full-time jobs to heat stress and is projected to reduce working hours materially with measurable GDP impacts. Climate shocks further depress economic growth through capital destruction, reduced labour productivity, agricultural volatility and other structural deficits. **Climate vulnerability may be the invisible economic shortfall.** Without a climate-adjustment, there may be a systematic bias to under-allocate resources to states with a climate-vulnerable profile and climate risk exposure and thus constraining their ability to invest in resilience.

Slow to respond and pro-cyclical:
Income distance adjusts slowly, and transfers adjust only gradually. States hit by cyclones, floods or droughts face immediate revenue losses but receive higher transfers only years later. This lag deepens fiscal stress and thus increasing the income gap. It also widens developmental gaps between affected states and prolongs hardships. It is necessary in a climate-exposed economy that formula-based transfers adjust to new realities of unpredictable extreme climate events rather than leaving states financially strained in the crucial recovery stage. **Ignoring asymmetric climate shocks risks pro-cyclical transfers making their scope very narrow. Climate adjustments are necessary to uphold the equity principle and for resilient growth.**

Does not price transition and physical risks:
Income distance does not take into consideration climate transition and physical risks that supress growth potential ex-ante. By focusing on realised outputs, the limitation lies in its blindness to future constraints. Physical climate risks and transition erode productive capacity before GDP impacts

The devolution formula accounts for equity and efficiency but there is no explicit measure of 'adaptive capacity gaps' which would exactly highlight the disparities in a state's ability to anticipate, prepare and respond to climate shocks.

are visible. States become structurally disadvantaged, under-compensated and ill-prepared for compounding shocks. States with climate-exposed agriculture or carbon-intensive industrial bases face higher adjustment costs and a chronic productivity drag. While making income distance climate-adjusted would reduce fiscal inefficiency and inequity. **Currently, fiscal equalisation is reactive, perpetuating vulnerability instead of proactively building resilience in climate-exposed states.**

Thus, embedding climate vulnerabilities into income distance would produce a bounded uplift for high-risk states. This recalibration is not about diverting resources from poorer to richer states, it is about separating climate vulnerabilities from governance effects. The equity purpose would be further strengthened while ensuring resilience under asymmetric climate shocks. Climate shocks structurally depress productivity, fiscal capacity and long-term growth trajectory but not necessarily all income gaps be due to governance deficits. The omission would perpetuate inequities, and vulnerable states would remain under funded.

3.3.4 No metric for adaptive capacity gaps

The institutional and investment readiness determines the degree and size of fiscal losses once a hazard strikes. The current devolution formula does not account for a state's adaptive capacity. Climate shocks are considered as fiscal risks and thus needs to be managed with ex ante instruments including risk reduction investments, preparedness systems and financial protection. International agencies like the World Bank argue that countries need 'comprehensive fiscal resilience frameworks that identify and assess physical risks, mitigate them through targeted investments, and pre-arrange financing to avoid disruptive budget reallocation when disasters occur.' **The devolution formula accounts for equity and efficiency but there is no explicit measure of 'adaptive capacity gaps' which would exactly highlight the disparities in a state's ability to anticipate, prepare and respond to climate shocks.**

3.3.4.1 Why adaptive capacity matters?

Infrastructure quality, institutional readiness, human capital, technology access and fiscal flexibility shape the adaptive capacity of a region. Lower adaptive capacity faces higher marginal costs of resilience. For instance, the same climate shock would cause a far greater disruption in a state with weaker adaptive capacity preparedness. **The deficits in a state's infrastructure would amplify vulnerability**

and eventually slow down economic recovery. Thus, creating a vicious cycle of hazard-damage-fiscal stress. This would lead to vulnerable states further away from their developmental path and increase the income distance.

The current devolution formula is distribution-wise neutral to readiness gaps of states as there is an absence of an adaptive capacity lens. According to the formula, two equally climate-prone states may receive similar per capita transfers despite one having a robust adaptive capacity and the other completely lack it. The states with more climate exposure and vulnerability would be further pushed down compared to states with less climate exposure. The climate-prone states would require higher investments to build a basic resilience threshold to lessen the impacts of climate shocks. However, the formula does not differentiate.

Explicit absence of adaptive capacity from the devolution formula means that there is **no systematic incentive to undertake cost-effective risk reduction**. The is an over-reliance on post-disaster grants. Even though they are vital, they are inherently reactive.

The current focus is on fiscal capacity but only captures realised economic output. The underlying structural resilience is not accounted for, and neither is how they determine the degree of any climate event. The population and area components of the formula are agnostic to hazard-adaptation needs. The tax effort criteria rewards revenue mobilisation without taking into consideration the fiscal drag caused by climate shocks. The absence of an adaptive capacity metric would result in high low-resilience states to fall into a 'resilience funding gap'. A new pool of climate-vulnerable states with high-risk and low-resilience would further increase the income distance. This would undermine the equalising intent of horizontal transfers.

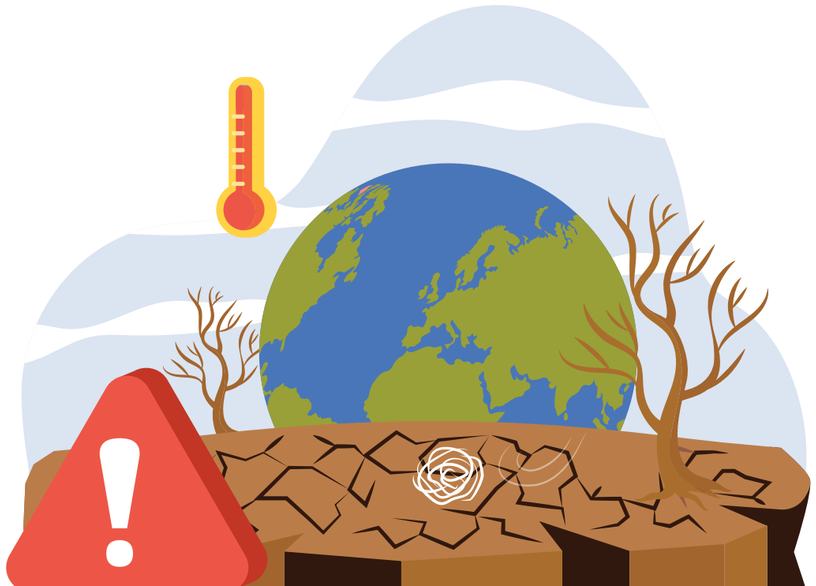
Importantly, **an adaptive-capacity lens is a complement to rather than a replacement for equalisation**. It reduces future liabilities for the states by limiting anticipated loss and recovery costs. The high flood losses experienced by India every year and increased urban exposures make the case for a rules-based, ex ante premium as part of devolution. This can alter behaviour away from relief and towards prevention and lead to every rupee of capital expenditure working harder under climate uncertainty.

The 5% weightage for climate is not a random number but it has its rationale in a climate profile assessment of the states and the principles of equity and efficiency.

3.4 Embedding climate risk

The Finance Commission is constitutionally tasked with recommending the distribution of central taxes among the states. The formula for fiscal devolution is ever evolving to accommodate a larger scope of horizontal transfers to maintain equity, efficiency and fiscal stability. With the introduction of the Forest Cover in the XIV Finance Commission, there was a recognition for the role of environmental stewardship. To curb depletion of forest cover, due to developmental activities, it was necessary to incentivise maintenance of forest cover. The weightage was increased to 10% in the XV Finance Commission as it had become a need within the framework of sustainability driven developmental activities. However, recent climate extremities ranging from floods, cyclones to heatwaves and droughts have shown that maintaining forest cover and the ecology is not quite enough. One critical dimension of the formula remains incomplete. It does not account for explicit economic shocks due to the challenge of climate risk exposure, climate sensitivity and climate adaptive capacity needs.

We propose that the **XVI Finance Commission introduce a Climate criterion into the fiscal devolution formula**. **The initial weight recommended for such an introduction is 5%.** Certain states face disproportionate climate hazards and simultaneously lack institutional, infrastructural and fiscal readiness. This 5% weightage is the first step towards recognising this exposure and disproportionality. The formula would be able to make fiscal transfers equitable not only in terms of income but also in terms of resilience. Thus, future proofing fiscal devolution against climate shocks.



3.4.1 The Proposed Formula

Criteria	15th FC	16th FC (Proposed)
	2021-26	*2026-2031*
Income Distance	45%	45%
Population (2011 Census)	15%	13%
Area	15%	13%
Forest and ecology	10%	9.0%
Demographic performance	12.50%	12.5%
Tax effort	2.50%	2.5%
Climate Risk	-	5.0%
Total	100%	100%

The following table shows the proposed distribution of weights for the XVI Finance Commission's fiscal devolution formula. The core structure of horizontal devolution is maintained even while introducing a climate component to the formula. This climate component would recognize that climate shocks warrant an immediate structural adaptation. Further, it would highlight that such externalities do determine state-level fiscal needs and developmental capacity.

Income distance, the core component of the formula is proposed to be maintained at 45%. This would ensure that the fiscal capacity equalisation continues to target the gap between a state's per capita GSDP and that of the richest state. While also taking into account climate shocks that can increase the disparity, it is expected that the climate component will enhance the efforts of the formula to reduce income distance. Thus, the income distance and the climate component would complement each other. Together, a solid 50% of the funds could be considered as equalisation efforts for the states.

The Demographic Performance and the Tax Effort components is proposed to remain unchanged. Thus, signalling a continued emphasis on efficiency, population management and incentivising revenue collection efforts.

3.5 Carving out 5% for Climate

3.5.1 Population (2011 Census): Reduction from 15% to 13%

The population component of the fiscal devolution formula traditionally has been one of the largest drivers. Population criteria in the formula directly shapes scale of public service delivery and expenditure obligations for the state. Larger populations require greater investments in public goods including health, education, infrastructure and social protection. The rationale is clear that larger populations would require greater transfers for it to be equitable.

However, the proposed formula recommends that reducing the population weight from 15% to 13%. This is to make space for the climate criteria without disturbing the 100% total.

The reduction in the weight of the population component does not signal a diminished importance of it as a fiscal driver. However, it only signals how there is an evolution of expenditure determinants. **In a context where adaptation, disaster risk reduction and resilience building have become core functions to essentially protect the population and the economy from extreme climate shocks, it is imperative to recognise that externalities impact the population.** Thus, only considering the population is a flat indicator in changing times. For instance, a medium-sized state facing repeated climate-hazards may require sustained capital outlays to build for resilience as compared to larger but climate-stable states over and beyond the routine public services.

The Indian population is growing at a rapid pace. The 2011 Census data captures demographic reality with a lag. Moreover, climate exposures are also evolving very rapidly, with occurrences of cloud bursts and urban floods being very common. Climate exposures would place the growing population at higher risks. Climate extremities have often led to the population being displaced and their livelihoods being hampered. Reducing the population criteria by a small, calibrated margin allows space to create for a component which is more dynamic and responsive to urgent risks. This would only enhance the basic population-based equity principle.

The reduction in the weight of the population criteria avoids overemphasising the size of the population at the expense of the structural disadvantages of the population. Therefore, this rebalancing would recognise the asymmetry of how

climate-exposed states face amplified per-capita costs and would integrate risk-adjusted needs along with population-based needs. Thus, it creates a hybrid approach that would account for both the public services demand of the population and the exogenous fiscal stresses of climate risk, making it more aligned with the equity and the efficiency objectives of fiscal federalism.

3.5.2 Area: Reduction from 15% to 13%

Infrastructure provision in large, populated states is more expensive. Thus, geographical area has been seen as a cost driver for public service delivery and is recognised in the devolution formula. Unit costs of public services increase in larger states and thus increasing costs of roads, communication networks and other public services. Scale-of-distance effects in governance and administration is compensated for states under the area criterion.

To accommodate the climate component in the devolution formula, a reduction of the area component from 15% to 13% is proposed.

While area as component still remains very relevant as there is huge differences in the size of the states, the expenditure implications of the state's due to climate vulnerability is expected to increase. Compact states in the hazard-prone zones like those in the coastal belts or the Himalayan slopes who are susceptible cyclones and floods, face a disproportionately higher fiscal need for resilience despite being smaller in size. Larger states not very susceptible climate risks are at an advantageous position.

Adjusting the formula to a reduced weight of area allows to distinguish between the pure geographical area cost drivers and hazard-related cost drivers. Hazard-related cost drivers of the state would be more accurately calculated in the climate component, reducing the inequity. The cost of building and maintaining a large road network in a larger state would be high compared to a smaller state. **However, if the smaller state is exposed to disasters at more frequent intervals than the larger state, the cost of recovery, relief, rehabilitation and maintaining the same road network with climate-resilient materials and systems would be much higher. The current formula considers both situations to be equal.** Ultimately, it underestimates the fiscal needs of the smaller high-risk states.

Climate risks are only amplifying and cannot be offset without fiscal interventions. There was an rebalancing need to recognise the source of fiscal stress as it is less from sheer size but more from climate extremes. Reduction in the weight accounts for two things. First, it acknowledges the legitimate area-driven costs of a state. Second, it also takes into account the exogenous, location-specific fiscal burdens. The second cannot be measured by a traditional area component. Thus, making it more equitable

3.5.3 Forest & Ecology: Reduction from 10% to 9%

The Forest and Ecology criteria was introduced to recognise the efforts to maintain dense forest cover in a time of rapid economic development. It a stewardship programme for the opportunity cost of maintaining forests and promotes for sustainable development. The formula incentivises preservation and acknowledges the role of ecology in carbon sequestration, watershed protection and climate regulation. However, it only shows a limited picture.

The proposed formula advices a modest reduction of the forest and ecology weight from 10% to 9%.

Rather than redefining the entire component only a reduction is proposed as the component is recognised as playing a pivotal role in achieving climate targets and in building climate resilience. This reduction can only be viewed as an alignment exercise with the climate component as it would be complementing the new introduction. Forest cover and ecology can be viewed as a sub-set of climate and ecology resilience as forest cover can mitigate some climate risks like reducing flood intensity or stabilising slopes. However, the climate metric is much broader and that would encompass critical segments like climate exposure, sensitivity and adaptive capacity needs. The climate component would be a more direct measure of hazard exposure or adaptation needs.

The partial shift of the weight would recognise both the requirement for a ecological value of forests and for a broader risk landscape. A state with significant forest cover but very low climate hazard-exposure would not require the same level of adaptation funding as compared to a state with high-risk exposures to cyclones but sparse forests. The current formula would only consider the share of dense forest in the state but would not calculate the climate-risk aspect. Thus, climate vulnerabilities would not be reflected despite having large dense forest covers.

A climate component needs to be more responsive and dynamic. The marginal reduction reflects the narrower scope of the forest cover in the whole climate resilience spectrum. A state's climate adaptive needs may arise from various climate hazards. Although, forests would be able to mitigate some exposures but would not be able to fully capture the adaptive needs that arise from frequent extreme events. Thus, reducing the 1% in the forest and ecology component, there is an incentive for preservation of forest cover and space for a dedicated funding channel for adaptation needs.

The space created for a 5% allocation for climate would benefit states in a much for comprehensive manner. It would take into consideration climate exposure, climate sensitivity and climate adaptive capacity. Thus, further strengthening the equity-efficiency-growth ideology of the fiscal devolution formula.

3.6 Design Principles

The 5% climate weight is consciously sized to support and not substitute for the core equalisation levers that the XV Finance Commission has adopted. The calibration is influenced by two precedents. First, the forest and ecology dimensions were first introduced to the formula at a low bound (for instance a 7.5% weight under XIV FC and later increased to 10%). Second, large unbounded reweighting of criteria drives volatility in share attribution of states and may weaken predictability.

Consequently, a 5% climate pillar is sufficiently large to adjust incentives and mitigate bias against high risk, under-allocated states, yet small enough to mean the bounds of income distance and drivers of demographic and area-based costs, and performance incentives, remain dominant.

It is, therefore, a sensible front row "first principle" introduction, and it respects the Finance Commission tradition of incremental, evidence-based innovation, while keeping the sum at 100% and the overarching balance of objectives intact.

In a modelling study conducted by the National Institute of Public Finance and Policy, covering 27 Indian states from 2003 to 2020, researchers examined the link between intergovernmental fiscal transfers (IGFT) and net forest cover (NFC).

Using econometric models with NFC as the dependent variable and IGFT, gross state domestic product (GSDP) with its squared term, and population as explanatory variables, the study found a **positive and statistically significant relationship between IGFT and NFC, indicating that higher transfers were associated with greater forest cover.** Population exerted a negative influence on forests, while GSDP followed an Environmental Kuznets Curve pattern: growth initially promoted forest cover but beyond a threshold, it reduced it. Descriptive statistics showed mean transfers of about ₹21.3 lakh (with a maximum of ₹225 lakh) and average very dense forest cover of 2,662 sq. km across states. The findings suggested that ecological considerations in Finance Commission transfers contributed to forest conservation outcomes.[xiii] Complementing this, another study showed that the Finance Commission strengthened ecological fiscal transfers by increasing the weight for forest cover from 7.5 per cent under the Fourteenth to 10 per cent under the Fifteenth Commission. Scatterplots confirmed a positive association, with beta coefficients rising from 0.044 to 0.056. The link operated indirectly, as transfers influenced states' ecological spending. Evidence of a "flypaper effect" suggested these transfers boosted forestry budgets more than states' own revenues, incentivising conservation. [xiv]

Earmarking a dedicated 5% of the fiscal devolution for climate adaptation and mitigation needs has the potential to generate significant multifaceted benefits for India's public finances and overall resilience. A study of 98 countries in the OECD database revealed that climate finance for mitigation in agriculture-based economies notably promoted the increase in production. Further analysis also showed that mitigation funds were more effective in countries with lower income. Allocation of a percentage for climate resilience would make states gain both resources and a policy indication for mainstreaming climate risk into budgetary planning, infrastructure development and social protection. A percentage-based allocation would be particularly impactful for India's most climate exposed sectors including agriculture, water, energy, construction and infrastructure as pre-emptive investment would generate high returns in avoided damages in the long-term. A climate-focused devolution would enhance sub-national autonomy and innovation for measureable improvements and innovations in climate-resilience and reduce fiscal liabilities for disaster.

The evidence clearly indicates that indicators such as forest and ecology are anchored in the equity-efficiency-growth triad. Similarly, incorporating climate risk and vulnerability into the devolution formula would have significant positive

implications for equity-efficiency-growth. Equity directs resources to states where needs are high due to exogenous climate risk, not because of governance failures, thus honing horizontal equity by distinguishing vulnerability from inefficiency. Efficiency criterion promotes ex ante risk reduction and preparedness (e.g., resilient infrastructure, reach of early warning), lowering expected losses and future allocated resources for relief. By cushioning climate headwinds that compromise labour productivity and destroy assets, the growth criterion secures medium-term growth trajectories and the tax base, thus reinforcing macro-stability.

The 5% climate criterion's design draws upon three mutually reinforcing pillars—Exposure, Sensitivity, and Adaptive Capacity.

They provide a thorough and equitable rationale for allocation. The pillars build an overall allocation formula based on current scenario, and not overly narrow or single dimensions of climate vulnerability across Indian states.

Exposure provides a solid, spatially verifiable evidence basis for calculation. It determines the physical location of people, and their assets and infrastructure, in hazard-prone zones such as floodplains, cyclone corridors, or drought-prone areas. This deepens the formula, by creating allocations based on the actual concentration of risk, and not on hypothetical probabilities of hazard. In the absence of exposure, the framework would not be able to distinguish between two states that are theoretically equally threatened, but practically very differently located.

The Sensitivity pillar provides a deeper element of calculation. It illustrates how the socio-economic and ecological context within which a hazard occurs affects the consequences. Two states may experience the same flood hazard and face the same expectations for losses, but their impacts will diverge sharply depending on the housing quality, reliance on rain-fed agriculture, or ecosystem fragility. By including sensitivity, it documents the different ways how shocks can turn into vulnerability. This dimension adds an element of equity to the design, reminding stakeholders that similar events can have profoundly different impacts.

The Adaptive Capacity pillar acts as the compensatory and forward-looking element. It recognises that vulnerability does not persist in its form or function, but is aspect dependent upon the nature of institutions, the resilience of infrastructure and the quality of governance. Incorporating adaptive capacity reinforces the calculation and prevents the formula from inadvertently rewarding states for persistent weakness and instead emphasises where resilience deficiencies remain and where financial transfers are likely to produce maximum marginal returns in fostering preparedness and ultimately reduced exposure to long term risk.

A 5% climate component makes the country's devolution formula forward-looking in terms of climate risk and actionable readiness.

What it achieves? The Climate criterion of the proposed devolution formula is designed to complement the other components. It does duplicate them or their intents. For instance, distance from income recognizes fiscal capacity. The forest criterion recognizes static ecological stocks. The climate criteria would recognise hazard-based risks and adaptive capacities. Thus, combining elements of both and a wider scope to look from. Furthermore, it stabilizes predictability as it would use rolling, multi-year calculations, so an allocation is not distorted by a single, extreme event. This disciplined approach of relying on climate exposure, sensitivity and adaptive capacity will make the climate component a more equitable, efficient and growth oriented.

A 5% climate component makes the country's devolution formula forward-looking in terms of climate risk and actionable readiness. Without losing its core equalisation component, it would improve allocative accuracy in exactly those states of the country that suffer from climate shocks. Lastly, it would enhance the growth dividend of public investment that climate risks have the potential to decimate.

3.7 Positioning India as a Global Pioneer

The proposal to include a specific Climate criterion in the XVI Finance Commission's formula for devolution is not merely a domestic reform but a world first. As far as the world is aware, no emerging economy has hitherto made climate vulnerability an explicit part of its fiscal equalisation framework. Though climate-resilient planning instruments or dedicated adaptation funds have been taken up in numerous countries, these tend to be on the periphery of core inter-governmental fiscal transfers. **India's action would rather put climate considerations right at the centre of national fiscal federalism, establishing a new standard for policy innovation.**

This strategy has strong demonstration power for other decentralised systems and federations in the Global South. African federations like Nigeria and Ethiopia, ASEAN members with sub-national autonomy like Indonesia and the Philippines, and Latin American nations with equalisation mechanisms like Brazil and Mexico are all confronted by the twin problem of spatial inequality and intensifying climate shocks. **By operationalizing climate vulnerability in its own equalisation formula, India provides a replicable model that is equitable, efficient, and resilient.**

The reform also provides an additional lever for climate diplomacy. India's G20 presidency, a constructive role in COP negotiations and MDB reforms already made India it a thought leader in linking climate with developmental ambitions. Illustrating that climate risk can be incorporated into a national transfer formula enhances India's legitimacy in promoting parallel action in the global climate finance architecture, particularly in the appeal for loss and damage funding and adaptation finance for the developing economies. It enhances India's chance to emerge as a leader of the Global South.

Above all, this change fills a critical funding gap. Climate adaptation funding if dealt with special-purpose schemes that tend to be grant-based, time-limited, and donor-dependent. Placing climate within the devolution formula guarantees a stable, rule-based, and locally funded flow of climate resilience consistent with constitutional provisions of fiscal fairness.

Chapter 4

Embedding Climate Risk in Fiscal Transfers: Global Insights

Their principal function is to create incentives for provinces, states, municipalities or local councils to conserve ecosystems, pursue low-carbon development, or respond to climate vulnerabilities before they become irreversible.

India's experience demonstrates that environmental considerations can be integrated into the very fabric of fiscal transfers. But as climate risks grow around the world, the question is bigger. How are other nations structuring their public finance systems to respond to this twin imperative of resilience and equity?

Following a proposal to factor climate vulnerability into India's fiscal devolution, it is worth studying how other countries are designing climate–development finance at the subnational level. Everywhere, governments are moving towards aligning public finances with sustainability goals, climate resilience, and larger ecological imperatives. The new challenge is not just mobilization of resources but translating national climate aspirations into local action—especially in the most climate-risk-exposed communities.

Although the mechanism varies by country, their principal function is to create incentives for provinces, states, municipalities or local councils to conserve ecosystems, pursue low-carbon development, or respond to climate vulnerabilities before they become irreversible. Mechanisms include but are not limited to intergovernmental transfers based on agreed formulae, budget tagging (such as a

Despite the increase in global climate finance, there remains a gap between the availability of funding and access to funding at local scales.

line-item for climate or health), targeted grants, established trust funds, and market instruments like green bonds.

Despite the increase in global climate finance, there remains a gap between the availability of funding and access to funding at local scales. Top-down allocation models that are usually reactive tend to de-spatialize and generalize the adaptive needs of vulnerable locations. In this regard, Ecological Fiscal Transfers (EFTs) and EFT-like models can provide an innovative response that correspond fiscal flows to climate or environmental performance.

The following is a comparative review of climate-linked fiscal mechanisms in twelve countries. From assessing institutional design, the nature of the financial instruments to the effectiveness in bridging the local climate finance gap, it offers lessons of countries trying to build climate resilience.

4.1 BRAZIL:
A Fiscal Innovation Rooted in Federalism

Category	Description	Key Indicators	Outcomes / Examples
Origins & Legal Basis	Created in 1991 as ICMS-Ecológico, following the 1988 Federal Constitution. Allows states to allocate part of state-level VAT (ICMS) using ecological criteria. Pioneering mechanism globally in linking fiscal transfers to environment.	25% of ICMS revenue under state discretion; criteria include protected areas, environmental compliance, water resources.	Established fiscal basis for eco-linked tax transfers; adopted first in Paraná; still operational across states with tailored laws.
Mechanism	State-to-municipality transfers based on ecological performance, complementing traditional economic indicators. Voluntary participation but attractive due to higher revenue shares.	Land under designated protection, water quality, vegetation cover (new reforms), compliance with laws.	Municipalities compete for higher scores; São Paulo includes tree/ vegetation cover aligning with Brazil's Paris Agreement restoration goal (12 million ha by 2030).
Rationale & Objectives	Incentivizes municipalities to internalize ecological value; direct compensation for conservation and sustainable use measures.	Biodiversity value, watershed conservation, legal compliance with protected area regulations.	Encourages proactive environmental planning, bridges conservation with fiscal policy, rewards municipalities for ecological stewardship.
Data & Distribution	Formula-based transfers structured by state legislation; ecological criteria verified and monitored by state agencies.	Spatial land-use data, protected area cover, water quality records, vegetation cover.	Differentiated allocations across municipalities; 5.75% of all municipalities benefitted by 2022.
Governance & Oversight	State environmental secretariats oversee monitoring and compliance, supported by state-specific legislation. Competitive dynamic embedded in allocation.	Verification of conservation metrics; monitoring of forest cover and land use changes.	Promotes measurable outcomes; incentivizes continuous compliance and innovation at municipal level.
Institutional Impact	Strengthens environmental governance at local level; facilitates collaboration between municipalities, civil society, and state agencies.	Technical capacity built via municipal environmental offices, partnerships, compliance frameworks.	Exponential rise in conservation areas in Paraná; enhanced fiscal advantage for municipalities with better ecological scores.

4.2 PORTUGAL:
Environment Fund for Municipalities

Category	Description	Key Indicators	Outcomes / Examples
Origins & Legal Basis	Introduced under the Local Finances Law of 2007; further shaped by legislation passed in 2016.	Legislative mandate establishing fiscal transfers linked to environmental protection.	First EU country to introduce a national EFT.
Mechanism	Operates through a central Environment Fund that provides lump sum transfers to municipalities.	Eligibility based on presence of protected areas (e.g., Natura 2000 sites, other conservation zones).	Compensates municipalities for land-use restrictions tied to conservation.
Rationale & Objectives	Recognizes opportunity costs of land-use restrictions and incentivizes local participation.	Transfers not earmarked but expected to support national environmental and climate goals.	Encourages investment in GHG reduction, carbon sequestration, water protection, waste management, energy efficiency, and bioeconomy.
Data & Distribution	Uses spatial datasets to inform allocation and eligibility decisions.	National land registries, GIS mapping of protected areas, Natura 2000 overlays, municipal area and elevation.	Allocation guided by data but without rigid ecological scoring.
Governance & Oversight	Funds used at municipal discretion but reporting and oversight mechanisms apply.	Municipalities must report on usage and align budgets with national oversight guidelines.	Strengthened accountability and coherence with national frameworks.
Institutional Impact	Shifted role of municipalities in conservation governance.	Expanded municipal responsibility for designating and managing protected areas.	Local governments became co-owners of environmental outcomes, integrating more deeply into national conservation strategy.

4.3 MALAYSIA:

Biodiversity-Focused Fiscal Transfers

Category	Description	Key Indicators	Outcomes / Examples
Origins & Legal Basis	Recent years have seen the piloting of a unique biodiversity-focused EFT model, reinforced by the anticipated Federal Climate Change Bill (2024). Establishes federal regulatory basis for subnational climate funds and EFTs, making Malaysia one of the few Asian federations aligning fiscal transfers with biodiversity goals.	Federal climate legislation; state-level biodiversity governance integration.	Legislative momentum for national climate and biodiversity finance coherence; Bill aims to formalize regulatory and data frameworks.
Mechanism	Federal-to-state fiscal transfers incentivize states to conserve high forest cover, ecological integrity, and water resources. Vertical international grants from climate/conservation partners complement domestic mechanisms.	Biodiversity value; forest cover; water resource density; ecological integrity.	Targeted support for states maintaining high ecological standards; piloting of new conservation finance tools.
Rationale & Objectives	Internalizes opportunity costs of resource conservation at state level, scaling up nature-based solutions and protecting ecosystems serving critical environmental functions (carbon storage, watershed protection, habitat preservation).	Pollution load; ecological vulnerability; biodiversity indices.	Expands nature-based solutions; compensates for non-commercial but valuable ecosystems.
Data & Distribution	Performance-linked formula using ecological and spatial data is under development; allocation guided by biodiversity value and stress mapping. Early stages rely on negotiated metrics.	Spatial datasets: forest cover, mapping of biodiversity hotspots, watershed data, stress indicators.	Expected data-driven allocation; pilots underway; performance-based formula to be codified.
Governance & Oversight	Federal climate/environment agencies coordinate with states. Future oversight to be formalized under Climate Change Bill; increasing requirements for reporting and data sharing.	Formalized reporting/ data mandates; federal agency coordination.	Builds institutional coherence; moves toward unified climate and biodiversity regulatory structure.
Institutional Impact	Strengthens federal–state collaboration, empowering states as stakeholders in biodiversity/climate governance. Positions Malaysia to evolve fiscal relationships for shared environmental responsibility while bridging tensions over resource control.	Enhanced state role in governance; integration with international financing.	Advances Malaysia's climate and biodiversity agenda; greater stakeholder "buy-in" on ecological initiatives.

4.4 INDONESIA:

Centralized Strategy with Local Delivery and Village-Level Vitality

Category	Description	Key Indicators	Outcomes / Examples
Origins & Legal Basis	Multi-level climate governance: national frameworks with district, city, and village participation. Key instruments launched since 2010: DAK Climate Fund, ICCTF, ProKlim program. Climate Budget Tagging (CBT) started in 2016, expanded to subnational governments by 2020.	National and subnational climate laws; budget tagging; climate fund operations.	Climate budgets integrated in public finance (3.5%-4.3% of APBN); ICCTF founded (2010); ProKlim launched (2011).
Mechanism	Climate funds allocated through performance-linked proposals (DAK Climate), climate finance pooling (ICCTF), and community-driven adaptation/mitigation initiatives (ProKlim). Green Sukuk and municipal bonds mobilize capital for low-carbon projects.	Local proposals aligning with national priorities; project reporting; finance mobilization.	~6,000 villages joined ProKlim by mid-2023; US$3.9B mobilized via Green Sukuk since 2018; pilot targeting 100 villages in 2024.
Rationale & Objectives	Foster resilience, low-carbon development, and adaptation at multiple governance levels; incentivize districts to tailor interventions for local climate vulnerabilities; mainstream climate objectives in state budgeting.	Project approvals: infrastructure resilience, mangrove restoration, emission reduction, climate vulnerability.	Measurable impacts in climate resilience, household incomes, low-carbon farming pilot, increased transparency.
Data & Distribution	Climate Budget Tagging (CBT) ensures spending transparency; Regional CBT (RCBT) piloted since 2020; performance data and reporting guide fund allocations. ICCTF channels both domestic and international resources.	Tagged climate expenditure (%APBN), reporting/auditing processes, regional/ subnational data.	Transparent tracking of climate-related expenditure; regional pilots in 22 areas; alignment with NDCs.
Governance & Oversight	Ministry of Finance oversees reporting, performance audits, and coherence. UNDP, UNEP provide technical support since 2014. Local governments maintain autonomy in implementing site-specific climate action.	Evidence-based reporting; audits; district autonomy; partnerships with international agencies.	Accountability measures in place; community and grassroots responsibility; increased low-carbon local interventions.
Institutional Impact	Central–local equilibrium: fiscal rigor at national level enables tailored, community-led climate solutions. Bureaucratic delays persist in proposal/fund utilization, but autonomy and mainstreaming are increasing.	Capacity-building in districts/ villages; multi-level climate finance instruments.	Green Sukuk: 6 issuances, $3.9B raised, 10.3 Mt CO_2 emissions reduced; ProKlim scaling ambition (to 20,000 villages by 2024).

4.5 FRANCE:

A Decentralized Model

Category	Description	Key Indicators	Outcomes / Examples
Origins & Legal Basis	Centralised climate finance anchored by national mandates and landmark laws, notably the Grenelle Environment Law (2009). Core instruments: Fonds Chaleur (renewable heat fund) managed by ADEME; Fonds Vert (Green Fund) created under the France Relance plan in 2023.	National legislation (Grenelle Law), targeted climate/ energy funds, EU collaboration frameworks.	National funds (Fonds Chaleur, Fonds Vert) established; aligned with EU Green Deal and RRF mechanisms.
Mechanism	Direct public funding for climate projects: subsidies up to 60% for renewable heat infrastructure, performance-based criteria for project selection. Strict technical and administrative oversight; regional prefects evaluate and distribute funds locally.	Project eligibility by thermal audit, energy yield, regional thresholds, robust technical proposals.	4,300 projects funded in 2017 to 10,000 in 2023 via Fonds Chaleur; diversified projects under Fonds Vert.
Rationale & Objectives	Accelerate energy transition, mainstream climate action in local governments, reduce fossil-based systems, and enhance resilience/ adaptation to climate risks. Prioritization amid fiscal constraints; balance national targets with local needs.	CO_2 reduction, renewable energy share, urban greening, biodiversity, adaptation metrics.	Increased local relevance; mainstreaming of climate action at municipal level; job creation among SMEs; decreased fossil heating.
Data & Distribution	Performance-driven funding, evaluation through audits, benchmarking, vulnerability assessments. Allocations based on local ecological/climate impact plans and national energy strategies. EU frameworks supplement domestic budgets.	Thermal audits, CO_2 benchmarks, compliance tracking, impact/ vulnerability indicators.	Stricter budget scrutiny in 2025; prioritization of high-impact investments; EU facility funding for cross-border projects.
Governance & Oversight	Fusion of technical precision with local administrative leadership. Regional prefects distribute funds, oversee evaluations, and ensure local-national alignment. Co-governance brings together municipalities, private sector and central agencies.	Regional/local governance, project audits, national-local delivery mechanisms; SME engagement.	Operational responsibility at local level; model blending national ambition with local delivery.
Institutional Impact	Strong synergy of national innovation and local implementation. Fiscal pressures in 2025 have led to stricter oversight and delegation. France positions climate action as mainstream in public finance, backed by EU and national objectives.	Collaboration with EU, knowledge sharing, increased scrutiny and fiscal discipline.	Substantial project growth; economic stimulus in renewables; replicable model for regional planning and cross-border cooperation.

4.6 GERMANY:

A Federal Balancing Act Between Ambition and Restraint

Category	Description	Key Indicators	Outcomes / Examples
Origins & Legal Basis	Federally centralized funding, decentralized execution. Flagship: Special Climate and Transformation Fund (KTF), established by Climate Protection Act and CO_2 Pricing Law. Governed by Federal Ministries.	Federal law (KTF), “debt brake” fiscal limits, EU ETS auctions.	KTF earmarked €212B (2024–27); strict fiscal discipline (“debt brake”).
Mechanism	KTF links CO_2 pricing revenue and ETS auctions to targeted investment: energy transition, renewables, e-mobility infrastructure. Regional adaptation by Länder (states).	Revenue from CO_2 pricing/ETS; earmarked funding shares for sectors.	€18.8B building efficiency, €12.6B renewables, €4.7B e-mobility (2024–27); €100B KTF allocation in 2025.
Rationale & Objectives	Accelerate energy/industrial transition, digital modernization, climate resilience. Supports “Energiewende”; aligns national ambition with local needs.	Sector priorities: heating, energy cost relief, hydrogen, e-mobility.	Climate neutrality by 2045; supports hydrogen valleys, port electrification, relief for households/industry.
Data & Distribution	Spending subject to strict reporting and audit; recalibrated post-2023 court ruling. Funds distributed and tracked by measurable outcomes when possible.	Budget allocation: 40% heating, 31% energy cost relief (2024); outcome audits.	Only 38/190 measures with CO_2 reduction tracked; streamlined to large-scale projects (€50M+).
Governance & Oversight	Federal oversight (Bundesrechnungshof audits); ministries coordinate with regional authorities for delivery/adaptation.	Audit findings, local tailoring, minimized admin for small projects.	Increased local autonomy; funding prioritized post-court ruling; coalition commitment to efficiency.
Institutional Impact	Structured catalyst for economic and industrial transformation; ongoing focus on fiscal discipline and streamlining.	Regional adaptation (hydrogen, renewables); coalition targets.	KTF enables large-scale transition, structural economic change, and compliance with climate law.

4.7 SOUTH AFRICA:

Innovation, Community and Institutional Backbone

Category	Description	Key Indicators	Outcomes / Examples
Origins & Legal Basis	Multi-tiered system combining central oversight (DBSA, SANBI) and local/ community action. Climate Change Act of 2024 (effective Feb 2025) established unified Climate Change Response Fund.	DBSA Green Fund (since 2012); Adaptation Small Grants Facility (ASGF); new 2025 Response Fund.	DBSA Green Fund managed by Development Bank; ASGF piloted grassroot grants; ECO-DRR GCF funding secured (2025).
Mechanism	Mix of grants and concessional finance for green infrastructure, adaptation, and community resilience. Funds distributed via national agencies, local municipalities, and SMEs.	Performance-linked milestones; audits; targeted impact metrics.	$235M Water Reuse Program (2023) in partnership with GCF; biogas, solar irrigation, wetland restoration projects.
Rationale & Objectives	Catalyse green transition, support just energy transition, empower vulnerable communities, diversify economy away from coal dependency.	Livelihood resilience; ecosystem restoration; climate-smart agriculture.	ASGF: Over 1,291 direct, 9,000 indirect beneficiaries (2015–21); Mopani grants (2024–25); biodiversity regeneration.
Data & Distribution	Compliance, audit, and reporting standards drive fund disbursement; performance measured against milestones in binding agreements.	Audited outcomes; beneficiary numbers; regional and sectoral spread.	ECO-DRR project (2025): $40.1M, 366,000 direct, 5.1M indirect beneficiaries; €4.7B EU package for renewables, JET-IP.
Governance & Oversight	Strategic direction by SANBI (ecosystem, adaptation) and DBSA (infrastructure/ finance), with local adaptation overseen by municipalities and SMEs.	National agencies' oversight; compliance audits; local government delivery.	President's G20 emphasis on equitable finance; slow rollouts but community focus; institutional reform efforts ongoing.
Institutional Impact	Structured for effect with multi-player partnerships, embedded governance logic, and systematic change agenda. Ongoing capacity and funding challenges.	Multilateral investment; local innovation; scaling adaptation.	EU and GCF investments for energy, transport, and skills; national drive for adaptation, resilience, and equity.

4.8 NEPAL:

International Climate Grants for Localized Resilience

Category	Description	Key Indicators	Outcomes / Examples
Origins & Legal Basis	New federal republic relying on targeted international grants, especially from the Green Climate Fund (GCF), for adaptation priorities. Green Climate Fund Regulation provides institutional guidelines.	GCF-based funding; regulatory framework for vertical transfers.	Anchored by GCF Glacial Flood Risk Project (2025–32) & Building Resilient Churia Project (2019–26).
Mechanism	Funds directed to high-risk ecological zones (mountains, Chure hills). Local Adaptation Plans of Action (LAPA) serve as community vehicles for intervention planning and grant allocation.	Ecological vulnerability mapping; community-led planning.	GCF projects focus on glacial retreat and land degradation districts; LAPA framework mainstreams local adaptation.
Rationale & Objectives	Build adaptive capacity in fragile mountain regions and "water tower" Chure hills; integrate Indigenous and local knowledge; targeted disaster risk reduction.	Vulnerability profiles; IPLC integration; context-specific adaptation.	Strengthened early warning for GLOFs; stabilized slopes, improved water retention, flood risk reduction for Terai.
Data & Distribution	Scientific guidance through DHM glacial mapping, satellite monitoring, and early warning systems ensures transparent, data-driven allocation.	Scientific data, risk profiling, monitoring, reporting requirements.	Enhanced disaster preparedness; environmental assessments drive grant allocation; regulatory safeguards.
Governance & Oversight	Funded projects implemented via community-led mechanisms, with oversight from national departments and adherence to GCF Regulation. Participatory governance for IPLCs.	National reporting; community-driven implementation; safeguards.	Strong local ownership; multi-stakeholder participation in vulnerable and remote districts.
Institutional Impact	Nepal localizes global climate finance through community planning and data-driven adaptation, despite lack of domestic EFT system.	Effectiveness in remote/ mountainous regions; replicable for low-income federal systems.	Demonstrated adaptive capacity; model for other similar countries; impact in high-risk ecological zones.

4.9 KENYA:

Participatory Devolved Funds

Category	Description	Key Indicators	Outcomes / Examples
Origins & Legal Basis	Multi-level system based on County Climate Change Fund (CCCF), rooted in devolved governance. Guided by Public Finance Management (Disaster Management Fund) Regulations (2022).	County-based funds, ward-level planning, regulatory backing.	CCCF operational; institutionalized in 2022 regulations.
Mechanism	CCCF aggregates climate finance from global, national, donor and domestic sources. 90% funds to public goods; distributed from counties to ward committees for participatory investment planning.	Funds pooled and allocated per climate vulnerability, digital resource mapping, and committee assessments.	Water access, ecosystem restoration, climate-resilient livelihoods prioritized; horizontal distribution to wards.
Rationale & Objectives	Localize climate adaptation, promote equitable investment, foster participatory decision-making and resilience for vulnerable groups.	Vulnerability/ resilience assessments; inclusivity metrics.	Community-driven investments tailored to gender, age, and production system vulnerabilities.
Data & Distribution	Resource mapping, Kenya Meteorological Department data, and technical tools inform planning; limits admin costs to 10%.	Downscaled climate data, digital mapping, strict fund allocation.	Transparent, data-driven allocation; 90% of funding to immediate local impact.
Governance & Oversight	County and ward-level committees plan, assess, and monitor investments; supported by World Bank and bilateral partners for scaling-up.	Local engagement, partnership funding, Cat DDO risk instruments.	$150M Financing Locally Led Climate Action Program (2021); technical/financial support to counties.
Institutional Impact	Model fosters transparency, local capacity, and community ownership despite investment gaps. Replicable for decentralized climate finance.	County capacity-building, administrative frameworks, international support.	CCCF scaled nationwide with donor support; recognized for strong community-grounded, bottom-up approach.

4.10 COSTA RICA:

Conditional Direct Transfers

Category	Description	Key Indicators	Outcomes / Examples
Origins & Legal Basis	Established by 1996 Forest Law (No. 7575), the PES program rewards individuals/ communities for ecosystem services. Managed by FONAFIFO.	Statutory basis, dedicated public fund, fossil fuel tax revenue.	Over 2.86 million acres protected; $565M+ in payments; reversal of forest loss.
Mechanism	Direct, conditional payments for carbon sequestration, biodiversity, watershed protection, scenic beauty. Funded by fossil fuel tax, contracts are 5 years, compliance verified by audits/GIS monitoring.	Conditional contracts; geospatial audits; sustainable tax-based finance.	Random audits, compliance checks, fixed-term conservation contracts.
Rationale & Objectives	Incentivize conservation, support small farmers, indigenous/underdeveloped areas; twin aims of environmental and social benefit.	Prioritizes <50ha farms, indigenous/ low-income areas, high-ecological zones.	Dual impact on livelihoods and sustainability; equity embedded in fund targeting.
Data & Distribution	Regional FONAFIFO offices decentralize management, assist in planning, monitor outcomes, adjust payments.	Regional autonomy, field monitoring, contract verification.	Bottom-up feedback, tailored payment adjustments, participatory local input.
Governance & Oversight	Transparent, accountable management via audits, technical support, field verification; transitioning to results-based models and marine sectors.	National and regional oversight, random verification, evolving frameworks.	Expanding into new ecosystem services; outcome-based disbursements piloted.
Institutional Impact	PES is a model for linking climate finance to local incentives; shows how transparent, community-centered finance drives change.	Financially enabled local stewardship, measurable ecological gain.	Socially inclusive growth, increased national forest cover, international model for PES.

4.11 UGANDA:

Centralized Policy-Driven Transfers

Category	Description	Key Indicators	Outcomes / Examples
Origins & Legal Basis	Policy-anchored, centralized approach. Embeds climate in public financial management via Climate Change Budget Tagging (CCBT) and conditional transfers. Strong legal framework: Constitution, Climate Change Policy/Act, Environment Act, PFM Act.	Constitutional and legal mandates; national PFM system; CCBT instrument.	Disaster preparedness codified; sector-specific grants; Vision 2040 prioritizes climate resilience.
Mechanism	Central budget earmarking, reactive conditional transfers to districts, sector-specific grants. Grant funding from GCF and partners, triggered by disaster occurrence and managed by line ministries.	Centralized financing; disaster-response activation; sectoral programming.	Districts request funds after events; multi-step centralized reallocation process; pilot DRF initiatives.
Rationale & Objectives	Coordinate and mainstream climate resilience in governance; support local governments after disasters; policy focus on sustainability.	No formal ecological scoring; vulnerability assessments; sectoral priorities.	Climate-sensitive programming in agriculture, water, etc.; new tools like forecast-based financing piloted.
Data & Distribution	No formal weighting of ecological criteria. Funding is reactive, not proactive; climate-tagged budgets emerging at local level.	Climate risk impact estimates (1–7% GDP); limited funding predictability.	Funding via contingency plus supplementary allocations; Working Group for Disaster Risk Financing (2023).
Governance & Oversight	Ministry of Finance, Planning and Economic Development oversees; ministries coordinate assessment, response, and fund flow.	High-level policy coherence; centralized oversight; legal compliance.	Central authority; operational bottlenecks; reforms toward more structured transfers underway.
Institutional Impact	Policy maturity but nascent operational systems. Exploring new green finance instruments and disaster risk financing.	Debt-for-nature swaps, green bonds; DRF pilot projects; local budgeting.	Example for centralized, policy-driven climate finance; reforms to enhance predictability and capacity.

4.12 CHINA:

Centralized Compensation Meets Ecosystem Stewardship

Category	Description	Key Indicators	Outcomes / Examples
Origins & Legal Basis	Centralized fiscal transfer system (NKEFA) started in 2008, refined multiple times, now covers 50.4% of land, 810 counties.	National program, county-based transfers, aligned with eco-civilization framework.	¥900B transferred (by May 2024); policy expanded for rural revitalization (2022).
Mechanism	Counties receive budget transfers for ecological protection; payments based on fiscal gaps, service values, protection costs, and performance.	FREG, ecosystem service valuation, performance-based bonuses/ deductions.	90% counties report stable/improved environments; 85.8% rated 'good' ecological quality.
Rationale & Objectives	Incentivize environmental protection (forests, wetlands, watersheds) over unsustainable growth; target rural and less-developed areas.	Forest cover, water quality, biodiversity, local service capacity.	Per-capita rural income up 3.6% (average); highest growth in biodiversity zones (10.6%).
Data & Distribution	Ministry of Finance enforces, monitors via tech (satellite, drone, integrated systems). Quotas and county-level audits.	County-level reporting, undisclosed tech-based indicators, quota system.	Empirical improvements in cities/provinces (e.g., Sichuan); performance-based transfers.
Governance & Oversight	Central ministries oversee, deductions for poor performance; top-down but locally implemented.	Monitoring, compliance, audits, policy support gaps.	93% regions support policy; <10% voluntarily reduce land-use; challenges in behavioral change.
Institutional Impact	Largest ecosystem services fiscal transfer scheme globally; integrating compensation with rural development and eco-tourism.	Rural revitalization, sustainable agriculture, science/green investments.	Eco-tourism, Great Green Wall, increased forest coverage (10% in 1949 to 25% in 2024); evolving PES model.

Chapter 5

Way Forward: From Assessment to Action

India is already showcasing that the climate signal is macro-relevant.

The climate crisis has emerged as an unequivocal threat. The Global Climate Risk Index 2025 estimates that more than 765,000 people died and almost USD 4.2 trillion (inflation adjusted) in direct losses resulted from more than 9,400 extreme-weather events between 1993-2022. These aggregate losses in economic output have primarily been driven by storms, floods, droughts and heatwaves. Global greenhouse gases and surface temperature are at record highs, as are ocean heat records and sea-level rise. These observations are not statistically significant abstractions, they are an accelerating liability on public balance sheets including diminished fiscal space, inequitable development spending and increasing liabilities. Climate finance should is no longer a niche instrument, but a macro-stabilisation strategy. Mitigation and adaptation funds allow countries to adapt at speed and scale.

India is already showcasing that the climate signal is macro-relevant. The RBI's 2022 Climate Risk paper warns of risks to financial stability posed by both physical and transition shocks where the overlap of agriculture, infrastructure gaps and low adaptive capacity occur. Independent evaluations are now demonstrating that 57% of the districts in India (home to 76% of the population) face high to very high heat risk and multiple large states are entirely in high-risk categories. The impact of warming is now layered, revealing already stressed hydro-climatic regimes face

monsoon variability and multi-hazard coastal belts. Together they are exponentially increasing the fiscal cost of the current "business-as-usual" trajectory.

Climate finance occurs through a patchwork of instruments and standards across the globe. UNFCCC mechanisms including the Green Climate Fund, the Global Environment Facility, the Adaptation Fund, the LDCF/SCCF provide various forms of funding ranging from grants, concessional debt to blended arrangements according to Paris Agreement principles on financing, and balance between mitigation and adaptation. Similarly, countries are leveraging multilateral vehicles and market-based instruments (sovereign and municipal green bonds) as sources of climate finance. While there has been an increase in volume, access, timeliness but alignment with local contexts remain unequal especially for resilience investments. The climate finance policies of countries are becoming increasingly clear. Most countries are developing domestic taxonomies, embedding climate risk into budgetary processes and linking inter-governmental transfers to climate-based outcomes, mitigation and adaptation.

India has developed a layered ecosystem. For instance, the NDRF and SDRF provides immediate relief for climate disaster. However, it does not seek to finance long-term reconstruction and systemic resilience. The National Action Plan on Climate Change (NAPCC) oversees national missions by sector, while the National Adaptation Fund on Climate Change (NAFCC) provides the financial base for state adaptation projects which has an overall expenditure of ₹847.48 crore. The Compensatory Afforestation Fund Management and Planning Authority (CAMPA) receives and deploys funds in the form of compensatory afforestation and passes back to the states the lion's share of (90%) funds to re-establish distinct forest ecosystems. India recently released its Draft Climate Finance Taxonomy (2025) to assist in channelling capital towards low-emission, climate-resilient activities, enhance tracking and reporting mechanisms, and curtail greenwashing practices. India's access to GCF resources has grown. Official tallies show cumulative project approvals in the USD 0.8–1.2 billion range via the financial mechanisms offered by the UNFCCC.

These instruments have been critical, but they are over-proportionately ex post. NDRF and SDRF are, structurally, built for relief and immediate rehabilitation not to 'harden' capital before the next shock. NAFCC fills adaptation gaps but is of limited reach compared to need and systemic resilience. CAMPA protects and restores ecological stock, but it does not typically internalise broader multi-hazard urban and economy-wide risks. As conditions worsen and compound, slow-onset stress intensifying rapid-onset disasters, response-only finance becomes increasingly fiscally pro-cycle. Money arrives in response to losses when the fiscal headroom is the smallest and reconstruction proposals are at their most costly. The result is a chronic cycle of depreciating assets, suppressed productivity and ever-increasing relief spending especially for low adaptive capacity states. The lesson from global experience and India's own data is clear that prevention and preparedness have higher social rates of return than relief, reduce fiscal volatility in states, and protect development gains. Moving a calibrated share of formula-based resources towards ex ante risk reduction is therefore a macro-prudential choice within fiscal federalism.

The lesson from global experience and India's own data is clear that prevention and preparedness have higher social rates of return than relief, reduce fiscal volatility in states, and protect development gains

India's Finance Commissions have developed a transparent, rules-based formula to allocate central taxes between states, involving an income distance, population, area, forest and ecology, demographic performance, and tax effort. **However, neither one of these terms could cost forward-looking climate risk or adaptive capacity.** Inserting a climate specific criterion in the devolution formula would do a lot to mainstream resilience from the fringes of schemes to being at the centre of horizontal equalisation, achieving predictability while correcting a well-documented allocation bias against high-risk, lower-capacity jurisdictions.

The weight at 5% is calibrated and is non-arbitrary. It is sufficiently robust to motivate changes in incentives and adequately resource states in high-risk positions but also limited so that income distance and other recognised cost determinants still take predominance. Its foundation is in an equity–efficiency–growth rationale. Equity, with a focus on differentiating exogenous vulnerability to climate from effects of governance, efficiency, with an appreciation for ex ante risk reduction and preparedness and growth through considerations of safeguarding productivity and follow-on asset loss that depress the state GDP. The climate component would meaningfully impact resources and underpin an advanced criterion, which, at a technical level, have a three-pillar construct (Assessment of Exposure, Assessment of Sensitivity, Assessment of Adaptive Capacity) using harmonised, multi-year data and indicator.

Firstly, it better aligns incentives by transitioning from relief-dominant financing to a prevention-dominant allocation, which requires states to invest in supplies that will be effective before shocks occur. **Secondly,** it is needs-based. The three-pillar framework makes distinctions about when hazards occur, and where harm or readiness is weakest, and not just counting hazard events or using proxies. **Thirdly,**

it reduces unexpected threats. Investments in resilient infrastructure, public assets climate-proofed, robust early-warning and response systems will reduce the long-term fiscal burden of disasters. Fourthly, it safeguards growth. Fewer lost days from shocks will help maintain output and reduce declines in productivity. Finally, it supports existing pillars with direct synergies. It does not replace income distance or forest ecology, it internalises forward-looking risk and readiness in a foreseeable, rules-based envelope.

Integrating climate within fiscal federalism is not just an economic adjustment but a moral imperative, one that ensures the growth path of India is resilient, equitable and future-ready. While the impacts of climate change are costly, extreme weather events are not something that we should respond to through disaster relief - we must work to embed resilience in fiscal policy at the get-go. Current arrangements, while important, place considerable emphasis on post-disaster recovery. Climate-specific component on the devolution formula of the Finance Commission would represent a structural change - moving from disaster response to disaster preparedness. Even a small 5% will create a win-win situation for states where they can enhance their adaptive capacity, grow in a low carbon future path and identify climate risk in their development processes. This shift helps promote equity as well as ensure climate justice can be integrated into India's fiscal federal structure.

i. World Meteorological Organization. (2023, May 22). Atlas of mortality and economic losses from weather, climate and water-related hazards (1970–2021). World Meteorological Organization.
ii. Swiss Re Institute. (2025, April 29). Natural catastrophes: Insured losses on trend to USD 145 billion in 2025 (Sigma No. 1/2025). Swiss Re.
iii. Center for Sustainable Cooling. (2023, November). The hot reality: Living in a +50 °C world – Making the case for cooling as critical infrastructure (COP28 Briefing Note).
iv. Food and Agriculture Organization of the United Nations. (2023, October 13). The impact of disasters on agriculture and food security: First-ever global estimation of the impact of disasters on agriculture. FAO.
v. Government of India, Ministry of Finance, Department of Economic Affairs. (2025). Economic Survey 2024–25 [PDF]. Government of India. https://www.indiabudget.gov.in/economicsurvey/doc/echapter.pdf
vi. Government of India, Ministry of Finance, Department of Economic Affairs. (2025). Economic Survey 2024–25: Climate and environment – Adaptation matters [PDF]. Government of India. https://www.indiabudget.gov.in/economicsurvey/doc/eschapter/echap10.pdf
vii. Murthy, C. S., & Sesha Sai, M. V. R. (n.d.). Agricultural drought monitoring and assessment (Chapter 13) in Remote sensing applications (pp. 303–330) [PDF]. National Remote Sensing Centre, Indian Space Research Organisation. https://www.nrsc.gov.in/sites/default/files/pdf/ebooks/Chap_13_AgricultureDroughtMonitoring.pdf prod-qt-images.s3.amazonaws.com+2Scribd+2National Rural Livelihoods Mission+2. **National Institute of Disaster Management. (2010).** Manual for Drought Management [PDF]. National Disaster Management Authority, Government of India. https://nidm.gov.in/pdf/manuals/drought_manual.pdf
viii. Roxy, M. K., Ghosh, S., Pathak, A., Athulya, R., Mujumdar, M., Murtugudde, R., Terray, P., & Rajeevan, M. (2017). A threefold rise in widespread extreme rain events over central India during 1950–2015. Nature Communications, 8(1), 708. https://doi.org/10.1038/s41467-017-00744-9
ix. Ministry of Power, Government of India. (2025, January 1). Improvement in power supply position: Record demand met — India successfully met an all-time maximum power demand of 250 GW during FY 2024-25 [Press release]. Press Information Bureau, Government of India. https://www.pib.gov.in/PressReleasePage.aspx?PRID=2089243,
x. Reserve Bank of India. (2023). Report on Currency and Finance 2022–23: Towards a Greener Cleaner India. Reserve Bank of India.
xi. Dasgupta, S., Barua, A., Murthy, I. K., Borgohain, P. L., Baghel, T., Sankhyayan, P., Vidya, S., Narwal, H., Jan, A., Vyas, S., Luniwal, Y., Ghosh, S., Cheranda, T. M., Alam, M. K., Matthew, S., & Pradeep, M. S. (2024). District-level climate risk assessment for India: Mapping flood and drought risks using IPCC framework. Department of Science and Technology, Government of India & Swiss Agency for Development and Cooperation.
xii. Council on Energy, Environment and Water. (2025, May 20). How extreme heat is impacting India: Assessing district-level heat risk [PDF]. Council on Energy, Environment and Water. https://www.ceew.in/sites/default/files/mapping-climate-risks-and-impacts-of-extreme-heatwave-disaster-in-indian-districts.pdf, **National Programme on Climate Change and Human Health (NPCCHH), National Centre for Disease Control & Ministry of Health and Family Welfare. (2024, December).** Report of Heat-Related Activities Conducted in India in 2024 [PDF]. Government of India Ministry of Health and Family Welfare. https://ncdc.mohfw.gov.in/wp-content/uploads/2024/12/Report-of-Heat-Related-Activities-2024_NPCCHH.pdf
xiii. Chakraborty, L. (2021). Mainstreaming climate change commitments through Finance Commission's recommendations (NIPFP Working Paper No. 328). National Institute of Public Finance and Policy. https://www.nipfp.org.in/publications/working-papers/
xiv. Chakraborty, L., & Chakraborty, P. (2024). COP28 and environmental federalism: Empirical evidence from an emerging economy, India (NIPFP Working Paper No. 379). National Institute of Public Finance and Policy. https://www.nipfp.org.in/publications/working-papers/

References

1. Asian Development Bank. (2021). Climate finance in Indonesia: Mobilizing resources for low-carbon development. https://www.adb.org/publications/climate-finance-indonesia

2. Austin, K. G., Baker, J. S., Sohngen, B. L., Wade, C. M., Daigneault, A., Ohrel, S. B., ... & Silva-Chávez, G. A. (2020). The economic costs of planting, preserving, and managing the world's forests to mitigate climate change. Nature Communications, 11(1), 5946. https://doi.org/10.1038/s41467-020-19578-z

3. Bird, N., Beloe, T., Hedger, M., Lee, J., Nicholson, K., O'Donnell, M., Gooty, S., Heikens, A., Steele, P., Mackay, A., & Miller, M. (2012, August). The Climate Public Expenditure and Institutional Review (CPEIR): A methodology to review climate policy, institutions and expenditure (UNDP/ODI Working Paper). United Nations Development Programme & Overseas Development Institute.

4. Buchner, B., Clark, A., Falconer, A., Macquarie, R., Meattle, C., Tolentino, R., & Wetherbee, C. (2019). Global Landscape of Climate Finance 2019. Climate Policy Initiative. https://www.climatepolicyinitiative.org/publication/global-climate-finance-2019/

5. Buchner, B., Clark, A., Falconer, A., & Wetherbee, C. (2021). Global Landscape of Climate Finance 2021. Climate Policy Initiative. https://www.climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-2021/

6. Catalano, M., Forni, L., & Pezzolla, E. (2019, July 30). Climate-Change Adaptation: The Role of Fiscal Policy. Prometeia Associazione/Università degli Studi di Padova. https://fsr.eui.eu/wp-content/uploads/2020/04/Pezzola-paper-TEMP-FSR-Climate.pdf

7. Climate Funds Update. (2023). Climate finance thematic funding windows. Heinrich Böll Stiftung & ODI. https://climatefundsupdate.org/

8. Federal Emergency Management Agency. (2022). Updates to ecosystem service valuation: Meta-analysis of forest ecosystem services. U.S. Department of Homeland Security. https://www.fema.gov/sites/default/files/documents/fema_ecosystem-service-value-updates_2022.pdf

9. Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. (2020). Germany's international climate finance. Government of Germany. https://www.bmu.de/en/topics/climate-energy/climate/international-climate-finance

10. Finance Commission of India. (2015). Report of the Fourteenth Finance Commission (2015–2020). Government of India. https://fincomindia.nic.in/

11. Finance Commission of India. (2020). Fifteenth Finance Commission report: Volume IV – The States. Government of India. https://fincomindia.nic.in/asset/doc/commission-reports/XV-FC-Volume%20IV-The%20States.pdf

12. Finance Commission of India. (2020). Report of the Fifteenth Finance Commission (2021–2026). Government of India. https://fincomindia.nic.in/

13. GIZ. (2021). Climate finance in South Africa: Country case study. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). https://www.giz.de/en/html/index.html

14. Global Center on Adaptation. (2025, March 27). Adaptation Finance. https://gca.org/programs/climate-finance/

15. Government of India, Ministry of Finance, Department of Economic Affairs. (2025). Framework of India's Climate Finance Taxonomy (Draft). Government of India. https://static.pib.gov.in/WriteReadData/specificdocs/documents/2025/may/doc202557551101.pdf

16. Government of India, Ministry of Finance, Department of Economic Affairs. (2025, August 5). Rajya Sabha Starred Question No. 171: Tax devolution to states [Reply]. Parliament of India. https://sansad.in/getFile/annex/268/AS171_JIj1kD.pdf

17. Indian Public Policy Review. (2025). Fiscal Federalism and Climate Change: Building the Institutional Framework in India, 6(1). https://www.ippr.in/index.php/ippr/article/view/346

18. Indian Public Policy Review. (2025). Fiscal Federalism and Climate Change: Building the Institutional Framework in India (PDF). https://www.ippr.in/index.php/ippr/article/download/346/139/518

19. International Labour Organization. (2019). Working on a warmer planet: The impact of heat stress on labour productivity and decent work. International Labour Office. https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_711919.pdf

20. International Monetary Fund. (2022, March 10). Economic Principles for Integrating Adaptation to Climate Change into Fiscal Policy. https://www.imf.org/en/Publications/staff-climate-notes/Issues/2022/03/10/Economic-Principles-for-Integrating-Adaptation-to-Climate-Change-into-Fiscal-Policy-464314

21. International Monetary Fund. (2022, March 16). Planning and Mainstreaming Adaptation to Climate Change in Fiscal Policy. https://www.imf.org/en/Publications/staff-climate-notes/Issues/2022/03/16/Planning-and-Mainstreaming-Adaptation-to-Climate-Change-in-Fiscal-Policy-512776

22. Ministry of Environment, Forest and Climate Change. (2012). National Adaptation Fund on Climate Change (NAFCC) – Guidelines. Government of India. https://moef.gov.in/

23. Ministry of Environment, Forest and Climate Change. (2015). Compensatory Afforestation Fund Management and Planning Authority (CAMPA). Government of India. https://moef.gov.in/

24. Ministry of Finance, Government of India. (2020). Report on National Disaster Response Fund (NDRF) and State Disaster Response Fund (SDRF). Government of India. https://dea.gov.in/

25. National Institution for Transforming India (NITI Aayog). (2018). India's progress on climate action: Finance, technology and capacity building. Government of India. https://www.niti.gov.in/

26. Organisation for Economic Co-operation and Development. (2023). Net Zero+: Climate and economic resilience in a changing world. OECD Publishing. https://www.oecd.org/content/dam/oecd/en/publications/reports/2023/05/net-zero_75cbd09c/da477dda-en.pdf

27. Organisation for Economic Co-operation and Development. (2025, May). Summary of OECD consultation with India's 16th Finance Commission. OECD.

28. Overseas Development Institute. (2020). Climate finance in Brazil: Mobilising resources for resilience. ODI. https://odi.org/

29. People's Bank of China. (2021). China's green finance progress report. Government of China. http://www.pbc.gov.cn/

30. Pritchard, S. B. (2023). Climate governance and federalism in India. In Climate Governance and Federalism (Chap. 9). Cambridge University Press. https://www.cambridge.org/core/books/climate-governance-and-federalism/climate-governance-and-federalism-in-india/9B45350B48B46F581DB3F4CDA0F5EF70

31. PRS Legislative Research. (2025). Report of the 15th Finance Commission (2021–26). PRS. https://prsindia.org/policy/report-summaries/report-15th-finance-commission-2021-26

32. Science. (2024). Climate adaptation finance: From paper commitments to impact. https://www.science.org/doi/10.1126/science.adx1950

33. Sciencedirect. (2021). Finance, climate-change and radical uncertainty: Towards prudent adaptation. https://www.sciencedirect.com/science/article/pii/S092180092100015X

34. Sciencedirect. (2022). How climate policies can translate to tangible change. https://www.sciencedirect.com/science/article/pii/S0959652622006497

35. United Nations Environment Programme. (2022). Global Climate Finance Report. UNEP. https://www.unep.org/resources/report/global-climate-finance-report

36. Wong, T. S., & Hussain, M. (2025). Financing a sustainable future: The effectiveness of climate finance. npj Sustainable Development, 5, Article 49. https://www.nature.com/articles/s41599-025-04939-0

37. World Bank. (2014). Climate change public expenditure and institutional review sourcebook. World Bank. http://hdl.handle.net/10986/37953

38. World Bank. (2018). Mobilizing climate finance: Lessons from South Africa. World Bank Group. https://www.worldbank.org/

39. World Bank. (2020). Fiscal policies for a low-carbon South Africa. World Bank Group. https://www.worldbank.org/

40. World Bank. (2021). Climate Change Budget Tagging: A review of international experience (EFI Insight–Governance). World Bank.

41. World Bank. (2021). Enhancing climate resilience in Brazil through innovative finance. World Bank Group. https://www.worldbank.org/

42. World Bank. (2022). Indonesia country climate and development report. World Bank Group. https://www.worldbank.org/

43. World Bank Group. (2023, December 1). The development, climate, and nature crisis: Solutions to end poverty on a livable planet – Insights from World Bank Country Climate and Development Reports covering 42 economies. World Bank. http://hdl.handle.net/10986/40652

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